

## Hydrothermal circulation and post-obduction hydration & carbonation of oceanic lithosphere - $^{87}\text{Sr}/^{86}\text{Sr}$ and oxygen isotopic study of Oman ophiolite

C. CHEN\*, C. ANDRONICOS, L.M. CATHLES AND W.M. WHITE

Department of Earth and Atmospheric Sciences, Cornell University, Ithaca, NY 14853  
(\*correspondance: cc839@cornell.edu)

We report whole-rock isotopic analyses on 33 samples collected from Nakhl, Sumail and Wadi-Tayin nappes of Oman ophiolite, sampling a transect from upper gabbros to the Moho Transition Zone.  $^{87}\text{Sr}/^{86}\text{Sr}$  and  $\delta^{18}\text{O}$  varied as follows: (1) upper gabbros:  $^{87}\text{Sr}/^{86}\text{Sr}$  0.7032~0.7080,  $\delta^{18}\text{O}$  2.4~6.3; (2) middle gabbros:  $^{87}\text{Sr}/^{86}\text{Sr}$  0.7031~0.7060,  $\delta^{18}\text{O}$  5.3~6.1; (3) lower gabbros:  $^{87}\text{Sr}/^{86}\text{Sr}$  0.7031~0.7064,  $\delta^{18}\text{O}$  3.4~6.7; (4) Moho peridotites and carbonates,  $^{87}\text{Sr}/^{86}\text{Sr}$  0.7035 ~ 0.7086,  $\delta^{18}\text{O}$  2.95 ~ 30.57. These data together with petrographic studies confirmed that the entire ophiolite section below sheeted dikes was subjected to >300°C hydrothermal alteration during its formation and that locally temperatures exceeded 500°C. High  $\delta^{18}\text{O}$  and  $^{87}\text{Sr}/^{86}\text{Sr}$  in excess of Cretaceous seawater (0.7079) clearly show that serpentinization and carbonation of the ophiolite have also occurred post-obduction. Four out of five samples with  $^{87}\text{Sr}/^{86}\text{Sr}$  > 0.7079 are from Moho Transition Zone: two samples magnesite rocks with  $\delta^{18}\text{O}$  ~30, the other two are serpentinites with  $\delta^{18}\text{O}$  > 7. One tiger gabbro has  $^{87}\text{Sr}/^{86}\text{Sr}$  of 0.7080 and  $\delta^{18}\text{O}$  of 2.4. Leaching experiments show that the radiogenic Sr is not restricted to carbonate vein minerals. Thus original isotopic information is easily overprinted by the late stage processes if the peridotites are entirely altered into serpentinites or carbonates. On the other hand, gabbros, which have cracks filled with carbonates but not fully altered, can preserve hydrothermal alteration information during formation.

## Atoll garnet in the Yukahe UHP eclogite: Evidence for melt/fluid activity during the eclogitic facies metamorphism

D.L. CHEN, L. LIU AND X.M. LIU

State key Laboratory of Continental Dynamics, NW Univ., Xi'an, 710069, PR China. (dlchen@nwu.edu.cn)

The typical mineral assemblage of the Yukahe eclogite from the North Qaidam in NW China is Grt+Omp+Phen+Rt+Coel. Garnets in the eclogite show two shapes of normal porphyroblast garnet and atoll texture garnet. In which, the normal garnet cores contain mineral inclusions of Pl, Amp, Ap, Zoi, Ep and Qz, and change into Omp, Phen and Rt in the mantles, the rims are clean with few inclusion. EMP analyses revealed a compositional zoning with a bell-shaped decrease of Sp and a bowl-shaped increase of Pyr content towards the rim and a small decrease of Pyr in the outmost rims. The atoll garnets commonly consist of a euhedral ring and a island/peninsula core of garnet, eclogite facies multiphase solid inclusions of Omp, Phen, Grt, Rt and Qz filled between the core and the ring. In a few cases the garnet core is totally missing and filled with a single Phen. The island cores contain the same mineral inclusions as those of in the normal garnet cores; the garnet rings, like the rims of the normal garnet, are clean without any inclusions. A successive compositional zoning with Sp content decrease and Pyr content increase were revealed from the core to the ring, similar to that of the normal garnets. Omp and Phen occur in the matrix and within the atoll have almost the same composition. EBSD analyses demonstrate that the island/ peninsula garnet cores or fractions inside atolls have crystallographic orientations identical to that of the atoll rings. LA-ICP-MS analyses indicate that Omphs in both the matrix or within the atoll display the same REE patterns with a peak in MREEs and a pronounced depletion in both LREEs and HREEs. Whereas, the rings of the atoll garnet, relative to the core, show a distinct enrichment in MREEs and a visible depletion in HREEs. The mineral assemblage and their composition within atoll garnet are as same as that of the peak metamorphism of the Yukahe eclogite except for Coel, combined with the existing geochemical and chronological studies of leucosomes interbedded with the UHP eclogite body, it suggests that atoll garnets in the Yukahe eclogite formed under eclogite facies conditions during almost the peak metamorphism. It provides good evidence for melt/fluid activity during UHP metamorphism.