Jason Dive J2-221, August 16-17, 2006 (GMT) NORTH SU

09:08 Off Deck
10:27 On Bottom: 3°48.16' S, 151° 05.94'E, 1360 m
23:50 Off Bottom: 3° 48.07'S, 152° 06.02'E, 1260 mbsl
01:11 On Deck

Aim:
The goal of the dive is to explore and sample the North Su volcanic and hydrothermal area.
The main area of hydrothermal activity - as detected during ABE Dive 194 - is located around the summit and on the SW and W slope of the North Su volcanic edifice, which has a basal diameter of 500 and is about 200 m high. We will sample corresponding fluid/solid pairs as usual and also collect representative volcanic rocks, both fresh and altered.

Co-ords for the landing site:

- **Lat/long: 3°48.16' S, 151°05.94'E, 1360 m**
- **UTM: 399965, 9579642 (WGS84 Zone 56S)**

Summary

Bach: Eh drops at 1280 mbsl on our way down. The seafloor is sedimented but littered with volcanic clasts, up to the size of several 10's of cm in diameter. Red and white staining of the sediment surface indicates microbial activity. The sediment staining picks up as we go up slope to our first waypoint, a solitary steep mound on the SW flank of North Su. That mound turned out to be a huge massive rock, sticking up from sediments vertically about 15m high (x3710, y3500, z1289, vvan#51482). It is most likely a volcanic spine or dike. There is minor diffuse venting along its base. The macrofauna in the SW flank area consists of pink shrimp and fish, including eels. After dealing with navigation issues for 35 minutes, we moved up the slope in a northerly direction and encountered increasing amounts of talus covering the sediments. At x3737, y3520, z1276 we reach a vertical wall that trends NNE and forms the prominent ridge visible in the ABE map. The wall is made up of massive volcanic rock; it is most like a volcanic dike (vvan#51575). We followed the base of the dike and discovered a site of white smoker activity around x3750, y3540, 1266 (vvan# 51581). Native sulfur forms flanges where it appears to have oozed out of the dike rock. Sampling the flanges was unsuccessful due to their extremely brittle nature. Just W of the dike is white smoker activity in a volcanic debris field. Black and yellow sulfur splashes litter the sediment surface here (vvan# 51640). We moved N along the base of a steep slope featuring clastic volcanic rocks and minor pillows. We looked for vent sites for fluid sampling and came across an area of intense white smoke activity just 10 m north of the sulfur splashes. Temperature probe measurement was not possible in the part of most vigorous venting due to poor visibility. Near the base of the vent sites, conditions were more benign, but fluid temperatures of only about 20°C were recorded. However, when the T-probe was stuck into the sediment, the temperatures rose up to between 272°C and 284°C! The T-probe was covered with sulfur when retracted from the sediments. It appears that the sediments are logged with liquid sulfur and the white smoke is seawater that gets flash-heated in contact with the liquid sulfur. We moved further up the slope, following the base of the wall and

measured 20°C in fluids venting from a collapsed roof of a pillow flow (vvan# 51809). At x3726, y3589, z1256, we found white smoke issuing from a crack in a steep slope in volcaniclastites and repeatedly measure temperatures of around 45°C in fluids venting from little funnel-like, sulfur coated hole in the wall (vvan# 51881). We decided to sample fluids here and measure temperatures of 45°C and 48°C for IGT bottles Nos. 8 and 7, respectively. We had just completed fluid sampling by firing a major sample bottle when the Tivey watch began.

Tivey: We move back east in order to look for some outcrop that Wolfgang remembers seeing but did not sample. We move a considerable distance back along the track but at a slightly higher elevation. At 14:31 we stop to sample an outcrop of very friable volcaniclastite. We eventually obtain two pieces (J2-221-4-R1 from upper portion of outcrop, J2-221-4-R2 from lower portion of outcrop, x3744 y3558 z1261 DVL target #7). We try to pick up a rock from the location of a billowing milky white smoker. We succeed in picking a rock from directly adjacent to the smoker which consists primarily of talus (J2-221-5-R1, x3751 y3553 DVL target#8). The vigorousness of the smoker makes us decide to make a temperature measurement of the smoker. We get a max T of 193C. We decide that it is hot enough for another fluid sample set. We take two gastights and a major water sample here (J2-221-5-W1-IGT6 max temp. 204C but varying 180-204, J2-221-5-W2-IGT5 max. temp. 215C, J2-221-W3-M2). Start to move 060 up the scarp and immediately got lost in the smoke and have to come up off the bottom. Reset Doppler (16:01) and try and drive back to scarp face. We move 310 and finally break out of the smoke. We see abundant floc on almost vertical walls and promonotories of outcropping material. The Fe-stained floc covers the entire outcrop surface making it difficult to ascertain lithologies. At 16:17 we stop to sample a massive looking orange-colored outcrop (J2-221-6-R1, x3770 y3621 z1202 DVL target #9). At 16:30 we move again semi parallel to the slop at azimuth 310. We come across smoking vents at 16:43 (z1202) and then get lost in more smoke. AT 16:56 we see a lot of floc in the water. E could have hit the scarp in this dense fog-like smoke (Note we did collect a volunteer sample on Jason underframe and this could have been from this collision with the wall). By 16:59 smoke had somewhat cleared and we stopped to sample the scarp. We get a piece of very friable volcaniclastic material (J2-221-&-R1-3 small pieces, x3757 y3657 z1192). We begin to move again at 090. We pass over a flow like deposit that looks sedimentary in nature with clasts in a finer matrix. At 1734: we reach a brecciated flow front. We climb this flow front and stop for a sample on top. A curiously large number of fish here. We collect sample (J2-221-8-R1, x3795 y3653 z1164 DVL target#11). At 17:52 we make a push for the summit and immediately see black smokers in the near distance.

Vanko: We came on watch right after the Tivey watch discovered black smoker activity near the summit of North Su. This is an active chimney area dominated by a 10 m-high structure that has multiple black-smoking orifices on it, from near the base to the top (vvan 52766). Some of these have nice beehives. Down closer to the sea floor, there is a ridge of black smokers and relict chimneys leading up to the big chimney: these are much smaller, more like meter-scale. We focused first on a small (10-20 cm high, about 5 cm across) delicate orifice that was pumping the most black smoke (vvan 52676). Out

temperature probe broke the chimney due to the brittle nature, but we clearly saw the chalcopyrite lining (vvan 52718 SciCam). The temperature of that fluid was 302°C, and we left the chimney in good enough shape for possible future sampling (vvan 52791). Returning to the sampling site after a look around, we try to sample a relict spire, but it crumbles badly (Sample J2-221-9-R1; vvan 52803). Turning to a thin conical spire about 60-70 cm tall, with a wisp of black smoke coming out of the top, we sampled it successfully (J2-221-9-R2; vvan 52859, 52884), and then measured the renewed and more vigorous than before black smoke coming out of the basal orifice to be 286°C (vvan 52924; x3801 y3666 z1164).
We explored up the ridge to the NE, past the tall active chimney, and found a whole line of relict chimney structures, perhaps hundreds of them. The only activity at present is shimmering water. Then, around 20 meters north we come across another small group of black smokers at x3800 y3686 z1158; vvan 53007). We are very near the summit of North Su. The chimney field here has a convex seafloor that is underlain by a slabby rock, which itself is underlain by very soft material judging by the way it is undercut. Shimmering water flows out from under the slabby rock. We sampled this slabby rock in two places: Sample J2-221-10-R1 (vvan 53048, x3808 y3692 z1157) and Sample J2-221-12-R1 (vvan 53305, x3802 y3691 z1155). In the interim, we also scoop sampled the soft disintegrating material beneath the ledge (Sample J2-211-11-R1), and we measured the temperature of the water coming out from beneath the slab (T= 68°C).

We continued the dive going off-summit, down the ridge to the SE. We encountered many old decayed massive chimney-like forms as well as jagged ridge peaks, all the terrane still being dusted in white "snow", and with numerous fish, shrimp and squat lobsters (galatheids). One pillar is over a meter in diameter, is slightly tilted, and could be sulfide or volcanic. We begin to find some shimmering water and then, in a cirque-like feature, a barren scree slope with a few white smokers (vvan 53480). One of them has a short broad white chimney, and we measure the temperature at 71°C. We take a sample of the chimney, which turns out to be rich in sulfur (Sample 211-13-R1, vvan 53484). Nearby in the scree we sample a gray rock (Sample J2-211-13-R2).
We now move west along contour with the aim of closing this dive track loop and either heading back up to the summit or down the flanks farther. We come across stark terrane with some rock jutting out of the scree. One sample of this is J2-211-14-R1, from a very soft outcrop. This and the previous rock turn out to be volcanic breccia.

Bach: We decided to complete the loop around the SW summit of North Su volcano and went down the slope to explore the base of a prominent escarpment on the SW flank. Dense white smoke covered the entire flank prevented us from doing so. We were forced to go down the slope all the way to the site of the sulfur splashes. We tried, again, sampling the sulfur flange, again without success. We sampled a piece of altered rock sitting on top of the liquid sulfur-logged sediments (sample J2-221-15-R1, x3745, y3547, z1260; vvan# 54019) and a piece of fresh lava from a nearby talus pile (x3746, y3550, z1262; vvan# 54047) before coming up to the surface.