Geochemical study of fresh volcanic glasses from ~145Ma Shatsky Rise

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Shatsky Rise is a Late Jurassic-Early Cretaceous large oceanic plateau located in the northwestern Pacific. It consists of three major massifs: Tamu, Ori and Shirshov Massifs from southwest (older) to northeast (younger), forming along the trace of a triple junction at a mid oceanic ridge. The Rise is 1000km × 200km in size. During the IODP Exp. 324 (Sept.-Nov., 2009) five sites were drilled on Shatsky Rise, two on Tamu Massif (Sites U1347 and U1348; east flank and north flank), two on Ori Massif (Sites U1349 and U1350; summit and east flank) and one on Shirshov Massif (Site U1346; summit). Unaltered fresh volcanic glasses were sampled from all sites except for Site U1349. Glass is preserved as thin rims of lava flow margins or fragments in volcanic breccias. All glasses (115 samples) are sub-alkalic (tholeiitic) basalts, with MgO and SiO_2 contents ranging from 8.5 to 5 wt% and from 48.5 to 52 wt%, respectively. Three types of magmas (normal-Ti, low-Ti and high-Nb) are identified in this study. Assuming that source of these magmas was depleted MORB source mantle [1], the trace element patterns of the normal-Ti magmas suggest that they formed at deeper depths within the garnet stability field (~3GPa), whereas the low-Ti and high-Nb magmas may have formed at shallower depths, where spinel was stable (~1 GPa). Glasses with high Nb/U from Site U1348 and high-Nb type from Site U1350 indicate that the magmas of Shatsky Rise require more than one mantle source. Deep mantle melting and multiple sources for these magmas are different from N-MORB and are important factors to constrain for genesis of Shatsky Rise.

[1] Mahoney *et al.* (2005) *Geology* **33**, 185–188.

Large regional variations in F/Cl ratios for the MORB source mantle

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Fluorine (F) and Chlorine (Cl) are highly incompatible in mantle-basalt systems (Dalou *et al.* 2011) and their abundances in basaltic melts are generally unaffected by solubility limits (e.g. Carroll and Webster, 1994). These features could make their abundance ratio (F/Cl) in mid-ocean ridge basalts (MORBs) a good additional tracer for elucidating how heterogeneity of the MORB source mantle has evolved. Using analytical procedures developed with a Cameca IMS 1280 at Woods Hole Oceanographic Institution, F and Cl concentrations in glasses of basaltic compositions are determined routinely with precisions of ±10% (2σ) for F and ±5% (2σ) for Cl. Based only on melt inclusion data obtained here and in literature (~220) from EPR (Siqueiros FZ, Saal *et al*. 2002; JdF Axial, Helo *et al*. 2011), MAR (17°N, FAMOUS, 23-27°N, 33°S), and Gakkel Ridge (Shaw *et al*. 2010), it is found that F/Cl ratios display non-overlapping clusters for regions, and subgroups of a region: F/Cl = 10±1 for MAR (17°N, 23-27°N, a subgroup of FAMOUS), consistent with the north Atlantic average value of Schilling *et al*. (1980). F/Cl = 5±1 for Gakkel and a subgroup of JdF, and samples from 33°S MAR and a subgroup of JdF and FAMOUA possess F/Cl=2.5±0.5. In contrast, the Siqueiros dataset display distinctly high and variable F/Cl (14 – 80). It is evident that the observed variations are not produced directly by seawater-related mechanisms, and that no single F and Cl composition can be assigned to the MORB source mantle, suggesting local as well as regional heterogeneity due to incorporation of lithologies with diverse F/Cl fractionation prehistories. It is also noticeable that the range of F/Cl in MORBs is significantly different from that for arc magmas (< 0.5, e.g. Le Voyer *et al*. 2010).