Geophysical Research Abstracts
Vol. 21, EGU2019-10415, 2019
EGU General Assembly 2019

Relative timing of kilometre-scale folding and magma transport in the mantle section of the 497Ma Leka ophiolite, Norway

J. Stephen Daly (1), Colm Long (1), Brian O'Driscoll (2), James Day (3), Mitchell Haller (4), Oisin Coffey (1), David van Acken (1), and Richard Walker (4)

(1) University College Dublin, UCD School of Earth Sciences, Dublin, Ireland (stephen.daly@ucd.ie), (2) University of Manchester, School of Earth and Environmental Sciences, Manchester, United Kingdom , (3) Scripps Institution of Oceanography, University of California San Diego, La Jolla CA, USA, (4) University of Maryland, Department of Geology, College Park MD, USA

Recent attempts to constrain the scale and origin of mantle geochemical heterogeneity have emphasised the value of the ophiolite sample archive because, ophiolites are relatively accessible and preserve the spatial relations of sampled material. Such studies (e.g. refs 1-3) suggest that geochemical and isotopic heterogeneity arises from temporally distinct melting and melt extraction events that are highly localised. As part of a multi-disciplinary geochemical and petrological investigation of an exceptionally well-preserved example, detailed field mapping and structural measurements in the mantle section of the c. 497 Ma Leka ophiolite4, Norway has revealed a large-scale upright, tight to isoclinal antiformal fold. The antiform has a NE-SW striking axial plane that is inclined steeply to the NW. The structure plunges to the SW with a wavelength of several km, and a minimum amplitude of c. 3 km. The Leka antiform was defined by mapping out the distribution and vergence of parasitic folds defined by foliation and subtle compositional layering in harzburgite and by discrete dm-scale layers of dunite, interpreted as early melt channels. The parasitic folds occur on a variety of scales from decimetres to tens of metres. Their vergence changes systematically across the axial plane of the Leka antiform, i.e. they define apparent dextral and sinistral shears on opposite limbs. In places an axial planar foliation is developed. On various length scales, the Leka antiform can be shown to predate a series of diverse ultramafic bodies, also interpreted as melt channels, but of a later generation. Metre-scale parasitic folds are cut by undeformed cm- to dm-wide pyroxenite and websterite dykes, while on a larger scale, undeformed (10s of metres scale) dunite bodies that also post-date the main fold appear to intrude the petrological Moho. On a still larger scale, the Leka antiform is spatially associated with a profound strike change in the petrological Moho. This structure seems to postdate the Leka antiform and its geometry is compatible with extensional deformation associated with the younger melt channel dykes. Recognition and mapping of these mantle structures raises the prospect of further refinement of existing isotopic constraints on the length-scales and causes of chemical heterogeneity and points to the potential of integrating geochemical sampling with structural constraints on various scales.
1. O'Driscoll, B. et al. EPSL 488, 144-154 (2018). 2. O'Driscoll, B. et al. J. Petrology 56, 1797–1828 (2015). 3. Haller, M.B. MSc Thesis, Univ. Maryland (2017). 4. Dunning, G. R. & Pedersen, R. B. Contributions to Mineralogy and Petrology 98, 13–23 (1988).