

Reorganization of the Pacific-Izanagi-Farallon Triple junction before the formation of the Shatsky Rise

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Shatsky Rise is an oceanic plateau located about 1600 km east of Japan. The rise is elongated southwest to northeast and has an area of about 25% more than islands of Japan. The rise contains three large volcanic massifs that rise to depths of 3200-2000 m. All three have domes of Cretaceous pelagic sediments up to 1 km thick at their summits (Sliter and Brown, 1993). The southern part of the rise has seismic velocity structures typical of oceanic plateaus: the layers are similar to oceanic crust but several times thicker (Den et al., 1969; Gettrust et al., 1980).

Shatsky Rise was formed at the Pacific-Izanagi-Farallon triple junction during the Late Jurassic and Early Cretaceous (e.g., Nakanishi et al., 1999). Between chrons M21 and M20 (148-146 Ma) the Japanese lineations reoriented by 25, indicating a reorganization of spreading on the Pacific-Izanagi Ridge (Nakanishi et al., 1999). They concluded that the appearance of a Shatsky hot spot caused a regional reorganization of the Pacific-Izanagi-Farallon triple junction. Simultaneously, the triple junction jumped northeast to the location of Shatsky Rise, annexing a piece of the Farallon plate and causing a short-lived microplate nearby (Nakanishi et al., 1999). Subsequently, the triple junction remained near the Shatsky hot spot as shown by the confluence of magnetic lineations along the rise to chron M4 (127 Ma). Shatsky Rise is the trace of the Shatsky hot spot on the Pacific Plate (Nakanishi et al., 1999).

On the other hand, Sager (2005) proposed that Shatsky volcanism occurred because the triple junction jumped to a location underlain by a large volume of anomalously fusible shallow mantle. Furthermore, Nd-Pb-Sr isotopic data for the few basalts cored and dredged from Shatsky Rise show a Pacific-MORB-type signature, not the expected ocean-island type signature of a plumehead eruption (Mahoney et al., 2005). Whether or not this MORB affinity is representative of the rise or characterizes only a few minor, late-stage magmas is unknown. To test plume head versus ridge tectonics models of Shatsky Rise formation, it is necessary to expose detailed configuration of the plate boundaries among Pacific, Izanagi, and Farallon plates before the formation of Shatsky Rise.

Bathymetric, geomagnetic, and gravity measurements were conducted during the YK08-09 cruise. Most of ship tracks were designed to identify magnetic anomaly lineations and to expose tectonic fabrics around Shatsky Rise. The detail bathymetric survey exposed the abandoned propagated ridges southwest of Shatsky Rise. Magnetic measurements by a proton magnetometer and Shipboard three components magnetometer revealed that the magnetic bights of lineations between chrons M23 and M21 do not exist. These observations indicate that the reorganization of the Pacific-Izanagi-Farallon triple junction started at chron M23 and did not synchronized with the formation of Shatsky Rise.