The Fe-O-S system at high pressure and implications for Earth's core

J.A. LANGLADE AND M.W. SCHMIDT

Institute for Mineralogy and Petrology, ETH Zurich Clausiusstrasse 25, 8092 Zurich (jessica.langlade@erdw.ethz)

The scope of this study is to further constrain the enigma of 'the light component in the core' which has major consequences for core formation models during accretion of terrestrial planets, in particular for the very initial stage when the metall fraction begins to melt but the silicates are still solid. Understanding eutectic compositions and temperatures at this early stage allows to model the beginning of core segregation.

Employing a Walker-type high-pressure multi-anvil device, we have investigated melting relations in the Fe-rich portion of the Fe-O-S ternary systems at 23 GPa, in particular the Fe-S eutectic as a function of oxygen concentration. With a stepwise addition of oxygen (0.5 wt% oxygen/step), we follow the compositional and temperature evolution of this eutectic until saturation in a FeO-phase is achieved.

The occurrence of melting is easily recognized by a change of texture. Our results indicate that the Fe-O-S eutectic occurs around 1000°C at 23 GPa. The eutectic temperature is less than 100°C lower than that in the pure Fe-S system at same pressure [1], suggesting that oxygen has a moderate effect on further depressing the melting temperature of the Fe-S system. The solubility of oxygen in the liquid increases by adding sulfur to the system and with increasing temperatures, suggesting that the oxygen concentration in the liquid core increase with sulpur content. On the other hand, sulfur solubility in the solid iron increases to the eutectic temperature and than decreases with increasing temperature. that the addition of oxygen to the system has no measurable effect on the sulfur solubility in the solid iron.

Our results suggest, that already at upper mantle pressures, O and S solubilities exceed those required to satisfy the Earths core density deficit [2]. The sulphur content in the inner core could be small considering the limited solubility at the eutectic temperature, which is much lower than inner core temperatures.

[1] Stewart *et al.* (2007) *Science* **316**, 1323-1325.
[2] McDonough & Sun (1995) *Chem. Geol.* **120**, 223-253.

Zircon geochronology of amph-rich gabbroic rocks and associated granitoids from Kyushu Island (southwest Japan arc)

A. LANGONE[1], T. MORISHITA[2] AND M. TIEPOLO[1]

[1]C.N.R. – Istituto di Geoscienze e Georisorse, U.O. Pavia, Pavia, Italy
[2]Frontier Science Organization, Kanazawa University, Kanazawa, Japan

Although amphibole is rarely a phenocryst in subduction related volcanic products, recent studies suggest that many arc magmas are residual after amphibole crystallisation. The petrogentic role of amphibole should be thus confined at mid/low crustal levels. Amph-rich rocks are found in arc settings either as crustal xenoliths or as exhumed mafic bodies in collisional settings.

Common feature of many exhumed amph-rich rocks from collisional settings is the pseudoporphyritic texture and their close association with granitoids. However, the effective genetic relationships between mafic and acid magmas are unclear and worth of a deeper understanding. In this work we have explored the petrogenesis and the relationships between amph-rich rocks and associated granitoids in two key localities in the Kyushu Island (southwest Japan arc): Shikano Shima Island and Kunisaki Peninsula.

Zircon from amph-rich rocks (quartz diorites) and granitoids were charaterised for internal structure with cathodoluminescence and *in situ* for U-Pb ages as well as trace element composition by ELA-ICPMS. Preliminary results confirm the Cretaceous age (close to 100 Ma) for both the mafic and acid rocks. An almost single age distribution (close to 100 Ma) is found for the granitoid rocks in both localities. Mafic rocks show a more complex age distribution with multiple age clusters both coeval with the granitoids and also slighlty older (up to 108 Ma).

The absence of textural evidence of inheritance in zircons from the mafic rocks suggests that older ages most likely date the emplacement of the mafic body, whereas the youngest ages are most likely related to equilibration induced by the granitic melt. The late intrusion of the cold acidic magma into a mafic crystal mush may also explian the pseudoporphyritic texture of the amph-rich gabbroic rocks. Mafic rocks seems to be coheval in both localities sugegsting a widespread production of highly hydrous mafic melts of mantle origin along the contiunental margin during the Cretaceous that slighlty predated the generation of the large volumes of granites.