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-emplacement subsidence of Shatsky Rise was estimated to be ~3000 m, which can be explained by thermal subsidence models. A slight increase of total subsidence was observed from the center of Tamu Massif (~2700 m) toward Ori Massif (~3400 m), implying existence of large buoyant mass, perhaps a refractory mantle root or prolonged magmatic crustal growth beneath the rise center.

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