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TITLE: The Shatsky Rise Supervolcano and the Formation of Oceanic Plateaus

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ABSTRACT BODY: Oceanic plateaus are igneous mountains constructed by massive eruptions of basalt and related igneous rocks. Because they are hidden beneath remote parts of the oceans, the structure and evolution of these mountains are poorly known. Shatsky Rise, in the northwest Pacific, is an oceanic plateau that formed ~145-125 Ma near a triple junction. It consists of three large volcanic massifs and a narrow volcanic ridge. Eruptions apparently began with the largest volcanic edifice (Tamu Massif) and waned through time with the formation of two other massifs. The discrete volcanic centers of Shatsky Rise likely resulted from relatively rapid drift of the Pacific plate relative to the melting anomaly. Tamu Massif is a supervolcano, i.e., a huge volcanic edifice with a volcanic center, like a seamount, but much bigger. Its area is similar to Olympus Mons on Mars, the largest volcano in the solar system. Geophysical data show that Tamu Massif has a shape that is symmetric across its axis. A seismic profile across the axis shows that lava flows flowed outward from its center. Seismic profiles in some spots over the axis show normal faulting that implies a volcanic rift zone, which is consistent with it being the major source of lava flows. Flank slopes are low, implying long, low viscosity lava flows. Coring on Integrated Ocean Drilling Program (IODP) Expedition 324 recovered basalt flows of two types: pillows and massive flows. Pillows are indicative of normal seamount volcanism at low effusion rates whereas the massive flows imply high volume lava flows with high effusion rates. Massive flows are typical of continental flood basalts and are also found on other large plateaus. On Shatsky Rise, thick massive flows are found on Tamu Massif, whereas pillows and thin massive flows characterize the other massifs. This trend supports the idea that Tamu Massif was formed by an initial massive eruptive event and afterwards volcanism waned as other massifs were erupted. Shallow water fossils and depth-diagnostic rocks and sediments indicate that the summits of Shatsky Rise massifs were near sea level at the time of formation. In this regard Shatsky Rise appears in between Kerguelen Plateau, which erupted mostly subaerially, and Ontong Java Plateau, which erupted mostly well below sea level. In sum, the structure and evolution of Tamu Massif appears much like that of a typical seamount, except that it is much bigger and was built by correspondingly larger and widespread eruptions. It similarities to Ontong Java Plateau imply analogous eruptive processes. Indeed, large oceanic plateaus may be made up of supervolcanoes like

Tamu Massif with overall plateau morephology dictated by interplay of the rate of volcanism and the rate of plate drift over the melting anomaly.

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