



### Purpose of the Dive

The objective of the dive was to explore the AVR of the Mid-Cayman Rise and look for hydrothermal vents.

### Description of the Dive:

Little Herc was launched at a site in the SE corner of the Mid Cayman Rise, for a transect to the NNW along the AVR that cuts the rifted Oceanic Core Complex at this locale. The ROV landed at 3501m (waypoint A01 = MCR106) and set down on thick biogenic carbonate sediment with one coral and anemone. The initial ROV temperature was 4.25°C. Between waypoints A01 and A02 we traversed a smoother, less (>1m dia) pockmarked biogenic carbonate terrain than seen in previous dives. The surface also lacked the grooves/scours seen in the shallow dives. Locally there were patches of coarser sediment including shell fragments, fecal matter, and brown rock fragments. The main megafauna was *Benthodytes* sp. and *Psychropotes* sp., *Sergestes* sp. and occasional macrourids. Marker MCR107 was set on a bamboo fall hosting dead coral, and other live biota. Marker MCR108 was dropped en route north toward waypoint A02 over fine, mottled biogenic carbonate sediment (heading change to 040°). The first outcrop (MCR109) consisted of a patch of very angular blocks/boulders (~30% of the hillslope) with clear 50cm-1m dia pillows exhibiting radial cracks; dusted by a thin sediment cover. The rocks here lacked the more obvious Mn-oxide coatings noted in outcrops atop the summit of Mt Dent, suggesting they are relatively young. In this location many of the pillows appear to be broken normal to their long axis, so cross sections through the lavas are exposed. The exposed rock surface was covered in large poriferans, a few gorgonians and some galatheids. Little Herc continued up to marker MCR110 with 30-60% exposure of clear pillow fragments showing radial fractures (with fine-grained margins > 10 cm thick), along the west side of slope. The lava tubes present here look to be *in-situ*, and apparently flowed down this volcanic construct. The ROV temperature remained at 4.25°C throughout.

Little Herc dropped marker MCR111 (3468m) at restricted, platy outcrops of 5-10 cm thick layers/sheet flows above pillows. Locally these flows make up to 30% of the slope. Spectacular flat upper surfaces of sheet flows were visible, each with an irregular base, likely due to draining of lava. Marker MCR112 (3469m) was set on more heavily sedimented (possibly older) pillows and rare (<10%) sheet flows. Little Herc completed the transect from marker MCR112 downhill to the saddle at waypoint A02 through thick biogenic sediment. Crossing this saddle point from south to north, there was an apparent increase in suspended particle concentrations, possibly due to currents focused across this bathymetric low. Marker MCR115 (3505m) was set on a wood fall with possible bark, and geographically related (?) anthropogenic deposits, including fabric (with thread) and a cocktail stirrer, all set with a thin sedimentary layer. The ROV continued NNW toward waypoint A03 along the western flank of a further topographic ridge, over thick, relatively flat/smooth biogenic carbonate with innumerable circular burrows up to 6-8 cm in diameter. Marker MCR116 was dropped on a wood-fall branch with assorted gastropods, isopods, galatheids and a sea squirt. The sedimentary areas contained numerous *Benthodytes* sp., *Sergestes* sp., two unidentified pennatulids, some galatheids, pagurids, poriferans, two ophiuroids, asteroids and several cerianthid anemones.

The ROV continued along the western slope of the small ridge hosting waypoint A03 at its summit. Marker MCR117 at 3477m was dropped along a ~ NNW trending ~ 2.5m high slump scarp/headwall (slumps to the west) cutting thick, lithified and layered carbonate sedimentary deposits. Layering was defined by variations in grain size and fragment color, with layers up to 50cm thick. The scarp was scalloped and oriented roughly 150-180°, locally with subparallel, incipient cracks in the sediment above the scarp, oriented at 345°. There was an apparent increase in scarp height to the north and the scarp

extended for more than 220m along strike before the path of the ROV was broken off from this trajectory to head uphill to waypoint A03 at the summit of the ridge crest. The biogenic carbonate below the scarp dipped gently to the west. Occasional topography in the slope suggested slumped sediment. Excellent video of the scarp system was observed at 14:16 ship-time (19:16 UTC) from Seirios.

Marker MCR118 was dropped as the ROV left the scarp at 3477m, heading NE, toward waypoint A03 over thick biogenic sediment. Upon arriving at the thickly sedimented summit of the ridge, there was insufficient time to continue to waypoint A04 and certainly not to continue upslope to the steep scarp immediately beyond waypoint A04 uphill to A05. Instead, it was decided to continue east and downhill to waypoint A03b, descending through the water column to a depth of 3520m where the ROV regained bottom contact at marker MCR-120 located on thick biogenic sediment. From here, Little Herc then traversed back up-slope to the West in the hope of encountering a first rocky outcrop on this northern topographic ridge prior to dive end. Marker MCR-121 (3525m) was set down on a thick section of lithified biogenic sediment with a scarp equivalent to that seen to the west of this hill at 3477m (roughly 50 m higher); we speculate that both scarps are related to slumping over a free surface (ie W and E), and represent outcrops of the same very gently east-dipping deposit of biogenic carbonate that has been lithified, and subsequently been gently tilted toward the east by faulting.

Little Herc was first driven NW in the direction of waypoint A04, but then turned to the west and then south to look for rock outcrop seen briefly during the traverse through the water column to MCR120. Marker MCR-122 (3494m) was dropped on heavily sedimented pillow basalts, with spectacular ropey, pahoehoe lava textures, interleaved with ~1m dia pillows showing radial fractures. The pillows were very obvious, perhaps more so than those seen on the western side of the southern ridge earlier in the dive. Small patches of sheet flow deposits were present, but were restricted to <5% of outcrop. Sponges were present on the lower parts of the outcrop. Marker MCR123 (3494m; HDG 294°) was dropped at a drained lava tube, adjacent to thick sheet flows (individual plates ~5-8 cm thick). The section of lavas preserved along this scarp varied north to south from pillows to lava tube to thick sheet flows and back into more pillows toward the south. This last section of rock supported many large poriferans, a few gorgonians and some galatheids.

Summary: by finding interleaved pillow basalts and sheet flows on either side of the ridge, we confirmed that what we had encountered was a volcanic ridge system; most likely a paleo-AVR. The thickness of sediment covering the ridge indicates that while the lavas preserved fresher textures than those observed on Mt Dent, there was no evidence for recent volcanic activity at the sites investigated. Similarly, there was no instance of any vent fauna being encountered during this dive.

Overall Map of ROV Dive Area	Close-up Map of Main Dive Site

**Representative Photos of the Dive**



**Platey slabs of basalt breaking away from the rock face**



Seastar working its way over sediment

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