Chemical reactions and element partitioning at the core-mantle boundary

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Recent advances in high-pressure spectroscopic techniques have led to the discovery of the spin transitions and a post-perovskite phase [1, 2]. Spin transition occurs in magnesiowustite, and perovskite in lower mantle conditions. The transitions might cause changes in partitioning behaviour between these minerals [1] although the pressure interval in spin transitions can be large at high temperature [3]. The post-perovskite phase with $CaIrO_3$ structure is stable at pressures above 110 GPa and at high temperature. The effects of Al and Fe on phase transition and element partitioning between post-perovskite and magnesiowustite are also under debate [4, 5]. In this talk, I will review these recent results on the phase relations at the base of the lower mantle including our new results on Mg-Fe partitioning between post-perovskite and magnesiowusitute, which shows a large compositional dependency in the partition coefficient.

The reactions between metallic iron and silicates are also essential process at the core-mantle boundary. I also summarize the recent results on the reactions between metallic iron and silicate/oxide under the lower mantle/CMB conditions [6, 7]. I also show our recent results on dissolution of O, Si, and H in metallic iron as candidates for the light elements in the core, and dissolution of K as a possible heat source in the core [8, 9]. Significant amount of O, Si, and H can be dissolved in molten iron at the CMB conditions, whereas dissolution of K might be limited and K may not be important as a heat source in the core.

[1] Badro *et al.* (2004) *Science* **305**, 383-386. [2] Murakami *et al.* (2004) *Science* **304**, 855- 858. [3] Lin *et al.* (2007) *Science* **317**, 1740-1742. [4] Mao *et al.* (2004) *PNAS* **101**, 15867–15869. [5] Murakami *et al.* (2005) *GRL*, **32**, L03304, doi,10.1029/2004GL021956. [6] Sakai *et al.* (2006) *GRL*, **33**, doi, 10.1029/2006GL026868. [7] Asahara *et al.* (2007) *EPSL*, **257**, 435-449. [8] Hirao *et al.* (2006) *GRL*, **33**, L08303, doi, 10.1029/2005GL025324. [9] Sano *et al.* (2008) *GRL*, Vol. **35**, L03303, doi,10.1029/ 2007GL031718.

Contrast occurrence of banded iron formations in western part of Isua Spracrustal Belt, West Greenland

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Banded iron formations (BIF) are widespread in Isua Spracrustal Belt, West Greenland (ca. 3.8Ga). Detailed geological surveys of BIFs in the western side of Isua were performed to find as to if (1) indicative materials for their depositional environments and (2) remnants of life were preserved.

In the northern part of low-strain area, BIFs were interbedded with graphitic schist. Laminations of graphite, quartz and magnetite/cummingtonite/anthophyllite layer are observed in microscopic scale in graphitic schist. Mg-Fe chlorite, ilmenite, zircon, monazite and apatite are distinguished as minor components. REE patterns of such graphitic schist are similar to other Archean shales. These geochemical characteristics and existence of detrital zircon suggest that graphitic schist was clear clastic marine sediments containing remnants of 3.8 Ga biota, probably analogous to reported metasediments [1]. Note that magnetite in BIFs also contains microscopic graphite inclusions.

In the east side of high-strain area, a few m thick BIFs occur adjacent to ultramafic rocks [2]. These BIFs consist of quartz and magnetite/amphibole layer, without having graphite. Garnet-chlorite-biotite schist appears next to BIFs in particular at the boundary with Ameralik dike. Geochemical and mineralogical studies indicate that such Al-rich sequences are metasomatic origin, suggesting the absence of clastic components in the eastern BIFs of the examined area. These magnetite-BIF in high-strain area could be relatively deep-sea chemical sediments contrasting to the clastics-rich northern BIFs.

[1] Rosing, M. T. (1999) *Science* **283**, 674-676. [2] Furnes *et al.* (2007) *Science* **315**, 1704-1706.