

1.4.P12

Evidence for large Mg-Fe+Mn substitution in serpentine minerals and brucite from South Chamorro Seamount serpentinites (Mariana forearc)

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The ultramafic clasts cored at South Chamorro Seamount in the Mariana forearc during ODP Leg 195 (Site 1200; [1]) consist of 40-100% serpentinized harzburgites and dunites. The serpentinization process produced serpentine minerals, mainly lizardite and chrysotile, and possibly minor antigorite, along with brucite and pure magnetite. The serpentine minerals and brucite partially or completely replaced olivine and orthopyroxene crystals and filled veins. Microprobe analyses have revealed a large chemical variability of both serpentine and brucite, testified by their Mg# (= atomic Mg/(Mg+Fe+Mn)), from 95 to 77 and from 89 to 61, respectively. Brucite, in particular, exhibits large Mg-Fe+Mn substitution between the pure end-members Mg[OH]₂ (brucite) and Fe[OH]₂ (amakinite), ranging from Br₈₉ to Br₆₀ [2]. Overall, the serpentine minerals and brucite from South Chamorro Seamount ultramafic clasts exhibit ranges of Mg-Fe+Mn substitution surprisingly larger than those observed in the relict olivine and orthopyroxene crystals from which they are derived. This, along with the absence of talc, implies serpentinization temperatures between 200 and 300°C, in agreement with recent thermal models indicating that the serpentinized mantle wedge of the Izu-Bonin-Mariana subduction zone is cold [3].

References

- [1] Salisbury M.H., Shonohara M., Richter C. et al. (2002) *Proc. ODP Init. Repts.* **195**, pp. 1-233.
- [2] D'Antonio M. and Kristensen M.B. (2004) *Proc. ODP Sci. Results* **195**, submitted.
- [3] Hyndman R.D. and Peacock S.M. (2003) *EPSL* **212**, 417-432.

1.4.P13

Incorporating scapolite solid solution in mineral equilibria modelling of carbonate rocks

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As scapolite is an important rock-forming mineral in carbonate rocks under amphibolite facies metamorphic conditions, it should be incorporated in mineral equilibria modelling. Up to now, only meionite could be used, but as it is stable at considerably higher temperatures than naturally occurring intermediate-composition scapolites, the results from thermodynamic calculations are not useful. We present a new thermodynamic model for carbonate-scapolites.

Scapolite forms a solid solution involving various substitutions from the end member meionite (Ca₄Al₆Si₆O₂₄CO₃): 3NaSi for 3CaAl and NaCl for CaCO₃ to make marialite (Na₄Al₃Si₉O₂₄Cl); CaSO₄ for CaCO₃ to make silvialite (Ca₄Al₆Si₆O₂₄SO₄) and so on. Because the carbonate rocks of interest contain little Cl, and the S they contain is held in sulphides, the model developed is for carbonate scapolites between meionite, through "mizzonite", NaCa₃Al₅Si₇O₂₄CO₃, to "carbonate-marialite", CaNa₃Al₃Si₉O₂₄CO₃.

Given the apparent stability of mizzonite, reflected for example in mizzonitic scapolites being able to occur with plagioclase which is both more and less calcic than scapolite, an empirical order-disorder thermodynamic model for scapolite was adopted. In this the 12 cation sites for Si and Al were divided into 9 T1-sites, occupied by 6 Si and 3 Al for all scapolite compositions, and one T2A and two T2B sites. The occupation of the T2 sites depends on the scapolite composition. To describe the solid solution between meionite and carbonate-marialite two parameters are used, a composition parameter $X = \text{Al}/3 - 1$ and an order parameter $Q = 3/2 (X - x(\text{Al}, \text{T2A}))$. The interaction energies and the enthalpy of the order-disorder reaction were adjusted so that the shape of the plagioclase-scapolite T - X diagram is produced.

Thermodynamic calculations in carbonate systems incorporating this scapolite solution model lead to reasonable results with the calculated stable mineral assemblages being comparable to the observed natural ones.