Origin of the Dunitic Transition Zone below oceanic ridges: insights from the Oman ophiolite

MATHIEU ROSPABE[1], MATHIEU BENOIT[1] AND GEORGES CEULENEER[1]

[1]Géosciences Environnement Toulouse (GET), Observatoire Midi Pyrénées, Université de Toulouse, CNRS, IRD, 14 avenue E. Belin, F-31400 Toulouse, France. mathieu.rospabe@get.obs-mip.fr

The understanding of the petrological processes occurring in the mantle-crust transition zone beneath oceanic ridges can be studied in the Oman ophiolite. The Maqsad area in the Oman ophiolite evolved in a MORB-like magmatic environment and presently exposes a >300 m thick Dunitic Transition Zone (DTZ) above a paleo-mantle diapiric structure. It was attributed to peridotite reactional melting or to the accumulation of olivine from Mg-rich melts whether a combined origin can not be excluded.

In the Maqsad area we sampled the DTZ along 19 cross-sections from the top of the mantle harzburgites to the base of the crust. The ~750 samples analysed revealed that the DTZ exposes a wide petrological variety of ultramafic rocks, from "pure" dunites to variably impregnated ones mainly containing interstitial poecilitic plagioclases and/or clinopyroxenes. The pure dunites display U- or V-shaped REE patterns that are consistent with a residual origin. The chemical composition of the impregnant plagioclase and clinopyroxene is also in agreement with crystallization from an interstitial melt of MORB affinity although the widespread occurrence of other minerals call for more complex processes.

Among other phases, Ti-rich orthopyroxene, pargasite, grossular, and gem-like diopside are present interstitially between olivine grains and as inclusions in chromite, showing that they are an early, high temperature features. Their chemical composition call for hybridization between a variably evolved MORB and hydrous fluids or water saturated silica-rich melts. Their distribution suggests that at some stage of the genesis of the DTZ, an ascending front of MORB melts met a descending front of hydrothermal fluids. These complex processes may account for the extremely variable trace element contents of both pure and impregnated dunites.