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| | Experiment title: P-V-T equations of state of andradite and grossular | Experiment number: HS-911 |
| Beamline: ID30 | Date of experiment: from: 24.03.99 to: 27.03.99 | Date of report: 28.02.00 |
| Shifts: 9 | Local contact(s): Mohamed Mezouar | <i>Received at ESRF:</i> |
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Report:

The minerals of the garnet group are major constituents of the upper mantle of the Earth, and play an important role in high pressure-high temperature petrogenetic processes. These minerals have a cubic cell, and an atomic structure formed by independent tetrahedra, octahedra and dodecahedra. The natural end members grossular ($\text{Ca}_3\text{Al}_2\text{Si}_3\text{O}_{12}$) and andradite ($\text{Ca}_3\text{Fe}_2\text{Si}_3\text{O}_{12}$) have been investigated at high temperature and high pressure conditions to determine their P-V-T EOS. Measurements have been performed on the ID30 beamline, by using a Large Volume Cell, over the following thermobaric range: from 300 to 1000 K, and from 0 to 6 GPa, by 0.3 GPa steps along isotherms at 300, 600, 800, 1000 K. Temperature has been monitored by a Pt-thermocouple, and pressure estimated by NaCl as an internal calibrant. A total of 120 diffraction profiles have been collected for both samples, and processed by multi-phase profile analysis according to the LeBail et al. (1988) method, as implemented in the GSAS software package (Larson and von Dreele, 1987). Fig. 1a and Fig.1b report the cell parameters versus P for andradite and grossular, respectively. The experimental P-V-T data have been interpolated by means of the Birch-Murnaghan equation

of state modified for the high temperature regime. The bulk modulus K_0 and the thermal expansion (α) have been determined. Grossular: $K_0 = 168.1 (\pm 1.4)$ GPa, $K'_0 = 4.0$, $\alpha = 25.7(3) \times 10^{-6} \text{K}^{-1}$; andradite: $K_0 = 157.8 (\pm 1.7)$ GPa, $K'_0 = 4.0$, $\alpha = 31.4(3) \times 10^{-6} \text{K}^{-1}$.

References

Larson AC and Von Dreele B (1987) LANL Report LAUR: 86-87.

LeBail A, Duroy H, Fourquet JL (1988) Mat. Res. Bull., 23, 447-452.

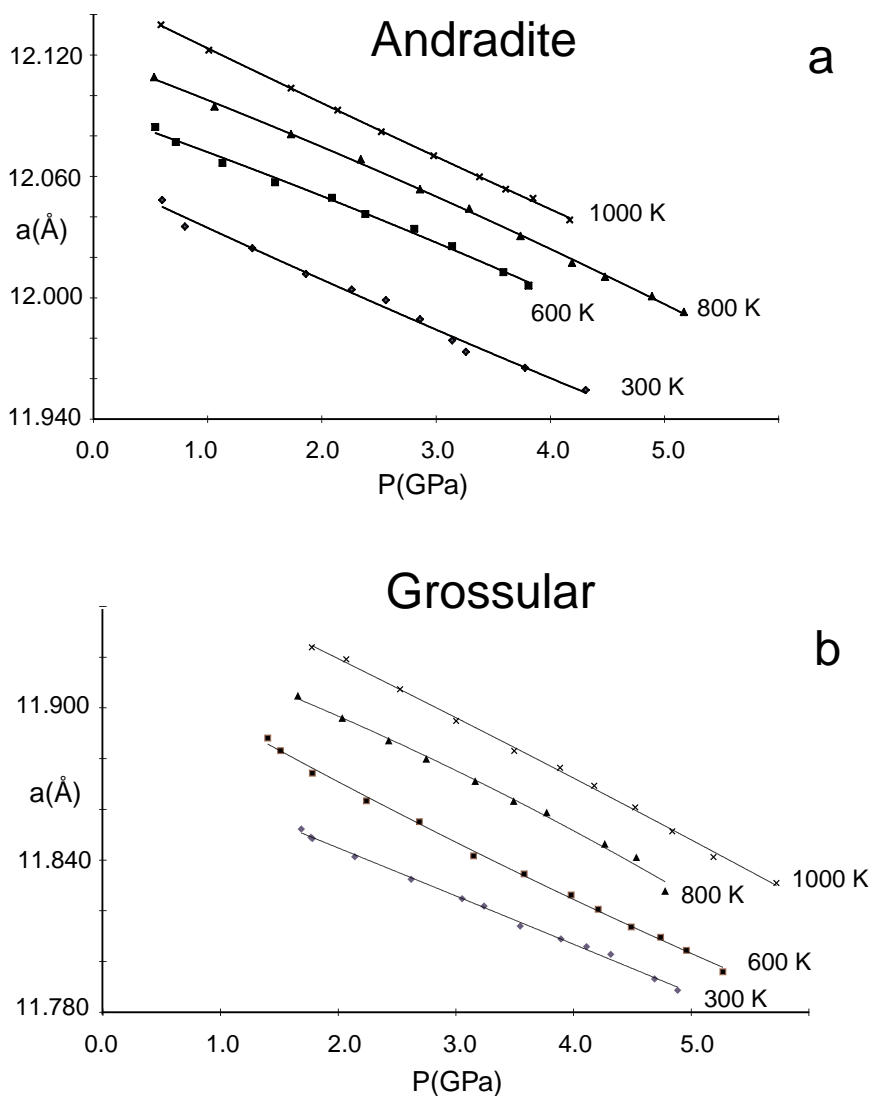


Fig. 1