



An experimental study on mineral sequestration of CO₂ in basic and ultrabasic rocks

F. Dufaud(1,2), I. Martinez(1,2), S. Shilobreeva(3), G. Fiquet(1,4)

(1) IPGP, Centre de recherches sur le stockage géologique du CO₂, Paris, France, (2) IPGP, Laboratoire de Géochimie des Isotopes Stables, Paris, France, (3) Vernadsky Institute of Geochemistry and Analytical Chemistry of Russian Academy of Sciences, Moscow, Russia, (4) IMPMC et IPGP, Dept de Minéralogie et Centre de recherches sur le stockage géologique du CO₂, Paris, France (dufaud@ipgp.jussieu.fr / Fax : +33 1 44 27 28 28 / Phone : +33 1 44 27 21 43)

CO₂ is one of the major gases responsible for the greenhouse effect. Mineral sequestration of CO₂ is the process that converts gaseous CO₂ into a geologically stable phase: a carbonate. Mineral sequestration in basic and ultrabasic rocks is an interesting option due to the strong thermodynamic disequilibrium between the CO₂ rich fluids and the constitutive minerals of these rocks. In order to study these reactions, we have carried out carbonatation experiments of olivines, serpentines and orthopyroxenes at elevated pressures (1-1.7kbar) and temperatures (400–500°C). Mineralogical study of the reacted samples using both SEM (Scanning Electron Microscopy) and TEM (Transmission Electron Microscopy) allows the identification of nanometer sized magnesite crystals. The amount of carbonate formed was measured by decarbonation of the reacted material. Isotopic mass balance calculations were also done; they provide a precise monitoring of carbonatation. Measured carbonatation ratio in such a closed system were found to be 8 wt% and 3, 5 wt% (of MgCO₃), for serpentine and olivine respectively, at 1.7kbar and 500°C. Moreover, addition of water in the system was found to enhance the process of carbonatation. Thermodynamic modelling of these results show that temperatures as high as 500°C are necessary to reach equilibrium on hour time scales. At 400°C, experimental data show that equilibrium was not reached after 4 hours. Extrapolation to storage site conditions (P=100-300 bar and T= 80-100°C) will be modelled and characteristic times for such reactions discussed. Finally, new experiments conducted at natural P-T conditions for CO₂ storage are in progress to validate our thermodynamic and kinetic model.