

Experimental modeling of sediment–peridotite interaction under temperature-gradient conditions

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The subduction factory [1] involves metasomatism and partial melting in a hot mantle wedge under the influence of fluid or melt generated in a downwelling oceanic slab. In order to explore these processes in a deep subduction zone, interaction between peridotite (garnet harzburgite) and model hydrous carbonated sediment (GLOSS composition of Plank & Langmuir [2]) was experimentally modeled in a multianvil apparatus at 7.5–10.5 GPa. A method was developed to maintain a steady temperature gradient within the sample. In most experiments, peridotite material was placed in the hot zone (at 1000–1300°C), and sediment, in the cold zone (500–1000°C). The products were analyzed with an electron microprobe and LA ICP MS. The main results are as follows. (1) Melt was collected in the hot zone and its composition depends on temperature at both hot and cold ends. (2) Olivine in peridotite was mostly replaced by orthopyroxene and magnesite and preserved occasionally near the sediment–peridotite boundary. (3) A garnet-rich zone was formed at the top of the sedimentary layer. (4) Sediment was transformed mainly to a orthopyroxene + garnet + clinopyroxene assemblage. (5) K-bearing hydrous phases (phlogopite or phengite) and carbonates were observed in the sedimentary layer at low temperatures in the cold zone (<600°C), otherwise K was completely mobilized by melt. (6) Na and Ca were retained to a large extent in the sediment up to ~1000°C owing to clinopyroxene crystallization. (7) Al was the most inert major component, while Si was transported from the sediment to peridotite, and Mg, Fe and Cr, from peridotite to sediment.

[1] Hacker *et al.* (2003) *J. Geophys. Res.* **108**, 2029. [2] Plank & Langmuir (1998) *Chem. Geol.* **145**, 325–394.