Goldschmidt 2022 Abstract
https://doi.org/10.46427/gold2022.10781

Geochemistry of the Upper Triassic (Carnian) oceanic basalts in the Jurassic accretionary complex of Japan, and their relationship with Wrangellia LIP magmatism

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The Carnian Pluvial Episode (CPE) was a phase of global environmental change and biotic turnover that occurred during the Carnian in the Late Triassic. The CPE is considered to have been caused by a large igneous province (LIP) magmatism, which resulted in the eruption of the Wrangellia flood basalts (FB) in northwestern Canada. In addition to the Wrangellia FB, Carnian oceanic basalts of an intraplate origin, including oceanic seamounts and plateaus, have been recognized in the Jurassic accretionary complex of the Sambosan Belt, Japan. These Carnian basalts originated from an open-ocean realm of the Panthalassa Ocean on the Izanagi Plate and were accreted along the East Asian subduction zone during the Late Jurassic. The contemporaneous emplacement of oceanic and flood basalts in the Sambosan and Wrangellia may suggest a single LIP origin for these basalts. Here we present new geochemical (major and trace elements) and Sr isotopic data to constrain the origin of the basaltic rocks of the Sambosan Belt in southwest Japan.

Whole-rock geochemical analyses for the Sambosan basalts indicate that these basalts are classified as alkaline basalts with high Na_2O concentrations. N-MORB normalized spider diagrams show the enrichment of large-ion lithophile elements (LILE) and high field strength elements (HFSE), suggesting an affinity with ocean island basalts (OIB). Discrimination diagrams based on least-mobile elements (e.g., Nb, Zr, and Y), suggest that the basalts have higher Zr/Y ratios than MORB with high Nb/Zr ratios (Nb/Zr>0.1) and are similar to within-plate basalts (WPB). Initial Sr isotopic ratios ($^{87}Sr/^{86}Sr$) of the Sambosan basalts fall in the range of 0.703 to 0.707. These ratios are not as depleted as MORB sources and indicate the Sambosan basalts were formed from an isotopically enriched mantle source.

Our data suggest that the Sambosan basalts preclude significant involvement of subduction zone and MORB components, and were derived from a mantle plume source in a mid-oceanic setting. Further geochemical research, such as Nd isotope analysis, will help to test the hypothesis that the basalts of the Sambosan Belt and the flood basalts of Wrangellia were erupted from the same LIP.