

Melting of carbonated eclogites

ROBERT W. LUTH

C.M. Scarfe Laboratory for Experimental Petrology,
Department of Earth and Atmospheric Sciences,
University of Alberta, Edmonton, Alberta T6G 2E3
Canada (robert.luth@ualberta.ca)

A major part of Peter Wyllie's work has been to understand the role of volatiles, especially CO₂, in petrogenetic processes in the Earth's mantle. A hallmark of his work was to use model systems to understand the fundamental controls on behavior of these volatile-bearing systems. Subsequent research has build upon this conceptual framework and extended it to higher pressures. Wyllie's work [e.g., 1] also provides insights into the effect of CO₂ on non-peridotitic lithologies such as eclogites. Such lithologies have higher variance than peridotites and therefore are more variable in their carbonation and melting behavior.

Recent studies on 'natural' carbonate-bearing eclogites at > 3 GPa [2-4] have found considerable variability in the location and shape of the solidus, which has been attributed to different bulk compositions and CO₂ contents [5]. To see if a model system perspective could help understand these differences, I determined the solidus in diopside-CO₂ [6], which introduced yet another shape of solidus to the eclogite menagerie.

New experiments on garnet-cpx-CO₂ (Py₇₀Gr₃₀-Di-CO₂) and garnet-cpx-coes-CO₂ shed some light on the differing behavior of these systems. The solidus of the former is indistinguishable from that of Di-CO₂ to 8 GPa, whereas that for the latter is similar in shape to that of [2], but offset to higher temperatures. Clearly, bulk composition is important – it is noteworthy that in the studies of [3-5], carbonate was stable at low pressures, rather than CO₂. This bulk compositional effect can be illustrated by projecting the compositions into CaO-MgO-Al₂O₃-SiO₂, and considering where they lie relative to the CaSiO₃-MgSiO₃-Al₂O₃ plane, which contains cpx and garnet. The compositions of [2], [6], and the present work lie either on the plane or to the SiO₂-rich side; those of [3]-[5] lie on the SiO₂-poor side. This difference is at the root of their different melting behavior.

- [1] Lee *et al.* (2000) *Contrib. Mineral. Petrol.* **138**, 199-213.
[2] Hammouda (2003) *Earth Planet. Sci. Lett.* **214**, 357-368.
[3] Yaxley & Brey (2004) *Contrib. Mineral. Petrol.* **146**, 606-619. [4] Dasgupta *et al.* (2004) *Earth Planet. Sci. Lett.* **227**, 73-85. [5] Dasgupta *et al.* (2005) *Contrib. Mineral. Petrol.* **149**, 288-305. [6] Luth (2006) *Contrib. Mineral. Petrol.* **151**, 141-157.

Evaluation of mineral reference materials for microanalysis of Ti-phases

GEORGE LUIZ LUVIZOTTO^{1*} AND THOMAS ZACK²

¹Max-Planck-Institut fuer Chemie, Joh.-Joachim-Becher-Weg 27, 55128 Mainz, Germany

(*correspondence: gluvizot@mpch-mainz.mpg.de)

²Institut fuer Geowissenschaften, Universitaet Mainz, Becher Weg 21, 55128 Mainz, Germany

In situ microanalysis of trace elements by LA-ICP-MS is one of the most important tools in geochemical studies. Its precision is sufficiently high for most applications. However, accuracy critically depends on the quality of the reference materials used for calibration (i.e., well constrained chemical composition and homogeneity). We have recently presented [1] four rutile crystals as potential reference materials for microanalysis (Sy, Diss, R19 and R10). Currently, we are assessing the application of these, as well as other recently presented mineral reference materials (titanite glasses - TIT200 [2], TNT150, 1500 [3]), to trace element analysis of Ti-phases by LA-ICP-MS. Analysis are performed with a 213 mm Nd:YAG laser system and a double focusing magnetic sector field ICP-MS. Relative sensitivity factors obtained for the mineral reference materials are compared with those from reference glasses (NIST 610 and 612, USGS and MPI-DING glasses). Results show that significant matrix effects can be ruled out for the investigated elements (V, Zr, Nb, Sn, Sb, Hf, Ta, W, Pb, Th and U), since sensitivity factors obtained for all reference materials are within the analytical uncertainty of ±5%. Mass interferences can be avoided by selecting the proper isotopes. Special attention is given to the new rutile reference materials. Results on the crystal that has the highest trace element concentration (R10) confirm previously presented data and show that its core is homogeneous within ±5% for most elements (e.g., Nb, Ta, Zr, Hf) and homogeneous within ±2% for Nb/Ta ratios. We are applying our knowledge to gain greater understanding of the Nb/Ta fractionation between Ti-Phases (rutile, ilmenite and titanite) and amphiboles in migmatitic mafic rocks from subduction zones, aiming to better understand the role of these phases in the fractionation of Nb and Ta during early continental crust formation.

- [1] Luvizotto *et al.* (in press). *Chem. Geol.* [2] Odegard *et al.* (2005). *Geostand. Geoanal. Res.* **29**, 197-209. [3] Klemme *et al.* (2008) *Geostand. Geoanal. Res.* **32**, 39-54.