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Multiphase magmatic history of the Oman-UAE ophiolite

K.M. GOODENOUGH[1], M.T. STYLES[2], R.J. THOMAS[2], D.I. SCHOFIELD[3], Q.G. CROWLEY[4] AND I.L. MILLAR[2]

[1]British Geological Survey (BGS), West Mains Road, Edinburgh EH9 3LA (kmgo@bgs.ac.uk)
[2]BGS, Keyworth, Nottingham, NG12 5GG
[3]BGS, Columbus House, Tongwynlais, Cardiff, CF15 7NE
[4]Dept. Of Geology, Trinity College, Dublin 2, Ireland

The Oman-United Arab Emirates (UAE) ophiolite is the largest ophiolite complex in the world. The majority of the ophiolite lies in Oman, but it has a northerly extension into the UAE. This has been mapped and studied in detail by the BGS since 2002, funded by the UAE's Ministry of Energy.

The Oman-UAE ophiolite was traditionally interpreted as a classic mid ocean-ridge ophiolite, but more recently it has been recognised that a second, voluminous phase of magmatism is superimposed upon the early MORB-like ophiolite sequence. In the UAE, our field mapping has shown that this later magmatic phase forms extensive intrusions including large gabbro plutons, tonalite bodies and mafic dyke swarms throughout the crustal sequence and the mantle transition zone. The later magmatism has been dated at 96.4 to 95.2 Ma [1], coeval with similar magmatism in the Oman sector of the ophiolite [2]. The age of the early magmatism is not yet known.

Petrology and mineralogy of the early magmatic phase are consistent with formation at a spreading ridge, but the magmas of the later phase were more hydrous. Dykes and lavas from the early magmatic phase have MORB-like geochemistry, whereas those from the later magmatic phase show geochemical features of subduction-related magmatism, such as lower Ti/V and Zr/Y. Whole-rock Pb isotope data also distinguish the two phases, and support a supra-subduction zone setting for the later phase.

The youngest, volumetrically minor magmatism, recorded in the UAE sector of the ophiolite as localised mafic dykes, has geochemical and isotopic signatures more like those of ocean island basalts, and may be associated with an extensional, post-obduction event. This magmatism is tentatively dated at about 91 Ma.

References:

1: Goodenough, K M et al. (2010). Architecture of the Oman-UAE ophiolite: evidence for a multi-phase magmatic history. Arab. J. Geosci. 3, 439-458.

2: Warren, C J et al. (2005). Dating the geologic history of Oman's Semail ophiolite: insights from U-Pb geochronology. Contrib. Min. Pet. 150, 403-422.