

Jason Dive J2-224, August 19-20, 2006 (GMT) SOUTH SU

08:17 Off Deck

09:29 On Bottom: 3° 48.43' S, 152° 06.30'E, 1420 m

23:56 Off Bottom: 3° 48.57'S, 152° 06.32'E, 1330 mbsl

01:11 On Deck

**MAGELLAN 06 Cruise Manus Basin
LEG 2**

Aim:

The goal of the dive is to explore and sample the crescent-shaped South Su volcanic and hydrothermal area. The waypoints guide to areas of Eh and/or optical backscatter anomalies. As much as possible of the South Su area will be explored. Fluid/solid sampling as usual. Shoot for high-T fluids from different areas or different appearance or for high – low temperature pairs that allow us to relate the two.

Co-ords for the landing site:

- **Lat/long: 3°48.43' S, 152°06.30'E, 1420 m**
- **UTM: 400615, 9579143 (WGS84 Zone 56S)**

Locations/waypoints:

Landing site: x4250, y2900, 1420 m depth. Ridge north of S Su.

WP1: x4100, y2865 – NW ridge; area of low backscatter, no Eh anomaly

Summary

Vanko: On the way down we see smoke in Medea's and Jason's cameras at a depth of 1185 m, which is over 100 m higher than the summit of South Su. Concurrently, Eh takes a dip from 126 to 120. The smoke stops after a few meters. The bottom at the landing site is old weathered rock and sediment. The terrane is deeply rutted, and we encounter a sharp ridge, which is sediment at the top, oriented about 240° (vvan 59742). Looking uphill onto South Su we see scree slopes with abundant red oxide and white rocks and crust. It looks very barren, and dead (the white does not look like the "live" microbial white material, but we did not get very close). Some rocks are clearly breccias. One spot has a bunch of rather large dead white clam shells, some articulated and others not (vvan 59776). The rock in the foreground near the clam shells look like it has constructional oxide features (bumpy knobs).

Bach: After transecting along the steep ridge scarp towards WP1 and crossing several tens of meters of sedimented, flat seafloor, we arrived at the north slope of the NW ridge and stopped to sample a bleached, brecciated rock that appears to be abundant in the area at x4131, y2853, z1352 (sample J2-224-1-R1; vvan# 59852). In the following 1.5 hours we had repeated problems with the ship navigation and were not able to move into the steeply faulted terrain ahead of us. Instead we explored the north-facing slope of the NW ridge and found minor diffuse venting with associated clam beds and scattered crabs. These were usually bound to fissures running up the steep wall or piles of rubbly talus of

mostly fresh lava. After re-gaining control of the ship we started a search pattern between the first two waypoints to survey the NW ridge for hydrothermal activity. The terrain has smooth, but steep slopes to the W, with thick sediment cover over what appears rock talus. The E side of the ridge is very steeply faulted and exposes the interior parts of the former volcano. In a gully that cut deep into the ridge, we sampled a bleached rock, most likely of the advanced argillic alteration type with sulfur veins (x4115, y2830, z1340; sample J2-224-2-R1; vvan# 60210). Crossing the ridge again in a westerly direction we pass over the highest point in the area and pick the strongest Eh anomalies yet. A detailed survey reveals a thickly sedimented dome with occasional outcrops of massive rock, colonized with microbial filaments. Except for numerous white patches and rare shimmering water, we find no other hydrothermal activity in the area. We decided to head for waypoint 2 on the SW part of the ridge and came across patches of mussel beds with tubeworm colonies and occasional clams near the base of the western slope of the ridge, when the Tivey watch came on.

Tivey/Rouxel: On our way to WP2, we stopped on mussel beds attached on volcanoclastic rocks with numerous white patches (x4043 y 2733 vvan 60387 13:59). Surrounding soft sediments (clays) in the immediate proximity of the mussel beds have white staining and, although we didn't see any shimmering water, we decided to take a temperature measurement. The surface gave $T=2.8^{\circ}\text{C}$ similar to background seawater and $T=4.8^{\circ}\text{C}$ deeper inside. We then headed at 215 toward WP2. EH slightly went down to 51 approaching WP2. Near WP2 (x4012 y2715 z1359, vvan60425 target 42), we found more dense mussel beds with tube worms and crabs lying on volcanic rocks. The temperature inside the mussel beds reached 3.6°C and 4°C inside rock cracks with light white staining (vvan 60444). We then decided to look around to find more (any) hydrothermal activity but found only more mussel beds along volcanic outcrops. We circled around WP2 during 10min and went E following small ridge covered by relatively altered rocks with thick sediment cover. We then moved further South of WP2 heading 187 for 30m. We found more white staining with small mussels beds. Along the talus, we found, what looked like brecciated and altered outcrop (x4016 y2690 z1348 vvan 60535/60549 14:57, target 43) but turned out to be mostly massive sulfides. After waiting for Medea repositioning, we tried to sample brecciated outcrop with thin FeOx coating. We got two pieces less than $\frac{1}{2}$ m apart (J2-224-3-R1 60568/60585). Since topography there suggests collapsed talus along fault (with landslide of volcanic sands vvan60503), we further explored the base of the steep talus and found mostly sediments and variably altered volcanic rocks. We slowly made our way back up to the top of the ridge (between 15:37 to 16:03). We passed by the fault wall (15m total offset) composed of brecciated rocks previously sampled (x4023 y2689 z1344 vvan60682 15:45). On the top of the ridge, we found mainly sedimented area with scattered volcanic outcrops harboring crabs and deep sea corals (?). Locally, white staining/patches on the sediments. At 1329m, we decided to leave WP2 since no hydrothermal activity was found and headed to East toward WP3 where another EH anomaly is suspected. On the way following the top of the ridge, we found shimmering water at x4109, y2719, z1315 (target 44 vvan60821) around mussel beds (J2-224-4-T1) and obtained a maximum T of 17°C . The maximum temperature measured inside the sediments with white staining yielded 24.7°C (J2-224-4-T2 vvan60835). EH went down to 0 during T measurement. Heading 94 toward WP2,

still following the ridge, we ran into an elegant jellyfish (vvanxxx) and found two mussel beds that appeared aligned along a straight line on the sediment, probably reflecting a system of faults oriented 140°. Before reaching WP2 located near a small bump on the flank of South Su, we finally found a group of inactive chimneys growing on a small sulfide mound covered with shrimps, mussels and crabs. Shimmering water is diffusing from the back of the mound. We sampled an entire spire from a group of 3 inactive chimneys with light color coating (J2-224-5-R1 vvan60935). We also sampled a piece of spire with darker color (J2-224-5-R2 vvan60976). We then found immediately 5 meters away of a complex spire with apparently active chimneys at x4260 y2681 z1308. One of the tall chimney (4m tall) is venting a dark gray smoke. At the base of the spire, we observed well developed white-coated flanges and sulfide mound with diffuse/clear venting. We sampled the upper part of the tall chimney that was venting (J2-224-6-R1; x4260 y2680 z1308 vvan61026) and measured max temperature (J2-224-6-T1 vvan61046) at 267°C.

Vanko: We came on watch at the beginning of sampling the first water samples. The black smoker stump has several orifices, and we obtained three water samples from one of the orifices (J2-224-6-W1-IGT4, T_{max} = 264°C, but it dropped toward the end to 225°C; J2-224-6-W2-IGT3, T_{max} = 271°C, steady at 270°C; and J2-224-6-W3-M2; vvan 61165). After the chimney fluid sampling, we turned our attention to one of several flanges that are located nearby (vvan 61209). We notice a mirror interface beneath one of them (vvan 61212) and take its temperature: flange top 10 cm from edge = 11°C; flange top 5 cm from edge = 14°C; flange at edge in flow = 25°C; water pool underneath flange = 241°C. We take two samples – the first is a chimney bud, inactive, grown out of the top of the flange, and the second is the flange itself (Samples J2-224-7-R1 is the bud, and J2-224-7-R2 is the flange edge). After we sampled the chimney bud, black smoker fluid started flowing out of the top of the flange at 293°C.

We deployed Marker 16 at this site, and then moved 12 m SW to another mound of chimneys located across a sedimented saddle. The mound looks old, with spindly old relics, abundant snails, shrimp, and just a little bit of activity. In one group of three beehives, we knock one off to reveal a perfect basal orifice. T with the probe is 284°C. The beehive disintegrated, but the underlying chimney was sampled (J2-224-8-R1; vvan 61358 shows the orifice, the T probe, and the broken chimney base sitting next to the orifice). We left a dive weight at this location to help find it again.

We explored the sulfide mounds in this area, which is a knoll SE of Marker 16, and find numerous groups of relict chimneys. Then we got underway NE along the NE extension of the croissant-shaped South Su. There is much sediment, pillars and outcrops of weathered rock, both volcanic-looking and volcanoclastic-looking. Near the end of the traverse, which revealed no further hydrothermal features, we stopped for an altered rock sample – Sample J2-224-9-R1 (vvan 61549).

After descending to the NE end of South Su, we fired the Niskin bottle at station 10, then ascended the SE flank obliquely on a southerly course. We crossed talus and scree, with some white rock debris, but no indication of active hydrothermal features. At one spot we had a chance to grab a piece of fresh-looking volcanic talus (J2-224-10-R1, vvan 61650). A beautiful sediment ridge was crossed (vvan 61680), and soon thereafter we

came across a few patches of oxide-stained sediment, some with shimmering water (vvan 61700).

Bach: We continued to head to the southwest and came to a patch of shimmering water with mussel, barnacles and snail beds (vvan# 61719). There are chimneys in the background. These are 30 m south of the previously spotted chimneys in the area, so we decided to find out how far to the south the hydrothermal field extends. A survey indicates that a large area of the SE flank here is hydrothermally active (from x4250, y2600 to x4300, y2630). The field features hundreds of small inactive spires and a much smaller number of structures taller than 1-2 m, many of which are actively venting or oozing clear to gray fluids. The most vigorous venting was observed in a cluster of three beehive-tipped chimneys in the SE part of the field. The previously located vent sites in the NW part of the area were re-visited for potential sampling, but after some discussion it was decided to sample the beehive structures from the opposite part of the field. A temperature of 279°C was measured in fluids venting from a very fragile, black structure, which appeared impossible to sample with the grab. After a beehive chimney there was accidentally knocked over, we sampled the lower part of the stem (sample J2-224,12-R1, x4300, 2642, z1327; vvan# 61960) and measured a of 288°C during IGT bottle sampling of the gray vent fluids. A major bottle sample was also collected here. The temperature at the outside of the wall of the part of the chimney that is still standing was measured at 11°C. That was the last science operation of dive 224.