Sea floor fracture and hydrothermal vein system in the Juan de Fuca ridge: IODP EXP 301

Shoichi Kiyokawa[1]; Masumi Sakaguchi[2]; Tetsuro Urabe[3]; Masumi Sakaguchi IODP Expedition 301 Shipboard Scientific Party [4]

[1] Earth & Planetary Sci., Kyushu Univ.; [2] Department of Geology, Kochi University; [3] Earth and Planetary Science,

Univ. of Tokyo,; [4] -

http://minmin.geo.kyushu-u.ac.jp/

The basement rocks from the core 1301B of IODP EXP 301 are corrected 180 m deep from basement (total depth 582.80 mbsf). It contains pillow breccia, pillow lava and massive lava.

In this time, we measured dips of veins and fractural structures totally 647 counts expect obviously younger fracture during drilling time. The vein count is increase to steep angle. Two peeks are identified as 55-65 degree and 80-90 degree area which is contained more than 70% in total counts. Each unit of vein dip summarized in Figure 2. Based on the vein amount / core length ratio, the pillow lava unit preserved many veins than that of the massive lava units. The massive lava contains variable orientation of vein rather than that of pillow lava unit.

We distinguish four types of fractures in the 1301B section as follows; 1: vein with halo structure, 2: vein without halo structure which include radial cracks along the pillow margin, 3: shear veins or fault of calcite filled with slickenfibers and 4: micro-vein (less than 0.05mm) which is identified in petrographic observation.

Vein containing halo structure

The vein containing halo structure, which is called -halo vein-, is most common structure in this site. The halo is normally black colored and sometimes contains dark greenish colored. Some of them contain brown iron oxide hallows. Most of this halo is 5-10mm wide along the veins. The vein filled with dark greenish, pale greenish, yellow brown colored minerals which are mainly sapoinite, celadonite and iron oxcide. Radial cracks along the grassy pillow margin also identified with halo, which is truncated by vertical halo veins.

Vein without halo structure

This vein, which is called -no halo vein-, is mainly identified in the massive lava and also some part of pillow lava. This vein amount is approximately 1/3 to that of the halo vein. The wall rock preserved thin clay minerals such as sapoinite, celadonite and iron oxide.

Shear veins or fault

There are three parts contains the filled with calcite slickenfibers or overlapping fibers on the steeply dipping vein surface. It is very difficult to distinguish shear veins and fault, because these features are preserved along the side of cores and no counter part wall. However, each fibers lineation plunge steep with asymmetric calcite crystals which shows down-dip movements. The shear veins are related by extensional normal faults deformation.

Micro-vein

This vein is less than 0.05mm which is only identified in the petrographic observation. They filled with are mainly sapoinite, celadonite and iron oxide. There are pinch-and-well, irregular and anastomosing structure in this vein.

The dip-angle variation of the halo vein and the without halo vein is different. The dip-angle of the halo vein is direct proportion to steep angles. However, the no halo vein in massive lava contains three peeks such as 15-30, 50-65, and 80-90 degree. Massive lava and pillow lava preserved similar characteristics. The pillow lava contains 20-35 degree and 80-85 degree.

Based on the shipboard observation, timing of formation of fracture and vein are as follows; 1: formation of radial clacks of pillow margin, when pillow lava cooling, 2: vertical clacks and normal faults with highly altered halo during spreading of sea floor, 3: younger fractures without alternation halo.