# Metamorphic Evolution of Carbonate-Bearing Eclogites from the Saxothuringian Zone (Czech Republic)

*Helena KLÁPOVÁ[1] and Gregory M. YAXLEY[2]*

[1] *Institute of Petrology and Structural Geology, Faculty of Science, Charles University, Albertov 6, 128 43 Praha 2, Czech Republic*

[2] *Research School of Earth Sciences, The Australian National University, Canberra ACT 0200, Australia*

A recent experimental study of the phase relations of carbonated eclogite (Yaxley and Green 1994) revealed that (a) carbonate is a refractory phase in a rutile eclogite residue, even in the presence of high degrees of partial silicate melting to form dacitic to rhyodacitic melts, and (b) the equilibrium carbonate composition depends on PT and bulk composition. In compositions with high Ca/Mg, the low pressure (P<2.0 kbar) assemblage of Mg-calcite + Py-rich garnet transforms to dolomite + Gr-rich garnet at high pressures (P>2.0 kbar). In compositions with low Ca/Mg, the low pressure assemblage of dolomite + Py-rich garnet transforms to Ca-magnesite + Gr-rich garnet at higher pressures.

Five carbonate-bearing eclogites from the Czech part of the Saxothuringian Zone exhibit natural evidence for the above phase relations. Samples with the most magnesian bulk-rock geochemistry (K670, H321 and H323) contain magnesite (Mg# = 81-85) ± calcite (Mg# = 27 at core to 79 at rim) cores surrounded by thin rims of dolomite (Mg# = 83-87), associated with garnet. Garnet is Py-poor and Gr-rich in the cores (e.g., $Gr_{27}Py_{10}Alm_{63}$ in K670). The calcite cores are inferred to be pre-eclogitic (low Mg#) and have undergone partial or complete replacement by magnesite, which has approached equilibrium with garnet cores under eclogite facies conditions. This prograde metamorphic path was followed by a brief, near-isobaric heating event during which dolomite rims formed on the magnesite ± calcite cores. The dolomite rims approached equilibrium with adjacent garnet rims, which are Gr-poor and Py-rich (eg; $Gr_{17}Py_{24}Alm_{59}$ in K670).

In contrast, samples with more calcic bulk-rock compositions (D521 and H324) display dolomite cores (Mg# = 84) surrounded by thin calcite rims (Mg# = 83). Dolomite has replaced inferred pre-eclogitic calcite during prograde metamorphism and the dolomite cores have approached equilibrium with adjacent garnet cores under eclogite facies conditions. A heating event at eclogite pressures resulted in the formation of high Mg# calcite rims. Dolomite rather than magnesite in equilibrium with garnet cores under eclogitic pressures is a response to varying bulk compositions rather than attainment of higher pressures by the magnesite-bearing group.

Comparisons between compositions of the experimentally and naturally crystallized garnet-carbonate pairs suggest that the eclogites achieved peak metamorphic pressure at P<2.5 kbar at temperatures of 650-700 °C. This was followed by a brief thermal event to ~750 °C at similar or slightly lower pressures. These temperatures are in agreement with the estimates based on the garnet-clinopyroxene Fe-Mg exchange thermometer according to Ellis and Green, 1979 (in Klápová 1990). Peak pressure estimates made on eclogites from the same area were calculated from equilibria among garnet, clinopyroxene and phengite using the calibration as proposed by Waters and Martin (1993). Calculated peak pressures correspond to 25.6-26.1 kbar at 650-700 °C with a suggested uncertainty of ± 2.5 kbar (Klápová et al. 1998) and are also in agreement with the herein made estimates.

## References

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