ESRF	**Experiment title:** High pressure powder diffraction on ordered and disordered lead feldspar ($PbAl_2Si_2O_8$)	**Experiment number:** HS316
Beamline: ID09	**Date of experiment:** from: 3/7/1997 to: 7/7/1997	**Date of report:**
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Report:

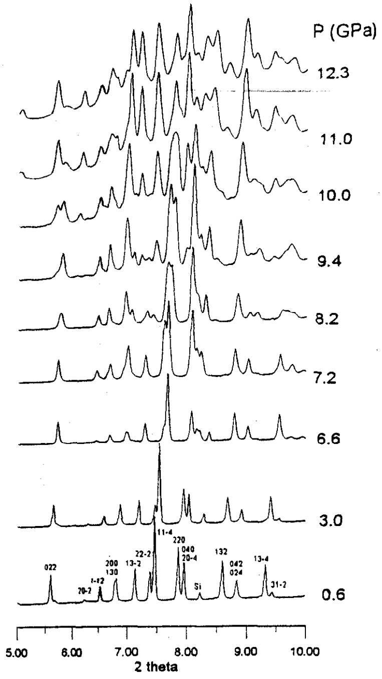
The high pressure behaviour of feldspars is a subject of recent and growing interest: in particular the attention is focused on the changes in bulk modulus and in the structural behaviour with pressure in natural and synthetic feldspar-s, with changing composition and degree of Al-Si order; as well the presence of phase transition with pressure is explored.

In the reported experiment in situ high pressure powder diffraction was performed in three samples of lead feldspar ($PbAl_2Si_2O_8$), a synthetic analog of anorthite ($CaAl_2Si_2O_8$). The samples were chosen with varying degree of order (Q_{od} ranging from 0.76 to 0) and loaded in a diamond anvil cell.

The powder spectra were recorded in the line ID09, using monochromatized radiation ($\lambda = 0.4487$Å); an image plate was used for the detection of the spectrum. The samples were compressed up to 12 GPa; a total of 65 spectra were collected.

The data on the image plate were integrated by means of the fit2d program, obtaining a one dimensional 28 vs intensity array.

The spectra conformed closely the pattern expected for lead feldspar up to $P \cong 7.0$ Gpa. At higher pressures sudden changes in the position of the reflections and few extra reflections appeared, suggesting that a phase transition was occurring. The newly formed phase disappears at $P \cong 6.0$ Gpa, during decompression, with a significant hysteresis.



The lack of split in reflections non equivalent in triclinic symmetry, the presence of non indexable reflections and the impossibility to refine a triclinic cell rule out that the high pressure phase is simply a triclinic feldspar, as it was reported for strontium feldspar (McGuinn and Redfem 1994). The evolution with pressure of the observed spectra is shown for ordered lead-feldspar in the enclosed figure.

Peak enlargement was observed with pressure, preliminary to amorphisation. However amorphisation was observed only in spectra at 10.0 and 7.7 Gpa, after fortuitous shock compression at 18 Gpa; in the same loading the crystallinity was recovered at room P.

Cell parameters were refined in spectra where lead feldspar was clearly the unique phase present. The bulk modulus obtained was K = 69.5(1. 1), 70.7(8) and 75.9(1.8) GPa for the three samples, increasing with increasing Al-S1 disorder, in the range reported for feldspars (Angel 1994).

The cell parameters show a compression pattern which is similar to that observed in anorthite, with $\Delta a/a_0 > \Delta c/c_0 > \Delta b/b_0$; detailed comparison with other feldspars (Downs et al. 1994, Allan and Angel 1997) and with the high T behaviour for lead feldspar shows that the strain tensor is more isotropic and the deformation along a is less prominent in lead feldspar at high pressure. As well an anomalous turnover in the behaviour of the β angle with pressure was observed, suggesting a change in the compression behaviour at $P \cong 2$ Gpa.

Rietveld refinement of the Pb position was performed in a series of spectra with P ranging from 0.6 to 6.5 Gpa, taken from the mostly ordered sample. The combined analysis of lattice and Pb coordinates evolution with pressure showed that the compression of the structure is mainly achieved by an approach along the a* parameter of Pb atoms in polyhedra facing through the OA1-OA1 common shared edge.

References

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