A NEW THERMODYNAMICAL DATASET FOR Mn-RICH MINERALS: APPLICATION TO THE ECLOGITIZED OCEANIC Mn DEPOSIT OF PRABORNA (WESTERN ALPS, ITALY)

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The Mn-ore deposit of Praborna is embedded in the Zermatt-Saas meta-ophiolites (Western Italian Alps). It is located in the Saint-Marcel Valley (Aosta Valley), where the ophiolites have been metamorphosed in high-P low-T conditions (2.0 GPa and 550 °C; MARTIN et al., 2004) during the Alpine orogeny. This deposit has been described as metamorphosed mineralized cherts, overlying the oceanic crust of the Liguro-Piedmont branch of the Tethys that opened during Jurassic between Europe and Adria (Africa). The ore displays a banded structure towards the gneiss contacts, with development of variable petrological assemblages, pointing out complex redox reactions at the high-P peak as well as during retrogression. The ore itself consists in thick quartz-braunite and quartz-piemontite-spessartine layers. Other more-or-less abundant phases are: i) amphiboles (sodic-calcic, ranging from tremolite and winchite to glaucophane, rare richterite; mangano-cummingtonite), ii) clinopyroxene (diopside-jadeite-aegirine solid solutions), iii) micas (Mn-bearing phengite and phlogopite); iv) feldspars (albite, Ba-rich microcline); v) other Mn-minerals (rhodonite, calcite-rhodocrosite s.s., hollandite); vi) accessories phases: rutile, barite, titanite, apatite, ardennite, romeite, (Ca,REE)-vanadates, androsite-(Ce). Although the Praborna mine has been studied by many authors, the origin of the ore and the petrological evolution at and after the high-P peak are still uncertain. The difficulty in studying such unusual Mn-rich parageneses, is the lack of thermodynamic data, which prevents modelling the P-T evolution. Therefore, we have built a new thermodynamic dataset, estimating the thermodynamic properties of our Mn-bearing phases (ΔH_f, S_0, V_{mol}, the C_P parameters, a^0 and κ), by using a combined polyhedra-analogous modelling. In fact, we have chosen the mineral most similar to the phase selected for estimation, generally the Fe analogue because of the chemical similarity between Fe and Mn. For estimating a particular thermodynamic parameter, we subtracted the contribution of the Fe polyhedra to this parameter (recalculated by linear regression, using phases from the database of HOLLAND & POWELL, 1998) and we added the Mn one. We used this new dataset to construct P-T and T-a(O_2) grids in simple (Mn-Si-O) and complex (NCFMASH+Mn) systems, and, thus, we obtained results that well agree with the experimental published data. The dataset also allows the construction of P-T pseudo-sections, by considering the chemical composition of some of the Praborna rocks, whose evolution is thus better constrained.

References

HOLLAND, T.J.B & POWELL, R. (1998): J. metam. Geol., 16, 309-343.
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