Geophysical Research Abstracts
Vol. 17, EGU2015-5250, 2015
EGU General Assembly 2015

Multipolarity remanences in lower oceanic crustal gabbros recovered by drilling at Hess Deep (Integrated Ocean Drilling Program Expedition 345)

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A long-term goal of the scientific ocean drilling community is to understand the processes by which the ocean crust is constructed through magmatism, deformation, metamorphism and hydrothermal cooling. Insights into the magnetic properties of the lower crust have come from drilling at oceanic core complexes and in tectonic windows. At the Hess Deep Rift, propagation of the Cocos-Nazca Ridge into young, fast-spreading East Pacific Rise crust exposes a dismembered, but nearly complete lower crustal section. Here, IODP Expedition 345 (Site U1415) recovered primitive plutonic lithologies including gabbro, troctolitic gabbro and olivine gabbronorite. These rocks exhibit cumulate textures similar to those found in layered basic intrusions and some ophiolite complexes. Metamorphism is dominated by background greenschist facies alteration associated with cataclastic deformation that likely results from Cocos-Nazca rifting. Some intervals display complex, multiple remanence components within individual samples. A high temperature component unblocks above 500°-520°C and an intermediate temperature component of nearly antipodal direction unblocks between 425°-450°C and 500°-520°C. In addition, a few samples display a third component that unblocks between 100-350°C that is nearly parallel to the highest temperature component. These multiple, nearly antipodal components suggest that remanence was acquired in different geomagnetic chrons, and represent the first multipolarity remanences seen in Pacific lower oceanic crust. Similar remanence structures, however, have been reported in lower crustal gabbros recovered from slow-spreading rate crust along the Mid-Atlantic Ridge, and have been interpreted to reflect protracted accretion or protracted cooling. In contrast, at Hess Deep unblocking temperatures appear consistent with temperatures inferred for successive phases of alteration, suggesting an alteration history spanning at least two polarity chrons.