Oceanic Intraplate Volcanism 2.0: LAB melt lavas in the NW Atlantic

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The study of active volcanism on the seafloor has traditionally been focussed along plate boundaries and at large, easily detectable intraplate volcanic provinces, mostly associated with hotspots. The rest of the seafloor remains largely un-investigated as the abyssal plains are generally assumed to be geologically inactive. Yet, mapping of the NW Atlantic indicated hard substrate by strong acoustic-backscatter anomalies on 20 Ma old, sedimented oceanic crust. Seafloor video observations confirmed that these strong acoustic-backscatter anomalies are caused by young lava flows. The "Balerion Lava Fields" have no distinctive bathymetric signature, apart from very small cones that presumably mark their eruption centres. Overlying sediments have Late Pleistocene radiocarbon ages of <50 kyrs, showing that this volcanism is considerably younger than the underlying crust. Rock samples are Si-saturated basaltic-andesites with a unique chemical signature anomalously depleted in Ca and Fe, unknown from other oceanic volcanism. MORB-normalised incompatible trace element patterns are steep but HREE depleted, with concentrations lower than in OIB magmas or, with the exception of the heaviest REE, in Petit-Spot magmas[1]. Their trace element patterns strongly resemble those from Mauna Loa shield stage tholeiites, lavas thought to be derived from a pyroxenite source[2]. Low Ca/Fe and high Ni contents in Balerion olivine phenocrysts (cf.[3]) as well as the elevated whole-rock Si strengthen this comparison. We postulate as source for these lavas, lithosphere-asthenosphere-boundary melts, known to be present under all ocean basins[4]. The pyroxenite-dominated source of these melts in the Atlantic may be related to the presence of crystallized melt pockets, residual from sub-axial melting, in the slow-spreading asthenosphere.

[1]Hirano et al., 2013; [2]Sobolev et al., 2005; [3]Sobolev et al., 2007; [4]Naif et al., 2013