Geochemistry and petrology of the Khantaishir ophiolite (Central Mongolia)

O. GIANOLA[1], M.W. SCHMIDT[1], O. JAGOUTZ[2] AND S. OYUNGEREL[3]

[1]ETH Zürich, 8092 Zürich, Switzerland (*correspondence: omar.gianola@erdw.ethz.ch) (max.schmidt@erdw.ethz.ch)
[2]MIT, Cambridge, MA 02139-4307, USA (jagoutz@mit.edu)
[3]Mongolian Univ. of Science and Technology, Ulaanbaatar 46, Mongolia (oyunas@must.edu.mn)

Ophiolites are slices of oceanic lithosphere incorporated into continental crust. They often allow, in complete sections, to constrain the petrological and spatial evolution of their constituent lithologies and hence to reconstruct past oceanic basins. Oceanic lithosphere forms after seafloor spreading, which may occur at mid oceanic ridges or in proximity of subduction zones. We present a preliminary petrological and geochemical investigation of the Khantaishir ophiolite, a little studied, ~400 km^2 sized body located in central Mongolia, in the middle of the so called Central Asian Orogenic Belt (CAOB). Aim is to understand its formation history and to reconstruct the tectonic setting where this peculiar ophiolite originated (i.e. mid oceanic ridge or subduction zone). This ophiolite shows a complete crust/mantle transition with a highly refractory mantle composed of harzburgites displaying locally dunitic channels. Towards its top, this mantle is replaced by pyroxenites in discrete zones with a reconstructed sub-horizontal orientation. The igneous crust itself is composed of gabbro, minor gabbronorite (both replaced by pyroxenites in discrete zones), intermediate dykes/sills (but not sheeted dyke complexes) and pillow lavas, capped by a sedimentary cover of cherts and limestones. Major and trace elements of the crustal rocks of the Khantaishir ophiolite are compared with chemical analyses of modern ocean crust-forming localities (i.e. the East Pacific Rise, EPR, the Mariana and the Lau backarc basins). Al_2O_3, TiO_2, MnO, Co, V and Zr vs. X_{Mg} show trends similar to those observed for the Mariana and the Lau backarc basins, rather than to that displayed by the EPR. Dykes/sills and pillow lavas of the Khantaishir ophiolitic complex are generally basaltic-andesitic to andesitic in composition (average SiO_2 of ~57%). Their low TiO_2 (<1.2%) and Ti/V ratio of ~10 contrast with MOR suites, which are basaltic (average SiO_2 ~50%) with TiO_2 values >1.2% and a Ti/V ratio between 20 and 50. This evidence suggests that the igneous crustal rocks of the Khantaishir ophiolite were originated from a mantle source modified by a subduction component.

New insights into the size of atoms from electron density distributions

G.V. GIBBS[1*], N.L. ROSS[1] AND B.B. IVERSEN[2]

[1]Department of Geosciences, Virginia Tech, Blacksburg, VA 24061, USA (*correspondence: ggibbs@vt.edu)
[2]Department of Chemistry and iNANO, Aarhus University, DK-8000, Aarhus, Denmark

V.M. Goldschmidt recognized that one of the key variables controlling trace element partitioning is the size of the trace ion relative to the size of the site in the crystal structure in which it partitions. To date, ionic radii have been used in lattice strain models to predict partitioning behavior [1]. However traditional strategies used to determine ionic radii, based on a rigid oxygen with a fixed radius, are flawed. Analysis of electron density distributions (EDD) of over 50 oxides and silicates show that the EDD of oxygen is not spherical and displays as many different bonded radii as it has bonded interactions [2]. As a result, the bonded radius of oxygen is not fixed: it decreases systematically from 1.40 Å when bonded to an electropositive atom like K to 0.65 Å when bonded to a highly electronegative atom like N. The observation that the bonded radius of oxygen depends on the polarizing impact of the bonded atoms has profound implications for trace element partitioning. Furthermore, models that incorporate bonded radii derived from EDD's may also be useful in predicting trace element partitioning in more intractable systems such as sulphides.

[1] Blundy and Wood (2003) *EPSL*, **210**, 383-397. [2] Gibbs *et al*. (2013) *J. Phys. Chem*. **117**, 1632-1640

DOI:10.1180/minmag.2013.077.5.7