Antarctic Politics and Marine Resources: Critical Choices for the 1980s

Center for Ocean Management Studies

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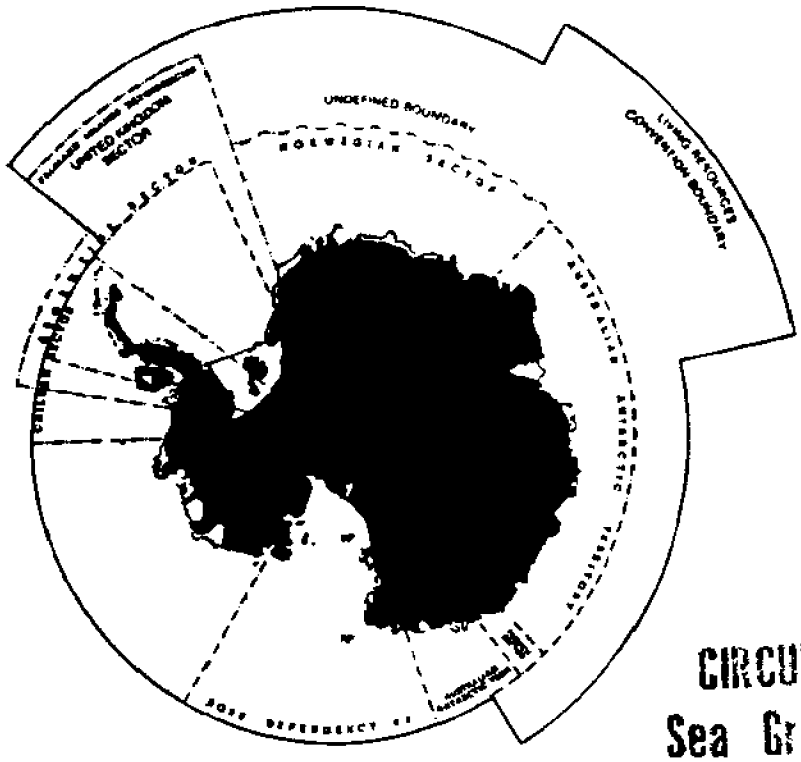

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Preface

The theme this year for the annual Center for Ocean Management Studies' conference is the Antarctic, a frozen continent, larger in size than Europe, which has, in recent years, become the subject of considerable international debate. Since 1961, when the Antarctic Treaty went into effect, a small number of countries — most of them developed — have jointly administered the area and protected it from environmental harm. In 23 years of treaty operation, the number of full members of the treaty system, originally 12, has grown only by 4, and many other countries are now concerned that the treaty members, acting as an exclusive club, may eventually seek to limit the exploitation of the Antarctic's resources to the full members of the treaty. In 1983, "The Question of Antarctica" was placed on the agenda of the United Nations General Assembly. The Assembly was requested to study the treaty system, and member States were asked to submit their views on the matter. This process was scheduled to be completed before the end of 1984.

One impetus for the increased interest in the Antarctic is the fact that in 1991, the 30-year Antarctic Treaty is scheduled for review. It may or may not be reviewed, renewed in its current form, amended, or terminated. Various proposals are being made for a future regime, one of them being that the area be declared the "common heritage of mankind," much as the area of the deep seabed beyond the limits of national jurisdiction were designated in the 1982 Law of the Sea Convention. Under such a regime, all nations would share in managing the resources of the Antarctic, and in receiving a portion of the revenues derived from resource exploitation. There seems little doubt that this common heritage concept will be the subject of considerable debate at the United Nations in the next few years.

But the major issues of the Antarctic involve more than its future regime. What is being done to explore the area, and ensure its environment against damage? How has the newly-created Convention on the Conservation of Antarctic Marine Living Resources fared? What is the United States doing to augment its own Antarctic program? Questions such as these loom large in the current context of Antarctic affairs and may prove useful when the world community is ultimately faced with the question, "Is not the current Antarctic regime the best arrangement which could be made to ensure the area's continued peace and protection?" The Antarctic is a fascinating geographical area whose time appears at last to have come. We hope that the proceedings of this meeting will contribute new information and new insights into the international dialogue concerning the Antarctic.

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Much effort, by many people, goes into the planning and production of any meeting and its resulting proceedings. All of them I thank for their efforts while some of them I will specifically mention. We were fortunate to have as planning committee members: Lewis M. Alexander, Conference Chairman and Director of the Center for Ocean Management Studies; Alan Ryan, Research Fellow, Center for Ocean Management Studies, The University of Rhode Island; Thomas Grigalunas, Professor, Resource Economics, The University of Rhode Island; Richard Burroughs, Assistant Professor, Graduate Program in Marine Affairs, The University of Rhode Island; and James P. Kennett, Professor, Graduate School of Oceanography, The University of Rhode Island. Without their help in the planning stage and their participation as session chairs, the meeting would not have addressed as much nor run as smoothly as it did. Many thanks. Without the speakers' presentations there would be nothing to put into print. Critically important to any meeting are the funding sources. We gratefully acknowledge funding support from: U.S. Department of State; U.S. Department of Interior: Minerals Management Service; Marine Mammal Commission; and National Oceanic and Atmospheric Administration: Sea Grant and Office of Policy and Planning.

No office functions with only one person. For their logistical and technical support I would like to give special recognition to the COMS staff. A well deserved thanks goes to: Carol Dryfoos, COMS Coordinator for her painstaking efforts toward consistency and readability of these proceedings; and to Janet LaCroix, COMS Secretary for her typing and phoning efforts. And finally, thanks to a number of students from the Graduate Program in Marine Affairs who helped with the transportation logistics.

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The Center for Ocean Management Studies was created in the fall of 1976 for the purpose of promoting effective coastal and ocean management. The Center identifies ocean management issues, holds workshops and conferences to discuss these issues, and develops recommendations and research programs to resolve them.

PART ONE

Antarctic Treaty System: An Analysis

We will begin our study of Antarctic politics and marine resources with an analysis of the treaty system. The present system grew out of a desire to maintain amiable relationships among the host of nations participating in the International Geophysical Year (IGY) in 1957/1958. This original group of 12 nations established and participated in the Antarctic Treaty and to date have only four additional members. Since the ratification of the treaty in 1961, Antarctica has been in the business of science, and the treaty has meant more duties than privileges to its members. The questions of potentially valuable resources, however, may mean the business of Antarctica is about to change.

That, of course, has attracted attention to the so-called "exclusive" membership and control through the Antarctic Treaty. These and other issues pertaining to the treaty itself, including its evolutionary abilities, will be addressed by two speakers and two commentators.

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CHAPTER 1

The Antarctic Treaty System: Overview and Analysis

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INTRODUCTION

In these remarks, I would like to offer an overview of the Antarctic Treaty and the Antarctic Treaty System. In so doing, I hope to suggest some analytical perspectives which might be brought to bear upon the Antarctic Treaty and to highlight what I believe are some of the salient, important characteristics of the Antarctic Treaty System.

To start with, I would like to suggest two approaches from which one might view what is now called the Antarctic Treaty System. The first of these is an approach based on the substantive content and substantive product of the system. The Antarctic Treaty System can be viewed as an inter-linked network of substantive agreements, which include the Antarctic Treaty itself and that body of agreed recommendations, agreed measures, and additional instruments which have been concluded pursuant to the Antarctic Treaty. The first perspective is that of looking at the system as a body of provisions, a body of measures that have been developed, beginning with the treaty itself, to deal with human activities in Antarctica. The second approach is to look at the Antarctic Treaty system as a system of governance, as an evolving set of political institutions which provide a means for identifying and responding to issues/activities/situations which require some form of common action among those active in Antarctica. To use a shorthand, I would like to suggest viewing the system from the point of view of its substantive content and secondly as a process or a mechanism, a set of political institutions.

THE ANTARCTIC TREATY SYSTEM — SUBSTANTIVE CONTENT AND PRODUCT

From either perspective, the Antarctic Treaty itself lies at the heart of the Antarctic Treaty System. I would like to briefly summarize the provisions of the treaty, underscoring those aspects which are significant with respect to how the system has developed in the period since the treaty entered into force in 1961.

In relation to other international agreements — the treaty is a surprisingly simple and precise agreement.

Two of the basic aspects of the treaty are outlined in the preamble. In the preamble, the parties to the treaty first set forth as a basic objective the reservation of Antarctica exclusively for peaceful purposes. The parties to the treaty resolve that Antarctica forever be used for such purposes and that Antarctica not become a scene or object of international discord. A second objective of the treaty relates to scientific research. The experience of the International Geophysical year (IGY) was a major catalyst in the initiative to conclude a treaty and the preamble to the treaty, therefore, asserts as a major purpose continuation of the freedom of scientific research in Antarctica as developed and practiced under the IGY and of the international cooperation both in research and logistics and other support activity which took place during that period.

To give effect to these objectives the treaty, in its operative provisions, bans all activities of a military nature, including the testing of weapons. The treaty further prohibits nuclear explosions and the disposal of radioactive waste in Antarctica.

With regard to scientific research, the operative provisions of the treaty establish an obligation that the freedom of scientific research and cooperation therein continue in Antarctica as applied during the IGY. Coupled with this obligation, the parties agree to the sharing of information regarding plans for scientific research in advance of those activities, to facilitate the exchange of personnel between expeditions and stations in Antarctica and to ensure that the observations and results of scientific investigation in Antarctica are shared and made freely available.

In support of its basic objectives, the treaty provides for a system of on-site inspection. Each consultative party has the right to designate observers who have free access to all stations and installations in Antarctica. This right of on-site inspection to ensure observance of the principles and purposes of the treaty is another of its important aspect.

To effectively establish its peaceful purposes and scientific research obligations, the treaty had to deal with the basic political and legal fact relating to Antarctica, that is the dispute, the disagreement among the nations who were then active and among the nations who are now active, over the status of Antarctica. Seven of the countries active in the IGY claimed territorial sovereignty in Antarctica. Some claims overlap and there are areas not subject to claims at all. The other nations active in Antarctica neither assert nor recognize such claims. Thus there was a disagreement over the political and legal status of Antarctica, which had to be dealt with in order to ensure the observance of the obligations set forth in the treaty. Article 4 of the treaty, which is I think a key provision, essentially rests on the approach that the positions of both claimant states and non-claimant states must be protected in the treaty. The position of each side is neither prejudicial nor weakened. At the same time, an approach is developed which permits both claimant states and non-claimant states to agree on how activities take place in Antarctica, to apply common sets of obligations to those activities with which the treaty deals without prejudice to their basic legal and political views.

I'd like to return to this point later. Article 4, which reflects the juridical accommodation achieved in the treaty, is an important element not only in the treaty itself but in the subsequent evolution in the Antarctic Treaty System.

Two final aspects of the treaty merit underlining. The first, is that the treaty is a limited purpose agreement. It deals with the peaceful purposes aspects, it deals with scientific research, it establishes an imaginative juridical, and political accommodation to allow obligations to be applied in those areas. It did not deal with other activities. It did not extend, therefore, the juridical and political accommodation to other activities, including resource activities.

The second aspect is that the treaty also provided a means for its future evolution. In Article 9, the treaty calls for a meeting of the twelve original signatories within two months of the entry into force of the treaty and for regular meetings thereafter for the purposes of exchanging information, consulting together and developing measures in furtherance of the purposes and principles of the treaty. The treaty further provides that, in addition to the twelve original signatories, representatives of other States that accede to the treaty may also participate in these consultative meetings, during such time as such parties demonstrate their interest in Antarctica by the conduct of substantial scientific research activity there, such as the establishment of a station or the dispatch of an expedition. There are now 31 parties to the treaty. Of these 31, 16 are consultative parties (the original 12 plus 4) with Brazil and India having become the most recent consultative parties.

Pursuant to this consultative mechanism, twelve consultative meetings have been held at approximately two-year intervals. A wide range of measures and agreed recommendations have been adopted at such consultative meetings — measures which are designed to give effect to the peaceful purposes and scientific research obligations contained in the treaty itself and measures which deal with new issues and new activities which have arisen since the treaty entered into force in 1961.

There have been close to 150 agreed recommendations adopted at the twelve consultative meetings. Some of the areas with which they have dealt are: the facilitation of scientific research, including the designation of sites of special scientific interest where human activity is strictly limited in the interest of facilitating particular kinds of scientific observations; facilitation of international cooperation, both in scientific research and in the logistics activities necessary to support scientific activity; cooperation in meteorology and exchange of meteorological data; cooperation in telecommunications and logistics, including cooperation in air transport and emergency assistance; tourism; reservation of historical sites and monuments; mitigating man's impact on the Antarctic environment; the exchange of information — elaborating the obligations set forth in the treaty itself, the preservation and conservation of wild life and living resources, including the Agreed Measures of the Conservation of Antarctic Fauna and Flora, which provide for a system of specially protected areas and specially protected species to ensure that the impacts of human activity upon native species of wildlife in Antarctica are properly controlled and regulated. There have been recommendations and measures dealing with the conduct and the organization of the consultative meetings themselves, and there have been recommendations dealing with resources — Antarctic marine living resources as well as mineral resources. As a result of

initiatives taken within the consultative meetings, several separate legal instruments have been negotiated and have entered into force — instruments which are linked to, but legally distinct from the Antarctic Treaty. These include the Convention of the Conservation of Antarctic Seals, which was negotiated in 1972 to deal with the possibility that there would be commercial sealing activities in Antarctica and to provide for proper regulation thereof were it to develop. More important is the Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR) which will be the subject of one of our half day sessions. It was from an initiative developed at the consultative meetings that the CCAMLR was elaborated and concluded (in 1980). It is now in force.

Finally it is pursuant to an initiative within the consultative mechanism that the on-going discussions to develop a system for dealing with Antarctic minerals resources has originated. The question of Antarctic mineral resources activity first appeared on the agenda of consultative meetings in 1973. In 1981 at a meeting in Buenos Aires the recommendation was adopted calling for a negotiation of a regime for Antarctic mineral resources.

There are a number of ways, therefore, that one can approach the substantive content of the Antarctic Treaty System. One can look at the treaty system as an arms control and disarmament mechanism. The treaty itself declares Antarctica as a zone of peace. One can look at the operation of this system from the point of view of how effective that zone of peace has been. One can look at it as a mechanism for promoting scientific research and cooperation therein. We have a session on Antarctic scientific activity. Those who have been involved in the major scientific disciplines which can be pursued in Antarctica recognize that Antarctic research activities over the past several decades have made many major contributions to those disciplines and to understanding the planet as a whole. One can look at the Antarctic Treaty System as a mechanism for facilitating international cooperation in Antarctic activities. In preparing the U.S. response to the U.N. Secretary General's request for views and information on Antarctica, we found that during the history of the U.S. Antarctic Program, there have been somewhere between 900 and 1000 foreign scientists who have worked with the U.S. program — scientists from some 30 countries. That is an interesting statistic. It is an indication of how the system both in the formal and informal sense has facilitated international cooperation. Finally, one must look at the Antarctic Treaty as a mechanism for conserving and managing resources — both mineral resources and living resources. Since these are major topics for other parts of our seminar, I will not go into greater detail on these latter points.

THE ANTARCTIC TREATY SYSTEM — A SYSTEM OF GOVERNANCE

Turning to the Antarctic Treaty from the other perspective, viewing it as a system of governance, as an institutional process, one should return briefly to the provisions of the treaty itself. As noted, the treaty does include rather simple provisions relating to what are now known as consultative meetings — not much more than that. In addition, there is an obligation for the parties to the treaty to establish working relationships with the relevant specialized agencies of the

U.N. system or other international organizations that have scientific or technical competence with regard to Antarctica. Within the treaty, therefore, there are two kinds of articles that deal with subsequent evolution of the system as a system of governance: those relating to the consultative meetings and that relating to cooperation with other organizations having a scientific or technical interest in Antarctica.

Again, as noted, there have been twelve consultative meetings. The XIII meeting will take place in Belgium in 1985. The development of the Antarctic Treaty System centers upon these consultative meetings. First, I would note, that the consultative mechanism had a ready-made scientific advisory body. The Scientific Committee on Antarctic Research (SCAR), a non-governmental body, an International Counsel of Scientific Unions (ICSU) body, was established as a coordinating body for the International Geophysical Year activities. It has become a permanent body within ICSU and has provided a continuing means for coordinating and facilitating scientific research activities and for identifying research priorities in Antarctica. The Scientific Committee on Antarctic Research has functioned in a very unusual way as a scientific advisory body for the evolving Antarctic Treaty system. It has done so as a non-governmental body and as a body that can provide an important peer review function for the actions undertaken within the Antarctic Treaty system.

The evolution of the system has involved two general kinds of action. The first has been an elaboration of the specific obligations contained in the treaty and the second has been the development of means of identifying and dealing with new issues. In an institutional sense, the system has demonstrated innovative and pragmatic qualities which have allowed it to assimilate new interests and deal with new situations. The regular consultative meetings with the advice of a Scientific Committee on Antarctic Research, have generally provided the vehicle for identification of issues, issues requiring common action. However, in response to such issues, a variety of techniques from an institutional perspective have been applied, including the meetings of specialists, meetings of experts, special consultative meetings devoted to particular topics and ultimately as with the CCAMLR convention, the development of new institutions.

The Antarctic Treaty itself and the Antarctic Treaty System are often considered somewhat elusive from a political science perspective, since they do not involve the establishment of permanent machinery. The secretariat function rotates among the consultative parties. Each host government in turn assumes the secretariat responsibilities for organizing meetings and for ensuring the necessary information flow to the participants. In spite of this lack of permanent machinery, the consultative mechanism has been able to evolve techniques for identification of issues, for analysis of issues and ultimately for negotiation and resolution of issues which is both pragmatic and flexible and which has permitted effective responses to be tailored to the particular kinds of problems which have been identified. These responses have included establishment of working relationships with other international bodies such as the World Meteorological Organization (WMO), International Telecommunication Union (ITU), the U.N. Food and Agriculture Organization (FAO), with a number of those bodies again having scientific and technical competence with regard to Antarctica. With respect to non-governmental

organizations. I have already mentioned the relationship with SCAR and there seems to be an emerging relationship with the International Union for the Conservation of Nature and Natural Resources (IUCN) as far as resource issues go.

In relation to the capacity of the Antarctic Treaty System to deal with new issues, it is important to cite Article 4 of the treaty, that is the approach to the juridical and political accommodation which is contained in Article 4. To a certain extent, the success of the Antarctic Treaty system in dealing with new issues has rested upon the ability of its participants to extend the spirit of that accommodation to new issues. The Article 4 accommodation between claimants and non-claimants was the basis on which the Antarctic Treaty itself was concluded and has been the oil which has lubricated the functioning of the Antarctic Treaty system. More on this point later.

From the point of view of governance, there are also a number of characteristics that one can identify in looking at the Antarctic Treaty System. First, the Antarctic Treaty system has demonstrated a gradualist and evolutionary approach to the resolution of issues by defining and dealing with issues which can be dealt with and not seeking to resolve issues that are not ripe for resolution. The second is a pragmatic and flexible approach to the question of institutions and institutional response, characterized by the establishment of the minimum machinery necessary and development of new machinery or new institutions only as and when necessary. These characteristics also rest to some extent upon decentralization of the institutional machinery and institutional concepts.

Third, the system has reflected the concept of participation in decision-making by parties demonstrating a concrete rather than simply a political interest in the activities being dealt with. The system is an open one in that no State is barred from participation in the activities or in the institutions dealing with the activities. Participation in decision-making does rest on the activities criterion, the criterion that was developed in Article 9 of the treaty itself.

A fourth aspect of the system, as a system of governance, is the establishment of functional relationships between Antarctic institutions and other institutions having competence relevant to the work of the Antarctic institutions or having contributions to make.

A fifth characteristic is the role of SCAR. The Antarctic Treaty System is a science-intensive system which has relied very heavily upon the scientists and upon the results of scientific observation and investigations in Antarctica as a means for defining issues that require governmental agreement and as a means for overseeing and reviewing the results of the intergovernmental responses to such issues once identified. The negotiation of the CCAMLR Convention is a good example of this phenomenon.

Finally I would return to the Article 4 concept. To my view, one of the most important characteristics of the Antarctic Treaty system is that it has applied a unique conflict resolution/conflict avoidance approach to issues in Antarctica. The participants have basic differences over the legal and/or political status of Antarctica. Yet, they cooperate peacefully there. If one looks at the countries that participate in the treaty system and the state of their relations, there are participants that have no diplomatic relations working effectively together within the Antarctic Treaty System. There are nations whose relations are not all that they could

be, including nations who in fact have been in armed conflict elsewhere and yet are still working together within the Antarctic Treaty System.

This characteristic relates to the philosophy that was applied in the treaty itself. Some commentators take the view that the Antarctic Treaty System somehow is an incomplete one. It is certainly not static, because it is continually evolving. However, it is sometimes argued that it is incomplete because the claims issue has not been "resolved." In this view, unless the claims issue is resolved, what we are dealing with is either a kind of interim agreement or one that is doomed to collapse when the tough issues, as they are sometimes described, relating to resources, for example, arise.

That argument misses the point. The Antarctic Treaty System rests upon the philosophy that an effort to resolve the claims issue in the sense of extinguishing claims, on the one hand, or perfecting claims, on the other, would simply lead to dispute, perhaps active conflict in the area. One of the basic elements in the Antarctic Treaty, and one of the unique elements of the Treaty, is that it has made Antarctica a going zone of peace. It actually works. It works because the parties recognize that it is possible to develop means of applying common sets of obligations to activities in Antarctica, to ensure that activities in Antarctica meet necessary criteria, including environmental and peaceful purposes criteria, without determining whether claimant States are right or whether non-claimants are right. A balance is established. An approach is taken which permits both claimants and non-claimants, consistent with their own legal views of the area, to apply obligations and the necessary standards and controls to activities. The issue of whether or not the claims issue has to be resolved once and for all is not a very relevant point.

Furthermore, it is sometimes argued that the Antarctic Treaty is fine as far as it goes; that it is easy to apply the treaty's approach to scientific research and peaceful purposes, but that it becomes more difficult to do so in regard to resources. In my view, however, the possibility of dealing with resources issues, in a way that will satisfy environmental and other necessary criteria, rests upon following the same approach. This would permit parties, regardless of their legal and political views on the status of Antarctica, to cooperate in a system which will ensure that necessary decisions can be made about potential resource activities and, if such activities were permitted, to ensure that the necessary obligations were applied to them. This philosophy, to call it that, is one that does require a good deal of forbearance and imagination but is one that has demonstrated its efficacy over the past two decades.

Application of the spirit which is contained in Article 4 of the treaty lies at the heart of the Antarctic Treaty System as a means of conflict resolution/conflict avoidance, as a means of governance.

CONCLUSION

In concluding this overview, I would like to refer to the remark made by the Norwegian representative in the U.N. First Committee about the debate on the Antarctic item last year. He described one of the most important aspects of the

Antarctic Treaty as "its potential for growth and development", calling it an "example of that rare species, a dynamic international legal instrument." I believe that is an accurate description of how the treaty system has functioned to date.

In summarizing the characteristics of the system, I would like to return to several points made at the beginning. The activities in Antarctica in 1959 when the treaty was negotiated which were most important were those related to scientific research and cooperation in scientific research and to reservation of the area exclusively for peaceful purposes. In spite of all the changes in the evolution and the possibility of human activity that has taken place in Antarctica, I would argue very strongly that they remain today by far the most important aspects of human presence in Antarctica and will remain so for the foreseeable future. There has been a great deal of emphasis upon resources, upon the environment, subjects which will properly be given major emphasis in these proceedings. However, it is important to note that what we have learned about the Antarctic environment, what we have learned about the possibilities of resources in Antarctica, and what we have learned about the requirements for managing and conserving each, has been fostered and engendered by the scientific activity and the cooperation in scientific activity that has been permitted and indeed promoted by the treaty and by the existence of an area reserved for peaceful purposes in which countries with very differing viewpoints, social systems, can in fact cooperate in a practical way.

If one looks at the new issues facing the Antarctic Treaty System, including the issues of resources and growing interest in Antarctica, I believe that one can be confident of its future viability. The manner in which it operates to prevent activities in Antarctica from becoming the source of conflict, the emphasis of the role of scientific research in the identification of issues and in proposing solutions to those issues, the way in which it facilitates the development of pragmatic and flexible mechanisms for negotiating and implementing necessary controls on human activity in Antarctica as and when such controls are perceived to be necessary, its capacity to accommodate and assimilate new players and new interests — all of these characteristics lend weight to this confidence in the health and resilience of the Antarctic Treaty System.

In looking at the characteristics of the system, I would like to come back to a couple of points made at the beginning. The activities in 1959 when the treaty was negotiated which were most important were those that were related to scientific research and cooperation in scientific research and thus reservation of the area exclusively for peaceful purposes. In spite of all the changes in the evolution and the possibility of human activity that has taken place in Antarctica. I would argue very strongly that those remain by far today the most important aspects of human activity in Antarctica and will remain so for the foreseeable future. There has been a great deal of talk about resources, about the environment, points that I have not dwelt upon too much today, because we will have ample opportunity to do so in our discussions. But it is important to note that what we have learned about the Antarctic environment, what we have learned about the possibilities of resources in Antarctica, and what we have learned about the requirements for managing and concerning each, have been very largely fostered and engendered by the scientific activity and the cooperation in scientific activity that has been

permitted and indeed promoted by the treaty. And by the existence of an area reserved for peaceful purposes in which countries with very differing objectives, social system etc., can in fact cooperate in a practical way.

Therefore in looking at the Antarctic Treaty System as it stands now it is the conflict avoidance, conflict resolution components of the system. The ability of the system to permit cooperation through the conflict avoidance/conflict resolution kind of approach that is its primary characteristic. One can look at not only the way in which the treaty system has evolved to date, but the way in which the treaty system will evolve on the basis of that point. If one looks at the new issues facing the Antarctic Treaty system including the issues of resources, including the issues of how the system assimilates and deals with new interests in Antarctica it seems to me we would be well advised to look at the system in light of its two or three primary characteristics.

One of course again how it operates to prevent activities from becoming the source of conflict and how conflicts are resolved. Secondly how the system which remains a science intensive one can permit or does permit the identification and emphasis of the role of scientific research in the identification of issues and the proposal of solutions to those issues. Thirdly the way in which the system has facilitated and does facilitate the development of pragmatic and flexible mechanisms for negotiating and implementing necessary controls on human activity in Antarctica as and when such controls are perceived to be necessary.

CHAPTER 2

The Antarctic Treaty: Victim of Its Own Success?

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INTRODUCTION

The Antarctic Treaty of 1959 evolved in a particular historical context: a world of only 80 sovereign nations, many newly fledged. It was a response to a particular situation: the need to find a *modus vivendi* for those countries that claimed territory in the area and those that did not recognize these claims. It was framed in terms of scientific research because of the growing scientific interest in the area and because this provided a good basis for agreement.

The treaty has proved an excellent instrument for the purposes which it set itself. This afternoon we shall be hearing about the achievements in scientific research made under its auspices. In the 20 odd years since it came into force in 1961, it has spread into new fields with considerable success. It has protected Antarctic fauna and flora from the influx of scientists and support personnel and the multiplication of stations. It has also developed guidelines for tourism, but these are all essentially non-contentious issues.

The treaty is now being asked to take on a new and very different challenge: the management of Antarctic resources, and to do so in a world which bears little resemblance to the one in which it was drawn up. There are now some 160 sovereign nations at the United Nations, many of whom would like a say in Antarctic management. In this new world, is it possible to establish sound arrangements for a new activity, such as resource management, on the basis of the Antarctic Treaty?

HISTORICAL CONTEXT

In order to appreciate the strengths and limitations of the Antarctic Treaty, it is important to understand its origins.

The agreement was designed to defuse conflict between claimants and non-claimants in Antarctica. Tension had started to build after the Second World War with a series of incidents between the United Kingdom, Argentina, and Chile.

Various solutions were put forward ranging from arbitration by the International Court of Justice (ICJ) to a condominium of claimants and non-claimants or even some form of U.N. role. But all of these proposed options foundered on the question of sovereignty: some of the nations involved were not prepared to make any concessions on this matter.

In the meantime, attention had turned to the potential contribution of Antarctica to scientific research. In the International Geophysical Year (IGY) of 1957/1958, nations with interests in Antarctica had managed to cooperate in an extensive programme of scientific research in the area despite their differences over claims. The ingenious idea of using scientific research as the basis for a political settlement had first been formulated in the Escudero proposal put forward by Chile in 1948. (Interestingly, this agreement was only designed to last five years.) When the IGY came to an end, the Americans decided to try to build on this arrangement and invited all the other countries which had been active in the programme to negotiate an Antarctic settlement on the basis of scientific cooperation. The result was the 1959 treaty.

The continent was opened up *in the name of* scientific research. Article IV freezes the territorial status quo: people are free to explore the continent, set up bases, and carry out scientific work anywhere without their acts having any repercussions on anyone's territorial pretensions. A tradition of jurisdictional ambiguity was thus established for Antarctica.

The treaty is silent on the question of resources. (An article provides for the possibility of future discussions on the preservation and conservation of living resources in Antarctica.) Some commentators attribute this omission to lack of interest in the resources, citing Laurence Gould's well-known statement before the 1960 U.S. congressional hearings on the treaty that he, "would not give a nickel for all the mineral resources" in Antarctica. Others argue that the negotiators recognized at the time that a settlement which covered resources would require a different approach. What is beyond doubt is that the treaty was not designed to manage resource development.

There are other relics of the past in the treaty. If national delegates were to sit down today and draw up an Antarctic Treaty they would not be able to include South Africa. Its policy of apartheid has been widely condemned by the international community, and it has had to vacate its seat at the U.N. and practically all other international bodies. By the same token, the regime would have to reflect many new concepts that have arisen in the past 25 years, particularly in relation to the Law of the Sea and seabed minerals.

But what dates the treaty more than anything else is the fact that 16 countries with no internationally recognized legal claim to the area are managing this vast continent. The treaty was signed by the 12 countries which had been active in Antarctica during the IGY: the seven claimants and five other states. It laid down that full "consultative" membership was to be reserved for the original 12 signatories and others which demonstrate their interest in Antarctica by "conducting substantial scientific research activity there." It was 18 years before a new State (Poland) joined. The group has now grown to 16. There is, of course, a separate category of acceding States. These have recently been invited to observe consultative meetings but still have no decision-making role.

ACHIEVEMENTS OF THE TREATY

The treaty has established a unique system for regulating and supervising scientific research which has reduced conflict between claimants and non-claimants and promoted large-scale cooperation best typified by projects such as the International Antarctic Glaciological Programme and the Dry Valleys Drilling Project. This cooperation as well as the routine exchange of plans, research results, and scientists, which is peculiar to Antarctica, has proved immune to the tensions of the world outside such as the USSR invasion of Afghanistan or the U.K./Argentina war over the Falklands/Malvinas.

In addition, treaty parties have adopted over 60 environmental protection recommendations. These include the Agreed Measures for the Conservation of Antarctic Fauna and Flora, under which individual animals and birds can only be taken within very strict limits. Fourteen areas of particular ecological interest have been set aside as specially protected areas in which human activity is banned. This strong environmental tradition had been carried over into the resource negotiations which are discussed below.

Another striking feature of the treaty is its establishment of the principle of demilitarization. It is the only area of the world where military installations and maneuvers are banned and all national activities are open to inspection by other countries. The treaty also forbids the testing of nuclear weapons and the disposal of nuclear waste in Antarctica.

In short, this is an extraordinary treaty without parallel anywhere in the world.

MAJOR DEVELOPMENTS SINCE 1959

In the years 1959-1975 while the treaty was protecting Antarctica, the world around was changing dramatically. The old colonial empires collapsed and it became ever more difficult for the great powers to act alone. New concepts evolved. For example, in 1970 the U.N. declared the seabed beyond national jurisdiction to be "the common heritage of all mankind." It was inevitable that in time these new ideas would be applied to Antarctica.

Meanwhile, Antarctic resources were attracting increasing attention. Krill, the small shrimp-like crustacean which is found in the ocean surrounding the continent, was suddenly seen as a new source of protein for humans or their cattle. There was also a growing realization, based on indirect evidence, that the Antarctic continental shelves may harbor oil and gas. And with this came apprehension about the environmental hazards of any resource exploitation that might take place.

The changed international atmosphere and new interest in Antarctic resources together produced two results. Firstly, the treaty parties embarked on a process of drawing up resource regimes. After signing the Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR) in 1980, they set about drawing up a minerals regime. The second result of the changes described above was that in November 1983 the U.N. held its first debate on Antarctica despite heavy lobbying from the treaty parties who have always been apprehensive about any

"outside" involvement in Antarctica. For the first time, treaty parties met their critics head on. It was decided that the U.N. Secretary General should prepare a "comprehensive, factual, and objective study on all aspects of Antarctica."

THE TREATY AND MINERALS

We now come back to the question raised at the beginning of this paper: Does the treaty provide a sound basis for managing Antarctica's resources? There are two major problems: firstly, the treaty was never designed to deal with resources; and secondly, and perhaps more importantly, it is now viewed by a growing body of States as a restrictive and unrepresentative club.

Resource management, and particularly mineral resource management, is qualitatively different from the management of scientific research. Mineral resources are intimately tied up with sovereignty, ownership, and secrecy. In a scientific research regime, there is no direct gain or loss to be had from sharing information; under a minerals regime, information itself is a resource. Thus, for example, on-site inspection, an important underpinning of the current scientific research regime, would not be easily accepted in the case of minerals. The environmental hazards are also qualitatively different. Is it possible to manage resources in the same open ambiguous manner as scientific research? Is it possible to manage resources without settling the question of ownership?

We have seen how the treaty deals with the issue of sovereignty: it sidesteps it. The same approach was used in the seals convention negotiated in 1972 and in CCAMLR. The CCAMLR reiterates the Antarctic Treaty's famous Article IV freezing claims and adds that nothing in the convention shall impinge upon coastal State jurisdiction within the convention area. Whose jurisdiction where is left unsaid. Because the convention extends beyond the treaty area and includes several islands outside the treaty regime, non-claimants can read this to refer to rights *outside* the treaty area. Claimants can read it to refer to rights both inside and outside the area.

Since the introduction of 200-mile fishing zones, all regional fishery arrangements everywhere have been renegotiated to take these zones into account. There is, therefore, nothing unusual about exempting areas under coastal State jurisdiction from the scope of a fishery commission's regulations. What is unusual is that in the Antarctic there is disagreement as to where coastal State jurisdiction begins and ends. Problems may not have arisen so far because the krill fishery is in its infancy. But, if fishing develops apace, there could be serious conflicts as to who is entitled to control it. Similar problems have arisen over tuna fishing off Latin America, but claimants and non-claimants may feel there is too much at stake in Antarctica to seek the sort of back door compromises which have oiled tuna fishing. They certainly felt there was too much at stake to allow the CCAMLR regulating commission to allocate catch quotas or introduce a strong system of enforcement — both held to be vital instruments of fishing conservations but both tied up with the question of sovereignty.

Although the convention is rightly hailed as an important achievement in before-the-event environmental regulation, applying the treaty approach of

"jurisdictional ambiguity" to the conservation of Antarctic living resources has left open considerable loopholes which may undermine its otherwise bold conservationist approach.

In their negotiations to establish a minerals regime, treaty parties are again applying a system of jurisdictional ambiguity. Their formal minerals agreement, whether convention, treaty or protocol, will say nothing about ownership of resources: this question will never be directly settled. The relevant attributes of sovereignty will eventually be hammered out but only on a case-by-case basis in terms of specific contracts between the companies or countries interested in exploitation and the claimants involved.

It has long been conventional wisdom to suggest that, when a minerals regime is eventually developed, a solution will have to be found to the territorial question. Minerals go even closer to the heart of sovereignty than fish because they are fixed in place and non-renewable. Indeed, until quite recently most commentators outside the system indicated that ownership would have to be settled before minerals could be developed. Those within the system were more sanguine but, when an embryonic version of a system of jurisdictional ambiguity was informally proposed by New Zealand in 1976, many delegates felt it was quite unrealistic.

Unrealistic perhaps, but the only way forward within the treaty system, as delegates increasingly realised. In my book, *Frozen Stakes*, I explored the possible options for the treaty parties and concluded that, if they were to construct a minerals regime *on the basis of the treaty*, they would have to fudge the territorial question.

But conventional wisdom is right: not only is a regime of jurisdictional ambiguity for Antarctic minerals hard to swallow at the conceptual stage but it leaves a host of serious practical problems. Many basic questions about control, responsibility, and enforcement remain unanswered. And here I get into practical problems myself. Because Antarctic negotiations are held in private and few documents are released, it is not possible to go into a detailed critique of the latest negotiating text. But a few general comments can be made.

The most recent document available to the public, the first "Beeby text" contained serious flaws in environmental protection, despite some commendable environmental principles. The environment is always the natural loser, be it *Amoco Cadiz*, toxic dumps in the USA or Lake Baikal in the USSR. Unless active, well-informed preemptive steps are taken to protect it, the environment will always come second and it will only be "after the catastrophe" that action is taken, rules tightened, and research done.

No doubt many of the environmental flaws in the first Beeby text have now been ironed out. But inherent weaknesses will remain in any system of jurisdictional ambiguity, however detailed the final treaty or convention. To avoid offending claimants or non-claimants the framework has to be a very open one. But ambiguity over who owns what can lead to ambiguity over who controls what. Can there be a solid legal framework for responsibility and enforcement with a single channel of command? Once mineral exploration starts, real problems will occur when things go wrong. Prevention of explosions and flooding during mining and blowouts during drilling will require real enforcement of strictly specified

standards. Can there be unambiguous arrangements for enforcement and responsibility in the case of accidents?

The attributes of ownership may be neatly divided up in the guidelines of the basic minerals agreement and the individual contracts. But there will be no agreement on the underlying legal basis for mineral operations, as was pointed out only too clearly by the U.K. representative at the U.N. debate last autumn when he said that the opposing views as to the legal basis on which Antarctic activity can be regulated were irreconcilable.

Will firm arrangements be made for compulsory jurisdiction in the event of disagreement between treaty parties? Neither the treaty nor CCAMLR contain such a provision. The failure to settle sovereignty makes this essential.

There are also dangers in leaving important environmental decisions to the small regulatory groups which seem to be a necessary component of this system of jurisdictional ambiguity. Not only does this militate against uniformity over the continent as a whole but, as a number of U.S. environmental groups have pointed out, since the contract will essentially be drawn up by operator and claimant with no conservation-minded party necessarily present, environmental concerns could be overridden.

Practical problems have already arisen under the treaty's system of jurisdictional ambiguity. In 1977, the treaty parties agreed to "refrain from all exploration and exploitation of Antarctic mineral resources while making progress towards the timely adoption of an agreed regime." But a number of seismic surveys are now underway, some such as that by the Japan National Oil Corporation more explicitly resource-oriented than others. Another example of the treaty's failure to prevent environmentally damaging activities is the devastation caused by the building of a French landing strip in Terre Adelie, wounding and killing a number of birds and destroying the habitat of many others. This was never raised within the treaty forum and may well be incompatible with the agreed measures. The treaty's loose structure, an essential by-product of the system of jurisdictional ambiguity, enables it to be ignored over difficult issues.

The British government has recently proved unable to prevent a British company (British Nuclear Fuels) from polluting British beaches with British nuclear waste. Will a treaty government be able to assure its public that environmental standards will be brought to bear against, for example, an Argentine company polluting a beach claimed by the Norwegians? And all this in a remote and extremely vulnerable environment.

In short, there is cause for concern as to whether the basic system of jurisdictional ambiguity enshrined in the Antarctic Treaty will prove a sound basis for managing Antarctic fisheries let alone minerals. But there is another more serious problem. The dispute over sovereignty no longer affects just 16 countries but the whole world.

In his speech opening the U.N. debate, the delegate from Antigua and Barbuda asked, "why should an island known for its beautiful beaches, halcyon climate, warmth, hospitality, and consummate skill at cricket be interested in an area where the world's lowest temperature — minus 125°F — has been recorded? I am, I believe rightly, interested in the fate of the Californian Condor and the destruction of the Tasmanian wilderness by the building of a dam. We are citizens of

one world." There is a growing swell of opinion in the international community challenging the treaty framework with its restrictive membership.

This interest has not sprung up overnight. India, for example, attempted to raise the subject before the treaty was signed. The issue would undoubtedly have aroused more interest at the time of signature had it not been for the fact that many developing countries were still under colonial rule or had only just achieved independence. From the midseventies onwards a number of these new countries had tried to raise the subject but were consistently rebuffed by the treaty parties, usually on the grounds that any move to open the Antarctic question at this stage would complicate the delicate Law of the Sea negotiations with their already overburdened agenda.

International organizations such as the World Meteorological Organizations, Food and Agriculture Organizations, U.N. Environment Programme and U.N. Economic and Social Council were also put off by treaty parties from involving themselves in Antarctica.

Finally, with the conclusion of the Law of the Sea negotiations in 1982, Malaysia brought the subject up. This move to put the subject on the U.N. agenda soon got wider backing. In Spring 1983 the summit meeting of the Non-Aligned Movement agreed that "the exploration of the area and the exploitation of its resources shall be carried out for the benefit of all mankind...." They called on the General Assembly to "undertake a comprehensive study in Antarctica ... with a view to widening international cooperation in the area."

As a result, the subject was placed on the U.N. agenda, and, as noted earlier, a full debate held and the U.N. Secretary General asked to prepare a report for next autumn.

In their speeches at the U.N., most developing countries expressed support for the treaty's achievements but wanted a greater say in future developments. This is not just knee-jerk envy or internationalism. Although Antarctica is subject to national claims and scientific research agreement, if there ever was an area that was intrinsically international and needed a genuinely international system of management, this must be it. The continent represents one-tenth of the world's land surface. It lies beyond the inhabited regional frontiers and is comparatively untouched by man. It also plays a part in man's survival everywhere. Why should outsiders have any respect for the principle of internationalism if it cannot be properly applied here?

It is often argued that the treaty is a self-denying ordinance, under which treaty parties acquire no rights. Under a minerals regime, it is maintained the area will still be open to all. But the principle of first come, first served will not satisfy many developing countries. Even revenue-sharing may not overcome this problem: they may want direct involvement in the operations themselves, in the administrative system, and in the financial benefits. And if they do not get it, because the big and powerful nations ignore then, Antarctica will become not a beacon of agreement and demilitarization but a source of friction, another thorn in the side of internationalism, another problem bequeathed to our children, just like the tragic farce of the Falklands/Malvinas.

In short, failure to listen to the views of developing countries could have repercussions on all international negotiations. It would increase tension and suspicion of these countries which are parties to the Antarctic Treaty, yet further weakening North/South relations in general.

In a narrower framework, if a large group of countries do not accept a regime, there will be temptations and excuses for outsiders to flout its rules. This is bad for the environment and for those who invest money and undertake exploration and exploitation. It is not likely but possible that a multinational company will "use" a country which does not recognize the legal validity of a regime as a flag of convenience for the company's operations and thereby seek to escape the restrictive regulations of the regime agreed to by its own government. In the medium term, some of the more technologically advanced developing countries would be able to operate in Antarctica off their own bat. There will be no clear legal structure to deal with this. It is also conceivable that members of the wider international community could take sanctions against countries whose companies, or which themselves, are active in Antarctica, on the grounds that they have appropriated a global resource for individual gain. We should not lose sight of the time scale. Exploration and exploitations may be delayed until well into the next century. Seventy-five years ago the sun never set on the British Empire and few people in the west had heard of Japan.

CONCLUSION

The Antarctic Treaty does not seem to provide a basis broad and solid enough upon which to construct resource management regimes. But it remains a unique and valuable instrument which has promoted scientific research, protected Antarctica's environment from the advent of man and his weapons and ensured peaceful cooperation in the area, keeping territorial conflict at bay. It should be preserved and more countries encouraged to join. The antagonism currently expressed towards the treaty would be dispelled if it were made clear that it did not claim to provide the constraints for controlling the area's resources. If anyone is trying to undermine the treaty, it is the treaty parties themselves by asking too much of it.

The United Kingdom delegate whose speech I referred to earlier went on to say: "It must be one of the choicer international ironies that so much good should come out of an inability to agree about the basis on which that good should be done." Is the treaty now falling victim of its own success?

The treaty should be left to run Antarctic affairs as it does today, with minor modifications to increase accountability such as wider circulation of documents, increased membership and closer consultation on all matters under its purview. There is no reason why treaty parties should not enjoy an important position in a future mineral regime, but it would be wiser for everyone to approach these negotiations from a different direction, recognizing the intereats of the wider community and trying to clarify the legal basis for operations. If the objection is raised that this would violate Article IV of the treaty, it would be worth considering

to what extent the draft minerals regime in effect violates this accommodation by divvying up the different attributes of sovereignty.

The treaty is a vital, if limited purpose instrument. The best guarantee of its survival is to recognize these limitations.

Commentaries

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As the first two presentations have made clear, it is helpful when analyzing the Antarctic Treaty system to have an eye to the past as well as to the future.

Certainly an understanding of the system requires careful consideration of the origins of the treaty itself. Barbara Mitchell has drawn our attention to the very great difficulties which faced the negotiators in 1959. At the center of these difficulties, and undiminished by the cooperation achieved during the International Geophysical Year (IGY), was the fundamental disagreement over sovereignty in Antarctica. Recent history reminds us that disputes about sovereignty are perhaps the hardest of all to contain, let alone resolve. In addition to the dispute between claimant and non-claimant countries and between the countries with overlapping claims, the negotiations took place against the background of a high level of tension between the United States and the Soviet Union which gave cause for concern that, despite their cooperation during the IGY, military competition between them could be extended to the Antarctic region.

THE IMPORTANCE OF ARTICLE IV

Why did it prove possible to negotiate a way through this situation? Essentially, I believe because all the governments concerned feared that if an accommodation were not found instability, if not chaos, might result.

How was the basic accommodation achieved? The key, as Barbara Mitchell points out, is to be found in Article IV of the treaty which in many ways is its *central* article. It was clear at an early stage in the conference that there was no way of resolving the problem through either the claimant States or the non-claimants giving away their basic position. What Article IV does is to provide a basis on which disputes about sovereignty can be put to one side. In essence it says that neither the treaty itself nor acts or activities taking place during the life of the treaty shall prejudice the position of: a) countries who claim to exercise sovereignty; b) countries who do not recognize such claims; or, c) countries who assert a basis of claim. Additionally, it prohibits new claims or the enlargement of existing claims.

Since this article is of such central importance, I want to say a few more words about it. It is sometimes suggested that the article freezes rights to territorial sovereignty in Antarctica or renders the claims ineffective. That is not the case. The claims cannot be enhanced in the life of the treaty but equally they are not diminished. To quote the words of a very experienced Antarctic negotiator, Keith Brennan of Australia, "The article therefore keeps alive — keeps 'simmering' as distinct from 'frozen' — claims to territorial sovereignty in Antarctica, and likewise keeps alive 'bases of claims' to territorial sovereignty." Or, as another Antarctic negotiator of long experience, Fernando Zegers of Chile, often puts it, "What was frozen was the struggle for sovereignty."

Thus, it was Article IV which was the key to the success of the 1959 negotiation as a whole and which allowed for the elaboration of the treaty's basic elements. Those elements have been well described and commented on by both speakers. In summary they are:

- The demilitarization of the entire continent, the banning of the testing of nuclear weapons, and the dumping of nuclear waste;
- The setting up of a system of on-site inspection to ensure that basic rules are observed;
- The protection of the freedom of scientific research and the maintenance of a unique system of cooperation in scientific investigation; and
- The provision of a platform for the development of a very broad range of specific measures in elaboration of the Treaty principles, including in particular, measures aimed at the conservation of resources and the protection of the very special Antarctic environment.

These elements are of great importance, but whether we are looking back at what has been accomplished under the treaty or looking forward to its future we must not overlook the fundamental reality that through it, and in particular through Article IV, a lid was put on the potential for tension, rivalry, dispute, and conflict inherent in the situation that existed in 1959. We must also remind ourselves that in the absence of the treaty this potential would exist today. Without question in my view, the most important fact about the treaty is the assurance it represents, and it is the only assurance available, that Antarctica will remain peaceful and stable and will not become in the words of the treaty, "the scene or object of international discord."

This stabilizing effect of the treaty is very important to countries like New Zealand for whom the Antarctic is their backyard. It is important to the claimant and non-claimant parties to the treaty who are active in Antarctica and who without it might find themselves in serious dispute or open conflict. And it is also important to the superpowers who might otherwise feel obliged to view the area in military and strategic terms. Finally, it is surely of some importance to the wider international community as a major contribution to the achievement of the purposes of the United Nations.

TREATY ACHIEVEMENTS

The speakers have both dealt with the way the treaty system has functioned in practice. I do not have time nor is it necessary for me to review and comment further on that. It is sufficient, *first*, to note that few have questioned that the record of achievements is impressive and, *second*, to emphasize Tucker Scully's comment that the hallmark of the system has been its dynamic quality which has enabled it to respond in a pragmatic and flexible way to changing circumstances and new situations. It is a constantly evolving system.

TREATY CHALLENGES

If we look toward the future, it is clear that there are two new and related challenges which the system faces. There is the task in which the consultative parties are currently engaged of devising a regime to govern Antarctic mineral resources, and there is the increasing interest which countries outside the treaty system are now showing in its activities. The question Barbara Mitchell asks in effect is, "Is the treaty system equal to these challenges?" My short answer to that question is not only that it is but that it has to be.

To explain the reason for that view I would go back to the origins of the current negotiation on minerals. They do not lie, as some would have it, in a desire on the part of the consultative parties to carve up the mineral resources of Antarctica amongst themselves before the rest of the international community can get organized to stop them. In fact, they go back about 15 years and they have to do with the same concern that launched the negotiations that led to the adoption of the treaty itself — namely a desire to avoid instability and conflict in the region. Barbara Mitchell points out that the treaty is silent on the question of resources. Back in 1970, at the consultative party meeting in that year, New Zealand made precisely that point and urged the consultative parties to consider the need for a comprehensive regime on Antarctic resources. Resources had not seemed an issue in 1959. Barbara Mitchell quoted Laurence Gould's famous pronouncement on the subject. But in 1970 New Zealand's concern was that with advances in technology it was at least conceivable that at some stage an unregulated scramble might develop, in particular over such mineral resources as the area might be found to hold. Any such scramble would bring back to center stage the conflicting positions about sovereignty that the treaty had successfully put to one side. In the worst case, the result could be the breakdown of the treaty with the loss of the disarmament regime it contains and, even more importantly, the loss of the stabilizing effect it has had on the entire area south of latitude 60°S. It could also, of course, have the most damaging consequences for the Antarctic environment about which New Zealanders as neighbors have a special concern.

The real origins of the negotiations and their continuing essential purpose is, therefore, political and not economic.

DEVELOPING A MINERALS REGIME

Tomorrow we will hear from the experts about mineral resources in Antarctica, and I would not wish to prejudge what they may tell us. So far, however, the information available to me would confirm what I have just said about the origins of the negotiations. There is, I believe, no certainty that minerals will ever be found there in commercially exploitable quantities. Laurence Gould could still turn out to be right.

I would be the first to agree that the negotiations of a minerals regime under the Antarctic Treaty system is not an easy task. I would agree too that it is more difficult or at least more complicated than the negotiation of the regime for the conservation of Antarctic marine living resources. But in the end, as is always the case, the question of whether the difficulties can be overcome is essentially a matter of political will. The difficulties facing the negotiators in 1959 must at times have seemed insuperable to them. An imaginative solution was found then and I am sure it can be found again now.

Whatever that solution is, it will have to ensure that a means is provided to deal with the practical realities of resource management including the problems mentioned by Barbara Mitchell of enforcement, responsibility, and dispute settlements. It will also have to provide a sound basis for protecting the Antarctic environment. The consultative parties have already made a commitment to that effect and certainly any regime which could not provide confidence in that area could not find acceptance in New Zealand. In short, to answer Barbara Mitchell's broader question, I believe it is possible to develop a regime for the effective management of resources without settling the issue of sovereignty. I would go further and say that it will have to be done without settling the sovereignty issue because there is no consensus on that issue.

COMMON HERITAGE

It is worth commenting here on the concept of the common heritage of mankind which, as Barbara Mitchell notes, has been talked about with respect to Antarctica. I would note that that concept could be applied to outer space and the deep seabed because there appeared to be a consensus on the status of those areas. Each had been the subject of extremely limited human activity and neither had been the subject of any claim to sovereignty. It is quite another matter to attempt to apply the concept to an area which has by now generated a very substantial history of human activity, which has been the subject of claims to sovereignty dating back at least 75 years, and which is the subject of a pre-existing legal regime amongst the States most directly concerned. I would suggest it is neither reasonable nor realistic to suppose that the common heritage concept can make headway with respect to Antarctica. There is no consensus on the legal status of the continent that would permit that.

There are, in any event, other elements in that concept that might give cause for concern to some — in particular, the fact that it is an exploitation and not a conservation concept. It represents a call for the exploitation of resources for

the benefit of all and not for conservation of the environment in which those resources are located.

I have made it clear I think that, in my view, the Antarctic Treaty is irreplaceable and that any regime to govern Antarctic minerals will have to be developed as a part of the Antarctic Treaty system. I have also said I believe that this system is equal to the challenge of devising a sound, effective, and environmentally responsible regime.

OTHER CONCERNS

Can it successfully meet the other issue which it now faces — the growing interest in Antarctica of countries which are outside the treaty system? This interest is of fairly recent origin. For the greatest part of the history of the treaty, the international community at large has shown little or no interest in it, in the work done under it, or in the biennial meetings of the consultative parties. At the same time, it is equally true that the consultative parties have done little to encourage such interest. Accordingly, there is currently something of an information gap and a considerable number of misconceptions about the treaty system.

I would note in passing that one of the most important of these misconceptions, which is represented in the charge of exclusiveness, relates to the consultative status provided for in Article IX of the treaty. The fact is that any party to the treaty that establishes a substantial scientific programme in Antarctica immediately assumes a range of practical, financial, and legal responsibilities relating to its activities on the continent (the discharge of which requires regular consultation and cooperation with the other countries carrying out similar activities). What may seem like exclusiveness, therefore, is really only a practical recognition that those who can best take decisions binding on those who are active in Antarctica are those who themselves, year after year, have supported programmes for the furtherance of scientific research and for the protection of the Antarctic environment.

The dynamic quality of the treaty system is, I think, already in evidence in the response of the consultative parties to the new level of international interest in Antarctica. As to the information gap, they have of course drawn attention to the fact that by demilitarizing the continent, keeping Antarctica a zone of peace, and protecting the freedom of scientific research there, the treaty has made a major contribution to the purposes of the United Nations and thereby benefits the international community at large.

A more concrete step is their offer to the U.N. Secretary-General to cooperate fully with him in the preparation of the study he was requested by last year's General Assembly to prepare and in particular to provide him with the information at their disposal. Of equal if not greater significance was their decision at the consultative meeting in September 1983 to admit observers from all the countries which are party to the treaty. This decision was followed by a further decision at the May 1984 meeting on mineral resources that all future meetings on that subject should similarly be open to these observers.

As to the substance of the minerals negotiations, the consultative parties have already made a public commitment that the minerals regime they are preparing will not prejudice the interests of all mankind in Antarctica. The involvement in future meetings of observers from all the countries which are party to the treaty will undoubtedly help in finding ways which give specificity to that commitment.

CONCLUSION

To sum up, I would argue that the Antarctic Treaty is irreplaceable. It has provided peace and stability in the region and a basis under which legitimate activities could be carried out in Antarctica by all those with an active interest there despite their differences on an issue as fundamental as sovereignty. I would also suggest that the dynamic character of the treaty system is such that there is no reason why it cannot continue to do so as the range of both activities and interests increases.

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The Antarctic Treaty clearly has operated successfully over the last quarter of a century. In his overview presentation, Tucker Scully eloquently provides this conference with an apt and useful analytical frame of reference in which to view the Treaty System. Similarly, Barbara Mitchell's paper supplies a thoughtful, cogent, and at times politically provocative attitude towards the contemporary Antarctic Treaty situation and the need therein for substantive change. I would like to direct my commentary primarily toward Barbara Mitchell's analysis, linking to it various facets of the Antarctic Treaty System which Tucker Scully describes in his opening remarks.

The thrust of Barbara Mitchell's paper addresses this query: Is it possible to establish an internationally sound and equitable arrangement for resource management under the aegis of the Antarctic Treaty System? Her conclusion is one of doubtfulness. Given the historical context of the treaty's evolution, coupled with the nuanced politico-legal ramifications stemming from the hallmark of "jurisdictional ambiguity" that underpins its operation, the Antarctic Treaty does not seem to supply the foundation necessary for constructing viable resource management regimes in the region. While I agree with much of this position, I also have some

qualms about it. So, let me proceed by setting out those issue areas held in common and then turn to those considerations which I found somewhat bothersome. Finally, throughout this commentary are interspersed my own thoughts on the Antarctic Treaty, the political cement which holds it together, and the prospects for its success over the next decade.

POSITIVE AND NEGATIVE ASPECTS OF THE TREATY

First, there is no question that the Antarctic Treaty has performed laudably well over the past 25 years in achieving those purposes for which it was originally designed. Both speakers plainly point this out: The Treaty has functioned effectively to promote scientific research and cooperation within the treaty area (i.e., south of latitude 60°S), in a climate of political collaboration and legal accommodation. Because of the treaty, Antarctica remains the only demilitarized continent; it is also denuclearized in terms of weapons testing and waste disposal, thereby making Antarctica in essence a nuclear-free zone. There is also provision for unannounced on-site inspection, no small feat today in itself.

The treaty, however, as Barbara Mitchell notes, is conspicuously silent on resource-related matters. In this connection, mention is made of Laurence Gould's statement in 1960 that he would not give a nickel for all the mineral resources in Antarctica. Interestingly enough, two years earlier Mr. Gould made, in my view, a more accurate and telling observation in a lecture before the American Geographical Society. He said, that it was "unwarranted to assume that great riches exist in Antarctica. But, it was just as equally unwarranted to assume that there were none." I agree with this latter point. All the geological evidence is not yet in to say with definitude whether portions of Antarctica might be prospective Prudhoe Bays or mineralwise, the continent is nothing more than a frozen white Sahara.

According to Barbara Mitchell's thesis, a principal factor faults the Antarctic Treaty in the contemporary international milieux. Only 16 states are managing resource-related activities around the continent. Furthermore, they have self-assumed this responsibility without any universally sanctioned or recognized international legal mandate.

Certainly, one can interpret that situation to be the case. Nevertheless, it is equally true that the treaty regime and the structural evolution of its systemic character since 1961 has undeniably been valid under international law. Moreover, it constitutes a legitimate instrument of policy regulation for those States party to its provisions. Not of less import is the fact that no State or group of States has yet tried formally to impugn the legitimacy of the Antarctic Treaty, the Convention of the Conservation of Antarctic Seals, the Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR), or for that matter, any of the several multilateral anti-pollution agreements that apply to the southern ocean.

In the same vein, the Antarctic Treaty System is open to all States. Any State may accede to any of these treaty instruments if its government so desires. Any

State may apply for consultative party status, if it so desires. Admittedly, admission to the Antarctic Treaty Consultative Party group (ATCP) is contingent upon demonstrating conduct of "substantial scientific research activity there" (Article IX, paragraph 2); but, nonetheless, the option to join is available for States willing to make that investment. Simply put, membership to the Antarctic Treaty System is open, and participation as a consultative party is attainable to those governments willing to invest the requisite time, money, and scientific commitment.

INTERNATIONAL AGREEMENTS TO FOSTER NATIONAL INTERESTS

On another tack, Barbara Mitchell detects a fundamental problem in that the ATCPs have chosen to apply a process of "jurisdictional ambiguity" to those regimes devised for Antarctic resource conservation and management. That is, both precise definition of resource ownership and clarification of sovereignty attributes were skirted in CCAMLR — just as they were by Article IV of the Antarctic Treaty and as they likely will be in the completed minerals regime text. The reason for this legal lacuna is plainly apparent. It represents a strategy of political pragmatism, one aimed at avoiding frustration of an agreement over the protracted legal nexus of competing national claims and territorial sovereignty questions. I agree that such jurisdictional ambiguity may be politically practical in the short run; but, over the long-term, I feel that failure to resolve the sovereignty issue entails a cop-out; furthermore, refusal to deal head-on with the ownership-of-resources question inevitably will perpetuate serious problems in the future, particularly with respect to safeguarding the Antarctic environment, both onshore and offshore. Thus, the catch-22 here is that if the ATCPs attempt to settle the claims issue, they can only foment discord. If they eschew it, they are able to promote collaboration through circumvention. In either case, the legal issues remain unresolved.

Herein, I think is couched a critical realization that is so obvious it is often overlooked, discarded, or merely taken for granted. National governments tend to formulate international agreements principally to further, enhance, or protect their own national interests. In fact, this reality explains why international law in general and the Antarctic Treaty in particular work. It is in the interest of participant parties for them to work. To be sure, this observation holds true for the ATCPs, just as it does for the U.N. General Assembly. Regarding the resource regime appendages in the Antarctic Treaty System, jurisdictional ambiguity provides a convenient vehicle for governments to protect their respective interests, goal-values, and priority concerns in the region. And, what specifically are those vital national interest concerns that make the Antarctic Treaty relationship so special and so desirable for the consultative parties? Though many interests could be enumerated, let me just tick off a few that stand out for States in the ATCP group.

First, strategically, a stable Antarctic Treaty regime is wanted to ensure the continued right of transoceanic transit through the Drake Passage, the main sea-lane separating Terra del Fuego from the Antarctic Peninsula. Certainly, this ambition would rank high for the United States, particularly in the event the Panama Canal someday were closed to shipping, for one reason or another. Second, for several States — namely, the Soviet Union and Japan, but also Poland, West Germany, Chile and Norway — securing access to krill looms large as a national priority. Non-living mineral resources figure no less salient. For States such as the United States, Japan, West Germany and the United Kingdom, there exists the aspiration to preserve, as a policy option, maintenance of legally-secure access to hypothetical Antarctic mineral and petroleum resources, should deposits ever prove geologically extant in commercially recoverable quantities. Exploitation opportunities are not the question here but rather retaining legally unfettered access to possible resource locations. A third obvious national objective shared by all ATCPs is the international scientific research and cooperation that is promoted by the treaty. Likewise, as aforementioned, a fourth national interest earmarking the ATCP relationship is the fact that the region is effectively demilitarized, which thereby contributes to world stability. International military friction has been preempted in the Antarctic through the treaty's prohibitions in Article I against, "*inter alia*, any measures of a military nature, such as the establishment of military bases and fortifications, the carrying out of military maneuvers, as well as the testing of any type of weapons." Still a fifth set of national interests relates to geopolitical anxieties, especially those felt by Latin American States. These states, in particular Argentina, see their exposed southern flanks as vulnerable to attacks from Antarctica. In fact, the continent has been depicted by Argentinian geopoliticians as a dagger pointed up at their country's soft underbelly. For Argentina expressly, but also for Chile and Brazil, security apprehensions in the region make participation in the Antarctic Treaty system highly preferable to no system at all.

COMMON HERITAGE CONCERNS

In concluding her paper, Barbara Mitchell makes the statement that, "...[I]t would be wiser for everyone to approach [the minerals regime negotiations] from a different direction, recognizing the interests of the wider community basis for operations." I certainly must concur that these ends are wholly desirable and necessary for the creation of a permanent stable mineral regime in the region. However, if one takes this position to its ideological extreme and inferentially construes it to mean that the Antarctic ought to be declared part of the "Common Heritage of Mankind" (CHM) associated with the Group of 77 and their aspiration of a New International Economic Order, I would have some grave reservations. In fairness to Barbara Mitchell, I do not mean to imply that she advocates this outcome in her paper. She does not. Even so, transformation of the Antarctic into a CHM regime undoubtedly would have powerful ideological appeal to the majority of States in the United Nations and, theoretically, it would offer greater economic equity and more universal participation in deciding Antarctica's future. Yet, the upshot of such a jurisdictional maneuver conceivably would drive

out the developed ATCPs from the regime and into a more vehemently nationalistic, covetous mind-set. Surely, this reaction would be likely for the claimant States, and perhaps, similarly, it would hold true as well for the United States and the Soviet Union, who thus far have refrained from formally staking claims in the Antarctic but reserve the legal right to do so.

THE NEED FOR NEW MANAGEMENT

Near her paper's end, Barbara Mitchell asserts that, "Although Antarctica is subject to national claims and a scientific research agreement, if there ever was an area that was intrinsically international and needed a genuinely international system of management, this must be it." In principle, I emphatically agree with her point. Antarctica is a unique piece of the global environment that should be carefully husbanded, prudently managed, and strictly protected for the benefit and enjoyment of future generations. In that respect, the Antarctic indeed inculcates a vital facet of the earth's heritage for all mankind. My misgiving with her assertion rests in the means used to achieve this end. How should this truly international common space area be governed such that its resources are most effectively conserved and best protected? I am not at all sure that the General Assembly forum today provides the best managerial vehicle to perform that conservation role. I would have less objection to a trusteeship arrangement wherein Antarctica might be declared a world park and placed thereafter under the U.N. Trusteeship Council mechanism — with apt consultative party representation — for supervision. Even so, such an arrangement finds scant support from the seven ATCPs who espouse territorial sector claims to portions of the continent. For the foreseeable future, the Antarctic Treaty System does furnish a regulatory mechanism devised by those States having the greatest historical experience in the region for strictly managing activities that, most likely, would be undertaken by their own corporate nationals. Despite its deficiencies, that arrangement seems to me more preferable than a majoritarian system governed by 160 states, of which 125 have no pertinent interests in or historical concerns with the region and whose recent voting preference in the United Nations appears to be determined more by political and ideological sway than by considerations of legitimacy or environmental preservation.

Having said this, let me plainly state that my personal preference for the Antarctic is the option that no commercial development — especially the extraction varieties — ever occur there at all. That may be only a naive hope on my part, but such a moratorium ostensibly would preclude pillaging and denigrating Antarctica's natural ecosystem, irrespective of whether the noble cause is that of global socialism to attain a "New International Economic Order" or private, free enterprise to promote worldwide capitalism.

LOOKING TOWARD THE FUTURE

At this juncture, I would like to engage in some rational speculation, prompted by both speakers" presentations, about the future course of Antarctic-related matters. Over the next five to ten years, it seems reasonable to forecast that the ATCPs will persist in working together to preserve the same treaty system that has evolved since 1959. The ATCPs probably will negotiate successfully and open for signature an Antarctic minerals regime agreement by 1987. This notwithstanding, there appears little, if any, chance of resource development inshore, onshore, or offshore Antarctica before the end of the century.

It is possible that the Antarctic Treaty System may be pointedly attacked in the United Nations. I do not foresee, however, the promulgation in the near term of any new U.N. convention dealing with Antarctic resource regulation or an imposed moratorium. But, even if one were to be promulgated, it would not likely enter into force with any political efficacy. Only a modicum of impact could reside in such a multilateral accord absent the cooperation and technology of developed States, and they already have their own treaty regime. Moreover, clearly it would be difficult to produce a viable new Antarctic regime without the major industrial powers and prominent political leaders of the Third World, and that describes precisely the composition situation with the present Antarctic Treaty: The Soviet Union, Argentina, Chile, India, and Brazil already hold consultative party status, and the Peoples Republic of China is presumed to be an ATCP candidate in the not-so-distant future.

Also important to realize is that the danger admittedly exists that the present treaty system actually could self-destruct. If requested by any consultative party, under Article XII, paragraph 2, a review conference could be convened as early as 1991. (Despite popular confusion over this point, the treaty neither expires in 1991 nor is the review conference mandatory. The session will convene only should any ATCP formally proffer such a request.) The possibility does exist that a review conference might provoke sufficient discord and political dissention among the ATCPs that the current treaty regime could collapse. (Perhaps somewhat unfairly, the recent admission of India and Brazil into consultative party status has aroused suspicion among political observers that either or both of these States might resort to the review conference opportunity as a tactic ostensibly aimed at bringing down, or at least incapacitating, the Antarctic Treaty System's operation). Regardless of the way events unfold, national interest considerations will remain paramount for the ATCPs. By this I do not mean to suggest that a review conference necessarily will unravel the treaty system. I merely want to note the possibility it could happen.

As a final observation, let me reiterate that my personal prerogative is for the Antarctic Treaty System to function with environmental preservation, protection, and conservation as its preeminent objectives. I would hope, therefore, that the continent and its circumpolar marine environs never would be opened up for commercial exploitation, irrespective of what kind of mineral regime is created. The lessons of Santa Barbara, the *Torrey Canyon*, the *Amoco Cadiz* and perhaps more glaringly, the Bay of Campeche — all graphically intimate that the possibility of eco-catastrophe actually exists for the Antarctic. The magnitude and

severity of threat is compounded when one realizes the harsh physical conditions of the region: drifting icebergs, some the size of Connecticut; hurricane-force winds; freezing sleet and rain; and prolonged, pervasive pack ice — all serve to make any offshore drilling operation continually vulnerable to extreme damage or even to being crushed. Though little remains known about the effects of petroleum spills upon frigid arctic-type environs, an oil disaster the size of Campeche could have profoundly detrimental impacts upon the delicate Antarctic ecosystem, especially in denigrating the salubrity of krill stocks.

Regardless of the regime which ultimately comes to make decisions in overseeing activities in the Antarctic, I would hope that these environmental concerns would be fully recognized and feasibly integrated into the region's regulatory mechanism. Only in this way can the unique environment that is Antarctica be preserved for the appreciation and enjoyment of future generations. Only in this way can Antarctica be elevated to the position of being truly part of the common heritage for all humankind.

Discussion

Hanson: I would like to give the panel members a chance to comment to one another before we open it up for questions or comments from the floor.

Mitchell: I have four comments to make in response to Tucker Scully's paper and the two commentaries we have just heard. During the break, I had various comments on my presentation. One person called me a "utopian" and another called me a "pessimist." Absurd! What am I? I think there is a very big danger in talking about the Antarctic Treaty System as a constantly, limitlessly evolving system. As Tucker Scully said, it is a limited purpose agreement that was how it originated. It is rather an elusive system, but what has happened is that various new instruments have been added on to the original treaty. But until now they have not really dealt with anything terribly different from scientific research. Resource management is completely different. I think one must beware of being overly optimistic about the treaty evolving to deal with this. It has evolved so far, but can it go on? Many people refer to the treaty as being dynamic, and I think one of the reasons it is dynamic is that the treaty itself says so little. Article IV, the jurisdictional article, does not solve the territorial disputes. No bureaucracy is set up, institutional arrangements are kept to a minimum, and there are no rules and regulations. It is, therefore, very easy for an arrangement like that to be dynamic. It ties nothing down at all. But none of this means that it is going to be able to deal with the question of resource management. On the same point, I think Tucker Scully described the philosophy underlying the Antarctic Treaty as the gradualist approach, as though this had been evolved very deliberately but this was in fact the only approach possible. We must not elevate the Antarctic Treaty System, if you want to call it a system, to anything more than it is which is really a series of ad hoc arrangements. And again, because of this we do not have any guarantee that it will extend into the field or resource management.

Secondly, I would like to respond to Bill Mansfield's comment. He insists it will be possible to apply the treaty approach to the question of resource management, simply because it has to be done. I am not sure one can always apply that argument — something will be done because it has to be done! There have been many examples where that has fallen flat. You could also turn the statement on its head and say, "it will be possible to solve the territorial claims because they have to be settled." I am personally not reassured by what you have said that it will be possible to build a safe resource management framework on the basis of jurisdictional ambiguity.

A third point about common heritage: I certainly do not think that the Antarctic should be settled in the General Assembly by 160 nations, 125, or however many it is, of which have no direct interest in Antarctica. I think another form of negotiation is necessary. I do not think that Antarctica should be declared common heritage. It is a very different situation from the seabed beyond national jurisdiction. We have got to look for a compromise.

Finally, the question of the treaty opening up. I am very glad to see that acceding States are being invited to the meetings, but they are only being granted an observer role. They cannot participate in decision-making and there is a big group of countries that will not want to join the treaty under those terms. Many developing countries would not want to be tied down by the responsibilities and obligations provided for in the treaty if they do not have any *quid pro quo*, so I do not think they will want to join under those terms. Those are the four points I wanted to make.

Hanson: Anyone else at the table?

Scully: I will comment primarily on Barbara Mitchell's points. First, I think I would disagree with, at least find certain inconsistency in arguing, that on the one hand the Antarctic Treaty insofar as it has gone as a limited purpose agreement has done a number of wonderful things and then at the same time argue that that has really been predicated upon ad hoc and sort of an almost accidental result of agreements among countries that were seeking a least common denominator approach. I just do not think that follows. I think that the agreement in 1959 and the way the system has functioned since then has in fact been a product of some innovative and imaginative approaches to multilateral diplomacy. It is my opinion that it is a limited purpose agreement and sought in 1959 to deal with the things that needed to be dealt with in 1959. It does not in my view discredit or in fact invalidate an assumption that the same approach offers the basis for dealing with new issues as and when they arise. In fact, it gives me some confidence particularly when I look at the international landscape and at other efforts that have been going on in these areas. It gives me some confidence that in fact the system will succeed. There is I think a sort of a "If it ain't broke, don't fix it" kind of attitude one can take. My first point would be that I think there is somewhat of an inconsistency in Barbara's points about the advantages of the treaty as a limited purpose agreement and then to belittle the way in which it has functioned. It seems to me that one is reversing the cart and horse by saying that, "I don't believe the resource issues can be dealt with and, therefore, the system has been one that cannot deal with them."

I would also like to address the question of jurisdictional ambiguity. This is an interesting term with a variety of meanings. In one sense, I think it has been used to mean irresolution or lack of resolution of the territorial claims issue — there is not international agreement as to whether there are claims, whether such claims are valid, or whether there are no claims. I quite agree with that point, but it is quite another thing to extend that to jurisdiction over activities. One can create a jurisdictional basis for regulating activities on a variety of foundations.

The question that seems to be that Barbara has raised with regard to jurisdictional ambiguity is to say because there is a disagreement over sovereignty, because sovereignty relates to resources, there cannot be a sound basis for regulating resources until one decides who owns or does not own the area. I do not think that follows, and I think one can look at that from the point of view of what may be the alternatives. One alternative, it seems to me, would be to resolve the issue in favor of sovereignty, to simply recognize claims. Now that could deal with ambiguity in a certain sense in that one would be simply agreeing that certain individual countries who could then provide for a manager to run the area. That

may or may not be good for the environment in terms of establishing a rational resource management system, but one would resolve the ambiguity in that sense. Once, however, it seems to me, one is looking at a composite management system which involves multilateral management in some fashion and international management in some fashion, one has exactly the same problem.

How then, if one establishes that the basis is a condominium or whatever, does one translate that into the detailed control of the activities. One could, I assume, write a detailed mining code with absolute completeness of what might happen in Antarctica, and how each of those might be regulated, enforced, etc. One could make it a simply and almost an automatic system. I think we would all agree that that is not a possibility. So it seems to me that what it comes down to is a decision-making system. How are decisions to be made about the activities; against what criteria; how are the decisions to be enforced; and, how are disputes to be dealt with about those decisions? Now that is just as much an issue if one has a clear basis for determining who owns or who does not own the area as if one does not.

The real issue is how does the decision-making system operate; how can the participants in the decision-making system protect their interests; do they feel they can protect their interests; and, what kinds of standards against what kinds of criteria are those decisions made? That it seems to me is the real issue in seeking to develop resource management arrangements which I would note has already been done with regard to living resources. That to me is more the issue than determining ownership. I think even if one were to determine ownership one would be faced with exactly the same kinds of issues. Unless one can write a detailed code which will put us all in the position of being crystal ball gazers and anticipating exactly what will happen in the 21st century, then I think the problem Barbara raises is, in fact, the problem that anyone would face in trying to write a framework agreement capable of dealing with new activities in the future and ensuring that those activities take place in a peaceful manner that will not provoke conflict and will take place in a manner that will become consistent with protection of the Antarctic environment. I do not think that those issues relate to the question of sovereignty and jurisdictional ambiguity in that sense.

Mansfield: I will be very short. I remain an optimist, Barbara, and the reason for it is that, if the consequences of failure are as I believe them to be, I think there is a great incentive for the political will to be present to reach agreement. I, like Tucker, also want to comment on this idea, which I think is a fallacy, that you have to settle the legal status before you can work out an effective regime. Tucker has dealt with this point in some detail. My point is that you do not have to go beyond the area of bilateral relations to find illustrations. We have many areas now where there are bilateral disputes between States as to the extent of their jurisdiction, most notably in the maritime area in a number of cases. The way this situation is resolved is to say, "well there is an area out there, the legal status of which we don't agree about, but let's put a management regime in place." It is simply untrue to say that you have to settle a firm legal basis for an area before you decide on an effective and detailed management system for it.

As to the membership question, Barbara suggests that a number of developing countries are not willing to join the treaty on the present basis, I would hope

that, as the treaty evolves and develops and as the information flow continues, all the countries which are not currently party to it will see that it does serve the purposes of the United Nations and their own interests as well and will join the treaty.

Hanson: Thank you.

Holser: I would like to make a comment with regard to the inability of the resolution of a resource regime without the resolution of sovereignty. Even though the fisheries resource is mobile, if you look throughout the nations of the world in their own particular territories, you will find that that is considered just as fixed a resource within their jurisdiction as the others. So I think CCAMLR is a good example of fixing a resource management regime without resolving the sovereignty question.

Behrendt: I would like to make a clarification, that both Barbara and Tucker touched on, regarding scientific research data as contrasted with proprietary mineral resource data. I would also like to mention the difference between proprietary minerals resource data and on-site inspections of mineral resources activities. I think the difference between the two types of data are basically whether they are public or not, at least in the preliminary stages of resource investigation. The actual data collection might be quite similar in the analysis and the interpretation of the data, and I think that was one point where Tucker and Barbara both agreed on the necessity for these data to be released under the Antarctic Treaty. But the on-site inspection which Barbara indicated might be a difficulty in a mineral resource activity. I would assume that any regime that would be developed would be similar to those in existence and the various countries that are regulating offshore petroleum activities now. Certainly in the United States, inspection takes place continuously either daily or weekly on all activities that are carried out and I would presume that this would also take place in Antarctica. This would not violate any proprietary data that might be related to the activity; an inspector would not necessarily see the proprietary data to decide that safe conditions existed.

Green: I has been reported that New Zealand has offered China a choice of sites in New Zealand's claimed territory and that, as part of any agreement, China would have to acknowledge New Zealand's special rights in the area as a claimant State. Would this not be an example of how the development of a minerals regime might be encouraging the claimant States to assert more vigorously their sovereignty claims?

Mansfield: May I comment? That newspaper report is factually inaccurate. My understanding is that the government of China did ask the New Zealand government for some advice and assistance as to suitable locations for their prospective bases in Antarctica. They were given assistance in the true spirit of the Antarctic Treaty. That is the factual situation. There is the possibility that if China, or indeed other countries, wishes to stage through New Zealand on route to Antarctica that that staging can be the subject of a separate agreement between the two countries. We have such an agreement with the United States, and we have a similar agreement with the Federal Republic of Germany. It is entirely possible

that other countries could have agreements with us of a similar kind relating to staging through New Zealand.

Brittin: I have an observation, perhaps a question for Barbara. I think that perhaps the fundamental question that I did not hear you address that basic to any kind of an arrangement between countries a treaty or what you will, is the question: Does this involvement increase the potential and the possibility of dispute between countries or indeed conflict between countries? I think that this is the key question. Collaterally to that, that support that is still an integral part of it is this: Going Tucker's route, so to speak, what is the likelihood of protecting our interests in freedom of scientific research, in the freedom of navigation, and protection of the environment? Is it better to take that route for those uses of the sea, or is your route better? I am not sure that I heard any discussion of those and I think they are quite important.

Mitchell: If you are looking for the arrangement that decreases the possibility of conflict and the potential for dispute between countries, you must bear in mind that the Antarctic Treaty, and any arrangement that is drawn up under its auspices, does leave this territorial dispute hanging. And it leaves it in such a way that real conflict could break out at some time in the future. I am constantly reminded of the Argentine/U.K. War over the Falklands/Malvinas, and you must bear this in mind whenever you look at the future arrangements for the area.

Scully: I would like to make one comment on Burt Brittin's comment and then on Barbara's response. As a preamble to that, I might add one point to Bill Mansfield's comment on the China question. We in fact have an agreement with New Zealand, as Bill mentioned, and that agreement is pertinent in terms of staging through Christchurch in New Zealand. It has been an extremely productive agreement for both sides, and it does not in any way impinge upon or involve the questions of sovereignty. It is a bilateral agreement and does not affect in any way New Zealand's view of Article IV or the U.S. view of Article IV. It is a very practical and cooperative arrangement. I would note also that the government of China (as well as other governments including India and Brazil) has also been in touch with us in terms of seeking advice on how to conduct scientific research activities in Antarctica. I think it is in fact part of the spirit in which the Antarctic Treaty operates. That is, when there is in fact a demonstration of interest, there is I think probably the most effective form of cooperation that I have seen in almost any international system both on a formal and informal basis.

I want to make a point about the sort of guillotine that is hanging over the consultative parties of the international community of the unresolved territorial conflict. People keep citing the Malvinas — or I guess I should say Falklands, Falklands/Malvinas. I would like to note that at the height of that crisis, during the time of physical hostilities and open warfare in the South Atlantic, there were two things that occurred with relation to the Antarctic Treaty that struck me. First of all, none of that conflict extended south of Latitude 60°S where in many instances, as I understand it, would have been to the strategic advantage of either or both combatants to do so. Secondly, during the same period when diplomatic relations shall we say were at a rather low ebb between Argentina and the United Kingdom, a session of the special consultative meeting on Antarctic mineral

resources took place in New Zealand, a country which for reasons of its old school tie had also broken relations with Argentina. At this meeting, both Argentina and the United Kingdom participated. They were able to work together in probably their only form of contact whatsoever during this period and were able to do so in a way that was both constructive and positive toward the ends that were being sought on the discussions. I think a clean and practical example is to look at the question of how the Antarctic Treaty System deals with the question of territorial sovereignty and whether or not it deals with it in a way that prevents conflict or plants the seed for future conflict.

Rowe: I would like to pick up on a point related to the concept or notion of jurisdictional ambiguity. Tucker Scully and Bill Mansfield both commented on it. It is an idea that I think is extraordinarily misleading. Tucker Scully has given a very eloquent explanation of why he feels it is misleading and I do not disagree with anything he said. Let me make perfectly clear that, from the Australian government's point of view, there is not a hint of ambiguity about who owns the Australian Antarctic sector. By the same token, I presume there is no ambiguity on the part of those who do not acknowledge the existence of claims in their attitude of who owns the Australian Antarctic territory. The point is, of course, that there is not a great deal of ambiguity at all. It is a clear, simple, and I might say a very inventive formulation which has formed the basis on which Antarctica cooperation has taken place since the treaty come into force. To suggest the existence of claims as the source of future instability, it seems to me, to be an assertion without foundation. Thus far cooperation has taken place in the Antarctic with the existence of claims. Both claimants and non-claimants we know have worked cooperatively in the Antarctic and the issue of claims has not been a problem.

Another point that was made was in reference to the increasing international interest in Antarctica, and I think that is true. There has been increased international interests. Last year, when Malaysia was joined by Antigua/Barbuda cosponsoring requests for inscription, the increase in the number of card-carrying opponents to the treaty increased to 100 percent. There are not two card-carrying opponents to the system. The increasing interest in the treaty has also been manifested by the fact that a number of countries joined the treaty over the last 18 months.

And I would like to make another point regarding the criticism that is often made about the treaty being a two-tiered system. Somehow it is discriminatory, but that is a criticism that is made most frequently and most ardently by those who are members of the treaty. It is not a criticism that is made by those acceding States nor consultative parties. It is usually worked within the Antarctic Treaty System. The last point I would make is that, if people have demonstrated interest in the Antarctic, come join the Antarctic Treaty.

Neshyba: I do not think that the point of view of the conservationists has been expressed adequately. A second point is one which perhaps the Law of the Sea people can answer. A nation under the exclusive economic zone idea must develop the resources, say the living resources, or face the potential of having those resources licensed to another nation. My question is, how does this impact reform the resolution of the offshore territorial sector idea of the treaty?

Joyner: A couple of comments about that. First, the Antarctic, as I have tried to indicate in my remarks, is a unique environment. One has to take a look at only the virgin, unadulterated landscape to see that it is pristine, and it would be a tragedy to see it oil-infested. The environmentalists, to a great extent, would prefer to see no minerals agreement consummated, because if you have a regime in hand, you therefore are going to invite some sort of development. People I have talked to along these lines have indicated that, if there is no minerals regime, there will be no cause for commercial development because incentive will not be there to go down to license. If you have a regime, then you have some place to go for licensing arrangements, and inevitably that will open up the Antarctic to develop. In terms of conservation, my impression is right now that there is no incentive in the commercial sectors to go to Antarctica because onshore resources elsewhere in the world are sufficient to meet world demand. The oil glut today and hard mineral supplies are adequate from other portions of the world, so it is not worth the money, the time, and the logistical problems that would be encountered in getting resources out of Antarctica, if indeed they do exist. The point you raised about the Law of the Sea and exclusive economic zone is a conference unto itself. But it is important to realize that so long as the so-called jurisdictional ambiguity exists and these claims are not recognized by the international legal community, say for the claimant States, it would be difficult to recognize the legality of EEZs which are proclaimed offshore. And there is a rather widespread impression in the international legal community that the waters around Antarctica are high seas rather than territorial extentions of the sectors although the maps depict the sector claims going out into the water past the shoreline. In fact, the water within those sectors is regarded as high seas, open to fishing and resource exploitaion by any State in the world.

Brittin: To answer you questions directly about the Law of the Sea Treaty and fisheries. There is not duty on the part of the coastal State to develop its fisheries to the maximum extent. There is no precise right for another State to come in and fish in those sections.

Scully: I think we are getting into issues that we are going to have a chance to discuss further later in the conference. I would just simply say with regard to the fisheries issue that insofar as the obligation (I assume you are referring to a full utilization obligation of other related matters with regard to EEZs) the CCAMRL sets forth as its objective a conservation standard that applies to the area that it covers as a whole, then it attempts to establish the machinery to implement that standard. Therefore, I do not think one has to get into that particular issue.

Hanson: I will allow one last question.

Rutford: I have a statement that I would like to make so we can think about it for the next few days. That is, that justifications that we always hear for the development of resources in the Antarctic are economic. My concern is that the development of resources in Antarctica will not take place for economic reasons, but for political reasons.

Hanson: Thank you. That's an interesting note to close on.

PART TWO

Antarctic Science Policy

Science has been a changing but nevertheless constant presence in Antarctica from the time of the first explorers. To frame out discussion for this afternoon we can envision at least three stages in its evolution. The first, in reality an age of exploration, had imprecise and clearly subsidiary scientific objectives. Scientific puzzles were occasionally probed, but nations and individuals were in Antarctica for other reasons.

In the second stage, science took on new dimensions as evidenced by the International Geophysical Year. A multitude of rich developments in a wide variety of basic scientific disciplines marked the period. Those international scientific arrangements preceded the Antarctic Treaty and have in large measure been tied to the history of its political success that the speakers referred to this morning. Our goal in this session is to explore the scientific background on three levels. First, we will consider international arrangements; second, a U.S. national perspective; and third, through a panel discussion, we will present individual U.S. organizations and their respective scientific roles in the Antarctic.

As we listen to these views, it may be important to speculate that a third stage in evolution of science is already upon us. New pressures on scientific research and the fabric of our current agreements in Antarctica have grown simultaneously from the perceived value of natural resources and the need to use certain of the basic sciences to assist in their management. Through an ecosystem-based management approach, the living resources are leading the way to a new fusion of science and public policy. Clearly, similar challenges lie ahead with respect to the minerals regime.

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CHAPTER 3

International Science Programs in Antarctica

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SCIENTIFIC COMMITTEE FOR ANTARCTIC RESEARCH

International science programs in Antarctica are coordinated by the Scientific Committee for Antarctic Research (SCAR), which is a member body of the International Council of Scientific Unions (ICSU). The Scientific Committee for Antarctic Research began as the Special Committee for Antarctic Research, put together in the midfifties to lay plans for the International Geophysical Year (IGY) program in Antarctica. That program was so successful that the member nations decided to make the arrangement permanent, and SCAR has been with us ever since.

In 1980, after 20 years of operation, SCAR undertook a careful review of its functions and structure. This was necessitated largely because of: 1) increasing pressures on the Antarctic scientific community to devote time, effort, and money to resource-related questions; and 2) growing interest of other international bodies in Antarctic affairs. Despite these changing outlooks, however, the established modes of operation were found to be generally satisfactory, and only some minor changes in structure were deemed necessary. Thus, for the foreseeable future, we can expect that SCAR will continue to operate much as it has done in the past, with its discipline-oriented permanent working groups and its groups of specialists to consider particular issues.

At present SCAR has nine permanent working groups which form the backbone of international scientific collaboration by providing the mechanism and opportunity for exchange of information about, and discussion of, national program plans and achievements and for the organization of major scientific symposia as required. Each national committee appoints a member to each of these groups; some have additional members nominated by other ICSU bodies. From time to time these working groups promote, or assist in the promotion of, collaborative studies between nations where, through joint planning and execution, more effective use can be made of the resources available for a particular study. An example of this is a recent decision of the Working Group on Glaciology to establish a subgroup to coordinate the glaciological and related scientific plans

of a number of national programs on the Filchner-Ronne ice shelves, which will be a counterpart in this region to the five-nation Glaciology of the Antarctic Peninsula Program that has been operating for ten years.

The group of specialists are formed and their membership selected (by the SCAR executive) to undertake tasks specified by their terms of reference. These are often of an interdisciplinary nature. These groups are not permanent, in the same sense as working groups, but some do have long life spans. Some of them are cosponsored by other international organizations. At present there are five such groups of specialists:

a. Antarctic Climate Research;
b. Antarctic Environmental Implications of Possible Mineral Exploration and Exploitation;
c. Seals;
d. Southern Ocean Ecosystems and their Living Resources (with three cosponsors); and
e. Antarctic Sea Ice (cosponsored by Scientific Committee for Oceanic Research [SCOR]).

Relations With the Antarctic Treaty

There is no formal direct link between SCAR and the consultative parties to the Antarctic Treaty. This is partly because the treaty has no headquarters or secretariat — each biennial consultative meeting being organized by the host government — and partly to maintain the distinction between the scientific and political forums. Nevertheless, there is effective interchange and SCAR is frequently invited to provide scientific advice to the consultative parties. This is done by: 1) consultative meetings recommending to their governments that through their national committees for SCAR they invite some action by SCAR; and 2) SCAR requesting its national committees to convey its responses, or other material, to their governments. This mechanism is perhaps unusual, but it has been reviewed from time to time and found to be satisfactory. Recommendations from treaty consultative meetings are made widely available by publication in the *SCAR Bulletin*.

I would like to consider the international science programs in terms, more or less, of the SCAR working group structure. However, I will not cover all bases but rather touch on several of the programs that are of particularly broad interest.

ANTARCTIC MARINE ECOSYSTEM RESEARCH

The Antarctic continent covers about 14 million square kilometers, an area larger than the United States and Mexico. The ocean south of the Antarctic convergence is about 10 percent of the world oceans and contains the largest ocean current system. It has a dominant effect on global circulation and on ocean mixing. Within these waters and around the edges there are diverse and productive ecosystems that have fascinated explorers and scientists for a long time, and have

been subjected to severe exploitation. The southern ocean is a region having a physical and ecological coherence that requires study in its entirety if one is to comprehend the dynamics of its water movements and its populations. But the very size of the area imposes limitations on research. It is apparent that any realistic southern ocean field program cannot be truly comprehensive and must select topics and regions within which to carry out research.

The general concern with conservation has focused on marine mammals as a critical issue and especially on the whale species, which spend part of their lives feeding in the Antarctic. This concern for marine mammals overrides strictly economic evaluations and in turn is related to questions about commercial exploitation of the whale's main food source, krill. Looming behind these immediate issues is the potential exploitation of the mineral resources and the consequent need to define methods for environmental protection. A committee of SCAR (Zumberge, 1979) has reviewed this aspect and emphasized the need for more information on the ecosystem, particularly near the edge of the continental shelf. All of these factors contribute to the desire for more studies of the Antarctic marine ecosystem, but there is also the intrinsic fascination of this system as an object for basic research that can deepen and broaden our understanding of ocean biology.

The BIOMASS Program

In 1972, SCAR biologists became aware of a developing fishery for Antarctic krill (*Euphausia superba*) and of the need to improve understanding of the vital role of this organism within the circum-Antarctic marine ecosystem. After much preparatory discussion, and in collaboration with other international organizations, a conference was held in 1976 that outlined the main objectives for a long-term international research program, Biological Investigations of Marine Antarctic Systems and Stocks (BIOMASS). This is a program in which several nations have joined together to improve their knowledge of the southern ocean ecosystems and their living resources. It includes two peaks of collaborative multi-ship investigations. The first of these was the First International BIOMASS Experiment (FIBEX) in early 1981 in which 13 ships of 10 nations worked together in a coordinated program covering a large area of the Scotia Sea, the Drake Passage and parts of the Indian and Pacific sectors of the southern ocean. This was the largest multi-ship marine biological investigation ever mounted; it demanded intensive and extensive preparation and planning.

The obvious achievements of FIBEX included a more reliable estimate of total krill abundance than had been possible previously, and new information on krill biology, ecology, behavior, and distribution. The lessons learned in FIBEX were applied in planning the Second International BIOMASS Experiment (SIBEX) which began this past southern summer season (i.e., 1983/1984) and will continue next season (1984/1985). At present, 17 ships of 11 nations are committed to SIBEX.

Studies of the abundance, distribution, and production of krill and its relationships to the physical and chemical environment continue to be the central objectives of the BIOMASS program, but SIBEX is giving more emphasis than before to trophodynamics, particularly with regard to fish, squid, birds and mammals (seals and whales). Areas designated for concentrated study include: a) the

western approaches to the Antarctic Peninsula, Bransfield Strait, and the South Orkney Islands; b) an area of the East Wind Drift between longitude 60°E. and longitude 80°E. with special reference to Prydz Bay; and c) an area in the Pacific sector, about longitude 160°E.

One of the greatest problems facing the BIOMASS community is that of the optimum utilization of the data. There are no provisions within the World Data Center system for numerical handling of large quantities of marine biological data, and the problems are compounded by the fact that the questions needing to be answered require a totally interactive data system relating data on zooplankton (krill), fish, and mammals to the physical/chemical environment.

Of high priority, therefore, is the establishment of a permanent BIOMASS data center. An "ad hoc" group has been formed to draw up criteria for the data center and to evaluate various possibilities. Specifications will have to include means for linking the BIOMASS data center with other elements of the world marine-science data and information networks, including any data center established under the 1980 Convention for the Conservation of Antarctic Marine Living Resources (CCAMLR), to which I will return in a moment. It is necessary to keep the BIOMASS and CCAMLR centers separate, because the former will be concerned with a scientific program while the latter will be concerned primarily with fishing statistics and management. Of course, there will need to be, and there is planned to be, extensive interchange between the two.

Conservation Measures

At this point I would like to say something about conservation measures. Since the early days of their existence, SCAR and the consultative governments of the Antarctic Treaty have been conscious of the fragility of the Antarctic ecosystem and of the need for protective measures. On recommendations formulated by SCAR, national governmental representatives in 1964 adopted guidelines for the conservation of Antarctic flora and fauna, and designated a number of Specially Protected Areas (SPAs). These measures became effective in 1966, and new SPAs have been added since. In 1972 the governments adopted, again on the advice of SCAR, another concept — that of Sites of Special Scientific Interest. More recently, a summary of these and other measures was produced by the treaty consultative parties for the guidance of visitors (tourists), and SCAR prepared the text for a visitor's introduction to the Antarctic and its environment that has been issued in three different languages by several national organizations. The existing conservation measures are reviewed periodically and SCAR is at present urging the designation of new sites to ensure that representative components of all ecosystems, as classified by SCAR in 1976, are afforded appropriate protective designation. SCAR is now in the process of compiling an annotated *Atlas of Antarctic Protected Areas* and preparing specific recommendations for the establishment of new sites.

Marine Conservation Conventions

With the specter of the disastrous decline of whales in mind and the possibilities of commercial fisheries for other species developing, the treaty governments have adopted two conventions on living marine resources. The first, the impetus for which came from SCAR, was the Convention for the Conservation of Antarctic Seals, adopted in 1972. Under the convention, SCAR is formally designated to undertake specific tasks with regard to data assessment and the provision of scientific advice. The Scientific Committee for Antarctic Research periodically compiles and publishes statistics on seals killed or captured. To date there has been no development of commercial sealing, but to meet its responsibilities under the convention, SCAR is ready to convene its Group of Specialists on Seals and take action, at short notice, should the need arise.

Of more wide-ranging significance is the 1980 CCAMLR about which we will hear a great deal more tomorrow morning. The Scientific Committee for Antarctic Research has no formal advisory role under this convention, but Article XXIII of the convention does state that "The Commission and the Scientific Committee shall seek to develop working relationships, as appropriate, with intergovernmental and non-governmental organizations which could contribute to their work, including SCAR, SCOR, and the International Whaling Commission (IWC)." The BIOMASS program is at the present time the main generator of scientific data which, supplemented by catch statistics from commercial operators, will be of value to the Commission's Scientific Committee. In September 1983, the Commission's Scientific Committee agreed to seek advice from appropriate SCAR groups on the use of birds and seals in monitoring the status of other species in the ecosystem. The commission undertook to finance the publication of a review of the Antarctic marine ecosystem that is now being prepared by the Group of Specialists on Southern Ocean Ecosystems and their Living Resources.

CONSIDERATIONS IN ARCTIC AND ANTARCTIC BIOMEDICAL RESEARCH

For human biology, field experiments in the Antarctic represent controlled studies with a selected, transient population, which is almost entirely white, male, and adult. The types of people who go to the Antarctic and their way of life there can be compared to astronauts in orbit. Biomedical research on persons in Antarctica can take into consideration such factors as the careful medical selection and screening of personnel who "winter-over" in the Antarctic. Comparative studies of the Arctic and Antarctic can help to differentiate between environmental changes resulting from "natural" variations (i.e. in the Antarctic) and those that result from human occupation and the application of technology (i.e. in the Arctic).

In the Antarctic, social and psychological data on the dynamics of isolated small groups continue to be useful and indicate the need for more sophisticated studies that include biological factors as well as the traditional psychosocial factors. Further, in the Antarctic, special ergonomic studies might indicate the extreme limits for human performance under climatic duress. Variations in strength,

performance time, heat exchange, accuracy of labor, and endurance could be investigated in this environment in a way that would not be possible elsewhere. An interesting experiment of this type, the International Biomedical Expedition to the Antarctic (IBEA) was completed in 1980-1981. The IBEA's research program was multidisciplinary, with projects in physiology, biochemistry, microbiology, immunology, psychology and behavioral adaptation, sleep, and epidemiology.

CLIMATIC VARIABILITY

The Antarctic region constitutes the strongest cooling center of the global system. As such it plays a critical but as yet poorly understood role in forcing the circulation of the atmosphere and the ocean and, therefore, in global climatic variability. Climatic variations in the Antarctic region also have a direct effect on the environmental feasibility of resource extraction, both on the continent and in the surrounding seas, and they play a major role in the global impact of such anthropogenic factors as carbon dioxide release. Improved understanding of climatic variability requires study not only of the atmosphere and ocean but also of ice on land and sea. In addition, the accumulation on Antarctica of snow from past ages provides a unique and detailed record of past climatic variations and atmospheric composition.

With the launching of the World Climate Research Program (WCRP) in 1980, SCAR realized that there was a need to identify what contributions Antarctic science could make to this global program. A SCAR group of specialists was charged with producing a report on *Antarctic Climate Research*, which appeared in November 1983. This report reviews the main areas in which research in the Antarctic could contribute to WCRP, identifies some deficiencies in data availability and understanding, assesses what contributions could be made by ongoing and planned activities, and advises on program priorities.

The WCRP itself is a broadly-based international program that includes:

1. The study of specific atmospheric, glaciological, oceanic, and land surface (including hydrologic) processes;
2. The development, evaluation, and use of climate models; and
3. Climate diagnostics, observational studies, and specification of data requirements.

The WCRP is focussed primarily on periods ranging from months to decades. The Antarctic regions exert a significant influence on these time scales through sea ice processes and the formation of Antarctic water masses. In addition, longer-term climatic trends and processes can be deduced from changes in the ice sheet topography, from the unique environmental record sealed in the ice, and from ice sheet model simulations.

An Antarctic contribution to WCRP should, therefore, include extensive and intensive studies of basic physical processes, of the mass balance of the Antarctic ice sheet and the ice core record of past climatic states, of sea ice formation and

decay, and of the formation of Antarctic intermediate and bottom-water masses which influence climate on time scales from decades to centuries. The knowledge and data gained from such work will have their own intrinsic value, and, when incorporated in models of the atmosphere and the ocean, will improve their ability to simulate the global climate and climate variations on time scales ranging from the seasonal to the interglacial.

Sea Ice

One of the more difficult areas for promoting research needed for studies of global climate is in the Antarctic pack ice zone. Although much information on sea ice variability will be possible from satellite measurements, this technique will not provide data on the structure and dynamics of the sea ice nor on its interaction with the water and the atmosphere. Also there is a need for biological data from this zone — the BIOMASS program has recently established a working group to specify these requirements. Although needed research in physical and biological sciences is being identified, the difficulties in mounting observational programs remain immense because of the logistic problems of working in this area, especially in winter. The Scientific Committee for Antarctic Research has therefore established, with the collaboration of SCOR, a new Group of Specialists on Antarctic Sea Ice to look into the practicalities of initiating the required studies. In the longer-term this may well require an imaginative approach to the development of new observational techniques.

The Ice Sheet

As for the main continental ice sheet, research over the past three decades has shown that it constitutes around 70 percent of the fresh water resources of the earth. If it all melted, sea level would rise by some 60m; a rise of only 6m of sea level due to disappearance of 10 percent of the Antarctic ice, for example all the ice above sea level in West Antarctica, would have drastic consequences for most of the inhabited coastal areas of the world.

Because of its size, the ice sheet is of importance to any studies of the global hydrologic cycle and to changes of world climate. The relatively slow turnover of ice (the annual snowfall is less than one part in ten thousand of the total volume of ice) suggests that the ice sheet may exert a stabilizing influence on climate. However, the stability of the ice sheet itself is not well understood. To forecast the effect of any global warming of climate on the Antarctic ice sheet requires improved knowledge of factors controlling the flow and melting of the ice sheet. Such studies are made by advanced techniques of radar sounding, satellite remote sensing, and drilling to obtain ice cores that record atmospheric conditions over the past 250,000 years.

UPPER ATMOSPHERE AND NEAR-EARTH SPACE

The upper atmosphere at high latitudes has rightly been called "earth's window to outer space." Many geophysical effects displayed there are direct manifestations of phenomena occurring in deep space that thus become available to "remote sensing" through this window in the polar regions. Even the deep-space medium itself — solar-wind plasma — enters in the form of a narrow beam through this window to interact with the upper atmosphere at high latitude in the so-called "cusp" regions. The polar regions of the earth are thus important areas for the study of space and its effects on our environment.

The reason for this circumstance is that a vast portion of the earth's magnetic-field envelop, or magnetosphere, is electrically connected to the polar regions. Processes occurring in the outer reaches of the magnetosphere often map back to the earth along magnetic field lines, which converge as they approach the earth at high latitudes. This geometry results in a spatial focusing action of magnetospheric disturbance, with the consequence that effects associated with extended regions of the magnetosphere can, in many cases, be sampled in narrow latitudinal intervals at low altitudes. These effects can be readily observed in terms of motions of atmospheric ions, electrons, and neutral gas, selective optical and x-ray emissions, magnetic perturbations, temperature changes, variations in the spatial distributions of plasma, radio emissions, and the onset of plasma turbulence. The aurora is the most conspicuous (and magnificent) high-latitude manifestation of magnetospheric activity. Caused by optical emissions from atoms excited by energetic electrons and ions precipitating from the magnetosphere, the aurora is a "live TV show" of energy-conversion processes occurring far out in space.

Far from being a passive energy absorber, however, the high-latitude ionosphere exerts an important feedback action on the magnetospheric and atmospheric regions to which it is linked, acting as an energy and momentum modulator, as a source of particles, and as a source of important perturbations to the underlying neutral atmosphere. There are many features of mid-latitude upper-atmosphere behavior whose origin can be traced to high-latitude processes.

The long-term practical goals of high-latitude studies are first to understand how matter and energy from the sun enter the terrestrial outer environment and are deposited in the atmosphere, and then to learn how the associated perturbations propagate to and affect lower latitudes and the planetary surface. This understanding, in turn, can be expected to lead to more reliable prediction and possible alleviation of the effects of space disturbances on some human technologies, such as communications systems and power transmission, and, perhaps, prediction of certain variations in climate.

Many of the effects associated with disturbances in space can be studied in either or both of the two polar regions. Most of these studies can be conducted more cost-effectively in the northern polar regions, but some require simultaneous measurements in the south. In addition, Antarctica offers unique observational opportunities, some related to the geographic asymmetry of the internal magnetic field of the earth and some to local conditions, such as the low electromagnetic

noise background, the generally good atmospheric viewing conditions, the extensive, thick ice sheet of nearly uniform dielectric properties, and the absence of national boundaries.

Antarctic studies have for many years contributed to the global programs of the Scientific Committee on Solar Terrestrial Physics (SCOSTEP) and have been closely linked with the International Association of Geomagnetism and Aeronomy (IAGA) Interdivisional Commission on Antarctic Research. Also, partly because of the inadequacy of satellite coverage for Antarctic ionospheric and magnetospheric studies and partly because of the value of remote sensing in studies of the atmosphere, ice sheets, sea ice and some aspects of marine biology, SCAR has sought a closer liaison with the Committee on Space Research (COSPAR). Other aspects of international collaboration and joint activities are being pursued by the SCAR Working Group on Upper Atmosphere Physics.

GEODYNAMIC, STRATIGRAPHIC, AND GLACIAL HISTORY OF ANTARCTICA

The Antarctic continent is unique in its relationship to the geographic and geomagnetic poles and in its ice cover. Whereas the Arctic is an ocean largely covered by ice and surrounded by land, the south polar regions consist of an isolated continent surrounded by ocean; the evolution of the Southern Hemisphere, leading to the present physical isolation of Antarctica, relates directly to the development of the present oceanographic circulation and marked climatic contrasts of the earth. Furthermore, the Antarctic continent and surrounding ocean basin, which together constitute the Antarctic plate, are an integral part of the geodynamic setting of the earth and contain information essential and possibly even key to understanding its evolution.

The principal objectives of geological and solid-earth-geophysical research in Antarctica are to determine the role of the south polar regions in global geodynamics, to understand the evolutionary history of the endemic biota of the continent and surrounding seas, to understand the role of the continent and its ice cover in the inception of the present ice age and its fluctuations, and to understand the role of Antarctica in the evolution of the present ocean circulation.

Recently, there has been increasing activity in marine geology and geophysics in the southern ocean, and it has become apparent that there is a need for a SCAR mechanism to coordinate and stimulate plans to these fields. The two earth science working groups of SCAR (Geology and Solid Earth Geophysics) are jointly formulating a proposal to SCAR for the establishment of a SCAR group of specialists, which will probably propose initial concentration on continental margin studies. The results of this activity are likely to be of value not only in contributing to the solution of interesting scientific problems of the history of the Antarctic plate, but also in relation to future assessment of the mineral potential of the region.

POSSIBLE ENVIRONMENTAL EFFECTS OF MINERAL EXPLORATION AND EXPLOITATION IN ANTARCTICA

As pointed out by this morning's speakers, the framers of the Antarctic Treaty were mute on the question of potential mineral resources in Antarctica. It was only a decade-and-a-half later that the Antarctic treaty nations began to face seriously the possibility of exploration for, and eventual exploitation of, Antarctic mineral resources.

Then the 12 original signatories of the Antarctic Treaty decided at their Eighth Consultative Meeting in Oslo in 1975 to ask SCAR to assess the possible impact of exploration and exploitation on the Antarctic environment, if it were to occur there. In response, the SCAR Secretariat prepared a short paper entitled "Antarctic Resources — Effects of Mineral Exploration" to which was appended a statement by the SCAR Working Group on Geology entitled "Mineral Occurrences and Mineral Exploration in the Antarctic." Both were submitted to the special preparatory meeting for the Ninth Antarctic Treaty Consultative Meeting, held in Paris during the summer of 1976. That meeting requested SCAR to undertake a more detailed assessment of the environmental impact of possible mineral exploration and exploitation in Antarctica. Consequently, SCAR, in 1976, authorized the establishment of a group of specialists for that purpose.

Their report, entitled *Possible Environmental Effects of Mineral Exploration and Exploitation in Antarctica*, was produced in 1977 and published by SCAR in 1979. Following this, the consultative parties again sought advice from SCAR on the possibilities for retrieving and analyzing relevant information from past and ongoing research, identifying new programs that would be required for furthering the assessment of possible environmental consequences, and on how to assess baseline levels of hydrocarbons in the Antarctic marine environment. The Scientific Committee for Antarctic Research's response to this was carefully compiled by a specialist group working over a period of two years and was submitted, through national committees, to a special meeting of government representatives last July (1983). More on all that tomorrow.

That completes my presentation — hardly comprehensive, but I hope inclusive enough to give you the feeling of the broad scope, and wide importance to the populated world, of the international science programs in Antarctica.

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CHAPTER 4

United States Antarctic Program

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It is with some reservations that I agreed to make this presentation. While my association with the U.S. program covers some 25-year period, it has been seven years since I was intimately involved with the inner workings of the United States Antarctic Program (USAP), and my present role is that of an observer supporter and sometimes critic of the USAP. My involvement as a member of the Polar Research Board and as a participant in the Treaty Consultative and Special Consultative meetings plus my return to Antarctica as a member of a geological field party in 1979-1980 have allowed me to stay somewhat current on the state of affairs as they relate to the trials and tribulations, successes and failures, and history of the USAP.

As I began to think about what I might say to you today, it became clear to me that it would be impossible, probably unnecessary, and certainly presumptuous for me to tell you about the current science programs funded by the National Science Foundation (NSF). As you are aware there are published summaries of current research available in a variety of forms. *The Antarctic Journal of the United States*, reports to the Scientific Committee on Antarctic Research (SCAR) and to the treaty, press releases, and articles published in scientific and popular journals and magazines, all provide the details of the individual research activities funded by NSF. As I contemplated what I might say that would be most useful, I came to the conclusion that my contribution might focus on the history of the USAP, the internal and external policies and forces at work that have helped mold the program, and the changes that have led to the present profile. I will attempt to be objective, and, when I lapse into subjections or editorial comment, I will try to remember to indicate that I have done so.

HISTORY OF THE UNITED STATES ANTARCTIC PROGRAM

With that as background, let me read to you from the White House Memorandum of February 5, 1982, signed by President Reagan, with regard to USAP and the United States Antarctic policy.

> I have reviewed the Antarctic Policy group study of the United States interests in Antarctica and related policy and program considerations as forwarded by the Department of State on November 13, 1981, and have decided that the United States Antarctic Program shall be maintained at a level providing an active and influential presence in Antarctica designed to support the range of U.S. Antarctic interests. This presence shall include the conduct of scientific activities and major disciplines, year-round occupation of the South Pole and two coastal stations, and availability of related, necessary logistic support. Every effort shall be made to manage the program in a manner that maximizes cost effectiveness and the return on investment.

That is the United States Antarctic Policy as it exists today.

The Beginnings of U.S. Interest

First, let us look at ancient history. Official U.S. Government involvement in Antarctic research apparently began with the Wilkes voyage in 1838-1842. The events that surrounded that cruise are reported elsewhere. It was almost 90 years later that the first Byrd expedition took place in 1928 to 1930. In the thirties, the second Byrd expedition (1933-1935) and the Lincoln Ellsworth Expedition took place. In 1939-1941 the U.S. Antarctic Service Expedition, led by Admiral Byrd, was conducted. It was during this period, 1928-1941, that airplanes, radios (with communication back to the United States), snowmobiles, and aerial photography, were introduced into the Antarctic.

Increased Interest Following World War II

Following World War II, Operation Highjump, the single largest expedition to Antarctica, took place in 1946-1947, followed by Operation Windmill in 1947-1948. At the same time, Finne Ronne led the Ronne Antarctic Research Expedition (1947-1948) and the first woman wintered over in Antarctica.

THE INTERNATIONAL GEOPHYSICAL YEAR

These operations were followed by a period of quiet on the part of the U.S. and it was not until the discussions began about a Third Polar Year, what we know as the International Geophysical Year (IGY), that official U.S. government involvement in Antarctic affairs resurfaced. In 1953, the National Science Board endorsed the concept of a third IGY and the National Research Council recommended that NSF administer the program. Congress appropriated funds and specified that NSF was to be the focal point for coordination of all government agencies involved in IGY activities.

The entry of the USSR into IGY appears to have caught the attention of both Congress and the Department of the Defense (DOD), and it may well be that the

increase in the size of the U.S. IGY program was a result of that Soviet influence. At any rate, the three planned U.S. stations (Little America, Byrd, and South Pole) suddenly grew to six with the addition of stations at Cape Adare (Hallett Station), on the Weddell Sea (Ellsworth Station), and on the Knox coast (Wilkes Station).

The National Science Foundation was to administer the science, the Department of the Navy was to provide the logistics support and run the operation. The agreement between Larry Gound and Admiral Dufek to "stay out of each others hair" set the stage for the next fifteen years of the USAP. In 1955 the Navy, under the flag of Deep Freeze I, set out to begin building the stations. The details of the IGY operation in Antarctica are reported in detail elsewhere. Let me simply say that the IGY was the starting point for many of the people whose names are associated with Antarctic science today.

INTEREST IN ANTARCTICA FOLLOWING THE IGY

The first indication of a continued U.S. program following the IGY surfaced in January, 1958, and in 1959 the decision was made and supported by the Congress that NSF should "bear full responsibility for the formulation and coordination of the total U.S. Antarctic Program with the DOD supplying logistics and having primary responsibility for carrying out the Antarctic operation as planned."

During the period from 1953-1958, the U.S. National Committee for the IGY, a National Academy of Science committee, had outlined research programs and selected scientists who were funded by NSF. There was no Antarctic staff at NSF during this period. In 1958 when the decision was made to continue operation in the Antarctic, Dr. T. O. Jones was appointed Antarctic Program Director under the Office of Special International programs in NSF. By 1960 the staff had grown to seven professionals, including George Tony, Mort Turner, Phil Smith, Ken Moulton, and Henry Francis. The chief Scientist was Bert Crary.

SCIENTIFIC COMMUNITY ACTIVITIES

Within the scientific community, parallel actions were taking place. In 1958 the National Academy of Sciences established the Committee on Polar Research, headed by Dr. Larry Gould, as a follow on to the IGY committee. At about this same time, SCAR was established and became a member of the International Council of Scientific Unions (ICSU) and the Committee on Polar Research (CPR) became the U.S. National Committee for SCAR.

In December, 1958, a conference was held at Dartmouth College to consider "the organization of polar research in the United States." The Committee on Polar Research met at Dartmouth at the same time and apparently participated in the discussions. Out of those meetings came two possible models. One was the concept of a polar institute, possibly along the lines of the Arctic and Antarctic Research Institute of the USSR in Leningrad. The second, proposed by CPR, was a model similar to what we know as the University Corporation for Atmospheric

Research (UCAR), and its operating unit, the National Center for Atmospheric Research (NCAR). The first model was government operated, the second was university operated.

In 1959 a committee entitled the University Committee on Polar Research was appointed by CPR to further consider the organization of U.S. polar research. The committee report, published in 1961, spoke to manpower and funding needs, the need for reliable logistics, but recommended "that no single or monolithic center or institute be established by either the Federal Government or by a group of academic institutions." The recommendation was also made that NSF fund Arctic research as part of the regular disciplinary funding and not as a special activity similar to Antarctic science funding. Finally, it was recommended that an Association of Universities for Polar Research be established as an advisory group.

That report certainly has had a continuing impact on the management of polar science and the relationships between NSF and the academic community. The U.S. does not have a single focused government operated polar research institute but rather funds research through universities or other agencies of the government.

THE EVOLUTION OF USAP

The NSF established the Office of Antarctic Programs in 1961. In 1963 it became part of the International Activities Division, and in 1965 it joined the newly formed Division of Environmental Sciences.

During most of the 1960s the USAP operated under a document known as A-51, A Budget Bureau document that provided for a complex management structure. The science plans were set and funded by NSF, but the Navy ran the operation in Antarctica. An admiral headed the operation, and there were detachments located in Washington, D.C., Quonset Point, R.I., Norfolk, VA., and Mayport, Florida, as well as in Christchurch, and in Antarctica. Station support and all operations were Navy matters. The bases of the USAP leaders who had to negotiate for science support from the Navy almost on a daily basis. As I look back on those years, I am amazed that so much was accomplished under such a difficult managerial model.

During most of the 1960s the ski equipped LC-130 aircraft was introduced into the Antarctic logistic operation, tubrine powered helicopters were used to support togographic and geologic field parties, air photos were taken by the thousands, new mountains were discovered almost daily, reasonably accurate maps began to appear, and a planning process began. It was also during this period that the first scientist was killed while engaged in field work in Antarctica.

Before returning to the discussion of the relationship between the various agencies within the U.S. government, let me remind you of the action on the international scene. You are aware that the IGY was conducted during the depth of the "cold war" between the U.S. and the USSR. Despite this, it was during the late 1950s that the Antarctic Treaty was negotiated. Signed in 1959 and entered into force in 1960, the treaty brought the 12 original signators together in a unique relationship that continues today.

U.S. policy and objectives in Antarctica were the subject of executive branch review as early as 1948 following Operations High Jump and Windmill. Further reviews were conducted in 1954, 1957, 1958, and 1960, most certainly as a part of the consideration first of participation in IGY and then as part of the negotiation, signing, and ratification of the Antarctic Treaty.

In the Congress similar discussions were taking place. References during the 1950s and early 1960s indicate Congressional discussions and actions relating to funding of the IGY, creation of the Antarctic Survey Medal, and finally ratification of the Antarctic Treaty. In 1960 and 1961 there was consideration of bills proposing DOD as the executive agency responsible for supervising Antarctic Affairs. I believe it was as a part of these discussions that the proposal was made to create a Richard E. Byrd Antarctic Commission, an agency that would have conducted the U.S. program in Antarctica.

In 1960 executive branch review established the NSF/DOD management relationship that prevailed until the early 1970s; NSF was funded for science, DOD for logistics. An annual planning cycle was initiated and projections to a longer term became part of this cycle.

In 1965 the Antarctic Policy Group (APG) was established. About the same time the impact on the Planning Programming Budgetary System (PPBS) led to the first five-year plan that was approved in 1966 by the APG.

In the late 1960s the DOD involvement in funding the logistic support came under scrutiny in Congress. If my memory serves me correctly the so-called Mansfield amendment to an appropriations bill required the DOD to get out of all but the defense business. As a result, the logistic support for USAP once again came under review.

In 1970 OMB Circular A51-Revised appeared, another Executive Branch review took place, and National Security Decision Memorandum 71 (NSDM 71) appeared. What A51-Revised said was that NSF was to be the lead agency in Antarctica and that it would fund the U.S. program. The DOD was to provide the necessary logistics support "on a mutually acceptable reimbursement or non-reimbursement basis." The Department of Transportation (DOT) was to fund icebreakers through fiscal 72 and then reach an agreement with NSF on reimbursement. The Department of State (DOS) was responsible for foreign policy and legal issues. The APG was to be chaired by DOS and the named members were NSF and DOD plus "other agencies who may be invited to participate on an ad hoc basis."

The Department of Defense presented NSF with the first of many lists of activities that were to be transferred to NSF for funding. The NSF in turn began the process of reducing the size of the DOD detachments. The Admiral was replaced by a Captain, the number of detachments was reduced, all Navy support activities were headquartered in California, and the funding of all this became a problem at NSF. Negotiation of a "Memorandum of Agreement" between NSF and DOD began, but it was years before this document was finally signed.

In the scientific community, the CPR published a volume in 1970 entitled *Polar Research*. This was an attempt to summarize the state of knowledge of both Antarctic and Arctic science and to suggest areas where additional research would be most valuable.

In the summer of 1971 Joe Fletcher became the Head of the Office of Polar Programs. The impending budget crisis led him to ask the Committee on Polar Research to review the scientific objectives of the Antarctic Research Program and to make recommendations concerning how to maintain a viable program in the face of the budget crisis. The result was a letter report from CPR that made some rather dramatic recommendations. Among these were that the research vessel *Eltanin* be tied up for several years. A ten-year program was laid out with input from the various disciplinary panels of CPR that existed at that time. These panel reports built on the work done for the *Polar Research* volume and led to a series of small reports that proposed research activities for the 1973-1983 period.

The Office of Polar Programs and DOD continued their budgeting battle with OMB in the middle. A transfer of funding responsibility continued, and military people were assigned to Polar Programs to assist with coordination between NSF and DOD. In 1973 funds were sought by NSF to procure three LC-130s and at the same time DOT sought funds for two new icebreakers. The National Science Foundation did not provide active support to the DOT's request for funding of the icebreakers. That decision haunts us today as the icebreakers were designed and built with little or no input from the scientific community who would later use them as research platforms.

More and more activities were being undertaken; Palmer Station was built and the research vessel *Hero* was put into operation. A new South Pole Station was established, Byrd Station was closed, and Siple Station became a major logistic effort.

In 1975 another budget crunch hit NSF, largely due to the inability of NSF and DOD to agree on who would pay for what. The Department of Defense took about $3 million out of their budget, NSF did not include in in their, and OMB left it out of both budgets.

The result was another Executive Branch review, another NSDM, NSDM 318, and a greatly increased NSF budget including funding for the new LC-130s. By this time *Eltanin* was being operated by the Argentine Navy with support from NSF, the Dry Valley Drilling Project (DVDP) was underway, and the Ross Ice Shelf Project (RISP) was getting started.

The policy statement issued contained within NSDM 318 made it clear to all that funding was NSF's responsibility, that the program was to be managed as a single package, that civilian contractors should be used where cost effective, and that DOD and DOT were to maintain the capability to support the U.S. program.

Of considerable importance to the program was the line that said funds made available to NSF for Antarctics were not to be utilized for other purposes. It further acknowledged that these assignments went well beyond the normal NSF role in other areas. This policy directive clearly placed the burden on NSF, a burden they really did not want to accept. Nevertheless, NSF was and is the single agency responsible for funding and managing the entire U.S. program.

Meanwhile other actions were taking place. In late 1969 in a letter to NSF the then Vice President of the United States designated NSF as the lead agency for the International Decade of Ocean Exploration (IDOE). The letter also called upon NSF to take the lead in the expansion of Arctic research. This led to a name

change to the Office of Polar Programs, for the first time an Arctic line item appeared in the NSF budget (remember back to the recommendations in 1961 from the COPR Committee), the Interagency Arctic Research Coordination Committee was formed with NSF in the chair, and the question of using Antarctic logistic support for Arctic operations became an issue.

Let us now look at another series of events. In early 1970 the planning for an Antarctic leg of the *Glomar Challenger* cruises began, and in 1973 the first holes for scientific information were drilled in the Ross Sea. The presence of hydrocarbons in one of the holes led to some fairly wild speculations. and in 1974 a much quoted but poorly supported, statement was made in the press that west Antarctica had an estimated petroleum reserve of 45 billion barrels of oil and over 100 trillion cubic feet of gas. This statement was made in the midst of the first U.S. gasoline shortage and was given wide coverage by the press. Unfortunately, these figures continue to be quoted despite the attempts by all to cite more recent.

A SWITCH TO RESOURCE ISSUES AND COOPERATIVE WORK

In the Antarctic Treaty venue things were heating up also. The treaty is silent on resource issues, and during the first decade of the treaty these issues were not discussed. The treaty meetings dealt with other issues, and during this period the Agreed Measures for the Conservation of Antarctic Fauna and Flora and the Convention for the Conservation of Antarctic Seals were the major items that resulted from treaty meetings.

In the early 1970s the resources issue came to the fore and delegates began to talk openly about these issues. By the mid-1970s the resources issue led to the Special Consultative Meeting in Paris, and a call to SCAR to look ar mineral resource issues. At the Paris meeting the U.S. offered to host a meeting on living resources, later held at Woods Hole Oceanographic Institute. From the meeting came the Biological Investigations of Marine Antarctic Systems and Stocks (BIOMASS) on the science side, and increased pressure on the treaty side to find some resolution for the marine living resources issue. The 9th Consultative Meeting in London was marked by a major discussion of the minerals issue (the Holdgate Report), but the marine living resource issue was selected as the resource issue to be resolved first.

These events had an influence on the state of affairs in the U.S. The APG, through its operating arm known as the Interagency Antarctic Group suddenly flourished. Where previously other agencies had stayed away from meetings, suddenly they had a reason to attend. The resource issues brought Commerce, Interior, CEO, EPA, Energy, to the table, and suddenly the quiet of the APG was broken by advocates from both sides of these issues. Personnel changes at both NSF and the State led to a somewhat different relationship between those agencies within in the APG, and the diminished role of DOD became quite apparent.

On the science side other things were happening. Whereas during the sixties the single largest projects had been the *Eltanin* cruises, first as joint geology-biology-oceanography cruises and then as separate discipline cruises, the on-land,

science had largely been single project oriented. Large complex research projects began to be proposed and funded. In the Arctic the Tundra Biome, Man in the Arctic, Arctic Ice Dynamic Joint Experiment (AIDJEX) and the Greenland Ice Sheet Project (GISP) appeared. About this time the Outer Continental Shelf (OCS) activity began under NOAA's Environmental Research Laboratory.

In the Antarctic, the Dry Valley Drilling Project (DVDP), the International Southern Ocean Survey (ISOS), the Ross Ice Shelf Project (RISP), the need to build a new Siple Station, and the desire to complete the circumpolar survey by *Eltanin*, (now ISLAS ORCADOS) caused some serious rethinking within NSF/DPP. Of particular concern was the long standing policy of equally funding for the various disciplines. Second was the question of how to deal with projects that involved several disciplines and, therefore, several program managers and slices of the DPP budget. Funding of RISP involving several disciplines and countries was no easy task.

The matter of Environmental Impact Statements (EIS) for the large projects emerged. The first EISs were done for DVDP and RISP. Work began on the EIS for the entire U.S. program.

All of these issues were ultimately resolved and "Big Science," often involving international components, was underway. Large field party earth-science programs began to appear in the alternate or every third year and this became the *modus operandi*. (For example, the large camp in the Ellsworth Mountains, the large camps on the Marie Byrd Land Coast, and more recently the large camp in North Victoria Land.)

In the Antarctic Peninsula area, the logistics effort shifted to a cooperative effort with the U.K., Chile, and Argentina to effect the annual resupply of Palmer Station and to aid in the removal of salvage material. South Pole and Siple Station became civilianized, contractor responsibilities increased, and a long-range planning effort for McMurdo Station, William Field, etc., was completed.

As the DPP budget continued to grow, NSF and the National Science Board became nervous about the size of the budget. Congress and OMB began to ask pressing questions about USAP. A high rate of inflation coupled with sky-rocketing fuel costs made the logistics side of the budget grow at an ever-increasing rate. Resource issues led other federal agencies to increase pressure on NSF to carry out resource assessment programs. The budget pressures on all agencies in the federal government led DOT (Coast Guard) to suggest that NSF assume the funding for all costs of the icebreakers while they were a deployment to an Antarctic project.

In the early 1980s another Executive Branch review, encouraged by OMB and the Office of the Science Advisor to the President was undertaken. This review, carried out under the APG, involved much greater involvement of other federal agencies (i.e., DOI, Marine Mammal Commission, Commerce, Treasury, etc.). And in 1982 another "Presidential Decision" was handed down. This was not in the form of a NSDM but rather was a White House Memorandum — the document quoted earlier in this chapter.

During the APG review process, NSF asked the Polar Research Board (PRB) to review the conduct of Antarctic Science. The PRB responded with a document entitled "Research Emphasis for the U.S. Antarctic Program," a statement of

prioritized research projects recommended for funding by NSF to maximize the impact of Antarctic science.

The Treaty Nations completed negotiations on living marine resources with the signing and entering into force of the Convention for the Conservation of Antarctic Marine Living Resources (CCAMRL). The decision was made to remove the minerals question from the agenda of regular Treaty Consultative Meetings and to consider this issue in a series of Special Consultative Meetings, the most recent held in Tokyo in late May, 1984. I would note that the development of U.S. positions for treaty meetings now includes much greater involvement of all federal agencies than in the early years.

During the past year there has been an initiative in the U.N. to consider "the question of Antarctica," and governments and other agencies around the world have been asked to provide input and comment on the Antarctic Treaty System.

U.S. ANTARCTIC PROGRAM TODAY

Today, the National Science Foundation is budgeted for and manages the entire United States national program as a single package. It funds university research and federal agency programs related to Antarctica, draws upon logistic support capabilities of government agencies on a cost reimbursible basis, and uses commercial support management where possible. Other agencies may, however, fund and undertake directed short-term programs of scientific activity related to Antarctica upon the recommendation of the Antarctic Policy Group and subject to a budgetary review process. Such activities must be coordinated within the framework of the NSF logistics support.

The U.S.G.S. recently carried out a geophysical cruise in the area south of Australia and in the Ross Sea, and was the first agency to exercise the option stated in President Reagan's White House memorandum. To ensure that the United States has the necessary flexibility, DOD or DOT are tasked to maintain the capability to support the program.

THE DEVELOPMENT OF U.S. ANTARCTIC SCIENCE POLICY

How does Antarctic science policy develop within the United States? It seems to me that it develops every time there is a budget crisis. The result has been that from an office in NSF that originally handled pass-through money to grantees selected by another group, the DPP has evolved into the manager of a program with an FY '85 budget of $115 million. Of that amount, $11 million is for direct science support and the remainder is for logistics.

THE EFFECTIVENESS OF U.S. PROGRAMS AND POLICY

What about the effectiveness of the USARP and the effectiveness of the policy? I sincerely believe that the scientific accomplishments have justified both their

existence and expense. The overall science and scientists are probably no better or no worse than those funded by other offices within NSF or those funded by other federal agencies. Science has been carried out under the most difficult conditions without the dollars available to buy success that has been characteristic of some projects funded by other agencies in other areas. I believe that time will judge U.S. science results to the best done in Antarctica and the equal of the science accomplished by non-polar scientists anywhere else in the world.

Now let me ask the question another way, and that is: Has the program met the objectives of U.S. interests in the Antarctic? I believe that the answer is yes. Let me ask a third question: Could we have done better? Yes, I believe we could have, but all can be proud of what has been accomplished.

LOOKING TOWARD THE FUTURE

What the future holds for Antarctic Sscience Policy as for the USAP, I cannot say. Policy issues will continue to be debated with the APG. There will continue to be budget pressures. The advocates of more directed or applied research as opposed to the more basic research funded by NSF will continue to seek policy changes. Those who question the appropriateness of having NSF as the responsible agency for the entire U.S. program undoubtedly will argue the case for a different management and funding scheme. The international scene, debates about mineral resources and changes in technology will all influence future policy decisions.

I am convinced, however, that history will show that NSF has carried out the policy directiveness to the best of its ability. Whether the policy itself has been the best possible is another question. My closing admonition to the NSF is to take a stronger leadership role in the development of the policy they are directed to carry out. Without such active involvement, I fear the policies will be unduly influenced by the marginal players in the policy game in Washington, D.C.

CHAPTER 5

Antarctic Science Programs

National Oceanic and Atmospheric Administration's Antarctic Activities

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INTRODUCTION

The National Oceanic and Atmospheric Administration (NOAA) carries out a variety of scientific research activities in support of its mission in the area covered by the Antarctic Treaty and in adjacent areas of the southern ocean. Some of this work is primarily of near-term importance for the rational management of Antarctica's resources — such as living resources research — and some of it has longer-term applicability and broader, global, significance — such as the work done at the South Pole Global Atmospheric Monitoring Station, which is part of a four-station worldwide network.

In addition to scientific research, NOAA provides certain services to those operating on and around the continent. For example, the Department of the Navy/NOAA Joint Ice Center (JIC) provides general area ice forecasts and has been called upon in recent years to provide increased direct ship support for scientific research and commercial vessels.

Drawing on its experiences in the management of marine living resources, as well as its extensive program of environmental assessment work in support of the U.S. Alaskan Outer Continental Shelf leasing program, NOAA expects over the next few years to contribute to the design and implementation of research programs connected with living and non-living resource activities in Antarctica.

In short, NOAA's Antarctic activities may be divided into three categories: a) research related to resource management; b) more basic research of longer-term applicability; and c) services.

RESOURCE MANAGEMENT-RELATED RESEARCH

The National Oceanic and Atmospheric Administration has conducted living resource research in cooperation with the internationally-funded Biological Investigations of the Marine Antarctic Systems and Stocks (BIOMASS) program set up under the auspices of the Scientific Committee for Antarctic Research (SCAR) and Scientific Committee for Oceanic Research (SCOR).

During the First International BIOMASS Experiment (FIBEX) in 1980-1981, NOAA funded and participated in a research project using acoustic techniques to survey krill populations. This work was supplemented by the participation of National Marine Fisheries Service scientists in the Second International BIOMASS Experiment (SIBEX)-Phase I during the recently completed austral summer. National Oceanic and Atmospheric Administration scientists aboard the *R/V Melville* and a Coast Guard ice breaker studied krill abundance and ocean circulation features in the immediate vicinity of the ice front, and identified schools of offshore krill.

The National Oceanic and Atmospheric Administration is currently planning to participate in SIBEX-Phase II as well as for a longer-term program. Should legislation implementing the Convention on the Conservation of Marine Living Resources (CCAMLR) be enacted in its present form, NOAA will be required by law (as primary U.S. government agency for implementation of CCAMLR) to design and conduct a three-year research program in support of the purposes of this convention.

Living resource research being conducted under the BIOMASS program is also likely to be of considerable value later in assessing the potential environmental impacts of Antarctic mineral activities. The National Oceanic and Atmospheric Administration has begun supplementing its BIOMASS work by participating in the recent geophysical surveys, conducted by the U.S. Geological Survey, designed to better understand the continental margin off Antarctica. These cooperative ventures in Antarctic waters are expected to increase.

Because so little is known about the Antarctic environment and the environmental impacts of mineral development, the first task of a mineral resource management system will be to develop a program of environmental assessment. The purpose of such a program should be to establish information needed for prediction, assessment, and management of the impacts of mineral activities on the marine, coastal, and onshore environments. The National Oceanic and Atmospheric Administration has designed and conducted such a multi-year program of environmental assessment at the opposite end of the planet which gives it a substantial body of expertise and experience in high latitude studies of considerable value to implementation of a regime to govern mineral resource activities. Since 1974, NOAA has participated in the design and conduct of the Alaska OCS Environmental Assessment Program. The early work of this program was criticized for lacking sufficient focus. However, over the years, the program has evolved such that it now establishes research priorities in the context of a long-range conceptual framework. This is the type of framework which will be needed prior to making mineral resource management decisions in Antarctica.

SCIENTIFIC RESEARCH NOT DIRECTLY RELATED TO RESOURCE DEVELOPMENT

The National Oceanic and Atmospheric Administration maintains a station at the South Pole, one of four baseline observation stations located in various parts of the globe which measure atmospheric trace elements believed to have a potential impact on climate. (The others are at: Barrow, Alaska; Mauna Loa, Hawaii; and in Samoa.) These stations are a part of the global monitoring network of the World Meteorological Organization.

The South Pole station measures CO_2, ozone, chlorofluorocarbons, NO_x, several components of solar radiation, various physical properties of atmospheric aerosols and standard meteorological parameters. Measurements since 1974 have shown gradual long-term increases of CO_2, NO_x, and other climatologically-active gases.

Working with Australian glaciologists, NOAA is updating and refining the existing description of the Antarctic ice sheet. The dynamic state of major Antarctic ice streams is also being investigated. This work is important for paleoclimatic reconstruction as well as study of a CO_2-induced warming trend.

SERVICES

The Navy/NOAA Joint Ice Center (JIC) provides:

- Weekly ice analysis charts covering all of Antarctica on a scale of 1:16 million;
- Thirty-day ice concentration outlooks for the western Ross Sea (ice concentration in tenths; open water and ice free); and
- Seasonal forecasts for ice recession patterns and fact ice recession in the Ross Sea.

In addition, the JIC has been providing direct ship-support for a number of vessels operating in Antarctica.

NOAA's National Environmental Satellite Data and Information Service (NESDIS) collects and maintains a variety of Antarctic environmental data sets. For example, NESDIS prepares monthly sea surface temperature charts for various parts of the Southern Ocean.

Also, NOAA's World Data Center-A for Glaciology (Snow and Ice) manages and distributes Antarctic data sets, including:

- Antarctic Ice Concentrations (1972-1980);
- Southern Hemisphere Ice Limits, (1973-1980); and
- Antarctic Microwave Sea Ice Data (1973-1976) and (1979-1980).

Last year the World Data Center WDC-A, in response to the needs of the World Climate Research Program, organized a SCAR-sponsored workshop in Hamburg

to address the need to "construct a single detailed inter-disciplinary set of all the data needed for Antarctic climate research."

Finally, NOAA/NESDIS has just updated its 1978 publication entitled: *Environmental Data Inventory for the Antarctic Area*. This document shows the amounts and distribution of data available from NOAA by data type, including geophysical, meteorological, oceanographic, and glaciological data. This document is available from NESDIS.

An Antarctic Marine-Geology Program: Possibilities

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A NEED FOR A BROAD ANTARCTIC PROGRAM

I would like to talk today from a United States Geological Survey (USGS) point of view but also to address a personal view of what I believe is the broader need for a different Antarctic program.

The USGS is a scientific research organization doing both basic and applied research — especially research dedicated to national concerns and needs. There are national needs tied up with Antarctica and its issues--they can be expressed in various ways, but one obvious need now is that the United States have an informed position in negotiating a minerals regime. That requires information. Such fact finding has been the 105-year labor of the USGS. We do not serve as advocates, except perhaps to advocate the development of a base of facts and geologic understanding to permit informed decisions. Antarctica certainly is a geologic entity that needs such facts and understanding.

For those of you who are not geologists, I would point out that the continent consists of two very different halves, neither of which is well understood geologically. As for the offshore portion of the Antarctic plate: it contains critical evidence of the way in which rifting and ocean spreading separated other plates like South America, Africa, and Australia. There is basic science to be done in the offshore region to solve major problems and to accumulate information of use in interpreting plate tectonics elsewhere in the world. That science cannot be done by examining unconnected outcrops or seismic lines. Such an approach to regional geology has to end up with results like that of the blind men describing the elephant. So, from a USGS geologist's perspective, I would like to discuss some aspects of a marine geology program and related resource aspects that cannot be ignored. (There are, of course, other perspectives than those of a geologist.)

IMPORTANT ASPECTS OF A MARINE GEOLOGY PROGRAM

It seems fair to say that, in geology and geophysics, the United States does not have a comprehensive program to investigate the vast Antarctic offshore domain. Other nations, most particularly Germany, Japan, and Russia, have made and continue to make organized marine geologic surveys covering large areas and including visits over a period of several years. From 1962 to 1972 some geologic and light geophysical data were gathered by the United States on cruises of the *R/V Eltanin* in shared-time arrangement with other disciplines. Since 1972, occasional lines of geophysical data have been gathered off icebreakers transiting Antarctic waters. The Deep Sea Drilling Project (DSDP), under the sponsorship of the National Science Foundation, conducted drilling and coring operations during 1972-1973 and 1974. But no systematic data gathering has been done by the United States to permit an orderly approach to gaining an understanding of the geology of offshore Antarctica.

Such understanding of the geology should be considered vital in these days when a serious effort is being made to fashion a minerals regime that it is hoped will be observed by all nations interested in the mineral resource picture of Antarctica. Offshore, that picture currently is focused on oil and gas potential. It is neither right nor practical that the United States or any other country should go out straightway to gather detailed data pointing specifically to possible offshore petroleum deposits. But the continent has fascinating offshore geology, and it is right and practical that the United States join other countries to engage in reconnaissance surveys to develop enough information to: 1) decipher the geologic setting and history; 2) translate what is learned to other areas of the globe with similar passive-margin plate-tectonic settings; 3) determine as reasonably as possible whether the offshore geology really does have resource potential, and, if so, where eventually exploration might concentrate; and 4) delineate the environmental problems or hazards that resource exploration or development would encounter and provide a basis for dealing with the situations.

Would an orderly program of geologic fact-finding bring on or speed the arrival of resource explorers? That seems doubtful to me. What is more likely to bring on exploration, in my opinion, is an uninformed but optimistic view, on the part of nations that need petroleum or companies seeking bonanzas, that Antarctica is a huge storehouse of energy riches. For instance, not long ago an article in the American Association of Petroleum Geologists' newspaper, "The Explorer," credited Antarctica with a probable 250 billion barrels of oil (not defined as onshore vs. offshore). That is a very large number, and it is an estimate so poorly based in knowledge of the geology that it could be called a wild guess. But once in print, such a number takes on a life of its own, and many people may choose to believe it and sooner or later may try to act on the basis of it. On the other hand, the USGS has estimated 15 billion barrels of recoverable oil. We estimated the offshore in-place resource (as opposed to recoverable) as 45 billion barrels, and typically it is the larger number that is misquoted as recoverable. This USGS estimate, like the industry estimate, is based on far too little information to have either credibility or reliability, and because of this it was not published (it became

available informally). But the point is that estimates are made and people are attracted. They will not forever be held at bay, and a good base of information is the only adequate position from which to develop mineral regimes, treaties, or (eventually) rules for environmentally sound resource exploration.

The value of even reconnaissance geophysical data across the broad reaches of offshore Antarctica combined with DSDP core data is shown very well in the results of cruises by the German Federal Institute for Geosciences and Natural Resources (BGR). In a brief interpretation Karl Hinz published in the 1983 *World Petroleum Congress Proceedings*, he established a preliminary geologic framework and picture of the sedimentary history of the Ross Sea and Weddell Sea. This preliminary view allowed interpretation that deep portions of those basins could have the right conditions for the generation of petroleum. But the scanty data also allowed for importantly different possibilities that would militate against the likelihood of petroleum occurrence. Still, it was an important start at understanding the underwater geology of the continent — regardless of the possible resource implications — and it certainly showed the abundant need for more information.

Just this year, the USGS, with the endorsement of the Antarctic Policy Group and the invaluable logistical support of the National Science Foundation, sent the *S.P. Lee* into Antarctic waters. Two cruises of 30 days each were completed off Wilkes Land and in an area of the Ross Sea not previously surveyed by other countries. The data have not yet been fully processed or analyzed, but they clearly add a great deal to the overall understanding of the geologic evolution of those areas. Subbasins and grabens and thicknesses of sediment fill were defined, along with fold and fault structures, providing interpretive insights into the geologic processes that accompanied the movement of other continental plates away from Antarctica. The cruises also provide environmental data that would be critical in even considering whether oil exploration could or should be done in the region. For example, there is a suggestion of recent active faults breaking the sea floor, and we discovered iceberg gouges of the sea floor, meters deep and tens of meters wide and in water 500m deep.

The USGS cruise represented the nation's first dedicated marine geology-multichannel seismic survey off Antarctica. We plan, as the treaty requires, open dissemination of the data and results. But long before the data are ready for full dissemination, they already have provided a basis for scientist-to-scientist exchanges of data between the USGS and the BGR. We hope to broaden such exchanges to include some of the other countries with major data sets. And we also hope that our timely release of the data later will encourage similar release of data held by other nations.

A LONG-TERM PROGRAM

It still remains that most data so far have been gathered in a reconnaissance mode, and they do not provide systematic coverage or anything like a complete basis for geologic interpretation. What is needed is a United States program of several years' duration, of reasonably assured funding continuity, and designed as a program to systematically gather data according to a comprehensive plan.

This approach differs significantly from the valuable multidisciplinary basic research that characterizes our nation's present Antarctic geology program. Both are needed. The offshore areas will require a large and sustained commitment to marine geology and geophysics and aeromagnetic surveys. The aerial surveys should extend onshore for some distance to provide for complete interpretation of the seafloor setting, because of course the geology does not stop at the water's edge. More research drilling should be included, because even the best interpretation of seismic data is limited if there are no samples of the rocks themselves.

Such a program should, as much as possible, be an international effort, with coordinated design, operations, data exchange, and interpretation by as many nations as are active in the region and willing to work together. This would save each nation enormous expenses and give new meaning to the Antarctic Treaty or minerals regime. It provides a truly international and, more important, a truly informed basis for Antarctic geologic science and provides a data base for the United States and other nations to make knowledgeable resource and environmental decisions. Only in this fashion does it seem likely that a wise balance can be achieved between the highly desirable protection of the pristine Antarctic region and the highly probable eventual resource exploration.

Antarctic Science — The Role of the Polar Research Board

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OVERVIEW

Since its founding in 1958, the Polar Research Board has served as a national advisory group on polar science and assisted U.S. Government agencies in the development and maintenance of strong programs of polar research that are responsive to scientific opportunities and national interests in the Arctic and Antarctic. A second major set of responsibilities derives from the board's role as U.S. National Committee for the Scientific Committee on Antarctic Research (SCAR) of the International Council of Scientific Unions (ICSU). The board is one of the units of the National Research Council (NRC), which was established by the National Academy of Sciences (NAS) in 1916 to associate the broad community of science and technology and of advising the Federal Government. The NRC

operates in accordance with general policies determined by the NAS under authority of its congressional charter of 1863 signed by Abraham Lincoln designating the Academy as a private, nonprofit, self-governing membership corporation. The National Research Council is the principal operating agency of the National Academy of Sciences, National Academy of Engineering, and Institute of Medicine. As such, the Polar Research Board does not undertake research but has issued a comprehensive series of reports with recommendations of research activities in the polar regions. The board's regional orientation and multidisciplinary character have resulted in a program of studies ranging from physical and life sciences to environmental and conservation matters. More than 100 distinguished scientists drawn from diverse organizations and disciplines in the United States and Canada serve on the board and its subgroups. Individuals are appointed by the President of the NAS to the board on the basis of personal professional qualifications and do not represent any group or institution. Members serve without compensation, although travel and related subsistence expenses incurred in connection with board activities are reimbursed.

The board meets semiannually to review its program, develop U.S. positions on matters to come before SCAR and provides a forum for the presentation and discussion of information about federal agency programs in the Arctic and Antarctic, as well as about the activities of nonfederal organizations with polar interests. The work of the board and its subgroups is supported by grants from the National Science Foundation, the National Oceanic and Atmospheric Administration, the Office of Naval Research, the Department of Energy, the Department of the Army, the United States Geological Survey and the Andrew W. Mellon Foundation.

This paper will address three of the board's major activities: 1) Research Emphases for the U.S. Antarctic Program; 2) Polar Research — A Strategy; and 3) the Scientific Committee on Antarctic Research.

RESEARCH EMPHASES FOR THE U.S. ANTARCTIC PROGRAM

In response to a request from the National Science Foundation, the agency assigned responsibility for the management, support, and coordination of the U.S. national program in Antarctica, the board recently presented its views on: a) the scientific disciplines that uniquely or substantially benefit from continuing research effort in Antarctica; b) the most important research questions in these fields and most promising opportunities; and c) the nature of the effort required to pursue these research opportunities.

The resulting report, *Research Emphases for the U.S. Antarctic Program*, identifies a small set of major scientific questions of outstanding importance in Antarctic research, recommends priorities among them as a guide to program planning, and suggests a variety of large-scale integrated research projects and smaller, more specific projects through which particular research questions or groups of questions could be addressed. The board recommends a mix of large- and small-scale projects that would constitute, together with basic ongoing data-gathering and monitoring activities, a timely, balanced, and scientifically productive U.S. Antarctic Research Program.

The board concluded that the selection of large-and small-scale projects and the sequence of their initiation should be tied to the fundamental scientific questions and opportunities in Antarctic research, and the implementation of projects should be characterized by an innovative approach to logistic support and to the use of facilities and instrumentation. The board offers some suggestions and recommendations for increased flexibility and innovative approaches to logistic support of research. Four broad multidisciplinary categories of polar research were identified: marine and terrestrial biological system; climatic variability; geodynamics, stratigraphic, and glacial history of Antarctica; and, the upper atmosphere and near earth space. In assigning priorities to the scientific value, the likelihood of achieving significant results with the anticipated level of support, relevance of the research of issues of resource management and protection of the environment, and U.S. commitments to international projects. The board gave "highest priority" to: a) extraction of the unique climatic record preserved in the Antarctic ice sheet; and b) study of the response of marine life to the unique environment at the edges of sea ice. "Very high priority" research included study of: a) phenomena in the Antarctic ionosphere and in the magnetospheric cusp and polar cap; b) the geological and glacial history of the Antarctic continent and surrounding sea floor and its relationship to the evolution of Antarctic climate and biota; c) atmospheric processes that maintain the Antarctic continental heat budget; and d) distinctive adaptive processes in Antarctic biota. "High priority" questions dealt with: a) the swarming behavior of krill; b) biogeochemical pathways in Antarctic ecosystems; c) energy flow and conversion along magnetic field lines; d) oceanic and atmospheric heat transfers; and e) the geological relationship between West and East Antarctica. The board urged that "priority" attention be given to: a) research on the winter behavior of krill; b) distribution and establishment of species on the Antarctic continent and sub-Antarctic islands; c) the effect of the southern ocean on the concentration and distribution of radiatively active gases in the atmosphere; d) the effects of boundary conditions on the configuration and dynamics of the Antarctic ice sheet; and e) and the Cenozoic evolution of the Antarctic ice sheet in relation to changes in sea level and long-term fluctuations.

With these fundamental questions and priorities as background, the board considered possible components of the U.S. Antarctic Research Program and recommended a set of large-scale integrated projects, small specific projects, and long-term monitoring efforts, the combination of which it regards as essential to an effective and balanced program: a) an integrated program of deep-, intermediate-, and shallow-ice-core recovery and analysis to examine the paleoenvironmental record; b) a study of the biological and physical processes associated with seasonal sea ice advance and variations in the ice-edge zone; c) a major interdisciplinary study of the continental margin in the Ross Sea area in Antarctica, involving marine geology and geophysics, oceanography, and marine biology; d) a program of auroral, magnetic, ionospheric, and thermospheric measurements from South Pole Station to develop an understanding of global energy transfer in the magnetospheric cusp and polar cap; e) an interdisciplinary investigation of the structure and intensity of the Weddell gyre and the impact of the associated fluxes on the climatic, glacial, and biological environment; f) a coordinated program of

geophysical studies aimed at understanding West Antarctic crustal structure and history and the dynamics of the ice sheet; and g) a multidisciplinary study integrating physical and biological measures to determine the causes for, the ecological consequences of, the swarming behavior of krill.

In regard to the recommended large-scale integrated projects, the board pointed out that these produce a significant budgetary and logistic impact on other parts of the U.S. Antarctic Research Program and that they also depend on and affect the availability of Antarctic scientists and the direction of their work. Thus it recommends that such projects be emphasized sequentially, with the phasing out of one and overlapping the buildup of another. Such a mode of operation implies a frequent and substantial redistribution of effort among disciplines rather than the short-term maintenance of a fixed ratio of support. Priorities were also assigned to the recommended large-and small-scale projects. Finally, the board emphasized the importance of a number of long-term, basic activities that include the production of topographic and geologic maps, the collection and analysis of meteorites, and monitoring programs that provide data on upper atmospheric, cosmic, and solar phenomena, earthquake and earth tides, and constituents of the atmosphere. In implementing the recommended projects, it urges a flexible, innovative approach to logistics and deployment of facilities and instrumentation, and the rapid and complete reduction of data and its placement in efficient storage and dissemination systems.

The report served as the basis for National Academy of Science testimony before Congress on the "Implementing Legislation for the Convention for the Conservation of Antarctic Marine Living Resources."

POLAR RESEARCH — A STRATEGY

United States concern about the polar regions has grown steadily in recent years with the recognition that the far North and South exert broad influence on the rest of the earth through their role in global climate and their resources. Some 50 percent of the oil under U.S. jurisdiction lies in the Arctic, and one of the world's major untapped sources of protein is found in the oceans surrounding Antarctica. The polar regions increasingly are subject to conflicting pressures of resource development and environmental protection.

Twice in the past three years President Reagan has issued memoranda on the subject. In 1982, he pledged this country to "a leadership role in Antarctica, both in the conduct of scientific research ... and in the system of international cooperation" established under the Antarctic Treaty of 1959.

Against this background, the Polar Research Board has been taking a look at the state of knowledge in polar science and is preparing a series of reports, *Polar Research — A Strategy*. Patterned after the 1970 report, *Polar Research — A Survey*, the new series reviews progress in the various disciplines of the polar sciences and draws attention to the principal scientific questions and research needs. Each report recommends a program of research priorities for the next decade and discusses the facilities and support required to achieve recommended research goals. To date, the following reports in the series have been issued:

An Evaluation of Antarctic Marine Ecosystem Research, 1981

Study of the Upper Atmosphere and Near-Earth Space in Polar Regions: Scientific Status and Recommendations for Future Directions, 1982

Polar Biomedical Research: An Assessment, with a separately bound appendix, *Polar Medicine — A Literature Review*, 1982

Snow and Ice Research: An Assessment, 1983

Permafrost Research: An Assessment of Future Needs, 1983

Four additional studies in the series are in progress, and plans for two new ones are under way.

Three of the strategy studies currently in progress deal with Antarctic solid-earth geosciences, Antarctic physical and chemical oceanography, and the polar regions and climatic change. The first is concerned with the evolution of the crust of the Antarctic continent and the adjacent seafloor and with the Antarctic environment. Geological processes, geodynamics, global climate links, and implications for potential resource exploration and development are discussed. A research strategy, including scientific priorities, methodology, and chronology for future research will be recommended. The oceanographic study focuses on water-mass conversion, dynamics and thermodynamics of the Antarctic Circumpolar Current, coupling of the southern ocean with the World Ocean, sea/air/ice interaction, and large-scale modeling. The third study looks at the polar regions as sources of climatic unrest, in particular, the influence of Antarctic sea ice on climate dynamics and the role of the Antarctic continent as a global heat sink. The study also deals with the development, using data preserved in ice sheets, ocean-floor sediments, and, in the Arctic, tundra and boreal zones, of a quantitative record of past climate variations and the processes responsible for them. The study concludes with a discussion of future environmental concerns, such as a possible increase in world sea level resulting from melting of Antarctic ice sheets. Research needs and priorities are outlined in each of these fields.

Subsequent to this workshop, in further discussions with the Department of Energy, agreement was reached on the need for the definitive study on the relationship between land ice and sea level, especially in relation to possible CO_2-induced climatic change. Several recent reports have asserted that glacier melt will significantly raise sea level over the next century. The study would examine the evidence for an exchange of water between land ice and ocean over the past century (including glaciological, oceanographic, and geoidal evidence), gaps in understanding of the processes involved in such an exchange, and predictions for the future. The study is expected to get under way by fall 1984.

In January 1984, the board's Committee on Polar Biomedical Research began work on a follow-up to its 1982 strategy study. The new study deals with: 1) improving awareness, access, and application of polar biomedical data; and 2) medical education and promotion of polar biomedical research.

SCIENTIFIC COMMITTEE ON ANTARCTIC RESEARCH

The Polar Research Board, on behalf of the NAS serves as the U.S. National Committee for SCAR. The principal purpose of SCAR is to foster international cooperation and coordination in Antarctic research. The Scientific Committee for Antarctic Research is a member of the non-governmental ICSU. Each of the 15 countries active in Antarctic research adheres to SCAR through its National Academy of Sciences, National Research Council or comparable body which sends delegates to SCAR meetings, which are held every two years. The Scientific Committee for Antarctic Research has nine standing Working Groups and five Groups of Specialists that carry out much of its work in support of this objective. It also sponsors symposia and conferences and publishes reports on these, as well as many handbooks, special reports, and documents helpful to those engaged in polar research. The Scientific Committee for Antarctic Research's recommendations are advisory only and are transmitted by the board to concerned federal agencies and scientific organizations for their consideration in developing Antarctic programs.

The 18th SCAR plenary session will be held in the Federal Republic of Germany in September 1984. Major agenda items will include Antarctic conservation matters, SCAR's response to the U.N. on a study on the Antarctic Treaty System and SCAR's response to the Antarctic Treaty Comsultative Parties request for information on man's impact on the Antarctic environment.

ANTARCTIC CONSERVATION MATTERS

Of particular concern to the board are the designated Sites of Special Scientific Interest (SSSIs) and Specially Protected Areas (SPAs). The board has surveyed the U.S. scientific community in regard to the nature of research conducted at the SSSIs, the need for continued protection for some sites, and possible new sites. Management plans for four new sites recommended for protection are being developed as well as the concept of a new category of protective areas. In accordance with a charge to the Subcommittee on Conservation from the SCAR XVII Plenary Session, plans were initiated for preparation of an atlas of SSSIs and SPAs. To assist in this endeavor, the Polar Research Board convened a special session at which concerned agencies and nongovernmental organizations could discuss plans for the atlas, SCAR activities related to conservation, and ways to strengthen these measures and enhance future conservation efforts. An "Atlas of Antarctic Protected Areas," is to be issued in 1985 prior to the joint SCAR/IUCN Symposium on the Scientific Requirements for Antarctic Conservation.

ANTARCTIC MARINE ECOSYSTEMS

From the days of earliest planning, the board has been active in the development of the SCAR international research program on Biological Investigations of Marine Antarctic Systems and Stocks (BIOMASS). The First International

BIOMASS Experiment (FIBEX) took place from January through March 1981 and resulted in a more reliable estimate of total krill abundance than had been possible previously as well as new information on krill biology, ecology, behavior, and distribution. The Second International BIOMASS Experiment (SIBEX) will span two southern summer seasons, 1983/1984 and 1984/1985 and will focus on both the relationship of krill to the physical and chemical environment and trophodynamics, particularly with regard to fish, squid, birds, and marine mammals. Seventeen ships representing 11 nations will participate in SIBEX. The board's report *An Evaluation of Antarctic Marine Ecosystem Research is guiding the national and international effort.*

Optimizing access to and use of the data from BIOMASS has been an ongoing concern and has lead to plans for a BIOMASS Data Center, which would be the first international center handling detailed numerical marine biological data. It would provide not only a data archiving and distribution system but computer facilities for future data analysis, and it would stimulate awareness and use of BIOMASS data through interpretation workshops.

ANTARCTIC MINERAL RESOURCES

In regard to Antarctic mineral resources, a member of the board chaired the SCAR Group of Specialists on Environmental Implications of Possible Mineral Resource Exploration and Exploitation, which prepared a report and recommendations to SCAR on this subject. Continuing concern about mineral resource questions and the role of the Antarctic Treaty in relation to them led the board to join with the Antarctican Society in sponsoring two lectures in 1983, one in April by G. Larminie of British Petroleum on "Applications of Arctic Oil Technology to Antarctica," and one in October by R. T. Scully of the Department of State on "Future of the Antarctic Treaty System."

CONFERENCE ON THE ANTARCTIC TREATY SYSTEM

Currently, the board is developing plans for a conference to discuss the operation of the Antarctic Treaty System. Increased interest in Antarctica and the Antarctic Treaty System, exhibited by recent United Nations activities, have made clear the need for heightened awareness of the realities of the Antarctic environment, current activities in the Antarctic and the nature and working of the Treaty System. Papers delivered at the conference would be published and are expected to be a useful resource for both the Treaty and non-Treaty nations, for science and industry, and for the broader international community concerned with the future of Antarctica.

Some Thoughts on Antarctic Research

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INTRODUCTION

The conveners of this conference have asked me to set forth the bases for Marine Mammal Commission (MMC) involvement in Antarctic matters, to describe what that involvement has been, and to give my personal views on the development of an integrated United States Antarctic research program.

COMMISSION INVOLVEMENT

The Marine Mammal Commission's involvement stems from its statutorily prescribed mandate under the Marine Mammal Protection Act of 1972 (MMPA). The act calls for the Commission to: "undertake a review and study of the activities of the United States pursuant to existing laws and international conventions relating to marine mammals;" conduct "a continuing review of the condition of the stocks of marine mammals;" "undertake or cause to be undertaken such ... studies as it deems necessary or desirable in connection with its assigned duties as to the protection and conservation of marine mammals;" "recommend to the Secretary (of State, Commerce, and Interior) and to other Federal officials such steps as it deems necessary or desirable for the protection and conservation of marine mammals;" and "recommend to the Secretary of State appropriate policies regarding international arrangements for the protection and conservation of marine mammals and suggest appropriate international arrangements for the protection and conservation of marine mammals."

While the foregoing provides the statutory rationale for the Commission's involvement in Antarctic matters, the practical biological facts dictating Commission participation are that at least 13 species of seals and whales, over 20 million animals, inhabit or migrate through the southern ocean which surrounds Antarctica. Although unregulated or poorly regulated sealing and whaling brought several of these species to near extinction, the end of commercial sealing and improved regulation of whaling under the International Whaling Commission (IWC) make threats from commercial exploitation no longer as serious as they once were. However, new threats have arisen as a result of developing fisheries, particularly the fishery for Antarctic krill, and the growing interest in offshore oil and gas resources.

The reason that the Commission, although primarily concerned with marine mammals, attaches such importance to Antarctic krill is because of the central

role which it occupies in the southern ocean food web. It is the dominant herbivore and the principal component in the diets of numerous species, including: fin, blue, humpback, and minke whales; crabeater and Antarctic fur seals; Adelie, chinstrap, macaroni, and rockhopper penguins; fishes; and squid. Some of these are eaten in turn by sperm whales, killer whales, leopard seals, and other species.

Because of the possible direct and indirect effects of fisheries and offshore oil and gas development on marine mammals, the Marine Mammal Commission has, since 1974, undertaken a continuing review of matters that might affect the structure and dynamics of the southern ocean ecosystem. In light of these reviews, the Commission has made numerous recommendations concerning the need for comprehensive biological and ecological research programs in the southern ocean as well as the need for international arrangements to regulate fisheries and offshore oil and gas activities.

A last factor dictating Commission involvement has been the expertise of the members of the Commission, the Committee of Scientific Advisors, and the staff. Taken as a whole, these three elements of the Commission may have more collective Antarctic biological expertise than any other agency. At least 17 of these people have been involved in Antarctic science and policy, some since the late '50s and early '60s. Their involvement has covered a broad range of activities including well over 150 expeditions, extensive data analyses of cetacean and pinniped populations, participation either as individual scientists or as members of U.S. delegations in a wide range of Antarctic scientific and diplomatic meetings, and service on one of the official U.S. Inspection Teams reviewing other nations' Antarctic activities pursuant to the provisions of the Antarctic Treaty.

Dr. Robert J. Hofman, Scientific Program Director of the Marine Mammal Commission, is a veteran of more than a dozen expeditions to the Antarctic, the author of significant contributions to the literature, and a member of the Antarctic Policy Group's interagency working group. He has also served as a member of the U.S. delegation at most negotiating sessions that have taken place over the last six or seven years.

My own involvement, which dates from my first trip in 1961, includes subsequent trips to the continent and onboard the *Eltanin* as the senior National Science Foundation (NSF) representative in charge of the research program, participation in the deliberations of the Intergovernmental Oceanographic Commission's Southern Ocean Working Group, service as a member of the Antarctic Policy Group, and my work with the Marine Mammal Commission.

With that explanation of the statutory mandate, the biological rationale, and competence underlying Commission involvement, I shall describe some Commission activities which relate to the Antarctic.

SOME ANTARCTIC-RELATED ACTIVITIES OF THE MARINE MAMMAL COMMISSION

In keeping with the wishes of the conference conveners to provide those assembled a reasonable understanding of the roles of the different Federal agencies in Antarctic matters, I shall touch on a representative sample of Commission activities.

Although Commission involvement in Antarctic matters dates from the establishment of a working Commission in 1974, it was in 1975 that the Commission first commented in broad terms on a number of points related to the southern ocean. In that letter to the NSF, the Commission noted that: krill management should be approached from an ecosystem perspective; that distribution, abundance, life history, and population parameters of affected species, including krill, are poorly understood and therefore do not provide a reliable basis for management decisions; that any krill harvest should not be of such intensity as to cause the depletion of species higher in the food web; that research in the area of "ecosystem response" should be given high priority; that the distribution, abundance, and life histories of species that feed on krill should be fully described as quickly as possible; that attention should be paid to the principle of establishing management regulations devoted to defining "research needs" and starting that research; that steps should be taken to identify research needs and priorities as well as to carry out needed research; and that such other steps as might be needed be undertaken to conclude an effective international agreement governing any krill fishery.

While our concerns were and have always been primarily directed by scientific considerations, it was also clear to us that if domestic and international political issues were not successfully addressed as well, we could talk about scientific needs *ad nauseum* without practical result. With this in mind and pursuant to our statutory mandate, we recommended to the Department of State in 1976 that it: 1) promptly undertake a review and re-evaluation of U.S. policy regarding the Antarctic; 2) that it pursue the development of a policy to conserve the living resources of the southern ocean and the development of an international convention to implement that policy; and 3) that it undertake measures to prepare a draft environmental impact statement in the course of developing both the policy and the convention. In the course of doing this, the Commission emphasized the need to define research needs and priorities and to implement a research program that would help to maintain the integrity of the Antarctic ecosystem.

In 1977, the Commission continued to encourage both the Department of State and NSF to develop, adopt, and pursue policies that would lead to international cooperative efforts to protect the Antarctic marine ecosystem. In these efforts, we stressed: the importance of management from an ecosystem perspective; the paucity of information about the life histories of affected species, including krill; the importance of ensuring that krill harvesting not be allowed to become so intense as to deplete species higher in the food web; the need for "ecosystem response" research to be given high priority; the importance of undertaking international protective measures to govern fisheries prior to actual exploitation; the need to identify research needs and priorities and carry out the research; and the need to take the necessary steps to conclude an international conservation agreement.

In 1978, the Commission wrote the National Science Foundation (NSF) recommending that it convene one or more groups of experts to render scientific judgments with respect to: a) the adequacy of the conservation principles in the draft convention developed by treaty nations; b) the establishment of ecologically sound quotas, including consideration by areas, of krill harvest in case such

information might be needed; c) those data which the U.S. should insist be required from vessels engaged in either experimental or commercial fishing in order to develop needed information; d) appropriate actions in light of the SCAR/SCOR plan for the Biological Investigations of Marine Antarctic Systems and Stocks (BIOMASS); e) the development of a long-term southern ocean research program with clearly defined objectives, carefully derived cost estimates, and a statement of ship and aircraft support needs; and f) essential conservation considerations for inclusion in any regime to be negotiated with respect to the exploration and exploitation of non-living resources. The Commission also recommended that NSF increase its scientific representation on the U.S. delegation involved in negotiating the Living Resources Convention.

Appended to the letter was a paper entitled "Research Needed to Ensure Conservation of Southern Ocean Resources." The paper describes information needs, research objectives, and research priorities for various components of the southern ocean ecosystem. With respect to whales, for example, the paper notes that several endangered species of baleen whales depend upon krill, that krill fishing is likely to be concentrated in the major feeding grounds of these whales, that fishing likely will occur during those months when whales are present and feeding, and that fishing effort most likely will be focused on the same kind of high density krill swarms upon which baleen whales are reported to feed. Noting that severely depleted whale populations could be affected adversely by even low levels of krill harvest, the paper suggests that high priority be assigned to assessing and monitoring the status of krill-eating whales and that these efforts be focused in the Scotia and Bellingshausen Seas where the krill fishery is focused.

It was also during 1977 and 1978 that the Commission developed the terms of reference for, contracted for, and published the first edition of John L. Bengtson's "Review of Information Regarding the Conservation of Living Resources of the Antarctic Marine Ecosystem." The Commission contracted with Dr. Bengtson to write this review because of the need for an updated, comprehensive overview of Antarctic marine living resources. The Commission is now supporting the writing of a second edition to be completed this fall. Like its predecessor which has been widely requested and used here and abroad, the second edition should assume an eminent place among Antarctic references. We felt it essential to publish the original volume because of the generally poor understanding of the structure and dynamics of the Antarctic ecosystem, the emergence of a conservation convention which would depend upon an ecosystem perspective for its success, and because of our commitment to help the many newcomers to Antarctic issues in their efforts to understand living resource issues. We also did it to provide NSF a background document which it could use as it wished in developing a U.S. position on Antarctic marine living resource issues as well as to provide those from this country and others a common reference text that might prove helpful during negotiating sessions and other meetings.

Some of the research recommendations contained in the Commission's 1978 letter were addressed when the National Oceanic and Atmospheric Administration (NOAA) and eventually NSF added their support to that of the Marine Mammal Commission's for the National Academy of Science's Polar Research and Ocean Affairs Boards to form a committee to make recommendations regarding

Antarctic marine ecosystem research. Starting in 1980, the Academy's committee, under the chairmanship of Dr. John H. Steele who is Director of the Woods Hole Oceanographic Institution, began its meetings which eventually led to the issuance of its now well-known report entitled, "An Evaluation of Antarctic Marine Ecosystem Research."

Other aspects of the recommendation contained in the Commission's 1978 letter were addressed when the Commission moved for the formation of the *Ad Hoc* U.S. Scientific Committee on the Antarctic. In this effort, the Commission received the immediate and enthusiastic support of both NOAA and the Department of State. The three agencies, with some NSF participation, have, from the first meeting, cooperated closely on all matters related to the content, conduct, and support of the meetings, the seventh of which took place earlier this year.

In addition to assisting with earlier consultative meetings, the Marine Mammal Commission helped develop U.S. positions for research related issues considered during the Xth Antarctic Treaty Consultative Meeting, the Special Meeting on Antarctic Mineral Resources held in Washington in December of 1980, and the XIth Antarctic Treaty Consultative Meeting in June and July of 1981. To help prepare for the latter meeting and subsequent negotiations on a minerals regime, the Commission, early in 1981, developed the scope of work and contracted for the preparation of a paper entitled "Environmental Aspects of Potential Petroleum Exploration and Exploitation in Antarctica: Forecasting and Evaluating Risks," a paper designed to provide the State Department and other agencies background information in preparation for the XIth meeting. At the meeting, delegates adopted a recommendation calling on governments to convene a special consultative meeting to: 1) elaborate a regime for Antarctic mineral resources; 2) determine whether the regime should be in the form of an international instrument such as a convention or take some other form; 3) establish a schedule for negotiations using informal meetings and sessions of the special consultative meetings as appropriate; and 4) take any other steps that might be necessary to facilitate the conclusion of a regime including a decision as to the procedure for its adoption.

This brings us to 1982 when the Department of State prepared and distributed a draft environmental impact statement on the Negotiation of an International Regime for Antarctic Mineral Resources. The Marine Mammal Commission commented on the draft as it had with the earlier draft environmental impact statement on the Convention on the Conservation of Antarctic Marine Living Resources, and also assisted the Department of State with preparations for the first session of the consultative meeting to begin elaboration of a minerals regime in June of 1982.

Nineteen eighty-two was also significant because the President reaffirmed U.S. interests in the Antarctic that year and directed that the U.S. Antarctic program be maintained at a level providing an active and influential presence designed to support the range of U.S. interests. The President also directed that the presence shall include the conduct of scientific activities in relevant disciplines and the year-round occupation of the South Pole and two coastal stations. According to the President's decision, NSF would: continue to budget for and manage the entire U.S. national program in Antarctica; fund university research and Federal agency programs related to Antarctica; draw upon the logistic support capabilities

of other Government agencies on a cost reimbursable basis; and use commercial facilities as necessary. The directive also provided that other agencies would be able to fund and undertake directed, short-term programs of scientific activity, subject to review and approval of the Antarctic Policy Group which is chaired by the Department of State.

Aside from the Commission's continuing involvement in efforts to assist in developing U.S. positions on issues, it is worth noting that two more Commission publications on Antarctica will be available later this year. The first, which I have already mentioned, is the revision and expansion of the 1978 review authored by John Bengtson. The second publication treats the question: Given the likelihood that impacts upon the Antarctic marine ecosystem are to be experienced, what species might be practically used as indicators of impacts realized and likely to be realized given the operational factors in force at the time? This paper, tentatively entitled, "Monitoring Antarctic Marine Interactions," should contribute significantly to the development of sound monitoring programs to track and evaluate changes as well as to predict those that may take place.

I trust the foregoing provides an adequate picture of the type of work which the Marine Mammal Commission has done and does to contribute to the development of biologically and ecologically sound principles and practices for incorporation into U.S. policies bearing on Antarctic marine living resources. Should you want more information, complete summaries of our Antarctic activities are contained in our annual reports.

Before leaving the subject, it may be useful to make mention of how the Commission does its work. I have alluded to letters of recommendation on various issues, comments on draft environmental impact statements, and other written actions taken by the Commission. These documents represent views carefully developed through intensive consultation, and a typical example of the process involved is seen in the drafting of our comments on the living resources draft environmental impact statement. That letter was developed as a result of consultation with the full Committee of Scientific Advisors, further deliberations with certain Committee members, Commission members, and invited outside experts, and the careful consideration and evaluation of all those findings by the Commissioners. This consultative process, adhered to over the years, is basic and most essential to all Commission work.

MY THOUGHTS ON ANTARCTIC RESEARCH PROGRAM MANAGEMENT

I shall not address research needs and priorities. They have been and are being described by the National Academy of Sciences, private groups, and a variety of Federal agencies. Similar exercises are also taking place abroad.

What I would like to do is to pose a general question for discussion: Are we in the United States using the best system possible to describe research needs, address those needs and, when appropriate, bring those findings to bear on policy determinations, or should we be looking at other approaches?

In the latter half of the 1970s, it became increasingly clear that the United States and other nations needed to address a wide variety of applied research questions as well as to continue the important basic research efforts which have long characterized Antarctic work. The need for applied work as well as the value of a continuing and strong basic research program have both become obvious as we have tried to describe underlying scientific rationale for certain aspects of the negotiation of the living and non-living resource regimes. While a number of agencies are now applying their talents, energies, and other resources to addressing practical questions related to exploratory and developmental processes that either are or may become associated with living and non-living resources, there is some question whether such a loosely structured approach is the most useful possible.

Based upon my observation of our programs and those which I know reasonably well in other countries, I think we should consider coalescing management responsibility and control for both basic and applied research activities in one agency. Doing so would, I believe, facilitate the development of coordinated, complementary, integrated research efforts that would better provide the necessary scientific guidance for dealing with the practical questions which must be addressed without in any way compromising or weakening the existing basic research program founded on the support of independent, non-governmental research at private universities and other research centers.

While I have no blueprint for such a restructuring of institutional arrangements, I would certainly endorse a careful examination of different ways of accomplishing this. We continue to operate within a framework developed as the outgrowth of activities undertaken more than 25 years ago during the International Geophysical Year, and it may be that the complexity and range of issues now before us require a different approach.

Discussion

Burroughs: Thank you very much. I would like to now open the floor to questions or comments.

Guilty: The United States has approximately 15 times the population of my own nation, Australia, but I suspect that as we have involved ourselves in Antarctic research in the last 20 or 30 years, we have generated almost as much information. This is my personal opinion and not as a member of the Australian Antarctic Division. The parallels that disturb me, in particular, are that between 1974 and 1984 our budget has increased by a factor of approximately ten, and I see that your budget has increased greatly as well. I am not convinced that the amount of science that we've been generating has increased at anywhere near that rate and I suspect that it may be almost static. The other thing that struck me was the incredible rate at which your program seems to be reviewed. I think it would be very interesting to see if there is a linear relationship between the number of reviews that you have and the number of reviews that we have. I would like to point out that we operate our program in a very different way. We have an Antarctic Division, a government instrumentality that provides logistic support, with a research institute within it. As a logistic support base, we provide support for other government agencies as well as to the academic community. One of the questions I have as the director of that research institute is which method of doing research is more effective — having a research institute or having the widely-scattered programs that you appear to have? I'd like to ask Dr. Rutford what method of research he thinks is most effective?

Rutford: I think the university-type research, for basic research, is the best way, although I have some concerns. As for applied research, I'm not sure universities are the best place to do it. It possibly could be done more effectively by contracting it out to civilians or other federal agencies or whatever. So my comment would be that some sort of mix would be the best way to do research.

The problem that faces the U.S. Antarctic policy is that a national program has been put into an agency that has a clearly defined basic research rule. Every time the National Science Foundation has tried to get into applied research it hasn't worked out very well. On the other hand, many of the mission agencies in the U.S. are no longer doing basic research. They are doing very specific applied research. Finally, I would say that every time that I have looked at this I come to the same conclusion. Unless a new agency was created within the Federal Government, the U.S. Antarctic Program is in the agency, NSF, where it should be. The National Science Foundation is probably the only agency that could have done the things that have been accomplished.

Burroughs: Is the U.S. Antarctic science system susceptible to some major derailments, because it is formulated through a series of budgetary crises?

Rutford: Well, crisis management is not new. Universities have existed that way for years, and I'm not sure that it is all wrong. If you plot the budget of NSF and then you plot the crises, what happens is every time there was a budget crisis, the Antarctic program got well. There was a reaffirmation of the policy; there really was nothing new. You can go back and look at the policy that was issued in 1948 and the wording is almost identical to what occurs in the policy today. So the question is, has the policy changed or does the new policy review become the excuse to increase the budget? Maybe that's the important thing. The budget has increased. The same thing happened in the U.K.

The USAP is the only program in the Antarctic that has aircraft that can go anyplace on the continent. It has involved a wide variety of scientific participation. I think without question, there's been as much or more of the scientific results published. My purpose this afternoon was to try to emphasize to people that there has been a interweaving of governmental and non-governmental inputs. If you look at the documents I referred to earlier and the 1985 budget request, you will see a direct correlation between what the scientific community in the U.S. said needed to be done and what is in the budget. Maybe that's not all bad.

CHAPTER 6

The Antarctic Treaty — A Reality Before Its Time

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I recall one of the first field projects during the austral summer months (1959) near the Transantarctic Mountains. The camp was located 400 miles south of the Little America Station and 2800 miles from New Zealand. We took the party of four out by airplane, left them off with their gear, waved good-bye and took off. The party took the inevitable photographs and then turned to setting up the camp. They unrolled their tents, took out the poles, and looked at the note tied to the end of each pole. It said, "The 3/4ths inch long, 3/8ths inch bolt and nut needed for this fitting can be obtained from your nearest hardware store." Ingenuity prevailed. Someone had packed some bailing wire.

Antarctica does not have any hardware stores, nor gas stations, nor grocery stores. There are only two differences between outer space and the Antarctic; the Antarctic has gravity and air to breath. While the cold is daunting, it is the lack of usable water that makes the Antarctic the most inhospitable place on the surface of the earth. By contrast, the Arctic is a banana belt. If abandoned or lost there, one can keep oneself alive if one knows one's craft. Unless one ends up among a tribe of emperor penguins or in a Weddell seal rookery, there is no craft which will save you in Antarctica.

Many of us who were involved in the negotiation of the Antarctic Treaty and its subsequent development shared the common experience of service in the Antarctic. It gave us a common denominator of understanding that helped to bridge many of the differences that arose as we sought a political solution for Antarctica.

One of Antarctica's most unique features is the treaty negotiated by 12 nations in 1959 which entered into force on June 23, 1961. The Antarctic Treaty reflects a mutuality of interest common among Great Britain, France, Norway, Australia, New Zealand, Argentina and Chile (the claimant nations) and the United States, the Soviet Union, Japan, Belgium, and Republic of South Africa (the non-claimant nations), namely the desire to:

- Protect claims or rights established by discovery, exploration and/or occupation;
- Prevent armed conflict in the area;

* This paper was given as the banquet address.

- Protect strategic interests;
- Ensure free access for peaceful purposes;
- Prevent Antarctica from becoming a testing site for nuclear weapons or a dumping ground for nuclear waste;
- Have a say in whatever happens in the Antarctic in the future; and,
- Extend the rule of law to the last great land form on the surface of the earth.

A number of factors entered into the willingness of governments to meet to discuss a regime for Antarctica.

- A not-to-distant British-Argentine mini-war in the Antarctic Peninsula;
- The projected inadequacies of the Panama Canal for super tankers and super carriers and a recognition of the strategic importance of the Antarctic sea lanes;
- The awesome expense of defending national interests in Antarctica by conventional military means;
- The uncertainty among the claimant nations about the security of their claims in the face of a concerted occupation by the United States and the Soviet Union; and
- A rising interest in 1954 among members of the General Assembly of the United Nations.

Certainly, the General Assembly interest in 1954 encouraged the claimant nations to consider the alternative the treaty offered between a situation of disputed claims and an imposed United Nations solution.

The International Geophysical Year (IGY), which operationally spanned the period of 1955 to 1959, provided a vehicle through which to achieve a foundation for the political settlement in Antarctica embodied in the treaty. Specifically it:

- Offered a goal and a set of tasks to which all the nations with historic interests in the continent and its surrounding oceans could subscribe and in which they could participate;
- Provided an international forum through the International Council Scientific Unions (ICSU) in which to ventilate and resolve issues, such as the distribution of station sites, which might have been very difficult for governments to achieve in available diplomatic forums;
- Provided a peaceful focus for the continued occupation of the continent and, because many of the synoptic scientific areas of study undertaken during the IGY were traditionally those in which military organizations had participated — weather forecasting, oceanography, geodesy — resources already in place in the Antarctic could join in the common, peaceful effort without resource dislocation or loss of face;

- Provided a setting in which the interested parties, and the political, logistic and scientific personnel of each of the governments with historic Antarctic interests could get to know each other; and
- Provided a successful pattern of peaceful cooperation, so successful in the fact that it was incorporated by reference into the Antarctic Treaty as its second principal theme. Article II states that, "Freedom of the scientific investigation in Antarctica and cooperation toward that end, as applied during the IGY, shall continue ..."

After 24 years, it is time to assess what we have gotten out of the Antarctic Treaty arrangement.

- We have had peace.
- We have not spent vast appropriations arming the continent and its approaches.
- We have instituted and exercised the only multinational, land-based, announced inspection program on earth.
- No atomic devices have been tested on the continent.
- One can land anywhere on the continent without passport and move freely from one place to another.
- We have collectively explored, measured and described an area roughly equivalent to the United States and Mexico combined, and we have helped each other to do it.
- We have developed a consistent body of rules of conduct for the area, including a system of measures to protect important aspects of the Antarctic environment.
- The treaty consultative process, despite the rigors of the rule of unanimity, has shown itself able to address the issues of mutual and common concern among the members of the consultative group, and it has spawned parallel and interrelated measures which have extended the rule of law to aspects and regions of the Antarctic system which were excluded or not explicitly covered in the Treaty itself.
- And, the treaty has enabled other nations which developed interest to accede to the treaty and enlarged the consultative forum to include those nations whose interests are sufficient to cause them to actively participate in the scientific work being done on the continent and its adjacent oceans.

Perhaps the most interesting feature of the treaty has been the use of its consultative process, first to achieve accord on a protective measure for Antarctic seals; thereafter, to serve as the forum in which to develop the framework and concepts for the Convention for the Conservation of Antarctic Marine Living Resources (CCAMLR); and finally, for the discussion of the concepts and provisions for an Antarctic Mineral Resources Regime. The greatest strength of the Antarctic Treaty is its flexibility and the capacity of the structure to evolve.

The possibility of the organic development of a system of interrelated and mutually reinforcing measures to broaden the application of law to the Antarctic and its surroundings was certainly foreseen by those who negotiated the treaty itself. I remember sitting in a restaurant in Santiago, Chile, in 1965 with representatives of several of the treaty parties most concerned with the measure that was to become the Convention for the Conservation of Antarctic Seals (CCAS). We discussed then the order of measures from seals to living resources of the southern ocean to mineral resources of the continent that would be required to fill out the Antarctic Treaty System. We all recognized that the treaty's capacity to address these questions would have a direct bearing upon the manner in which the original treaty consultative parties would view their options in 1991 when any one of them may request a conference to review the performance of the treaty.

The fact that it has been possible to achieve this development shows the inherent strength of the system which, despite the original skepticism of several of the member states, has gained their confidence. In fact, the wisdom of the drafters of the Antarctic Treaty was to recognize two issues about which all the principals agreed — peaceful uses and the freedom of scientific investigation — to have these serve as a foundation upon which to establish the confidence of the participating parties and then to provide them with a mechanism by which to gradually address other significant issues of mutual concern. Over 23 years these governments have come to see that the Antarctic Treaty System has protected their interests and enabled them effectively to address new issues as they have arisen. During two decades in which the world has moved towards political disorder, the Antarctic Treaty System has forged a greater order for the Antarctic continent and its immediate environs.

Now there are voices raised who would exchange the Antarctic Treaty System for some other arrangements under the United Nations.

To all of those my message is, beware. The issue with which they meddle is not the protection of the Antarctic environment. It is not who will reap the benefits of the harvest of Antarctic resources. The issue with which they trifle is sovereignty; who owns the Antarctic, a question that has lain at rest for 23 years, but which is very much alive.

In the period immediately preceeding the Washington Treaty Conference in 1958, the nations that were to become the Antarctic Treaty Consultative Parties, first individually and then collectively, chose between asserting each, its sovereign rights in Antarctica and joined in a collective political settlement which preserved these rights but which permitted the building of a system of peaceful cooperation outside the framework of sovereignty. They chose the latter course because they understood their rights and interests to be better served by such collective action.

This decision to join in the negotiation of an Antarctic treaty, however, in no way implied or proclaimed a renunciation of rights or claims by the original treaty consultative parties. Article IV is specific on this point. Rights and claims were placed in suspension and each of the original parties agreed that whatsoever was done while the treaty is in force shall not hereafter constitute the basis of a claim.

We can speculate that science alone was not the only reason the Antarctic Treaty consultative parties occupied an extensive array of stations during the period of 1955 through 1960. The scientific objectives of the IGY provided reason for and legitimized a sustained and amplified occupation of the Antarctic continent by those nations with historic interests, occupation that will support and substantiate claims to sovereignty hereafter should it be necessary. We also tend to forget that the IGY did not occur while Article IV of the treaty was in force and thus that these IGY activities are not subject to its provisions with respect to constituting a future claim. It is also important to note that parties acceding to the treaty and entering into Consultative status since 1961 are carrying out activities which hereafter may not constitute the basis of a claim. So long as this is true, the original Antarctic Treaty consultative parties may be comfortable about other nations participating in Antarctica.

Nor did these nations declare that they might not exercise their rights and claims hereafter. In fact, the architects of the Antarctic Treaty made provision in Section 2 of Article XII for just such a reconsideration after the treaty has been in force for 30 years, namely in 1991 and thereafter.

It is a dangerous view today to assume that over the last 23 years the rights and claims in the Antarctic have atrophied. I have no doubt that, should the original Antarctic Treaty consultative parties perceive that their rights and claims are no longer secured by the Antarctic Treaty System, they will terminate the treaty arrangement and the effect of Article IV and either proceed unilaterally or in some collective manner to protect their right and claims.

Only so long as each of the original Antarctic Treaty consultative parties perceive that their sovereignty and interests continue to be protected through the structure created by the Antarctic Treaty will the presently achieved peaceful balance of these asserted claims and established rights stay in place.

It would be one of the ironies of the 20th Century if the United Nations General Assembly, in pursuit of the principal of universal participation, were to cause a resurgence of sovereignty and nationalism in the Antarctic and weaken or destroy the one treaty today that effectively carries out the greater principal set forth in the Charter of the United Nations — Peace.

And one has to ask who could stop the original treaty parties from asserting sovereignty over portions or all of the continent? Possession is 90% of the law. Further, consider the problems of operating in the Antarctic. In addition to an established presence on the continent, every major port (except one — Lorenzo Marques) and all airports best located to support Antarctic operations lie within the territory of one of the original Antarctic Treaty consultative parties. One should also assume rightly that the nations currently maintaining stations on the continent command the most strategic location for access to and for travel within the continent.

Nor has anyone made a case that Antarctica would be better managed under some other regime. Arguments have been made that:

— The matter of claims remains ambiguous;
— The deliberations of the Consultative Parties are carried out under the cloak of secrecy;

- These deliberations about Antarctica do not reflect global issues of concern to all nations;
- Some great resource treasure is about to be absconded;
- Access to the decision-making councils comes at too high a price – the willingness to pay for the privilege of working and freezing in Antarctica; and
- The Antarctic Treaty parties cannot enforce their own rules to protect the Antarctic environment.

It is a mistake at this time to try to be too tidy about the jurisdictional relationships that lurk in the background of the Antarctic Treaty System. The important point to realize is that, on any significant matter within the treaty area, the concerned parties can agree to address the matter, that when they do so with the agreement of all the consultative parties and that when they do so, they agree to address the issue outside the domain of sovereignty. The test is whether programs, activities, mutual assistance, and enforcement can be administered and carried out in the presence of ambiguous jurisdiction. To date one must conclude that it is possible, at least as possible as it is in the other parts of the world where jurisdiction is clear and defined. Let us not apply standards of performance in judging the Antarctic system that are more severe than the standards we apply in the rest of the world.

While the confidential nature of the Antarctic Treaty consultative process was a necessary step in the treaty's early days to allow confidence to build among the original treaty parties, it is time to open the consultative meetings to wider participation; certainly to the representatives of the acceding parties; to the representatives of Scientific Committee on Antarctic Research (SCAR) and other ICSU's; to U.N. specialized agencies; and to non-governmental organizations with a direct interest in Antarctic issues.

The Antarctic Treaty and its purpose to develop Antarctica for peaceful purposes needs a constituency. It is just to say that those with the responsibility to manage their government's activities in Antarctica have done a less than adequate job of instructing the public in the progress of the political, logistical, and scientific development of Antarctic knowledge and enumerating the benefits of these efforts for the good of mankind. However, the process of opening the consultative forum is underway and the solution does not reasonably require or warrant undoing the whole Antarctic Treaty System to achieve the objective. It is important that those now outside the consultative process make it clear that their desire to participate is constructive in terms of developing the Antarctic Treaty System and that they have something to contribute to the peaceful development of the area.

One of the crowning achievements of the Antarctic consultative process has been its ability by and large to agree that issues which divide the parties in other international forums shall be discussed in these other forums. The United Kingdom and the Government of Argentina served together in the Antarctic Treaty consultative process even while they were engaged in the Falkland Islands war. The Korean airliner incident did not inhibit the continued consultation among the Antarctic Treaty consultative parties over the question of a regime for mineral

resources in Antarctica. South Africa continues to be a full participant in the treaty's consultative process. There is no demonstrable advantage to carrying our disagreements into every international forum. The United Nations was established as the place for such ventilation. Let us leave it there and not turn every forum into a United Nations. It is well also to remember that the Antarctic Treaty consultative process cannot function unless all of the original consultative parties are present.

The Antarctic is thought by many to be the last great pot of gold at the end at the resource rainbow. To listen to the chorus of cries about sharing these vast resources echoes the battle cries of the miners who went to Sutter's Mill in 1849, to Australia in 1851 and to the Klondike in 1896.

Persons, familiar with the Antarctic, have to be skeptical about the amount of *useable*, mineral resources there actually may be on the Antarctic continent and its adjacent offshore areas. One must suspect that the cost of extraction will put these resources beyond the reach of almost everyone and that in the world market place it will be long time, if ever, before these resources are competitive. Furthermore, I would suggest that it is only those nations already consultative members of the Antarctic Treaty who by and large have the technological capability to find and extract such resources.

There may be a temptation to look at Antarctica as an extension of the "Law of the Sea" question and these non-renewable resources as part of the "common heritage of mankind". I suggest that there is little similarity. Uses of the high seas are historically viewed by nations as available to everyone. The land mass of Antarctica is claimed in part by seven nations. Five other nations, including the United States and the Soviet Union, hold liens on it, if you will, rights and interests established by discovery, exploration, and occupation. I would suggest that, if there is a parallel between the Law of the Sea experience and Antarctica, it is a negative one. As many coastal states reacted to the common heritage principal by extending their jurisdiction seaward over adjacent areas. The application of the principal to Antarctica might well trigger a similar response among the original Antarctic Treaty consultative parties.

In the negotiation of the CCAS and the CCAMLR, the Antarctic Treaty consultative parties have recognized the limitations set forth in Article VI of the treaty to the effect that nothing in the treaty shall jeopardize the exercise of rights of nations on the high seas. The taking of seals, fish, and other marine resources are an established right on the high seas and thus their regulation is properly the subject of a convention agreed outside the Agreed Measures process of Article IX of the treaty.

Non-renewable resources on or adjacent to the Antarctic continent are an entirely different matter. Unlike the CCAS and the CCAMLR, non-renewal resources is an issue that effects the sovereignty of the original Antarctic Treaty consultative parties and these parties have the option of either managing the exploration for and the exploitation of such resources through a convention to which other nations may be signatory or through a measure which limits participation to parties consulting under terms of Article IX of the treaty.

It is a measure of the confidence that the original Antarctic Treaty consultative parties have gained in the treaty that they are willing to discuss measures to

regulate the exploration and exploitation of non-renewable resources and that they are considering presently a measure open to other nations. This willingness, however, should under no circumstances be viewed as a lessening of interest or concern for the rights, interests or asserted claims of the original consultative parties in Antarctica. It is an effort on their part to resolve the mineral resource question so as to minimize potential discord in the spirit of the Antarctic Treaty.

It was equally the mutual concern about protecting the Antarctic environment that provided the common ground on which twelve representatives of delegations at the Sixth Antarctic Treaty Consultative Meeting in Tokyo first met informally without translators over coffee under the agenda item "other business" to discuss the effects of explor-ation for and exploitation of mineral resources in Antarctica and agree that it was a matter for future consultation.

If one considers the effort spent on the Agreed Measures for the Conservation of Antarctic Fauna and Flora, the CCAS, CCAMLR, and the mineral resources measure, which are after all in themselves conservation measures, the Representatives of the Antarctic Treaty Consultative Parties have devoted a substantial portion of their time to conservation matters, more time and effort than has been devoted over the same period to the subject by any legislative body which deals with more issues than just conservation matters.

There remains, however, a concern whether the consultative parties have the will to enforce the measures their governments have enacted. There is the fear that when environmental push comes to mineral resource shove the environment will be the loser. It is suggested that the Antarctic environment would be more protected under the status of "World Park" as declared by the United Nations.

This is not a new idea. It was first suggested at the First World Conference on National Parks in Seattle in 1962. National Parks are peculiarly U.S. institutions and not everyone would agree that they are a total protection against the pressures of development, including mineral development. One has to ask who would administer this world park. The record of the U.N. environmental agency does not inspire confidence. If turned over to the present occupiers of Antarctica as a commission in trust for the United Nations why would the French, for example, be any more swayed in their decision to build an airfield through a penguin rookery under the threat of U.N. disapproval than they are under the possible censure of their consultative colleagues.

More to the point is to build those national and international coalitions which can effectively make public concern known to governments with responsibilities and programs in Antarctica and require these governments to be accountable. As we have learned in our domestic fight for environmental awareness and sensitivity, vigilance is the price of a clean environment, and governmental institutions have to be taught how to be accountable. In the case of Antarctica we start with governmental institutions already sensitized to a considerable degree, to a much greater degree in fact than the General Assembly of the United Nations and all but a few specialized U.N. agencies.

One avenue immediately available is greater reliance upon the inspection process called for under Article VII of the treaty. While principally undergirding the peaceful purposes of the treaty, inspection in Antarctica can focus on any activity

carried out there and report on compliance with any measure adopted by consultative parties under terms of Article IX.

Equally effective would be an alliance between environmental interest and the scientists who carry out their research in Antarctica. The perpetuation of Antarctica as a scientific laboratory is inseparably tied to the preservation of the natural environment. It is much more in the immediate interest of the scientist to preserve the natural condition in Antarctica than it is in the interest of the politicians who run governments. There are no voting constituents in Antarctica although I am sure that had Mayor Daly lived long enough he would have figured out a way over time to have the emperor penguins vote Democratic in the Chicago primaries.

The scientist, who conceived the IGY and its Antarctic program, achieved their success because they were willing to enter the arena of national and international politics to achieve their aims. For the first ten years during which the treaty was in force, the representatives of science continued to play a major role in the development of national Antarctic policy and the extension of these policies through the device of the treaty's consultative process.

Recognition of the role of science as the predominant interest in the formulation and execution of United States Policy for Antarctica was reflected in President Nixon's announcement in 1970 of the transfer to the National Science Foundation (NSF) of the responsibility to budget for all aspects of the United States' activities in Antarctica including the programs' logistic support previously budgeted by the Department of Defense. The National Science Foundation accepted the budgetary and housekeeping functions and eschewed the leader's role in setting policy.

The scientific community is ambivalent about assuming roles of political leadership. Scientific statesmanship takes time and energy away from research. Commitment to this cause or that party has inherent risks. As Antarctic issues of concern to governments have moved away from a focus on science to address matters of resource management, the U.S. Antarctic scientific community appears to have withdrawn from the deliberations and determinations of national Antarctic policy. And yet, scientific research is Antarctica's principle product, and its pursuit remains the *raison d'etre* for national presence on the continent.

There is at stake right now for the Antarctic scientific community:

- The scientist's right of freedom of access;
- The continued uninterrupted flow of data;
- The continued priority availability of the logistic support upon which scientific field work depends;
- The impact of non-conforming activities on the areas where research is best conducted;
- The potential pollution of the environment; and
- The maintenance of an assigned seat in the councils of government and at the Treaty Consultative Meetings.

Is the issue of non-renewable resources and the regulation of exploration and exploitation a concern of the U.S. Antarctic scientific community? Certainly. Whose

specially protected area is going to be covered with crude when the well blows out? Whose study plots in the Dry Valley are going to be ground into oblivion when the drunken tractor driver goes for a drive? Whose support helicopter is going to be diverted to get the appendicitis case out from a mining camp? Whose C-124 Hercules is going to be sent on a search and rescue mission when some aerial geophysical survey plane disappears beyond the Ellsworth Mountains?

More important, who is going to serve as the watchdog, the traffic cop, to make the judgment when exploration or exploitation can be safely carried out, to decide what limiting conditions will be placed on a permit to extract? How many U.S. scientists who are conducting research in Antarctica know the current provisions in the draft agreement on non-renewable resources pertaining to the role of the scientific advisory group and the extent and limits to its authority and review power? Has the NSF discussed with these scientists the evolution of the concepts for this regime as they have developed since the first discussions of the issue in Japan at the Sixth Consultative Meeting? Has the NSF presented to the drafters of the U.S. position the views of these scientists either offered individually or through the Committee on Polar Research of the National Academy of Sciences (NAS)?

The scientific community, the group most effected by mineral resource exploitation, has to ensure that instruments ratified by the governments which represent their interests include the statements of principle which recognize the need for scientific judgment and contain the procedures that bring these judgments to bear on the decisions to explore, exploit, and extract mineral resources, or for that matter govern any other peaceful activity in Antarctica.

Antarctic scientists must speak out. The agency of government which support their specific research must also reflect their broader concerns about the development of the political structure of Antarctica that protects research opportunities and about the protection of the Antarctic environment. If the U.S. scientific community individually and through the Committee on Polar Research of the NAS were to take a public stand on such environmental issues, the conjunction of their interests with those of non-governmental, conservation organizations would be irresistible.

In conclusion, let us:

- Reaffirm that Antarctica shall be used for peaceful purposes only and to that end work to strengthen and support the Antarctic Treaty and the system of governance which is based on it;
- Reemphasize that scientific research and the products of this research shall be the principle product of Antarctica and that they shall be used in so far as possible for the benefits of mankind;
- Urge Antarctic scientists to play an active role in the development of national Antarctic policy as well as actively pursue their research aims;
- Restate the commitment to the protection and preservation of the natural environment in the treaty area and seek ways within the

Antarctic Treaty System to translate these goals into effective measures of enforcement and accountability;

- Restate our commitment to refrain from and to discourage the introduction into the councils of Antarctic affairs extraneous and decisive political issues unrelated to the furtherance of the treaty and its systems of regulatory measures adopted for the Antarctic and the southern ocean;
- Call upon our national institutions which are charged with the responsibility to plan, organize and carry out national Antarctic research programs to exert their efforts, and with our help, to better inform the public about the nature of Antarctica and the activities that are carried out there; and
- Open the consultative process to other interested nations and organizations which either have a legitimate interest in Antarctic affairs or a contribution to make to its peaceful development.

In the United States let us reexamine whether the NSF is the appropriate agency of government to further the development of U.S. activities in Antarctica or whether it is time to consider the establishment of an independent agency or commission to fulfill that purpose and to coordinate the activities of the several federal agencies that have research and regulatory roles to play in Antarctica.

Let us not be distracted by the immediate specter of non-renewable resources in Antarctica, but let us get in place the necessary regulatory structure before exploitation becomes a reality.

Let us not be mesmerized by the call to apply the common heritage principle to Antarctica. Let us remember rather that this principal connotes chiefly exploitation and sharing of natural resources and bears little or no relationship to the principal of environmental preservation or to the peaceful pursuit of scientific research.

And, let us remember that it is not in anyone's interest to test how far the Antarctic Treaty consultative parties will waive and dilute their rights to and sovereignty over the Antarctic continent. Rather, it is wisdom to see how we can further the arrangements that have been begun and to which the nations with claims, historic rights, and interests in Antarctica have come to trust. To those who would like to replace the Antarctic Treaty with some other arrangement, I urge they consider whether they could renegotiate today any multi-national measure that would approach the Antarctic Treaty in terms of the positive benefits it offers mankind.

I suggest that any alternative less than the present treaty will be a very expensive alternative. Dissolve the Antarctic Treaty, and thereby Article IV, and national security interests in the region will dramatically inflate military budgets. Frankly, as an environmentalist of long standing, I would prefer to have those tax dollars cleaning stacks to stop acid rain. I would prefer to see these tax dollars going to help the community and economic development of some emerging nation.

Let us keep in the forefront of our considerations that the primary purpose of the Antarctic Treaty to which all is subordinate is the maintenance of Antarctica "for peaceful purposes only". All other uses, objectives, interests, activities are subordinate to this single purpose. There is no non-renewable resource in Antarctica that is more valuable to mankind than this primary goal of the Antarctic Treaty. To those who ask what benefit mankind derives from Antarctica and the Antarctic Treaty, the reply is Peace.

PART THREE

Marine Living Resources

Antarctic marine living resources were the first of the major resource questions to be tackled by the Antarctic Treaty consultative parties, resulting in the negotiation of the Convention for the Conservation of Antarctic Marine Living Resources, called CCAMLR.

We will begin our session with two speakers. The first will be talking about the resource background. What is the state of play in the ecosystem in terms of the Antarctic marine living resources, and why did the concerns for those resources lead to action? This will take us to our second presentation on the history of the negotiation of the CCAMLR and where we stand with that convention now.

Following the two major addresses, we will have four panelists. The first will represent the environmental community, commenting on how that community perceives the activities that have gone on to date with regard to Antarctic marine living resources. The second panelist will be discussing legislation which the United States is now considering to implement the CCAMLR for U.S. citizens. The third panelist will discuss the economic aspects of Antarctic fisheries, looking particularly at the kinds of vessels that might be employed in the fishery, what countries are involved, and exactly what fishing activity is taking place. We will conclude with a panelist discussing the status of krill research. Krill, of course, is the animal which is basic to the Antarctic marine ecosystem.

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CHAPTER 7

Fisheries Overview

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INTRODUCTION

One of the reasons for the increasing interest in many countries during the last 25 years in the southern ocean around the Antarctic is the presence of major living resources. The most important Antarctic marine food resources are the krill and some of the fish species. These resources can provide large quantities of animal protein needed in future years to feed the quickly increasing human population. However, it is important to limit the utilization of these valuable stocks to a permissible level so as to prevent over-exploitation of the food resources and to protect the overall Antarctic marine ecosystem against too rigid influences by man.

The krill (*Euphausia superba*), a euphausiid crustacean reaching a maximum body length of about 6cm, is widely distributed in the cold upper water layers, mostly between the surface and 200m depth, of the Antarctic ocean (Figs. 1 and 2). The abundance of krill has been known since the explorations of Captain Cook in 1775, since large quantities of krill were seen by the whalers in the stomach contents of the baleen whales.

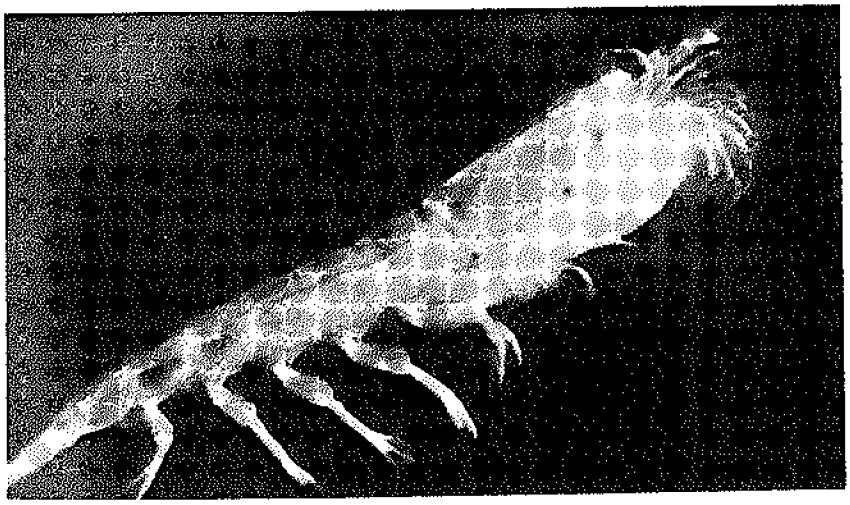

Fig. 1. Antarctic krill (phot. Siegel).

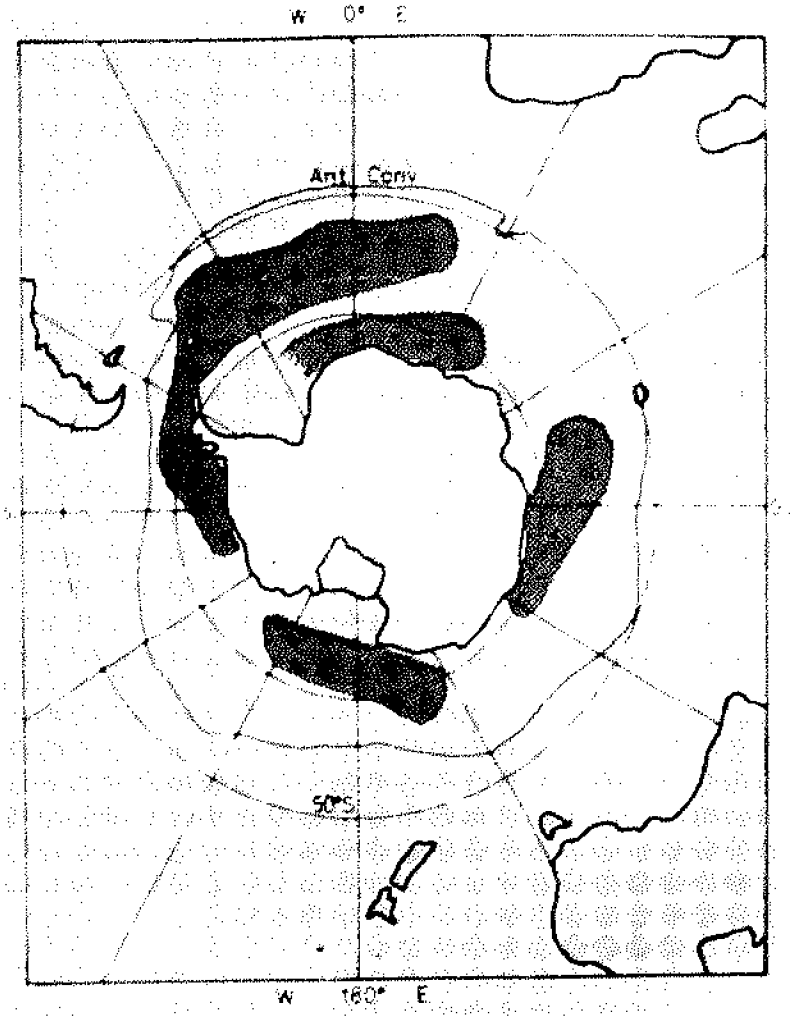

Fig. 2. Major areas of krill distribution.

KRILL AS A FOOD SOURCE

However, it was not until the early 1960s that plans were implemented to use the krill as a direct source of human food. The first explorations for the establishment of a krill fishery were started by the Soviet Union, followed by ships from Japan and later from several other countries.

Through these activities, a proper technical basis was developed for the commercial krill fishery. Hydroacoustic equipment was adapted to locate krill concentrations and pelagic trawls were developed with special designs for this type of fishery (Figs. 3 and 4). Considerable progress was made as well in the field of krill processing and development of various krill products (Fig. 5). In this latter area, difficulties arose when a high fluoride content was identified in the krill meat processed for human consumption. However, during subsequent experiments it was found that in living krill the fluoride is concentrated in the shell only so that the meat contains low levels of fluor provided the krill is processed immediately after catch and the shell separated entirely.

Fig. 3. Echo sounder trace of krill swarm (phot. BFA fur Fischerei).

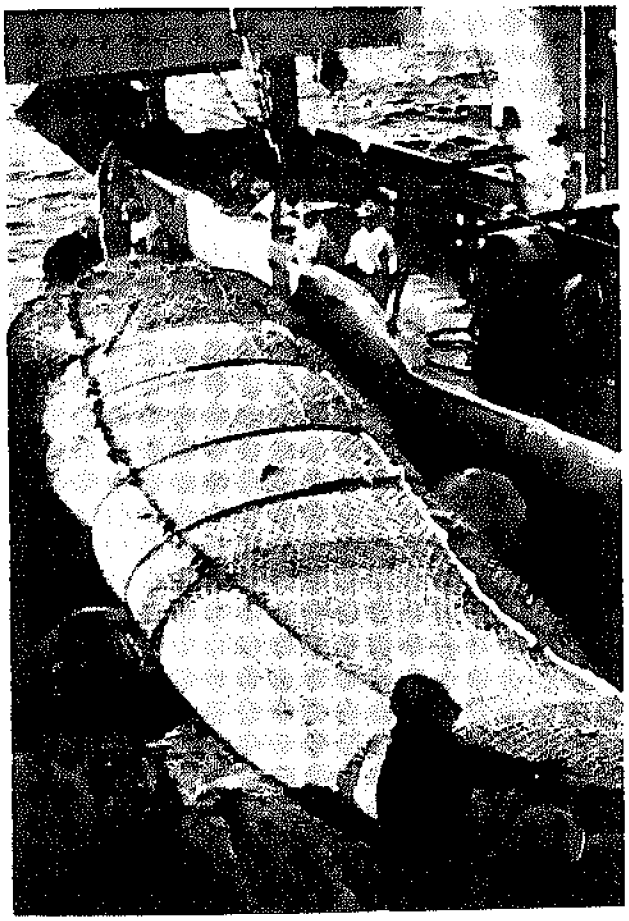

Fig. 4. Pelagic trawl with large krill catch (phot. BFA fur Fischerei).

Fig. 5. Production of minced krill meat with bone separator (phot BFA fur Fischerei).

With these technical innovations, a commercial krill fishery in the Antarctic developed which presently produces approximately 530,000 metric tons of krill annually (Fig. 6). Most of these catches are made in the Atlantic sector, notably the waters near South Georgia, the South Orkney Islands, and north of Elephant Island. Since the 1976/1977 season, increased landings have come also from the Indian Ocean sector whereas catches in Pacific waters have been rather small so far. Almost 90 percent of the total landings are made by ships from the Soviet Union, about 6 percent by vessels from Japan and the remainder by trawlers from Poland, the German Democratic Republic, and some other countries.

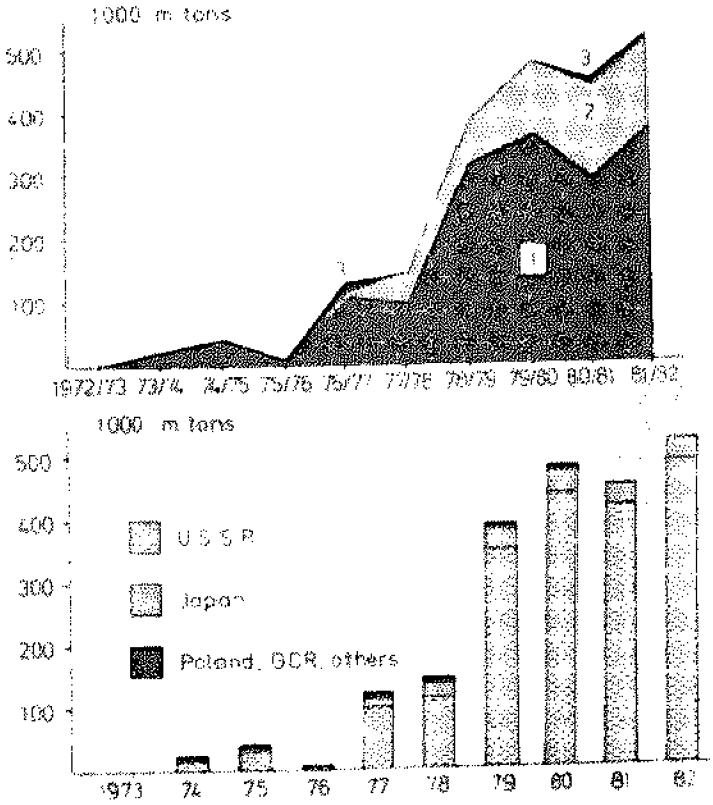

Fig. 6. Landings of Antarctic krill by areas and countries
1. Atlantic Ocean
2. Indian Ocean
3. Pacific Ocean
From FAO Yearbook of Fishery Statistics.

Further expansion of the krill fishery with steep increases in catches seems possible, particularly since there exist a large number of suitable factory trawlers which could divert their efforts to Antarctic waters if fishing opportunities for distant-water fleets diminish further in other parts of the world. Limiting factors are remoteness of the Antarctic Ocean, tough weather and ice conditions, and the shortness of the fishing seasons (about 5 months). High fuel costs and limitations in selling suitable products at good prices on the world market are also deterrents to the development of this fishery.

FISHERIES STUDIES

However, the question arises to what extent the commercial krill fishery could be developed further without detrimental effects to the krill stocks and to the marine ecosystem as a whole. Sound scientific knowledge is required to answer this question.

Systematic investigations on krill started during the second decade of this century with expeditions of the British research vessel *Discovery*. Interest in and concern about the development of both krill and finfish fisheries provided a strong impetus for the promotion of scientific research, especially during the past 20 years. Particularly the international program of Biological Investigations of Marine Antarctic Systems and Stocks (BIOMASS) with its two phases of closely coordinated multi-ship surveys of the First International BIOMASS Experiment (FIBEX, 1980/1981) and the Second International BIOMASS Experiment (SIBEX, 1983/1984 and 1984/1985) contributed greatly to, and will further provide, better knowledge of the biology of the krill and of other components of the Antarctic marine ecosystem.

Investigations have shown that krill forms dense concentrations at certain times which seem to be influenced by water mass structure and transport (Fig. 7). There are diurnal migrations of krill with denser concentrations at night near

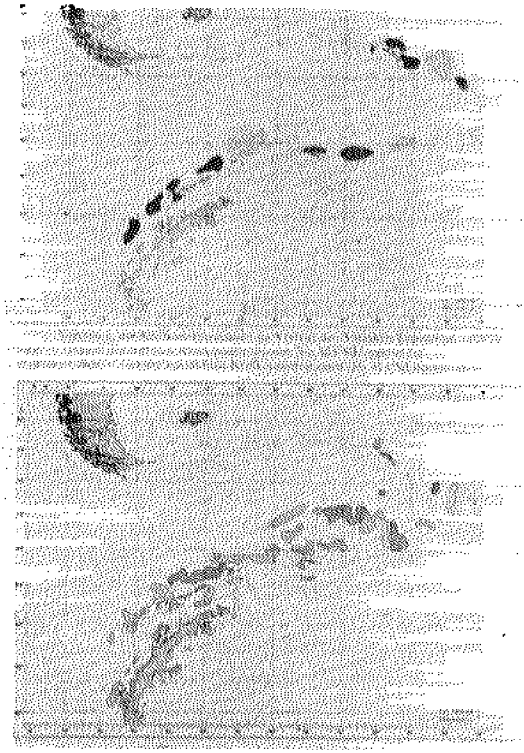

Fig. 7. Distribution of main krill concentrations in the Scotia Sea during German (F.R.G.) expeditions 1975/76 *(above)* and 1977/78 *(below)*.

the surface and more scattered distribution during the day. Krill are also able to move actively, even opposite to the currents, when feeding or spawning. Reproduction takes place over a considerable period of time, mostly between December and March. Development from the egg to adolescent krill runs over 12 larval stages. Recent studies have shown that krill may live for at least six years whereas previously its life-span had been assumed to be three to four years. Little if any is presently known on the identification of separate krill stocks and on the processes of their biological reproductive cycles.

Joint hydroacoustic surveys during FIBEX in the Atlantic and Indian Ocean sectors, combined with net sampling programs, provided the first preliminary direct estimates of krill biomass. Based on the results obtained in limited areas of investigation, the total biomass of krill has been roughly estimated at 200 million metric tons. A "super swarm" located near Elephant Island covered an area of about 450 square kilometers and may have contained perhaps some 2.5 million metric tons of krill. However, it must be realized that estimates of biomass through such methods are difficult, particularly since krill distribution is very patchy and it is not known how much krill is scattered over wide parts of the Antarctic ocean outside the dense concentrations. Other independent estimates of overall krill biomass amounted to 500-750 million metric tons or ever more.

KRILL MANAGEMENT

Improved knowledge on all these aspects is urgently required to provide the necessary scientific basis for a sound development and proper management of Antarctic krill fisheries which is one of the important tasks for the recently established international Convention for the Conservation of the Antarctic Marine Living Resources (CCAMLR). From our present knowledge it may be safe to assume that the krill resources will allow a continuous annual catch of several tens of million metric tons of krill without detrimental effects to the stocks and to the marine ecosystem (compared to the present total annual world fish landings of about 75 million tons). The actual krill catch of 530,000 metric tons (1981/1982) represents roughly only 1 percent of the possible level of exploitation. However, it will be important to avoid a concentration of krill fishing on only a few localities. We must also assume that any influence of the fishery on the krill stocks and their consumers could presumably only be detected after the catch of very large quantities of krill. Most important is the timely establishment of an international strategy for the development and management of the krill fishery.

FISH STOCKS AND THEIR UTILIZATION

Another major resource is the fish stocks around the Antarctic and Sub-Antarctic islands and near the continent. There are about 100 fish species, most of them endemic to the area, of which about 25 are of commercial interest (Fig. 8). These fishes are mainly demersal, living near the bottom but also moving further up in search of food, mostly krill.

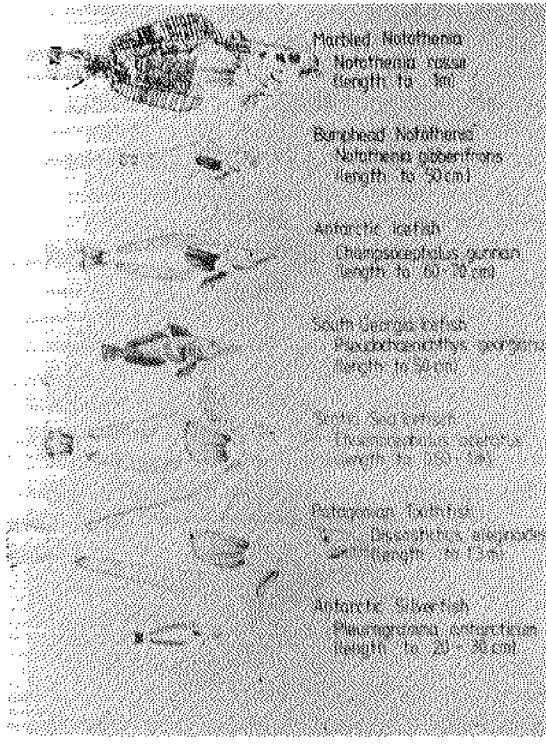

Fig. 8. Some commercial fish species of the Antarctic ocean.

Commercial utilization of Antarctic fish stocks started in the late 1960s with fishing vessels from the Soviet Union. In the Atlantic sector rather large catches were made in the beginning, and recent landings were in the order of 100,000 metric tons per year (Fig. 9). The waters around South Georgia, South Orkneys, Elephant Island, and the South Shetland Islands are the major fishing grounds. Fishing around the Kerguilen Islands in the southern Indian Ocean started slightly later, catches were in some years as large as 100,000-200,000 metric tons but remained during recent years at a level of 20,000 tons annually (Fig. 10). Different from the fishing areas in the Atlantic sector, fishery regulations and a licensing system have been introduced by the French authorities after the establishment of an exclusive economic zone around the Kerguelen and neighboring islands in 1978. Thus, fishery exploitation in these waters is now restricted to levels likely to produce the maximum sustainable yield. In the Antarctic Ocean, fisheries for finfish are almost entirely carried out by vessels from communist countries, especially from the Soviet Union (about 80 percent of the landings), Poland, German Democratic Republic, Bulgaria, and possibly others. Only recently have some trawlers from France commenced fishing around Kerguelen.

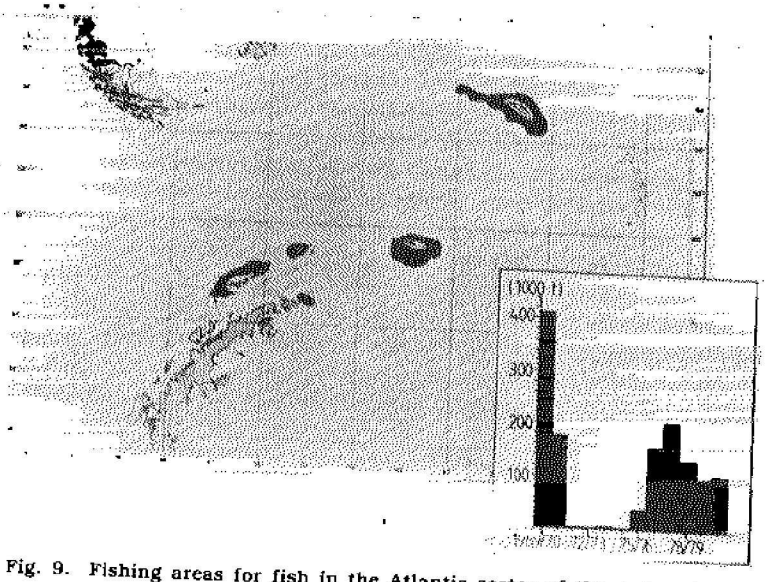

Fig. 9. Fishing areas for fish in the Atlantic sector of the Antarctic and annual fish landings from these waters.

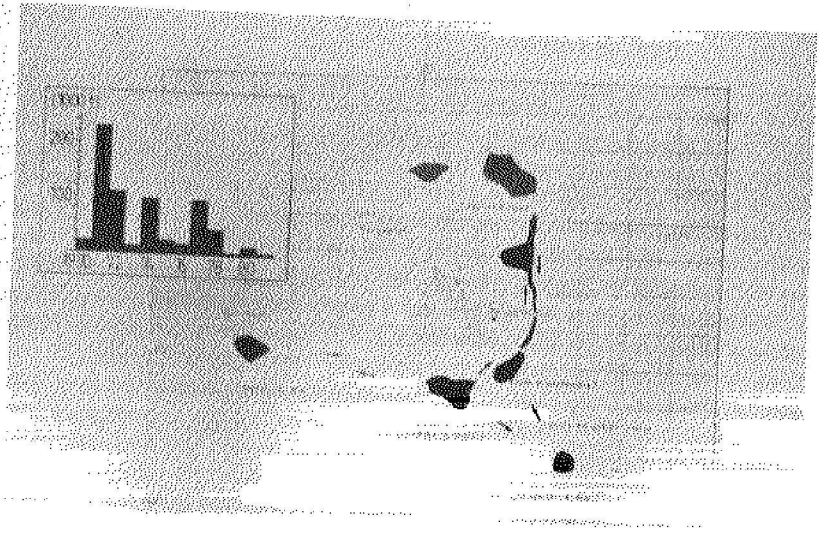

Fig. 10. Fishing areas around the Kerguelen Islands in the Southern Indian Ocean and annual fish landings from these waters. From Hureau (1980).

Unfortunately for the commercial fisheries in the Atlantic sector there is still a serious lack of detailed data. Therefore, only rather preliminary assessments of the status of the fish stock have been made. These studies indicate, however, that the fishery resources seem to be rather limited and vulnerable to heavy exploitation. The fish stocks concentrate on the shelf areas around islands with little if any migrations to other groups of islands. Intermingling seems to be limited to the oceanic transport of early life stages of Notothenioids and juvenile ice-fishes to neighboring areas. Furthermore, most fish species have a low production of eggs and slow growth so that many fishes are already caught before they reach sexual maturity. Since juvenile and adult fishes inhabit the same waters, young fishes are caught along with the older ones, particularly as there are presently no regulations for mininum trawl mesh sizes. The observed decreases in catch rates and in the sizes of fish caught as well as changes from one fishing ground to another and from one major fish species to another must be considered as indications that the fisheries exploitation had already seriously effected the fish stocks.

Young stages of Antarctic fish species have been observed in considerable numbers in or near krill concentrations. A special question is, therefore, what quantities of small fish are accidentally caught during the krill fisheries, thus decreasing recruitment to the fish stocks. Improved assessments of the actual status of the fish stocks as a basis for proper management of these resources are urgently required and it is hoped that with additional data this can be achieved soon by CCAMLR.

SQUID AS A RESOURCE

A further valuable food resource of the Antarctic ocean are the cephalopods, particularly squid. Since they are excellent swimmers, it is rather difficult to catch them with present techniques. Little is known about the size of these resources. However, they must be quite considerable because squid and their remains (beaks) are frequently observed as stomach contents of sperm whales, elephant seals, penguins and other animals. No squid fishery has developed yet in the Antarctic but such a development seems possible dependent on technological progress and future demands on the world market. An assessment of the squid resources appears an important task, also since squid have to be considered as major predators on krill.

SUMMARY

A summary overview on rough estimates of the size of the main marine living resources in the Antarctic together with preliminary figures for the annual food consumption, krill, cephalopods and fishes, is present in Fig. 11. As a result of extensive whaling, the number of baleen whales decreased to about one third of the original population. It can be estimated that the present annual consumption of krill by whales is of the order of 40 million metric tons which may be

about 150 million tons lower than the food requirements of the original population. Altogether whales, seals, birds and fishes may consume roughly 165 million metric tons of krill annually, and this does not include an additional substantial quantity eaten by cephalopods. These estimates indicate the enormous size of the krill resources and they show that krill forms the main food basis for the existence of the whole Antarctic marine ecosystem. The relationships within this ecosystem which are rather complex are shown in a very simplified picture in Fig. 12.

	Stock (1000 mt)	Biomass (1000 mt)	Annual food Consumption in Antarctic (Mill. mt)		
WHALES (Initial)	975	43000	190	2	4
WHALES (Present)	338	7000	43	04	09
SEALS	17000	3600	64	6	8
BIRDS	344000	800	34	14	8
FISHES		15000	25	+	+
CEPHALOPODS		?	++	+	+

Fig. 11. Living Antartic marine resources and their estimated annual food consumption in the Antarctic (whales: excluding figures for sperm whales). After Laws (1977).

Maintenance of the ecological relationships and restoration of depleted populations as well as prevention of irreversible changes in the marine ecosystem are important objectives of the CCAMLR. In developing a strategy for the management of this ecosystem it must be realized that this system is not in balance. The whale stocks decreased steeply due to whaling. The large amounts of krill, perhaps 150 million tons, no longer consumed by whales improved the food situation for other components of the marine ecosystem, and in fact substantial increases in the abundance of some other major krill consumers, especially the stocks of several penguin species and crabeater and fur seals, have been observed. It is therefore not possible to conclude that a restriction or even ban of krill fishing by man will necessarily result in a corresponding increase of the whale population which, of course, is not desirable. Thus, any proper management of the marine ecosystem must take all components of the system into consideration and include right from the beginning other most abundant krill consumers in addition to the whales.

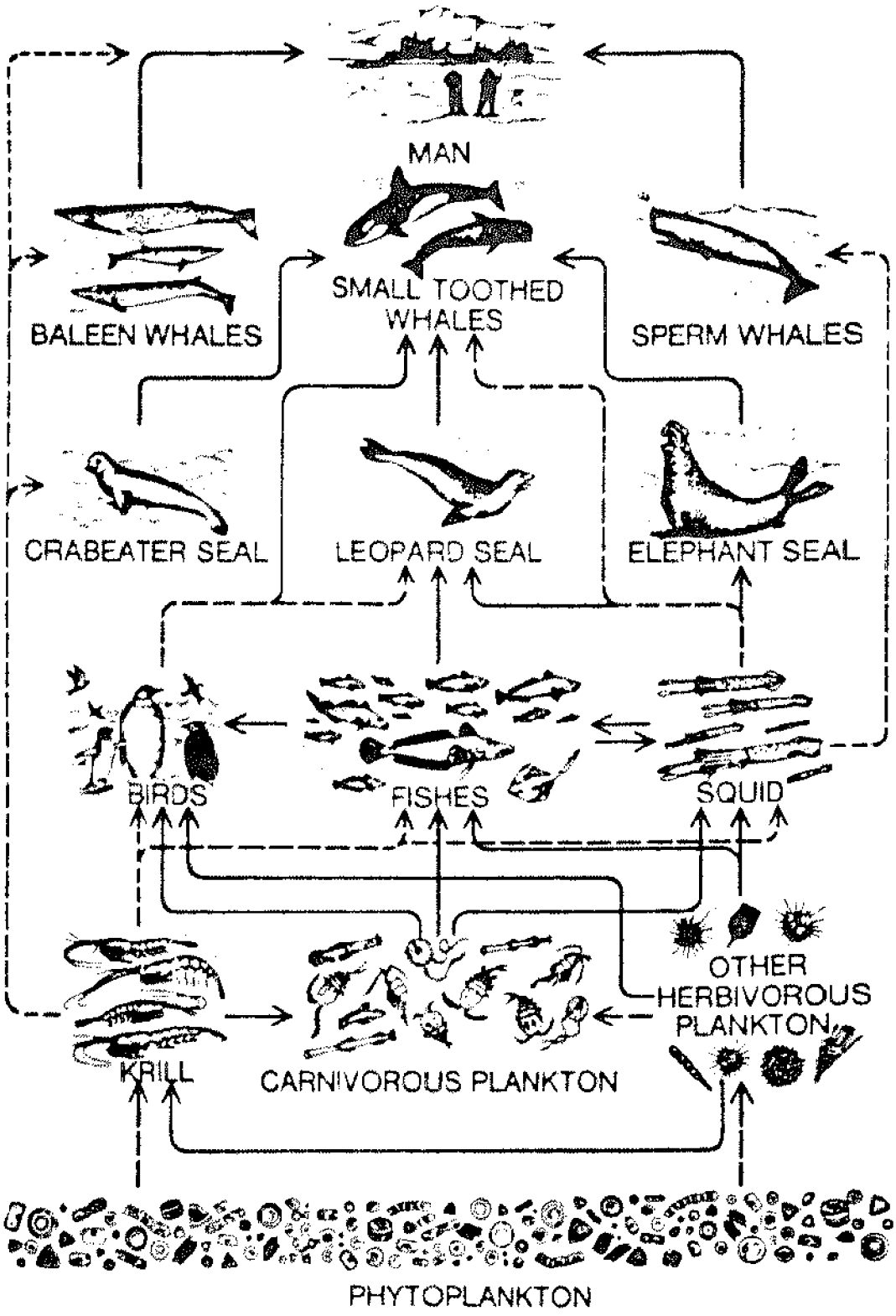

Fig. 12. Simplified structure of the Antarctic marine ecosystem. From Beddington and May (1982). Reprinted from "Scientific American" 247(5), November 1982 with kind permission of the publishers.

CHAPTER 8

The Convention on the Conservation of Antarctic Marine Living Resources

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In this paper, I will try to answer five questions: 1) what is the Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR)?; 2) what are the key elements and the unique features of the Convention?; 3) what concerns and events led to the Convention?; 4) what steps have been taken to begin implementing the Convention?; and 5) what types of problems might be encountered in continuing efforts to implement the Convention?

WHAT IS CCAMLR?

The Convention on the Conservation of Antarctic Marine Living Resources is an international conservation agreement. It is part of the Antarctic Treaty system and is intended to ensure that the Antarctic marine ecosystem is not affected adversely by harvesting of Antarctic krill, *Euphausia superba*, or other marine living resources. It was concluded at a Diplomatic Conference held in Canberra, Australia, May 7-20, 1980 and entered into force on April 7, 1982 (30 days after deposit of the Eighth Instrument of Ratification).

Most people involved in the negotiation thought that it probably would take five years or more, following signature in 1980, for the convention to enter into force. The fact that it entered into force in less than two years is significant and illustrates the importance attributed to the convention by the contracting parties.

WHAT ARE THE KEY ELEMENTS AND UNIQUE FEATURES OF CCAMLR?

From an operational perspective, the key elements of the Convention are Articles I, II, VII, IX, XII, XIV, XV, XVII, XVIII, XIX, XX, XXIII, and XXIV.

Article I indicates that the convention applies to the living resources in the marine area south of the Antarctic Convergence. It defines Antarctic marine living resources as "the populations of finfish, mollusks, crustaceans and all other

species of living organisms, including birds, found south of the Antarctic Convergence." It defines the Antarctic Convergence using a series of map coordinates.

Article II indicates that the objective of the convention is the conservation of Antarctic marine living resources, and notes that, for the purposes of the convention, the term "conservation" includes rational use.

Perhaps the most unique feature of the convention is the ecosystem-oriented conservation standard embodied in paragraph 3 of Article II. This paragraph directs that harvesting and associated activities be conducted so as to:

- Prevent any harvested population from falling below the level which ensures the greatest net annual increment;
- Maintain the ecological relationships between harvested, dependent, and related populations of Antarctic marine living resources;
- Restore depleted populations; and
- Prevent or minimize the risk of changes in the marine ecosystem which are not potentially reversible over two or three decades.

Article VII establishes the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR). Membership in the Commission includes the contracting parties that participated in the May 1980 conference at which the convention was adopted, and is open to any State which has acceded to the regime, during such time as that party is engaged in research or harvesting activities in the convention area, and to any regional economic integration organization, during such time as its States' members are entitled to be members.

The European Economic Community (EEC) has acceded to the convention and is a member of the commission pursuant to the latter provision. In addition to the EEC, the present members of the commission are: Argentina, Australia; Belgium; Chile; the Federal Republic of Germany; France; the German Democratic Republic; Japan; New Zealand; Norway; Poland; South Africa; the Union of Soviet Socialist Republic; the United Kingdom; and the United States.

The functions of the commission are described in Article IX. Among other things, these functions are to:

- Facilitate study of Antarctic marine living resources and the ecosystem of which they are a part;
- Compile data on the status of, and changes in the distribution, abundance and productivity of, harvested and dependent or related species and populations of Antarctic marine living resources;
- Ensure the acquisition of catch and effort statistics; and
- Formulate, adopt, and revise conservation measures on the basis of the best scientific information available.

The commission also is directed to take full account of the recommendations and advice of the Scientific Committee, to publish and maintain a record of all conservation measures in force, and to publish relevant data and reports of the Scientific Committee. Article XII of the convention requires that commission decisions on matters of substance be taken by consensus and that the question of whether a matter is one of substance be treated as a matter of substance.

The requirement to publish relevant data, the reports of the scientific committee, and the conservation measures in force is of great potential importance since it ensures that the basis of decisions and the decisions of the commission and the scientific committee will be available and subject to external review. The consensus system of decision-making also is of great potential importance since it in effect gives each commission member a veto which could be used to impede or prevent effective implementation of the convention.

Article XIV establishes the Scientific Committee for the Conservation of Antarctic Marine Living Resources. The Scientific Committee is to provide a forum for consultation and cooperation concerning the collection, study, and exchange of information concerning Antarctic marine living resources. The convention directs, among other things, that it:

- Establish criteria and methods for determining needed conservation measures;
- Regularly assess the direct and indirect effects of harvesting on the status and trends of Antarctic marine living resources; and
- Formulate proposals for the conduct of national and international research programs related to Antarctic marine living resources.

To facilitate the work of the Scientific Committee, Article XX of the convention requires that members of the commission provide:

1. (To the greatest extent possible) such statistical, biological, and other data as the CCAMLR and Scientific Committee may require to carry out their functions;
2. Information about their harvesting activities, including fishing areas and vessels, so as to enable reliable catch and effort statistics to be compiled; and
3. Information on steps taken to implement conservation measures adopted by the commission.

The article also provides that advantage shall be taken of harvesting activities to collect data needed to assess the impact of harvesting. This last provision is unique and could be of great importance since it constitutes an obligation or directive to use vessels engaged in harvesting and related activities to help obtain information necessary to meet the convention objectives.

Article XXIII of the convention requires that the commission and the Scientific Committee cooperate with the Antarctic Treaty Consultative Parties (ATCPs) on matters falling within the competency of the ATCPs, to cooperate with the

Food and Agricultural Organization and other specialized agencies of the United Nations, and to seek to develop working relationships with the Scientific Committee on Antarctic Research (SCAR), the Scientific Committee on Ocean Research (SCOR), the International Whaling Commission (IWC), and other intergovernmental and non-governmental organizations which could contribute to their work.

Article XXIV provides for the establishment of an observation and inspection system to ensure observance of the provisions of the convention and, pending establishment of the system, directs that commission members seek to establish interim arrangements for carrying out inspections according to basic principles set forth in the Article.

In addition there are three Articles which are of potential significance due, in part, to their financial implications. These are Articles XV, XVIII, and XIX. Article XV provides for appointment of an Executive Secretary and staffing of a Secretariat. Article XVIII provides that the CCAMLR and the Scientific Committee shall have four official languages — English, French, Russian, and Spanish. Article XIX provides that commission members shall contribute equally to the budget during the first five years after the convention enters into force and that the contributions thereafter shall be determined according to two criteria: the amount harvested and an equal sharing among all parties.

WHAT CONCERNS AND EVENTS LED TO THE CONVENTION?

The primary impetus for the convention was concern about the possible indirect effects of krill harvesting in the southern ocean. Antarctic krill is the dominant herbivore in the southern ocean food web and the principal component in the diets of: fin, blue, humpback, and minke whales; crabeater and Antarctic fur seals; Adelie, chinstrap, macaroni, and rockhopper penguins; and several species of fishes and squid. Some of these species are eaten in turn by sperm whales, killer whales, leopard seals, and other species. Thus, harvesting of Antarctic krill could affect these dependent species as well as the target krill populations.

Experimental harvesting of krill was initiated in the early 1960s and began to expand in the early 1970s (Bakus, et al. 1978). At the VIIIth Antarctic Treaty Consultative Meeting, held in Oslo in 1975, the representatives of the consultative parties recommended (Recommendation VIII-10) that their governments: initiate or expand studies of Antarctic marine living resources; encourage further cooperative studies among the consultative parties; encourage studies which could lead to development of effective measures of the conservation of Antarctic marine living resources; and urge the SCAR, through their national committees, to continue its work on these matters and to consider convening, as soon as practicable, a meeting to discuss current work and report on programs for the study and conservation of Antarctic marine living resources. They also recommended that the subject "Antarctic Marine Living Resources" be included on the agenda for the Ninth Consultative Meeting.

In response to the request in Recommendation VIII-10, the SCAR Group of Specialists on Living Resources of the southern ocean organized and convened a conference to review knowledge of antarctic living resources and to develop

a proposal for future cooperative studies. The conference was held in Woods Hole, Massachusetts, August 17-21, 1976. It, and subsequent meetings of the Group of Specialists, resulted in a report which summarized existing knowledge of the biology and ecology of Antarctic marine living resources and outlined a recommended plan for "Biological Investigations of Marine Antarctic Systems and Stocks (BIOMASS)" (SCAR/SCOR, 1977).

The principal objective of the BIOMASS Program is "to gain a deeper understanding of the structure and dynamic functioning of the Antarctic marine ecosystem as a basis for the future management of potential living resources." Implementation of the program began with planning and conduct of a coordinated, multi-national, multi-ship research effort. This program, called the First International BIOMASS Experiment (FIBEX), was conducted during the 1980-1981 austral summer, involved 13 ships from 11 nations, and was designed primarily to improve knowledge of krill distribution and abundance. A Second International BIOMASS Experiment (SIBEX) was initiated during the 1983-1984 austral summer and will continue during the 1984-1985 austral summer. Its primary objective is to obtain a better understanding of the dynamics of the krill-dominated part of the Antarctic marine ecosystem, particularly the relationship between the advance and retreat of sea-ice and krill distribution and abundance.

Also in response to Recommendation VIII-10, the subject of "Antarctic Marine Living Resources" was considered during the IXth Antarctic Treaty Consultative Meeting held in London in 1977. At this meeting, the representatives of the consultative parties recommended that a definitive regime for the conservation of Antarctic marine living resources be concluded before the end of 1978 and that a special consultative meeting be convened in order to elaborate the regime. They also recommended that the regime should provide for the effective conservation of the marine living resources of the Antarctic ecosystem as a whole, that, where necessary for effective conservation, the regime should extend north of latitude 60°S. (the northern boundary of the Antarctic Treaty area), and that the regime should not apply to species such as whales and seals already regulated by existing international agreements.

Pursuant to this recommendation, a Special Antarctic Treaty Consultative Meeting was held in Canberra, Australia, from February 27 to March 16, 1978 to begin elaborating a living resources regime. Before and during this meeting, draft regimes were submitted by eight delegations. After preliminary discussion, elements of the various drafts were combined to form a composite discussion draft.

Not all issues could be resolved during the meeting. It was not possible, for example, to reach agreement on the basic conservation principles or standards to be embodied in the regime, the system of decision-making to be used, and the possible participation and role of the European Economic Community. Consequently, a second session of the Special Antarctic Treaty Consultative Meeting was held in Buenos Aires, Argentina, from July 17-28, 1978, and informal consultations were held in Washington, D.C. (September, 1978); Bern, Switzerland (March, 1979); and during the Xth Antarctic Treaty Consultative Meeting held in Washington, D.C. (September 17 to October 5, 1979). Agreement on the basic conservation standard (Article II) was reached during the Buenos Aires meeting.

A consensus system of decision-making was agreed during the informal consultations in Washington, D.C. in September, 1978. General agreement on remaining difficulties was reached during the Xth Antarctic Treaty Consultative Meeting and, as noted earlier, a Diplomatic Conference was held in Canberra, from May 7-20, 1980, to conclude the Convention.

WHAT STEPS HAVE BEEN TAKEN TO BEGIN IMPLEMENTING THE CONVENTION?

During the Diplomatic Conference held in May 1980, it was agreed that a meeting should be held in 1981 to determine steps that might be taken to facilitate early operations of the commission, Scientific Committee, and executive secretariat to be established when the convention came into force. This meeting, held in Hobart, Australia, from September 10-24, 1981, provided an opportunity for a preliminary exchange of views on a number of procedural and administrative issues, including rules of procedure for the commission and Scientific Committee, initial staff requirements for the secretariat, financial requirements, and timing and agendas for the first commission and Scientific Committee meetings.

The convention entered into force on April 7, 1982 and the first meetings of the commission and Scientific Committee were held in Hobart, from May 25 to June 11, 1982. During its first meeting, the commission elected a Chairman and Vice-Chairman; adopted rules of procedure, financial regulations, and staff regulations; appointed an Executive Secretary; concluded an interim headquarters agreement; and, prepared budgets for 1982 and 1983. Australia was elected the first Chairman and Japan the Vice-Chairman of the commission. It was decided that, after the Australian term, the chairmanship of the commission would automatically pass to the other members in the order of the member states arranged alphabetically in the English language. In addition to appointing an Executive Secretary, the commission authorized the executive secretary to hire a scientific officer, data manager, administration/finance officer, and a steno-secretary.

The first meeting of the Scientific Committee was somewhat less productive. There were differing views as to the types of decisions that should be subject to decision-making (voting), when the European Economic Community and/or its member states should participate in decision-making, and whether decisions should be taken by consensus or by some type of qualified majority of the members present and voting. Consequently, it was not possible to reach agreement on Rules of Procedure, and, although informal discussions were held, it was not possible to reach agreement on a plan for the future work of the committee. A chairman and two vice-chairmen were confirmed in accordance with a commission agreement concerning election and rotation of the Chairman and Vice-Chairman of the Commission. Observers from the Food and Agriculture Organization of the United Nations (FAO), Institutes for Oceanography (IOC), International Whaling Commission (IWC), and International Union for Conservation of Nature and Natural Resources (IUCN) were present for the meetings of both the commission and Scientific Committee but, because most discussions dealt with procedural matters, they were not permitted to attend or participate in many of the discussions.

The second meetings of the commission and the Scientific Committee were held in Hobart from August 29 to September 9, 1983. The issues concerning Rules of Procedure of the Scientific Committee were resolved early during the meetings and the committee was able to begin consideration of a number of matters bearing upon implementation of the convention. Discussions focused on two general areas: 1) information and data requirements; and 2) research requirements and management goals.

Information and Data Requirements

After initial discussion, an ad hoc working group was constituted to facilitate consideration of this subject. Discussion within the group led to general agreement on: procedures for determining and reporting data from past fishing and scientific activities in the convention area; the types of catch, effort, and related biological information that would be desirable to collect during future fishing operations in order to permit the types of stock assessments that ultimately may be necessary to effectively meet the convention objectives; and the types of data from 1982-1983 and 1983-1984 fishing operations that should be compiled and distributed in advance, or brought to the next meeting, in order to facilitate the work of the Scientific Committee. It was not possible to reach agreement on the precise types of fishery and related information that would be required to meet the convention objectives, or how such data should be reported and synthesized to best meet the needs of the Scientific Committee and commission. It was agreed that the Secretariat's data manager would: consult with members during the inter-sessional period to facilitate identification and compilation of existing data; participate in the inter-sessional meetings of the ad hoc data working group; and, consult with the IWC, the North Atlantic Fishery Organization (NAFO), and other relevant data centers to determine how their experience might be used to expedite the development of an effective data base and data processing system.

Research Requirements and Management Goals

Discussion under this subject heading covered a broad range of topics including: the need to promptly assess the status of certain exploited fish stocks; the potential use of indicator species to detect and monitor the possible effects of krill harvesting on dependent and related populations of Antarctic marine living resources; the possible utility of a joint commission/committee seminar to consider management objectives and alternative approaches to ecosystem management; and, the desirability of providing funds to FAO to assist in the preparation and publication of "Species Identification Sheets for the Southern Ocean." As a result of these discussions, it was agreed that: fish stock assessment would be included as a special item on the agenda for the 1984 Scientific Committee meeting; to facilitate consideration of this agenda item, members would review and provide comments, evaluations, and/or data concerning the stock assessments done by the BIOMASS Working Group on Fish Biology (now Fish Ecology) and reported

in BIOMASS Report Series No. 12; the BIOMASS Working Party on Bird Ecology and the SCAR Group of Specialists on Seals would be asked for their views concerning the possible use of birds and seals as indicators of the state of the Antarctic ecosystem; the SCAR Group of Specialists on Southern Ocean Ecosystems and their Living Resources would be requested to provide copies of the species data summaries being up-dated by members of the group; the subject of management goals and the ecosystem approach to management would be included as a special agenda item for the 1984 and subsequent meetings of the Scientific Committee; and, funding would be provided to FAO to facilitate preparation and publication of "Species Data Sheets for the Southern Ocean."

The committee also considered cooperation with other organizations, proposals for the establishment of subsidiary bodies, and arrangements for the next meeting. It was agreed that the committee should continue efforts to develop effective working relationships with FAO, SCAR/SCOR, IWC, IOC, and IUCN, that an ad hoc working group on publication matters would be constituted to consider and make recommendations concerning documentation and publication policy; and that the 1984 meeting would be held in Hobart, September 3-13, 1984, in conjunction with the commission meeting.

During its second meeting, the commission approved the "Scientific Committee's Rules of Procedure"; received the report of the Scientific Committee; noted that the Scientific Committee had made progress in determining data requirements and collection procedures; welcomed an invitation to hold the intersessional meeting of the ad hoc Data Working Group in Woods Hole, Massachusetts; established a Standing Committee on Administration and Finance; extended the interim headquarters agreement; and, adopted provisional budgets for 1984 and 1985. The commission considered, but did not approve, requests from two non-government organizations, Greenpeace International and the Antarctic and Southern Ocean Coalition (ASOC), for observer status at meetings of the Commission and Scientific Committee. It was agreed that the executive secretary would write to both organizations requesting information as to their ability to contribute to the convention objectives.

Observers from FAO, IOC, IUCN, IWC, SCAR, and SCOR attended the meetings of both the commission and the Scientific Committee.

WHAT TYPES OF PROBLEMS MIGHT BE ENCOUNTERED IN CONTINUING EFFORTS TO IMPLEMENT THE CONVENTION?

As noted earlier, the CCAMLR is unique in a number of ways. It applies to an entire, definable marine ecosystem; it requires that harvesting and associated activities consider and avoid adverse impacts on dependent and related species and populations, and the ecosystem as a whole, as well as on harvested species and populations; and, unlike most conservation agreements, it was established before the principle species of concern, *Euphausia superba*, had been overharvested and required emergency management measures.

There are no precedents for the ecosystem perspective embodied in the convention and no models that can be used to accurately predict the likely direct

and indirect effects of different harvest levels and strategies. Also, relatively little is known about the southern ocean ecosystem. Therefore, the greatest potential impediment to achieving the convention objectives no doubt will be lack of information. Information, for example, on the basic structure and dynamics of the Antarctic marine ecosystem, on the discreteness, size and productivity of harvested and dependent species and populations, and on fishing effort and the quantities, sizes and biological characteristics of species which are taken, including by-catch, by year, season, and locality.

Articles IX, XV, and XX of CCAMLR recognize the need for adequate and reliable data and, as noted earlier, the Scientific Committee, as one of its first tasks, has taken on the job of defining data needs and the procedures that should be used to collect, report, and archive various types of data to best facilitate the work of the commission and the Scientific Committee. (The purpose of the June 1984 meeting of the ad hoc Data Working Group in Woods Hole was to continue this effort.) The committee also has recognized that it will not be possible to assess and monitor each and every species that could be affected indirectly, as well as directly, by harvesting and associated activities, and has initiated consultations with the SCAR Group of Specialists on Seals and the BIOMASS Working Party on Bird Ecology to determine what species or populations of seals and birds, if any, might function as sensitive indicators of harvest-caused changes in krill distribution or abundance.

The BIOMASS Program, mentioned earlier, has provided and is providing some of the basic biological and ecological data needed to achieve the convention objectives. There presently are no plans, however, for a Third BIOMASS Experiment. In addition, while there can be no doubt that additional research is needed, there are differing views as to the types of studies that are needed most and whether they should be formulated and coordinated under the auspices of SCAR, as was done for BIOMASS, or under the auspices of the new Living Resources Convention. Failure to resolve these differences of view and to continue and expand basic as well as applied research in the southern ocean could delay or prevent effective implementation of the Convention.

Another potential impediment is the fact, as noted earlier, that commission decisions must be made by consensus. This gives each member a veto which can be used for political, economic, or other reasons to block action. Thus, the success of ongoing efforts to define and obtain necessary information will depend, to a great extent, on the desire of all parties to have the convention work. More importantly, since the convention provides that harvesting and related activities in the convention area shall be unregulated until such time as the commission decides that quotas, gear restrictions, or other types of conservation measures are necessary, it is clear that the success of the convention itself will depend, to a great extent, on the desire of all parties to see it succeed. If the desire is there, it should be reflected in the willingness of fishing nations to adopt conservation measures indicative of the degree of uncertainty concerning the possible direct and indirect effects of various harvest levels and strategies; in the willingness of both fishing and non-fishing nations to invest in long-term programs to assess and monitor key components of the southern ocean ecosystem; in the timely submission by contracting parties of both scientific and fishery data; in the staffing

of the executive secretariat; and, in the support of the Scientific Committee and commission.

A fourth potential impediment could be difficulty elaborating and implementing an effective system of observation and inspection, and, pending establishment of this system, development of interim arrangements as envisioned by the convention. This is important for two reasons. First, an effective system of observation and inspection is necessary to verify compliance with conservation measures that are adopted. Second, an effective system of observation and inspection, combined with appropriate and effective conservation measures, are necessary to reaffirm and demonstrate the viability of the convention and the Antarctic Treaty System of which it is a part.

CONCLUSIONS

In conclusion, it seems to me that the Convention on the Conservation of Antarctic Marine Living Resources is innovative, well conceived, and, if implemented effectively, fully capable of assuring that utilization of the fishery resources and associated activities do not have adverse effects on the Antarctic marine ecosystem or any of its component elements. In addition, while lack of data and a number of other things could prevent or impede effective implementation, it seems to me that the rapid ratification and "start-up" of the convention demonstrate a commitment to the convention objectives and provide reason for optimism. Actions taken in the next several years will determine whether or not this optimism is justified.

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CHAPTER 9

Living Resources: A Variety of Perspectives

Conservation of Antarctic Marine Living Resources: The Environmental Perspective

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INTRODUCTION

The Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR) is particularly noteworthy in at least three respects.

First, a major Antarctic fishery had not emerged by 1980, making CCAMLR one of the few international treaties concerned with the conservation of wildlife to be concluded prior to significant commercial pressure on the species it was primarily designed to protect. This is significant because experience with whaling and fishing industries throughout the world has demonstrated how difficult it is to conserve the resource once the industry has become overcapitalized and overexploitation has become the norm. The CCAMLR provides a unique opportunity to manage Antarctic marine living resources wisely from the outset.

Second, CCAMLR obliges its parties to adopt an "ecosystem approach" to the exploitation of such marine living resources. The major impetus for the convention was the likelihood of a greatly expanded unregulated commercial harvest of krill and the possible effects of that harvest on numerous other species, including baleen whales, seals, penguins, and fish. The convention represents an effort to ensure that the harvest of krill will be carried out in a way that gives consideration to the impact of that harvest not only on krill but also on these other species, thereby protecting the stability of the Antarctic marine ecosystem. The traditional approach of fisheries treaties is to consider only the stock being fished when setting harvest levels.

Third, although krill represent the major concern giving rise to the convention, they are not its exclusive focus. Rather, by its terms, the convention applies

to all Antarctic marine living resources, a term defined to include living organisms, including birds, found south of the Antarctic convergence. Although this immense stretch of ocean really represents many ecosystems, the convention defines as just one ecosystem the "complex of relationships", extending over this area, of such resources "with each other and with their physical environment."

Despite the innovation and breadth of CCAMLR, the effective conservation of Antarctic marine living resources will rest largely on interpretation of Article II of the convention. Indeed, perhaps the most important and most difficult conceptual task relating to implementation of the convention will be the interpretation of the principles of conservation of Article II and their translation into criteria and methods for the formulation of conservation measures. In this commentary, we interpret these conservation principles, set forth appropriate measures that can and should be implemented pursuant to them, and finally discuss two obstacles to effective implementation of such conservation measures.

INTERPRETATION OF THE PRINCIPLES OF CONSERVATION

Article II's principles of conservation must be read as complementary guides in pursuit of the overall goal of preserving Antarctic natural marine ecosystems while also allowing some degree of harvest.[1]

The first conservation principle permits harvesting and associated activities as long as they do not cause a decrease in the size of any harvested population below a level close to that which ensures greatest net annual increment. This standard draws upon and is similar to the management regimes for the Marine Mammal Protection Act and the International Whaling Convention (IWC). The level of greatest net annual increment is the ultimate limit on harvest. If a population is below that level, then harvest must be consistent with recovery to that level or must cease. This principle encompasses not only krill and whales, which are of course subject to harvest, but all populations of other species that directly or indirectly interact with a harvested population.

In terms of establishing harvest levels for krill, the possibility that this species is not significantly above the level of greatest net annual increment calls initially for an extremely conservative harvest under Article II throughout Antarctic marine ecosystems. Such a view led some U.S. scientists to recommend in 1979 that the harvest of krill not exceed 2.5 million tons, and subsequently in 1982 that same group called for a limitation on the allowable annual rate of increase of harvest rather than an absolute ceiling on the amount.

Whales and other predators comprise all other current or foreseeable harvest in the Antarctic. Establishing levels of greatest net annual increment for these species raises important questions about the appropriate choice of baselines for population levels. For example, the blue and humpback whales are severely depleted with reference to initial population sizes. Through over-harvest, the blue whale has declined from some 200,000 to 10,000 individuals and the humpback whale from 100,000 to 3,000 individuals. However, because of the apparent increased abundance of other krill predators, such as minke whales, seals, penguins and squid, these depleted whale species may not have access to the amount of

krill that sustained their initial populations. Indeed, if viewed solely in terms of the currently accessible krill source, these endangered species might now be considered to be at or near the level of greatest net annual increment mandated by the convention.

Such a conclusion would be unwarranted. The level of greatest net annual increment required by the convention was conceptually derived from and should follow the established policies of the IWC and the U.S. Marine Mammal Protection Act. Under these laws, initial population sizes — those historic levels which evolved over many years and which only recently have been altered dramatically by human activity — serve as reference points. This choice provides a guarantee of population stability of some genetic and evolutionary standing. Any alternative post-exploitation baseline would counter-intuitively reduce the convention requirements for restoration of exploited populations in proportion to the degree of exploitation before establishment of the baseline.

The second conservation principle of Article II requires harvesting and associated activities to be conducted so as "to prevent changes or minimize the risk of changes in the marine ecosystem which are not potentially reversible over two or three decades." Hence, while the first principle sets limits on the degree to which populations may be altered by human exploitation, this second principle sets a rate at which such changes must be reversible. This principle is an important innovation in conservation law because it addresses the resilience of an ecosystem to harvest and associated activities.

Perhaps the simplest application of this principle concerns the introduction of alien species. Introduction and successful establishment of virtually any alien species in an Antarctic ecosystem would permanently alter that ecosystem, at a minimum by addition of one species, and therefore would not be consistent with the principle of reversibility. It would appear appropriate for the commission to adopt a conservation measure that would prohibit introduction of any alien species into any Antarctic ecosystem unless the existence of the species can be easily terminated (e.g. sledge-dogs). Such a measure would extend unambiguously to marine ecosystems what is already required for the Antarctic continent and ice-shelves under the Agreed Measures of the 1959 Antarctic Treaty. Because of past experience with the introduction of anadromous fishes in South America, any such measure should include agreement not to release exotic species north of the Antarctic convergence when such species are likely to spend part of their life-cycle within the convention area.

The third principle of Article II calls for the maintenance of ecological relationships between and among harvested, dependent, and related populations. On its face, this principle is obscure. If it referred to roles which organisms play — such as prey, predator, competitor, or symbiont — then extinction might be the minimum that must be prevented consistent with this principle. Such an interpretation would strip the provision of any significance, however, because other provisions of Article II require limits on harvest well before a species would ever become endangered.

A better interpretation of this principle would require the designation of protected areas of sea, where harvest would be prohibited except as useful in modifying ecological relationships to restore the ecosystem to such a structure and

function as it was before harvesting occurred. This interpretation would simply extend to the sea the well-established notion that pristine areas should be maintained in Antarctica. Maintenance of such areas is a traditional tool of ecosystem conservation and is specifically contemplated in Article IX of the convention. The presence of substantial pristine areas in the southern ocean also would tend to buffer harvested areas against the risk of inadvertent overexploitation. Through such an interpretation, this principle is a useful component in Article II, complementing the other two principles and enhancing their effectiveness in accomplishing the general conservation goal of preserving the natural marine ecosystems of Antarctica while allowing for some rational use. This third principle of Article II is also a mandate for basic ecological research. If the convention parties must maintain ecological relationships that are not necessarily addressed by the principle of stable recruitment or reversibility, then they must know what those relationships are.

IMPLEMENTATION OF THE PRINCIPLES OF CONSERVATION

To implement the foregoing conservation principles, the convention establishes regulatory and scientific bodies with the authority to impose a fully panoply of conservation measures and the flexibility to adopt or to revise such measures expeditiously. The principle regulatory organ of the convention is the Commission for the Conservation of Antarctic Marine Living Resources. All signatories and certain other parties are represented on the commission.

Recognizing the recency of establishment of the conservation principles in Article II of the CCAMLR, the commission should consider the following actions in implementing the conservation principles of Article II.[2]

- Sound implementation of the principles will require subdivision of the convention area. Priority should be given to identifying geographic divisions that rest upon a sound and finely-constructed ecological foundation.
- Management indicator species and depleted species should be identified as soon as possible, and sampled periodically for appropriate life-history statistics in each agreed-upon subdivision of the Antarctic marine complex of ecosystems.
- A substantial portion of such ecologically differentiated areas should be completely protected from harvest and associated activities.
- Harvest effort in portions of those areas open to exploitation should be regulated differentially, in order to facilitate assessment of the effects of harvest pursuant to an agreed-upon experimental design.
- Harvest of krill and other species should be so regulated in any open area that the harvest is consistent with the maintenance or restoration of the harvested species, indicator species, and depleted species to levels of greatest net annual increment above, defined with respect to initial population size.

- Article II's principle of reversibility should address adaptive change resulting from artificial selection as well as ecological change. A methodology for correlating harvest practices with rates of reversal of the effects of harvest should be developed for harvested species, indicator species, and depleted species.
- Basic research on Antarctic marine ecosystems should be enhanced, even though the research may have no obvious application to stable recruitment or to reversibility of change.

OBSTACLES TO IMPLEMENTATION OF THE PRINCIPLES OF CONSERVATION

There are at least two potential impediments within the convention that could prevent effective implementation of appropriate conservation measures. First, adoption of all conservation measures will require consensus voting by the commission and, second, any party can escape the requirements imposed by adopted conservation measures after giving public notice of such a decision.

Article XII of the convention requires the commission to make substantive decisions by consensus and provides that determinations as to whether any particular decisions are substantive or procedural in nature are to be "a matter of substance." That provision effectively gives each commission member a veto over virtually any decision because the convention does not automatically implement any specific conservation measure or specific fisheries data reporting requirements. Hence, any single member or minority can block adoption of measures that would strengthen conservation or data reporting requirements.

The potential for such minority vetoes was apparent at the first meeting of the commission and Scientific Committee in May - June, 1982. The USSR prolonged debate on many issues by tenaciously advancing every detail of its position. The Soviets may also be a stumbling block to timely adoption of conservation measures and reporting requirements. The USSR krill fishery is reportedly 500,000 metric tons per year, by their own estimates, whereas the Japanese report only about 30,000 tons and the other fishing nations report less. Furthermore, several stocks of finfish may already have been depleted by Soviet fishing. The Soviets are in no hurry to have detailed reporting requirements or harvest restrictions imposed by the commission. Such an approach would appear to contravene Article XXII of the convention, which obligates each contracting party to undertake "to exert appropriate efforts, consistent with the Charter of the United Nations, to the end that no one engages in any activity contrary to the objective of this Convention." This article can be read to mandate efforts against minority vetoes within the commission as well as efforts against those who stand outside of the convention.

In the Pelly Amendment to the Fishermen's Protective Act, the Congress has authorized import restrictions against nations whose activities undermine the effectiveness of international programs for fisheries conservation or for endangered or threatened species. Perhaps because of its power, use of the Pelly Amendment has been threatened but never made. It would be valuable to have a device to

address the problem of minority vetoes that could be more easily, and more frequently, employed. Such a device would have less dire consequences than full use of the Pelly Amendment.

One such authority that we have recommended for inclusion in the implementing legislation for the convention would be a procedural requirement for congressional notification in the case of any instance when a minority of commission members blocks an action sought by the majority. The provision could appropriately require that the notification include a brief description of the action blocked, a determination of whether the nation or nations should be certified under the Pelly Amendment, and a statement of those actions, if any, which the Secretary of State or Secretary of Commerce intend to take in response to the veto. To make the notice requirement effective, it should be mandatory.

Even if certain conservation measures are adopted by the commission, however, Article IX paragraph 6 of the convention permits commission members to escape any otherwise binding conservation measure provided that notice of such decision is given to the commission within 180 days after a member has been notified of the measure in question. An additional procedure provides opportunity for commission members to reconsider their positions in light of any such reservations. Given the damage that such reservations to conservation measures could do to operation of the convention, any intention to reserve should be subject to the greatest possible public scrutiny.

Any decision by the United States to take a reservation should be preceded by proposal in the *Federal Register* and opportunity for comment. For reservations by other commission members, notice should be given in the *Federal Register* so that conservation organizations and others will have timely opportunity to endeavor to persuade reserving governments to reconsider. Such a provision is especially important in light of our long-standing conservation interest in the endangered great whales. Even though the United States currently has no Antarctic fishery, a notice requirement for U.S. reservations is appropriate because we may establish a fishery at some future time and because we may find reasons to consider a reservation other than those dependent upon the existence of a domestic Antarctic fishery.

CONCLUSION

The CCAMLR was adopted in 1980 and entered into force in April, 1982. Since then, the commission has met twice and resolved principally minor procedural matters. Whether the convention will live up to its great potential in preserving the Antarctic through its comprehensive ecosystem approach therefore remains to be seen. At this point, however, it is clear that the stage is set for a willing international community to establish a precedent of prudent use and conservation of one of the world's last unspoiled natural areas.

NOTES

[1] See also, T. Scully, W.Y. Brown, and B.S. Manheim; The Convention for the Conservation of Antarctic Marine Living Resources: A Model for LME Management; AAAS Symposium on Variability and Management of Large Marine Ecosystems (in press).

[2] For an extended discussion of the implementation of Article II's conservation principles, see W.Y. Brown, the Conservation of Antarctic Marine Living Resources, *Environmental Conservation*, Volume 10, pg. 187. 1983.

Implementing the Convention on Conservation of Antarctic Marine Living Resources: The Legislative Process

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Scientific interest in the Antarctic began in the 1800s and expanded greatly in the 1920s and 1930s with the development of aerial and motorized exploration. As a result of this early exploration, seven countries claimed sovereignty over territory in Antarctica by 1959. The claims for four countries — Australia, France, New Zealand, and Norway — were mutually accepted. The claims of three other countries — Argentina, Chile, and the United Kingdom — overlap and conflict in the area of the Antarctic peninsula south of Cape Horn. The United States, the Soviet Union, Belgium, Japan, and South Africa have made no territorial claims in Antarctica and do not recognize the claims of others. However, they reserve all their basic historic rights.

During the 1957-1958 International Geophysical Year (IGY), a 12-nation scientific effort comprised of the seven claimants plus the U.S., USSR, Japan, South Africa, and Belgium created the biggest Antarctic expedition of all time. The cooperation exhibited during the IGY led to the 1959 signing of the Antarctic Treaty by the 12 IGY nations. The three main provisions of the treaty provide that:

1) Antarctica will be used for peaceful purposes only; 2) freedom for scientific investigation will continue; and 3) all claims to territory in Antarctica are frozen. The treaty does not effect the claim of any of the signatories to rights or claims in Antarctica and prohibits asserting new claims. The current 14-member nations meet approximately every two years in consultative meetings to discuss issues that concern the treaty.

The Antarctica Treaty has been an unusual and successful example of international cooperation among States with differing political systems as well as different legal and political views regarding Antarctic jurisdiction. However, the treaty does not apply to activities in Antarctica other than those enumerated above. Among those areas with which the treaty does not deal are the questions of resource development. At the time of the conclusion of the treaty, the prospect of these activities seemed too remote, and the issues they posed too difficult.

On the subject of non-living resourse exploitation, the Antarctic Treaty is nonspecific. Minerals were originally slated to be the second resource issue to be discussed by the treaty parties after the first consultative agreement on Antarctic seals. Living resources, and in particular the question of krill, quickly overtook the minerals issue on the agenda. Currently, the question of a minerals regime is being considered by both member governments and non-member parties.

AGREED MEASURES AND THE ANTARCTIC CONSERVATION ACT

Initial measures to protect and preserve the plants and animals of Antarctica were first recommended by the United States and agreed to by the consultative countries at the Third Antarctic Treaty Consultative Meeting in 1964. These "Agreed Measures for the Conservation of Antarctic Flora and Fauna" were of limited usefulness in protecting marine living resources because they refer only to mammals and birds and do not effectively apply to the high seas. The Antarctic Conservation Act of 1978 (ACA) implemented the Agreed Measures adopted at the 1964 consultative meeting and also implemented Recommendation VIII-3 of the Eighth Meeting which designated sites of special interest and defined the scope of permissible activities allowed within these sites. To accomplish this purpose, the act directed the Director of the National Science Foundation (NSF) to establish a regulatory system to control: 1) the taking of plants and animals native to Antarctica, the introduction of non-native species, and the disposal of pollutants by U.S. citizens; and 2) other activities of U.S. citizens in certain areas of Antarctica.

By 1977, the consultative parties had agreed that conclusion of a new legal regime to provide for the conservation of Antarctic marine living resources was their first priority. The focus on conservation of Antarctic marine living resources was the culmination of several factors. First, scientific studies in the polar regions had uncovered that Antarctic waters offered significant marine living resource potential. Second, attention had begun to focus on Antarctic krill, a small shrimp-like crustacean, rich in protein which is found in Antarctic waters in very large quantities and was reviewed as a potential source of protein for commercial exploitation. Third, the decrease in fish landings from traditional fishing grounds and the establishment of the 200-mile fishing zones by a number of countries

stimulated the search for new fishing areas, including the waters around Antarctica. Fourth, the potential that the Antarctic marine ecosystem was too fragile to sustain uncontrolled harvesting of krill, which play an essential role in the Antarctic food chain, alerted biologists to potential dangers of living resource development. Most importantly, there were identified large gaps in our understanding of the Antarctic marine ecosystem and thus in the data necessary to ensure proper management of marine resources there.

The combination of the above listed factors led the consultative parties to conclude, at their 1977 meeting in London, that negotiation of an agreement to provide further conservation of Antarctic marine living resources was necessary.

THE CONVENTION ON CONSERVATION OF ANTARCTIC MARINE LIVING RESOURCES

The Convention on Conservation of Antarctic Marine Living Resources (CCAMLR), which was concluded in 1980, and entered into force on April 7, 1982, derives from the initiative taken by the Antarctic Treaty consultative parties in 1977. The convention sets forth a conservation standard which reflects U.S. concern for an ecosystem approach to the management of Antarctic marine living resources. Consistent with its conservation objectives, the convention applies to a geographic area designed to approximate the full extent of the Antarctic marine ecosystem. The convention area is considerably larger than that covered by the Antarctic Treaty which applies only to the area south of latitude 60°S.

The convention also provides for the establishment of machinery necessary to carry out its objectives. This includes the Commission for Conservation of Antarctic Marine Living Resources, which is headquartered in Hobart, Tasmania; the Scientific Committee for the Conservation of Antarctic Marine Living Resources, designed to provide objective scientific assessments and recommendations to the commission; and a secretariat to serve both the commission and the Scientific Committee. The convention provides that the commission will operate on the basis of a consensus or no objection procedure which has been characteristic of the Antarctic Treaty system.

ANTARCTIC CONSERVATION LEGISLATION AND CONGRESSIONAL OVERSIGHT

During the Third Consultative Antarctic Meeting in 1964, certain recommended measures to preserve and protect the plants and animals in Antarctica had been recommended by the United States and agreed to by the consultative countries. These "Agreed Measures for the Conservation of Antarctic Flora and Fauna" limited the taking of native species of plants and animals, controlled the introduction of non-native species into Antarctica, regulated the disposal of pollutants in Antarctica, and provided for the protection of certain areas. The National Science Foundation (NSF), which has primary responsibility for United States activities

in Antarctica, had adopted the terms of the agreed measures and recommendations as interim guidelines. The Department of State (DOS) requested enactment of H.R. 7749, the Antarctic Conservation Act of 1977, in June of 1977, because of the lack of statutory authority to enforce the guidelines and because of increasing public interest and activity in Antarctica. In 1977, H.R. 7749 was introduced to implement the Agreed Measures and to establish regulatory authority for the NSF. The DOS believed that enactment of the bill would underscore the commitment of the United States to the protection of Antarctica's unique environment.

On June 13, 1977, Mr. Murphy of New York, Chairman of the Committee on Merchant Marine and Fisheries, introduced at the request of the DOS, H.R. 7749, the Antarctic Conservation Act of 1977. The bill was referred jointly to the Committees on Merchant Marine and Fisheries and Science and Technology, and joint hearings were held on the legislation on September 12, 1977, by the Subcommittee on Fisheries and Wildlife Conservation and the Environment of the Committee on Merchant Marine and Fisheries, and the Subcommittee on the Environment and the Atmosphere of the Committee on Science and Technology.

H.R. 7749 was reported from the Committee on Merchant Marine and Fisheries on March 31, 1978, and from the Committee on Science and Technology on May 18, 1978. H.R. 7749 was signed into law on October 28, 1978.

Congressional interest in establishing a comprehensive and effective international convention for the conservation of living marine resources of Antarctica was further evidenced by the introduction of H.R. 10905 by Representative Edwin B. Forsythe, ranking Republican member of the Subcommittee on Fisheries and Wildlife Conservation and the Environment of the Merchant Marine and Fisheries Committee in 1978. This bill provided for the establishment of a program to study, assess, and monitor the living marine resources of the Antarctic Ocean. H.R. 10905 was then superseded by H.R. 12668, which included an essential ingredient of H.R. 10905, a program for the development of data necessary to establish conservation regulations for the harvesting of krill. H.R. 12668 also provided for the establishment of a similar program to protect and conserve the living resources in the Arctic Ocean. H.R. 12668 was passed by the House and sent to the Senate in May of 1978 but no further action was reported.

The Senate was also busy reviewing U.S. Antarctic living marine resource policy in 1978. Hearings were held before the National Ocean Policy Study of the Committee on Commerce, Science, and Transportation on June 14, 1978. These hearings were conducted as oversight in the negotiations between the United States and the 12 other parties to the Antarctic Treaty on a governing regime for the conservation and management of living marine resources in the Antarctic. Emphasis during these hearings was on the need for interagency coordination in conducting Antarctic research. Questions were raised concerning the adequacy of U.S. research capabilities, including the need for additional research vessels with icebreaking capacity.

RATIFICATION OF THE CONVENTION

During 1979 and 1980, negotiations were conducted during the Antarctic Treaty consultative meetings to develop a regime for the Antarctic marine living resources. These negotiations produced a draft convention which was finalized at a diplomatic conference held in Canberra, Australia, May 7-20, 1980. The convention was signed in September, 1980, and forwarded to the Senate for consideration on December 2, 1980. The convention applied to all species of living marine organisms which occur south of the Antarctic convergence and provided for the establishment of a Scientific Committee, commission, and executive secretariat to identify and take such actions as may be necessary to consider these species and the ecosystem of which they are a part. The convention was designed to come into force 30 days following ratification by 8 of the 15 signatory nations. The first meeting of the commission was scheduled to be held within three months following entry into force. Hearings on the convention were held by the Senate Committee on Foreign Relations on October 27, 1981. The U.S. Senate gave its advice and consent to the ratification of the convention on December 16, 1981, and the convention entered into force early in 1982 with the first meetings of the Antarctic Commission and Scientific Committee taking place in late May and early June of 1982.

IMPLEMENTING LEGISLATION

In 1983, H.R. 3416 was introduced by Chairman Breaux and Mr. Forsythe at the request of the Administration to implement the CCAMLR. The bill as introduced was referred to the House Merchant Marine and Fisheries Committee and Foreign Affairs Committee. A summary of the bill, as introduced, follows:

A. Findings, Purpose, and Definitions
   - — provided legislative authority necessary to implement the convention for the United States
   - — regulated the harvesting of living organisms south of the Antarctic convergence

B. Representatives
   - — provided that the United States representative to the commission would be a federal employee appointed by the Secretary of State with concurrence of the Secretary of Commerce and Director of the National Science Foundation
   - — the representatives to the Scientific Committee would be appointed by the Secretary of Commerce with concurrence of the Secretary of State and Director of the National Science Foundation and would be a federal employee

C. Conservation Measures and System of Observation and Inspection

- authorized Secretary of State, with concurrence of Secretary of Commerce and Director of the National Science Foundation, to accept or not accept a conservation measure adopted by the commission
- authorized Secretary of State, with concurrence of Secretary of Commerce, Director of National Science Foundation, and Secretary of the Department housing the U.S. Coast Guard to agree to a system of observation and inspection

D. Unlawful Activities

- it would be unlawful to:
  1) harvest in violation of the convention;
  2) violate a regulation issued under the act; and
  3) handle any marine living resource or product harvested in violation of the act.

E. Regulations

- authorized Secretary of Commerce to issue regulations to implement act in consultation with the Secretary of State and other appropriate agencies

  Note: This adds regulatory authority to Commerce which previously had only enforcement authority.

F. Civil and Criminal Offenses

- established the liability for civil penalty of any person who commits an act prohibited by Section 6
- the Secretary of Commerce was charged with assessing the civil penalty and the authority to remit or mitigate a penalty
- provided the opportunity for a hearing and for judicial review of a penalty
- provided that a person is guilty of an offense if that person commits any act prohibited by Section 6, and prescribed punishment for an offense

G. Federal Agency Cooperation

- authorized the Secretary of Commerce and the Director of the National Science Foundation, in consultation with the Secretary of State and other appropriate Federal agencies, to design and conduct a directed research program on Antarctic marine living resources and to furnish facilities and personnel to the commission

H. Authorization of Appropriations

- authorized to be appropriated from time to time monies necessary for:

1) travel expenses of the United States representatives;
2) U.S. contribution to the budget of the commission; and
3) the directed research program and the furnishing of facilities and personnel to the commission.

In preparing for a hearing on H.R. 3416, the Subcommittee on Fisheries and Wildlife Conservation and the Environment sought the opinions of individual U.S. scientists on the adequacy of the U.S. Antarctic scientific research program, as well as the opinions of the Administration and concerned public interest groups on the specifics of H.R. 3416 and a number of possible amendments. The subcommittee, which was already familiar with the National Academy of Science's (NAS) 1981 "Steele Report" evaluating Antarctic marine ecosystem research,[1] as well as the 1983 NAS report on Antarctic research priorities,[2] was concerned that the implementing legislation further U.S. interests in both the scientific as well as the policy arena. This was based on the assumption that there may be some merit in altruistic endeavors pursued as science-for-science-sake, but the United States must first give consideration to the relevance of the research to U.S. national and international interests, which, as noted in the Steele Report, are not necessarily identical with those of other countries.

Representatives of the Antarctic scientific community were asked to advise the subcommittee on whether current and planned research in their fields was sufficient to provide the information necessary for national and international resource management decisions under the CCAMLR, as well as decisions which may be required under the to-be-developed Antarctic minerals regime. If the scientists believed such research was not adequate, they were asked to elaborate on the areas where additional attention was necessary and by what institutions. They were also asked for recommendations for improving the collection of information and incorporation of research expertise in setting U.S. Antarctic policy. Finally, the scientists were asked whether the process by which national and international priorities are set and decisions made is adequate to guarantee informed involvement by the U.S. delegation to CCAMLR.

The subcommittee also asked each member of the Antarctic Policy Group[3] a series of questions relating to agency responsibilities for Antarctic policy, the decision-making process for establishing Antarctic research priorities, the amount of coordination between involved offices, and the criteria used to evaluate research efforts.

The responses of the scientific community to the subcommittee's inquiry were not promising. In particular, serious questions were raised about:

— The failure of NSF to exercise a consistent and effective position of leadership in Antarctic research;
— The inadequacy of U.S. resources devoted to Antarctic research;
— The fragmentation of the U.S. research effort;
— The research limitations imposed by the availability of only one U.S. ice-strengthened oceanographic research vessel (that vessel

largely devoted to a transportation and supply function for Palmer Station on the Antarctic Peninsula);

- The need for mechanisms for expanding participation by U.S. scientists in policy discussions;
- The insufficiency of ecosystem modeling research, and other research necessary for living and non-living resource management decisions;
- The inadequacy of oceanographic facilities essential to overcome the logistical difficulties of working in the southern ocean;
- The overemphasis by the NSF on funding research of theoretical nature; and
- The lack of NOAA/NMFS personnel with Antarctic expertise.

The degree of frustration with the administration of the U.S. research program was evident in letters written to the subcommittee by prominent U.S. scientists. For example, one letter described the lack of U.S. commitment to Antarctic leadership:

> "... since 1972, the U.S. Antarctic research efforts have witnessed a period of major retrenchment at just the time when most other Antarctic Treaty signatories have greatly expanded their research presence in the Antarctic. At the present time, we have little information to even crudely evaluate the onshore or offshore non-living resource potential of Antarctica. Consequently, there is little *scientific* basis to guide future U.S. policy positions on these issues. The U.S. has fallen from a position of leadership in Antarctic research to another 'face-in-the-crowd' of interested observers."

Another letter criticized the extent to which limited research funding was being manipulated:

> "... [some] people spend a great deal of time and effort trying to influence (with increasing success), and keeping track of, blocks of money, and basically are spending their creative energy on non-scientific activities ... The end result is that [they] spend their creative energy politicking and find their science *directed* by the funding; they dare not take chances with creative innovations which involve risk (but are the heart and guts of progressive science)."

Supplementing the views of individual members of the scientific community were the comments of public groups concerned with Antarctic policy. Two groups submitted exhaustive comments, the Antarctica Project[4] and the Environmental Defense Fund (EDF),[5] for themselves and a number of other environmental organizations.

The EDF focused its comments on the need for public participation and broader agency involvement in the U.S. decision-making process with respect to

the CCAMLR, and on the necessity for a directed research program under the leadership of the Secretary of Commerce. Although urging Commerce involvement, EDF also expressed exasperation with NOAA for its failure to take its rightful place in Antarctic affairs. In the words of EDF:

> "NSF and NOAA appear to agree in principle on a division of responsibility between basic and directed research in the southern ocean, but whereas NSF has requested and received appropriations to carry out its apparent mission in Antarctica, NOAA has reserved a seat on the Antarctic express, but failed to buy a ticket."

The EDF recognized, as did the subcommittee, that simply giving NOAA a mandate to carry out a directed research program was unworkable because the agency had not undertaken the planning necessary to justify such a program. In fact, NOAA had not even requested an appropriation for an Antarctic program. The National Oceanographic and Atmospheric Administration/National Marine Fisheries Service participated actively in the First International Biological Experiment (FIBEX) under the Biological Investigations of Marine Antarctic Systems and Stocks (BIOMASS) program in early 1981. They had used approximately $185,000 in this effort, with $135,000 accumulated from a special NOAA Administrator's Fund and $50,000 from NMFS reprogramming. Although NOAA/NMFS participation in the Second International Biological Experiment (SIBEX) under BIOMASS, was urged by the BIOMASS organizers and NSF, the Administration did not request Antarctic program funding for NOAA/NMFS for FY 1984. This, despite a NMFS request for $315,000 and a NMFS statement to NOAA that "...continued minimal participation (in BIOMASS) is essential to maintain our credibility in the Antarctic marine science community...." Furthermore, efforts by the House Committee on Merchant Marine and Fisheries to secure such funding failed for lack of support from the Administration and the House Appropriations Committee.

Despite, or perhaps because of, NOAA's lack of leadership in Antarctic affairs, EDF called upon the subcommittee to amend H.R. 3416 to require the Secretary of Commerce, in coordination with the Director of NSF, and in consultation with the Secretary of the CCAMLR, to prepare and carry out a plan of research designed to facilitate implementation of the convention.

The second area of EDF concern centered around the question of public and agency participation in the convention decision-making process. Amendments were proposed in this area to:

1) Specify that the Secretary of State must, at least annually, unless the commission prescribed otherwise, prepare and transmit to the commission and to the Scientific Committee established under the convention a report addressing the requirements of convention Articles XX, XXI, and XXII, and make such reports available for public inspection. Article XX provides for reporting by commission members of statistical, biological, and other data and information on implementation of the convention. Article XXI provides

for reporting of enforcement measures. Article XXII requires member nations to report any activities coming to their attention which are contrary to the objectives of the convention.

2) Require notification to Congress of instances where a majority of Commission members is blocked from taking action by a minority of members. According to EDF, since the convention requires that substantive decisions be made by consensus, any commission member can effectively veto virtually any decision, including adoption of conservation or data reporting requirements. The EDF believed that such a notification requirement would facilitate use of the Pelly Amendment to the Fishermen's Protective Act. This Act allows import restrictions against nations whose actions diminish the effectiveness of an international fishery conservation program.

3) Require public notice in the *Federal Register*, and opportunity for comment, on any proposed reservation of the United States or any notification of reservation made by another commission member pursuant to Article IX, paragraph 6, of the convention. A commission member can escape being bound by a conservation measure if he gives notice of a reservation within 180 days of being notified of the measure. When this occurs, other commission members may also reconsider their positions. The EDF expressed the opinion that because reservations to conservation measures could do serious harm to convention operations, they should be subject to the greatest possible public scrutiny.

4) Incorporate a provision which would require agencies responsible for implementation of the convention to provide the greatest possible opportunity for input from the environmental and scientific communities in the development and negotiation of U.S. positions.

5) Require concurrence of the NSF in the promulgation of any regulations by the Secretary of Commerce. The EDF proposed this amendment to avoid overlap with NSF, which has authority for issuing regulations relating to the taking of any native mammals or birds south of latitude 60°S. under the Antarctic Conservation Act of 1978.

6) Clarify that the purpose of consultation with other agencies under the legislation is to ensure compliance with the Marine Mammal Protection Act of 1972, the Endangered Species Act of 1973, the National Environmental Protection Act of 1969, and other laws applicable to conservation for the Antarctic ecosystem.

The comments of the Antarctica Project were supportive of the EDF proposals, with particular emphasis on the need to: 1) *direct* NOAA, NSF, the Marine Mammal Commission, and interested agencies to prepare the type of research and monitoring program required to effectively implement CCAMLR; and 2) *direct*

those same agencies to analyze the needs of the commission's scientific committee and secretariat so that facilities and personnel of the United States may be detailed to facilitate the work of CCAMLR. Taking note of the President's 1982 directive for agencies other than NSF to "...fund and undertake directed short-term programs of scientific activity related to Antarctica upon the recommendations of the Antarctic Project endorsed NOAA assuming the initiative in directing research designed to provide information needed to manage the southern ocean."

The Antarctica Project also added some of its own observations and suggestions for amendment to H.R. 3416, including proposals that: 1) the Administrator of NOAA be substituted for the Secretary of Commerce as the individual responsible for deciding, with the Secretary of State and Director of the NSF, whether the U.S. should file a reservation to a conservation measure; 2) the reservation process should be subject to a formal rule-making procedure; and 3) concurrence of the Marine Mammal Commission should be required before promulgation of any regulations by the lead agency.

The legislation was reported by the subcommittee, with amendments, to the full committee on Merchant Marine and Fisheries on September 20, 1983, and was reported by the full committee on September 22, 1983. As reported by the committee, the bill contained several technical and two substantive amendments. The first major amendment adds an additional finding declaring that a directed research program concerning the living marine resources of the Antarctic is essential to achieve United States objectives under the convention, and directs the Secretary of Commerce, in consultation with the NSF, other appropriate U.S. officials, and the executive secretary of the convention to prepare a continuing three-year plan for a directed research program on Antarctic living marine resources. The plan shall:

- First, describe priority directed research needs for convention implementation;
- Second, identify which of those needs will be fulfilled by the United States; and
- Third, specify other research needs including funds, personnel, and facilities, including the need for and cost of enhanced ship capacity, to carry out other U.S. research objectives in Antarctica. This three-year plan is required to be developed by February 1, 1984, and will take effect during FY 1985. The plan should be updated annually with the final plan being developed for FY 1987, to cover research requirements through FY 1990.

In order to support an expanded and more comprehensive program of research on Antarctic marine living resources, improved research capacity may be found necessary by the agencies. A letter from the National Academy of Sciences Polar Research and the Ocean Services Board, to the President's Office of Science and Technology, dated February 6, 1980, records the Board's reasons for believing the "modernization or replacement of the only ice-strengthened research vessel

available to the U.S. scientific community is of urgent importance." The question of additional research facilities, including an ice-strengthened research vessel, should be addressed in the development of the directed research programs of the NSF, NOAA, and other involved agencies.

In preparing the directed research program plans, the committee urged NOAA to review and take into account comments concerning information needs, research objectives, and research priorities described in the Marine Mammal Commission letter to the NSF, dated December 14, 1978; Research Emphases for the U.S. Antarctic Program, Polar Research Board, et al., 1983; and An Evaluation of Antarctic Marine Ecosystem Research, Committee to Evaluate Antarctic Marine Ecosystem Research, 1981.

The second major amendment would require the Secretary of State to publish in the *Federal Register*: a) if practicable, timely notice of each proposed decision regarding the acceptance or non-acceptance by the United States or a conservation measure adopted by the commission, and to invite public written comments thereon; and b) notice of each final decision. The intent of the committee in making this amendment was to provide a forum for public participation in Antarctic decision-making without imposing the rigidity of a formal rule-making procedure on the DOS.

The House Foreign Affairs Committee's Subcommittee on Human Rights and International Organizations, held a hearing on H.R. 3416, as reported by the Merchant Marine and Fisheries Committee, on April 12, 1984. Testimony during that hearing was presented by Administration witnesses and environmental groups on three resolutions concerning U.S. policy on marine mammals, as well as on H.R. 3416. Markup of H.R. 3416 has not been scheduled by the Foreign Affairs Committee, as of this writing, pending final decision on amendments being discussed between the Administration and congressional staff.

NOTES

[1] *An Evaluation of Antarctic Marine Ecosystem Research*, Committee to evaluate Antarctic Marine Ecosystem Research, National Research Council, National Academy of Sciences, National Academy Press, Washington, D.C., 1981.

[2] *Research Emphases for the U.S. Antarctic Program*, Polar Research Board, Commission on Physical Sciences, Mathematics, and Resources, National Research Council, National Academy of Sciences, National Academy Press, Washington, D.C., 1983.

[3] Department of Commerce, Department of Defense, Department of the Interior, Department of the Treasury, Department of Transportation, Department of Energy, Environmental Protection Agency, Council on Environmental Quality, Arms Control and Disarmament Agency.

[4] The Antarctica Project submitted its statement on behalf of Greenpeace-USA, Ocean Society, Natural Resources Defense Council, Sierra Club, Defenders of

Wildlife, Connecticut Cetacean Society, Friends of Whales, Fund for Animals, the Center for Environmental Education, the Monitor Consortium, and the Antarctic and Southern Ocean Coalition (ASOC) which has over 130 organizations from 23 countries as members.

[5] The Environmental Defense Fund submitted its statement on behalf of itself, Center for Environmental Education, Friends of the Earth, International Institute for Environment and Development, National Audubon Society, National Parks and Conservation Association, National Wildlife Federation, Natural Resources Defense Council, Sierra Club, and World Wildlife Fund — U.S.

Economic Aspects of Antarctic Fisheries

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INTRODUCTION

Growing resource scarcity resulted from the dwindling stocks of conventionally harvested species, and extension of national jurisdiction with subsequent restrictions on the long-range fleets, have greatly contributed to the increased interest of many nations in the economic potential of the southern ocean.

Countries with large distant-water harvesting capabilities and high demand for fish food were particularly encouraged to look for new fishing opportunities when it was found that Antarctic fishery resources could support sustained, large-scale operations.

Antarctic krill, finfish resources, and marine mammals are of most immediate economic value for these states, since they can be taken by existing fleets composed of hunting ships, factory trawlers, mother-ships and other long-distance fishing vessels.

While technological advances in extraction and utilization of these resources indicate that world fisheries will be able to expand quickly in the southern ocean, many biological, economic, political and legal problems related to these activities are still not fully resolved.

The collapse of many of the world's fisheries, including those of whales and seals, shows how easily and quickly a fishery can become over-exploited. Indeed, the finfish resources of Antarctica have already been badly depleted and pressures on seal stock and Antarctic krill, "the protein source of the last frontier" are growing with subsequent intensification of the international concern that now attends the development of the Antarctic fisheries.

The global impact of this activity is based not so much on the current — relatively modest — harvest level of the Antarctic marine living resources, but rather because it may effect the equilibrium of the whole Antarctic ecosystem. Ecological implications of krill exploitation have not yet been definitively identified and very little is known of the factors controlling the abundance of krill in that area. Although commercial exploitation of the Antarctic marine living resources has been expanding during the last several years, there is no effective resource management regime which would ensure the rational utilization and controlled expansion of the fisheries in Antarctic waters.

The nature of krill and other Antarctic fishery resources, extreme remoteness of the southern ocean fishing grounds in relation to the world's main population centers, and adverse hydrometeorological conditions, require sophisticated technology in harvesting, processing, and preserving. Efficient support of long-range fishing operations and product deliveries to the consumption markets from this remote area are needed on a sustained basis. These factors may put the Antarctic fishery resources beyond the reach of all but the most advanced fishing nations. Marine living resources of Antarctica, particularly krill, finfish and seals are the main targets in the present expansion of these states to the fishing grounds of the southern ocean.

Because the Antarctic finfish resources are already showing clear signs of depletion, the most significant potential as a source of marine protein is the krill. However, processing difficulties of krill into economically viable food grade products delay the moment in which it will be possible to undertake a series of initiatives assuring peaceful and equitable use of this source of food for the growing world population. At present, however, the krill fishery is still surrounded by many uncertainties and exploited through subsidized fishing effort of the few developed fishing countries.

If Antarctic marine living resources are to serve as an important and long-term source of sea protein, the economic efficiency of their use becomes particularly important in these fisheries. This goal can be achieved by high production yields and low costs of harvesting/processing operations. At present, krill processing probproblems and high cost of operation of the factory ships are the most immediate obstacles for further expansion of a large-scale fishery in this region. This paper addresses some of the most important economic aspects of the Antarctic fishery and discusses some principal problems of the distant-water fleet activities in this area.

THE GROWTH AND DECLINE OF ANTARCTIC FINFISH FISHERY

The finfish fishery in Antarctic waters may serve as a typical example of the resource exploitation pattern based on the Maximum Sustainable Yield (MSY) concept so much criticized for ignoring the complex set of interrelationships found among elements of the marine environment. It has already been proven repeatedly that the MSY appears to lead to a classic fisheries development cycle of: discovering a new resource; rushing to utilize it; capitalizing of a new fishing fleet; overfishing based on maximizing the "sustainable yield" of one species while providing a

return on capital investment in the fleet; and, collapse of the fishery. All to often, this collapse leads to exploitation of another species and repetition of the same cycle as fleet operators seek to sustain a return on their capital investment (Barnes, 1980).[1]

Although an exploitation of Antarctic and sub-Antarctic fish stocks has already been carried on for many years, and catches in some areas have been quite large, there has been no precise information available about volumes or fishing effort in these regions. Prior to 1977, the only catches made in the southern ocean that have been reported to the Food and Agriculture Organization (FAO) by species are Antarctic krill, southern blue whiting and Patagonian hake. Probably the main reason for this is that the two fishing grounds known to be intensively exploited until that time, Kerguelen and South Georgia, were not included in the reporting areas covering Antarctic waters.

According to FAO data, the southern blue whiting (*Micromesistius australis*) catches during the last ten years increased more than six times as Table 1 shows. The major part of these resources have been recently harvested in the sub-Antarctic waters of the Southwest Atlantic. It is important to note that until 1977 the only country engaged in these fisheries was the Soviet Union. By 1979, six nations had become involved. After widespread extension of national jurisdiction over coastal fishery zones (1977), the southern blue whiting catch grew from about 16,000 in 1976 to 158,000 tons. In 1982, Poland remains the leading fishing country of this species with a yearly catch of over 130,000 metric tons.

Table 1

Volume Of Southern Blue Whiting Catch
During 1976-1982 (in metric tons)

Country	1976	1977	1978	1979	1980	1981	1982
USSR	15.881	26.070 (81)	17.461 (81)	32.051 (81)	29.625 (41)(81)	23.387 (41)(81)	18.126 (81)
Poland	—	2.060 (41)	11.717 (41)	35.870 (41)	54.218 (41)	48.419 (41)	130.173 (41)
West Germany	—	—	1.520 (41)	106 (41)	—	—	—
Argentina	—	—	2.598 (41)	2.159 (41)	2.351 (41)	4.538 (41)	7.016 (41)
East Germany	—	—	—	138 (41)	37 (48)	—	
Chile	—	—	—	2.602 (87)	3.288 (87)	5.086 (87)	3.231 (87)
TOTAL	15.881	28.130	33.296	72.926	89.519	81.432	158.546

— Magnitude known to be negligible or zero

Source: *FAO Yearbook of Fishery Statistics*. Vol. 50, 1980, Vol. 54, 1982.

Note: Numbers in brackets show area of fishery according to FAO codification system:
41 and 48 — Sub-Antarctic waters of Southwest Atlantic Ocean
81 and 87 — Southern Pacific and Pacific Antarctic

The Patagonian hake fisheries have been developed principally by Argentina and Brazil. In 1975, these nations harvested 142,600m tons of this species, i.e., over 90 percent of the total Patagonian hake catch in the Southwest Atlantic. Everson (1977) suggests that only a small proportion (if any) of this catch was taken in Antarctic waters.

Other species (mainly Nototheniidae) were not separately reported until the mid 1976s but their catches were probably included under the general heading of "Unspecified Demersal Percomorphs." The FAO sources report the catch of these species in sub-Antarctic areas to be as shown in Table 2.

Large-scale bottom sea fisheries, principally by the USSR distant-water fleets, occurred during 1966-1975 in the Patagonian Shelf, Scotia Sea and around the sub-Antarctic islands. Peak Soviet catches have been about 426,000m tons in 1970, mainly around South Georgia and about 236,000m tons in the next year in the southern Indian Ocean (mainly around the Kerguelen Islands). The growth of Soviet fisheries in these areas is shown in Table 2.

The Soviet Union began extensive surveys of the southern ocean living resources as early as 1947 during its first whaling expeditions. Over a period of 30 years, these research activities led to the discovery of commercial concentrations of finfish and krill (Bogdanov, Muromtsev, 1977). They were later harvested on a large scale by this country. Although the data regarding the fishing effort applied in these fisheries is scarce and it is therefore difficult to fully evaluate the effects of these operations, they did, however, certainly contribute to endangering the equilibrium status of the ecosystems where these fisheries were developed. The Soviet exploitation pattern of these resources resembles the characteristic features of unrestricted fisheries leading to depletion of the exploited stocks so widely described and discussed by many fishery writers. Table 3 illustrates the growth and decline of the South Georgia and Kerguelen fisheries during 1968-1974.

Since fish populations living in South Georgia and Kerguelen shelves are relatively small they would not support an intensive fishing effort during a long period of time. As a result both stocks have been severely depleted.

The checkered history of the fishery around the Kerguelen islands has been later confirmed by Duhamel (1982). After the Soviets discovered substantial concentrations of fish in the area initial catch rates were high but there was a dramatic decline followed by a steadier rate of exploitation by Russian, Polish, and later French ships since the Exclusive Economic Zone was declared in 1978 by France.

Table 4 presents combined catch trends and fishing effort used in the Kerguelen finfish fishery. It could be noted that the catch in 1981 was about 10 times lower than in the record 1971 year, when about 230,000m tons of Nototheniidae species were taken mostly by the Soviet long-range fleet.

Because more systematic data on fish catches have been supplied recently by nations involved in southern ocean fisheries, it is possible to assess major trends of the fishery resource use in this area. Based on FAO data for 1977, Table 5 shows the volume and composition of catch of all participating nations. At that time only the Soviet Union, Poland and East Germany were harvesting finfish stocks, at the rate of approximately 300,000m tons per year. Antarctic ice fish and Antarctic cod were the main target species. During that period the Soviet Union took nearly 90 percent of the total Antarctic finfish catch.

Table 2

Reported Catch Of Unspecified Demersal Percomorphs
In Sub-Antarctic Fishing Grounds (in metric tons).

Area	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
USSR	13.500	32.700	17.00	98.00	426.600	246.400	130.600	35.300	124.765	30.982
Other Countries	72.500	58.700	83.400	85.200	23.600	24.500	20.400	22.500	34.787	35.850
Total	86.000	91.400	100.400	183.200	450.200	270.900	151.000	57.800	159.552	66.832

Sources: 1) FAO (1974, 1976) *Yearbook of Fishery Statistics.*

2) Hureau, J.C. (1973) Les possibilities d'exploitation des resources marines dans les isles australes francaises. *Bull. Mus. Natt. Hist. Nat.* (3° Serv.) (Ecol. Gen. 10), (154):185-91.

3) Everson, I. (1977) The living resources of the southern ocean.

Table 3

Growth And Decline Of Selected Bottomfish Fisheries In The Southern Ocean — An Example Of The Soviet Catch During 1968-1974 (in thousand metric tons).

Year	Total Catch	Southwest Atlantic (mainly South Georgia region)	South Indian Ocean (mainly Kerguelen area)
1968	6	5	1
1969	90	89	1
1970	418	405	13
1971	228	16	212
1972	105	2	103
1973	10.4	0.4	10
1974	91	4	87
1975	18.5	—	18.5
1976	51.9	51.9	—

Source: Elwertowski, 1977.

Table 4

Catches And Fishing Effort (USSR, Poland, France) Reported Inside The Exclusive Economic Zone Of Kerguelen Islands.

	Total Catch (tonnes)	Total Effort (Number of Trawlers)	Fishing Days
1970	21,000	?	?
1971	229,500	?	?
1972	112,800	?	?
1973	13,100	2.3	503
1974	101,400	14.2	2,584
1975	25,071	3.8	980
1976	17,409	2.6	679
1977	98,583	12.1	3,101
1978	45,642	13.3	1,645
1979	3,882	1.6	191
1980	17,250	2.8	776
1981	24,920	3.0	981

Source: Duhamel, 1982.

Growing pressure on these resources led to a quick reduction of the exploited fish populations. In 1980 the total reported catch was only about 100,000m tons. Antarctic ice fish catch dropped 8 times, and Antarctic cod stock yielded only 8,000 tons, 80 percent less than three years ago. In 1982 the total catch grew to 137,000m tons as a result of increased yield of Antarctic ice fish and some Notothenilidae species. Table 5 and 6 illustrate the collapse of Antarctic finfish fisheries.

The depletion of Antarctic finfish stock has been reported in an earlier study of Polish biologists (Sosinski and Kuranty, 1979) who compared the seasonal fluctuations in catch volume in 1977 and 1978. According to these authors, for nearly all harvested species in the Scotia Sea catch per unit of effort was almost ⅓ lower in 1978 than in the previous year. Presently, many species (South Georgia ice fish, Antarctic cod, Antarctic ice fish, and others) are taken before reaching their sexual maturity, their length being lower from season to season. One can summarize that the intensive fisheries in Antarctic seas have caused a great reduction in exploited stocks. This suggests that many species are presently over-fished and urgently need enforceable international management measures for conservation and rational utilization of these already decimated resources.

Unfortunately the provisions of the Convention for the Conservation of Antarctic Marine Living Resources (CCAMLR) do not foresee any economic regulation of the fishery which would include quotas or a licensing system. As Stevens (1983) observes, harvesting states have shown little inclination to voluntarily restrict their levels of effort and catch, and, given the complexity of environment, species, and other relationships in any given fishery there is a general incentive to identify factors other than catch level (and certainly not that of the state in question) as being responsible for the failure of conservation efforts.

COMMERCIAL EXPLOITATION OF ANTARCTIC KRILL: CURRENT TRENDS AND USERS

The Fishery

Although exploratory fishing of krill in Antarctic waters has been in progress since the beginning of the 1960s, increased international interest in large-scale harvesting of this species developed as a result of an extension of national jurisdiction on traditionally exploited fishing grounds. Distant-water fishing nations, particularly the Soviet Union, Japan, Poland, East Germany, Bulgaria, South Korea, and other nations, have intensified their effort particularly in 1977 and 1978 when large exploratory fishing expeditions have been sent to Antarctic waters. As a result, nearly a three-fold increase of krill catch has been reported in each of these two years.

Table 7 shows that the yearly harvest of krill in Antarctica grew steadily from 2,000 tons in 1970 to about 530,000m tons in 1982. Only in 1970 and 1972 has the Chilean catch of krill been larger than that obtained by the Soviet Union. With these two exceptions the USSR catch of krill has always placed that country as an undisputed leader of Antarctic krill fisheries. At the present time (1982) the

Table 5

Nominal Catches of Finfish By Species And Countries
In Main Antarctic Fishing Areas During 1977.

Area/Country	Scotia Sea Ice Fish	Patagonian Hake	Antarctic Cod (Nothotenlidae)	Antarctic Ice Fish	Patagonian Tooth Fish	South Georgia Ice Fish	Other Species	Total
Atlantic, Antarctic								
Soviet Union	—	1.682	37.885	106.418	1.521	—	—	147.506
Poland	1.340	—	7.735	3.949	321	6.343	2.555	22.234
German Democratic Rep.	—	—	790	—	—	—	678	1.468
Indian Ocean, Antarctic								
Soviet Union			55.855	54.208	—	—	.254	101.317
Poland			39	54	—	—	23	116
Total	1.340	1.682	102.304	164.629	1.833	6.343	3.510	291.641

Sources: 1) FAO Fisheries Circular, No. 648, FIDI/C648, Rome, 1978.

2) Technika i Gospodarka Morska, Nr. 5(323), 1978, p. 309 Table 1.

Table 6

Nominal Catches Of Finfish By Species And Countries In Main Antarctic Fishing Areas During 1982 (in metric tons).

Area/Country	Scotia Sea Ice Fish	Patagonian Hake	Antarctic Cod (Nothotenidae)	Antarctic Ice Fish	Patagonian Tooth Fish	South Georgia Ice Fish	Other * Species	Total
Atlantic, Antarctic								
				(18,009)	(224)		(28,612)	(46,395)
Soviet Union	—	—	—	57.433	534	—	44.212	102.179
	(3,942)		(6,169)	(1,189)		(1,453)	(10,959)	(23,969)
Poland	676	—	1.209	4.446	(257)	956	2.121	9.408
East Germany	—	—	(1.237)	(3.648)	—	(2,330)	(1.055)	(8.268)
Bulgaria	(22)	—	(616)	(129)	—	(64)	(34)	(865)
Indian Ocean, Antarctic								
				(128)	(20)		(24,197)	(24,345)
Soviet Union	—	—	—	14.996	180		10.246	25.422
Poland	—	—	—	—	(7)		(367)	(374)
Total	(3,964)		(8,022)	(23,101)	714	(3,847)	(64,774)	(104,216)
	676		1.209	76.875	(506)	956	56.579	137.009

— Magnitude known to be negligible or zero.

* Mainly Gunther's Notothenia, Scaled Notothenia, Marbled Notothenia and Bumphead Notothenia.

Numbers in brackets related to the 1980 catch.

Sources: Yearbook of Fishery Statistics #54 (1982) and #50, 1980.

Soviet fishing fleet is approaching the yearly catch level of about 0.5 million metric tons. It means that this country's krill harvest makes about 93 percent of the world catch of this species in Antarctic waters.

Japan is the second largest user of Antarctic krill resources with the catch in 1982 equal to 36,000 metric tons. The Japanese harvest level had stabilized during the last four years, while the role of Poland in the krill fishery had been substantially curtailed in recent years. The East German and Bulgarian fishing of this species have practically ceased as well. It is expected, however, that these countries may renew their krill harvest in the near future.

Utilization of Krill: Progress and Problems

Antarctic krill is considered a most difficult raw material for processing purposes. Krill is extremely small — the weight of each individual is about 1 gram. Krill poorly resists all mechanical stresses and decomposes very quickly after being caught.

Even cursory review of the krill as a raw material indicates the difficulty of the utilization of this species. When considering processing methods of krill it is also assumed that they must be simple, inexpensive, and effective in order to produce massive quantities of products acceptable for international and domestic markets. The question is, have these objectives been satisfied? In some methods of krill processing the progress was substantial, thus justifying large-scale krill harvest. For example, the utilization of krill as a raw material for krill meal production and as a frozen whole product for feeding of fur animals, poultry, and fish in aquaculture have been advanced largely in the Soviet Union. Much less spectacular progress has been made in processing technology of krill for direct human consumption. For several years Russians have been producing coagulated krill paste "Okean." Some Soviet factory-trawlers, such as "Mayakovskij" class vessels, have been equipped with krill paste producing installations delivering ready-made products to the Soviet human consumption market. However, because of its poor quality and short shelf life the paste "Okean" has not been accepted by the Russian consumers. Efforts are presently being made to increase the quality of this product and utilize it as a component of other food commodities. Some quantities of peeled krill meat are being presently sold in the Russian market under the trademark, "Antarctic Shrimp."

In Japan krill is sold as a whole frozen product for direct human consumption but the demand for it is limited.

A number of krill products have been distributed on an experimental basis during recent years. Whole, boiled, and then frozen krill have been sold in that country, while Chileans have tried to introduce canned krill meat. Coagulated paste has been tried in the West German market as a component of processed cheese spreads, fish balls, and pate (O'Sullivan, 1983).

Failure to introduce the processing technology of inexpensive, food-grade products based on krill, has left Russian fishing companies with one alternative use of the resource: reduction to the krill meal. From the first years of the commercial exploitation of krill, conventional fish meal plants installed onboard older factory trawlers were employed assuring meal — raw material — recovery ratio

Table 7

Volume Of Antarctic Krill Catch (Exploratory And Commercial) During 1970-1982 (in metric tons)

Country	1970	1972	1975	1976	1977	1978	1979	1980	1981	1982
USSR	100	2100	21.700	38.900	105.049	116.601	295.508	440.677	420.434	491.656
Japan	—	—	2.540	4.830	10.517	26.063	36.909	36.283	27.832	35.909
Poland	—	—	—	.575	6.968	30.000	—	.226	—	.004
Chile	1900	4400	.821						—	.494
East Germany	—	—	—	.400	—	.008	.102	—	—	
Bulgaria	—	—	—	—	—	.094	.046	—	—	
Total	2000	6500	25.061	44.705	122.534	172.766	332.565	477.186	448.266	528.063

— Magnitude known to be negligible or zero.

Sources: I. Everson (1977), *FAO Yearbook of Fishery Statistics* Vol. 40 (1976), 50 (1980), and 54 (1982), N. Hawkes, Moratorium set on Antarctic oil at October Meeting, Science, November 18, 1977, Vol. 198, No. 4318, The Oriental Economist, February, 1977, p. 12. Polish Maritime News, No. 226, June, 197, FAO Fisheries Circular No. 648, FIDI/C648, FAO, Rome, 1978, Technika i Gospodarka Morska, No. 9 (315) September, 1977, p. 568.

equal to about 18 percent. Russian factory trawlers still use so-called "one-step method" by thermically processing and drying krill in the same processing phase. The final product has low nutritional value and contains up to 13 percent of the shell (Bykowski, 1982). When production of tail meat was undertaken onboard these factory ships, the yield was 10-13 percent only. Two factors affected such low recovery yields:

a) Inadequate installations (originally used for finfish processing); and

b) Varying physical and chemical properties of krill.

Newer krill meal production technology suggested both by some western technologists (including such companies as Baader, Alfa Laval, Laitram and others) and Polish researchers reduce the content of harmful shell in the krill meal to six percent only. The recovery ratio, however, is low: 11 percent only. The resulting product has been found safe as a fodder for all agricultural animals.[2]

Low recovery ratios in krill meal production require large quantities of the raw material thus forcing fishing vessels to stay longer at sea although without frequent unloading to support ships or traveling back to the home ports.

Up-to-date international efforts to develop satisfactory krill meal production technology have been based on use of processing installations existing onboard conventional factory ships. Processing lines of these vessels were complemented with additional installations such as shell separators, or other auxiliary machines. However, this resulted in low production efficiency and relatively low product quality, particularly when simplified one-step krill reduction methods are used.

Fishing and Support Operations

Among numerous natural factors affecting krill harvesting/processing activities, two of particular importance for fishing fleets operators should be mentioned:

a) Geographical location of the fishing grounds; and

b) Seasonal limitations of the harvesting operations.

The krill harvesting season is short: it lasts approximately three to four months (December-March) although large vessels capable of operating in the pack ice may extend the season until May. The krill is protected against human predation during a large part of the year, not only by the rough weather conditions but also by wide ice coverage of the waters south of the Antarctic convergence.[3]

Although krill have circumpolar distribution, the most important fishing grounds are located in the Scotia Sea and adjacent waters. It takes an average fishing vessel over 30 days to reach them from European or Far East base ports.

Antarctic krill fishery involves catching and processing technologies different than those used in the finfish fishery. Vessels engaged in krill fishing should ideally be specially designed and equipped with fishing gear and processing installations for this specific purpose only.

In order to meet high operation costs, catch rates, and processing outputs should also be high. Krill offers much lower recovery ratios of the final product than most of the traditionally harvested finfish species do.

To produce comparable amounts of krill meal, for example, it is necessary to install processing plants with production capacities two to four times higher in krill operations in order to equal a final product volume comparable to that in finfish fisheries. Because of space limits aboard factory ships, it is difficult to install separate processing installations for krill and finfish processing. As a result, up-to-date long-range companies were forced to send different ships engaged in krill and finfish fisheries. This tendency can be observed in Soviet and Japanese expeditions, although both countries are utilizing their vessels in different ways in southern ocean fisheries. The Soviet Union relies heavily on specialized support ships while Japan is presumably making use of the normal trading routes served by international shipping lines to bring home its catch (Everson, 1978).

Table 8 provides a sample of the composition of the Soviet, Japanese and Polish fleets developing exploratory and commercial fisheries in Antarctic waters. The vessel types and numbers are obviously not definitive as the information available was incomplete, but it provides an indication of the tendencies in the use of Antarctic resources. Large factory trawlers, usually over 2,000 gross tons each, were mostly employed in krill/finfish harvesting processing operations. Their krill catching rates are about 120-150 tons per day (Bogdanov, Ljubimova, 1978). According to the Russians, the best types of vessels to be used in krill fisheries are factory-trawlers type "BMRT" (Bolshoy Morozilnyj Rybolovny Trazler — Large Refrigerated Fishery Trawler) or "SuperAtlantik" (Lestev, 1978), on which it is possible to process krill with two to three processing lines. In Japanese krill fisheries, auxiliary vessels may also support flotilla-type operations in which a smaller catch of about 350 gross tons each cooperate with the factory-membership of 8,000 gross tons.

However, extremely high perishability of unprocessed krill makes typical mother-ship fishing operations extremely difficult. It would take too much time for a catcher boat to harvest enough krill to fill her holds, return to the floating let alone to the land-based processor, and transfer its full cargo for further processing.

Also the short fishing season in Antarctica and lack of post-krill-season employment opportunities for the mother-ship fleet in other parts of the southern ocean, makes this alternative uneconomic even for subsidized operators.

As an up-date experience shows, the most realistic form of krill exploitation is the use of large factory trawlers, capable of a daily harvest of 100-200m tons of krill, during the short Antarctic season. This means that these vessels should also be able to engage in the fin fishery during the remaining part of the year. Eastern bloc fleets have tried to achieve these goals by refurbishing older factory trawlers, and re-designing fishing gear and processing plants onboard these vessels.

The important condition is that all vessels sent to Antarctica, for economic reasons, should stay in the southern ocean during the whole year. During the Antarctic summer these ships will catch krill, while later they will be employed in high seas fishing grounds in the South Pacific, South Atlantic and Indian Oceans.

Table 8

Composition Of Some Fishing Fleets Operating
In Selected Antarctic Fishing Grounds

Season	Area	Fleet Nationality	Composition	Number Of Vessels
1971-72	Kerguelen Islands	USSR	Factory Trawlers	77
			Transport Vessels	18
1976-77		Japan	Trawlers	5
1977-78		Japan	Trawlers	9
1977-78	Scotia Sea	Poland	Factory Trawlers	4
			Research Ship	1
1977-78	South Orkneys	USSR	Trawlers	32
			Tankers	4
			Factory-Mother Ships	11
			Tug	1
			Research Vessel	1
1978-79		Japan	Trawlers	7
			Research Vessel	1
			Mother Ship	1
1978-79	South Georgia South Orkneys	Poland	Factory Trawlers	4
			Research Vessel	1

Sources: Inigo Everson, Antarctic Research, Polar Record, Vol. 19, No. 120, 1978. Polish Maritime News, No. 226, June 1977.

Sea Technology and Economic (monthly) No. 9/327, September 1978, p. 524.

Thus the contemporary concept of economic use of the Antarctic fleet includes its employment both in waters adjacent to Antarctica as well as in sub-Antarctic fishing grounds where other species than krill can be harvested during the same year. In the most remote fishing grounds, like those existing around Antarctica, harvesting activities may only expand with the assistance of support fleet capable of assuring uninterrupted factory-trawler operations during the whole season. Only large support ships, tankers, and specialized refrigerated fish carriers are capable of bringing supplies, picking up fish cargoes, and offering other support services in the entire area and in all hydrometeorological conditions.

At the present time, only Soviet bloc nations and Japan own sufficient numbers of mother-ships and fish carriers to support their Antarctic operations. Soviet mother-ships do not process krill but can reprocess fish, or store frozen krill products. The largest fleet of these vessels operates under the USSR flag.

Altogether, Soviet bloc mother-ship and fish carrier fleet accounts for 92.6 percent of the world potential in this group of vessels (*Lloyd's Register of Shipping*, 1981).

Although the Russians were purchasing mother-ships and transport vessels from the Japanese, West German, French, and other Western shipyards, the bulk of this fleet has been built by Poland and the German Democratic Republic. Polish shipyards have delivered over 50 percent of Soviet mother-ships presently in use, while the East Germans specialize in refrigerated fish carrier deliveries.

The importance of specialized fish carriers in Soviet support fleet is growing and the number of factory mother-ships decreases slowly, however, recent deliveries of highly sophisticated floating processors and growing interest in the open ocean and still unrestricted fishery resources are suggesting that the Soviet Union will continue to employ factory mother-ships in its long-range fisheries.

We can thus expect that in Antarctica, fishing operations will also be supported in the future by factory mother-ships and specialized fish carriers. Their support potential (processing and fish preserving, capacities, supplying facilities at sea, etc.) assure further expansion of Soviet operations in the southern ocean and adjacent areas. However, employing conventional support ships in krill fisheries, will present a major problem as in general, the existing processing equipment for finfish cannot be used in the production of food products from krill.

Although installation of both fish and krill processing plants onboard those large vessels would be possible, there again is the problem of fresh krill cargo transfer at sea from the catcher boats. Perhaps deliveries of krill in detachable cod ends will be more feasible in Antarctic conditions. This will imply construction of specialized krill processing factory mother-ships or krill factory trawlers, producing high value krill food products for human consumption, krill meal as a fodder for animals, and highly valuable chitin-chitosan from krill shells for various industrial uses.

HARVESTING MARINE LIVING RESOURCES OF ANTARCTICA: AN ECONOMIC VIEW

Although several modes of operation have been offered when envisaging the future commercial krill fishery (Michell and Sandbrook, 1980), only one system is currently in use in the Antarctic fisheries: the factory trawlers operating with support of the auxiliary ships. There is no land support for the distant-water fishing vessels, as yet, although some countries have negotiated an access to port facilities with Argentina and Australia. These efforts, however, are guided by a desire to create the resupply and repair bases rather than to establish land processing facility for the Antarctic marine living resources.

In order to decrease per unit costs of operation factory trawlers are kept the whole year in the southern ocean. Crews are changed (for example in Lima, Peru) and after conclusion of the krill season these vessels are involved in finfish fishery mainly in the sub-Antarctic regions of the Atlantic, Pacific and sporadically Indian Oceans.

It is assumed that a typical factory trawler operating in the Antarctic waters will stay at sea in average about 260 days. There are approximately 180 fishing days for each vessel.

Since no specialized krill fishing vessels are involved in Antarctic fishery, it is also expected that each factory trawler is able to carry out both krill and finfish fishing/processing operations. It is therefore assumed that such vessels will be utilizing 50 percent of their fishing time (90 days) for krill and another 50 percent for the finfish fishery.

If an average catch yield per day will be 130 tons of krill (100 tons of krill is processed by the newly installed and 30 tons by the old fish meal plant), the daily production of krill meal is 19.5 tons (recovery ratio = 15 percent). During 90 days of fishing operations, there will be about 1755 tons of krill meal.

During the second part of the exploitation season, the vessel will move to the sub-Antarctic finfish or cephalopod grounds where daily catch rates are about 25 tons. After 90 days, the vessel would harvest approximately 2250 tons of fish or squid. If krill meal price CIF (cost, insurance, and freight) Hamburg is assumed to be $420./ton, and the value of one ton of frozen fish or squid is $800, then the total value of the catch would be ($737,100 + $1,800,000) $2,537,100. On the cost side there will be substantial increase in fuel use, particularly for travel (both routes = 24,000 miles) and mother-ship service.

Long-range Antarctic fisheries also incur the high costs involved in maintaining ships and crews at sea far from home bases. The operating costs of factory trawlers and large support fleets in Antarctic waters, including labor costs and energy outlays, may well be more than twice the operating costs of equivalent vessels on traditional fishing grounds. Often, these costs will more than offset the technological advantages of the long-range fleets and their ready access to Antarctic or sub-Antarctic fishing grounds and to markets for their products.

It should be noted that fishery resources of Antarctica are considered by all presently involved nations as a last resource base which can be taken without substantial legal or political impediments and where their overcapitalized fleets can still be employed. However, from an economic standpoint, it has been stated repeatedly that utilization of Antarctic fishery resources is less efficient for these countries than those taken in traditional fishing grounds, presently within the 200-mile economic zone of other States.

Participation of fishing fleets from the free market economy countries in commercial exploitation of the Antarctic fishery resources will be influenced mainly by the market factors existing in particular Western countries. For the U.S., the economic importance of these resources will be shaped primarily by availability of competitive and still underdeveloped fishery resources in the U.S. fishery conservation zone, development of new technological solutions to harvest and process small crustaceans at sea as well as by changing market demand.

NOTES

[1] During the 1975-1976 Antarctic Expedition of the Federal Republic of Germany, the almost complete lack of large fish of some Nototheniidae species over

90cm in length was associated with the impact of USSR fishing which had been carried on quite intensively since the end of the sixties. See: Research and Exploration of the Resources of Krill and Food Fish in the Antarctic, Report on the 1975-76 Antarctic Expedition of the Federal Republic of Germany, Federal Research Center for Fisheries, Hamburg and Institute for Marine Science, Kiel University, Hamburg, April, 1977, p. 26.

[2] An average content of fluor in the new krill meal is 1800 mg/100g. This is almost four times less than ECC required maximum contents of fluor in fish meals.

[3] During the Antarctic winter, an area of 22 million km² (60 percent of the total oceanic area) is covered with ice, while in the summer (November to April) this coverage is reduced to 4 million km², or 11 percent of the area.

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First and Second International BIOMASS Experiments and Recent Research on the Abundance of Krill (Euphausia superba) *in the Southern Ocean*

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HISTORICAL BACKGROUND

The development of the Biological Investigations of Marine Antarctic Systems and Stocks (BIOMASS) began in 1974 at the first meeting of the Scientific Committee on Antarctic Research (SCAR) and the Scientific Committee on Oceanic Research (SCOR) Group of Specialists. The planning for cooperative studies concentrating on different components of the Antarctic ecosystem including a specific program was drafted at the 1976 meeting of the Group of Specialists. This program was named the First International BIOMASS Experiment (FIBEX) and was to take place in 1980/1981. The objectives of the program were directly concerned with determining the abundance of krill *(Euphausia superba)* in the Antarctic, what proportion of the population was distributed in patches, and what is the structure of patches and swarms. The observations were to be made acoustically, recognizing that the acoustic method would underestimate the population where it was not sufficiently dense to be detected. Also the portion of the population occurring near the surface would not be adequately measured and some degree of underestimation would occur where the swarms were very dense, due to acoustic shading from the individuals above. The Group of Specialists also recognized that time and number of available ships would preclude a survey of the entire southern ocean. The planning for FIBEX continued through the Group of Specialists meetings at Kiel (1978), Krakow (1979), and Buenes Aires (1979), culminating with the final formulation of objectives at Dammarie-les-Lys in June 1980. The objectives were to study methodology for assessing abundance, describe the distribution of krill in three selected areas (Fig. 1), and the measurement of abundance of krill in the southwestern Atlantic sector.

FIBEX FIELD OBSERVATIONS

The field portion of FIBEX was completed during December 1980 to March 1981, with the major portion of joint operations in January. Twelve ships from

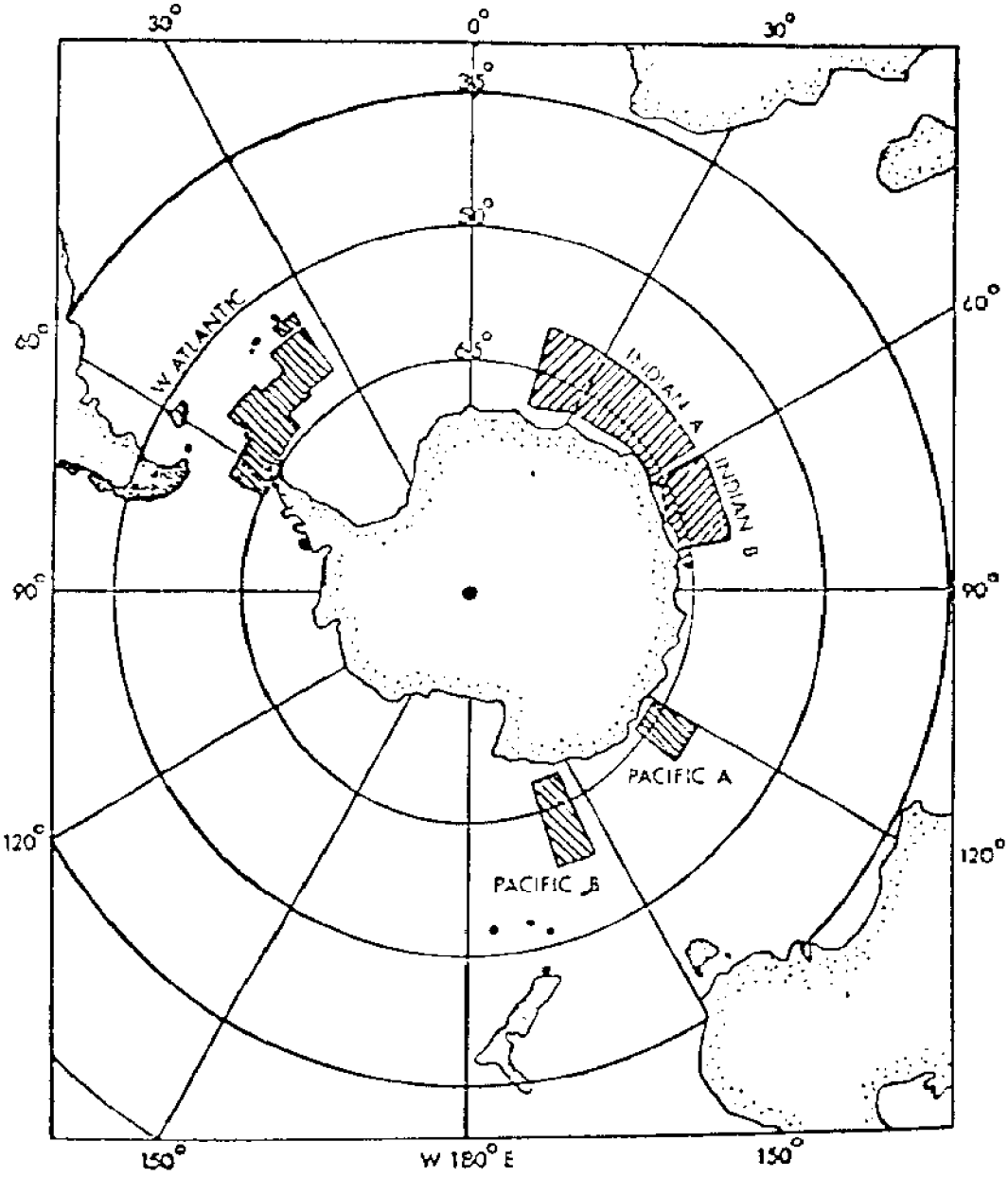

Figure 1. Areas selected for FIBEX field observations.

ten countries participated in some degree in the surveys (Table 1). Ten of these ships worked strictly in the framework of the FIBEX coordinated surveys. R/V *Melville* (USA) and R/V *Meteor* (FRG) were conducting general biological and physical oceanographic surveys in the area. The British Antarctic Survey vessel RRS John Biscoe developed mechanical problems and had to drop out. The survey in the Atlantic sector was characterized by the presence of numerous patches of adult krill. One of these was a "super-swarm" estimated to contain 2 million +/- 1.2 million metric tons and covering 5 by 11 nm with a thickness of 50-200m. In addition, a large concentration of larval krill were found in the area between the South Shetland Islands and the South Orkney Islands. Large portions of the Indian sector surveyed had high abundance of krill, especially near the continent. The Pacific sectors were much smaller and generally had low abundance.

Table 1

Survey dates and areas for ships participating in FIBEX acoustic survey.

Ship	Country	Area	Dates
Nella Dan	Australia	62°S to continent 60°E to 90°E	Jan. 18-Feb. 13, 1981
E.L. Homberg	Argentina	56°S to 62°S 42°W to 48°W	Jan. 19-Feb. 16, 1981
Itsumi	Chile	61°S to 64°S 54°W to 63°W	Jan. 28-Feb. 28, 1981
Marion-Dufresne	France	60°S to 64°S 30°E to 50°E	Feb. 12-22, 1981
Walther Herwig	FRG	57°S to 64°S 48°W to 56°W	Jan. 26-Feb. 21, 1981
Kaiyo Maru	Japan	63°S to 68°S 30°E to 55°E	Jan. 16-29, 1981
Umitaka Maru	Japan	58°S to 68°S 120°E to 165°E	Dec. 29, 1980 Feb. 5, 1981
Professor Siedlecki	Poland	59°S to 66°S 66°W to 56°30'W	Feb. 14-Mar. 13, 1981
S.A. Agulhas	South Africa	60°S to 70°S 15°E to 30°E	Feb. 16-Mar. 10, 1981
Melville	USA	58°S to 61°S 46°W to 49°W	Jan. 24-Mar. 3, 1981
Odyssee	USSR	56°S to 61°S 40°W to 34°W 53°S to 55°S 34°W to 38°W	Feb. 7-24, 1981

FIBEX DATA WORKSHOP

Following the field operations, the post-FIBEX Data Workshop was held in Sept./Oct. 1981 in Hamburg (FRG). Acoustic, oceanographic, and biological data were provided to the conveners of the workshop and were entered into a relational data-base, developed at the University of Hamburg, for analysis and interpretation. The logistics of data handling consumed much of the workshop, however, the acoustics data and some of the physical oceanographic data were analyzed as well as preliminary interpretation of some of the biological data. One of the important aspects of this workshop was the excellent cooperation between contributing nations. Much of the data were in a very preliminary state and contained errors and omissions. The efforts to standardize the format and content of the data provided a strong basis for cooperative data sharing which will be of assistance

at workshops of this type whether for management studies or scientific investigations. There have been several subsequent workshops on subsets of the data and more are planned. The final repository of the data is still under advisement, the British Antarctic Survey (U.K.) and the Polar Research Institute (FRG) have both offered computing facilities. The SCAR/SCOR Group of Specialists will soon decide which of these facilities will be accepted for the BIOMASS data-base.

SIBEX OBJECTIVES

The Second International BIOMASS Experiment (SIBEX) was planned to follow on during 1984/1985 to provide additional information about the Antarctic ecosystem. The objective is to provide observations of small scale processes, especially patch and swarm related phenomena. Data workshops coordinating the data from FIBEX and SIBEX are in the planning stages.

RECENT FIELD OBSERVATIONS

My co-workers (T. S. English and K. Daly, University of Washington; O. A. Mathisen, University of Alaska) and I have been involved with both of these experiments. We have collected and analyzed or are analyzing acoustic and other data on the abundance and distribution of krill in relation to the open ocean and near and in the ice covered areas of the Weddel Sea. In 1981, our component participated in two multidisciplinary cruises aboard R/V *Melville* as part of research funded by the National Science Foundation (NSF) and National Oceanic and Atmospheric Administration (NOAA). We surveyed much of the Scotia Sea during January 1981 as a ride-along project on a physical oceanographic survey. During February-March 1981, the second cruise was biologically oriented. The results of this acoustic survey were included in the FIBEX workshop. The large "super-swarm" was observed during this second cruise (Fig. 4). The development of the swarm was documented and took place over two to three days. While we were working in the vicinity of Elephant Island, we observed 35-40 Soviet trawlers fishing before, during, and after the formation of the "super-swarm." This intensity of trawling was unexpected. A rough estimate of the amount caught per-ship-per-day was 10-20,000 metric tons of krill. Subsequent to our observations of the "super-swarm', we proceeded down Bransfield Strait and returned to Elephant Island about two weeks later. When we re-occupied the area, we found much reduced abundance of krill (Fig. 5) and only a few trawlers were in the area. Tables 2 and 3 describe the areas we surveyed and the biomass and confidence intervals around them for the blocks shown in Figs. 4 and 5.

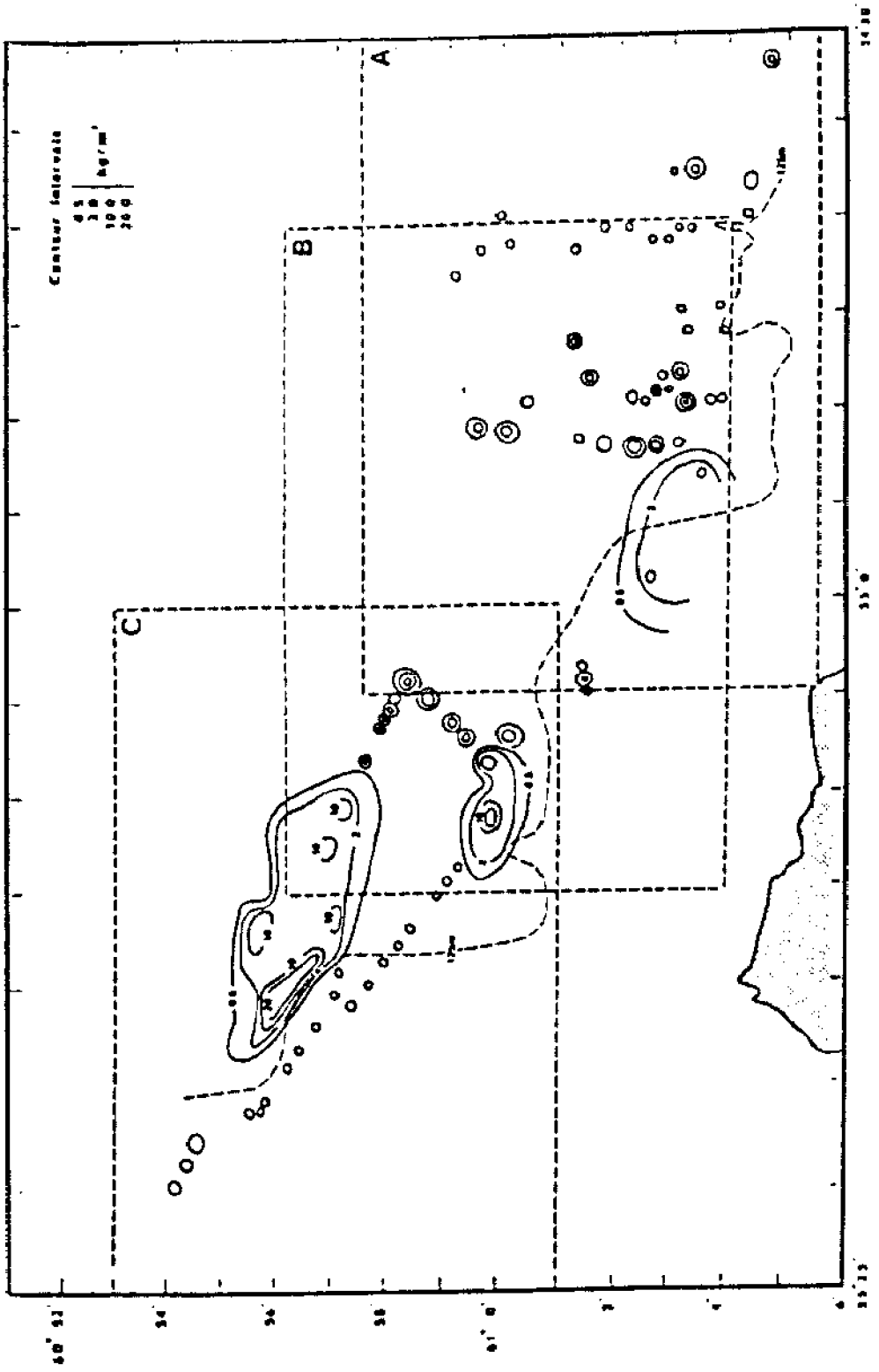

Figure 4. Contour plot of data from 5-8 March 1981, blocks A, B, C (from Macaulay, et. al; in press).

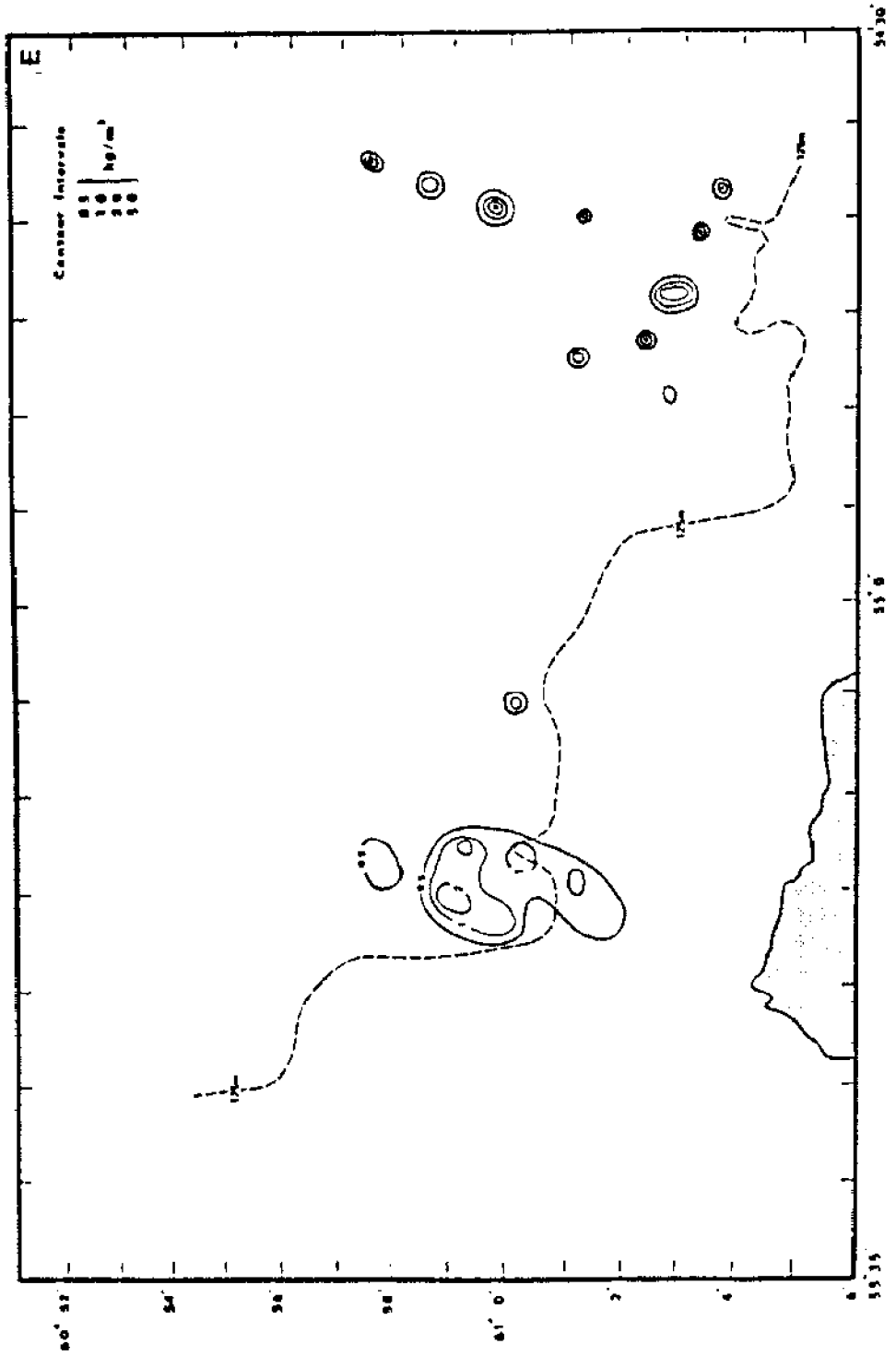

Figure 5. Contour plot of data from 20-21 March 1981, block E (from Macaulay, et. al; in press).

Table 2

Area, Date Occupied, And Geographic Boundaries For Analyzed Blocks.

Block	Area (km)	Date March	S. Lat.	S. Lat.	W. Long.	W. Long.
A	465.1	5	60°57.5'	61°5.5'	55°5.0'	54°30.0'
B	465.4	6-7	60°56.0'	61°4.0'	55°15.0'	54°40.0'
C	466.3	7-9	60°53.0'	61°1.0'	55°35.0'	55°0.0'
D	235.1	10	63°8.0'	63°16.0'	59°20.0'	59°1.0'
E	898.8	20-21	60°52.0'	61°4.0'	55°20.0'	54°35.0'
F	74.9	23	60°55.0'	61°0.0'	55°54.0'	55°45.0'

Table 3

Biomass By Block And Variance Estimators (95 Percent Confidence Limits) For Estimated Biomass (in million metric tons).

Block (N)	Biomass	Simple variance	H. Formula b. mean	H. Formula t. mean	Cluster formula
A (396)	0.1221	0.0029	0.0909*	0.0750	0.0620 +
B (316)	0.2067	0.0119	0.1960	0.1331	0.2164 +
C (979)	2.1280	0.0259	2.0890	1.2510	1.2290
D (348)	0.0988	0.0017	0.0630	0.0594	0.0343 +
E (1288)	0.2059	0.0020	0.2453*	0.1867	0.0861
F (40)	0.1317	0.0121	0.0827	0.0693	0.1191 +

Note. b. mean is block mean for covariance; t. mean is transect mean for covariance; simple variance is Var; N is number of observations used in calculations. 95 percent confidence interval is $t.96\sqrt{var}$; * is significant difference at 95 percent level for b. mean vs. t. mean variance.; + is significant difference at 95 percent level for t. mean vs. cluster variance.

Based on the results of these surveys, several of the investigators involved aboard R/V *Melville* proposed to NSF for additional work during 1984 to search for patches and swarm formation and maintenance. In addition, a process oriented study with emphasis on the ice edge zone planned to investigate the region eastward from the South Orkney Islands. Both of these projects were funded by NSF with additional support from NOAA. The data from these two cruises are

only now being analyzed. Preliminary analyses of these observations indicate much lower abundance of krill in the area than was observed in 1981. The dominant organisms in the populations were salpas, amphipods, and euphausiids other than *Euphausia superba*. A rough guess at abundance would place the population at 25-40 percent of what it was in 1981. The size and frequency of patches was much less and the large concentration of *E. superba* larvae was not found. In fact, the abundance of euphausiid larvae was extremely low. Environmental conditions were noticeably different, in that water temperature in the vicinity of Elephant Island was 0.5 to 1.5° C warmer than in 1981. There were trawlers present near King George Island (two Japanese and one Soviet) and there were a few large patches North of King George Island. It is my understanding that the British Antarctic Survey investigations near South Georgia this year also found very low abundance of krill.

IMPLICATIONS FOR MANAGEMENT

The implications for management of the krill resource is that there is much greater variability in stock size than has been usually presented. Clearly if the estimate of krill abundance made during FIBEX (250-600 million metric tons) is adjusted for conditions observed this year, the excess of krill available for harvest above the requirements for whales, seals, and birds could well be zero. A large part of the successful management of this resource will depend on an accurate estimate of abundance. An index to the potential population one to three years in advance would seem to be the general abundance of larvae. Sufficient information exists within the BIOMASS data-base as well as other sources (eg. Parfenovitch, 1982) to select sites where larval abundance samples could be taken. An example would be the area eastward from Elephant Island. This also presupposes a program of regular and systematic annual assessment of other factors affecting recruitment to the population. Heavy fishing pressure in a year such as this one would certainly depress the already depleted stocks of krill possibly for many years. After SIBEX ends (1985), there will be a need for continued monitoring of the status of krill stocks by more than just direct fishery catch statistics. The three-to five-year life span of *E. superba* combined with the strong tendency to aggregate in similar size (year class) groups means that catch statistics alone could give a false impression of future stock size. In addition, the proportion of the krill population not aggregated is still poorly known.

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Discussion

Ryan: Thank you very much. You have given us an indication that krill is not the simple animal that we thought it was nor is the question of krill availability as simple as we thought. Apparently the inter-annual variability is quite extreme. We have just a few minutes for questions.

Mitchell: I think that most conservationists feel that CCAMLR is a great innovation because it addresses the living resources below latitude 60°S. as a whole and because it was drawn up in advance of exploitation. But there have been many comments that the mechanism to regulate the fishery lacks teeth because of the inability of the commission to allocate the catch to individual nations. I wonder if any of the speakers would like to comment on those issues.

Sahrhage: The convention as it has been drafted actually gives full possibility to addressing these matters. The regulations allow the commission to set a total allowable catch (TAC) for krill or fish. It is up to the commission to split this by national quota. There is no limitation on the commission mentioned in the text of the convention.

Mitchell: Can I just say that the treaty parties, in 1977, specifically and explicitly agreed that the regime would exclude catch allocations and any economic regulation of the fishery. I know certain countries would flatly oppose it because it brings up the question of claims.

Scully: As one who was involved in the negotiations, I think I can help clarify this issue. That reference, in the report of 1977, was to the fact that the convention itself would not include entitlements. In some of the pre-history of the negotiation there was some effort to include in the convention itself entitlements for specific countries. The reference in the report of 1977 was to make clear that that was not the case. It was in no way construed then or construed in the negotiation of the convention itself as a limitation on the power of the commission to allocate catches at such a time as such allocations would become necessary.

Mitchell: But wouldn't it be difficult to do because of the claims situation?

Scully: A lot of people said that it would be very difficult to negotiate the convention at all because of the same situation.

Can I make one more point on that? Insofar as issues which cause disagreement and which have caused disagreement among nations and other fishery organizations, gear and effort restrictions have been far more controversial than national allocations. I would note that those are specifically mentioned in the convention as well as anything necessary to achieve the conservation objectives. During the course of negotiation, it became difficult to come up with an exhaustive list of what might be the possible conservation measures, and therefore, it was decided and agreed by all the participants in the negotiation that there should be an illustrative list of the types of conservation measures but that the commission would

in no way be limited by the convention. The commission would be permitted, in fact, by the convention to undertake any conservation measures of whatever nature it thought to be necessary to achieve the conservation objective. I won't argue about the difficulty of what will happen if and when that point is reached. However, I think it is incorrect to say that there is any limitation in the convention on the possibility of the types of conservation measures that could be considered or implemented in the future.

Hofman: I would like to add one more thing to that point. I think it is inappropriate to cast the question relative to allocation as a claimant issue, because the concern at that time for those countries who were not engaged in and had no plans for fishing, was that the fishery would reach the total allowable catch with no opportunity for new entrants. I think that the concern was really a typical fishery problem more than it was a claimant issue.

Mitchell: To what extent do you think voting requirements and the inspection system are going to be problems in regulating the fishery?

Hofman: Well, as I pointed out in my prepared remarks I think they both are potential problems. I think the major potential problem is lack of information. We are beginning to recognize that the system is much more complex than we had envisioned even as recently as the end of the negotiations. If it was very clear what to do, I do not think we would have much of a problem. The basic problem is one of matching the conservation measures to the degree of uncertainty relative to our knowledge of the structure and dynamics of the system. The potential exists. Whether or not it becomes a problem depends upon the will to succeed and the amount of trust that has been built up. Some evidence of that will and trust in the next several years might be: 1) If we come up with conservation measures that are conservative and that reflect the degree of uncertainty relative to the structure and dynamics of the fishery system; 2) If those countries who are not involved in fishing as well as those who are involved in fishing continue and expand both basic and applied scientific research; and, 3) If the problems relative to sharing of both scientific and fishery data are worked out. These three examples are all things that I think you can look toward for evidence of the will and the determination to succeed, and by that I mean if these potential problems become actual problems or not.

PART FOUR

Minerals Regime for Antarctica

Since 1982, the Antarctic Treaty consultative parties have been negotiating a legal regime to govern the possibility of minerals development in Antarctica. This act itself has tended to create intensified interest about the mineral potential of Antarctica, especially at this stage, the marine hydrocarbon potential, if any. During this session, the speakers will examine the issue of marine mineral resources and the associated international political relationships that are developing. This issue has been receiving its share of the press these days. For instance, recent discussions published in the international journal, *Nature* and in the *Explorer* which is published by the American Association of Petroleum Geologists.

The first presentation will set the stage by addressing the geological setting of the oceans surrounding the Antarctic continent. This will include some discussion about the hydrocarbon resource potential in the Antarctic region and will also mention or summarize many of the things that we simply do not know at this point.

The second presentation will be concerned with the economics of Antarctic hydrocarbons. This will be followed by panel members who will further discuss the potential of mineral resources in the marine regime of Antarctica and especially relationships with the developing legal regime.

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CHAPTER 10

An Overview of the Geological History of Antarctica With Regard to Mineral Resource Potential

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INTRODUCTION

From the outset, one must openly acknowledge that we know remarkably little about the geological details of the vast, frozen Antarctic continent. This paper will focus, de facto, on our goals for unraveling the geological history there and our aspirations to assess the potential Antarctic mineral resources.

A lot has been learned about the Antarctic compared to what was known prior to the International Geophysical Year (IGY). Until the early 1970s, the United States enjoyed an undisputed leadership role in Antarctic geoscience and marine research. However, this is no longer the case as other nations have expanded their research efforts while those of U.S. scientists have contracted. Nonetheless, a broad geological framework now exists for addressing the issue of the unknown mineral resource potential of Antarctica. The formation and concentration of mineral deposits are only one by-product, albeit an important one, of the total spectrum of geological processes acting on the earth for the last few billion years. This paper very briefly reviews the geological approaches to investigating Antarctica, summarizes the first-order characteristics of the continent and the adjacent offshore regions, and highlights our basic state of knowledge (or lack thereof) regarding Antarctic mineral resources, particularly offshore hydrocarbons.

Because most of the Antarctic is both geographically remote and geologically inaccessible, much of our geological knowledge and many of our resource speculations are the consequence of a stochastic or probabilistic analysis. The balance of our present "resource wisdom" for Antarctica is based largely upon informed extrapolation of geological information from better studied regions elsewhere which were once contiguous with Antarctica. Few Antarctic geoscientists take issue with the general conclusion that we are only slightly better off than "guessing" when it comes to assessing the oil and other mineral potential of Antarctica. In spite of this sobering fact, it is important to focus on the

elements that we do know, how this knowledge came about, and how we might best utilize it to guide our future research and policy making activities in the Antarctic. It is also important to identify the most conspicuous resource-related geological problems and to devise a rational plan to solve these problems in the near future.

Antarctic geosciences research is aimed at investigating the evolution of: 1) the crust of the Antarctic continent and the adjacent seafloor; and 2) the Antarctic environment, including climate and biota. The key word is evolution. We want to know not only what is there, but how it got there. Both of the topical areas cited above are extremely important and in many ways closely interrelated. The approach to scientific research can vary dramatically, depending upon one's research perspective. The important research perspectives regarding the Antarctic certainly include: potential mineral resources, geodynamics, paleoenvironment and global climate, and modern processes. These research perspectives involve considerable overlap. The perspective of paleoenvironment and global climate is extremely important because of the likely role that the Antarctic has played in controlling present and past climates and ocean circulation on a global scale. The environmental importance of the vast Antarctic ice sheet which presently covers more than 90 percent of the continent is not fully understood.

Looking first for the most fundamental geological elements, one soon realizes that Antarctica is composed of a few discrete elements bounded by major crustal discontinuities (see Fig. 1). These crustal discontinuities are manifested dramatically in three different types of tectonic/geological boundaries. The first is the continent to ocean basin discontinuity which characterizes about 80 percent of the circumAntarctic "periphery." This continent-ocean boundary (COB) represents a rifted, faulted boundary of the continent along which the other fragments of ancient Gondwanaland (Africa, South American, India, and Australia, and New Zealand) once resided. The boundary is marked by a major change on crustal thickness from thin oceanic crust to thick continental crust. The change occurs typically over distances of 100-300 kilometers, usually extending seaward of the shoreline across what is known as the crustal transition zone. This is the geological setting where many coastal sedimentary basins, well known for their hydrocarbon plays elsewhere in the world, are found. The COB crustal transition zone and its associated sedimentary basins can be used as important aids in extrapolating geological information from other regions to the Antarctic, and is especially pertinent to the offshore hydrocarbons issue.

In addition to the rifted passive margins cited above, there is a relict subduction zone (active margin) present on the Pacific side of the Antarctic peninsula (Fig. 1). This boundary is also the site of a major discontinuity in crustal thickness but was formed by tectonic processes which involved the underthrusting of oceanic lithosphere beneath the Antarctic peninsula many millions of years ago. The total length of this subduction boundary is small compared to the periphery of Antarctica but it is of resource interest because many of the metalliferous ore deposits, mined elsewhere in the world, have been found in similar tectonic settings. Sites of subduction are typically associated with active volcanism accompanied by hydrothermal metamorphism and mineralization.

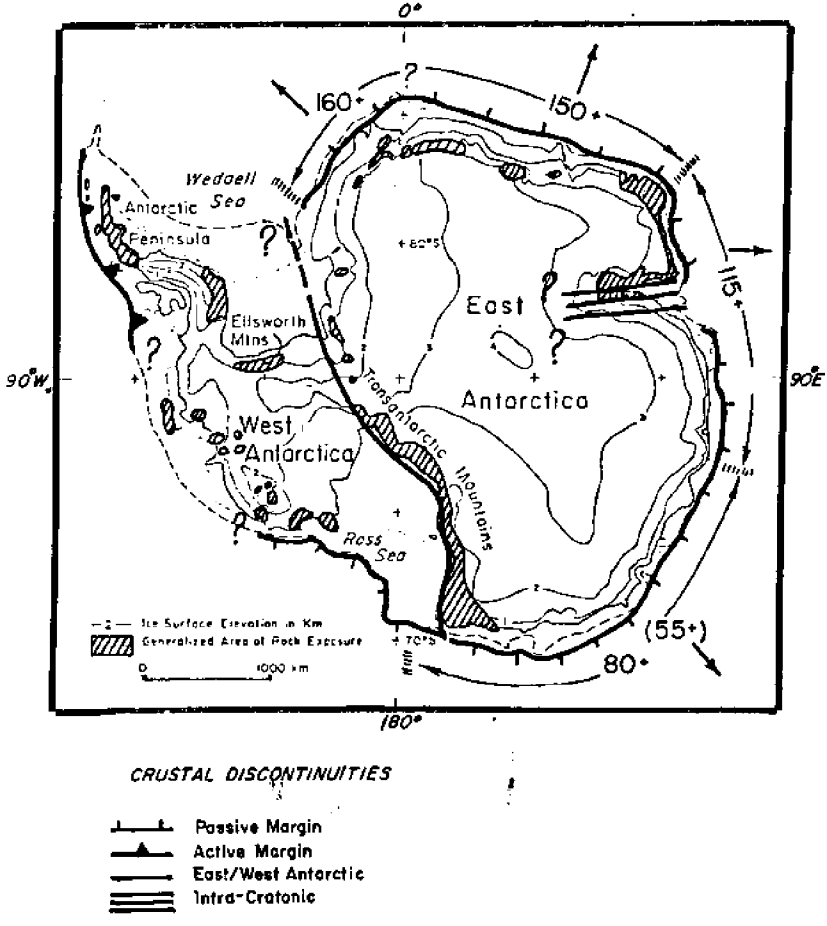

Figure 1. Antarctic crustal discontinuities and key place names. Sectors of East Antarctica rifted at various times shown ca. millions of years before present. Approximate directions of subsequent drifting are indicated by the arrows.

Approximately 50 percent of the Antarctic periphery is virtually unexplored with regard to the nature of the structures there. The southwestern Weddell Sea and the Amundsen Sea regions are very poorly known because the presence of year-around sea ice there prevents conventional offshore exploration efforts.

Another important major crustal discontinuity is an intracontinental one which lies along the boundary between the two subcontinents of East Antarctica and West Antarctica. East Antarctica is characterized by a crustal thickness of about 40 kilometers. The basement rocks are believed to be quite old and are overlain by a very thick continental ice sheet. East Antarctica is described as a stable, cratonic region. In contrast, West Antarctica is composed of younger crust which is also thinner, 30 km or less. The basement there may be composed of several

large blocks which in places are connected only below present sea level. These two contrasting sub-continents appear to have been "welded together" during the Paleozoic or, alternatively, rifted apart much later in the Cretaceous. The relict rift, if present, passes through the "central" Ross embayment; the hypothetical suture zone between East Antarctica and West Antarctica is presumed to lie near the eastern flank of the Transantarctic Mountains. These mountains have undergone dramatic uplift (several km) and the possible interrelationship between the vertical motion of the Transantarctic Mountains and growth and fluctuations of the East Antarctic ice sheet is the subject of extensive ongoing research.

THE GEOLOGY OF THE SEAFLOOR ADJACENT TO ANTARCTICA

Figure 2a shows the ship tracks along which geophysical data were obtained in the southern ocean. These data were collected primarily from the midsixties to the midseventies. There is a conspicuous absence of data from the near coastal region and across the continental shelves and slopes. Figure 2b shows the track locations of new multichannel seismic (MCS) data acquired during the period 1976 to 1984 by a number of different countries. This seismic data is similar to that

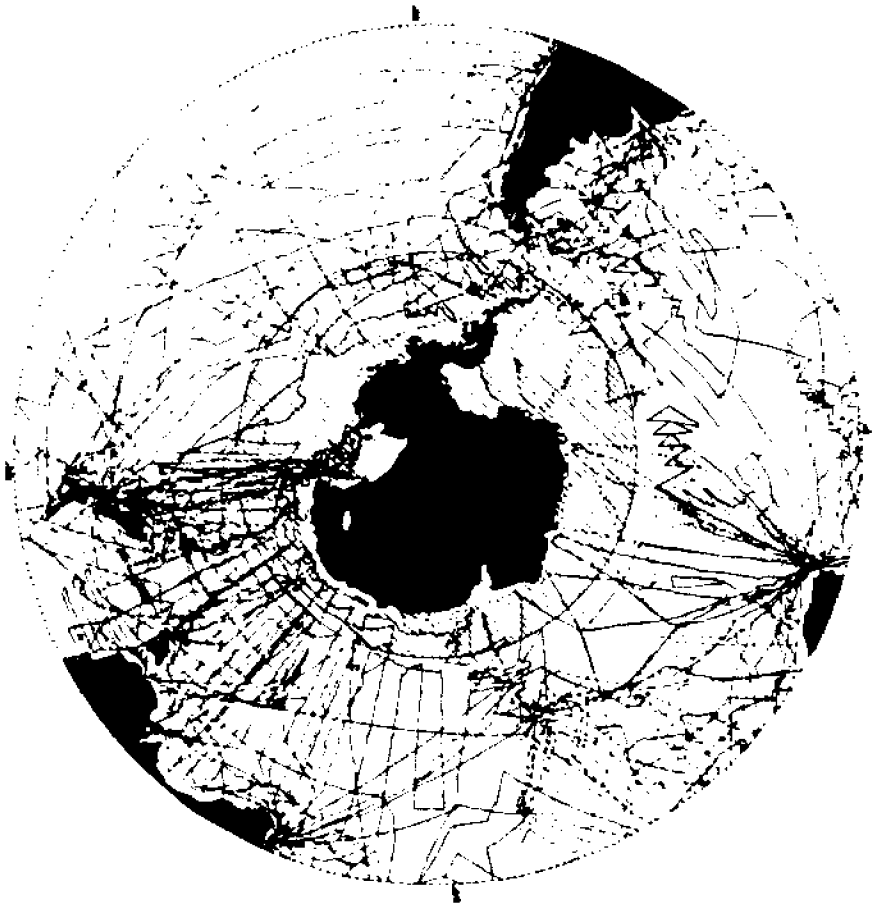

Figure 2. a) Geophysical track lines [bathymetry, magnetics, single channel seismic (some), gravity (some)].

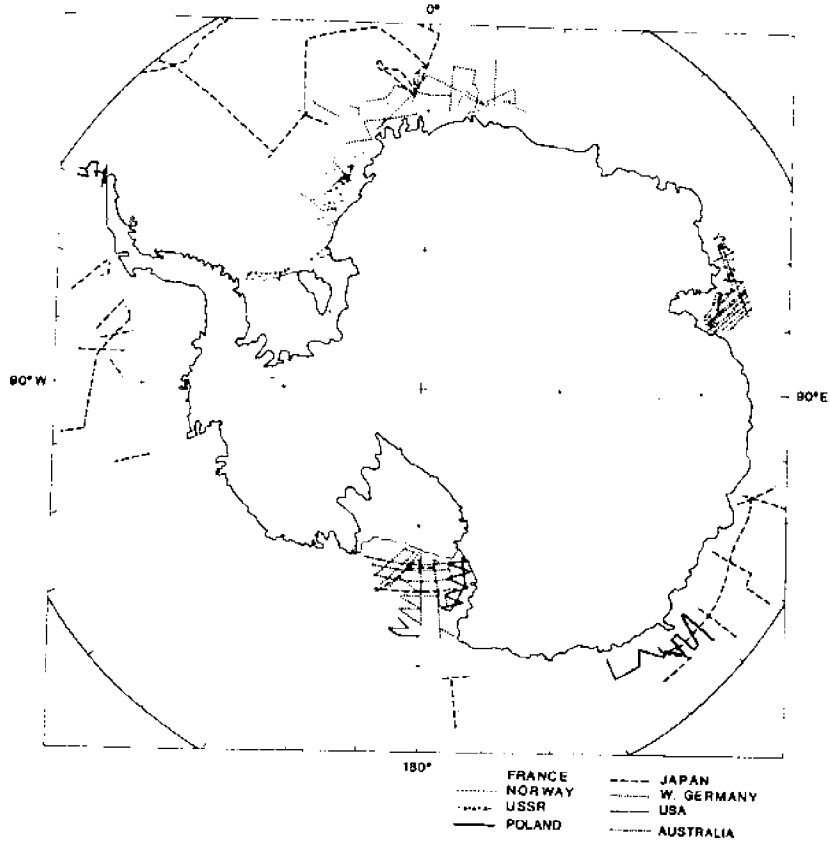

Figure 2. b) Multichannel seismic track lines.

collected to assess crustal structure during oil exploration surveys. The data shown here represent about 30,000 km of shiptrack, or 5-6 months of field work. Considering the extremely large perimeter of the Antarctic continent, even this amount of MCS data, collected recently across the continental shelf regions, must be considered minimal. Out of nearly 600 Deep Sea Drilling Project (DSDP) sites that have been drilled over the past 16 years of the drilling program, only about 10 sites have been drilled in the southern ocean south of latitude 60°S.

The Ross Sea embayment is by far the best explored of the offshore regions. Recent concentrated surveying efforts by Bundensanstalt fur Geowissenschaften und Rohstoffe (BGR), Hannover, FRG; Institut Francais du Petrole (IFP), France; Japan National Oil Company (JNOC); and, the United States Geological Survey (USGS), coupled with less sophisticated geophysical surveys done earlier, now provide a reasonably good reconnaissance picture of the geological structures beneath the Ross Sea shelf and adjacent the continental rise (see Fig. 3). Recent

seismic data show that the Ross Sea shelf (Fig. 3) is underlain by three discrete sedimentary basins. In many places, the subsurface geology is characterized by dipping strata which have been truncated, presumably by grounded glacial ice of previously greater extent. In 1973 the drilling vessel *Glomar Challenger*, as part of the DSDP, drilled four holes on the Ross Sea shelf. Those results were reported by Hayes and Frakes (1975) and generated considerable speculation in the news media regarding the hydrocarbon potential of this region. Traces of hydrocarbon gases were found in three of the four DSDP Ross Sea shelf holes, but as stated repeatedly by the shipboard scientists, because their origins and in situ concentrations are not known, it is premature to attach any economic significance to those results at this time. Reconstructions do place the Ross Sea region in close proximity to the producing oil fields of the Gippsland basin (between Australia and Tasmania) and to the Taranaki gas fields of western New Zealand. Because of this, and because the Ross Sea shelf is reasonably surveyed, it still represents the region of greatest current interest regarding the offshore hydrocarbons in the Antarctic region.

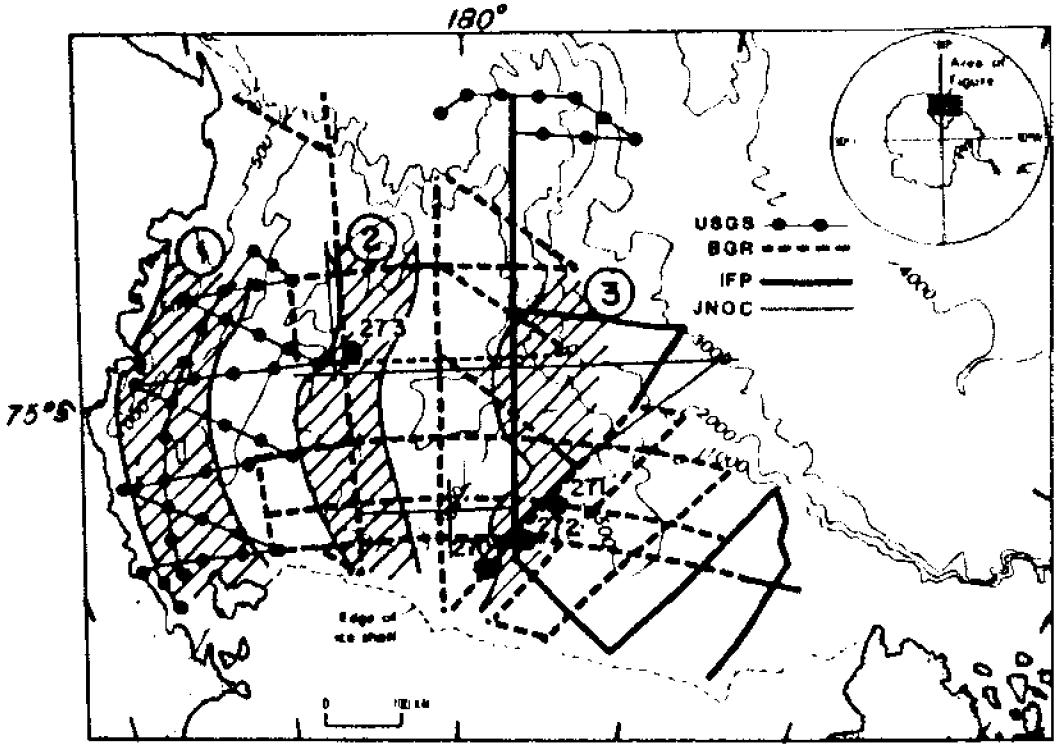

Figure 3. Ross Sea MCS tracks, DSDP sites, and sedimentary basins. (1 = Victoria Land Basin; 2 = Central Basin; 3 = Eastern Basin). (Modified from Elttreim and Cooper, 1984).

The Antarctic is essentially aseismic and nearly all the earthquake activity associated with the Antarctic plate lies along the spreading ridge axes which define the borders of the plate. The encircling nature of these ridges implies that the Antarctic plate is being "left passively behind" as these ridges generate new material and migrate northward.

The extent of sediment cover over the Antarctic plate has been mapped, but the data for these maps is primarily from the deep ocean basins. The geophysical tracks shown in Figure 2a recorded continuous magnetic measurements which have been used to identify the age of the underlying crystalline rocks (through the seafloor spreading studies). Characteristic magnetic anomaly lineations define isochrons which can then be used to reconstruct the relative positions of the Gondwanaland continents at various selected geological times. Offsets in the magnetic lineation pattern define fracture zone traces which are coincident with the actual paths of movement (flow lines) of the Gondwanaland fragments as they dispersed from Antarctica. Identification of these paths is crucial to effect a *precise* prebreakup reconstruction of Gondwanaland. Various continental fragments broke away from East Antarctica at different times. Figure 1 shows the approximate age and direction of initial rifting and drifting along various sectors of East Antarctica.

RECONSTRUCTIONS

As mentioned, the magnetics data can be used to reconstruct the relative positions of the continents and Australia and Antarctica are used here as an example (see Fig. 4). These reconstructions are important because they define the age of the pre-rift geology which should be continuous between Australia and Antarctica. The better known geology of Australia can be extrapolated onto the Antarctic continent by using the relative positions of the two reconstructed fragments. Reconstructions also help define the topographic barriers to ocean circulation which may have played important roles in modulating climate and eventually in initiating the Antarctic ice sheet.

Because the Pacific region of the Antarctic perimeter is poorly surveyed in the vicinity of the Amundsen Sea, it is not possible to unequivocally reconstruct the relative positions of New Zealand and Antarctica. However, the relative positions of Australia and Antarctica are fairly well determined (through time) as are those of Australia and New Zealand. One can use this approach to infer the New Zealand to West Antarctica reconstructions. In doing so, Hayes and Ringis (1973) found unacceptable overlaps of the continental fragments (see Fig. 5). The implication from that study is that there has been relative motion between East and West Antarctica *since* the breakup of New Zealand and Antarctica. Various investigators have continued to study this problem and have proposed similar conclusions. If East Antarctica and West Antarctica could be properly restored to their original, pre-breakup positions, the apparent unacceptable overlap would be resolved.

The entire Gondwanaland supercontinent can be reconstructed back to Jurassic time using similar techniques (see Norton and Sclater, 1979) as shown in Fig. 6. The uncertainties in such reconstructions are unfortunately of the order of hundreds of kilometers and much tighter constraints must be imposed before the results can be used to predict the details of Antarctic near-coastal geology that are crucial for meaningful resource assessments.

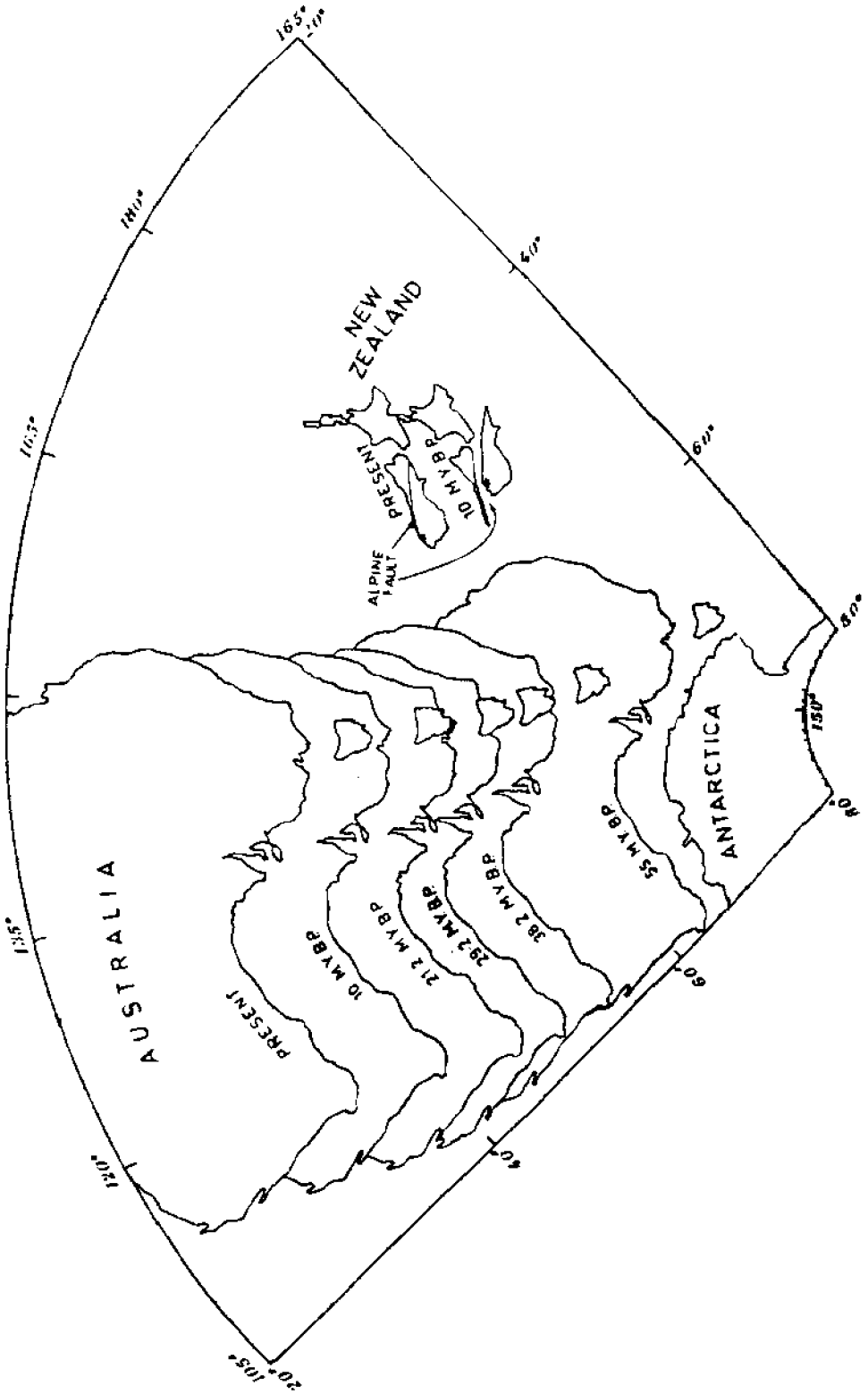

Figure 4. Australian-Antarctica reconstructions (modified from Weissel and Hayes, 1982).

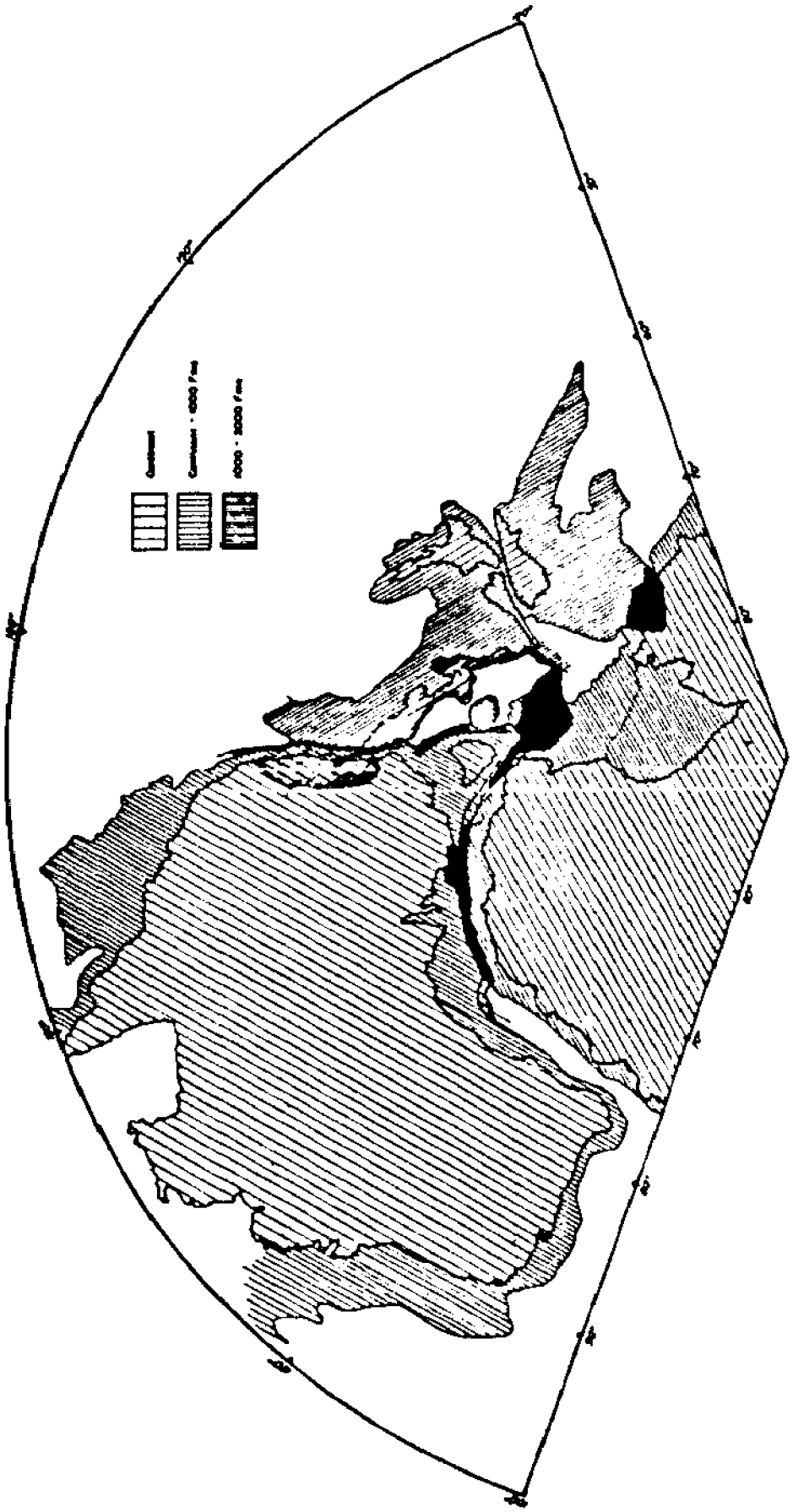

Figure 5. Australia-New Zealand-Antarctic reconstructions (modified from Hayes and Ringis, 1973).

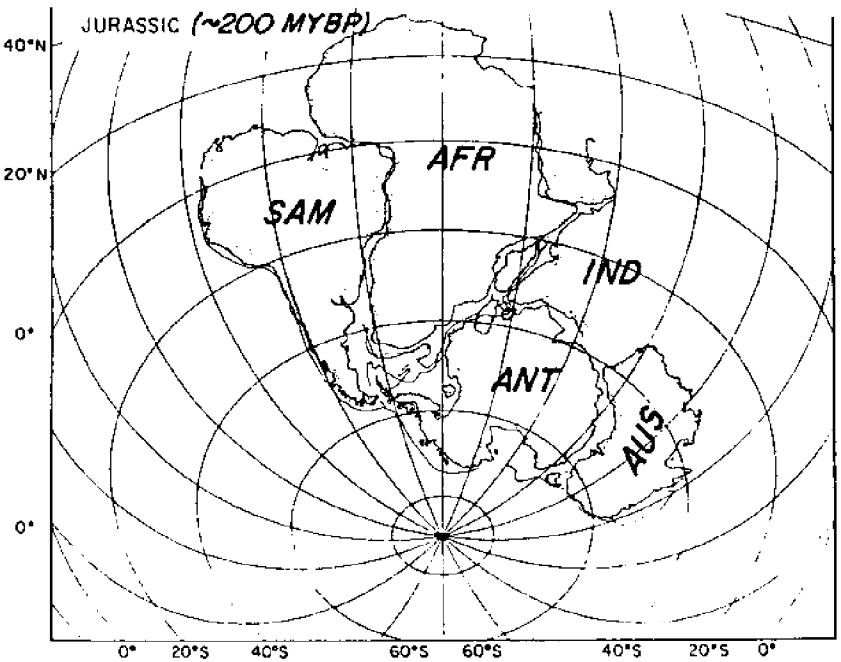

Figure 6. Jurassic Gondwanaland reconstruction (modified from Norton and Sclater, 1979).

On the Antarctic continent, one area is of particular interest. The Dufek Massif in the Pensacola Mountains (see Fig. 1) is a layered ultramafic complex second in size only to the Bushveld complex of South Africa. These types of deposits elsewhere in the world constitute our major chromium, vanadium, and platinum reserves and they also contain important amounts of nickel, cobalt, copper, and iron as well.

CONCLUSIONS

Although there is clearly a pessimistic outlook for any near-term extraction of Antarctic minerals, nonetheless, a basic understanding of the mineral potential of the continent is important in guiding future Antarctic mineral policy and assessing long-term mineral and oil reserves. We acknowledge that Antarctica constitutes about 10 percent of the world's land area and in all probability has a proportional mineral endowment. We also recognize that only a fraction of this land area is not perpetually covered by ice. Even so, discovery of even a tiny portion of the presumed mineral endowment in Antarctica could have an impact on the long-term use of very limited strategic minerals.

A straight stochastic estimate of Antarctic mineral resources, based purely on area, is probably a poor approach because so much of the continent and offshore sedimentary basins are inaccessible. To help focus our future research activities, we need much better constrained reconstructions. More reconnaissance multichannel seismic data in the near offshore region coupled with aerogeophysical surveys over the continent are desperately needed.

The bottom line is that making an intelligent assessment of Antarctic mineral resources, whether or not they are ever seriously considered for exploitation, requires much more field research than carried out to date. We do not yet fully understand even the most fundamental geological units in Antarctica. Our access to rock exposures is totally uneven and our reconnaissance data on the continent and offshore, as a whole, is sparse and uneven. Although ideally one would like to have a uniform geophysical/geological coverage of the entire continent and offshore region, this is not a practical goal for the foreseeable future. In this regard, the best strategy for future research is to focus properly our limited research resources on a few carefully selected study areas.

The question of the inception of Antarctic glaciation remains a major problem of global importance; this phenomenon has undoubtedly had an effect on the climate, ocean circulation, sedimentation, and the marine hydrocarbon resources everywhere else in the world.

At the present time, even our most optimistic estimates of the minerals of Antarctica lead most of us to conclude that their exploration and exploitation would not be economic in today's market. Appreciation of our planet's limited resources and our continuing conspicuous consumption of them, cautions us not to discount the possible long-term utilization of selected minerals which undoubtedly will be discovered eventually in Antarctica.

ACKNOWLEDGMENTS

This work was supported in part by National Science Foundation Grant DPP82-00239. I acknowledge the important contributions of many colleagues who, through ongoing discussions, have contributed to the ideas summarized in this brief paper. Drs. Steve Lewis and Jeffrey Weissel reviewed the manuscript and provided constructive comments. I thank the organizers of the conference for inviting me to participate.

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CHAPTER 11

The Economics of Antarctic Oil

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The topic of my presentation, "The Economics of Antarctic Oil," in terms of prognosticative certainty might aptly be compared to the topic, "The Economics of Lunar Gold." The similarities are manifest. In neither case do we have knowledge of:

1) The qualitative and quantitative existence of the resource;
2) The costs attendant to resource extraction;
3) The competitive position of the resource in the market place vis-a-vis alternative resources; and
4) The political regime that will be responsible for resource management.

Of these four points, as they apply to Antarctica, resource discovery and delineation will be technically possible within a comparatively short time. And the last — a political regime for minerals management — is currently being negotiated by the Antarctic Treaty consultative parties. The point dealing with the prospective economic utility of Antarctic oil in the marketplace, to me, is currently most nebulous. As an oil person, I have often said that someone eventually may take some oil out of Antarctica, but I rather doubt that such petroleum operations ever will be cost effective.

ANTARCTIC OIL — TIMING AND ECONOMICS

Now, let us review the position of any oil potential from Antarctica in terms of timing — that is, when it will be needed. And economics — cost versus price and the resulting margin of profitability. To do this, we must understand existing and possible future petroleum relationships on a global scale.

Petroleum Supplies Today

As all of you here know, economic growth relies on energy. Prior to the OPEC-induced oil price increases of 1973/1974 and 1979/1980, when internationally traded crude oil sold in nominal dollars for less than one-tenth the current $30 barrel price, the reliance of the world's industrial economics on energy was such that each percentage increase in real economic activity required a corresponding increase in energy consumption. Since the two oil price shocks, the relationship has declined significantly owing to conservation and more efficient utilization of energy through capital investments in new equipment. Further, growth in the use of petroleum, the most expensive of the major energy sources, has declined in proportion to other fuels because of the additional component of fuels substitution.

I might add here that present forecasts of petroleum consumption are all significantly lower than were forecasts made in the days of "cheap Arab oil." For example, in early 1973, many of us in industry were saying that by 1985 the non-communist world would be consuming over 90 million barrels per day of petroleum — up from the 1973 demand level of 47 million barrels per day. Here we are at the middle of 1984 and the consumption, at 45 million barrels per day, is just half of that 1973 forecast — and slightly under actual 1973 consumption. Why? Many reasons — but the principal one is price. At a dollar a pound, we would eat a lot more chateaubriands then we do at ten dollars a pound. And, contrary to the prior expectations of many industry economists, the consumption of petroleum behaves in a similar manner — a reflection of a basic economic tenet — the elasticity of demand to price.

Future Consumption

Now look at some expectations of future petroleum consumption. Assuming — and this is a most hazardous assumption — that there is essential stability in the major petroleum supplying and in the major petroleum consuming political spheres, and given an economic growth outlook of about 2.5 percent to 3.0 percent per year for the industrialized Organization for Economic Cooperation and Development (OECD) group countries and a higher growth rate of 5.0 percent per year for the developing countries, the demand for petroleum by year 2000 may fall in the 55 to 60 million barrel per day range for the non-communist world. You must remember that since shortly after World War II, petroleum has been the single most important fuel in the world. Currently petroleum supplies over 50 percent of the non-communist world's energy; and petroleum and natural gas collectively supply over two-thirds of the energy. For lack of a readily available alternative, petroleum will remain the dominant fuel for many years to come.

As I have previously stated, prices are a significant determinant in how much petroleum is used. An outlook published recently by the Department of Energy's Energy Information Agency suggests that prices in constant dollars may increase from the current $30 per barrel level to about $50 toward the turn of the century. I believe that is as good a guess as any. However — should the present regime

in Saudi Arabia be replaced by a theological autocracy similar to that in Iran — or some similar political upheaval befall some of the other major oil producing regions of the world, I dare say that a price spiral similar to the two previous spirals of 1973/1974 and 1979/1980 will take place. Conversely, if some major new — and geologically unexpected — discoveries were to be made — and developed quickly — the price of crude oil in year 2000 might be the same — or even lower — than today's price. Of these two possibilities — that is, political shock or geological fortuity — I would gamble on the shock factor as being more likely. I am saying here that the potential for much higher petroleum prices by the end of the century is very real.

Global Sources

Why? Let us review the global sources of petroleum supply. Currently the organization of petroleum exporting countries — OPEC — produces just under 20 million barrels per day — or about 45 percent of the non-communist world's consumption of 45 million barrels per day. These countries, if the market were there, could produce well over 30 million barrels per day. The non-OPEC crude oil producing countries of the world, on the other hand, are producing at full capacity and, in the process, are depleting their reserves much faster than are the more important OPEC members. Now, let us review the global crude oil proved reserves situation.

Proved reserves are those quantities of naturally occurring hydrocarbons that geological and engineering studies demonstrate, with reasonable certainty, to be recoverable from known reservoirs under existing economic and operating conditions. Total proven reserves in the world, as of the beginning of 1984, amounted to 670 billion barrels of which about 450 billion — or two-thirds — are in OPEC countries. Considering this reserves position — and in view of a likely decline in crude oil productive capacity in countries such as the United States, the United Kingdom and other non-OPEC oil producers in not too many years, OPEC — should it maintain its cohesiveness — once again will not only be able to strongly influence the prices at which international petroleum is traded through the supply allocation mechanism, but OPEC also will be able to exert leverage in certain areas to attain political objectives.

We have considered a rather broad overview of the global petroleum outlook. Now let's briefly address when, and if, any Antarctic oil may fit into the scheme of things.

Antarctic Oil — Timing

The present overhang of surplus petroleum producing capacity in the world — between 12 and 15 million barrels per day of crude oil for which there is no market — is such that the potential Antarctic crude oil resources will not be needed for many years to come. Probably well after the turn of the century.

Admittedly, crude oil, because of the geological time required for genesis, migration and entrapment, is in finite supply. But how finite? The world's proved

reserves amount to nearly 700 billion barrels and mean value estimates of additional resources prepared under the energy information agency's "Foreign Energy Supply Assessment Project," suggest that an additional 450 billion barrels of recoverable oil will be found in the present major producing areas of the Middle East, north and west Africa, North America, the North Sea, and South Africa. Unquestionably, these resources can be found and developed at significantly lower costs than can Antarctica's potential resources. And in addition to these conventional proved and prospective crude oil resources, there are vast amounts of unconventional petroleum liquids that technically could be brought to stream. These include liquids from such sources as oil shale, the Athabasca Tar Sands of western Canada, the Orinoco heavy oil belt in Venezuela, coal synthesis and widespread application of enhanced oil recovery techniques. Some, if not all, of the unconventional petroleum sources may be cost competitive with Antarctic oil.

Physical Environment

Now, let us briefly review the physical environment in which we may be operating. Antarctica's oil potential, because of geological factors, lies offshore on the submerged continental margin. Target areas include the Ross, Amundsen, Bellingshausen and Weddell Seas of western Antarctica and the Amery Basin in eastern Antarctica. The Antarctic environment, is, physically, the most hazardous on earth for conducting petroleum exploratory and development activities.

Water depths of the continental shelf exceed 1500 feet — the deepest shelf of all the continents. Antarctic seas have open water for only several months each year. Permanent ice shelves average nearly 1000 feet in thickness and move outwards at rates up to nearly one mile per year. These shelves then break into tabular icebergs — over 10,000 annually. The sea around Antarctica freezes each year nearly doubling the size of the continent. When this pack ice breaks up, it can move at rates of up to 40 miles per day. And compounding all of this is that Antarctic seas are exceptionally stormy with almost non-stop westerly gales. Winds up to 200 miles per hour have been clocked.

What all this boils down to is that the installation of Antarctic oil production facilities will prove to be the costliest, most technically challenging project ever faced by the petroleum industry. However, given the experience that industry has gained in the North Sea and is now gaining in the Arctic waters of North America, I believe that an Antarctic oil discovery of economic dimensions technically can be developed and at tolerable environmental risk.

Economic Dimensions

I just alluded to "economic dimensions." What might these constitute for Antarctica? Certainly, an economic discovery would have to be of giant (i.e. 500 million barrels) to super giant (i.e. exceeding one billion barrels) proportions. In the case of Antarctica, this would mean reserves comparable to the Prudhoe Bay Field on the north slope of Alaska. And in addition to this critical reserves requirement, an Antarctic discovery must have reservoir characteristics capable of sustaining high producing rates — in the range of hundreds of thousands of barrels

of oil per day per facility. (By "facility" I refer to a group of 20 to 40 wells tied into a central production system, such as a platform — not a single well.)

Production Costs

I do not know what these Antarctic production facilities will cost. But I can provide you with cost figures in other parts of the world — we come now to the concept of "capital cost per daily barrel of production." To determine the "cost per daily barrel" one divides the total investment required for a producing facility by the initial daily producing rate. In its simplest form, assume an oil well costs one million dollars and yields 1000 barrels per day. The cost per daily barrel, accordingly amounts to $1000.

Costs per daily barrel range upwards from a few hundred dollars in the Middle East to 15 to 20 thousands dollars in the North Sea. And in Arctic waters, the National Petroleum Council, in 1981, estimated that Chukchi Sea oil would exceed $30,000 per daily barrel of production. If we guess that Antarctic oil might cost 50 percent more than Chukchi Sea oil (and I believe I am erring on the low side here), we are looking at $45,000 dollars per daily barrel of oil. But that is only part of the picture. Because climatic, ice, and other conditions might only allow for seasonal, i.e. austral summer, production from certain prospective areas of Antarctica, the production investments might only be working half time — or less. That, then would serve to raise the investment costs to nearly $100,000 per daily barrel. Here is where the competition from synthetics may come into play.

COMPARATIVE COSTS

The Congressional Office of Technology Assessment, in June 1980, estimated that the investment costs for oil shale (updated to 1983 dollars) would be in the range of $40,000 to $50,000 per daily barrel. To support these investments — i.e. yield a rate of return of 12 percent to 15 percent — oil prices would have to rise to the $60-$85 per barrel range in 1983 dollars. Prices eventually may go this high — but in the process of price escalation people will continue to move away from oil to cheaper alternatives and more efficient energy systems. We have vividly seen how high prices have negatively influenced petroleum consumption throughout this past decade. The process will continue — to the possible extent that international energy markets ultimately may be unwilling to pay the price that would be required to support Antarctic oil operations.

CONCLUSION

In closing, I would say that Antarctic oil potential, from a purely economic viewpoint, does not seem to have much going for it. Certainly, not in this century. And even its ultimate utility is to be questioned. Nonetheless, if the Antarctic Treaty consultative parties can successfully agree to a minerals regime wherein United States private industry can effectively compete with oil entities from other

countries of the world — particularly national oil companies — I am very certain that someday we will go down there and give it a go. Petroleum geologists have a proclivity towards optimism (they have to) — and just possibly — as remote as it may seem now — Antarctica may fool us all and yield some real whopper oil fields. You never know until you look.

CHAPTER 12

Developing Legal Regime

Are there Petroleum Resources in Antarctica?

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INTRODUCTION

There are no known petroleum resources in Antarctica. Nonetheless current concern relative to world supplies of oil and gas has turned the attention of geologists, geophysicists, economists, lawyers and statesmen from a number of countries to Antarctica. The Antarctic Treaty nations are presently wrestling with the problems of establishing a mineral resources regime, most recently at Tokyo in May, 1984. Exploitation of any metallic minerals that could be mined would be many years in the future even if deposits were to be found that might be economic in other parts of the world. The only mineral commodity with the possibility of exploitation within the next two or three decades is petroleum. Most of Antarctica is covered by a moving ice sheet about 3 km thick. The only areas accessible to presently available or soon to be developed technology are the continental margins possibly including the areas beneath ice shelves.

Nehring (1978) estimated that a total of 4 to 10 super giant oil fields containing 30-100 billion tons remain to be discovered in the world. Likely nothing smaller than giant and more probably super giant fields would be economic in the harsh Antarctic environment, particularly given the present world petroleum "glut." Considering that Prudhoe Bay is the only super giant oil field in the U.S. and that it is only about 12 km across, Antarctic petroleum exploration appears to be a difficult problem indeed.

Inferences from the known geology of Antarctica and sparse geophysical work suggest the presence of significant thicknesses of sedimentary rock in large areas throughout west Antarctica and several areas in east Antarctica (Fig. 1). The Amery Ice Shelf area of east Antarctica might be considered on the basis of the large indentation in the continent suggesting a possible failed rift analogous to the petroleum rich Benue Trough area of west Africa. In this paper I review the available geophysical data and discuss the results of drilling on the continental margin by the Deep Sea Drilling Program (DSDP).

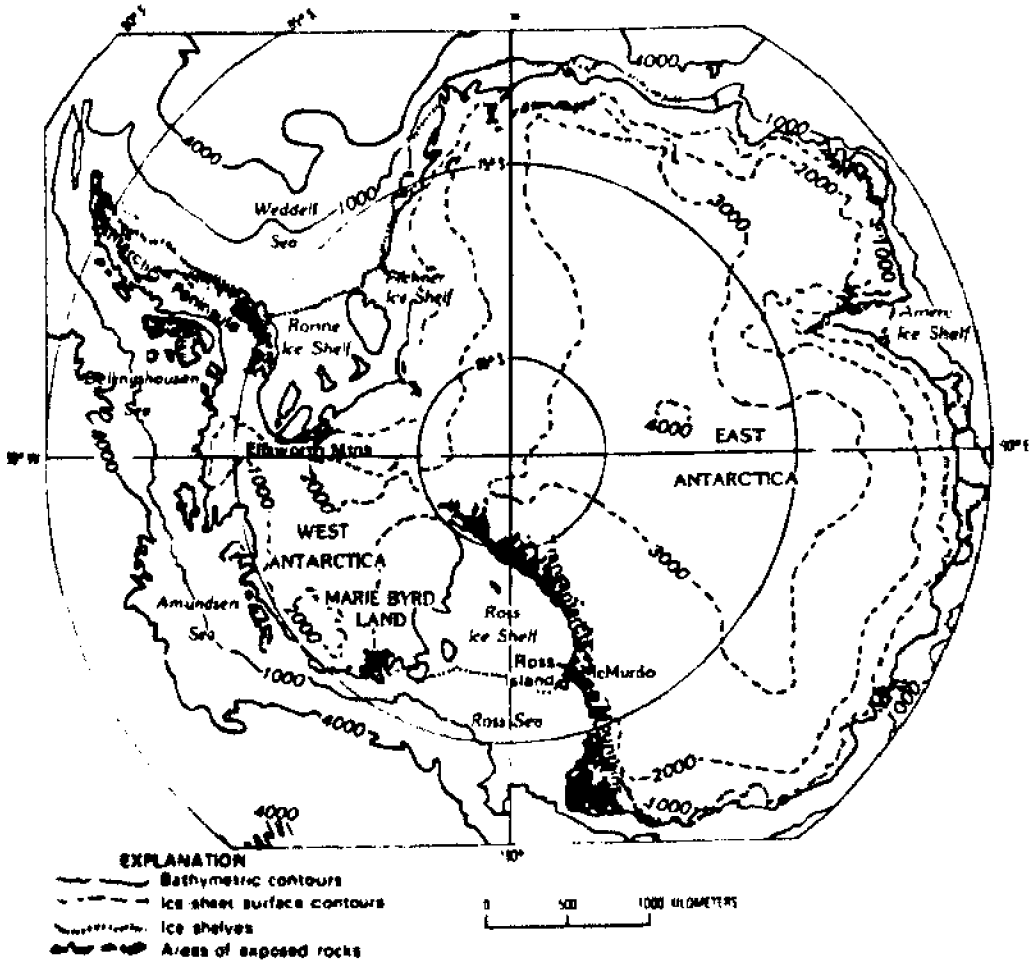

Figure 1. Index map of Antarctica showing major geographic features discussed in text, including the continental margin. Bathymetric contour interval 3000 meters; ice-sheet surface contour interval 1000 meters.

SUMMARY OF GEOLOGY

Antarctica (Fig. 1) is generally divided into two parts, geologically and topographically. That semi-circular area lying mainly in the eastern hemisphere is known as east Antarctica. There the ice sheet is mostly over 3 km high and bedrock is near sea level or below in places. Subglacial mountain ranges exist with as much as 4 km of local relief. The rocks of east Antarctica are rarely exposed except at the coast and along the Transantarctic Mountains marking the boundary with west Antarctica. East Antarctica, where outcrops exist, is mainly a craton consisting of Precambrian crystalline metamorphic complexes welded together in late Precambrian or early Paleozoic time. These older rocks, deformed and folded in early Paleozoic time, are overlain unconformably by the generally flat lying Beacon Supergroup sedimentary sequence ranging from Devonian and possibly Silurian to early Jurassic in age. The Beacon rocks are particularly well exposed in the Transantarctic Mountains (Fig. 1).

West Antarctica lying only in the western hemisphere, is much lower, and in many areas the bedrock is more than 1 km below sea level. West Antarctica is faulted and fragmented and may consist of several microplates, as discussed by Dalziel and Elliot (1982), including the 5 km high Ellsworth Mountains (Fig. 1) (mainly upper Precambrian and Paleozoic sedimentary rocks folded in Mesozoic time) and the Antarctic Peninsula (consisting largely of upper Mesozoic and Tertiary stocks and batholiths intruding Mesozoic sedimentary and volcanic sequences). Sedimentary rocks are locally abundant in Marie Byrd Land. Tertiary and Quaternary volcanic rocks crop out in Marine Byrd Land and in the McMurdo area.

All of the known geology on land is based on samples from highly competent outcrops projecting through the ice as mountain ranges and isolated nunataks. Therefore, sampling is biased and the Cretaceous and Cenozoic basins containing unmetamorphosed sedimentary rocks likely to contain petroleum, that would be expected from analogy to other continents, are not exposed but probably are present beneath the ice sheet and continental margin.

GEOPHYSICAL STUDIES

Some geophysical work was carried out in Antarctica during the 1930s and 1940s, but the 1950s saw the beginning of systematic reconnaissance seismic reflection, refraction, gravity, land magnetic and aeromagnetic studies. The early seismic reflection work on the oversnow traverses was primarily directed at measuring ice thickness, with few sub ice reflection results reported. No modern multichannel seismic reflection data have been collected on the grounded ice sheet or floating ice shelves of Antarctica. The seismic refraction results from the oversnow traverses were biased towards the higher velocities because the seismic velocity of ice is about 3.9 km/s, precluding direct observation of lower velocity sedimentary rocks in basins beneath the ice.

Radio echo ice-sounding from the air has allowed continuous measurements of bedrock topography over large areas of Antarctica, but only recently have simultaneous aeromagnetic measurements been made, allowing subglacial geologic interpretations. Aeromagnetic data without radio ice thickness measurements have been obtained on a reconnaissance basis mostly on widely spaced profiles throughout large areas of Antarctica. In west Antarctica, my colleagues and I have reported substantial (> 5 km) thickness of non-magnetic presumably sedimentary rocks west of the Ellsworth Mountains including the areas beneath the Ross Ice Shelf and continental shelf, and thick but undetermined amounts of sedimentary rock between the Pensacola and Ellsworth Mountains.

In recent years, geophysicists from the USSR have collected substantial amounts of closely spaced aeromagnetic data in the Filchner and Ronne Ice shelf area south of the Weddell Sea. Their data suggest a 12-15 km thickness of sedimentary rock beneath the continental shelf in that area (Masolov, 1980).

The results from magnetic surveys in west Antarctic (Fig. 1) discussed above suggest that there are several kilometers of sedimentary rock beneath the ice sheet and continental shelves. By analogy of sedimentary basins in other continents and the known geology of west Antarctic, we might expect Cretaceous and Tertiary

age rocks to comprise a substantial part of the unexposed sedimentary section. Because a thick section of Paleozoic and older sedimentary rock is exposed in the Ellsworth Mountains, sedimentary rocks of this age may also underlie the Ronne Ice Shelf (Fig. 1). Bibby (1966) reported that a thick succession of Cretaceous sandstone crops out at the north end of the Antarctic Peninsula and that a few outcrops of sedimentary rocks of Tertiary age are also found there. Truswell (1982) reported early Cretaceous to early Tertiary rocks beneath the narrow continental shelf of east Antarctica at several places.

In recent years ships from Norway, the Federal Republic of Germany, the USSR, and Japan have collected multichannel seismic reflection profiles over the continental margin in the Weddell Sea area (Fig. 2). The USSR collected 12 channel seismic reflection data over this area along the tracks shown between longitude 15°W and longitude 60°W from 1980-1982, (Ivanov, 1983) which indicated about 10-12 km thickness of sedimentary rock beneath the Ronne-Filchner Ice Shelf area.

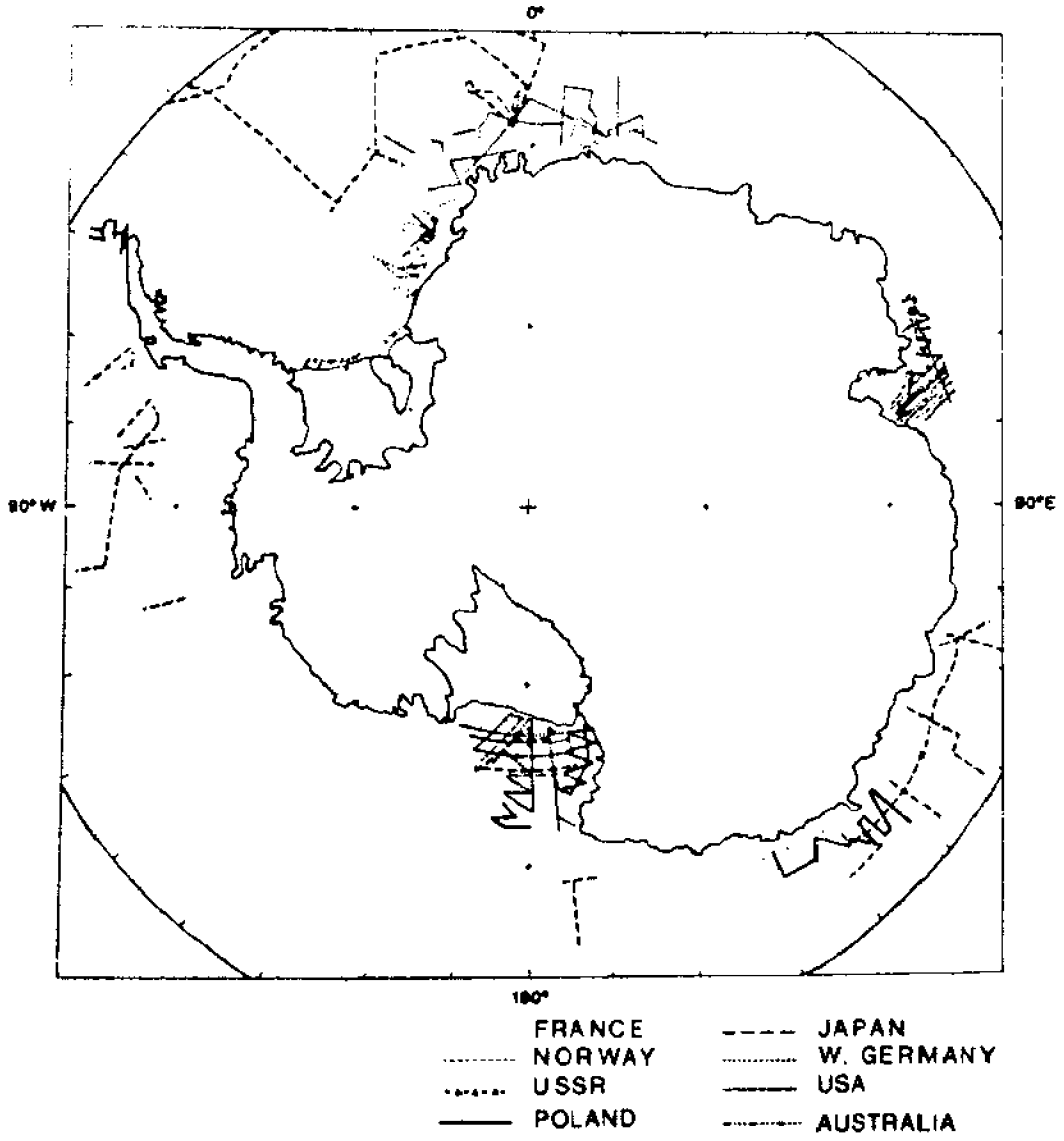

Figure 2. Marine multichannel seismic profiles in Antarctica collected through 1984 with country of origin shown. Compare Fig. 1 for geographic locations referred to in text.

In 1982-1983 the R/V *Hakurei-Maru* from the Japan National Oil Corporation (JNOC) collected 24 channel reflection profiles in the southern Weddell Sea along the track lines shown in green from Okuda and others (1983). Their preliminary interpretation indicates about 1.5 km of sedimentary rock on the continental slope near longitude 5°W. In 1976-1977 the Norwegian Antarctic Research Expeditions (NARE) acquired 16 channel data along lines shown (Fig. 2). The profile across the Crary Trough (southernmost profile in Fig. 2) which extends across the front of the Filchner Ice Shelf, is shown in Fig. 3 (from Haugland and others, 1983).

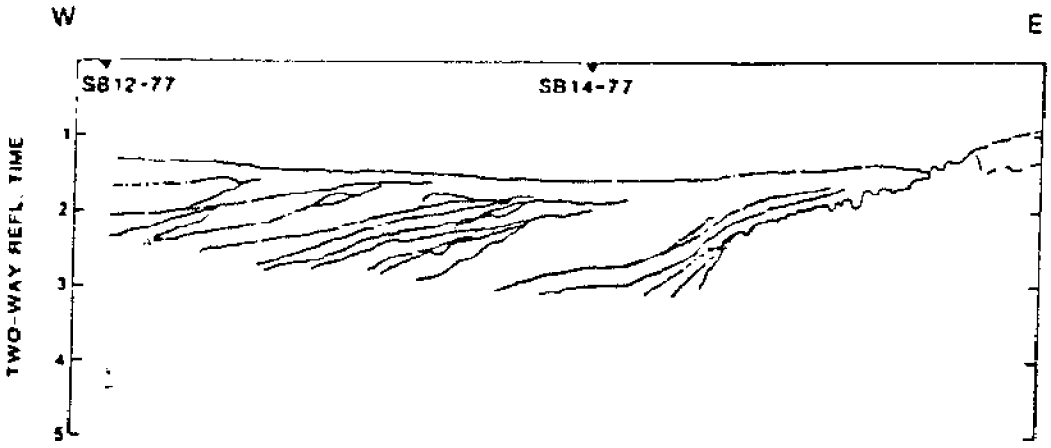

Figure 3. Seismic-record section across the Crary Trough. From Haugland and others (1983). Kindly furnished by Yngve Kristoffersen. SB, sonobuoy location. Length of profile, 150 km. Reflection time in seconds.

The westward dipping reflections are consistent with the thick section of sedimentary rock in the western Weddell Sea continental shelf and Ronne Ice Shelf area inferred from the Russian aeromagnetic data mentioned previously.

In 1978 the German Federal Institute for Geosciences and Natural Resources (BGR) collected 6000 km of 48-channel data over the continental shelf between longitude 25°W and longitude 20°E as shown in Fig. 4 from Hinz (1982) and Fig. 5 which shows examples of profiles from Hinz's (1982) report. He reported the "Explora Wedge" of seaward dipping reflectors having seismic velocities of >4.5 km/s overlain by sediments up to from 3-5.2 km thick having velocities of 1.6-3.6 km/s. These lower velocities seem reasonable for Tertiary or possibly Late Cretaceous age rocks. Hinz (1982) interpreted the >4.5 km/s velocity, seaward dipping reflectors as evidence of volcanic layers rather than sedimentary rock and therefore infers a low petroleum prospectivity for the margin in this area.

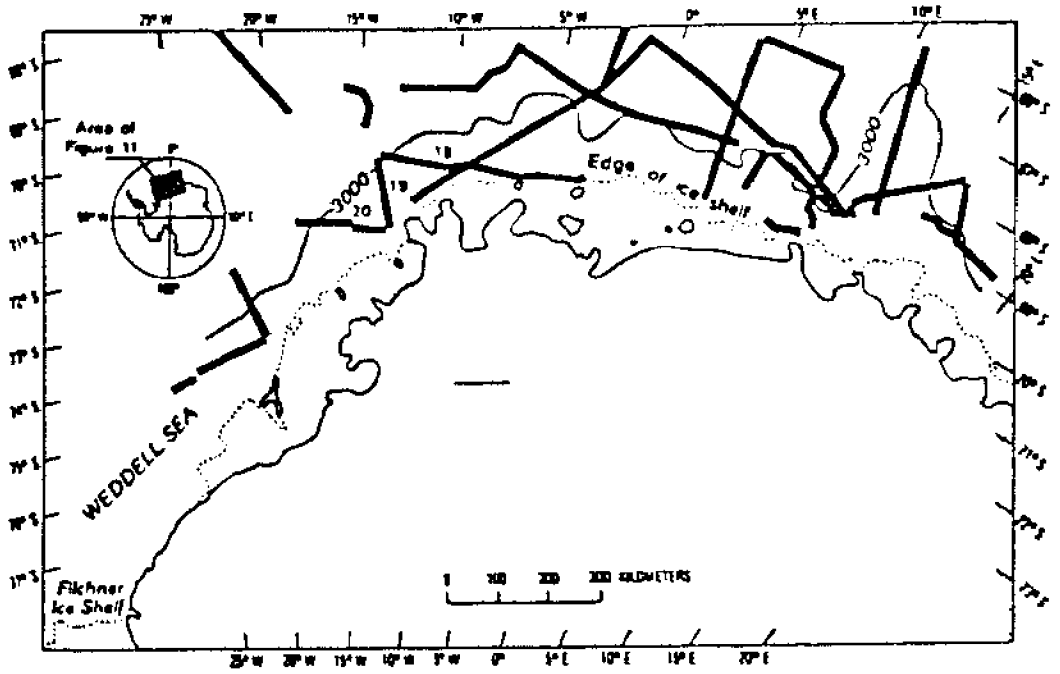

Figure 4. Ship *(Explora)* tracks (heavy line) over the Weddell Sea continental margin along which multichannel seismic and other geophysical data were collected by BGR in 1978. Bathymetric contour in meters. (Modified from Hinz, 1982.)

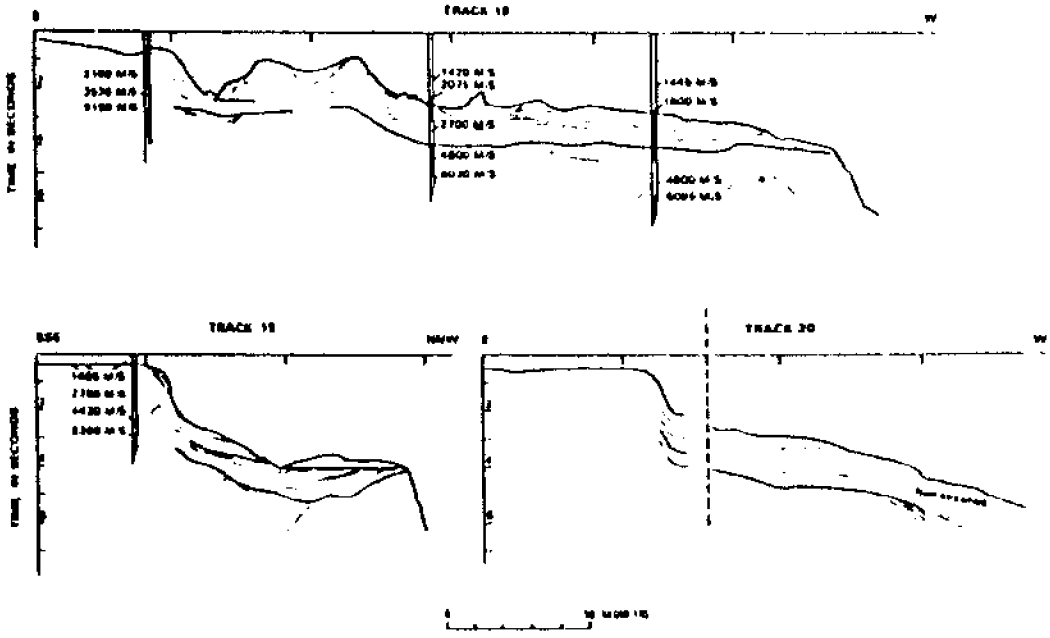

Figure 5. Three examples of interpreted profiles from seismic reflection data along tracks of Figure 4. Vertical lines are locations where velocities were determined by sonobuoys. Vertical dashed line indicates jog in track. (Modified from Hinz, 1982.)

I will turn now to the Ross Sea, where sea ice conditions are much more favorable.

The *Glomar Challenger* on Leg 28 of the Deep Sea Drilling Program (DSDP) drilled a series of holes in the Ross Sea continental shelf (Fig. 6). Results from

these four holes showed a Paleozoic continental basement overlain by a section of early Oligocene to late Miocene, Pliocene, and Pleistocene rocks.

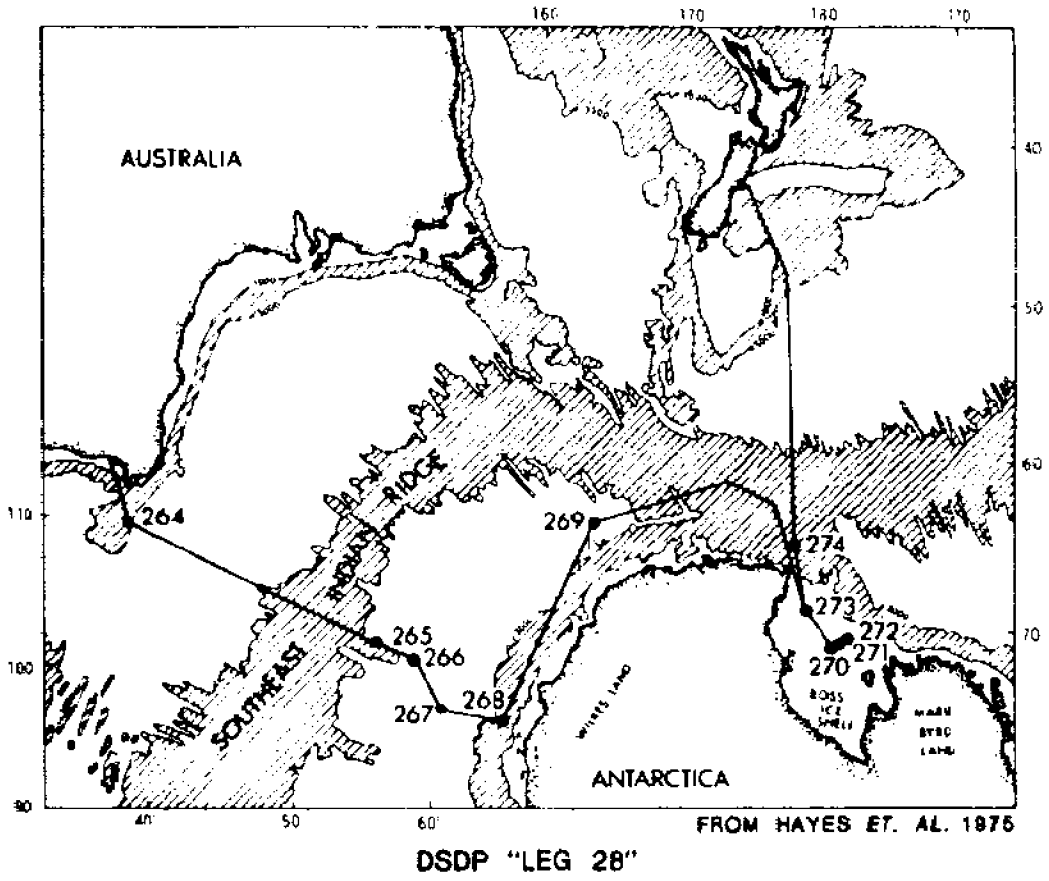

Figure 6. Cruise track (heavy line) of *Glomar Challenger* DSDP leg 28, and locations of core holes in the Ross Sea. (From Hayes and Frakes, 1975.)

Although small amounts of methane and ethane were reported in parts of the dominantly nonmarine Miocene sedimentary rock, "Shipboard Scientific Party" (1975) considered it premature to attach any economic significance to the hydrocarbons. McIver (1975) also analyzed samples from these cores, and reported significantly higher amounts of ethane and heavier homologs in these samples than from others collected by DSDP. He suggested this as evidence of local organic diagenesis. Claypool (1984) considers these results, however, as "essentially the same as DSDP coring worldwide," and therefore not necessarily of any significance to petroleum resources questions.

In 1980 the German Federal Republic acquired 7000 km of 48-channel data over the Ross Sea continental shelf shown in Fig. 7. In 1981-1982 the French Petroleum Institute (IFP), also using the same ship *Explora*, collected about 1500 km of 48-channel data in the Ross Sea area as shown. No results from the French work are available. Davey and others (1982) reported on sedimentary basins in the Ross Sea, based on data from seismic refraction and variable angle reflection measurements using sonobuoys. These results indicate three major basins with sedimentary rock thickness exceeding 4 km in a central trough basin along about

the 175°E meridian. In 1983 the JNOC ship *Hakurei-Maru* also collected multi-channel reflection profiles in the Ross Sea area but no results are known. In February 1984 the USGS ship *S.P. Lee* collected 2000 km of 24-channel data. I will refer briefly to these results later.

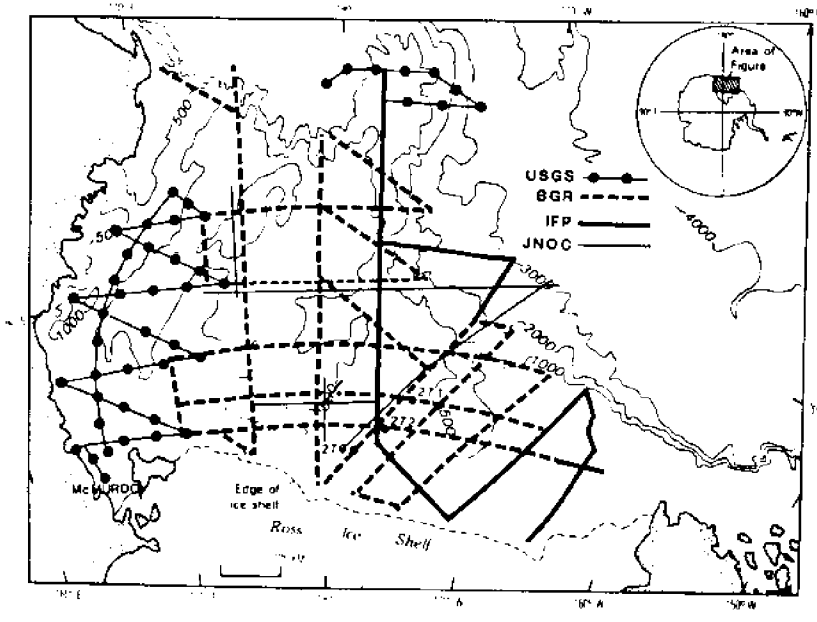

Figure 7. 1980 Ross Sea continental shelf data as collected by the German Federal Republic.

Hinz (1982) interpreted the German data shown in Fig. 8. This profile over the eastern part of the Ross Sea shelf was tied to the DSDP holes. This enabled Hinz to interpret the approximately 6 km of section (above RS6) as post Oligocene in age and therefore probably all glacio-marine sediments. Thus, this part of the section would not seem likely to contain significant amounts of hydrocarbon deposits.

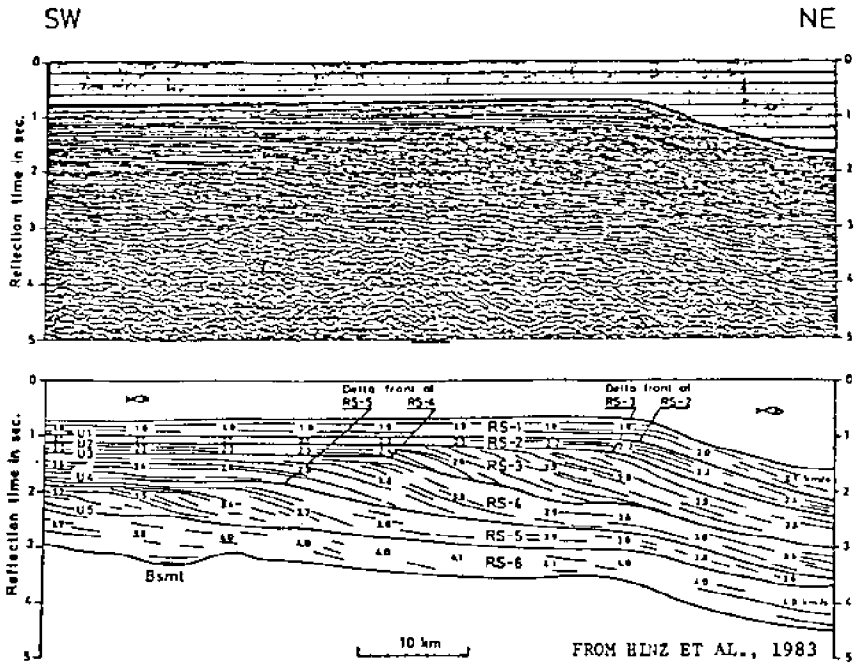

Figure 8. Reflection seismic record from the outer part of the eastern Ross Sea shelf with a diagram of the interpreted seismic sequences and interval velocities in km/s. RS-1 to RS-6 refer to the interpreted seismostratigraphic sequences, and U1 and U5 refer to unconformities. For location see Fig. 1. From Hinz et al., 1983.

Figure 9 is a profile from a 24-fold record section collected by the *S.P. Lee* in 1984 over the Victoria Land Basin at the west side of the Ross Sea continental shelf. Processing is not completed but a substantial thickness of sedimentary rock is apparent, as reported by Eittreim and others (1984).

In the 1981-1982 season *Explora* collected 48-channel reflection data for the IFP along the 3000 km of lines shown (Fig. 2) over the east Antarctica continental margin near Wilkes Land and Terre Adelie. The *S.P. Lee* also collected 2000 km of 24-fold data in this area as shown, in January 1984. In December 1983-January 1984 the *Hakurei-Maru* measured the lines indicated.

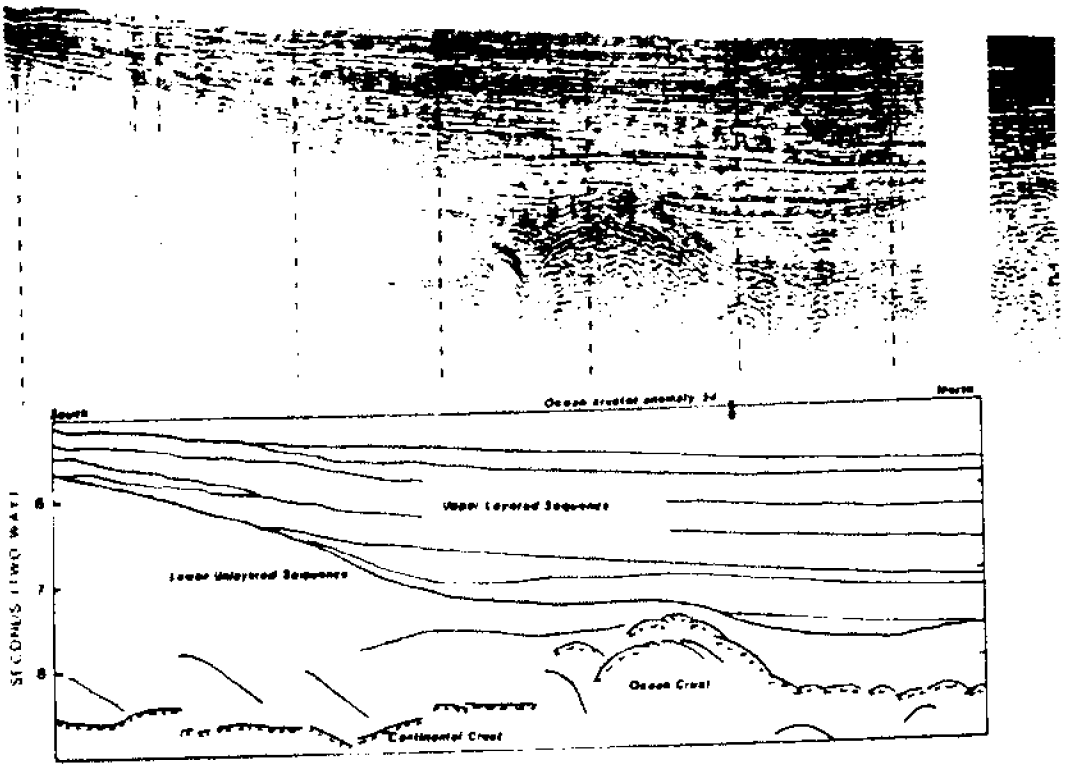

Figure 9. Unprocessed single-channel seismic record made from one channel of the MCS system across the presumed continent-ocean boundary. One second of reflection time equals approximately 1 km; less for the shallower sediment and more for the deeper strata. From Eittreim and others, 1984.

Figure 10 shows an example of part of a record section crossing the Wilkes land continental margin from the USGS data. Eittreim and others (1984) inferred the ridge as the transition from oceanic to continental crust.

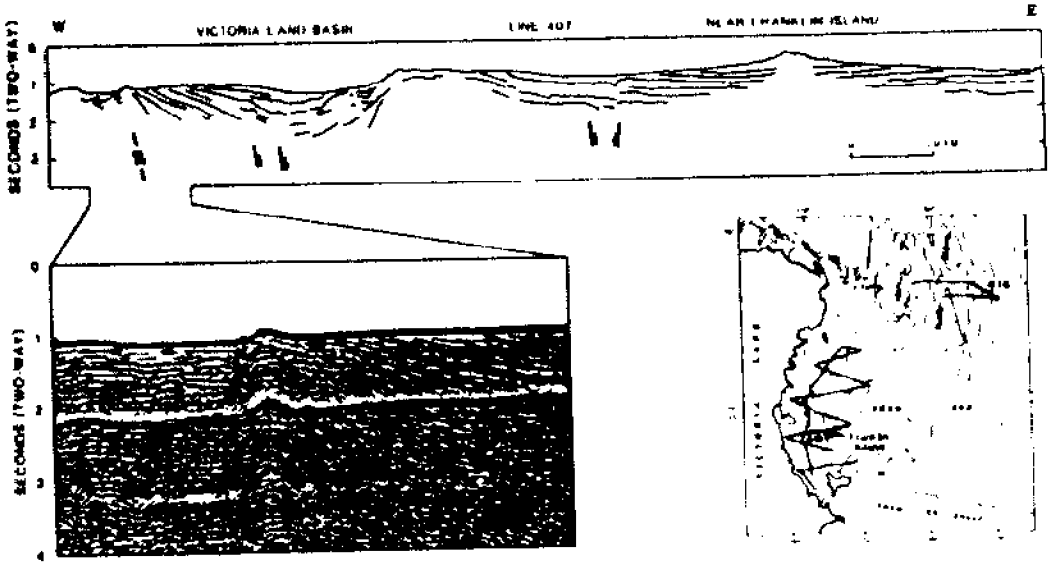

Figure 10. Line drawing and multichannel seismic-reflection data from line 407 across the Victoria Land basin in the western Ross Sea. Faults and uncomformities are found in the sedimentary section and reflect relative vertical displacement in the western Ross Sea region. Bathymetry in meters. From Eittrem and others, 1984.

The *Hakurei-Maru* collected more than 3000 km of 12-channel (3-fold) reflection data in the Bellingshausen Sea area in 1981 along the lines shown in Fig. 12. Kimura (1982) reported that maximum sedimentary rock thickness of about 3-3.5 km.

The Australian Bureau of Mineral Resources (BMR) collected about 5000 km of 6-channel reflection data on closely spaced lines over the continental margin in the area offshore of the Amery Ice Shelf (Fig. 1) during 1981-1982 as reported by Stagg (1983). This survey when published should provide very interesting information on this most likely area in east Antarctica for petroleum resources.

The tectonic relationships of west Antarctica are complex subsequent to rifting which was probably initiated in Jurassic time, as suggested by the ages from 163-179 m.y. of the Ferrar Dolerite and correlative intrusions found along the Transantarctic Mountains. The limited geophysical data discussed in this report and general geologic considerations suggest that the continental shelves of the Ross, Bellingshausen, Amundsen and Weddell Seas including areas covered by ice shelves and large areas of the Byrd subglacial basin contain sections of Cretaceous and Tertiary sedimentary rock several kilometers thick. Probably large areas beneath the ice sheet in east Antarctica such as the Wilkes subglacial basin are also underlain by several kilometers of sedimentary rocks of similar ages as suggested by the magnetic depth estimates.

Data are insufficient to predict which of the areas along the west Antarctic continental margin might be the most prospective for petroleum resources. The Ross Sea has generally favorable sea ice conditions in summer, but the recent work of Hinz discussed earlier suggest that the eastern Ross Sea would not be a very likely area for petroleum, unless post Oligocene glaciomarine sediments could generate significant hydrocarbons.

On the other hand, the likely greater thickness of sedimentary rock beneath the Weddell Sea shelf might make that area the most promising location for petroleum deposits in Antarctica, however, sea ice conditions are much more severe in the Weddell Sea than the Ross Sea. There is little or no information on the Bellingshausen and Amundsen Sea shelves to allow speculation as to their petroleum resources potential relative to the Ross and Weddell Sea shelves.

ENVIRONMENTAL HAZARDS

Antarctica has the most severe environment on Earth in which to carry out petroleum exploration or exploitation. Were these activities to occur, much research would be required into the types of hazards that might be encountered and the types of ecosystems that might be disturbed. Generally, groups dealing with potential environmental problems have concentrated on climatological, oceanographic, and glaciologic hazards and the vulnerable Antarctic ecosystems while largely ignoring the geologic hazards that could actually lead to blowouts and oil spills.

Considering the expense incurred in Antarctic research, ships conducting the marine geophysical surveys for geologic framework studies should also collect as much data relative to environmental hazards as possible as was done by the

S.P. Lee. For example, one of the high resolution profiles suggests a fault scarp cutting the sea bottom over the Victoria Land Basin associated with recent uplift of the Transantarctic Mountains implying caution is necessary in the area.

The Antarctic continental shelf is about 500 m deep, or deeper than that of the other continents, and this would have a strong bearing on the difficulty of exploratory or production drilling, subsea completion of oil wells or risk from icebergs to subsea installations.

A Minerals Regime for Antarctica: The Minerals Management Service Perspective

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The discussions held between the members of the Antarctic Treaty group toward developing a minerals management regime can be described by three major categories: 1) the management organization; 2) the selection of potential developers; and, 3) supervision required for those development operations. The Department of Interior (DOI), through the Minerals Management Service (MMS), is responsible for the administration of mineral development on the U.S. Outer Continental Shelf and in the exclusive economic zone. With nearly 30 years of experience, they provide advice to the Department of State on some of the problems, both legally and operationally, that can occur in Arctic-type environments.

BASIC SCIENCE SHOULD CONTINUE

The basic concept of permitting research and acquisition of raw resource data to support regional mineral evaluation by members of the treaty organization should be continued unhampered regardless of the implementation of any management concept that might be developed for the Antarctic. Previous discussions at this meeting have described the risks created by unqualified estimates that are developed without good basic resource data. Only the acquisition of dependable data will permit proper mineral resource planning for the future.

THE MANAGEMENT REGIME

The DOI has supported the establishment of a regional or geographically limited management regime composed of appropriate members of the treaty organization. The major requirements that we support for inclusion in any management regime are: a single member should not be permitted veto power; the decisions of the management group should be implemented through a majority vote; and, the country representing the operation should be a member of the management regime. The establishment of a program to permit evaluation of the mineral resources needs to recognize the stages involved in that process — prospecting, exploration, and development.

We have recommended the free exchange of research data by all participants in the treaty organization during the prospecting stage to be continued as presently defined and implemented. We feel that the entities that develop exploration data for specific resource evaluation should be permitted to retain that information on a proprietary basis, however, that data should be shared with the management regime on a confidential basis. Also, it should be available for release and publication when it is no longer needed for its commercial value to the explorer. Regulations and supervision of activities conducted under such a management regime could be the responsibility of the sponsoring nation with clear provisions for open inspection of the operation, in a manner similar to that presently being practiced in the Antarctic.

THE DEVELOPMENT RIGHTS

These comments have not addressed the means to award the rights to prospect, explore or develop the mineral resources. Those rights should be flexible and recognize the different resources and their locations whether offshore or onshore as well as the different entities that are interested in exploring for those resources. The potential exploitation of mineral resources of the Antarctic requires a well-planned and well-managed program to permit a proper evaluation. Now is the time to plan that program in order to permit a full evaluation of the management concept. Let us not delay and therefore be forced to develop a program in haste without a full consideration of the environmental and economic balance that is needed for wise decision-making.

Environmental Issues in the Antarctic Minerals Negotiations

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I have been asked to do two things today: to cover the environmental issues and concerns that arise in the developing legal regime for Antarctic minerals, and to ensure that in doing so I represent the views of the whole spectrum of environmental "constituents" interested in these negotiations.

I think it will be easier to deal with the last question first, in a few introductory remarks, leaving the rest of my presentation open to comment from others who might wish to add to or correct my characterization of environmental issues in these negotiations.

CONSTITUENTS

There is no doubt that all of the environmental constituents of Antarctica are worried about the prospect of minerals development there. We would all prefer that the area be left in its pristine state, valued for the advances this permits in scientific knowledge and our understanding of the Earth and its processes, for the protection afforded living species in the area, and for its aesthetic qualities or what has been termed "wilderness value."

A number of environmental groups worldwide have endorsed the idea of keeping Antarctica as a world park fully protected from any minerals development, at least for the foreseeable future and have urged suspension of the minerals regime negotiations. Some of these groups, however, as well as others like my own organization, recognize that the minerals negotiations will continue and believe that the next best option to prohibiting minerals development is to ensure that if such development does one day take place, it is conducted in accordance with a legal regime that provides very stringent safeguards against potential damages to Antarctic freshwater and terrestrial environments, the surrounding atmospheric and marine environments, and living species in the area. We have been working with U.S. and foreign government representatives to try to achieve these goals within the minerals regime negotiations.

In addition to environmental organizations worldwide, the following groups have also expressed concern for the protection of the Antarctic environment and its living species, particularly with the advent of the minerals negotiations:

- The Antarctic Treaty Consultative Parties (ATCPs), who in Recommendation XI-1 containing the terms of reference for the minerals negotiations, agreed that one of the five basic principles of the regime should be protection of the unique Antarctic environment and of its dependent ecosystems. Among them, countries most nearly adjacent to the Antarctic continent generally recognize the possibility of more direct impacts on living species off their shores and climate conditions;
- The Antarctic scientific community, whose members value their pristine laboratory;
- International organizations with responsibility for the world environment like UNEP; and, most recently
- A number of countries currently not party to the 1959 Antarctic Treaty whose representatives spoke during United Nations debates last fall.

POTENTIAL DAMAGES

I do not plan to go into detail about the potential for environmental damage posed by minerals development activities in Antarctica. The subject has been well covered in numerous publications that stress the harshness of Antarctic weather, currents, and ice conditions and the vulnerability of polar areas and Antarctic ecosystems. These conditions will affect not only exploration and development activities but also the transport of materials associated with such activities to and from Antarctica. The area may be damaged not only by exploration and development vehicles and equipment or accidents resulting in spills, it may be affected by logistics and support activities as well, both on land and at sea.

ENVIRONMENTAL ISSUES

I would like now to address several environmental issues raised by the elaboration of a legal regime for Antarctic minerals development. I have divided these into seven topics for ease of discussion, but they are obviously interrelated in numerous ways.

In reviewing these issues, one should bear in mind that the regime for Antarctic minerals development being considered will not set forth in detail a complete mining code; it will provide a framework for the dynamic growth of institutions and regulations if and as minerals activities become feasible. From an environmental point of view, it is therefore critical, *first*, that this dynamic growth be channeled by strict *standards* or *principles* that are clearly and directly applied to all decisions taken under the regime; and *second*, that the procedures for taking these decisions provide adequate safeguards to protect the Antarctic environment.

Principles/Standards

Into this category fall requirements for environmental impact assessments prior to the conduct of any Antarctic mineral resources activity and environmental and safety standards against which all minerals activities must be judged. This spring 11 major U.S. environmental organizations prepared a set of recommendations for the U.S. government from which I quote some examples of these types of standards:

> No Antarctic mineral resource activity shall be conducted until the appropriate institutions of the regime have determined that the activity in question, by itself or in combination with all other activities (including but not limited to the introduction of alien species, all Antarctic mineral resources activities, scientific and logistical support activities, harvesting of Antarctic marine living resources, and associated activities) will not directly or indirectly:
>
> 1. Cause or contribute to any but localized changes of the Antarctic atmospheric, terrestrial, freshwater, and marine environments and associated ecosystems that are not reversible within two to three decades after the cause of the change has been removed;
> 2. Result in the decrease in size of any harvested population in Antarctic marine living resources to levels below those which ensure its stable recruitment. For this purpose its size should not be allowed to fall below a level close to that which ensures the greatest net annual increment;
> 3. Affect the maintenance of the ecological relationship between and among harvested, dependent and related populations of Antarctic marine living resources and the restoration of depleted populations to the levels defined in [2] above;
> 4. Adversely affect unique biological communities or areas of special biological, scientific, historic or aesthetic importance; ...and
> 5. Adversely affect the value of Antarctic atmospheric, terrestrial, freshwater, and marine environments as pristine environments relatively undisturbed by human activities, for scientific research and for the detection and monitoring of global and regional environmental parameters.

In an effort to promote the integration of the various legal instruments of the Antarctic Treaty System, a subject to which I will return, the chapeau and paragraphs 4 and 5 reference other activities and uses in Antarctica. Paragraphs 2 and 3 above attempt to apply consistent standards among these instruments by paralleling the conservation standards set forth in the Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR).

The operational and safety standards recommended were:

No Antarctic mineral resource activity shall be conducted until it is determined that:

1. Technology and procedures are the best available to provide for safe operations and ensure con formity with the principles set forth in [previous paragraphs] of this article;
2. There exists the capability to monitor adequately key system components and/or environmental parameters and report thereon;
3. There exist adequate contingency plans and equipment to minimize the environmental risks from accidents such as oil spills and to contain and remove pollutants; and
4. There exist adequate plans to ensure restoration of the environment during the conduct of the activity and once the activity ceases.

The most critical principle of the entire regime, however, may well be what is referred to as the information standard: that no mineral resource activity may be conducted until available information is sufficient to conclude that the other principles and standards of the regime will not be violated. The environmental groups have stressed this principle because they fear that, if there is pressure to proceed with minerals activities in the future, decisions to allow minerals activities may be taken before there is adequate data on the Antarctic environment and its associated ecosystems, on potential impacts of activities and environmental hazards like ice and weather conditions, and on the nature and effectiveness of equipment and operational procedures to guarantee that the other standards will be met.

The recommendations of the 11 U.S. environmental organizations go on to specify what the information requirements for the regime should be. Various environmental groups have also encouraged the development of national and international research programs that would help fill data requirements, noting the Recommendation XI-1 stipulation that the regime should "promote the conduct of research necessary to make environmental and resource management decisions which would be required." But national budgetary constraints make it unlikely that significant results will emerge in the foreseeable future.

A second concern voiced by environmental groups with respect to adequacy of information is that once minerals activities commence, much of the data will be deemed proprietary by the operators and thus will not be made available to decision-makers under the regime. The 1982 Law of the Sea (LOS) Convention texts addressed this problem in Annex III, Article 14 as follows:

1. The operator shall transfer to the Authority, in accordance with its rules, regulations and procedures and the terms and conditions of the plan of work, at time intervals determined by the Authority all data which are both necessary for and relevant to the effective exercise of the powers and functions of the principal organs of the Authority in respect of the area covered by the plan of work.
2. Transferred data in respect of the area covered by the plan of work, deemed proprietary, may only be used for the purposes set forth

> in this article. Data necessary for the formulation by the Author ity of rules, regulations, and procedures con cerning protection of the marine environment and safety, other than equipment design data, shall not be deemed proprietary...

The CCAMLR contains a related provision in Article XX stating:

> 1. The Members of the Commission shall, to the greatest extent possible, provide annually to the Commission and to the Scientific Committee such statistical, biological, and other data and information as the Commission and Scientific Committee may require in the exercise of their functions...
> 2. The Members of the Commission agree that in any of their harvesting activities, advantage shall be taken of opportunities to collect data needed to assess the impact of harvesting.

If the information standard in the minerals regime is effectively worded and implemented, it will provide an incentive for operators to make required information available, because until a positive decision is taken under the regime, based on adequate data, no minerals activities may proceed. The minerals regime could incorporate additional incentives for operators and states to provide information to the institutions of the regime. As for the other principles of the regime, while general agreement exists in the negotiations with respect to their content and scope, careful attention must be devoted to the clarity and precision of their formulation.

Decision-Making

Recommendation XI-1 specifies that the regime should include, in addition to means for "assessing the possible impact of mineral resource activities on the Antarctic environment in order to provide for informed decision-making," means for "determining whether mineral resource activities will be acceptable." The establishment of a minerals regime will not automatically give the go-ahead to minerals activities but will require a positive threshold determination that they may proceed. The points at which this and other determinations are made and the decision-making procedures applied will be critical to effective implementation of the principles noted above.

— *Procedures*

Environmental groups have emphasized that decisions to proceed with minerals activities should be approved by a significant majority of the countries involved in the minerals regime, including the more "conservation-minded" among them. They believe that if some decisions are to be taken by groups of states that do not involve all states parties to the regime, the majority required should be higher and/or the decision should be reviewed by a plenary organ of the regime.

Their rationale is not only that a larger number of approvals, that is, a collective judgment, will promote the sound application of environmental and other principles, but also that this will help balance the pressure to go ahead from those proposing development activities and those who would benefit from them and will help guarantee consistent application of the regime's principles throughout the geographic area to which the regime applies.

In addition to decisions to approve activities, the institutions of the regime will be called upon to draft general guidelines and specific regulations governing different categories of mineral resources, in particular geographic areas of Antarctica. These must explicitly give effect to the principles of the regime if they are to implement it effectively.

Environmental groups support a strong and independent role for the scientific, technical, and environmental advisory committee in reviewing all pending decisions and measures to ensure consistency with the principles of the regime and consistent application within the area of the regime. They believe that the technical expertise of advisory committee members will help balance national, political, and economic considerations that might prevail in the decision-making process, although some groups have expressed doubts on this point that I will address later.

The environmental groups are also concerned that the regime provide adequate scope for review and modification of measures adopted under the regime to take account of newly-acquired data on environmental considerations in Antarctica, the resources themselves, cumulative effects of all activities in the area and improvements in applicable technology and operational procedures. If and as minerals activities commence, the information base cannot but increase substantially. Finally, they firmly support a review process at the stage when an operator seeks to proceed from exploration to development activities. Not only is it likely that more information of the types noted above will exist, it is also probable that the operator will have acquired more information on the nature and impacts of the activities than was available when exploration activities were described and approved.

— *Decision-Making Points*

The four stages in the draft minerals regime have been identified as prospecting, the threshold decision as to whether mineral resource activities could be acceptable in a particular region of Antarctica, and approval of exploration, and approval of development.

Several environmental groups have expressed concern over the possibility that prospecting activities may be allowed to proceed without a requirement for approval or the adoption by the institutions of the regime of regulations covering this activity. They have also raised the question of the availability of procedures to suspend or terminate prospecting activities deemed damaging to the Antarctic environment. While this issue gets tied up with claimant states' assertion of rights and the need for economy and a gradual call-up of the institutions under the regime, the solution may lie in defining prospecting to exclude any but fairly harmless

activities like remote sensing and providing for the possibility of review, regulation, suspension, or termination. This would avoid a prior requirement to approve prospecting activities. Recommendations to this effect were included in the paper presented by the U.S. environmental groups this spring.

Threshold decisions on the acceptability of mineral resource activities in Antarctica then became the first key decision required under a minerals regime. Environmental groups favor a consensus decision on this point and, as I noted earlier, wish to ensure that these decisions are based on sufficient information. I have already mentioned the environmental groups' concerns with respect to decision-making procedures generally. These all apply to the decisions to approve exploration and later development activities.

Monitoring, Inspection, and Enforcement

Dividing responsibilities for these activities under the minerals regime between the relevant claimant State(s), the State(s) sponsoring mineral resource activities and the institutions created by the regime is another question complicated by the need to avoid prejudicing either the claimant or the non-claimant position. Barbara Mitchell in her presentation mentioned the difficulties of agreeing on enforcement and responsibility in the situation of jurisdictional ambiguity that exists in Antarctica. Aside from seeking effective provisions in the regime, the environmental groups have not addressed these issues in detail. They have recommended that in addition to stipulating that Antarctic mineral resource activities shall be open to inspection in accordance with Article VII of the Antarctic Treaty, the commission of the minerals regime should be empowered to appoint independent inspector(s) to monitor compliance with the regime and measures adopted pursuant to it. They have also recommended that reporting requirements for sponsoring States and the institutions of the regime include reports on compliance with the regime and be maintained as part of the public record of the regime. I will refer to this again in my presentation when I deal with the issue of accountability.

Two other important issues in this area will be devising procedures that allow for: 1) the expeditious suspension of a potentially damaging activity; and 2) challenges to monitoring and enforcement practices on the grounds of non-compliance with the regime and measures adopted pursuant to it.

I would like to come back to this question of jurisdictional ambiguity that has arisen several times during our meeting. I would like to bring up again what Tucker Scully commented on yesterday, when he was responding to Barbara Mitchell's points in this area. He mentioned that jursidictional ambiguity with respect to the position of claimant and non-claimant states is an accepted part of a treaty system. In his view, that does not necessarily mean that there would be jurisdictional ambiguity with respect to applying jurisdictions under Antarctic regimes — that with respect to actually enforcing or, say, monitoring an operation covered by an international agreement, the agreement itself would provide for that jurisdiction. He also said that in the case of the regimes we have been working on in the Antarctic Treaty context, these are framework regimes; so that

the actual specification as to who would monitor or enforce would be worked out under the regime.

I agree with that completely as far as it goes, but I think there still is a difficulty with ensuring that when it is ultimately worked out, it is effective. And I do feel that is complicated by the issue of jurisdictional ambiguity.

That does not lead me to the conclusion that we need to scrap the Antarctic Treaty. It leads me to the conclusion that because this is a potential for problem, the need for accountability in the regimes is much greater. It is for that reason that a lot of the public interest community is pushing for an external accountability function in the treaty system as a whole. And certainly in a minerals regime, we want to know whether or not it is being effectively enforced, because there may be problems with carrying out this enforcement.

I bring this up also in the case of the French airstrip question, which was raised yesterday. The Antarctic Treaty does not provide procedures for someone to actually question whether or not a country is complying with a regime. Now, on the one hand, that is part of the flexibility of the system and that is not a bad aspect, but on the other hand, it is not easy for someone who is interested in the subject to find out whether or not the regime is being effectively complied with. I think this problem is worth considering in more detail. It would be useful to think about ways to improve the treaty system in this area of ensuring compliance. As I said, this does not lead me to conclude that we have to scrap the Antarctic Treaty System. I just flag this as a continuing problem, particularly as more countries and individuals become interested in "Is this system working effectively or not?"

Responsibility, Liability, and Compensation

This is the major topic on which the environmental groups have yet to focus in detail and where they have much practical experience in the international arena on which to draw. It has only recently been much discussed in the Antarctic mineral negotiations. While a number of international instruments address these questions with respect to say, vessel-source pollution in the marine environment or states' responsibility and liability in outer space, the issue is again complicated by jurisdictional ambiguity in Antarctica: who may institute proceedings and what is the applicable law? It is linked to dispute settlement questions as well.

The regime will also have to address what damages would in fact be subject to liability provisions. Liability for damages suffered directly by a natural or juridical person and for costs incurred in containing, cleaning up, and restoring affected areas is generally accepted in national and international practice, albeit with certain financial limits. Whether in addition a specific person or legal authority may be entitled to sue for compensation for environmental damages resulting in this case from mineral resources activities in Antarctica, in the event that otherwise no person or authority would have standing to sue, is a more controversial issue that has arisen in other international forums such as the United Nations Environment Program (UNEP). This question and the possibility of establishing or resorting to an existing compensation fund to cover costs incurred beyond the liability limits that may flow from the regime also deserve consideration in the Antarctic minerals negotations.

Protected Areas

The designation of protected areas under the Antarctic minerals regime is another major issue for the environmental groups. Recommended criteria for such designations include biological, scientific, historic and aesthetic significance, and the possibility of retaining undisturbed "control" areas to study impacts of activities elsewhere. Some groups have noted the importance of adequate buffer zones around protected areas.

In the U.S. groups' recommendations, they sought to explicitly link the threshold determination of acceptability of minerals activities in specific regions of Antarctica to designation at that time, prior to any activities (without prejudice to such designations at any other time), of protected areas within the region that would be off limits to minerals activities. They also urged protected area status under the minerals regime for all areas protected under the other legal instruments of the Antarctic Treaty system and under additionally relevant international legal instruments.

For those groups advocating the world park idea and wilderness values in Antarctica, seeking designation of large sections of Antarctica as protected areas is an alternative path.

Accountability

A more theoretical concern of the environmental groups, though one with practical significance both for the minerals negotiations and for the future of the Antarctic Treaty System generally, is how to ensure the accountability of the regime — how to guarantee that it is working effectively as a regulatory and environmental protection mechanism. Questions in this area arise on two fronts: a) are effective checks and balances incorporated into the procedures of the regime? and, b) are procedures available to reassure, if not verify, its effectiveness to non-parties to the regime?

With respect to the internal workings of the regime, environmental groups have raised questions about how to insulate national scientific and technical advisers on the regime's Advisory Committee from national political and economic considerations. They have sought to strengthen the independence and continuity of the regime's staff, inspectors and expert advisers and to ensure that in conveying its advice to the decision-making bodies, the Advisory Committee fully reflects all views. Another internal mechanism for checking the workings of the regime's procedures is to ensure that the regime does not stifle and in effect facilitates the ability of different institutions within the regime and States parties to review and question improper decisions or inaction on the part of the regime's institutions, as well as the compliance of specific minerals activities with it. Several representatives of public interest groups have drawn attention to the Antarctic Treaty System's apparent weaknesses in this area of ensuring compliance with the terms of its legal instruments. In this area we would need to explore more fully first recourse to mechanisms other than judicial procedures.

One proposal put forward by a coalition of environmental organizations would address these issues of the internal workings of the regime by establishing an

Antarctic Environmental Protection Agency (AEPA) as an institution of the minerals regime. The coalition points out that the EPA's responsibilities could be broadened to cover all Antarctic activities with a potential environmental impact. The AEPA would have its own professional staff whose functions would include preparing and reviewing environmental assessments, reviewing adequacy of information, drafting environmental regulations, and monitoring and inspecting operations. It could also design and carry out relevant scientific research on its own or in cooperation with other international research programs. And it would constitute a forum in which questions could be raised regarding the adequacy of assessments, regulations, compliance, etc.

Other groups question the feasibility of creating a new institution and whether it could preform its functions any more effectively than the advisory committee if that committee had access to a good professional staff and/or *ad hoc* technical advisers.

On the second question, the availability of procedures to reassure non-parties to the regime of its effective operation, the environmental groups have recommended that all non-proprietary data and information, measures adopted and reports issued under the regime be maintained as part of a public record. The regime's reporting requirements for States parties and the institutions must be formulated to guarantee ample information in these documents. The non-governmental groups have also endorsed the right of observers under the regime, including international and non-governmental organization representatives' observers, to receive prior notification of all pending decisions and relevant documentation. They would be accorded the right to comment on these matters within established time limits. These comments would also be maintained as part of the public record. Providing for the possibility of comment from others outside the regime would go further in ensuring public scrutiny of regime activities.

The final accountability question is whether outsiders should have any role in challenging institutional decisions or inaction, or compliance with the regime by operating entities. Outsiders might as a first recourse accomplish this challenge role indirectly, by raising the problem with parties to the regime or within its institutions. Their direct recourse would be an option to pursue challenges through judicial proceedings.

Integration and Consistency Within the Antarctic Treaty System

In discussing the principles of the minerals regime, I mentioned that I would return to this question later on. It is a concern shared by the environmental groups and by many participants in Antarctic discussions. For as living resources harvesting and the possibility of mineral resources development combine with increasing tourism, scientific research and logistics and supporting activities including navigation, the possibility of congestion, accidents and cumulative environmental impacts increases. How to ensure consistent application of environmental and safety standards and better coordination among the different institutions and legal instruments that compose the Antarctic Treaty System merits further consideration. Two difficulties in this regard under the present system are the absence of any institutional structure under the 1959 Antarctic Treaty and

the practice of depositing and/or headquartering the different legal instruments and institutions in different countries.

Providing that observers from one regime's technical staff may attend meetings under another regime will improve upon the present system, where particular countries may or may not coordinate their technical experts' representation at the varied meetings. The proposal for an AEPA addresses this issue by favoring an extension of its centralized role to all Antarctic activities.

CONCLUSION

These concerns affecting protection of the Antarctic environment and its associated ecosystems are well known to those negotiating the minerals regime. Most are genuinely interested in establishing a regime that adequately deals with them and are in fact bound to do so by Recommendation XI-1 as I noted earlier.

But the best of intentions could be affected by the difficulty of reaching political accommodations in the regime, the sense of urgency driving the negotiations, and most particularly the imperative of devising a decision-making structure that does not prejudice either the claimant or the non-claimant position. It is up to the Antarctic environmental constituents to maintain the pressure for effective treatment of these, and possibly other, issues in the negotiations and to explore viable solutions to them.

Discussion

Kennett: Thank you very much. We have heard a wide-ranging analysis of many of the issues concerning the minerals regime. The discussion has included comments about the geological setting and the geological history of Antarctica; some rather brief comments about potential hydrocarbon resources around the Antarctic region with an assessment of the economics in relation to the world economy; some aspects of the legality of the minerals regime itself; and then finally, the environmental concerns relating to any potential mineral exploitation in the future. We now will open up the floor for questions and discussion.

Todd: We have heard today only about the possibilities of hydrocarbons as far as mineral resources. I was wondering if one of the panel members could give us a little bit of context about the possibility of other minerals on the continent itself.

Behrendt: There are mineral occurrences throughout Antarctica. There have been no ore bodies found anywhere on Antarctica that would be of commercial interest in any other part of the world even if transportation and refining capabilities were present. That is not surprising, however, since only two percent of the rock on the continent sticks out from the ice and it has never really been prospected for minerals in the sense that it has been done in other parts of the world. There is a copper province in the peninsula as well as a number of other occurrences, but in fact, these have all been looked at very superficially. There is quite a large bibliography available reported throughout the literature culled from many geologic reports by many nations, but nothing that would be economic, as I say, anywhere else.

Now the Dufek Intrusion is perhaps a little different. It is a large, layered mafic intrusion that in other parts of the world, such as the Bushfeld Complex in Africa in particular, contain rich deposits of platinum-group metals and other metals. Like the continent as a whole, the Dufek is exposed in only three percent of its area as well. It has about 50,000 square kilometers area beneath the ice estimated from aeromagnetic surveys. The Bushfeld Complex is about 66,000 square kilometers. The Dufek may be of the order of 10 kilometers thick. There are about two kilometers of both upper and lower sections exposed. Drilling of this body has been proposed. This is of interest because it is a rather unusual body and it is located right on the junction of a very steep gravity gradient between west and east Antarctica. It is of the same age as the Jurassic Ferrar Diabase that extends all across Antarctica. This is the same age as the breakup of Gondwanaland, and was thus associated with contemporaneous rifting. However, chemical analyses of the samples collected from this intrusion have not yet shown anything economic. There have been trace elements of various metals, but nothing for instance in the platinum group, that would be remarkable. Iron in this material

creates magnetic anomalies, but none of the iron observed in Antarctica would be economic within the foreseeable future.

I might also mention coal. Despite the abundance of coal in Antarctica as measured by Australian and Soviet geologists it is not even economic to use it to heat the nearby Soviet station at Beaver Lake but rather makes more sense to bring oil in from the Soviet Union. So that is one picture of the economics of coal-mining in Antarctica.

Hayes: I might make one further comment concerning the resources in the deep-sea bed immediately around Antarctica, specifically the iron manganese oxide nodules that are very commonplace in the deep ocean basin. Questions have been raised about their potential economic worth and, although the climate for mining manganese nodules in general seems to wax and wane, I think one factor that is reasonably well-documented so far is that the primary metals of interest are trace metals in the manganese nodules — cobalt, nickel, and copper. The chemistry of the nodules are primarily iron and manganese oxide, however, the percentage by weight of the other economically interesting metals varies by a factor of two or so depending upon where you are in the ocean basin. It turns out that there are many places with vast fields of manganese nodules that sit in more tropical climes that I think will be of interest for manganese nodule mining long before any of the nodules in the high latitude regions at least as they are known and assayed at this point.

Behrendt: I want to add one quick comment to that. Because of the very statement you made in your last sentence, the members of the Antarctic Treaty, when starting the negotiations on the Mineral Resources Regime in Buenos Aires in 1981, excluded the marine manganese nodules. The current regime being negotiated does not extend out to the deep-sea bed but only to the continent of Antarctica.

Kennett: I might add that, in terms of the manganese nodules story, the large known deposits around the Antarctic tend to be north of the Antarctic Convergence and within the sub-Antarctic regime rather than associated with the Antarctic water mass. And, as Dennis Hayes said, they tend to be poorer in some of the valuable trace elements than the vast deposits known in the tropical area such as the equatorial Pacific. So that is something to keep in mind.

Hayes: I would like to make one comment about the Antarctic Peninsula area which has strong similarities in its tectonic setting to other active arc and subduction zone regimes. These areas tend to be the centers of mining activities for certain minerals such as cooper in northern Chile. To date, we have been unsuccessful in trying to develop some sort of a working paradigm that relates the tectonics to the actual concentration of metalliferous ore deposits. While it is true that there is an association between many of these ore deposits and this tectonic setting, there are many places with the same tectonic setting that have no ore deposits. I think before any effort is made to explore the peninsula region, we need to understand a lot more about what is happening elsewhere in the world. The Antarctic is a tough place to go wildcatting whether it is for ores or hydrocarbons. We have to have some way to focus our exploration activities before too much effort is devoted there.

Sawyer: John Garrett mentioned that oil drilling in Antarctica would be possible under conditions of what you consider to be "tolerable, environmental risk." Would you like to define tolerable, environmental risk?

Garrett: I would describe tolerable environmental risk as being a range of things. If it looks like there is going to be a surplus of a resource, that society needs, for a long, long time and the economics of developing that resource, in an environmentally sensitive area, is a long way out in time, then tolerable environmental risk, in the case of Antarctica, would mean that guaranteed pristiness will be eternally preserved. If, on the other hand, we were to be denied resources that were vital to the economic activity of society, I think the threshold of tolerable environmental risk would be considerably lower. It is a range. If those resources are not perceived to be needed, I am sure that those responsible for managing Antarctica's affairs will make it so difficult for us (i.e. petroleum industry) to guarantee pristiness of the environment, that we won't chose to go.

Hayes: Setting aside for a moment the economics of actually exploiting and developing resource commodities in the Antarctic, the discovery of proven reserves or reasonable assessments of resources in that region, even in the event that they were never to be extracted and used, could have an important impact on the policy and politics governing the economics and distribution of those resources elsewhere in the world.

Kimball: I just wanted to come back to your question and John Garrett's answer. Our hope is that the principles that I was talking about would not be that subject to flexible interpretation depending on the pressures to develop oil in the world. I recognize that there may well be political pressure at some time when those decisions may be taken, but the attempt in the writing of the regime is to set strict standards which would have to be met before decisions were made to proceed with development.

Garrett: Probably no one will go down to Antarctica for economic reasons; however, they may go down for political reasons. Given the structure of the petroleum industry of the United States I would say that no American private capital will go to Antarctica strictly for political reasons. If on the other hand, our government feels there are strong political reasons why we should investigate Antarctica, you'll have to form a United States oil and gas company — "United States Antarctic Incorporated" to do the job. Once we have that, I would ask the question: Do you think the budget deficit now is bad?

To me resources are essentially economic in character. They are political in that they occasion controversies over ownership and use issues among different societies and different groups of people, but I think in practically all cases, you are really dealing with economics. The political factor of these economics, in the case of Antarctica is largely one of resource ownership. As I said earlier I think that the material balance of the amount of energy required to recover Antartica's energy resources as opposed to what these resources are worth in the marketplace will be for negative for many years to come.

If I can just diverge for a minute, Lee Kimball brought up the fact that some people have thought that it might be good to put a moratorium on Antarctic minerals activity. I think once you put a formal moratorium on something, it is

like taxes; it never goes away. From the standpoint of United States industry, if there were a 25-year moratorium de jure against any activity in Antarctica you'd see the technical research (that ultimately will be needed if anyone is going to look there and I am convinced that someday somebody is going to look) come to a standstill, at least as applies to the specific directionality of Antarctic operations. If you avoid a formal moratorium, certainly our petroleum industry will be a lot more comfortable. You have a *de facto* moratorium now anyway; that is, an economic moratorium. Should the consultative treaty parties say, "let's put a moratorium on any minerals activity until they are needed," it will not benefit United States industry. Furthermore, at the point in time when it is perceived that these resources are needed and they are made available for exploitation, the competitive pressures will be such among potential operators that United States private industry may elect not to participate; accordingly it is possible that only national oil companies would embark in the search and development effort — and this effort would be for largely political reasons.

Alexander: I keep hearing moratoriums and mineral regimes and the ghost of Arvid Pardo goes by. One thing that I wanted to ask Lee Kimball is about the structure of this new regime that is going to operate. Will there be a Secretariat? Who will make the decisions? Are these the questions we are just getting to now? I hope we do not get back into the same battle we did over the International Seabed Authority (ISBA). So many people were represented in the ISBA that it was in danger of collapsing under it's own weight.

Kimball: I don't know if you were here, but I tried to address that at the beginning. First the minerals regime will be a framework regime; it is not going to set out the kind of detailed mining codes that the Law of the Sea negotiations produced for deep-sea mining. Second, the structure would be to have a commission which would be a plenary decision-making body, an advisory scientific, technical, and environmental body, a secretariat and limited membership regulatory committees which would take some decisions on minerals activities in restricted geographic areas. There is a strong concern among the negotiators that the institutions not be established or called up until there is a real requirement for them to be there. You have to balance between economy and institution building with the need for carrying out certain functions when required. The regulatory system and terms will by no means be spelled out in the kind of detail that the seabed mining texts have.

Berkman: One of the questions right now with CCAMLR is that the ecosystem concept is being defined in terms of air/sea/ice, benthic, communities, seals, everything. And it seems that if nations or industries are conducting activities in the Antarctic, their findings could be pertinent to this elaboration of what an ecosystem really is, and in terms of managing the Antarctic as an ecosystem there seems that they should be required to translate this information into the ecosystem concept.

Kimball: Well, let me say that I think what you are saying is that it would be preferable if that information were publicly available so that those working on the ecosystem concept can use it in developing that concept within the marine living resources convention. The same would be true in the minerals regime: that

one should be able to use all the public information gathered under the minerals regime to help implement the other conventions. I think if the information is made public, it would automatically mean that the individuals working with the marine living resources conventions implementation would, of course, have access to it and use it in developing their own information data base.

Behrendt: I'd like to expand on that comment. I think you put your finger on a good point that has been discussed quite a bit in the treaty meetings. You were speaking primarily of the ecosystem data but it also applies to all of the other types of data whether they are public or proprietary originally. I think the main resource that is going to come out of Antarctica and the minerals activity and perhaps through CCAMLR as well will be a great enrichment in scientific data. It is very expensive to do research in Antarctica. Most all the work done there is not ultimately going to be worth anything economically. There seems to be a general consensus emerging to eventually release proprietary data that might be collected under a minerals regime. Specifics of *when* data are released will probably be a subject of some differences of opinion. But ultimately the fact that proprietary drill data, biological data, physical oceanographic data, geophysical data, that will be collected at a very high cost during prospecting, exploration and exploitation will ultimately be available to scientists. I don't think anyone is arguing that basic principle. It is only the timing and under what conditions and so on.

Kimball: I wanted to make one comment going back to the mention of moratoriums again, because that word has been used somewhat loosely. There are two moratoria that have been mentioned. One is a moratorium on minerals activities and one is a moratorium on the negotiation of the minerals regime itself. Conventional wisdom has it that it is preferable not to place a moratorium on the negotiation of the regime, to be able to have the regime in place before anyone is actually proposing minerals activities and also to fill a gap that may exist in the treaty system. On the moratorium on activities I think one can say that there is a moratorium on minerals activities at the present time, and that the way the regime under negotiation is being constructed, it will prohibit minerals activities until it is determined that those activities are acceptable according to the principles of the regime. There is an effective moratorium on those activities until a positive decision is taken.

Hayes: Now, I'd like to comment on that and a related matter. Earlier when you were speaking, you were talking about the possibility of defining prospecting as any activity that carried with it any potential damage to the environment. It seems to me that we very soon get into this dilemma of needing to have enough scientific information available to help shape the regime in a sensible way and on the other hand, preempting that scientific investigation on the grounds that you really do not know all of the possible effects. I recoiled a little when I thought I heard you say something about defining prospecting as anything with any potential damage to the environment. It seemed to me that again it is a matter of scale; it is a matter of degree; it is a matter of all these things that we are all concerned about being undefined or ill-defined. We need so much basic information before we can establish a framework to develop a regime.

Kimball: I think I either misstated or you misunderstood what I said. The recommendation of the environmental committee would be to define prospecting to exclude activities that could have a significant effect on the environment. These activities would fall into the next exploration stage which requires prior approval. Less potentially damaging prospecting activities like remote sensing work could proceed without prior approval under the regime.

Hayes: I guess the difficulty I have is in the kind of language that talks about *significant*. It is similar to the same question that was raised over here about what is an "acceptable environmental hazard?" What is a significant risk? I don't know how one regulates or monitors that because it is qualitative. Maybe it is my own ignorance I am expressing here, but that kind of language seems unworkable to me.

Behrendt: Can I comment on that? I think perhaps there is a misunderstanding because prospecting is that activity which is assumed not to be harmful to the regime. Let us say just going out and doing seismic surveys to look for possible oil traps would be prospecting, but since that is no different from the type of scientific information collecting commonly allowed under the Antarctic Treaty and done by research groups. In the way the regime is shaping up, there would be no regulation of it. It would be just like other activities under the Antarctic Treaty that have to be done in a safe way. I think that the information collecting you are saying is not affected. It is only when you get into things like exploratory drilling, or the development of an oil field that you begin to get beyond that. That is when other safeguards need to be met. The only difference between scientific studies and prospecting is whether the data are proprietary or not, not whether they are environmentally harmful or not. This is the way that negotiations in the treaty are going.

Neshyba: I see Antarctica as a resource for science, not as a place where scientists go to do science but as a scientific thing in itself. It is the resource. If scientists who perceive a juicy scientific problem that can only be addressed in Antarctica have to compete for dollars with people who are being asked to do science down there to support the management or the impact of resource extraction then I am going to get awfully perturbed. This is a problem.

Kimball: No, that statement was made in terms of providing incentives to get data needed to make decisions within the minerals regime. Those incentives would obviously be for those proposing the activities -- the commercial operators or State entities. Certainly in the U.S. if you are talking about private entities, what you are trying to provide is something which says "you the operator because the regime requires certain types of information before a decision is made on minerals activities, therefore, have an incentive to provide as much information as possible to the institutions." It is not one that creates the competitive drive for funds between the science that is currently being done and the attempt to gather the kind of information that will be required for the minerals regime from the operators.

Behrendt: It will only be competitive if the National Science Foundation is supporting hydrocarbon explorations.

Hayes: Not only that, but I think we have so much basic science to do before anyone will reasonably talk about private industry looking at that in a resource assessment mode. I think that there is so much of a difference there. I do not see it as any competition at all. I see it as a positive impetus that may in fact lead to more research dollars in basic research in Antarctica.

PART FIVE

The Future of the Treaty System

Welcome to the final session of this conference on the Antarctic. We have heard earlier from participants who hold that the current Antarctic Treaty System is dynamic, flexible, and durable; therefore, there is reason for it to remain unchanged in the coming years. We have also heard from Barbara Mitchell and others that there are a lot of countries which have not been invited to the banquet table, in that they do not have the means to qualify under the treaty terms for full membership in the system. Yet, as time goes by, they may wish to be included in the Antarctic's decision-making process — a move which would require changes in the existing regime. In addition, we have also heard, regardless of who the treaty members are, that the present regime may prove inadequate in coming years for the protection of the area's fragile environment, particularly in the light of possible resource exploitations taking place there. So we have two basic questions to consider. First, should the treaty be changed, or can it survive for the foreseeable future as it is? Second, if there is to be change, in which direction should such a change occur?

We have an outstanding forum of experts this morning to address these issues.

Lewis M. Alexander
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CHAPTER 13

The Future of the Antarctic Treaty System

One Consultative Party Outlook

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BACKGROUND

Antarctica is said to be the world's coldest, quietest, cleanest, highest, driest, windiest, and most remote continent. I should like to make three things clear at the outset. First, the future of Antarctica involves the national and security interests of the Australian Government and people. It is very important to us. Second, I am speaking here today in my capacity as the Australian Permanent Representative to the United Nations; not as the spokesman for the 16 Antarctic Treaty Consultative Parties. This latter role was one which I received simply because of Australia's chairmanship of the Antarctic Treaty Consultative Party Meeting in Canberra in September 1983. I have no doubt, however, that much of what I have to say would have the wholehearted endorsement of the members of the Antarctic Treaty. Third, I do not pretend any personal expertise on Antarctica. It is the only continent I have not visited.

Antarctica for Australia is not, as it is for many people, remote, distant, and mysterious. It is a neighboring continent to our immediate south. Antarctica lies approximately 1,700 miles to the south of Hobart. It is many thousands of miles south of Rhode Island.

I am reminded by this reference to distance, of an observation once made by former Secretary of State, Dr. Kissinger. When Dr. Kissinger visited Jakarta in December 1975 with President Ford — at the time I was the Australian Ambassador to Indonesia — there was a delay at Halim airport where we were all assembled to bid farewell to the President. Making conversation, I said to Dr. Kissinger, "Mr. Secretary, in Indonesia you are not so far from Australia. It's a pity you could not have included it in your itinerary." Dr. Kissinger said, with that sharp sense of humor for which he is well known, "Mr. Ambassador, I have a very heavy schedule. And I always try to visit a country like Australia on the way to somewhere else. Unfortunately, Antarctica is not on my travel schedule." The point I am making is that Australia is relatively close to Antarctica; much

closer and of more immediate importance to Australia that it is to, say, Malaysia, or Antigua and Barbuda, or any of the other cosponsors of the resolution on Antarctica at the United Nations General Assembly last year.

Australia's links with Antarctica go back a long way. Australian explorers and scientists have been active in the area for the better part of this century. Australia also administers the Australian Antarctic Territory. We are one of the few countries in the Southern Hemisphere with ice and snow on our boots. We have played our part in the responsible management of the continent. We are deeply concerned that nothing should be done to jeopardize the pattern of international cooperation which has been developed under the Antarctic Treaty for the responsible management of the Antarctic continent.

We share the broadly held concerns of the international community that Antarctica should not become a source of international discord and that nothing should be done to disturb its fragile environment, with all the consequent implications that this might have; not the least of which would be its effect on the world's climate. It is for Australia, as a regional country, enormously important that the continent remain demilitarized and free of conflict.

AN OPTIMIST'S VIEW ON THE FUTURE

I have been asked, at this seminar, to speak on the topic, "The Future of the Treaty System." My first observations are that I do not have a crystal ball; and that those who seek to predict the future do so at their own peril. I am, however, by nature an optimist. I am confident that Antarctica will continue to be managed by those countries who have joined — and those who will join — the Antarctic Treaty for the benefit of and in the interests of all mankind as it has been for nearly 25 years.

I regret that I was unable to be here on Monday morning for the discussion and analysis of the Antarctic Treaty System, for that should underpin what I wish to say today. It seems to me that we cannot adequately address the future of the system without giving due acknowledgement to the past, to those features which have made the Antarctic Treaty one of the most stable, as well as one of the most innovative, of international treaties. Its strengths and its capacity to adapt to meet new circumstances will, in my view, ensure its continuation.

NEW INTERESTS IN ANTARCTICA

In 1983 the delegations of two tropical countries, Malaysia and Antigua and Barbuda, raised the question of Antarctica in the United Nations for reasons which, frankly, we have never fully understood. Antarctica was not, at that time, an issue on the international scene.

Malaysia and its Association of Southeast Asian Nations (ASEAN) partners expect Australia to consult them on issues of serious concern to them, especially in areas close to their own region such as IndoChina. We do so and give considerable weight to their views in formulating our own policies on such matters.

It is not surprising, therefore, that we should expect Malaysia and its ASEAN partners to do likewise on issues of serious concern to Australia, especially in areas close and important to us like Antarctica. So it was with some regret that we found Malaysia had launched its initiative on Antarctica in the United Nations without consulting, in advance, Australia or New Zealand or, indeed, its other ASEAN partners.

At the time of the consideration of the Malaysian request for inscription of an item on Antarctica on the agenda of the United Nations, the Australian delegation associated itself with the Antarctic Treaty Consultative Party members who did not participate in the decision to agree to inscription. We did this because we believed sincerely that the Antarctic Treaty System was operating well and should not be placed in jeopardy. Despite this attitude, we nonetheless participated in drawing up, with Malaysia, a consensus resolution which, amongst other aspects, called upon the Secretary-General to prepare a "comprehensive, factual, and objective study" on Antarctica for presentation to the General Assembly at its 39th Session.

There must, however, be some doubt as to whether, given the scope of the task presented to him, the Secretary General will be able to conclude his task in time for the coming session of the General Assembly. We await the outcome of the Secretary-General's study with interest. We believe that it would be premature to prejudge the outcome of his study and we believe it would be premature to consider actions which might be taken, in anticipation of his findings and of reactions to these findings.

COMMON HERITAGE V NATIONAL CLAIMS

During last year's debate in the General Assembly, a number of criticisms were directed against the Antarctic Treaty; namely that is was exclusive and secretive; that is was colonialist; and that, through its accommodation of the question of claims in the language of Article IV of the treaty, it was somehow contributing to a climate of instability in the region. Calls were also made for the application of the "common heritage of mankind" principle to Antarctica and for the expulsion of one of the members of the treaty — South Africa.

It is true that a number of countries have indicated they would like to see Antarctica declared "the common heritage of mankind." Australia is in favor of this principle in the Law of the Sea and outer space contexts, but we do not believe it is practical or appropriate in the case of Antarctica. Seven countries including Australia, maintain territorial claims in Antarctica and, I might add, national settlements. Antarctica cannot therefore be regarded, in any realistic sense as, "beyond national jurisdiction." Even if these territorial claims are not recognized, such claims nevertheless are facts of life.

The claim was made at the General Assembly last year that the exploration and settlement of the Antarctic continent had been impelled by some "colonialist impulse." The Australian Government does not accept that view. Australia is a Southern Hemisphere country. It has a relationship with the Antarctic which, in

geographical terms, is not dissimilar from the relationship that a number of northern hemisphere countries have to the Arctic; or, for that matter, which some states have with parts of their territory which are separated by sea, such as Western and Eastern Malaysia. But beyond that the words "colonialism" and "colonialist impulse" evoke, in this day and age, emotions which are not relevant to what has been taking place in Antarctica. No indigenous peoples have been repressed. Even if it might be alleged that the penguins have been denied their right to self-determination, I believe these charming creatures would, if they could speak, welcome the protection of the environment which the Antarctic Treaty has accorded them.

SCIENCE AND MEMBERSHIP

What has been taking place in Antarctica is essentially scientific investigation and scientific endeavor, the results of which have been made freely available to mankind as a whole. This work, often undertaken at considerable financial cost and at personal risk, has added greatly to the sum total of the world's knowledge.

The treaty is not exclusive or a "closed shop," as it has been called, which discriminates against less technologically advanced countries which do not have the capacity to mount scientific programs in Antarctica. Any country may join the treaty and countries with diverse economic and political interests have already done so, while others have expressed their intention to join. Non-consultative parties attended the 12th conference of the Antarctic Treaty Consultative Parties as observers in Canberra last September. At the meeting on the minerals regime in Tokyo last month it was also agreed that non-consultative parties should observe the next Antarctic minerals meeting.

Also the treaty is not "a rich man's club," as it is sometimes claimed. The membership of the treaty cuts across differences of ideology, wealth, development, and geography. It is a truly representative international instrument. In recent years, Third World countries have adopted a genuine participatory role in activities in Antarctica and in decision-making on developments on that continent. Brazil and India have recently joined Argentina and Chile as consultative parties, while China has also acceded to the treaty.

States carrying out substantial scientific activity may, in addition, choose to become consultative parties to the treaty. The consultative parties include both developed and developing countries. The Antarctic Treaty has often been criticized for allegedly establishing two classes of citizenship — consultative parties and non-consultative parties. But as I have already said all parties to the treaty — that is non-consultative parties as well as consultative party members — have the right to attend regular meetings of the consultative parties. I should also add that these criticisms are usually made by those outside the treaty, rather than by those who have chosen to join it.

Non-consultative parties have presumably wished to limit their commitment to Antarctica, short of that implied by consultative status, yet still wish to play a role in the region and to accept the obligations of membership. It is not that

the consultative parties enjoy special benefits from their status. Rather, they share obligations and responsibilities. Those benefits which do flow are essentially benefits of a scientific and technical nature; and these benefits have been made available to all States and to the international community as a whole, without discrimination.

In fact, it should be emphasized that, *for the foreseeable future, the Antarctic continent's only export will be knowledge.*

Some members of the United Nations have called for the expulsion of South Africa from the treaty. The Australian Government has unequivocally condemned and deplored the institutionalized racism, which the system of apartheid in South Africa involves. But the Antarctic Treaty is a functioning international instrument, which cannot be replaced or altered except by its contracting parties. In this connection I should say, with reference to South African membership in the treaty, that this is really an issue for the parties to the treaty themselves to determine as is the case in any other treaty system.

THE TREATY'S POSITIVE ASPECTS

I should like now to turn to the reasons why Australia believes strongly in the Antarctic Treaty and the system it has established, and why we are opposed to any attempts to weaken or replace the treaty.

First of all, the Antarctic Treaty has proved a uniquely successful instrument of international cooperation. Those countries which have been active in Antarctica, including particularly the two superpowers, have been obliged to set aside the differences which often divide them elsewhere and to cooperate peacefully in all areas of Antarctic activity. It would be true to say that, to a great extent, the future of Antarctica depends on the continuing consensus between the superpowers that it is in their interests, not only for Antarctica to be demilitarized but also for superpower global rivalries to be set aside, at least in this region of the world.

Let us not forget the Antarctic Treaty is a major disarmament agreement. It explicitly prohibits military activities. It forbids nuclear explosions in Antarctica. It prohibits the dumping of nuclear wastes there. These are not mere paper prohibitions. They are enforced by a comprehensive system of on-site inspection. *Antarctica is in fact the only operative nuclear free zone in the world today.*

The demilitarization of the Antarctic continent is of great value globally. It is also of specific value to Australia, as a neighboring country. It is a situation which we cannot lightly put at risk.

We believe too that the Antarctic Treaty has developed effective measures to promote scientific research and to protect Antarctica's extremely fragile environment, including the marine living resources of the continent.

The treaty sets aside potentially difficult problems stemming from rival sovereignty claims in Antarctica. By the provisions of the treaty, no new claim, or enlargement of an existing claim, may be asserted while the treaty is in force. Surely the removal of the potential for disputes relating to the exercise of sovereignty, through a formula which does not prejudice the position of any party,

as set out in the Antarctic Treaty, is an achievement to be welcomed and maintained.

The Antarctic Treaty Consultative Parties are engaged in negotiations to establish a regime which would govern the exploitation of any mineral resources in Antarctica in the future. In 1977 parties agreed to a moratorium on minerals exploitation and development, until a regime regulating such exploitation was adopted. They realized that ground rules must be established before pressures to begin minerals activity built up. They also agreed that any regime established would be open to States which commit themselves to the objectives and principles of the Antarctic Treaty and that such a regime should not prejudice the interests of all mankind in Antarctica. It was further agreed that the protection of the unique Antarctic environment, and of its dependent ecosystem, must be a basic consideration in any minerals regime and that it must include a means for assessing the possible impact of any future mineral resource activities on the Antarctic environment and for determining whether such activities would be acceptable. Such an approach, with its concern for environmental protection, stands in marked contrast to the assumption of unfettered exploitation, envisaged in a common heritage approach.

This group had a very useful discussion yesterday on the question of a minerals regime in Antarctica. From what I understand was said at that meeting, it is clear that there is little prospect of any large scale economic activity taking place in Antarctica in the foreseeable future. It is equally clear that when — and if — minerals exploitation does occur, it will be carefully and properly regulated.

Australia accepts that the present treaty system may not be perfect. We in Australia adopt a flexible and forward-looking approach to meet changing circumstances. Clearly the treaty must continue to evolve and adapt to changing circumstances, taking into account the aspirations of all nations. The point is that the treaty allows for such evolution. I would also concede that recent criticisms have had the advantage of leading members of the treaty to be more open — by inviting, for example, acceding States to consultative meetings and by increasing the flow of information. Yet that demonstrates precisely the flexibility and responsiveness of which the treaty is capable. Information has always been made available to the international community on all aspects of activity in Antarctica. Now that greater interest has been expressed in the workings of the consultative meetings, more information has been provided in response to that interest.

The treaty is designed to provide the framework for activity in Antarctica indefinitely and it has no set period of operation. There is, however, provision in Article XII of the treaty for a conference of all the contracting parties to be convened to review its operation, if a request for such a conference is made by one of the consultative parties. Such a request can be made after the expiration of 30 years from date of entry into force of the treaty, that is, after 1991. If members wish it, that could be an opportunity for review, if that is considered necessary.

SUMMARY

I have spoken at some length about what we perceive to be the achievements of the Antarctic Treaty system and of the desirability of maintaining that system intact. It has served the international community well. It would be quite unrealistic, in current international circumstances, to expect that any new instrument could have the same provisions for demilitarization, for setting aside potential disputes over territorial sovereignty, and for harmonious international cooperation in scientific research and environmental protection.

In short, a new instrument would not protect important international interests in Antarctica, as effectively as does the current treaty. And any attempt to revise this situation would, in our view, risk reopening the very contention and competition which the treaty was created to do away with. That is why the Australian Government would oppose any attempts to establish parallel or new mechanisms for the management of Antarctica.

For those who wish to effect change, including Malaysia, we issue an invitation to join the treaty, as India and China have recently done. This is not a difficult step.

Australia sees no valid reason for the replacement of the Antarctic Treaty system, or for the international community to take actions which could place in jeopardy such a successful international instrument. We firmly believe that the Antarctic Treaty offers the best means, in a complex and troubled world, of maintaining and promoting international cooperation in Antarctica.

I think we need to be practical and realistic in our approach to Antarctica. Expanding the decision-making process to include a large number of nations, without a demonstrated interest in Antarctica or experience there, would risk kindling new rivalries in that so far peaceful continent and could add to the previous failures of the United Nations. Just as Antarctica's unique environment must continue to be protected from exploiters so, I believe, its political and economic future needs also be protected from idealogues, however well intentioned they may be. On their part, the treaty partners need to be flexible and understanding in their approach to the legitimate concerns of others and to avoid seeking narrow national advantages.

The Antarctic Treaty system is an evolving experiment which has, as I have said, served the world well. It deserves the opportunity to prove again its adaptability and the capacity of its members for adjustment and compromise.

In the longer term, I believe the best way of broadening the management of Antarctica and of taking into account the interests of all would be to encourage more accessions to the treaty and to work out ways of improving the workings of the treaty system without, however, affecting the treaty itself, which Australia and its other members regard as irreplaceable.

Antarctica is now on the international agenda. How will it be handled in the future? Clearly all interested countries will want to consider carefully the comprehensive, factual, and objective study which the Secretary-General has been asked to produce. This, inevitably, will take some time and we should not prejudge the Secretary General's study for which the General Assembly of the United

Nations has asked. It would be premature to consider other possible steps on Antarctica until the study itself has been evaluated. It could be that the Malaysian initiative will lead to the strengthening, rather than the weakening of support for the Antarctic Treaty system as the value of the treaty becomes more widely understood.

CONCLUSION

In conclusion, I believe the principal aspects of the Treaty — demilitarization, denuclearization, the sharing of scientific information, the protection of the fragile environment, the putting aside of territorial claims, and practical cooperation — must be preserved. It is, in my opinion, extremely doubtful if it would be possible, in the present international climate, to achieve such valuable assets in any new arrangement.

To use the language of the treaty, it seeks "in the interests of all mankind" to ensure "that Antarctica shall continue for ever to be used exclusively for peaceful purposes and shall not become a scene or object of international discord." These are noble objectives. They should not be interfered with lightly. As the old American adage goes, "if it ain't broke, don't fix it." Well, the Antarctic Treaty is not a broken instrument. And so I would urge our friends not to try to fix it but to accept it and seek to build on the framework it provides.

The Malaysian Perspective

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INTRODUCTION

I have been invited here as a representative of the Malaysian Government which has recently taken interest in the Antarctic. In general, I will be reflecting the attitudes of my government — wanting to be cooperative, positive, and not confrontational. I look forward to our discussions and I am grateful for this invitation because seminars are a learning experience.

QUESTIONS SURROUNDING ANTARCTIC MANAGEMENT

We need an answer to the question: How do we get wider international participation in management and decision-making in Antarctica? Hopefully, that will ensure wide and more lasting international acceptance of the system in Antarctica.

The main thing, it seems to us, is to agree on the objectives — what are we trying to do? Then, having agreed on the objectives, to see if the present system meets those objectives of ensuring greater international participation in the management and decision-making in Antarctica. If they do not, we need to look at the possible amendments that may be needed.

A question that has been asked from time to time is: How did Malaysia, so far away from Antarctica, and unlikely to send an expedition there, get interested in the Antarctic? I assure you it was no casual lighthearted venture. Indeed, we have already paid a price for our interest in Antarctica. Some of our close friends, whose views we respect and who we have close relations with, are consultative parties in the Antarctic Treaty are not happy with us for this expressed interest. Also, those of you who are familiar with the United Nations will know that, in the U.N. culture when you are identified with one item, people come to you to horsetrade their vote.

We share the objectives of the treaty — peaceful use, nonmilitarization, nonnuclearization, promotion of scientific research, and protection of the environment. So, as I said, we did not go into this casually or irresponsibly. We went into this as calmly and calculatedly as we could, knowing full well what we were in for, with full respect for what has been done and achieved in Antarctica.

PHILOSOPHICAL ISSUES

Our problem with the current system is, what I may call, conceptual or philosophical. The fact is that all decisions on Antarctica are made by the consultative parties. That is why we have used words such as "exclusive," "secret," and "unaccountable" in describing the present system. Antarctica occupies some one tenth of the globe and has strategic importance. Its ecosystem is fragile. It has marine resources and possibly mineral resources. It is of great significance to the world's meteorology and to the world's telecommunication system. It is not permanently settled. There is no internationally accepted sovereignty on Antarctica. And, so it seems to us, looking at Antarctica, there are many global interests at stake — security interests, economic interests, environmental interests and meteorological interests.

First, it is very difficult for us to accept that the current system is not exclusive. The fact is that admission requires certain qualifications of a nature which only relatively rich, technologically developed countries can meet and furthermore these are qualifications set by the consultative parties themselves, not set by anybody else.

Second, I would like to refer to the term, "secrecy." From time to time we are told to look at all the documentation. The question becomes how do others,

who are not consultative parties and who may see those documents after decisions have been made, feel that they are participating in decision-making? These documents are working documents discussed and decided upon by the consultative parties and, in the process of discussions, the nonconsultative parties and those of us who are not parties to the treaty are not involved. In that sense it is secret.

Third, we have said that the consultative parties are "unaccountable," and the response has been that the consultative parties look after mankind's interests. Our response is, who defines the interest of mankind, except mankind itself? Who appointed the consultative parties to look after the interest of mankind? It seems to us axiomatic that the interests of mankind could be defined only by mankind and that those who are trustees should be appointed by those over whom they are to exercise trusteeship. And, incidentally, trustees should have no material interest in the trust property! So again the argument that the 16 look after the interests of mankind and their good-will should not be doubted does not fully convince us.

There is also the argument, which I hope is not being asserted today, that the consultative parties have a "right" to their trust which cannot be disputed. They were in Antarctica first, they have the scientific experience, they have the technological expertise, and they spend a lot of money as opposed to these ideological new nations. In any event, how does this justify exclusive rights? In the U.N. debate, the phrase used was "special responsibility." That those who went in first with the technological experience, expertise, and who have invested a lot of money, have a special responsibility which very quickly translates to exclusive rights.

Then it is said, "But, you know, the rest of you are consulted from time to time. You can always express your views and always be consulted." To this I can only say that I hope we are not consulted in the same way that the ancient Chinese are reputed to consult their deceased ancestors. We wish to be consulted, seriously. That is really the answer to the question, why did Malaysia bother itself with Antarctica? Because we have real problems with answering the question why should decisions regarding Antarctica, that impinge global concern, be made in an exclusive forum, which is not responsible to the international community?

POSSIBLE FUTURE SCENARIOS

Having said all that, what then is our objective? What system do we envisage? Is it a universalist system in which there will be one country, one vote in the usual U.N. tradition which would establish, if you like, a U.N. council on Antarctica? Or is the current system good enough, which is another school of thought? Or somewhere in between, bearing in mind that there are many international organizations in which the principle of one nation and one vote is not absolutely sacrosanct? The Security Council is obviously one where there is the veto; the IMF, and the World Bank, where they have weighted voting; IFAD, and I may say, other specific economic arrangements in which Malaysia participates actively such as the Rubber Agreement and the Tin Agreement. At this point, I must emphasize again

that I am speaking not as representative of my government, but in my personal capacity.

There is a wide spectrum, a universal system on the one hand, the current system on the other, and somewhere in between. Where do we stand? Here I beg to shield and protect myself in the phrase — we do not know. But, let me assure you that we are anxious to preserve and to build upon the success of the Antarctic Treaty. We understand especially the concern with preserving international peace and security and also, of course, the technical achievements of the treaty. We understand these concerns. We hope there will also be understanding of our concern, which is greater international involvement.

As I said, we are not wedded to any particular formula. Should we join the treaty? This is a point which has been made to us from time to time. The problem with that is we are not quite sure what the role of the nonconsultative parties are. We looked at it, and we noticed that it took nearly 23 years at the last consultative meeting in Canberra, before the nonconsultative, the acceding parties, were allowed to be observers and that is a very long time. What is the incentive and how do we get involved in decision-making by becoming acceding parties?

We look at the current minerals negotiation and notice that the nonconsultative parties have been admitted as observers; we notice that these acceding nonconsultative parties have been plaintively knocking at the door for quite sometime before gaining admission. We are not even quite sure, as observers in the consultative meetings and as observers in the negotiations for the Minerals Convention, what their actual role is and what their contributions are. Whether they participate actively, whether they have the right to submit papers, whether they have the right to speak, whether they have the right to discuss, whether they have the right to put points of view across. What exactly is their role and how do they contribute to making decisions? And what are we to make of what we hear about closed meetings of Heads of Delegations, from which the observers are excluded and at which important decisions are made?

The marine resources negotiations were negotiated by the consultative parties who then decided to call a diplomatic conference — whose invitees they determined and whose rules and procedure they determined. So, we do not have altogether an image, shall we say, that predisposes us to join the treaty. This is another area perhaps we could explore.

COMMON HERITAGE

What then do we really want? As I said we do not know, but certainly we have ideas about the objectives and I emphasise the objectives, as opposed to the structure, of a regime, which would be acceptable, which needs to be refined, adjusted, and worked at by all interested countries. These preliminary ideas can be summarized in the phrase, which I fear evokes doctrinal and emotional responses, "the elements of common heritage." (As I say, common heritage is a trigger expression.)

We acknowledge problems with asserting common heritage in relation to Antarctica. The obvious problem, of course, is that the claims exist. Whether we like

it or not, whether anybody likes it or not, claims exist. They are held with great fervor and emotion particularly by some of the countries, probably by most of the countries. And, whether they are justified or not, this is a fact. As a diplomat, I live with such facts of life. So, we do acknowledge this as a fact.

At the same time, a case can still be made for common heritage in Antarctica. After all, sovereignty has not been established or recognized by the international community, except inter se, between the seven claimants. As that is the case, who then has sovereignty? Why should it not, then, be vested in the international community? Likewise, a case can be made on the grounds that as the nonclaimant consultative parties to the treaty themselves assert that the entire continent and its resources should be open for their use, why should this not then be applicable to the international community as well? If the nonconsultative parties and the consultative parties who are nonclaimants to the treaty, assert, as they do, that the resources of all over Antarctica are open for their use, why should this principle then not be also applicable to the international community? We acknowledge the reality of the claims. We acknowledge the emotions behind these claims. But a case can be made for asserting the principle of common heritage.

We talk instead about the elements of common heritage in relation to Antarctica, its peaceful use, environmental protection, nonappropriation, and conservation of resources, while bearing in mind future generations, international management, including involvement of the international agencies as appropriate, and equitable benefit sharing. The question is, how best can all this be done? Our attitude, which I have tried to sketch in a tentative, open-minded way, is that we will need to confer together to see whether we can evolve such a system.

This is already 1984, some 23 years after the treaty came into force. In these 23 years many countries have become independent. The international community has, in terms of independent nation States, increased in number quite dramatically. There is also, if I may use the phrase, a great democratization of international affairs, or at least a wish for greater democratization, that countries should be involved in decision-making on international peace and security, on international economic issues, on all issues which effect them. There is greater interest in Antarctica. The United Nations Conference on the Law of the Sea (UNCLOS) has taken place, the convention has been adopted, the principle of common heritage has been adopted. And, UNCLOS demonstrated a working method by consensus. The UNCLOS has produced the international seabed authority whose composition is interesting. So, these are important developments which have taken place in the international community since 1961 which should be born in mind as we look at Antarctica in 1984.

Sometimes I wonder: what if the Antarctica Treaty was negotiated and concluded today, in 1984? What would the international reaction be? Indeed, I wonder also, if one looks at the more recent Convention on Marine Resources, if there had been more knowledge of the way it was negotiated as there is now in 1984, what would the international reaction have been? Likewise, what would be the reaction of the international community to the way the Convention on Mineral Resources is currently being negotiated? It has been asserted that the Antarctic Treaty and its system has shown flexibility. I accept that. It has shown flexibility in some ways. It has shown the capacity to adjust, to meet real needs. Although,

let me also say, that it sometimes gives the impression of great reluctance to adjust and to be flexible. It gives the impression of too little, too late. Nevertheless, the central issue remains which is the acknowledgement of the legitimate interest of the international community in Antarctica.

If Malaysia has been difficult, if it has been inconvenient in raising these questions, I hope it will be regarded as a liberating service that we have done for the international community to ensure justice and, therefore, long-term stability in Antarctica.

Environmental Community Suggestions

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I was asked to speak today about the alternative management methods and changes the public interest community would like to see in Antarctica and to add my own views on this subject. Since there is very little on record that one could say represents public interest community views except with respect to environmental matters (which I discussed in my presentation yesterday), I will have to absolve any other members of the public interest community from endorsing this presentation.

The first question that comes to mind when asked what alternative management methods and changes might be desirable, is what is wrong with what we have got. In her opening presentation, Barbara Mitchell raised the following problems:

1) Lack of availability of public information;
2) The exclusivity of Antarctic decision-making, particularly in light of what has been termed the democratization of international decision-making over the last two decades;
3) Lack of clear lines of responsibility and enforcement ability within the Antarctic Treaty System, stemming partially from jurisdictional ambiguity in Antarctica; and
4) Uncertain ownership of the non-renewable mineral resources of Antarctica, leading to doubt about who should benefit from their development.

To this list I would like to add four others:

5) The specific non-governmental organization concern with accredited observer participation in Antarctic meetings and forums;

6) The adequacy of data and research programs, required to effectively implement the conservation standard in the Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR), about which Bruce Manheim spoke yesterday, and the principles and standards that will govern mineral resource activities;

7) Ensuring consistency and coordination among the various legal instruments and institutions of the Antarctic Treaty System, particularly with the establishment of an Antarctic minerals regime, a problem I mentioned yesterday; and

8) The general issue of accountability, which I also touched on yesterday in the context of the minerals regime. This latter is obviously linked to all of the others. I have chosen to single it out because the term seems to have been interpreted in different ways by those interested in Antarctica and I think it would benefit from further discussion.

These problems, however, do not automatically lead me to conclude that an alternative management regime is required. To confirm how difficult it is to get agreement on these questions, I do not agree with Barbara Mitchell, as part of IIED's four-person Antarctic team, that the Antarctic Treaty System does not seem to provide a solid enough basis upon which to construct resource management regimes. Fortunately, IIED has never attempted to reach a consensus policy decision on this subject.

I *would* conclude that if the Antarctic Treaty remains (and I hate to repeat this quote once again) "that rare species, a dynamic international legal instrument," as the Norwegian representative claimed in United Nations debate last fall, it may be built upon in a manner that resolves these problems. The fundamental question is whether those *within* the system are willing to do so, and whether they and the treaty system's critics have the patience to consult together to find acceptable solutions to the problems. Their fundamental difficulty is that unlike the situation that prevailed when the world community agreed to design a novel regime for the deep seabed beyond national jurisdiction, those involved in this exercise will not be dealing with a clean slate.

THE TREATY SYSTEM

The Antarctic Treaty has proven an effective mechanism for over two decades in fulfilling the purposes for which it was concluded and in meeting new challenges. But during the last two years, those questioning the present operation of the treaty system have grown more numerous and more vocal. It is quite clear that the treaty will lose its effectiveness the moment it can no longer avoid Antarctica becoming the scene or object of international discord. This makes international acceptance of Antarctic regimes a *sine qua non* of the continuity of the system.

Conversely, if international disagreements over the system of governance in the area heat up, neither the continuity of peaceful international cooperation in scientific research there, nor adequate concern for protection of the Antarctic environment and conservation of living resources there can be guaranteed. It is for these reasons that public interest organizations active in the environmental and world peace movements are interested in the broader question of the future of the system. In addition, for those supportive of international institutions as necessary forums for the management of today's problems of global dimension, the management system in Antarctica offers certain useful lessons and precedents. If it can be built upon to take account of problems identified in an internationally-acceptable manner, the result will be all the more compelling as a model for international problem-solving.

SOLVING THE PROBLEMS

What I will attempt to do today is to explore the eight problems I have mentioned, look at what is being done about them within the treaty system and suggest some additional possibilities. In doing so, I have chosen to treat all of these problems as part of the larger issue of accountability, because it seems to me that the growing interest in and questions about Antarctica deserve a forthcoming response, and that the evolution of the treaty system in the directions I will explore can meet outside concerns and may be just as effective in broadening the base of Antarctic decision-making — the crux of international community attention on the system as Ambassador Zain has noted — as trying to design a new decision-making system for Antarctica.

Because this evolutionary approach is probably the only alternative to more fundamental, abrupt, and disruptive changes in the management system for Antarctica, it seems to me that the onus lies with the Antarctic Treaty Consultative Parties (ATCPs) to explore through external consultation and other means how best to proceed with developing what I will call the "treaty system option" for the future of Antarctica. I would agree with Ambassador Woolcott that the ATCPs should be flexible, but would urge that in addition they take the initiative. If they don't, they may produce "too little, too late," as Ambassador Zain said, and the initiative may be taken out of their hands. They will then have to choose whether or not to cooperate.

At the same time, those outside the Antarctic Treaty System would do well to remain open to new ideas rather than to revert to unproven ground such as that of the deep seabed mining regime in the 1982 Law of the Sea Convention. I think Ambassador Zain's suggestion of building on the *elements* of the common heritage of mankind is a very constructive one.

Of the problems I noted at the outset, it seems to me that the availability of information, observer status, and coordination within the Antarctic Treaty System are all what I would call functional difficulties. It may take some time and a slight increase in financial commitments, but they can easily be dealt with by actions taken within the existing treaty system. Inadequate data and research programs are primarily a financial problem and thus need entail no major changes

in the system either. Responsibility and enforcement, however, and the ownership of Antarctic mineral resources are more problematic. Because they relate to the opposing positions on claims and jurisdiction that underlie the Antarctic Treaty, the problems and questions they may give rise to are to a large extent inherent in the treaty system. If this is the case, the ATCPs may have to accept that preserving the structural ambiguity of the Antarctic Treaty System *requires* an even more open attitude toward accountability for their stewardship than would normally obtain in multilateral agreements of international import. I will return to this issue later.

AVAILABILITY OF PUBLIC INFORMATION

While the ATCPs do not fully accept the charge that there is too much secrecy surrounding their meetings and activities, they have begun to acknowledge that in light of increasing international and public interest in Antarctica, it is in their interest to see that available information is both more ample and more accessible. Not only does the perception of secrecy fuel suspicions about what the ATCPs are doing in Antarctica, it also raises questions as to whether the ATCPs are effectively carrying out their self-appointed stewardship responsibilities in Antarctica.

Greater availability of information will demonstrate that the ATCPs are willing to account for their role and will debunk false assumptions and expectations about Antarctic affairs. For those new to Antarctica and the Antarctic Treaty System, it will help create an informed basis for involvement in Antarctic affairs — a criterion for participation in Antarctic decision-making.

What has been accomplished in this area already?

- September, 1983, at the XII ATCP meeting, the ATCPs agreed to make available to the United Nations Secretary-General and to the acceding states to the Antarctic Treaty reports on their regular meetings; as and when appropriate to draw the attention of any specialized agency of the U.N. or other international organization having a scientific or technical interest in Antarctica to any part of the report of the meeting or any information document submitted to the meeting and made available to the public, relevant to the scientific or technical interest that agency or organization has in Antarctica; to increase the availability of background material on the Antarctic Treaty and the recommendations adopted pursuant to it; and to explore additional means to facilitate public availability of information through the depositary government as well as public availability of documents from meetings.
- The XII consultative party meeting report was more detailed than has been the case with many past meeting reports, and it is to be hoped that this practice will continue.

- Under the CCAMLR, the reports of both the Commission and the Scientific Committee are publicly available and all conservation measures adopted under the Convention are to be maintained as part of a public record. Additional provisions call for publication of relevant research and data.
- The ATCPs are currently providing armloads — boxes — of information to the U.N. as raw material for their study on Antarctica. Some may call it propaganda, but regardless, it will increase the flow of information on national programs and activities in Antarctica.

To enhance the accountability aspect of the public record of the Antarctic Treaty System, the record, including that of the future minerals regime, could include in addition reports on inspection and compliance with the various regimes.

I would also hope that the minerals regime will maintain the full public record advocated by the 11 major U.S. environmental groups that I mentioned in yesterday's presentation. This would include proposals and comments received on them, in addition to all measures adopted, reports produced, and non-proprietary data gathered under the regime.

Another aid to the information flow on Antarctica might be to ensure that the Scientific Committee on Antarctic Research (SCAR) issue its own reports on activities related to Antarctica for all those international organizations with which its parent body the International Council of Scientific Unions (ICSU) holds consultative or associated status. I understand that ICSU is preparing a submission for the U.N. study on Antarctica.

Finally, and somewhat controversially, it does not seem to me that untold harm resulted from the "leaking" of the chairman's draft text of the Antarctic minerals regime last year. In light of growing outside interest, I do not see why this text should not be made available to interested nations and organizations.

This was always the case with the Law of the Sea negotiating texts. It is also quite clear that the constructive comment from outside groups increased substantially once they could focus their comments on specific, existing provisions in the chairman's text.

OBSERVER STATUS

While the increase in information flow helps inform others about the management of Antarctic affairs and responds to the call for greater accountability on the part of the ATCPs to the wider international community, attendance at meetings goes even further toward achieving these goals. From personal experience, I can vouch for the fact that reading reports and documents probably only takes one about half way in understanding the workings of the Antarctic Treaty System. What has already been done?

- The U.S. has for several years accepted non-governmental organization representatives as members of U.S. Antarctic delegations. Within the last year, this practice has also been adopted by Australia and New Zealand.
- Under the CCAMLR, observers from invited international and non-governmental organizations take an active role in the institutions established. They are the Food and Agriculture Organization of the United Nations (FAO), the Intergovernmental Oceanographic Commission (IOC), the International Whaling Commission (IWC), the International Union for the Conservation of Nature and Natural Resources (IUCN), SCAR, and the Scientific Committee on Oceanic Research (SCOR).
- At the XII consultative party meeting, the ATCPs agreed to consider on a case-by-case basis observer status at future ATCP meetings for international organizations having a scientific or technical interest in Antarctica. This option has long been available to them under Article III of the Antarctic Treaty.
- The acceding states recently became a new category of observer within the treaty system. In April, 1983, they were invited to attend the XII consultative party meeting and at that meeting they were invited to the XIII meeting in 1985. (I find Ambassador Zain's comment that it took 23 years for the Antarctic Treaty System to take this step a bit below the belt, since no one asked until about three years ago.)
- In May, 1984, the acceding states were invited to observe future meetings of the special consultative party meetings on the minerals regime negotiations.

Given the increase in international interest in Antarctica, there are a variety of ways in which extended relationships with international organizations could help broaden the base of Antarctic decision-making. Seeking closer cooperation between the Antarctic Treaty System and other international organizations was mentioned in this context during the 1983 U.N. General Assembly discussions on Antarctica and Ambassador Zain has cited that option again today. In addition to the organizations already noted, the U.N. itself, the U.N. Environment Program (UNEP), the Intergovernmental Maritime Organization (IMO), the World Meteorological Organization (WMO) and other international non-governmental organizations have programs relevant to Antarctica. Inviting observer participation as appropriate from these organizations would:

1) Initiate a process of familiarization with Antarctic decision-making and decisions taken on Antarctic matters and help develop trust and mutually-beneficial working relationships between the Antarctic Treaty system and larger-membership international bodies;

2) Allow significant input and comment from the international organization observers to the proceedings of the Antarctic Treaty System, which could reflect pertinent decisions taken in the larger-membership organizations; and

3) Assist in identifying areas where collaborative research projects with international organizations would contribute to the objectives of both the Antarctic Treaty System and the international organization(s) concerned. The Scientific Committee on Antarctic Research (SCAR) reporting requirements suggested earlier and the active involvement of SCAR observers in this process could also contribute to designing new research programs.

Although many of the developing countries may not be able to afford to develop their own national Antarctic programs, participation in Antarctic science through collaborative international programs may be a feasible option. It could also make them more eligible for Antarctic decision-making status.

Similar results would flow from the observer role of the acceding states. One might expect over time that as familiarity and trust develop, at least the *de facto* distinction between the ATCP's and the observers' participation in meetings would diminish, since Antarctic Treaty meetings are conducted as discussions leading to consensus rather than as voting exercises. The acceding states may speak freely and submit and receive documents at meetings.

Finally, designation of additional non-governmental organization observers on national delegations would help alleviate credibility problems encountered by the Antarctic Treaty System with those outside.

CONSISTENCY AND COORDINATION WITHIN THE ANTARCTIC TREATY SYSTEM

I do not believe I can add anything to this point that I did not say yesterday with respect to the minerals regime. There is an awareness of the problem within the Antarctic Treaty System and various mechanisms to address it are being considered. Its relationship to accountability is primarily one of ensuring the effective internal workings of the system and conveying this to the wider international community and general public.

ADEQUACY OF DATA AND RESEARCH PROGRAMS

Leaving aside the financial implications of this issue, as part and parcel of increasing the store of Antarctic knowledge, efforts could be made to broaden international participation in research programs and thus knowledge and understanding of Antarctic matters. Several of the acceding states to the Antarctic Treaty began their Antarctic involvement through cooperative programs with the ATCPs before becoming party to the Antarctic Treaty. The Peoples Republic of China (PRC) is a case in point. Among the acceding states, Brazil and some

of the eastern European countries have participated actively in ATCP research programs. Brazil's achievement of ATCP status last year developed through this cooperation. Tucker Scully mentioned in his opening presentation the number of foreign nationals that have participated in the U.S. research program in Antarctica.

Collaboration in Antarctic research programs may lead additional countries to take an interest in Antarctic Treaty proceedings and to seek observer or consultative status. I already mentioned the possible role of international organizations in furthering this process. The decisive factors in whether or not these efforts will be made will be the degree of interest among those outside the system in taking part and decisions about funding priorities by those concerned.

I would draw your attention in this regard to the statement made by the representative from Bangladesh during the 1983 U.N.General Assembly debate on Antarctica, where he noted the difficulty of qualifying for consultative status for many countries "which genuinely and sincerely desire to participate in exploration and scientific research." He proposed that instead of single-country membership, participation in the Antarctic Treaty System by a recognized and established regional or sub-regional group might be considered, or affiliation of a developing country with one or more treaty countries in scientific endeavors. The latter option reflects the course taken by the PRC. The former might be built upon through linkages with international organizations.

RESPONSIBILITY AND ENFORCEMENT

There is no doubt that accountability to those outside the Antarctic Treaty System on responsibility and enforcement within the system is an important aspect of the enforcement "problem," and that awareness of this is dawning within the system. Yesterday I noted the proposal for an Antarctic Environmental Protection Agency (AEPA) is this context, the role of amplified reporting requirements on compliance and the possibility of external challenge to compliance with Antarctic regimes. I will not discuss these possibilities further. I *will* repeat, however, what I feel is the critical issue: it is not clear, given the jurisdictional ambiguity in Antarctica, that significant improvements in the mechanisms for responsibility and enforcement can be formalized within the Antarctic Treaty instruments. If this is the case, the ATCPs may have to accept that preserving the structural ambiguity of the system requires an even more open attitude toward external accountability for their actions than would normally obtain in multilateral agreements.

OWNERSHIP OF ANTARCTIC MINERAL RESOURCES

The same point should be made with respect to the ownership of Antarctic mineral resources. The ATCPs do not plan to resolve this issue in the minerals regime negotiations. As a group, they do not claim to own the mineral resources.

They will build the Antarctic minerals regime on the same ambiguous legal basis that underlies the rest of the Antarctic Treaty System.

Because this is the question that gives rise to much of the recent international community interest in Antarctica, *because* the ATCPs maintain that they will uphold their stewardship role for Antarctica and have pledged in Recommendation XI-1 that the minerals regime shall not prejudice the interests of all mankind in Antarctica, and *because* they wish to maintain the Antarctic Treaty's structural ambiguity, it is incumbent upon them to account for how they plan to devise a widely acceptable minerals regime. A first order of business for the ATCPs would be to consult with countries outside the system to explore their questions and concerns about the ownership of Antarctic minerals.

In that the ATCPs have only just invited acceding states to the Antarctic Treaty to attend the minerals regime negotiations as observers, it may be premature to expect them to act immediately on this broader front. On the other hand, waiting too long may drive outside States to act on their own.

ACCOUNTABILITY

To summarize, then, accountability may be broadly construed to include efforts:

1) To expand and deepen outside knowledge about Antarctic affairs through increasing publicly available information, expanding observer participation, and developing more ample working relationships with larger-membership international organizations; and
2) To respond to the upsurge in interest in participating in Antarctic activities through promoting collaborative programs that involve a wider spectrum of the international community and could lead to increased membership in the Antarctic Treaty System and more countries being eligible for decision-making status.

These efforts may cause additional evolutions in the functioning of the Antarctic Treaty System without altering its fundamental structure in any way. Precisely because the questions about who owns and who benefits from minerals in Antarctica, and about the effective enforcement of Antarctic Treaty System prescriptions, stem from the structure of the ambiguous legal basis of the system, holding themselves accountable for verifying that they are in fact carrying out their self-appointed mandate becomes all the more important for the ATCPs. The alternative to addressing treaty problems and a broader base for Antarctic decision-making would seem to be more radical change and possible confrontation.

DECISION-MAKING

How, then, do the elements of accountability so construed relate to the charges of exclusive decision-making leveled at the Antarctic Treaty System? As far as

I can identify them, the following criticisms of the Antarctic Treaty decision-making process have emerged:

1) That the ATCPs are not fully representative of the world community as it exists today;
2) That the price of consultative status is too high;
3) That the distinction between ATCP rights and acceding states' rights it too great; and
4) That consensus agreement for new members to participate in decision-making is inappropriate.

What changes have already taken place in Antarctic decision-making through an evolutionary process?

— Since 1982 five countries have acceded to the Antarctic Treaty: the PRC, India, Hungary, Finland, and Sweden.
— In 1982 Brazil and India attained ATCP status and two-to-three of the other acceding countries have indicated that they intend to seek ATCP status. The terms of admission have probably become somewhat more relaxed then when Poland became the first country to move from acceding to consultative status in 1977.
— Acceding states have been invited to participate in both regular and special consultative party meetings with rights to speak freely in discussions and to submit and receive documents. They cannot take part in decision-making. As noted earlier, the de facto distinction between observing states and ATCP states in treaty meetings is likely to diminish over time.

If collaborative research programs with non-party states, acceding states and international organizations grow, the number of countries eligible for decision-making status will increase. By stimulating the flow of public information to interested outsiders, by enhancing the role of observers, and by building more deliberate and more frequently-traveled links between the Antarctic Treaty System and international organizations with relevant expertise in Antarctic matters, the ATCPs can build support for the Antarctic Treaty System and acquire more experienced and knowledgeable participation in the system.

The criteria for Antarctic decision-making are adequate experience and expertise in Antarctic affairs. The ATCPs must now ensure that as long as these criteria are met, the door is open to all comers.

When I began this talk, I said that I thought the term accounttability was being interpreted differently by different individuals interested in Antarctica. Some view accountability as implying a superior role for those to whom the accounting is made. I would see it rather as a responsibility by those within the system to themselves — the kind of responsibility one has to oneself to evaluate internal and external criticism to maintain self-esteem. It is also a responsibility to those

affected by their actions, who have expressed a wish to know more about the Antarctic Treaty System.

As I said at the outset, it is up to those who would prefer to build on the Antarctic Treaty System to determine how far they are willing to go in the area of accountability in lieu of being confronted by major institutional changes. During this interim period when there is an expression of outside interest in the system with little expertise to back it up, the ATCPs should go out of their way to inform outsiders about the system and to consult informally about activities in Antarctica. If not, there may be other forums in which an accounting could take place.

But those outside, if they are truly interested in becoming involved in Antarctic affairs, also have a responsibility. They have a responsibility to first explore the responsiveness and adaptability of the Antarctic Treaty System and to grant adequate time to that process to find mutually acceptable outlets for their interest.

Discussion

Alexander: Thank you very much, Lee. We will open the session to discussion. Would any of the panel members like to make any comments?

Woolcott: Well, I had a fair go at the beginning, but in the United Nations we always think it is a disadvantage to speak first and that is why they have instituted the right of reply. First, I was very encouraged by much of what Ambassador Zain-Azraii said particularly about the open-minded approach which Malaysia will be adopting on how this issue may be considered in the future as well as the acknowledgement that the treaty does contain some very valuable assets which should be built on. I think he poised a most important question "Why should the Antarctic Treaty consultative parties in a sense claim to be the trustees for mankind?" Surely the only trustee for mankind is mankind itself and presumably, Ambassador Zain, you would regard the United Nations itself as being the best organization to represent mankind. Is that right?

Zain-Azraii: That's a loaded question.

Woolcott: I think the reason that the consultative parties did what they did, of course, is that they are the countries which have shown a historical interest in Antarctica. They have undertaken effort there at considerable costs on many occasions. They welcome others joining that board of trustees, if we want to use that analogy — like India, and Brazil and China — China has not yet become a consultative party, but may well do so. One of my personal concerns is that it is useful not to have organizations that are too large because they tend to become unmanageable. Ambassador Zain mentioned Malaysia's membership in the international tin agreement and the international rubber study group. The countries which are involved in bodies like that are the countries which are primarily interested in tin and rubber, although the price of tin and rubber probably affects every country in the world. My experience with UNCTAD, (the United Nations Conference on Trade and Development) and with other global negotiations is that it is very difficult if you have a very large body. The U.N. is now composed of 159 countries since the accession of Brunei Darussalam. It is very, very difficult to get a group that size to agree. This gets back to one of the concerns I may have mentioned in my remarks and that is if we try to change the existing system, rather than build on it, we may well end up with something which is quite unworkable.

Another brief comment I'd like to make: Ambassador Zain spoke of the central question being to acknowledge the interest of the international community in Antarctica and spoke of Antarctica being an issue of global concern. I am not quite sure how extensive that interest is. My understanding is that when Malaysia first launched this at the non-aligned meeting in New Delhi, there was not a great deal of interest amongst the non-aligned countries. The same was the case in the

United Nations itself. Last year there was not a great deal of interest in Antarctica in the Third World and to a large extent the black African interest was related to the political issue of South Africa's membership.

I think the availability of information has greatly improved and perhaps, I would agree with Zain when he said that this has happened with some reluctance, but it has happened nonetheless. It was a very important step forward that the records of the twelfth meeting of the ATCPs in Canberra were made available to the Secretary General of the United Nations and are now available in the six official languages of the U.N. A point which Lee Kimball made was to the affect that the treaty is not fully representative — I guess there may have been an element of truth in that. On the other hand, it is a very broadly based treaty and I am not sure it is fair to say it is not now fully representative. It presently includes the two most populous countries on earth, India and China, which are both Third World countries. Secondly, it includes both the superpowers the United States and the USSR, so that gives it a sort of global dimension. Then it also includes the five permanent members of the United Nations Security Council, four of them as consultative parties and one as a non-consultative party. It includes Brazil, the largest country in Latin America. It does not include a black African country, however, there is no reason why it could not if a black African country developed an interest in Antarctica.

Alexander: Thank you very much. Ambassador Zain-Azraii?

Zain-Azraii: I have very little to add, but I thought that Lee Kimball's remarks were helpful and very much to the point. The notion of accountability as a way of seeing how the legitimate interests of the present participants in the treaty and the treaty system and those outside could be reconciled is a very good approach. I think talking about exchanges of information and making information more available is also important. One particular area would be that of describing the role of the non-consultative parties in the Antarctic Treaty and the Treaty System. I believe both Tucker Scully and Lee Kimball have written papers on this subject but I think that is one area on which more widely disseminated information about what the non-consultative parties actually do in the system would be useful. I think Lee's remark that the consultative meetings are not so much decision-making by vote but discussions leading to consensus is a very telling point.

I have a few other comments. The consultative bodies must try to abide this notion that somehow they are trustees. Trustees are appointed by those for whom they hold trusteeship. They should have no material interest in their trusteeship. They are accountable to those they have trusteeship over. I also think the notion of representation is one that the consultative parties should avoid. I take the point that 159 people just cannot manage an issue like Antarctica, but indeed, there are ways that the U.N. does handle these things. The U.N. is a large group, there are ways in which it delegates its authority and so on, but as I said I decline to answer this question on the grounds that it really is a very large question, in fact, it is the core of what it is we are trying to do. The tin agreement and the rubber agreement, of which we are parties, are good examples in which countries which are interested in this issues are invited by the United Nations to a conference to define the agreement. In both the tin agreement and rubber agreement there

is weighted voting, the rules and procedures are not the straightforward U.N. rules of procedure, however, these were defined at a U.N. conference to which everyone was welcome to come, to contribute, and to reach a decision on these matters.

I would like to make one or two points that I should have made earlier. Yes, I think we in Malaysia might have consulted at greater lengths with those interested in this issue of Antarctica before proceeding. Indeed, the Malaysian Prime Minister raised it first of all in a statement to the General Assembly in 1982. In the course of 1983, we did engage in some consultation with Australia and other countries. The point has been made that, just as countries which are aware of our concern on Southeast Asian matters consult with us, we should also worry about their concerns about Antarctica and consult with them. We have tried to do that. Maybe we have failed to do it as much as we ought to.

I want to exchange one adage with Ambassador Woolcott who says "if it ain't broke, don't fix it." I believe there is also a saying which says "the squeaky wheel gets the oil." The wheel is squeaky. I think we have drawn attention to that. If it gets the oil, we will be very happy.

Alexander: Lee, do you want to make any additional comments?

Kimball: I think I have had my turn already.

Alexander: All right. We now open the floor to general discussion.

Sahrhage: I think that if one speaks about the future of the Antarctic Treaty System, one should also consider the question of the establishment of base stations in Antarctica. We have heard during the last few days that one article in the Antarctic Treaty makes it conditional in order to obtain consultative status that there is a major demonstrated scientific interest. Now after the signatories, there were four countries who have been given consultative status. The first was Poland, the second the Federal Republic of Germany, and then Brazil and India. In this article it is not mentioned that this scientific activity should be landbound and connected to a station. I am concerned that others wanting to achieve consultative status will develop more stations because we do have already quite enough off-site stations particularly in the Antarctic Peninsula area. I think that each of these stations are having some effect on the environment. In my personal view, the establishment of such stations should be based on the scientific necessity and not on political issues. There should be ways and means that nations could share such stations or I would argue that marine bases or seagoing activities in the scientific field should be counted in the same way as landbound stations in connection with consultative status.

Kimball: As far as the environmental implications, I think they are obvious, but not something I have thought about. However, the idea of sharing stations and other kinds of joint activities down there not only would avoid the problem you are talking about, but also contribute to the kind of criteria for qualification in the system itself, and would be easier for outside States to meet. That idea might be well-considered.

Scully: I would like to make a point in response to Dietrich Sahrhage's comments on the question of stations. The treaty does not provide that the establishment of a station is the criterion and that has not been the criterion applied in all four instances. In two of the instances, permanent manned stations had been established, and in a third instance, an unmanned meterological station had been established. In the fourth instance, the activities were primarily marine research activities. The question is really one of interest and how the interest is demonstrated. The treaty has an activities criterion related to scientific research. The question that comes up with regard to interpreting that criterion, is how to demonstrate or assess the seriousness and the duration of such interest. Obviously, the establishment of a station is a very clear indication of preparedness to sustain an interest in scientific activity in Antarctica over a long period of time. But I don't think it is accurate to say that the establishment of a manned station was in fact an absolute criterion applied in those four cases.

Alexander: Does anybody else want to comment on this particular issue?

Williams: I have a little different wrinkle to put on this. One thing that hasn't really been discussed at this conference is the rapidly changing technology that can be applied to Antarctica, particularly in the aspect of satellite remote sensing. Now, it is quite possible to collect scientific information of Antarctica without setting foot on it. Our capability in this area will grow extensively in the next couple of decades. At the present time, we have Landsat type data, which is available to all nations in the world. We have higher resolution data that is coming from the new Landsat spacecraft. We have the French SWAT coming next year. We have a whole series of other nations who will be getting involved in collecting data of the planet from orbital altitude, which means you don't necessarily have to set foot in Antarctica. Particularly in the mapping area, you can map Antarctica with some of the future systems that are coming. Now what effect does that have on what Ambassador Zain said about the price of consultative status being too high? That may not be the case over the next decade. It may be quite possible to do significant scientific work in Antarctica, particularly, say topographic or glaciological types of studies without actually having to establish a station. Does that kind of research by a country that does not have the means to establish a station, qualify them for consultative status in much the same way as Dietrich Sahrhage had mentioned about doing marine work around the continent without actually touching the continent physically? Can you comment on that?

Alexander: Do you want to comment on this?

Zain-Azrail: In the area of technology, I'm a total amateur. But I would comment on Tucker's point, of how is interest demonstrated and this linkage the possibility that the price would be lower. I'm not sure that is a real question. The question is how do we qualify? In order to qualify we should demonstrate interest and how, therefore, do we demonstrate interest? If one sees Antarctica as a science laboratory, then members who want to make decisions, who want to be involved in this management must demonstrate an interest, a capacity, an expertise, and experience, willingness to invest, and so on. Member countries participate in the Law of the Sea Conference. Member countries participate in the disarmmament negotiations. Member countries participate in trade negotiations and so on. One

doesn't ask them to demonstrate an interest. One says the conference is there, you can come, you can contribute at a smaller level. And in the course of those conferences, you negotiate to work out a format, a convention which is acceptable to all. Knowing very well that if everybody comes and everybody insists on a one nation, one vote, no agreement will be reached and the whole thing will be in chaos. Everybody knows this, but in fact, when the conference is called by the United Nations, certain member countries come, certain others do not. They work very carefully, they understand the reality of power, and they understand the reality of weights of interest. As a result of it, something evolves which is acceptable to all.

I am walking warily into this area which says how do you demonstrate interest to justify your being involved in any way in Antarctica? And it is linked to this question that perhpas the price can be made lower because I want to really ask if the question is real in the context of Antarctica as an area of international interest. If you see it as we do, Antarctica is an area of global concerns because it raises global questions, then it is not so much whether the entry fee should be larger or smaller, but really the question is should there be an entry fee? I know this raises the whole question of whether I am advocating as universal system and I said this is another topic altogether, which I have tried to touch on in my earlier remarks. But really the question is "is Antarctica just a scientific laboratory for which you have to demonstrate a competence, an interest, and a willingness to invest, or an area of concern in which we have an interest and need not demonstrate it by paying an entrance fee?"

Kimball: I agree Antarctic has global aspects, global implications. I think what we need to consider is how you get from where we are now to where you might want to go and this problem of whether or not it's a clean slate, is a very valid one. Now because it's an ongoing decision-making one might argue ought to have a certain amount of expertise and experience of what's going on in Antarctica. It seems to me that without necessarily saying that the price is you must do "x" amount as opposed to "y" amount of research. The need is that there be some kind of expertise and how do you get that if you're going to involve yourself tomorrow or next week in a process that's ongoing.

Woolcott: I do not want to intrude in the highly technical areas raised by Mr. Williams, but I would make a couple of comments related to the sort of criteria by which you stake a claim to be involved in Antarctica. Ambassador Zain mentioned the Law of the Sea and said that everybody had the right to be involved in Law of the Sea matters and indeed they do. But I think there is an important distinction between Antarctica and the Law of the Sea. In the case of the Law of the Sea — as distinct from Antarctica — was no treaty in force. There was nothing that had existed for a number of years, and to which a number of countries had adhered before negotiations which led to the signing of the Law of the Sea Convention. But in the case of Antarctica, there is an existing treaty. There is a demonstrated interest, criteria are being developed which may be changed, that is true. However, it is a system that has been in effect for a number of years. When we are dealing with a global issue such as nuclear balance of terror which as the capacity to destroy the earth, then naturally every country in the world

is or should be interested in disarmament discussions. For that reason I do not think a global conference on disarmament is a fair analogy with the Antarctic system.

Alexander: Tucker, did you want to make another statement?

Scully: Well, I'll be glad to say a word or two. From a conceptual point of view I won't go back to the question of jurisdictional ambiguity. But I do think that there has been in all of the presentations several issues that relate to the question of whether Antarctica is susceptible to a universalist approach. It seems to me that, if one looks at the United Nations or one looks at other international agreements, many of the most successful applications and achievements of universal principles are through organizations and agreements that are not necessarily universal in character. I think this is important as we look at how the U.N. has operated as the primary example of a universal organization. I do not have much difficulty in seeing a major role for the U.N. as a universalist organization or any particular difficulty with the need for a universal forum in which major issues can be considered. However, I do not accept a supposed dichotomy between universal participation organizations and organizations which are based upon some more defined interest criterion or activities criterion insofar as their ability to achieve universal principles. The Antarctic Treaty is a good example of an agreement reflecting universal principles — those principles that are enunciated in the preamble — and one through which those principles have achieved successful realization in practice. I'd just make that as a conceptual point. The problem it seems to me, that Ambassador Zain and Lee Kimball, particularly, have concentrated upon is the question of interest and how one defines interest. The Antarctic Treaty has worked and worked extraordinarily well because a mechanism has been devised through which interests can be identified. It is not an inflexible standard as Ambassador Woolcott has mentioned. But there has been a means through which concrete interests in the activities in the area can be expressed. Those interests then become the basis for working out a practical and effective accommodation to the problems that are posed by the activities in the area. The Antarctic Treaty is a science intensive system. Apart of its ability to respond to new situations, to deal with new forms of activity and thus new difficulties of a political, environmental, and economic nature rests on the capacity of the system to bring to bear a scientific perspective — one which unites and can cut across a whole spectrum of political perspectives in defining the requirements of common action.

With regard to the question of participation, we are not dealing with a clean slate. We are dealing with a system which has been in place, and quite successfully in place. It is important to look at what has happened when new issues have arisen within that system as well as to envision the type of hypothetical difficulties that may exist in the future. The record is quite a good one and I think if we wish to see activities and interests in Antarctica accommodated and dealt with in a reasonable fashion, we would we well-advised to look at how the system has operated, how it has responded and how it can be made to be more responsive in the future, rather than thinking or conceiving of a clean slate. If we look for a clean slate, we would simply be extending what is an all too prevalent pattern conflict and competition into Antarctica.

If I can come back to the question of interest for a moment, and the question of a price of admission, it seems to me that it may well be a valid point that the price of admission in some sense has been defined as being too high. But we should be clear as to what we mean when we are talking about the price of admission. The price of admission insofar as expressing an interest in Antarctica accession through the treaty is zero. Insofar as conduct of scientific research, I would quite agree that the price of admission — the price of conducting scientific activities — is not a negligable cost. As has been pointed out, however if there is an expression of interest, a preparedness to engage in those activities, many vehicles are available. Many vehicles have been found through which that interest can be recognized and pursued in collaborative projects with those who in fact are active. So I think we have to be careful when we look at the question of the price of admission. No system will work unless the participants in that system have some means of defining their interests and expressing their interests in a way that will allow a basis for common action.

In looking at how the Antarctic Treaty System has evolved or how it may evolve, we must keep in mind that the criterion of defining interest in some way is, has been and will be a very important component of the system, the system that has effectively achieved the only going zone of peace that I am aware of in the post War World.

Finally, just a question with regard to information. I quite agree with the point that information is a two-way street. Again, I think that there has to be some definable interest in the information that is available. In the discussion that has been associated with the United Nations initiative, there have been several kinds of information that have been referred to. There have been some rather specious charges that the results of scientific activities in Antarctica have been kept secret. There have been some less specious charges that information about the operation of the Antarctic Treaty system has been secret or not widely available. I think one must keep these two points separate. Having been involved with one of the super powers in providing a decent box of information to the United Nations, I would note that that box was filled with a bibliography of publicly available information that anyone with the interest in obtaining it could have found through public libraries within the United States. One has to look again at the question of information in relation to interest. I do not think it is sufficient to say I have an interest — tell me what it is. There has to be a two-way street in seeing the question of information about the system resolved. In returning to the mysterious Norwegian representative and his reference to the dynamic quality of the Antarctic Treaty System, I think it has demonstrated the capacity to resolve this issue and I am quite confident that it will do so.

Alexander: Thank you very much.

Holser: There's been a bit of discussion about the price of admission to the decision-making process. I think Ambassador Zain mentioned a couple of organizations that were established under the U.N. which probably today have a fairly good price of admission to a significant decision-making role. I would assume that a national power which neither purchases nor produces primary rubber would not have very much of a decision-making role in the rubber agreement or the

tin agreement similarly. I am not sure. I am not an international lawyer and am not familiar with either of those two agreements, but I assume as one talks about weighted votings, there must be a binary weighted voting system as we have in the Antarctic Treaty System.

Alexander: Anyone else?

Francis: I have a question for the Ambassadors. You discussed with us the benefits of greater participation in the Antarctic decision-making process. Our colleagues from Australia have made it clear that they take their sovereignty claim in Antarctica very seriously. Certainly in the past, the United States has taken its established rights in Antarctica seriously and I have every reason to believe we still do. I would like to discuss one of the risks of developing a new regime for Antarctica. I'd like your comment and wonder whether you consider the possibility that the response to that process might be the assertion by one or several of the original treaty parties to portions of the Antarctic continent or to adjacent areas. Also, please comment on the possibility of discord particularly given the present composition of consulting and acceding parties.

Zain-Azrai: Absolutely. I think we are very conscious of the fact that a number of current claimant States feel very strongly about their claims and are not willing to have these claims adjudicated because they say national partimony is not something you negotiate in a court of law. We are very conscious of this. There are other countries which have expressed themselves in somewhat more emotional language than Australia has on this matter as well. We acknowledge this as a fact of life. We also are aware that some claimants have said that, if you disturb the current claimants status, the current abmiguity about sovereignty in Antarctica, we shall assert our claim and some of these countries are relatively powerful countries. No. We are very conscious of this also. Now, as I said on the one hand, there are those who say to us, Malaysia, if you seriously believe in a universalist system, you should say so. You should say quite simply these claimants should drop their claims and should give Antarctica over to U.S. trusteeship. The U.N. will manage it by appointing a U.N. counsel on Antarctica, with the one nation, one vote method. Now that is the universalist model.

We have not said that. We may yet say it for all I know, but we have not said that to date. Because we are conscious that we are not starting from a clean slate. We are conscious that that treaty exists. We are conscious of the many virtues of the treaty and of the many valuable, constructive things the treaty has achieved. We believe there are problems with the acceptability of the treaty at present. We believe at this moment what is needed is for everybody to acknowledge that there are certain deficiencies and defects in the treaty and its system. What are they? I think as a result of this mornings seminar, I have learned a great deal. One defect is this notion of accountability. The other area is the demonstration of interest. You are not looking at Antarctica only as a scientific laboratory. You just asked the question only to divert our attention away from our major concern, but I think your response is a very good one which is that in the particular context of Antarctica, there is need to demonstrate. It seems to me that this is another area which one could develop furhter and in which we could educate each other. So the way we see it, is we have no answers. We are not advocating

as of yet. I have no brief to advocate a universalist system. If I have, I will. But we are not advocating a universalist system, we are only saying that the current system has deficiencies and we want us all, if we can, to agree that there are deficiencies. Then we say, "What are these deficiencies and what are the best means of overcoming those deficiencies taking into account the realities of the current situation?" So that is the way we see it and believe me, we are very conscious of the claims and of the potential claims.

Alexander: We have time for one last question.

Woolcott: Let me just make a comment about the risk of developing a new regime. I'd just like to go back to the point that even if one were to concede, for purposes of argument, that there are deficiences in the treaty and these deficiences should be identified, I would be fairly certain that they would be better managed within the existing treaty system than by trying to develop a completely new regime in the present international climate, and in the United Nations, given the size of the organization and the divisions which exist within it.

Maquieira: It is my impression that if you start tampering with one aspect of Antarctica, you will probably effect those other aspects that you consider beneficial. That is why we sustain the fact that the treaty can only be changed from inside and we are always encouraging countries to become members of the Antarctic treaty, to understand the Antarctic, to show their interest. The alternative of trying to obtain treaties from outside without assuming a committment to the objectives sustained in the treaty is quite dangerous at the present. Therefore, it is very important from my point of view, that we maintain this indivisibility of Antarctica activities. All the evidence surrounding the Antarctic treaty shows it as part of a whole interactive system. One must be careful of tampering with certain parts.

Alexander: Ambassador Zain, do you wish to comment?

Zain-Azrail: I think those are very valid comments, and I take them to heart. As I said, one of the lessons that I learned this morning is this area of demonstrating interest. I think it is an area that I personally would want to explore further in the particular context of Antarctica. One point of interest is that certain international agencies have a clear expertise and interest in environmental matters, meterological matters, telecommunication matters and might be more involved also. They have a demonstrated interest or a demonstrated expertise in these areas. This is a valuable point, at least for me, and something that again perhaps the two sides (if I can characterize it that way) might explore further to answer this question: "Why is it necessary, in the particular context of Antarctica, that interests should be demonstrated? How best could that interest be demonstrated? Is it an unfair demand made on countries which are technologically less developed?" I think these are questions that I personally would hope to be able to explore with others to my benefit.

Alexander: I want to thank the panel and thank all of you for coming and we hope to see you next year.

Antarctic Politics and Marine Resources: Critical Choices for the 1980s

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