

Dive 4614, 9 April 2010 Dive Summary

Observers: Ken Rubin (p), Brendon the cook ("PIT") (s), Mark (pilot)

This dive visited the ridge axis and northern flank at 91° 54'N on a zigzagging, generally north-to-south trajectory designed to identify volcanic units and to investigate their contact and stratigraphic relationships. The region sits astride the axial graben, which I think of as the tectonic but not necessarily the volcanic axis, plus generally unfaulted terrain north and south of that. The youngest-appearing unit we found was formed of high effusion rate sheets and associated lobate lavas that issued from a series of eruptive vents aligned on a nearly E-W lineament south of the tectonic axis. 15 samples of mildly Mn-coated, generally fresh basaltic lava were taken on the dive were collected.

The dive targeted regions of both faulted and unfaulted topography, and areas of acoustic backscatter contrast evident in the Haymon-White dsl-120 survey data and the Sentry bathy survey data collected during this cruise. We started in sedimented pillows (Van Andel age 3) north of the axis and soon traversed into much younger sheet flows (Van Andel 1.5) that had flooded an area stepped down across a 2 to 3 m offset fault.

The dive then visited two similarly sedimented pillow mounds, one of which may have been the source of the sheets, although the traverse from sheets to pillows on the eastern mound was abrupt and the sheets appear to lap up onto the pillow deposit. Only two small (<1m) fissures were encountered in the region, both near the turn from SE to W, near WP3.

After visiting a second pillow mound west of this, the dive dropped into the tectonic axis, encountering extinct hydrothermal chimneys on a constructional pillow slope near the north wall, then traversing over a pillow mound to a deep beyond it (we drove roughly 100 m past WP5 over a gentle pillow mound slope (we had no navigation fixes from the ship between WP4 (above the wall) and where we eventually took sample 5 (100m past WP5).

The dive then went east over two pillow mounds that had been viewed by Towcam the previous night, where we observed many extinct hydrothermal chimneys near the base of a roughly E-W trending fault that split the seamounts and that marks the southern boundary of the tectonic axis. These pillows were dusted with hydrothermal and pelagic sediment and had significant sediment accumulation in pockets between pillows. An area of dead mussel shells was encountered on a traverse north towards the opposing graben wall.

A third mound near the southern graben wall was also visited; it had lobate lavas on its top, pillows at its northern base, extinct hydrothermal chimneys on the southern part of the summit, and a small fracture marking the southern graben fault. There was no vertical offset to the fault trace on the dive traverse, in contrast to up to 20m throw along this fault just a few 100m west, indicating that faulting was quite recent.

On the far side of the fault trace, we encountered pillow lavas across a presumed contact (the pillow mound samples at WPs 10 and 12 are the only plagiophyric rocks we collected on the dive). The pillow mounds sit on a pedestal also composed of pillows. Below that are lobate lavas that transition into sheet flows ranging from lineated to ribboned to hackled in places. The sheets appear to have less sediment accumulation than the pillows and potentially post date them. It is my inference that the lobates and sheets are a distinct unit from the pillows.



The final traverse of the dive was due west, across a series of mounds and small pushup structures that clearly appeared to be aligned along an eruptive fissure. This traverse was entirely in the sheet/pillow lithology mentioned in the preceding paragraph. High effusion rate lava morphologies were encountered near each of the vent structures, particularly at the last WP of the dive, where samples 14 and 15 were taken. Sample 15 is from a high standing, 2m tall edifice that was in a group of similar structures with V-shaped clefts in their tops and built of piled up spatter and highly vesicular scoriaceous material (although this wasn't true "scoria" in the subaerial definition). I interpret this

to be a vent-proximal spatter rampart. A frame grab image from the port camera is included at left.