SO201 Leg 1b
KALMAR

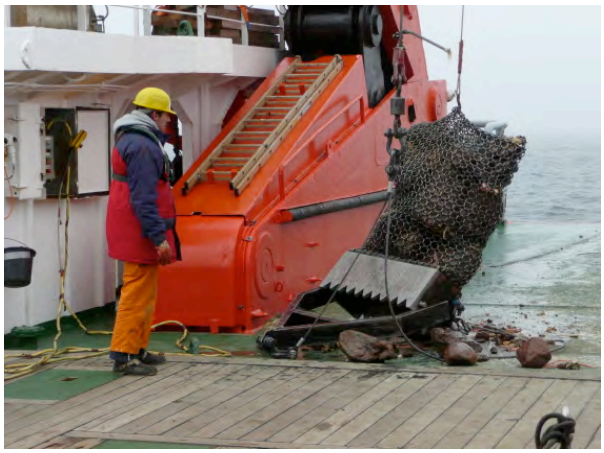
Weekly Report No. 2
(18.06. – 24.06.2009)

R/V SONNE
54°04,1´ N / 173°16,6´ E

At the beginning of the second week of SO201 Leg 1b KALMAR, mapping and sampling in the northern part of the Emperor Seamount Chain has been finished. Dredging at two ridges, which extend form Tenji Seamount to the northwest, yielded lavas and volcaniclastic breccias. On the morning of June 18th the *RV Sonne* reached approximately 120 km further east to our next target, the Emperor Trough. This feature represents a NNW-striking fracture zone in the ocean crust. The part of the Emperor Trough that we are studying is characterized by a ~10 km wide graben reaching maximum water depths of more than 6,000 meters. The trough has steep flanks with as much as 1,000 meters of relief. Along the western flank of this structure we carried out what will be the deepest dredge haul on this cruise, which recovered porphyric lavas out of up to 6,000 meters water depth.

From the Emperor Trough we sailed to the northeast, toward the Aleutian Arc. Bathymetric maps based on satellite altimetry ("predicted bathymetry") reveal more than 30 seamounts, each more than 3,000 meters high, in the area between the northern Emperor Seamounts and the Aleutian Arc. We mapped portions of and sampled three of these seamounts. The westernmost seamount has a guyot-like morphology, with steep flanks and an erosional plateau at the top. Guyots are ocean island volcanoes that became inactive, were eroded down to sea level and then slowly submerged to deep-ocean depths. Today's water depth above the erosional plateau indicates that this seamount has subsided more 3,400 meters. Two dredge hauls carried out at its southeastern slope of this seamount, just beneath the plateau edge, recovered porphyric lava with large feldspar crystals. The two other studied seamounts are located ~100 and 180 km northeast of the guyot on younger ocean crust, to the north of the Stalemate fracture zone. These seamounts are ~2,500 m high, ridge-like structures, which are elongate in a south-east to north-west direction. Dolerites and volcaniclastics were the dominant rock types dredged at this location.

A chain bag dredge before....



...and after a successful dredge haul.

At noon of June 21st we arrived at the western Aleutian chain. In this area our studies focused on the Ingenstrem Depression, a ~60 km long and 10 – 15 km wide basin between Attu and Buldir islands. Mapping during the U.S. WAVE expedition with *R/V Thompson* in 2005 revealed that this area is marked by numerous small and apparently very young volcanic cones, each approximately 1-4 km in diameter at the base and several hundred meters in height. Lavas dredged from these cones during the WAVE-Expedition have an unusual chemical composition indicating that they may provide key information on the generation of island arc magmas. Detailed sampling was carried out in the Ingenstrem

Depression during SO201 Leg1b. To sample the wide variability expected in lavas of this area, dredges were taken from locations along much of the length of the depression from morphologically different volcanic structures. In total, we sampled 15 volcanoes in water depth of 500 – 1,500 meters in only 39 hours. This was possible due to the huge effort from the crew and scientists. The dredges yielded porphyric basalts, andesites and dacites. Basalts from one dredge contained olivine-rich mantle xenoliths (spinell perditotes) as well as xenoliths of metamorphic rock, apparently from the deep crust beneath the location.

The first step of rock preparation: Crushing of large blocks on deck.

The second step: Classification and further preparation in the labs of RV SONNE.

After finishing our work in the Ingenstrem Depression, the RV SONNE sailed to the Bowers Ridge. This distinctly arcuate ridge, which is up to 15 km wide, rises from water depths of ~3,900 meters to nearly sea level. Despite it's large size and importance for the understanding of the Bering Sea-Kamtchatka-Aleutian system, the origin of the Bowers Ridge is still largely unknown. Prior to our cruise, rock samples from the ridge, which could provide detailed information on its composition and age, did not exist. Seismic profiles collected in the 1970's, reveal a thick blanket of sediment, especially on the flanks of the ridge, making dredge-sampling of the basement of Bowers Ridge difficult. Our reconnaissance mapping along the northeastern and northern slopes of the ridge revealed a morphology characteristic of thick sediment accumulation. Deep canyons cut the flanks of the ridge, indicating erosion and mass transport from the top of the ridge into deeper adjacent areas. Above its flanks the ridge top is a flat plain, submerged to depths of 100 - 500 meters. As expected, our first dredge haul along the northern flank of Bowers Ridge recovered solidified sediment (mainly carbonates). Further to the northwest, we successfully dredged a collection of magmatic rocks from four locations along the upper slope of the ridge. The samples mainly comprise basaltic and andesitic lavas, presumably from the Bowers Ridge basement. We expect these samples to provide new and important information on the geological history of Bowers Ridge.

Complementing extensive mapping of the ocean floor, a total of 28 dredges have been carried out during SO201 Leg 1b. Of these, 25 dredges recovered magmatic rocks (without dropstones), 6 contained volcaniclastic rocks and 5 had sedimentary rocks. Seven of our dredges contained thick encrustations of Fe-Mn oxides. At this point, none of our dredges have returned empty.

This week the weather was on our side, and did not hinder our studies. Often it was cold and foggy or rainy, but we also enjoyed some sunny hours, which are not common in this area in the summer months. All participants are well and send greetings to everyone at home.

For all cruise participants
Reinhard Werner (chief scientist SO 201 Leg 1b)