ESRF	**Experiment title:** High-pressure EXAFS studies of Fe-and Ge-bearing amorphous and quasicrystalline materials	**Experiment number**: HD-258
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Shifts: 18	**Local contact(s)**: Dr. Sakura PASCARELLI (e-mail: sakura@esrf.fr)	*Received at ESRF:*

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Report:

We conducted an extremely productive pilot study to develop the EXAFS techniques for the high pressure study of two archetypal 4^{th} row elements: Ge and Fe. We looked at a number of model materials: Ge, GeO_2 glass, $FeGeO_3$, and $(Fe_{0.4}Mg_{0.6})SiO_3$. Crystalline elemental Ge has many pressure-induced phase transitions including metallization and electronic changes, and the well-known crystal structures from XRD provide a validation of the EXAFS approach. We studied this material to 60 GPa (Figure 1). The structure of glass GeO_2 has been studied by EXAFS to 29 GPa and XRD to 15 GPa. We extended the study of GeO_2 to 44 GPa over several increasing and decreasing pressure cyclesv(Figure 2). A number of structural and electronic transitions have been observed in $FeGeO_3$. Ge (Figure 3) and Fe (Figure 4) EXAFS of $FeGeO_3$ to 22 GPa provided element specific information through a transition that was observed at 20 GPa. $(Fe_{0.4}Mg_{0.6})SiO_3$ in post-perovskite structure plays a key role in the core-mantle boundary of Earth above 100 GPa. Its crystallinity disintegrates below 90 GPa but is poorly understood. This sample was especially challenging due to its thickness and the strong absorption by the diamonds anvils. We address these issues in our new proposal by using a stronger gasket and with the novel composite diamond anvils.

We are currently working on analysis of the results which is largely be conducted by Maria Baldini who is currently receiving training from Sakura Pascarelli in this area, and who will spend a month in ESRF in January 2009 to work on the results from this pilot study.

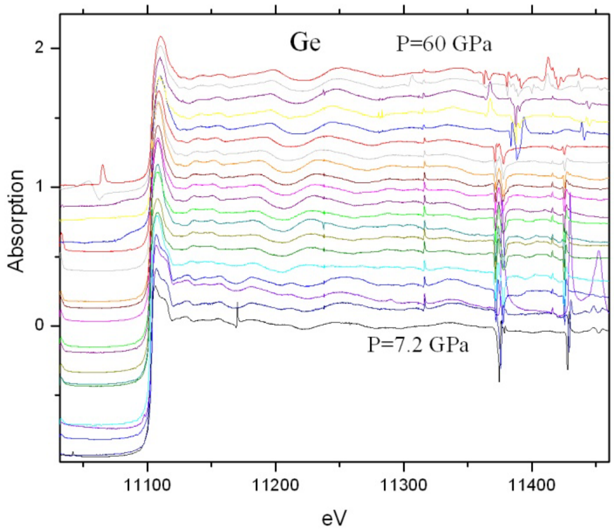

Figure 1. Ge EXAFS for crystalline Ge sample collected upon increasing pressure. The spectra correspond to from bottom to top: 7.2, 8.7, 9, 9.5, 10.5, 13, 13.9, 14, 15.8, 18.2, 20.9, 22.8, 25.3, 29.4, 35.2, 42.8, 47.6, 48.1, 52.4, and 60 GPa.

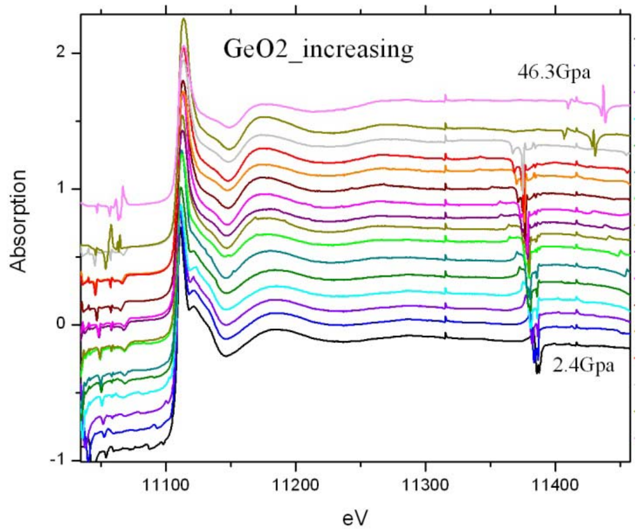

Figure 2. Ge EXAFS for amorphous GeO_2 sample collected upon increasing pressure. The spectra correspond to from bottom to top: 2.4, 4.9, 6.6, 6.8, 8.4, 10.5, 13.1, 16.7, 19.3, 22.2, 27.4, 30.2, 34.5, 38.8, 42.3, and 46.3 GPa.

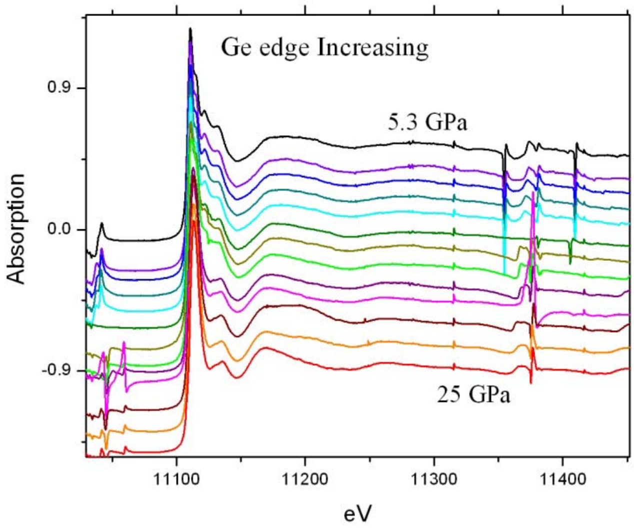

Figure 3. Ge EXAFS for $FeGeO_3$ sample collected upon increasing pressure. The spectra correspond to from top to bottom: 5.3, 6.9, 7.7, 8.4, 9.4, 9.6, 12.5, 14.2, 17.8, 19.8, 22.4, 23.3, and 25 GPa.

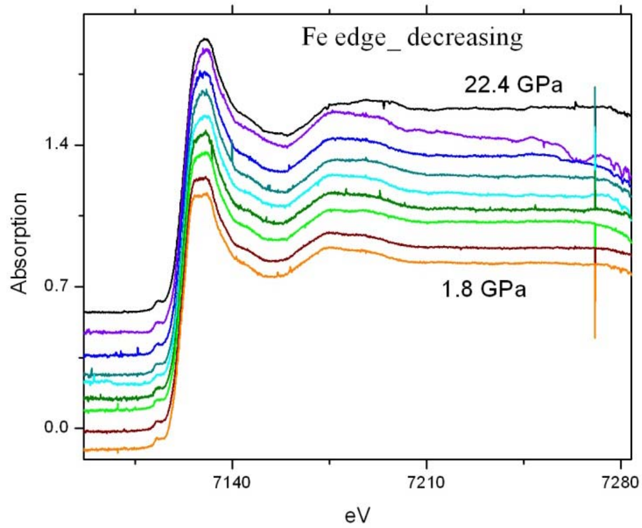

Figure 4. Fe EXAFS for $FeGeO_3$ sample collected upon decreasing pressure. The spectra correspond to from bottom to top: 1.8, 2.9, 6.4, 7.7, 9.3, 11.7, 14.2, 17.1, and 22.4 GPa.