Low degree hydrous and anhydrous partial melting of peridotite

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Current experimental data on partial melting of peridotites generally refer to quite high degrees (>10%) of partial melting and are of restricted applicability to the problem of M.O.R.B. genesis. It is widely believed that the oceanic upper mantle melts in a fractional or near-fractional manner by 6 to 20% (Kinzler & Grove 1991) and therefore melt compositions corresponding to <5% melting must be measured. In order to improve models of low degree melting we have conducted a series of peridotite-basalt sandwich experiments at 15 kb and 1270°C to 1350°C and have obtained a series of melts in equilibrium with a spinel lherzolite residue at degrees of partial melting equivalent to 1–10%.

Reversal experiments are a necessary check on equilibrium and these have been carried out on the liquids produced just above the peridotite solidus. A common problem with many experimental mantle melting investigations is the presence of water in the capsule due to initial adsorbed water and Hydrogen ingress throughout the duration of the experiment. Many experimentally produced melts contain in the order of 1wt.% H_2O which is much greater than that contained in M.O.R.B.'s (approx. 200 p.p.m.). We have developed a technique which allows truly anhydrous experiments to be conducted. If melting experiments performed containing 1wt.% H_2O are compared with those containing <0.1wt.% H_2O (see Fig.1) then it can be seen that the melting reaction close to the peridotite solidus is heavily dependent on the presence of water.We have quantified the melting reaction in terms of crystal–liquid equilibria and find, when corrected for Fe/Mg ratio, that our results agree well with those of Walter and Presnall conducted in the NCMAS and CMAS systems.

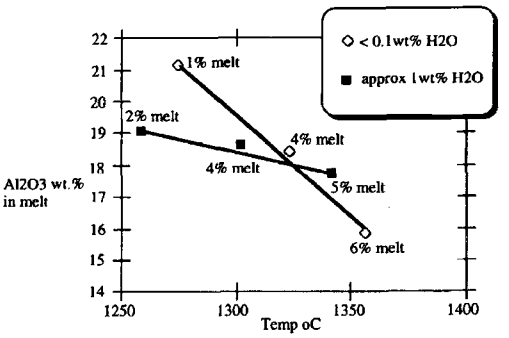

FIG. 1. Plot of Al_2O_3 content of melt *vs.* Temp. °C. Numbers refer to %% melting of MORB pyrolite-90.

References

Kinzler, R.J. and Grove, T.L. (1991) *J. Geophys.l Res.*, **97** 6885–906.

Walter, M.J. and Presnall, D.C. (1994) *J. Petrol.*, **35**, 329–59.