

Jason Dive J2-223, August 18-19, 2006 (GMT) NORTH SU II

08:58 Off Deck

09:55 On Bottom: 3° 48.01' S, 152° 06.08'E, 1160 m

00:00 Off Bottom: 3° 48.02'S, 152° 06.02'E, 1200 mbsl

01:05 On Deck

Aim:

The goal of the dive is to continue to explore and sample the North Su volcanic and hydrothermal area. An area of black smoker hydrothermal activity was detected during J2 dive 221 and is located around the summit of the North Su volcanic edifice. The highest priority of dive 223 is sampling corresponding fluid/solid pairs there, as well as collecting representative fresh and altered volcanic rocks the summit and flanks of North Su. The plan is to sample a black smoker fluid/chimney pair early on in the dive and then spend some time looking around for a second sample, which could be either a second black smoker system in a different area of the summit, or a cooler fluid from the known area of venting (see below), or what appears to be a system that might be transitional between the “sulfidous” black and “sulfurous” white smoker systems. We need hence to extend the survey of the summit area beyond the surveyed area in the S and SW.

If time permits, we will explore the area between North Su and Suzette to find out what the structural relation between the two might be.

Co-ords for the landing site:

- **Lat/long: 3°48.014' S, 152°06.080'E, 1160 m**
- **UTM: 400215, 9579902 (WGS84 Zone 56S)**

Summary

Bach: We landed in an area of steep fault walls with white staining and poor visibility owing to thick white smoke in the water column. We move west to the site where black smoker were located during dive 221. We had problems locating the site, due to poor visibility and 14 m NW offset in the Nav data relative to Dive 221. After finally locating the black smoker complex, we set up to sample chimney and fluids from orifices about half way up the 11 m tall chimney complex that is colonized with shrimp and crabs. The top of a black smoker chimney was recovered and safely stowed away in the basket (sample J2-223-1-R1; x3802, y3665, z1157, vvan# 56977). A T probe measurement gave 288°C, but the thermocouples on IGT bottles fired here record 299° and 300°C. A major bottle sample was also collected here, before the dropped Marker 19 and left the site. We continued on to explore the summit area of North Su, but continuous white-outs and a near collision with a rock pillar forced us to seek shelter in the westernmost area of the summit, where visibility was better. We worked our way around the western side of the summit and came to a site of venting of clear fluid from a hole in the ground, just below the pavement that was sampled during Dive 221. The temperature of the venting fluids was determined to be 90°C (x3798, y3698, z1156; vvan# 57267). The sediments immediately adjacent to the hole are 54°C hot. We continued on to the northern side of the summit area, but ran into white-out problems again. A radar survey (range=50 m)

indicated that the major tall structures in the summit area appear to be the chimneys that we just sampled. Two mounds in the eastern part of the summit area cannot be accessed, but do not appear to be associated with tall, chimney-like features. We continue our survey to the northeast, following a ridge that runs down the flank of the volcano. Outcrops of massive volcanic rock along the ridge may suggest a dike. A volcanic rock sample (J2-223-3-R1) was collected at one of these outcrops (x3850, y3705, z1170; vvan# 57414). Further down the ridge in a NNE direction, we came to an area of diffuse venting through in a talus field. There is a rich biota here that appears to be distinct from other vents and seeps so far detected in the North Su area. Massive snail beds, barnacles, crabs, limpets, and eel-like fish are abundant, and maximum temperatures of 32°C were detected for the diffuse fluids (x3853, y3771, z1200; vvan# 57511). Another site of diffuse venting several meters to the northeast shows similar fauna plus miniature tubeworms (57534) and large scaleworms. Temperature here was 23°C (x3759, y3773, z1202; vvan# 57550). Following the 1200m depth contour to the SE, we continued to find hydrothermal seep; however, the appearance and faunal composition changed dramatically as we approached the fields of acidic white smoker activity. A diffuse flow patch at x3868, y3772, z1201 (vvan# 57565) shows much fewer specimen of mollusks, had no fish, barnacles, and tubeworms, but features extensive white mats and pink shrimp in addition to the white shrimp seen before. Further to the SE (x3891, y3766, z1205) diffuse sites have even thicker white mats, very few snails and shrimp, but numerous crabs (vvan# 57595).

Tivey: We continued to move south around the volcano to the south moving past talus slopes with occasional patches of white staining. No sediment. Some zones of the white patches are extensive being several meters across. At 14:08 we came across altered outcrop with Fe-staining. At 14:14 we came into a large area of white bacterial mat., with white staining on the rock and biota including snails, crabs. At 14:17 we reached a large promontory outcrop jutting out from the slope. We stopped and sampled this outcrop (vvan 57686, J2-223-5-R1 x3893 y3667 z1198 DVL target #26). We then climbed up over the steep scarp and outcrop on a course of 286. We crossed several very steep almost vertical cliffs and overhanging cliffs in some places. The rock outcrop is universally a reddish coarse volcanoclastic breccia. Some whiter areas look like sulfur-cemented debris forming a coating on the slope (14:34). We drove off the scarp into smoke and lost sight of the bottom for a moment. Once we are back in optical view we continue over large massive outcrop of the reddish volcanic breccia. At 14:42 we find extensive white bacterial mats and smoke with lots of small white crabs on the rock outcrop. We arrived at an area of large boulders of the volcanic breccia (14:49) and outcrop. We found a small linear crack in the outcrop coated with white biological growth each side. We stopped and took a temperature here (J2-223-6-T1 max temp 59C, x3845 y3672 z1166) and a rock sample (J2-223-6-R1) At 15:20 we continued on our course of 301 for a short distance. We crossed more shimmering water areas and crossed over a volcanic knob covered with white bacterial mats. At 15:35 we arrive at some tall knobs of volcanoclastic outcrops. One looks like it has already been sampled, we took a very small piece from it anyway (J2-223-7-R1, x3818 y3688 z1159 DVL Target#28). At 15:52 we arrived at the summit of the volcano. We crossed over the active black smoker vents and traversed to the north side of the summit. We continued over lava flow units

sloping downhill. At 15:56 we came to a large smooth slope surface composed of consolidated breccia and hyaloclastite. We repeatedly tried getting a sample of this but were unsuccessful, the material was too friable. We picked up a piece of platy material from the top of the slope, an Fe-stained < cm thick plate (J2-223-8-R1, X3796 y3709 z1162 DVL Target 29). We moved north down the northern slope. We traversed across several large blocks and pillars of volcanoclastic breccia. We reach a promontory cliff face and see a small sulfur looking flow that has seeped across the lava rock outcrop and forms a hanging ledge. We collect a sample of this sulfur flow (J2-223-9-R1) and the vesicular volcanic lava (J2-223-9-R2, x3812 y3764 z1190). At 1200 m depth we began to move laterally along the contour to the north east. At 1701 we arrive at a small hydrothermal animal community in zone of white bacterial mats and shimmering water on talus. There are two chimney like constructs a meter or so high there. We take a sample of the talus from the base of these “chimneys” and pick up 3 pieces of rock covered in tiny clams (J2-223-10-R1, x3858 y3771 z1198). We deployed Marker #17 at this site. We descended the slope a few tens of meters and headed back west with the idea of circling around to the west of the volcano.

Vanko: We began moving west and soon encountered an outcrop with shimmering water coming out of a good slit-shaped orifice as well as from underneath, accompanied by white bacterial mat (vvan 58334). The temperature of the clear flow was 102°C. In the background, we could see a barren slope covered with whitish/yellowish crust, maybe sulfur, and with patches of overlying iron-red crust. Reaching up with the T probe, we got up to 125°C just by poking the crust. Drifting over to the crust, we found that poking under it gave us T up to 230°C, and the poking initiated flow with gray smoke, so we prepared to take water samples. With much difficulty we obtained two gas-tight samples (J2-223-11-W1-IGT5, T_{max} = 240°C, vvan 58446-58538; and J2-223-11-W2-IGT6, T_{max} = 202°C; vvan 58678), but it is important to note that the second was from a clear flow about a meter away from the first. There may be particulates in the sample, and lacking a good orifice we did not take a majors sample. Two rock samples here were J2-223-11-R1, a piece of the rock lying adjacent to the flow of the second sample (W2-IGT6), and J2-223-11-R2, a scoop bag sample of the crust and underlying dark sediment from the first water sample (W1-IGT5).

We then went west along contour and turned downhill when we saw that this barren slope led down to a 1-m plus ledge (vvan 58803, 58890). Shimmering water was flowing out from under the ledge at 89°C, and the ledge rock itself was very hard. We took two samples of the ledge rock on the ground just in front of it, J2-223-12-R1 and R2 (vvan 58950 and 58959, SciCam has the lasers on them; we may combine these into one number later if they are identical). We went west another 20 meters or so to a ridge and tall rock pillar, and around the west side of it found active shimmering water emerging from three different levels of hydrothermal flange (vvan 58995). We took sample J2-223-13-R1, the flange material, and measured the water flow at 212°C. We decided that we could not get a clean majors sample here, though.

Moving upslope we cross volcanic scree or talus, then encounter a large brown rock with white-lined crack running through it, emitting water at 82°C. Sample J2-231-14-R1 is a piece of this rock with the white coating (vvan 59163).

Bach: We decided to extend the survey to the SW of station 14 to explore mounds and scarps on the western flank of North Su. There is patchy diffuse venting, concentrated around large boulders and outcrops of poorly sorted breccias. Going up slope to examine a gully between a ridge and a mound on the volcano flank, we find black smoker issuing from small smokers that sit on a pavement-like feature that caps breccia rock (x3754, y3706, z1194; vvan# 59256). Several meters SW of that flange is a tall chimney complex that is vigorously venting black smoker fluids through multiple orifices. We set up against the structure about half way up and measured a temperature of 319°C for flashing fluids venting from fragile orifices (x3747, y3700, z1182; vvan# 59293). The chimney, despite its height (c. 11 m) is very crumbly and multiple pieces fell into the basket during recording the temperature and sampling the orifice with a major bottle (sample J2-223-15-R1). A piece of the chimney wall below the orifice was recovered after fluid sampling was completed (sample J2-223-15-R2). We further explored the field that appears to extend for about 10 m to the SE and from there 20 m to the north and features mostly inactive, small chimneys and a fauna that is dominated by shrimp and crabs. From the southernmost extension of the field we moved 50m SE to examine a similar gully and found only diffuse venting with little biota there. We had just enough time to pick up a piece of talus (J2-223-16-R1) there before we had to come up.