Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.37417

Hidden, young lavas on the 20 Ma old abyssal plain: A new form of oceanic intraplate volcanism

FROUKJE M. VAN DER ZWAN[1], COLIN W. DEVEY[2], NICO AUGUSTIN[1], DOMINIK PAŁGAN[3], MARTIN SCHADE[4], CHRISTOPH BÖTTNER[5], RENAT R. ALMEEV[6] AND GARETH R. DAVIES[7]

[1]KAUST - King Abdullah University of Science and Technology
[2]GEOMAR Helmholtz Centre for Ocean Research Kiel
[3]Faculty of Oceanography and Geography, Department of Marine Geophysics, University of Gdańsk
[4]Institute of Geosciences, University of Kiel
[5]Department of Geological Sciences, Stockholm University
[6]Leibniz University Hannover
[7]Vrije Universiteit Amsterdam

The abyssal plains cover more than half of Earth's surface and are generally regarded as volcanically and hydrothermally inactive environments that progressively accumulate pelagic sediments with age. This assumption is the basis for models on e.g., oceanic crust evolution, chemical budgets of the deep ocean floor, and the distribution of hard-substrate benthic habitats. Here, we present high-resolution acoustic data, seafloor observations, and sample characteristics from the NW Atlantic abyssal seafloor that reveal 360 km^2 of young (<50 ka) volcanism on 20 Ma oceanic crust. These Balerion Lava Fields do not display a significant bathymetric expression and are only detectable from the surface by a stronger acoustic backscatter, pointing to limited sedimentation [1]. Geochemistry of the lavas reveals that the lavas are Si-saturated basaltic andesites with low Ca and Fe at relatively high Mg contents. Whole rock trace element and elevated Ni, low Ca/Fe olivine chemistry signatures resemble those of Hawaiian samples from Koʻolau and Mauna Loa that have been linked to pyroxenite-bearing mantle sources [2]. Isotopic compositions are close to the PREMA mantle domain [3]. Small (<1 mm), skeletal phenocrysts suggest rapid crystal growth and ascent of low-viscosity, possibly superheated melts with little or no crustal storage. Regional bathymetry and tectonic structure are consistent with normal 20 Ma seafloor subsidence and deformation, providing no evidence for anomalous lithospheric thinning, intraplate extension, or a mantle thermal anomaly. Instead, the geochemical characteristics point to magma generation at >2 GPa from a pyroxenite-rich source within the asthenosphere [cf. 4]. We propose that the Balerion volcanism reflects melting of anomalous volumes of recycled oceanic crust, rising in the convecting upper mantle. Such processes may occur widely beneath oceanic plates, representing a form of intraplate magmatism independent of both plate tectonics and mantle plumes.

[1] Mitchell (1993), *Geophys. Res. Solid Earth* 98, 22477-22493

[2] Sobolev et al. (2005), *Nature* 434, 590-597

[3] Zindler and Hart (1986), *Ann. Rev. Inc.* 14, 493-571

[4] Lambart et al. (2016), *Geophys. Res. Solid Earth* 121, 5708-5735