[EE] Evening Poster | S (Solid Earth Sciences) | S-IT Science of the Earth's Interior & Tectonophysics

[S-IT25]Deep Carbon: Diamond formation and carbon speciation in Earth and planetary processes

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Diamonds are observed in various localities including terrestrial and extraterrestrial environments. However, there are several reports on the diamond localities from non-traditional sources including ultra-deep seated diamonds, ultrahigh pressure metamorphic rocks, various magmas, some meteorites and terrestrial craters. These diamonds might be formed by shock events, crystallization from fluids, magmas, or metallic melts, and CVD process. In this session, we welcome papers on occurrence and origin of diamonds from traditional and non-traditional sources in earth and meteorites. We also encourage the experimental studies on diamond genesis, speciation of carbon bearing compounds in terrestrial rocks and meteorites. We welcome papers on formation mechanisms of diamond in natural metal-carbon systems, chromatographic study of deep seated and experimental fluids. We also welcome papers dealing with behavior of organic materials at high pressure and high temperature corresponding to the deep earth and planets. In some chromitites, various enigmatic high pressure phases have been reported as inclusions together with diamond. We also encourage the presentations on descriptions and discussions on the origin of these materials.

[SIT25-P01]Revision of the $CaCO_3$–$MgCO_3$ phase diagram at 3 and 6 GPa

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Subsolidus and melting relationships in the system $CaCO_3$–$MgCO_3$ have been reexamined using a Kawai-type multianvil apparatus at 3 and 6 GPa in graphite capsules (Fig.1). Phase boundaries were delineated according to the chemical composition of phases measured by electron microprobe in energy dispersive mode and identification of crystal phases by Raman spectroscopy (Shatskiy et al., 2018).

At 3 GPa, the dolomite-magnesite solvus intersects the melting loop at about 1250 °C, and the isothermal three-phase line so produced represents the peritectic reaction: dolomite (Ca# 43) = magnesite (Ca# 13) + liquid (Ca# 48), where Ca# = 100×Ca/(Ca+Mg). The melting loop for the $CaCO_3$ –$MgCO_3$ join extends from 1515 °C ($CaCO_3$) to 1515 °C ($MgCO_3$) through a liquidus minimum at 1230 °C (near 53 mol% $CaCO_3$). Starting from 1425 °C at £30 mol% $CaCO_3$ in the system, the liquid quenches to dendritic carbonate and periclase and contains rounded voids, indicating an incongruent melting reaction: $MgCO_3$ (magnesite) = MgO (in liquid) + CO_2 (fluid and/or liquid).

At 6 GPa, aragonite + magnesite assemblage is stable up to 1000 °C. The reaction aragonite + magnesite = dolomite locates between 1000 and 1050 °C. The presence of dolomite splits the system into two partial binaries: aragonite + dolomite and dolomite + magnesite. The dolomite-magnesite solvus intersects the melting loop between 1400 and 1450 °C, and the isothermal three-phase line so produced represents the peritectic reaction: dolomite (Ca# 31) = magnesite (Ca# 21) + liquid (Ca# 57). The melting loop for the $CaCO_3$–$MgCO_3$ join extends from 1660 °C ($CaCO_3$) to 1780 °C ($MgCO_3$

) through a liquidus minimum at 1400 °C and 62 mol% $CaCO_3$.
The compositions of carbonate crystals and melts from the experiments in the carbonated eclogite (Yaxley and Brey 2004) and peridotite (Dalton and Presnall 1998) systems are consistent with the geometry of the $CaCO_3$-$MgCO_3$ melting loop at 3 and 6 GPa: Ca-dolomite melt coexists with Mg-calcite in eclogite and peridotite at 3 GPa and dolomite melt coexists with magnesite in peridotite at 6 GPa.
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References
Dalton, J.A., Presnall, D.C. (1998) Contrib. Mineral. Petrol., 131: 123-135.
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Yaxley, G.M., Brey, G.P., (2004) Contrib. Mineral. Petrol., 146: 606-619.

Fig. 1. Isobaric *T-X* diagrams for the system $CaCO_3$-$MgCO_3$ at 3 and 6 GPa. Arg – aragonite, Cal or Ca-Dol – Mg-bearing calcite or Ca-rich dolomite, Dol – dolomite, Mgs – magnesite, F – CO_2 fluid, L – liquid. Open and grey circles indicate composition of solid phases and liquid. Grey numbers denote eutectic and peritectic compositions in mol% $CaCO_3$.