Goldschmidt 2000
September 3rd–8th, 2000
Oxford, UK.

Journal of Conference Abstracts
Volume 5(2), 434

High-Pressure and High-Temperature Reactions Between Mantle Minerals and Metals in the Fe-Si-O-S System

Laurent Gautron (gautron@univ-mlv.fr)[1], **Valérie Malavergne** (malaverg@univ-mlv.fr)[1], **Isabelle Martinez** (martinez@ipgp.jussieu.fr)[2] & **François Guyot** (guyot@lmcp.jussieu.fr)[3]

[1] Lab. Géomatériaux, Université de Marne la Vallée, 5 Bd Descartes, Champs-sur-Marne, 77454 Marne la Vallée Cedex 2, France
[2] Lab. Géochimie Isotopes Stables, Institut de Physique du Globe de Paris, 4 place Jussieu, 75252 Paris Cedex 05, France
[3] Lab. Minéralogie et Cristallographie de Paris, Université Paris 6, 4 place Jussieu, 75252 Paris Cedex 05, France

Metal-silicate reactions at high pressure and high temperature are studied in order to understand the core-mantle boundary, and to elucidate the nature of the seismically anomalous D" layer. Moreover, knowing high-pressure and high-temperature partitioning of elements like Si, O or S between metal and silicates could constrain the nature of the light elements in the core and then contribute to the understanding of the segregation of the Earth's core.

Results from some previous studies (Knittle and Jeanloz, 1991 ; Ringwood and Hibberson, 1991; Ito et al., 1995; Goarant et al., 1992) suggest that silicon and oxygen could be light elements of the core. More recently, Gessmann and Rubie (1998) have observed that the solubility of silicon in liquid metal at 9 GPa seems to preclude this element as a major light component in the Earth's core. Other studies (Urakawa et al., 1987; Sherman; 1992) showed the possibility of high-pressure solid solution between S and Fe, suggesting that sulphur could be one of the major light elements of the core. In order to have a better understanding of these phenomena, we have performed new high-pressure and high-temperature experiments at (P,T) conditions of the mantle, in a multianvil apparatus (MA) and in a laser-heated diamond anvil cell (DAC), on mixtures of enstatite and (Fe, Si) alloys, and on mixtures of enstatite or diopside and iron sulphur Fe-10 wt% S. Quenched samples were observed by Scanning Electron Microscopy, Electron Microprobe and Transmission Electron Microscopy.

Almost all the samples display a typical texture which shows that the metallic phase was melted. Similarly to a preliminary study (Poirier et al., 1998), we observe chemical reactions between molten (Fe, Si) alloys and mantle minerals leading to a dissolution of oxygen in the molten metallic phase. In some DAC experiments, we also observe that silicates in contact with (Fe, Si) alloys are enriched in FeO at ambient or high pressure. However we note that the reactions between (Fe, Si) alloys and silicates are limited, especially in the MA experiments where the system (Fe, Si) alloys-silicates appears to be quite stable at pressures up to 25–GPa and temperatures up to 2000 C. Reactions between iron sulphur and silicates are more extended, leading to a higher iron content in the silicate phase in contact with the melted metallic phase. We make some thermodynamical calculations to try to explain the reactions we observed, and we discuss the influence of pressure, temperature and oxygen fugacity on these reactions between silicates and metals.

Knittle E & Jeanloz R, *Geophys. Res. Lett.*, **16**, 609-612, (1991).

Ringwood AE & Hibberson WO, *Earth Planet. Sci. Lett.*, **102**, 235-251, (1991).

Ito E, Morooka K, Ujike O & Katsura T, *J. Geophys. Res.*, **100**, 5901-5910, (1995).

Goarant F, Guyot F, Peyronneau J & Poirier J-P, *J. Geophys. res.*, **97**, 4477-4487, (1992).

Gessmann CK & Rubie DC, *Geochim. Cosmochim. Acta*, **62**, 867-882, (1998).

Urakawa S, Kato M & Kumazawa M, *High Pressure Research in Mineral Physics, editors: Manghnani & Syono*, 95-111, (1987).