

Ontong Java - Manihiki - Hikurangi Plateaus: The largest magmatic Event on Earth during the Phanerozoic

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The Ontong Java, Manihiki and Hikurangi Plateaus and associated volcanism covered nearly 1% of the surface of the earth at ~123 Ma. In the talk I will present results that our group at the GEOMAR Helmholtz Centre has obtained from the Hikurangi and Manihiki Plateaus on three research cruises with the German Research Vessel SONNE. Bathymetric mapping and sampling with a remotely operated vehicle (ROV), chainsack dredging and gravity coring were conducted during the cruises. On the recovered volcanic rocks, we have carried out Ar/Ar age dating and compiled an extensive geochemical dataset, including volatiles, major and trace elements, and Sr-Nd-Pb-Hf isotopes. In the talk, I will combine our results with published data from the Ontong Java Plateau. The three plateaus had a similar temporal and geochemical evolution. They began with a main tholeiitic plateau stage (c. 126-116 Ma) followed by a later (seamount-forming) alkalic stage of volcanism (lasting more than 30 million years on each plateau). Glasses from the tholeiitic plateau stage lavas show the H₂O and CO₂ contents of the magmas were low and therefore melting was dry. The tholeiites can be generated by ~30% melting of a peridotitic source at temperatures of ~1500-1550°C. The trace element and isotope data show that the two stages of volcanism were derived from distinct sources and under different conditions. The geochemical data support a common origin for the three plateaus, consistent with the three plateau fragments having once formed a single mega-plateau. Evidence for large degrees of melting of an enriched peridotitic source at elevated mantle potential temperature favors a plume-type model for the origin of these plateau fragments. The late alkalic stage of volcanism is more difficult to explain, since the plateaus were located thousands of kilometers apart when this volcanism occurred between 110 and 50 Ma ago. We favor detachment or delamination of the base of the plateau fragments to explain the late-stage volcanism.