[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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Tue. May 22, 2018 5:15 PM - 6:30 PM Poster Hall (International Exhibition Hall7, Makuhari Messe) 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-P02]The *T-X* phase diagram Na₂CO₃–CaCO₃ at 3 GPa

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Phase relations in the system Na₂CO₃–CaCO₃ have been studied at 3 GPa and 800–1525 °C. The system has one intermediate compound, Na₂Ca₃(CO₃)₄, at 800 ºC, and two intermediate compounds, Na₂Ca(CO₃)₂ and Na₂Ca₃(CO₃)₄, at 850 ºC (Fig. 1a). CaCO₃ crystals recovered from experiments at 950 °C and 1000 °C are aragonite and calcite, respectively. Maximum solid solution of CaCO₃ in Na₂CO₃ is 20 mol% at 850 ºC. The Na-carbonate–Na₂ Ca(CO₃)₂ eutectic locates near 860 °C and 56 mol% Na₂CO₃. Na₂Ca(CO₃)₂ melts incongruently to Na₂ Ca₃(CO₃)₄ and a liquid containing about 51 mol% Na₂CO₃ at ~ 880 °C. Na₂Ca₃(CO₃)₄ disappears above 1000 °C via incongruent melting to calcite and a liquid containing about 43 mol% Na₂CO₃. At 1050 °C, the liquid, coexisting with Na-carbonate, contains 87 mol% Na₂CO₃. Na-carbonate remains solid up to 1150 °C and melts at 1200 °C (Fig. 1c). The Na₂CO₃ content in the liquid coexisting with calcite decreases to 15 mol% as temperature increases to 1300 °C. CaCO₃ remains solid up to 1500 °C and melts at 1525 °C (Fig. 1d).

Considering the present and previous data, a range of the intermediate compounds on the $CaCO_3 - Na_2CO_3$ join changes as pressure increases in the following sequence: $Na_2Ca(CO_3)_2$, $Na_2Ca_2(CO_3)_3$ (0.1 GPa) → $Na_2Ca(CO_3)_2$, $Na_2Ca_3(CO_3)_4$, $Na_2Ca_3(CO_3)_4$, $Na_2Ca_3(CO_3)_5$ (6 GPa) (Fig. 1b). Thus, the nyerereite stability field extends to the shallow mantle pressures, whereas the shortite stability field terminates somewhere between 0.1 and 3 GPa. Consequently, findings of nyerereite and shortite among daughter phases in the melt inclusions in olivine from the sheared garnet peridotites are consistent with their mantle origin.

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Fig. 1. (a) The system Na₂CO₃–CaCO₃ at 3 GPa. (b) Comparison with previous data at 0.1 GPa (Cooper et al. 1975) and 6 GPa (Shatskiy et al. 2013). (c) Na₂CO₃ melting. (d) CaCO₃ melting. Arg = aragonite; Cal = calcite; Na₂ = solid solution of CaCO₃ in Na₂CO₃; Na₄Ca = Na₄Ca(CO₃)₃; Na₂Ca = Na₂Ca(CO₃)₂; Na₂Ca₃ = Na₂Ca₃(CO₃)₄; Na₂Ca₄ = Na₂Ca₄(CO₃)₅; L = liquid; F = CO₂ fluid.