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Carbonate stability in the Earth's interiors

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The fate of carbonates subducted deeply (>300 km) in the Earth's mantle was not so long ago a matter of debate: would carbonate compounds remain stable of would they decompose to yield " free" CO2 component capable of diffusing as a fluid and triggering melting in hot areas? In order to resolve this issue, petrological experiments were carried out in the diamond anvil cell nearly two decades ago. They showed that carbonate compounds (mostly magnesite) are the stable form in the presence of silicates down to the lower mantle for temperatures approaching those of the geotherm. While direct petrological experiments provide the best evidence for carbonate stability, thermodynamic modelling is still subject to considerable uncertainties owing to the long-range extrapolations of properties measured on pure compound over a limited P-T range. We will review some of the measurements that may help improving thermodynamic models of carbonate stability. At shallower depths, carbonate transportation to deep Earth may be limited by their reactivity with other compounds and especially aqueous fluids. Recent experiments designed to measure carbonate solubility and reactivity at pressures and temperatures relevant to the subduction context will be presented.

Keywords: carbonate, deep earth, stability, solubility