5.6.P11

Strain localization on an oceanic detachment fault system, Atlantis Massif, 30°N, Mid-Atlantic Ridge

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Microstructural observations, mineral chemistry, and spatial distribution of strain fabrics in outcrop samples collected from Atlantis Massif, the active inside corner high at 30°N, Mid Atlantic Ridge, suggest that strain is localized near the subhorizontal domal surface, indicating that this surface is an exposed detachment fault. Amphibolite- and granulite-facies deformation fabrics in peridotite and gabbro are dominated by crystal-plastic flow and diffusive mass transfer. Amphibole-plagioclase thermometry in highly deformed gabbro samples indicates strain localization at temperatures ranging from 850 to 650ºC. Two oxide thermometry on exsolved ilmenite lamellae in magnetite suggest that gabbro was not deformed at temperatures lower than 600ºC, indicating that low-temperature strain is partitioned into altered peridotite. Low-temperature (<400°C) greenschist and sub-greenschist deformation of peridotite is dominated by diffusive mass transfer and lesser cataclasis during growth of schistose tremolite and chlorite to produce semi-brittle deformation fabrics with micro-boudinage textures. A clear relationship is demonstrated between deformation intensity and structural depth beneath the subhorizontal surface of Atlantis Massif. Discontinuous high-intensity crystal-plastic deformation fabrics are found at all structural depths (0 - 520 m) beneath the surface, indicating that high-temperature, granulite and amphibolite-grade deformation was not localized in a single shear zone. In contrast, semi-brittle deformation is concentrated less than 90 m structurally beneath the surface, and cataclastic deformation in the upper 10 m. Localization of semi-brittle and brittle deformation fabrics supports the hypothesis that the domal surface is the exposed footwall of a detachment fault, and therefore that Atlantis Massif is analogous to a continental metamorphic core complex. At depth beneath the rift valley, extensional strain was localized into granulite and amphibolite-grade shear zones over a wide zone. As peridotite and gabbro are tectonically denuded to shallower depths, strain becomes progressively localized into a narrow (<100 m wide) greenschist-grade shear zone surrounding the main detachment. High-temperature and low-temperature deformation likely occur contemporaneously on differing levels of the normal fault system during lithospheric extension at the ridge-transform intersection.

5.6.P12

Mesozoic zircon from gabbronorite of the MAR axial zone, 6°N

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Studied sample was dredged during 10th Cruise of the R/V Akademik Ioffe in 2001 in an axial zone of the Mid-Atlantic Ridge (MAR) near the Sierra-Leone FZ (Central Atlantic) from slope of deep (about 4 km) rift valley [1]. Slopes of the valley are composed of peridotite, troctolite, gabbro, gabbronorite, Fe-Ti-oxide gabbro, diorite and trondhjemite. Gabbronorite, from which zircon grains were separated, consists on mainly plagioclase and clinopyroxene; orthopyroxene, magmatic brown hornblende (hastingsite) and ilmenite are subordinate; small rare grains of apatite and zircon associate with them. The rock has cataclastic texture manifested as deformed plagioclase and pyroxenes crystals and appearance of neoblastes. In this process zircon was often divided into small fragments. The same rocks were dredged in many places in the studied area, suggesting that their widespread distribution *in situ*..

Zircon grains for analyses were conventionally separated using magnetic separators and heavy liquids. After that they were handpicked under microscope and classified by size, color and morphology. About 70-75% of each fraction was studied under a scanning electron microscope equipped with BSE and CL detectors. Remaining zircon grains were studied by U-Pb isotope method (TIMS).

Zircon of coarse fraction (≥450x250 µm) occurs as transparent and semi-transparent fragments of prismatic crystals. CL studying revealed specific sectorial zoning in the zircon fragments of evidently magmatic origin. In some cases, relatively large crystals were fragmented into small grains. Three fractions of the most transparent idiomorphic crystals and their fragments were chosen for isotope dating.

U concentration in the studied zircon varied from 1264 to 1336 ppm, [Pb]rad - 75.7-108.7 ppm; $^{206}Pb/^{204}Pb$=79.08-124.6. Subconcordant age (97.42±0.15 Ma) was obtained using small the most idiomorphic and transparent crystals.

The data obtained suggest the Mesozoic age of the gabbronorite zircon that corresponds to the time of their magmatic crystallization. Probably, this gabbronorite was a block of ancient oceanic lower crust, exposed near the bottom of the modern deep rift valley. From such point of view, the crust of the low-spreading MAR has had a multistage origin. The age obtained could correspond to the age of a remelted protolith recycled during the new oceanic crust formation.

References

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