

Solid Earth Geophysics



Data Services

Key To Geophysical Records Documentation No. 22



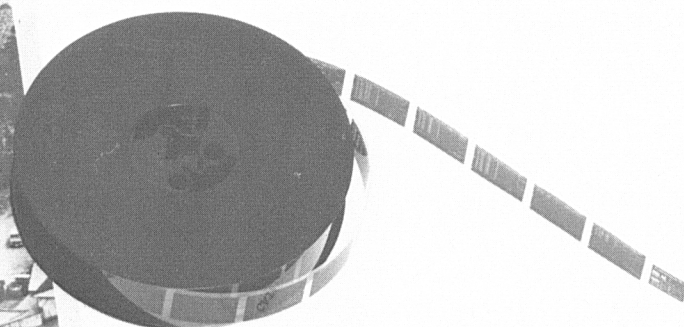
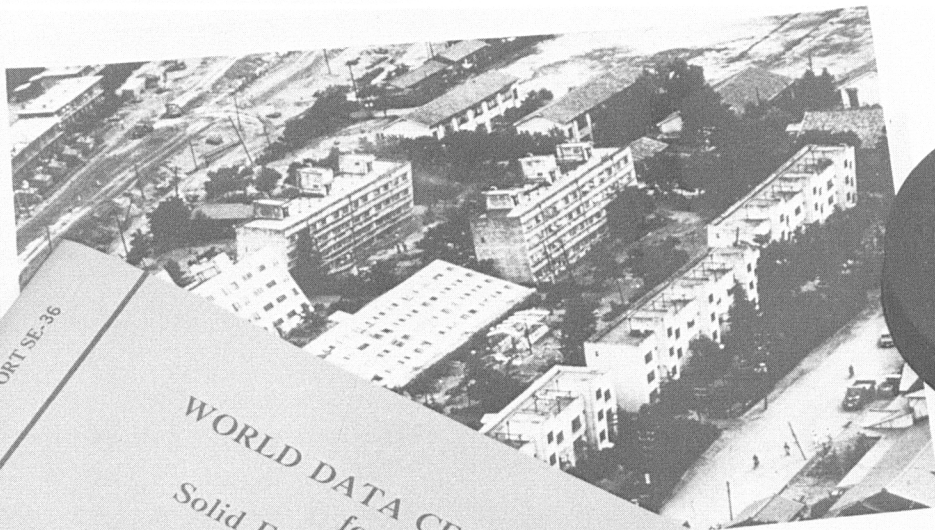
U.S. DEPARTMENT OF COMMERCE • National Oceanic and Atmospheric Administration

National Environmental Satellite, Data, and Information Service

National Geophysical Data Center

Boulder, Colorado 80303


January 1987



REPORT SE-36

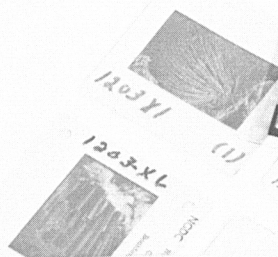
WORLD DATA CENTER A

for
Solid Earth Geophysics

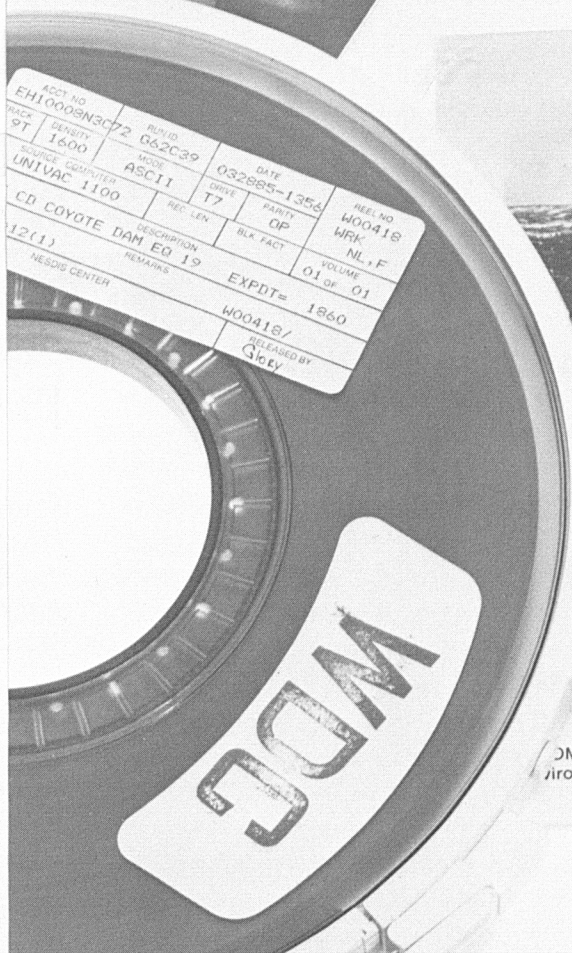


OF SUBMARINE VOLCANOES AND HYDROLOGICAL PHENOMENA
ASSOCIATED WITH VOLCANIC EVENTS
1500 B.C. TO DECEMBER 31, 1899
September 1984
GEOPHYSICAL DATA CENTER

CATALOG OF GEOLOGICAL AND GEOPHYSICAL DATA 1/1982
for the NATIONAL PETROLEUM RESERVE IN ALASKA
KEY TO GEOPHYSICAL RECORDS DOCUMENTATION NO. 16

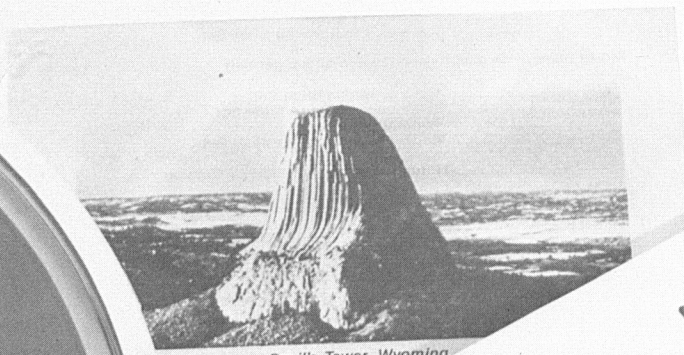


in your national
data center



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WDC



Devil's Tower, Wyoming

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COMMERCE National Oceanic and Atmospheric Administration
Environmental Data and Information Service

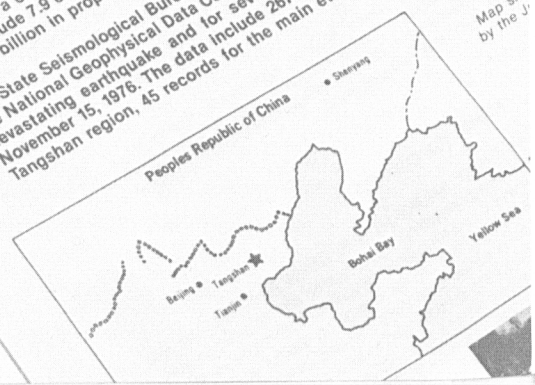
地震

DATA ANNOUNCEMENT

NEW DIGITAL STRONG-MOTION DATA FROM THE PEOPLES REPUBLIC OF CHINA

Tangshan, a city of one million inhabitants in northeastern China, was destroyed by a magnitude 7.9 earthquake in July 1976. About one-fourth of its citizens were killed, and \$2 billion in property damage was sustained.

The State Seismological Bureau of the Peoples Republic of China recently furnished the National Geophysical Data Center (NGDC) with digital strong-motion data from a devastating earthquake and for several strong aftershocks that occurred November 15, 1976. The data include 287 records produced by accelerographs in the Tangshan region, 45 records for the main event, and 222 for the aftershocks.



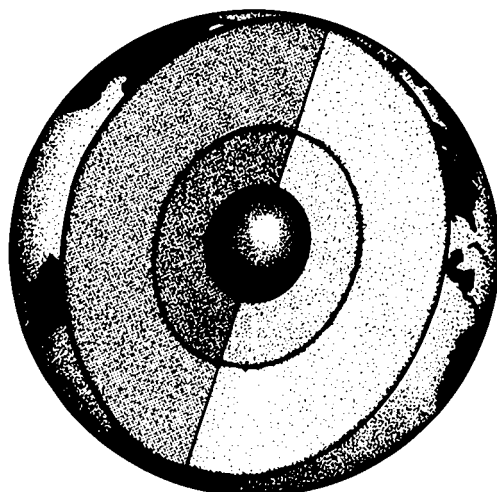
Map shown by the U.S.

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Cover Photograph: Earthrise from the Moon (NASA Photo).

Introduction



The National Oceanic and Atmospheric Administration (NOAA) collects, manages, and disseminates many kinds of scientific data that result from our inquiry into the environment. The National Geophysical Data Center (NGDC), one of the several data-management centers of NOAA, is responsible for data activities in the fields of *seismology, gravity, topography, geomagnetism, geothermics, marine geology and geophysics, and solar-terrestrial physics*. NGDC also provides facilities for World Data Center-A (including the disciplines of Solid Earth Geophysics, Marine Geology and Geophysics, Solar-Terrestrial Physics, and Glaciology—Snow and Ice) under the auspices of the National Academy of Sciences.

This pamphlet briefly describes the principal products and services NGDC provides through its Solid Earth Geophysics Division (SEG). Among the most important activities of SEG are acquiring and archiving data, processing and formatting data into standard sets, developing useful data products for customers, and advertising and disseminating data to the scientific, academic, and industrial communities.

SEG data support many scientific and engineering endeavors, both in the assessment and mitigation of geologic hazards (for example, earthquakes and tsunamis) and in the exploration for minerals and petroleum. SEG data also support basic and applied research in many of the earth science and engineering disciplines. Customers range from the general public, to data managers, engineers, and scientists in private industry, academia, and Federal and State Governments.

SEG provides data and products in the fields of *seismology* (including earthquake and engineering seismology and tsunami), *gravity, topography, land seismic reflection, geomagnetism* (both Earth-surface, airborne, and satellite data), *geothermics, and geochemistry*. Typical services include:

- Selective searches of data bases
- Customized data retrieval and output
- Computer-generated data products—including formatted listings, data summaries, map plots
- Technical reports, catalogs of data inventories
- Facilities for guest workers
- Publication of selected reports for other organizations (through World Data Center-A)
- International data exchange (through World Data Center-A)
- Data systems for managing all types of geoscience data
- Data management and archival for special projects



Cooperative Institutes

To foster the development of technology in remote sensing, mineral and energy resources, and management and application of geoscience data bases, NGDC has joined with the University of Colorado and the Colorado School of Mines to form two cooperative institutes:

- Cooperative Institute for Research in Environmental Sciences (CIRES)
- Cooperative Institute for Geodata Management and Applications (CIGMA)

CIRES, managed by the University of Colorado, is involved in a wide range of activities—glaciology research (including directing the National Snow and Ice Data Center for NGDC), remote sensing (including operating the newly formed Center for Earth Observations and Remote Sensing), seismology, and many other disciplines.

CIGMA, operated by the Colorado School of Mines, was recently established to foster research and development focused on the management and application of large geoscience data bases.

Additionally, NGDC's parent organization—National Environmental Satellite, Data, and Information Service—is establishing several cooperative institutes that will focus on remote sensing as applied to natural resources. Each of these institutes is dedicated to increasing the synergetic benefits of cooperative research and development for scientists in Government, academia, and industry. Inquiries about these institutes may be directed to NGDC.

World Data Center-A

World Data Center-A for Solid Earth Geophysics (WDC-A) exchanges data internationally, and assists scientists in obtaining copies of original or calibrated data held by other scientists or other World Data Centers. WDC-A also publishes data reports, maps, and compilations, including selected manuscripts, for international organizations. Both NGDC and WDC-A encourage data-exchange agreements with other organizations.

Visiting Scientists Program

NGDC and WDC-A operate a modest visiting scientist program, which provides space and access to computers, plotters, and data files to researchers who need to access large amounts of data. Contact NGDC for details.

Mail Lists

Data announcement fliers often are issued to advise the public of the availability of new or revised data. These announcements include source of data, a brief description, geographical coverage, dates of surveys or events, and specific information for ordering. Summary catalogs describe specific data sets and services (see p. 18).

NGDC maintains mailing lists that are used to announce the availability of new data in all disciplines. Data-announcement fliers and other materials are mailed to names on those lists as new data become available. You may request that your name be added to a specific mailing list by writing NGDC.

Information for Ordering

For more information on any of the data or products in this brochure, please write to NGDC at the address below or call the telephone number given. Please note that regulations of the U.S. Department of Commerce require prepayment on all non-Federal orders. Telephone orders will be accepted, but data cannot be shipped until payment or credit card authorization is received. Checks and money orders must be made payable to COMMERCE/NOAA/NGDC. Or orders may be charged to American Express, MasterCard, or Visa card, by telephone or letter. Inquiries, orders, and payment should be addressed to:

*National Geophysical Data Center
NOAA, Code E/GCI
325 Broadway
Boulder, CO 80303 USA*

*Direct telephone inquiries for general information to:
Commercial: (303) 497-6419
FTS: 320-6419
Telex: 592811 NOAA MASC BDR*

Global Data Sets

The global habitat is becoming an increasingly popular subject for research. Global assessment of the environment and natural resources of all types is being done by national and international organizations. Projects such as the International Geosphere-Biosphere Project, a major interdisciplinary, cooperative effort scheduled for the 1990s, are designed to coordinate and increase efforts in this work. Geographic information systems and remote sensing (see sections that follow), which are vital to the development of global data sets, are important techniques for such studies.

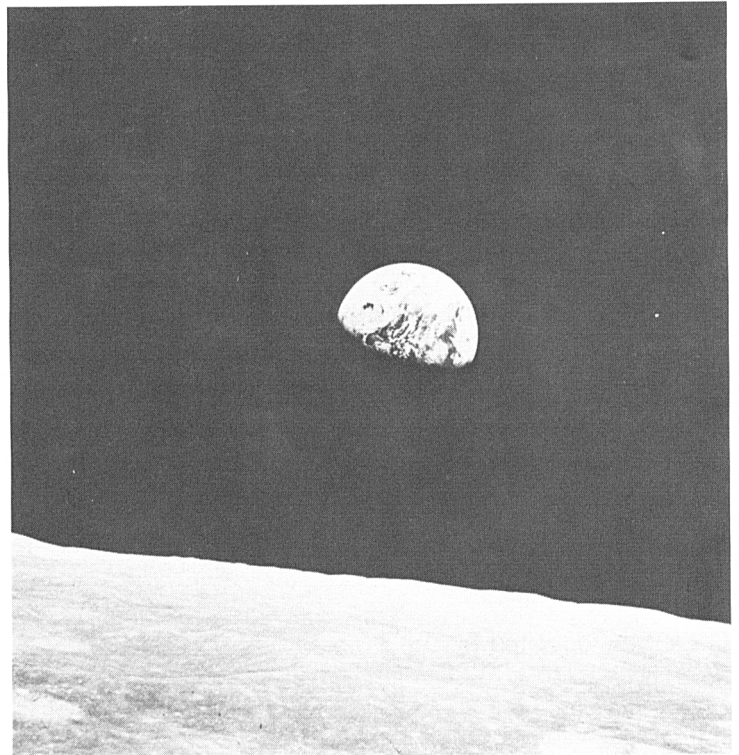
NGDC is working to enhance the quality of its existing data and to develop new data bases, and encourages other organizations to develop compatible data sets for global assessments (see section on *World Data Center-A*).

Geographic Information System

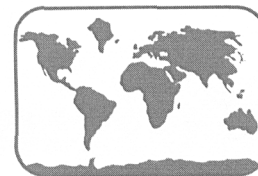
A Geographic Information System (GIS) consists of a multi-category map-registered data base, which is digitized and stored with associated files of tabular data on a computer. The data base may include geological, geophysical, topographic, base-map (including coastlines, political boundaries), and other types of data. The computer system stores and manipulates the data, which can aid analysts in solving myriad problems. Resultant information may be displayed in any of several map-based or tabular-report formats.

SEG has successfully used GIS technology to manage inventories of data at NGDC, and plans further GIS development. SEG, who also has used GIS and image-processing technology to provide unique quality-control checks of several kinds of data, now provides a GIS service facility for other research laboratories.

One of the most important aspects of GIS technology is data management. NGDC's long experience in this area places it in a unique position to assist GIS facilities in management of data—including non-geoscience data. NGDC welcomes inquiries about this and other services.



Earthrise from the Moon (NASA Photo)



Remote Sensing

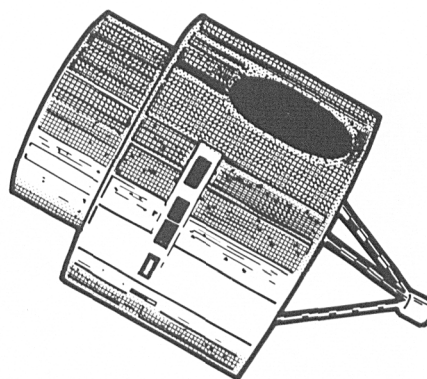
Remote sensing is broadly defined as the observation of Earth from a distance. Although gravity, aeromagnetism, seismics, and some other geophysical methods technically involve remote sensing, this term is most commonly associated with airborne or spaceborne imagery, such as that from Landsat or from aircraft multispectral scanners.

Remotely sensed imagery provides a means of rapidly interpreting the land surface—and by inference, the subsurface—using established and experimental procedures of analysis and interpretation. These procedures include both manual and digital techniques.

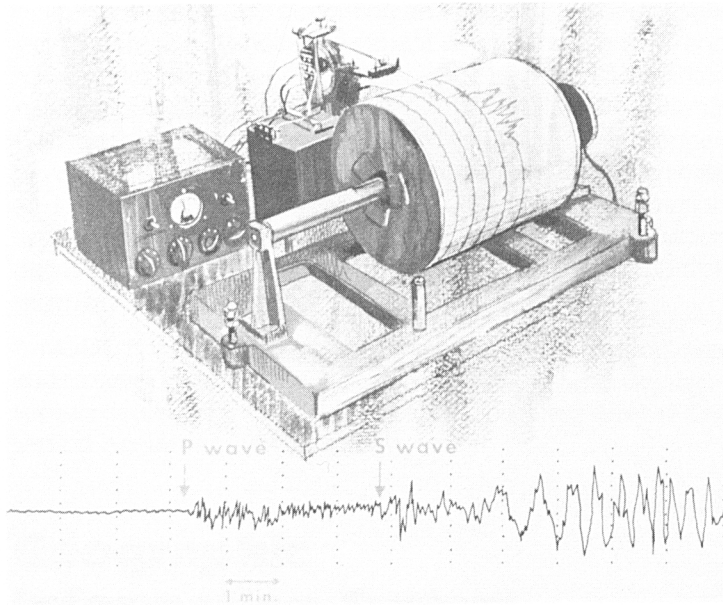
The integration of remotely sensed imagery, as well as derived analyses and interpretations, provides valuable data for inclusion in a GIS (see previous section). Remote sensing has proven useful in mineral and petroleum exploration, hydrologic and engineering investigations, agriculture and forestry studies, and land-use planning. Future applications of remote-sensing techniques include siting and monitoring of waste repositories and processing plants, and location and cleanup of old, contaminated sites.

NGDC is coordinating the development of a group to assist users of NOAA polar-orbiter satellite data, including the Advanced Very High Resolution Radiometer, which is being increasingly used in regional remote-sensing studies because of its frequent and wide-area coverage and its low cost. NGDC also is investigating the use of these and other data for base maps and interpretive tools, and as constituents of a GIS (see previous section).

The technology of digital image processing, which was developed for remotely sensed imagery of Earth, medical imagery, and others, also can be used to process and display geophysical, topographic, and other data. And it can assist in providing better control of data quality. NGDC scientists plan to use this technology increasingly in data management as well as in scientific investigations.



Seismology



The word seismology comes from the Greek word *seismos*, meaning earthquake. Several of the more than a million earthquakes occurring throughout the world each year are large enough to cause many deaths and injuries and heavy property damage. Therefore, NGDC and WDC-A collect data on earthquakes for the researcher and engineer who are studying ways to reduce the earthquake hazard—and for the lay person who is interested in learning more about the vagaries of Planet Earth. Earthquake data bases include:

- **Earthquake Hypocenters**—A global file of data of 600,000 earthquakes and other earth disturbances, 1897-1986 (plus damaging events prior to 1897). Each record includes date and origin time of event, and geographic location, and may include depth, magnitude, maximum intensity, and related earthquake phenomena (e.g., casualties, damage, faulting, volcanism, tsunamis). This data base was formed from data furnished by the U.S. Geological Survey (USGS—earlier data were provided by the U.S. Coast and Geodetic Survey and NOAA), California Institute of Technology, University of California, California Division of Mines and Geology, Lamont-Doherty Geological Observatory, Academy of Science of the USSR, Bureau Central International de Seismologie, International Seismological

Centre, Department of Energy, Mines, and Resources of Canada, Japan Meteorological Agency, New Zealand Department of Scientific and Industrial Research, and many other sources worldwide. A descriptive catalog (*KGRD-21, Summary of Earthquake Data Base*) is available. Data retrievals (computer printout listing, map plot) by:

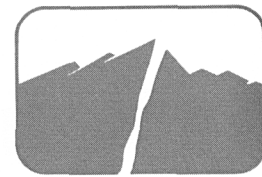
- Geographic area
- Area in a radius (e.g., 75-km radius of 37° N, 121° W)
- Time period (e.g., 1900-82)
- Magnitude range/depth (e.g., magnitude 5 and larger)
- Maximum intensity (Modified Mercalli—MM)
- Cultural effects (e.g., damage, casualties)
- Associated phenomena (e.g., faulting, tsunamis)
- Any combination of the above.

The complete data file is available on 9-track magnetic tape (1,600 or 6,250 bpi; ASCII or EBCDIC character sets) sorted either chronologically or geographically. Quarterly updates are available on magnetic tape (only *Preliminary Determination of Epicenters*).

- **Significant Earthquakes**—A global file holding data on 2,500 destructive earthquakes, 2000 B.C.-A.D. 1986. Each record meets one or more of the following criteria: \$1 million (1979 dollars) or higher damage, 10 or more deaths, magnitude 7.5 or larger, or MM intensity X or larger. Each record contains (where available): date and time of occurrence, latitude and longitude of city or area, depth, Richter magnitude, number of casualties, damage, and literature citations. A descriptive catalog (*Report SE-27, Catalog of Significant Earthquakes, 2000 B.C.-A.D. 1979*) is available. Data retrievals (computer printout listing, map plot) by:

- Geographic area
- Time period
- Dollar amount of damage
- Number of deaths
- Any combination of the above.

The complete data file is available on 9-track magnetic tape (1,600, or 6,250 bpi; ASCII or EBCDIC character sets).



Tsunami Damage at Seward, Alaska, Port Facilities (March 1964).

● **Earthquake Intensities**—Holds data on 22,000 earthquakes, 1638-1982, for the United States. It contains 140,000 earthquake MM intensity observations gathered from many sources. Each record contains date, time, and geographic location of earthquake (where available); name of reporting cities and their geographic locations; and MM intensity at each city. *KGRD-19, Summary of Earthquake Intensity File*, describes this data base. Data retrievals (computer printout listing, magnetic tape, map plot and limited retrievals on 5¼" floppy disks) by:

- Geographic area
- Area in a radius (e.g., 100-km radius of 40° N, 112° W)
- Time period
- City, State name
- MM intensity range
- Any combination of the above.

The complete data file is available on 9-track magnetic tape (1,600 or 6,250 bpi; ASCII or EBCDIC character sets). Felt and not-felt questionnaire reports and newspaper clippings can be purchased on 16-mm microfilm.

● **Tsunami (Seismic Seawaves)**—A unique set of data bases that support the interests of engineers, oceanographers, and seismologists. A descriptive data announcement is available. Specific holdings include:

● **Historic Tsunami Data (2000 B.C.-A.D. 1986):**

Global data base holds about 6,600 digital records for 2,000 events, including data on tsunamis in the Mediterranean and Caribbean Seas and the Atlantic, Indian, and Pacific Oceans. Each entry contains cause of event and source location, magnitude of generating earthquake and tsunami, wave height at 4,500 locations, description of damage, number of deaths, and event validity. A descriptive data announcement is available. Data retrievals (computer printout) by:

- Geographic area
- Time period
- Tsunami or earthquake magnitude
- Maximum wave runup height
- Any combination of the above.

Seismology (Cont.)

- **Tide Gage Records:** Includes about 3,100 records of tsunamis dating from the year 1850 from United States and foreign tide stations (on microfiche; also a few digital records).
- **Photograph File:** Contains more than 700 photographs of property damage, coastline flooding, and advancing waves (35-mm slides, glossy prints). See "Tsunami Slide Set" described in next section.
- **Natural Hazards Slide Sets**—Several unique sets of 35-mm slides that depict geologic hazards throughout the world. These slide sets provide a unique and affordable tool for presentation to both technical and nontechnical audiences. Each set includes 20 slides (and a list of description captions) on the following subjects:
 - **Earthquake Damage—General (Color):** Illustrates several kinds of effects caused by 11 earthquakes in 7 countries, including strike-slip and thrust faulting, surface ruptures, landslides, fissuring, slumping, and sand boils, as well as structural damage.
 - **Earthquake Damage, San Francisco, California, Apr. 18, 1906 (B&W):** Includes a panoramic view of San Francisco in flames a few hours after earthquake, dramatic damage scenes from the area, and other unique photographs.
 - **Earthquake Damage, Mexico City, Mexico, Sept. 1985 (Color):** Shows different types of damaged buildings and major kinds of structural failure.
 - **Earthquake Damage to Transportation Systems (B&W, Color):** Depicts earthquake damage to streets, highways, bridges, overpasses, and railroads caused by 14 earthquakes in Guatemala, Japan, Peru, and United States.
 - **Earthquake Damage to Schools (B&W, Color):** Represents 13 destructive earthquakes that occurred in 7 countries from 1886 to 1980, and graphically illustrates potential danger to school structures from major earthquakes.
 - **Tsunami—General (B&W, Color):** Depicts advancing waves, harbor damage, and before-and-after structural damage caused by 13 tsunami events occurring in the past 95 years in the Pacific region.

Earthquake Damage at
Charleston, S.C., August 1886.



- **Volcanoes in Eruption (B&W, Color):** Depicts explosive eruptions, nuees ardentes, lava fountains and flows, steam eruptions, and fissure eruptions from 20 volcanoes. Volcano types include caldera, cinder cone, complex, fissure vent, lava dome, shield, and island-forming.
- **Volcanic Effects (Color):** Illustrates several rock formations and features resulting from volcanism in Australia, Canary Islands, New Zealand, Scotland, and United States. Includes illustrated brochure.
- **Strong-Motion Accelerograph Records**—A file of digital data on about 365 earthquakes, 1933-86, that occurred in 16 different countries or island groups. *Report SE-38, Strong-Motion Accelerograph Records*, describes the NGDC strong-motion program. Data retrievals (on magnetic tape, floppy disk) by:
 - Date of earthquake
 - Acceleration of gravity
 - Recording station
 - Country/State
 - Any combination of the above.



Data are available for the following regions:

- Asia: China, Japan, Taiwan
- Europe: Italy, Rumania, USSR
- Western Hemisphere: Chile, El Salvador, Mexico, Nicaragua, Peru, United States (including Alaska, California, Hawaii, Mississippi, Missouri, Montana, Nevada, New Hampshire, South Carolina, Washington)
- Western Pacific Ocean: New Zealand, Papua New Guinea, Solomon Islands, Tonga/Fiji Islands.

Other data available from SEG are:

- **Reld Earthquake Catalog**—A comprehensive collection of earthquake and volcano data detailed on 3" by 5" index cards and in newspaper clippings; covers from the time before Christ to 1931. Available on 16-mm microfilm.
- **Historical Seismograph Station Bulletins**—Includes 400,000 pages from bulletins, from about 500 seismograph stations worldwide (1900-65). Available on 16-mm microfilm and 105-mm microfiche. *Report SE-37, Inventory of Filmed Historical Seismograms and Station Bulletins at World Data Center A*, describes these bulletins.

NGDC Earthquake Intensity File Search: Earthquakes of intensity 8+ within 75 km of 37°N, 121°W, 1900-82. Jerry Coffman, NGDC

STATE	CITY	MM INT	COORDINATES N LAT (deg)	LONG (deg)	DISTANCE FROM SOURCE (km)	*****EARTHQUAKE UT YEAR MO DA HR MN SEC	SOURCE INFORMATION COORDINATES N LAT LONG (deg) (deg)	MAG	DEPTH (km)
CA	SAN JUAN BAUTISTA	11	36.84	121.54W	182	1906 04 18 13 13	38.00 123.00W	8.3	0025
CA	CHITTENDEN	10	36.91	121.61W	173	1906 04 18 13 13	38.00 123.00W	8.3	0025
CA	WATSONVILLE	10	36.92	121.76W	163	1906 04 18 13 13	38.00 123.00W	8.3	0025
CA	BLANCO	9	36.68	121.73W	185	1906 04 18 13 13	38.00 123.00W	8.3	0025
CA	BUCKER	9	37.05	121.59W	163	1906 04 18 13 13	38.00 123.00W	8.3	0025
CA	MOSS LANDING	9	36.80	121.79W	171	1906 04 18 13 13	38.00 123.00W	8.3	0025
CA	COYOTE	8	37.22	121.74W	141	1906 04 18 13 13	38.00 123.00W	8.3	0025
CA	GILROY	8	37.01	121.57W	168	1906 04 18 13 13	38.00 123.00W	8.3	0025
CA	HOLLISTER	8	36.85	121.40W	191	1906 04 18 13 13	38.00 123.00W	8.3	0025
CA	LOS BANOS	8	37.06	120.84W	218	1906 04 18 13 13	38.00 123.00W	8.3	0025
CA	MORGAN HILL	8	37.12	121.65W	154	1906 04 18 13 13	38.00 123.00W	8.3	0025
CA	NEWMAN	8	37.32	121.03W	190	1906 04 18 13 13	38.00 123.00W	8.3	0025
CA	SALINAS	8	36.67	121.65W	190	1906 04 18 13 13	38.00 123.00W	8.3	0025
CA	SAN JUAN BAUTISTA	8	36.84	121.54W	182	1906 04 18 13 13	38.00 123.00W	8.3	0025
CA	SANTA CLARA	8	37.19	121.71W	145	1906 04 18 13 13	38.00 123.00W	8.3	0025
CA	SOLEDAD	8	36.42	121.33W	230	1906 04 18 13 13	38.00 123.00W	8.3	0025
CA	VOLTA	8	37.10	120.93W	208	1906 04 18 13 13	38.00 123.00W	8.3	0025
CA	WATSONVILLE (10 MI E)	8	36.90	121.59W	175	1906 04 18 13 13	38.00 123.00W	8.3	0025
CA	COYOTE	8	37.22	121.74W	4	1911 07 01 22 22	37.25 121.75W	6.6	
CA	GILROY	8	37.01	121.57W	31	1911 07 01 22 22	37.25 121.75W	6.6	
CA	MORGAN HILL	8	37.12	121.65W	17	1911 07 01 22 22	37.25 121.75W	6.6	
CA	SANTA CLARA	8	37.19	121.71W	8	1911 07 01 22 22	37.25 121.75W	6.6	
CA	WATSONVILLE (10 MI E)	8	36.92	121.78W	9	1954 04 25 20 20 28	36.93 121.68W	5.3	

TOTAL NUMBER OF EVENTS RETRIEVED IS 23

NATIONAL GEOPHYSICAL DATA CENTER/NOAA BOULDER, COLORADO 80303

PAGE 1

Example of Computer Retrieval from EARTHQUAKE INTENSITY DATA BASE

Gravity

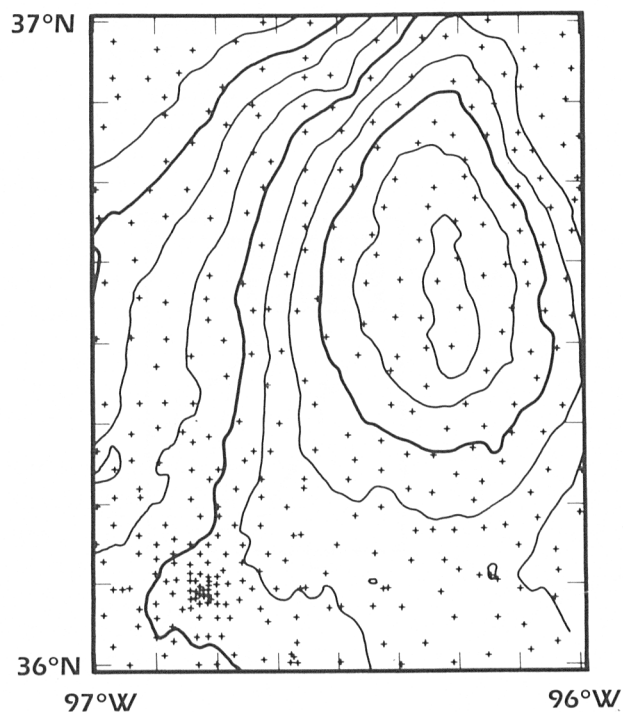
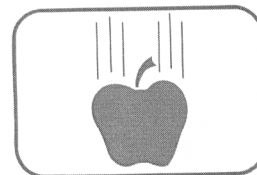
Gravity data have many applications, both on Earth's surface and in space. They include:

- Searching for oil, gas, and mineral deposits
- Identifying hazards
- Calibrating inertial navigation and guidance systems
- Computing Earth gravitational models

The largest and most active files of gravity data at NGDC are the digital gravity files of the United States, contributed by many organizations and compiled by the Defense Mapping Agency (DMA) and the NOAA National Geodetic Survey (NGS). In addition, NGDC archives some international gravity data and marine gravity data.

Digital gravity data include:

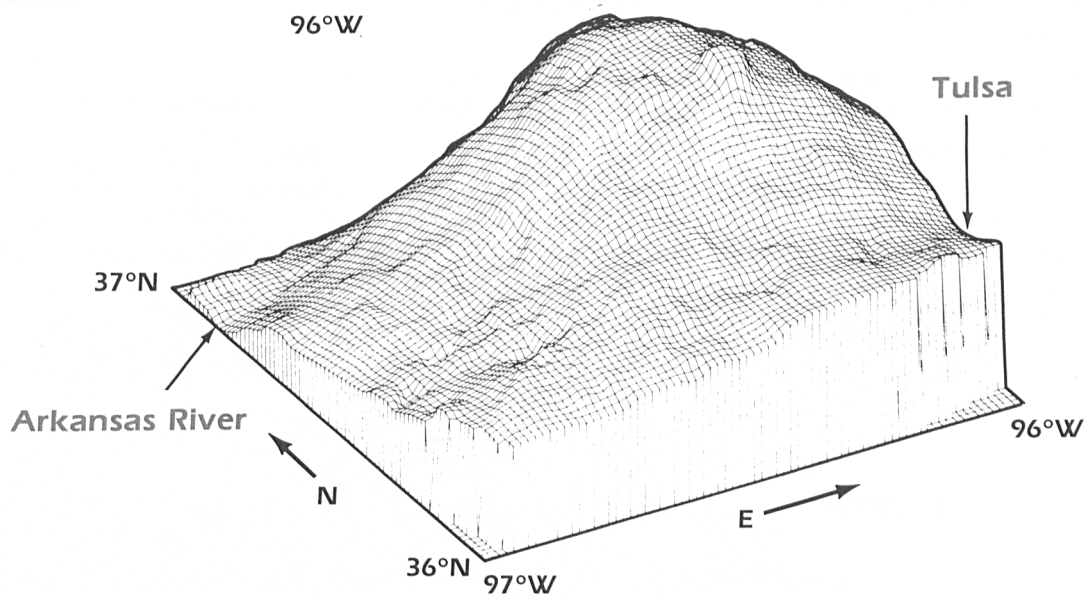
- U.S. gravity data base, which was compiled by DMA, contains information on more than 725,000 gravity stations in the conterminous United States and Alaska. The file holds:
 - Bouguer and free-air anomalies (including standard deviation), observed gravity
 - Latitude and longitude
 - Elevation
 - Documentation reference numbers
- U.S. terrain-corrected gravity file, compiled by the National Geodetic Survey (NGS) of NOAA. Each record has indicators that define data quality and includes terrain corrections for all point gravity values where substantial variations in local topography exist. The file contains data on 860,000 gravity stations.
- U.S. gridded gravity data base, constructed by the USGS. The data are on a 4- by 4-km grid and consist of observations for the conterminous United States (Bouguer anomaly) and U.S. continental shelf (free-air anomaly). The data base was contoured to produce the "Gravity Anomaly Map of the United States," published by the Society of Exploration Geophysicists.
- National Petroleum Reserve—Alaska (NPRA) observations, compiled by USGS. This data file consists of free-air and Bouguer (non-terrain corrected) data from 53,000 stations.
- Southwest Alaska and Arctic National Wildlife Range (ANWR) data, compiled and corrected by USGS. This data base consists of:
 - Non-terrain corrected gravity data from the southwest peninsula of Alaska
 - Terrain corrected gravity for the ANWR
 - 3-min mean elevation data used to correct the ANWR gravity data
 - 1-min mean elevation for ANWR
 - Quarter-minute mean elevations for ANWR
- California-Nevada data, compiled by USGS. Each of the 60,000 observations includes observed gravity; free-air, Bouguer, and isostatic anomalies; terrain corrections; and elevation.
- New Mexico gridded gravity data, compiled by University of Texas at El Paso. The file consists of 21,000 points and was used to create the overlay map, *Bouguer Gravity Anomaly Map of New Mexico*.
- Isostatic anomaly data, compiled by the USGS. These data were used to produce the *Isostatic Residual Gravity Map of the United States*. The data are on a 4- by 4-km grid and consist of 1 million points.
- Global gravity data from GEOS-3 satellite, compiled by Ohio State University. This data set includes gravity data for the world on a 1° by 1° grid as well as geodetic observations from GEOS-III satellite altimetry data.
- Antarctic data (south of 45° South), containing both land and marine data. Compiled by NOAA and DMA, this file contains 57,000 observations.



Gravity Contour Plot
Contour Interval = 5 mgal

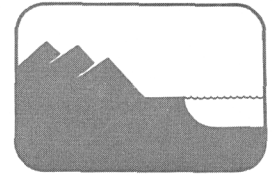
North-Central Oklahoma

Gravity Transect Plot
Grid Interval ~ 0.7 N.M.



Gravity Data Produced by Potential Fields Graphics System.

Topography



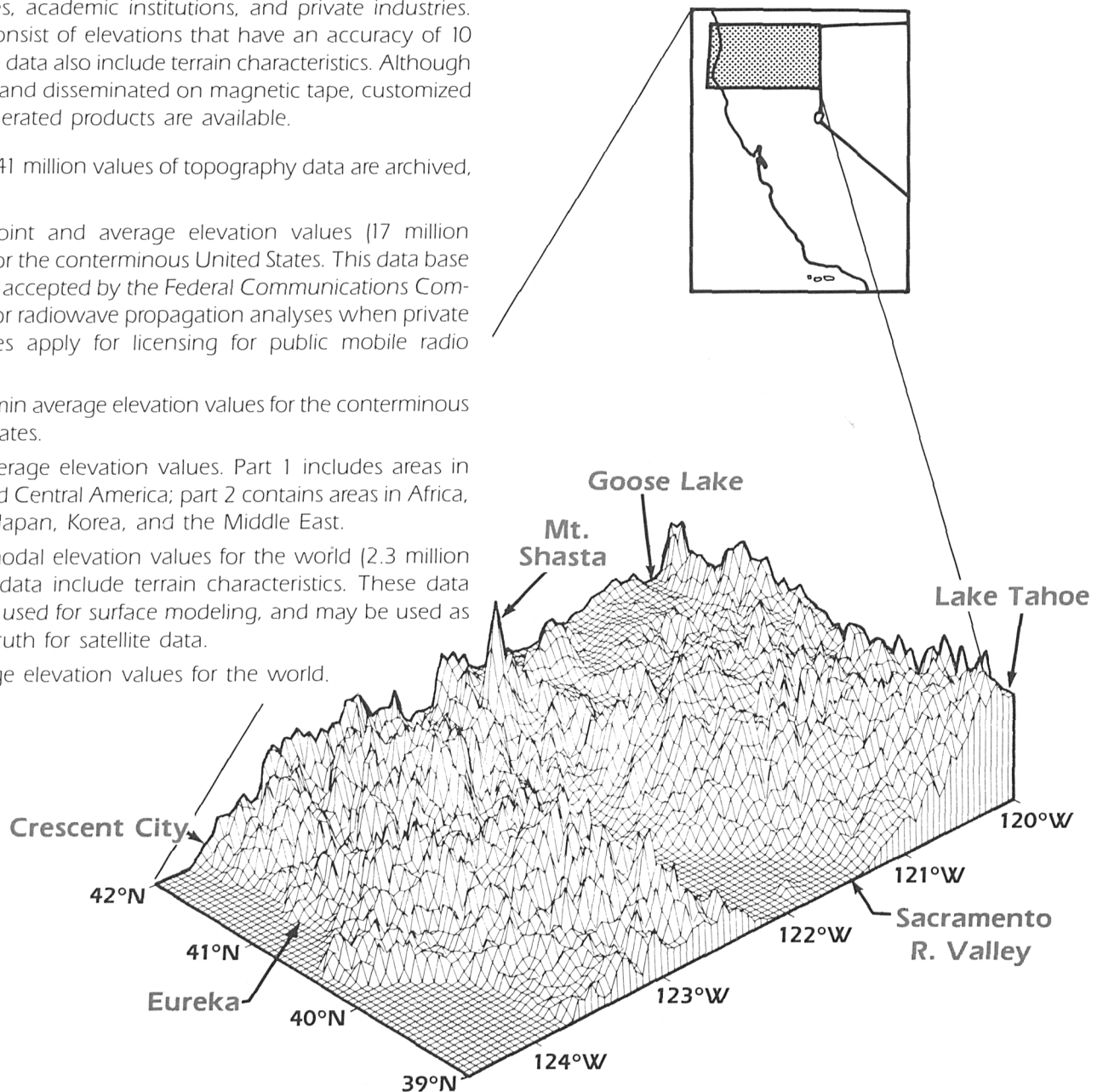
Topography is the general layout of a land surface, including its relief and the position of its features—both manmade and natural. Measurements that are taken while surveying land are used to make feature maps of the surface. In conjunction with surface or satellite measurements, topography data also are used to evaluate resources or hazards.

NGDC obtains topographic data from several U.S. Government agencies, academic institutions, and private industries. These data consist of elevations that have an accuracy of 10 to 20 m; some data also include terrain characteristics. Although data are held and disseminated on magnetic tape, customized computer-generated products are available.

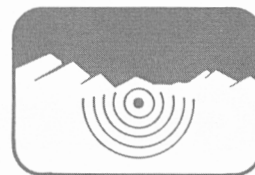
More than 41 million values of topography data are archived, including:

- 30-sec point and average elevation values (17 million records) for the conterminous United States. This data base has been accepted by the Federal Communications Commission for radiowave propagation analyses when private companies apply for licensing for public mobile radio service.
- 1- and 3-min average elevation values for the conterminous United States.
- 5-min average elevation values. Part 1 includes areas in North and Central America; part 2 contains areas in Africa, Europe, Japan, Korea, and the Middle East.
- 10-min modal elevation values for the world (2.3 million records); data include terrain characteristics. These data often are used for surface modeling, and may be used as ground truth for satellite data.
- 1° average elevation values for the world.

Three-Dimensional Plot of Topography Data for Northern California



Land Seismic Reflection



The seismic method of geophysical prospecting uses the generation, reflection, refraction, detection, and analysis of acoustic waves in Earth. NGDC files contain land seismic data for several areas in the United States:

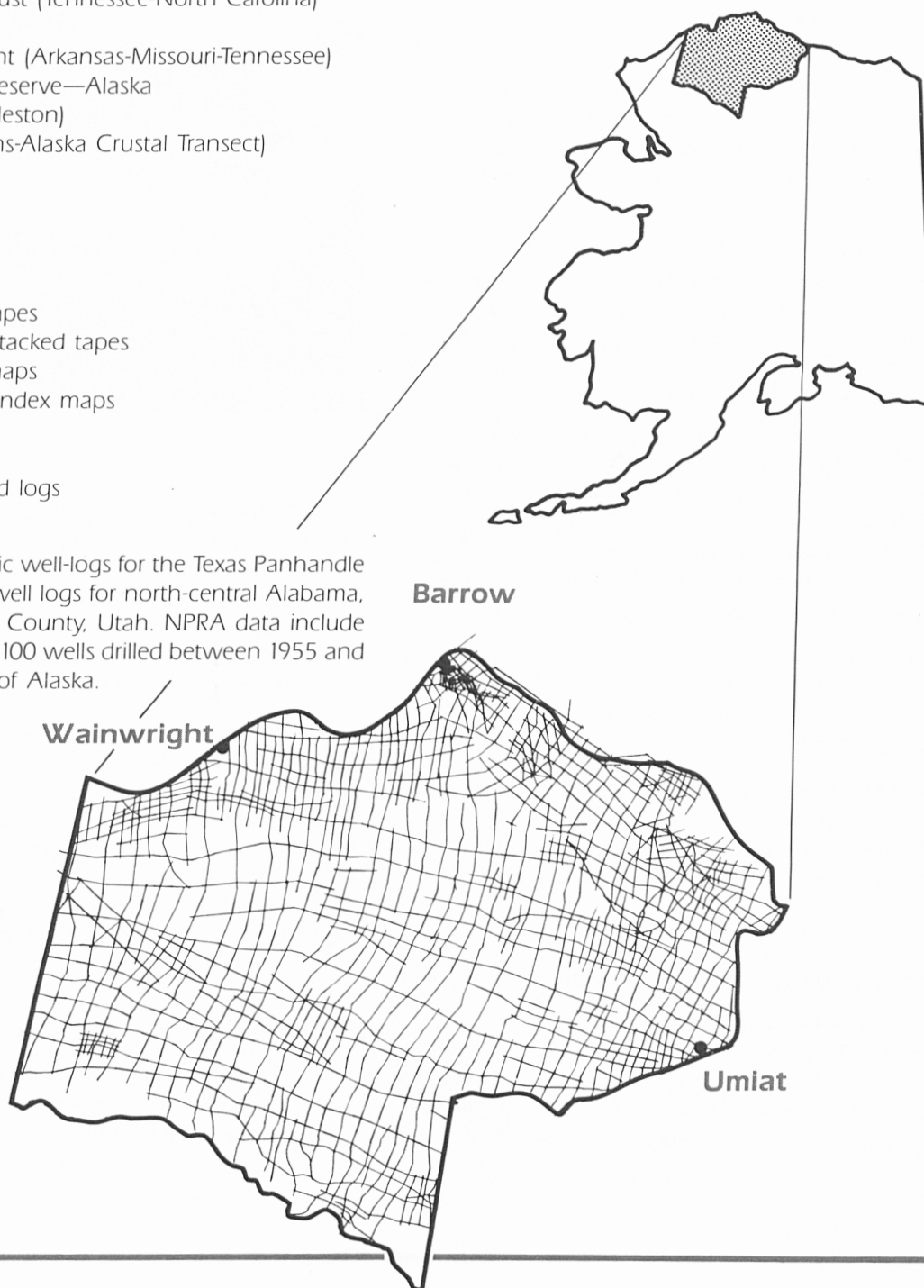
- Appalachian Overthrust (Tennessee-North Carolina)
- Central Virginia
- Mississippi Embayment (Arkansas-Missouri-Tennessee)
- National Petroleum Reserve—Alaska
- South Carolina (Charleston)
- Southern Alaska (Trans-Alaska Crustal Transect)
- Texas Panhandle
- Wyoming (Red Bird)

Data may include:

- Demultiplexed field tapes
- Unfiltered/ungained stacked tapes
- Shot-point location maps
- Seismic line location index maps
- Stacked sections
- Velocity analyses
- Survey field notes and logs
- Descriptive texts

NGDC also archives seismic well-logs for the Texas Panhandle and the NPRA, and coal well logs for north-central Alabama, east Kentucky, and Emery County, Utah. NPRA data include information on more than 100 wells drilled between 1955 and 1981 on the North Slope of Alaska.

Land Seismic-Reflection Surveys on Alaska's North Slope



Geomagnetism

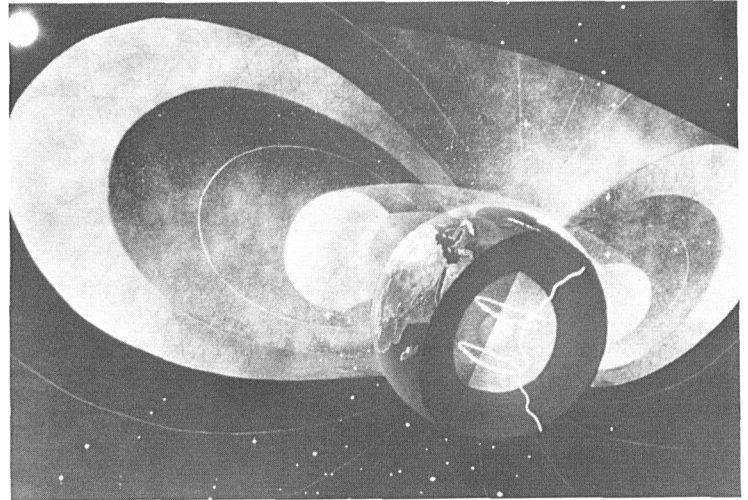
Geomagnetism, the study of Earth's magnetism, is the oldest branch of geophysics. We do not know when people first began to use Earth's magnetism in a practical way, but it clearly was many centuries ago. The first practical use of geomagnetism probably was for navigating the oceans, and today it influences our lives in many additional ways ranging from finding one's way through a forest to prospecting for petroleum and minerals.

Basic geomagnetic data can be divided into Earth-surface, airborne, and satellite observations. A fourth category is represented by mathematical models of the magnetic field, which use data from any of the other three types of observations.

- **Earth-Surface Vector Data.** To measure Earth's magnetic field at any location, scientists determine the direction, intensity, and variation of the field. Data gathered from these studies have been linked to such diverse occurrences as changes in global climate, several diseases, and strandings of marine mammals. These data include:

- Magnetic Field Survey Data. This file contains about 310,000 high-quality magnetic observations taken from air, land, and ocean surveys worldwide since 1900. Three magnetic elements listed below were observed at most locations. Where possible, the values for other magnetic elements (usually the north component and east component) were computed:
 - Declination, inclination, and horizontal intensity, or
 - Declination, horizontal intensity, and vertical intensity or total intensity.
- Secular Change Data. This file contains the Observatory Annual Means Data and International Repeat Station Data. It is the main source for tracking the long-period changes in the direction and intensity of Earth's magnetic field.
- The Observatory Annual Means File holds about 13,000 observations from observatories operating since about 1800.
- The International Repeat Station File contains about 11,000 measurements (including latitude, longitude, and altitude) of the magnetic field taken at exact re-occupations of sites of previous observations.

Earth's Magnetic Field

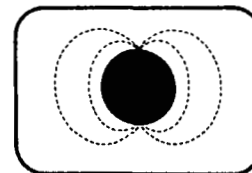


- **Airborne (Aeromagnetic) Data.** Results of magnetic observations made since 1953 using airborne magnetometers are held in this data base. The U.S. Geological Survey (USGS) is a major contributor of the data, which now are available as digital records on magnetic tape or as profiles on microfilm. The NGDC archive contains 37 million observations covering more than 250 surveys.

Airborne observations have many uses, including exploration for oil and minerals, modeling of magnetic fields, and geophysical research. Surveys include both low- and high-density data. The low-density data are usually observed at higher altitudes and are used mainly for modeling and charting of the main magnetic field. High-density data are used mainly for magnetic anomaly mapping, mineral and petroleum exploration, and other geologic studies.

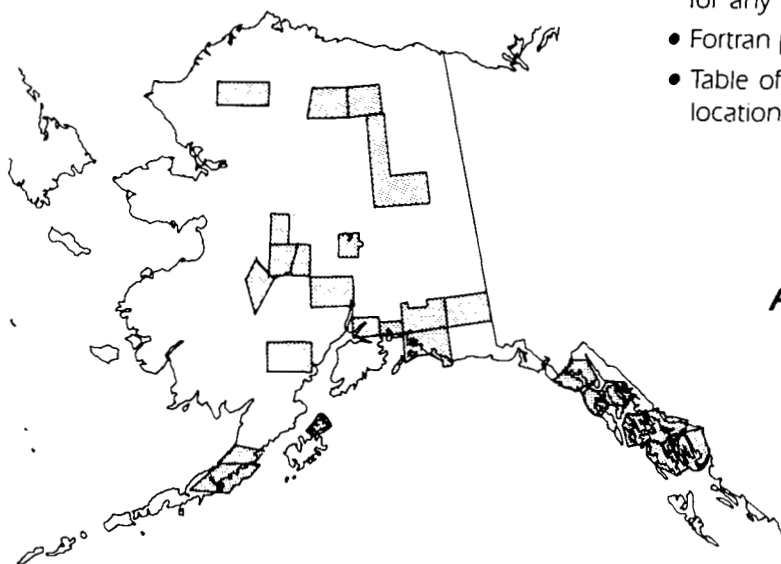
Areas surveyed and data contributors are:

- World coverage, mostly ocean areas (Project Magnet, U.S. Naval Oceanographic office)
- Canada (Department of Energy, Mines and Resources)



- Nordic countries and Iceland, Greenland Sea; British Columbia, Pacific Ocean; Canadian Arctic; West, Central, and Eastern Canada (Department of Energy, Mines and Resources)
- Greenland Sea (Woods Hole Oceanographic Institution)
- Vale-Owyhee; central and northern Cascades; portions of Cascades in north California and south Oregon (Oregon State University)
- Northeast, central, and east-central Minnesota (Minnesota Geological Survey)
- South Michigan Peninsula (Michigan State University)
- Conterminous United States and worldwide (U.S. Naval Oceanographic Office)
- Japan (Japanese Maritime Safety Agency)
- Antarctic-Greenland (National Science Foundation)
- Atlantic continental margin (U.S. Geological Survey)
- National Petroleum Reserve—Alaska (U.S. Geological Survey)
- Portions of Continental United States and Alaska (U.S. Geological Survey)
- Arctic Basin (U.S. Naval Research Laboratory, U.S. Naval Oceanographic Office, U.S. Naval Ocean Research and Development Activity, and Woods Hole Oceanographic Institution)

Gridded aeromagnetic data for New Mexico, compiled by the USGS, also are available. An overlay map has been created from those observations (about 1.3 million values, covering the period 1960-82).



- **Satellite Magnetic Survey Data.** About 17 million selected magnetic observations from several orbiting low-altitude satellites are held in this file. All the observations represent total intensity with one exception: MAGSAT data contain both scalar and vector values. Satellites for which data are held and interval of operation are:

- Vanguard (9/59 - 12/59)
- Aloutte (11/62)
- Cosmos-49 (10/64 - 11/64)
- OGO-2 (10/65 - 10/67)
- OGO-4 (07/67 - 01/69)
- OGO-6 (6/69 - 8/70)
- MAGSAT (10/79 - 6/80)

- **Magnetic Field Models.** Mathematical models of Earth's magnetic field often are used in conjunction with observed data for many applications in geophysics and space science. They are used to develop magnetic charts or to derive magnetic anomalies for observed data. Because models are predictive by nature, data used in their development must be both accurate and timely. All models available from NGDC are spherical harmonic models except for some of the regional models for the United States, which are polynomial. Some of the special data products NGDC can furnish using the models are:

- Computed values of the magnetic field and its annual change for a specific point
- Grid values of the magnetic field and its annual change for any geographic area
- Fortran programs utilizing spherical harmonic models
- Table of secular change in declination for a specific location.

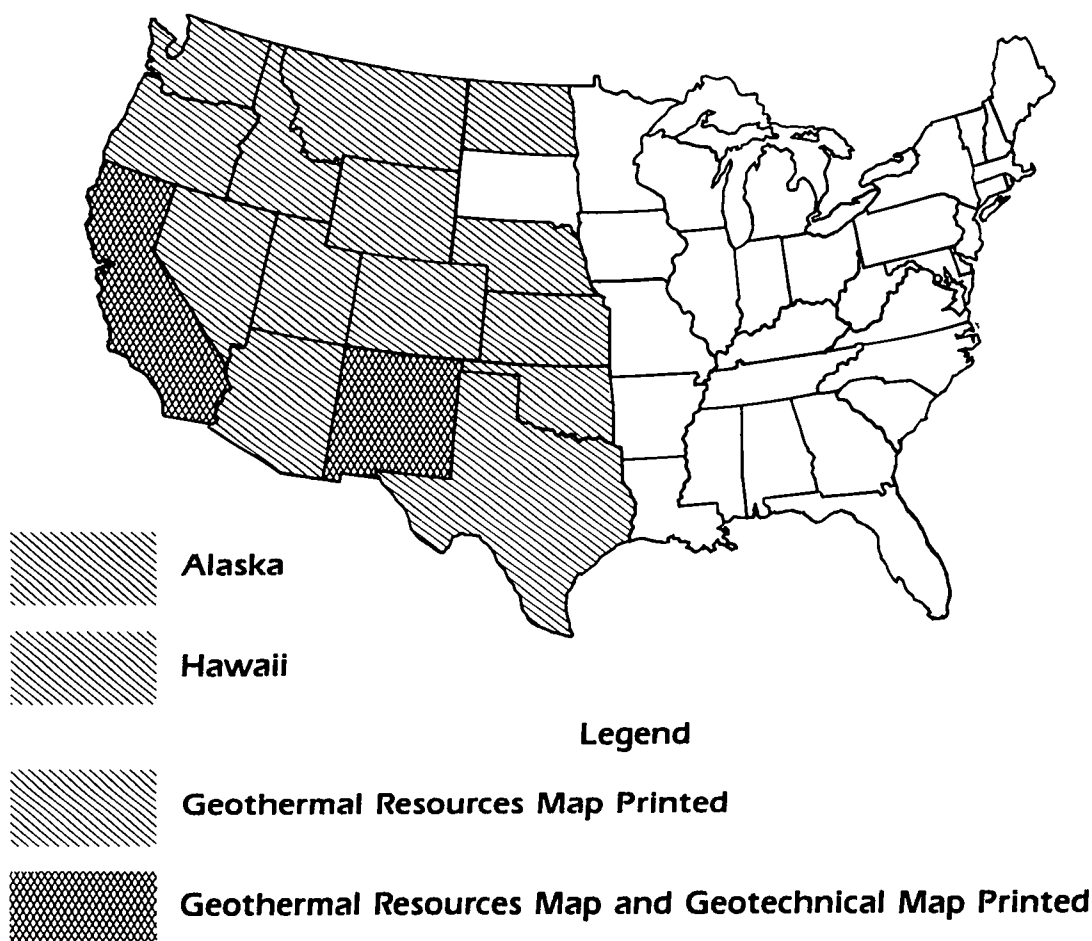
Aeromagnetic Survey Data Available for Alaska

Geothermics



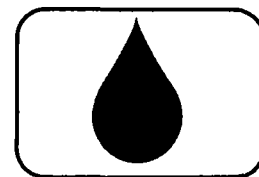
Geothermics is the study of heat generated in Earth's interior and its manifestation at the surface—hot springs, for example. NGDC has produced for the U.S. Department of Energy geothermal maps from data provided by many States, significantly increasing public awareness of this innovative energy resource. Maps and data products available are:

- 27 State and regional maps showing geothermal energy resource potential, geothermal gradient, and heat flow;
- Digital data base of more than 6,000 records of thermal springs and wells compiled from State map series above;
- World heat-flow measurements from thousands of sites; each measurement has an identification code, latitude, longitude, height of the temperature-measuring elements, temperature gradient, thermal conductivity, and heat-flow value;
- Geothermal gradient computer file that holds data on more than 1,700 thermal wells (includes latitude, longitude, well depth, heat flow, thermal conductivity, and reference); and
- Volcano data file containing more than 1,500 records, each of which includes name, country, geographic position, last known eruption, and number of eruptions.



State Geothermal Resources Maps Produced by National Geophysical Data Center

Geochemistry

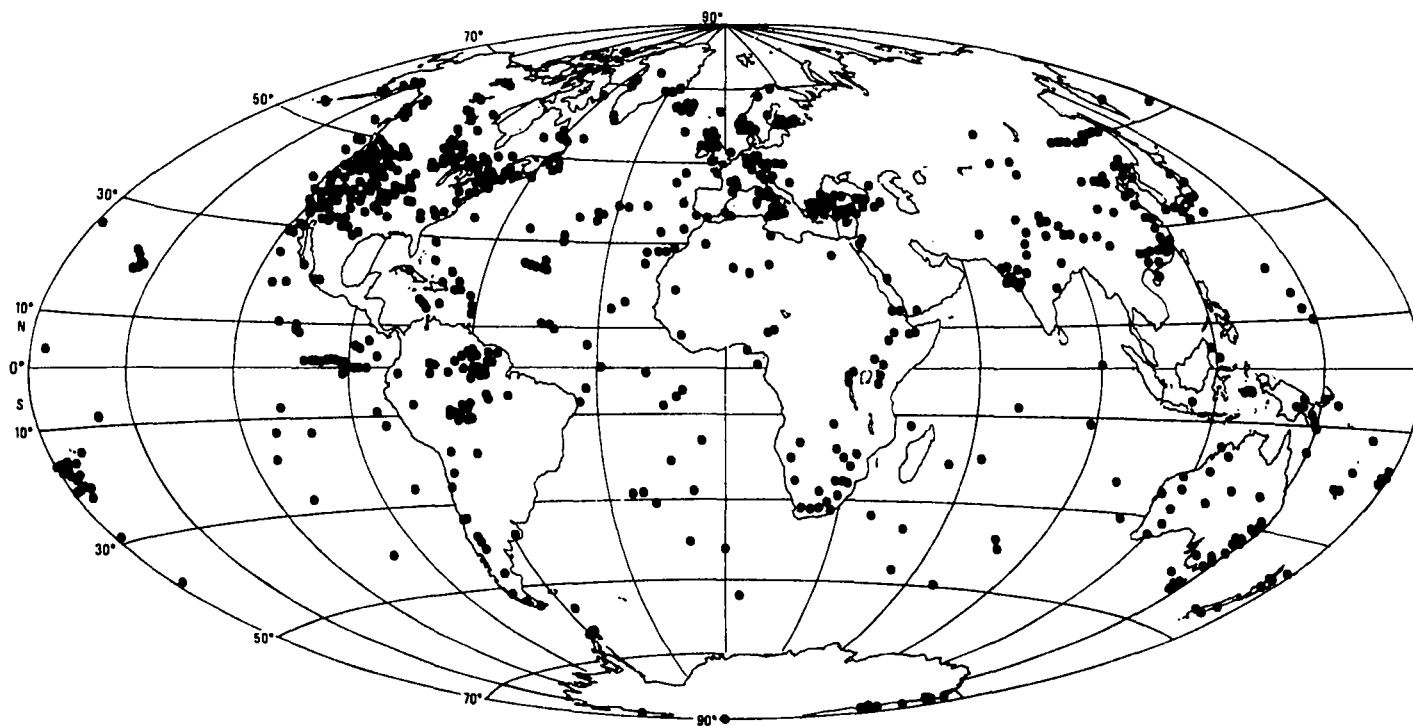


Geochemistry is the science that studies chemical composition and chemical changes in the Earth. Two significant data bases used by the geophysical community to study the distribution and amounts of chemical elements in igneous rocks are PETROS and the Igneous Petrological Data Base (IGBA). These are described below along with a data base of well core analyses from the National Petroleum Reserve—Alaska (NPRA).

- **IGBA Data Base.** This file holds more than 10,000 geochemical specimen descriptions from 962 published sources. It contains global petrological information, including the largest and most complete collections of data for

the Canary Archipelago and the Mt. Etna volcanic field. The geographic areas covered are: Africa, Americas, Asia, Australasia and Antarctica, Europe, North and South Atlantic Ocean, Indian Ocean, and Central Pacific Ocean.

- **PETROS Data Base.** This file contains more than 37,000 major-element chemical analyses of igneous rocks collected worldwide. Analyses include percentages of at least nine major oxides; calculated average rock compositions and reference information also are given.
- **NPRA Data Base.** Analyses of well cores (rock fraction only) from 68 test wells on Alaska's North Slope are available in computer printout format and on microfilm.



Locations of Data from IGBA Data Base.

Publications and Maps

Various publications and maps have been produced by NGDC. A listing of these items is included in the free brochure, *Publications, Maps, and Data Services—Available from the National Geophysical Data Center*. The brochure also lists free catalogs and fliers which describe data bases for solid earth geophysics.

For information about data services, products, and costs call:

Commercial: (303) 497-6419
FTS: 320-6419
Telex: 592811 NOAA MASC BDR

Address all inquiries to:

National Geophysical Data Center
NOAA, Code E/GC1
325 Broadway
Boulder, CO 80303

