	Experiment title: Density measurements on Fe-S-Si liquids at high pressures and temperatures by X-ray absorption.	**Experiment number**: HS2340
Beamline: ID30	**Date of experiment**: from: 03/09/2003 to: 09/09/2003	**Date of report**: 26/08/2004
Shifts: 18	**Local contact(s)**: M. Mezouar	*Received at ESRF:*

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Report:

Density of liquid Fe-Si alloys was measured *in situ* up to 5 GPa-1725 K by an X-ray absorption technique [1] in the Paris-Edinburgh cell. A high energy monochromatic beam was used. As the absorption coefficient of X-rays, μ, for a given element increases both with its atomic mass and with the wavelength, an optimum value was found for E=46.7 keV. For a given composition, ρ_{liq} values at different pressures are fitted to a second order isothermal Birch-Murnaghan equation of state to extract the bulk modulus (Figure)

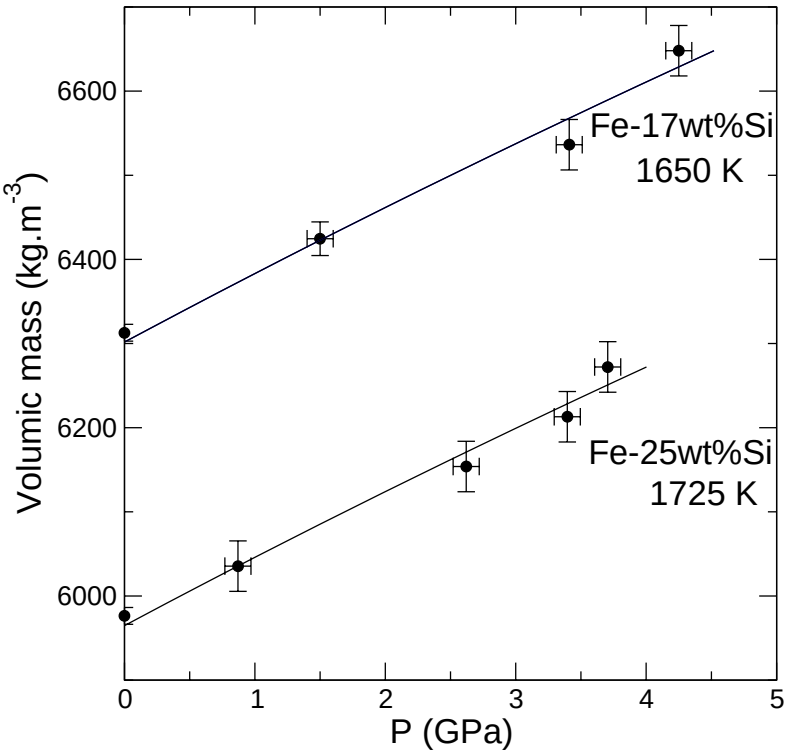

Figure: Measured volumic mass of Fe-Si liquids as a function of pressure. Lines are Birch-Murnaghan fits of the data.

Results:

Increasing the amount of silicon in liquid iron decreases the bulk incompressibility by only -0.5 GPa per 1 weight% of Si [4]. These data confirm our previous prediction of a negligible effect of Si on liquid Fe bulk properties, prediction based on the observation of a similar local structure in liquid Fe and liquid Fe-Si alloys [3]. Si and S have therefore opposite effects on P-waves velocity ($v_P=\sqrt{(K/\rho)}$), both elements reduce the bulk density of liquid iron but only S affects its compressibility [2]. Since compression-wave velocities in the Earth's outer core are slightly higher than in pure liquid Fe in the same P-T conditions, it implies that Si would correct this discrepancy while S would increase it.

References:

[1] Katayama et al., 1996, *High Pressure Res.*, **14**, p.383.
[2] C. Sanloup et al., 2000a, *Geophys. Res. Lett.*, **27**, p.811.
[3] C. Sanloup et al., 2002, *J. Geophys. Res.*, **107**, p.ECV-4.
[4] C. Sanloup et al., 2004, *Geophys. Res. Lett.*, **31**, L07604.