

Paleo-elevation and subsidence of ~145 Ma Shatsky Rise inferred from CO₂ and H₂O in fresh volcanic glasses

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Shatsky Rise is a large Mesozoic oceanic plateau located in the northwest Pacific. It consists of three massifs, Tamu, Ori and Shirshov Massifs, which formed along the trace of a mid-ocean ridge triple junction. Because of this setting, Shatsky Rise is uniquely suited to testing plume head versus ridge-controlled hypotheses of oceanic plateau genesis. We estimated paleo-eruption depths of Shatsky Rise massifs based on dissolved CO₂ and H₂O of volcanic glasses and core descriptions that were cored from five drilling sites of Integrated Ocean Drilling Program (IODP) Expedition 324. The elevation of Shatsky Rise is estimated to be 2500-3500 m above the surrounding seafloor, which is consistent with a mantle plume formation if the average crustal thickness and density of Shatsky Rise are 21 km and 2.9-3.0 g/cm³, respectively. Short-term subsidence, which may be due to rapid isostatic adjustment of volcanic load, was detected from the downhole depth estimate profile of one drill site. Post-emplacment subsidence of Shatsky Rise was estimated to be ~3000m, which can be explained by thermal subsidence models. A slight increase of total subsidence was observed from the center of Tamu Massif (~2700m) toward Ori Massif (~3400m), implying existence of large buoyant mass, perhaps a refractory mantle root or prolonged magmatic crustal growth beneath the rise center.

This research was supported by IODP After Cruise Research Program, JAMSTEC.

Keywords: Shatsky Rise, volcanic glass, water, CO₂, subsidence, elevation