Report HC1911

Properties of intermediate compounds in the Fe-FeS phase diagram over the 10-25 GPa pressure range: implications for Mars and Mercury cores

High pressure-high temperature experiments were carried out on the high pressure ID27 beamline. Different Fe-S samples with compositions of 6wt%S, 16wt%S and 30wt%S were heated up to 500°C and compressed between 12 and 25 GPa under vacuum and resistive heating.

Pressure was calibrated from the NaCl EoS, used as pressure medium. We were able to clearly identify the domain of stability for the Fe_3S_2 compound, that is stable over a small pressure range of only 4 GPa (Figure A). We are currently trying to index the structure of this intermediate compound.

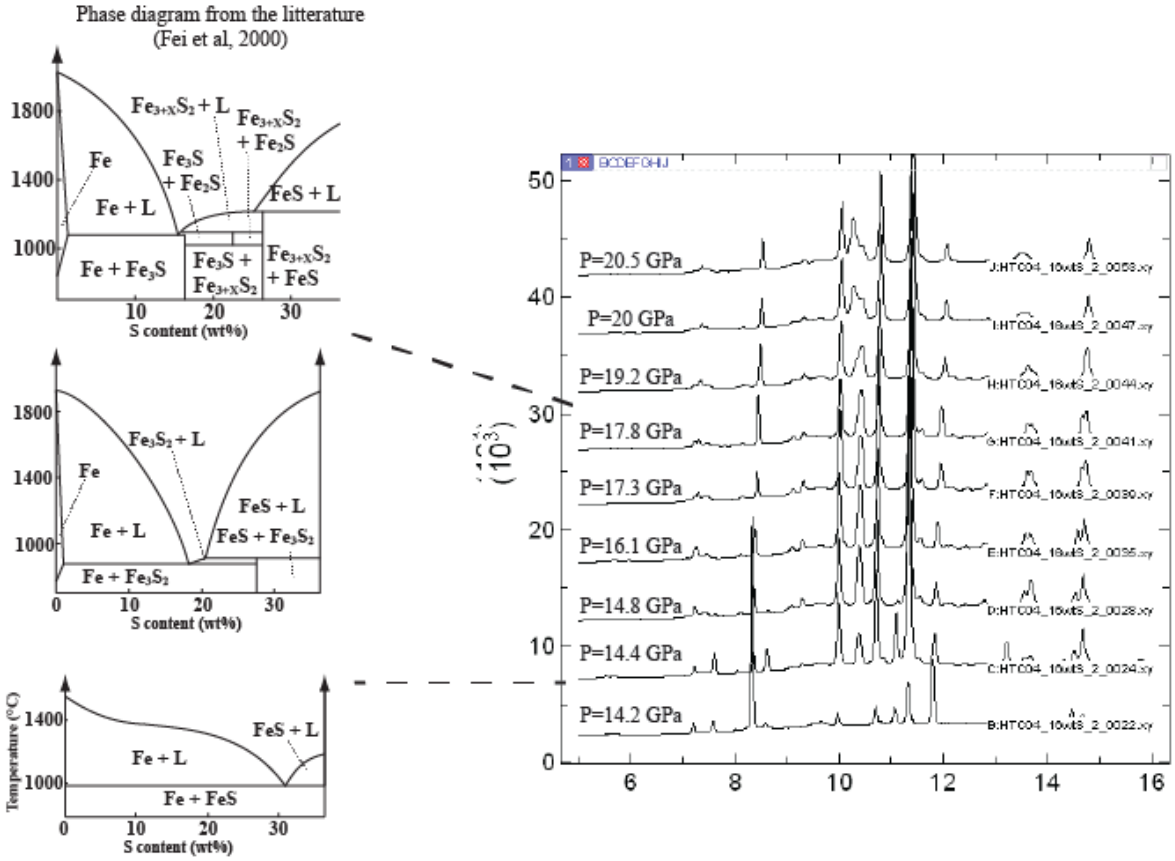

Figure A: Evolution of the Fe-FeS phase diagram from ambient pressure up to 21 GPa (Fei et al., 1997, 2000). From previous studies, stability field of intermediate compound Fe_3S_2 was established between 12 and 21 GPa. Here we show that the pressure domain is largely smaller, betwwen 14 and ~18 GPa. Over 19 GPa, this compound decomposes and new phases are stabilized, such as Fe_3S.

Unfortunately, oxidation problems were present in high S content sample (30wt%S) and it was therefore impossible to examine appearance of Fe2S or other compounds presented in the phase diagram over 20 GPa, for high S content (Figure A).

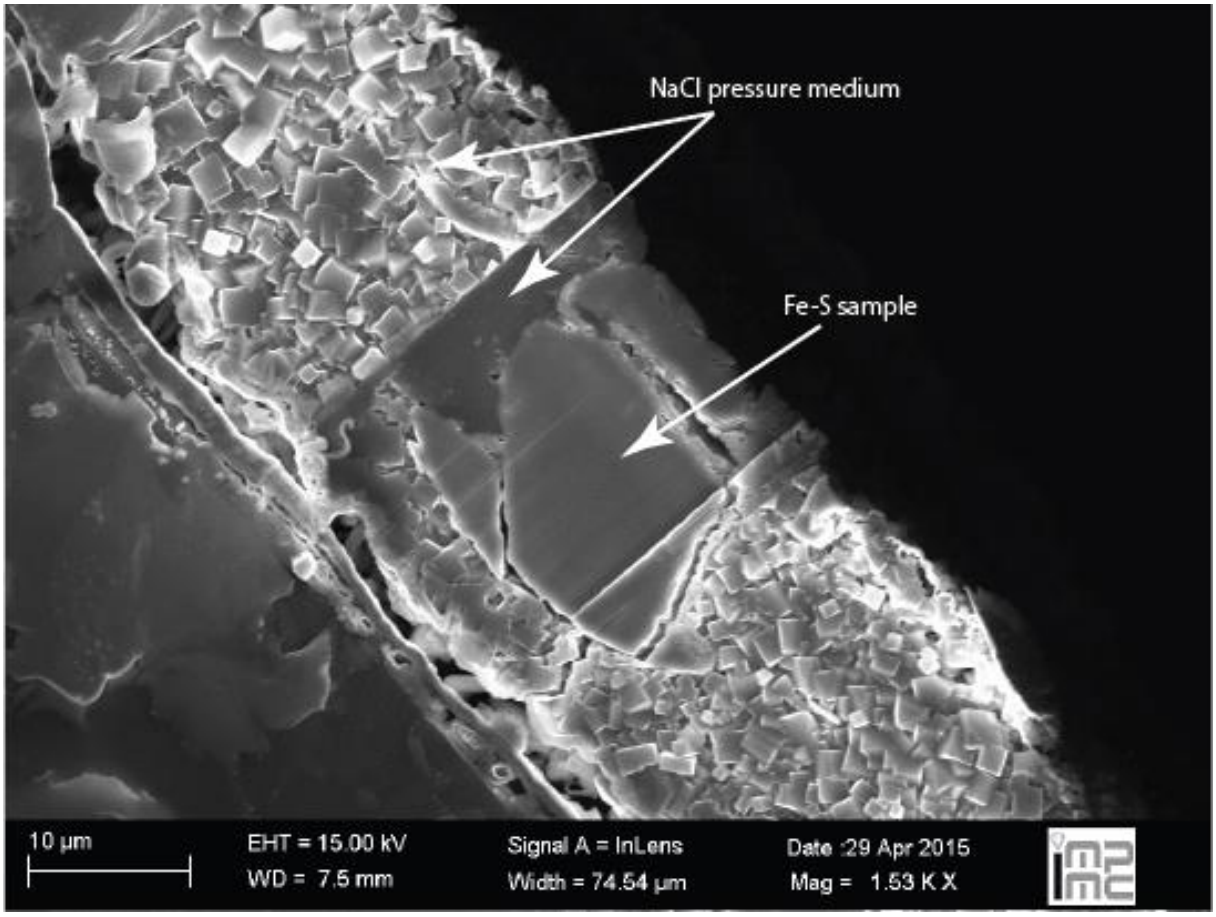

Figure B: SEM image of the FIB cut of the recovered sample from high pressure.

Recovered samples were cut using FIB (Figure B) in our laboratory (IMPMC, Paris). Homogeneity and purity of the samples were checked, however Fe30wt%S shown high O contamination.