Si-rich veins formation in lower oceanic crust during slab bending

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Atlantis Bank oceanic core complex in the rift-mountains of the Southwest Indian Ridge represents the largest known exposure of the lower ocean crust (640 km^2). Deep drilling into the gabbro massif recovered two generations of felsic veins (diorite, quartz diorite, tonalite and trondhjemite) representing the last stages of its formation with envolving stress field. They occur in ferrogabbros with both normal and reverse shear sense reflecting a change of stress field from tensional to compressional during slab bending beneath the detachment footwall. The formation temperature of veins were determined by amphibole-plagioclase geothermometry and oxidation state by magnetite-ilmenite geothermometry in ferrogabbros. The reverse-sheared ferrogabbros related to first generation (magmatic) are characterized by a large proportion of orthopyroxene and magnetite, a restricted oxidation range, high formation temperature and low Cl/F ratios of hornblendes. However, the ferrogabbros with normal sense of shear corresponding to second generation (anatectic) contain less orthopyroxene and magnetite, much more hornblendes instead, and formed under a wide range of oxidation state and hornfels or granulite facies conditions. The Cl/F ratios of the hornblendes in these host gabbros are high, which indicates seawater-derived fluid are involved in the formation of the veins. We proposed that the first magmatic veins crystallized from high-silica hydrous silicate melts following magnetites precipitation, while the second anatectic veins were generated by hydrous partial melting of the gabbros under granulite or hornfels facies conditions in or near the dike-gabbro transition.