

***In-situ* study of the structure of talc and 10Å phase at high pressure using synchrotron IR spectroscopy and XRD**

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Knowledge of the fate of hydrous minerals following subduction is fundamental to our understanding of subduction processes, such as volcanism, and if we are to determine a general water audit for the Earth.

Two important hydrous phases proposed to transport water into and within subduction zones are talc ($\text{Mg}_3\text{Si}_4\text{O}_{10}(\text{OH})_2$) common in hydrated oceanic crust, and 10Å phase, a hydrate of talc formed at high pressure. Structural changes at high pressure significantly effect mineral stability therefore, we have studied a natural talc sample and two synthetic 10Å phase samples at ambient temperature and high pressure using *in-situ* synchrotron infrared (IR) spectroscopy and X-ray diffraction (XRD) and diamond anvil cells.

The XRD data indicated none of the samples reacted at high pressure and the data were used to calculate the compressibility of the samples up to the maximum pressure investigated (~10 GPa), which were in agreement with previous studies [e.g. 1].

The infrared data were used to provide information on the position of the hydroxyl groups (and interlayer water in 10Å phase) within the structures and their bonding behaviour at high pressure. The hydroxyl group in talc was found to compress steadily with pressure (peak shift $+0.99 \text{ cm}^{-1} \text{ GPa}^{-1}$). 10Å phase has a peak with similar shape, position and intensity which we infer to indicate a hydroxyl in an equivalent structural environment. However, the position of this peak remains static up to 2 GPa before shifting at a similar rate to that of talc; suggesting mainly compression of the interlayer up to 2 GPa before compression of the talc-like 2:1 layers (containing the hydroxyl group). The resolution of a new O-H stretching peak for 10Å phase above ~2 GPa indicates a change in hydrogen bonding of an O-H within the structure, presumably due to the nearing of the 2:1 layers and interlayer water at high pressure. This is of particular interest as the position and co-ordination of the hydroxyl and interlayer water in 10Å phase, which will have a significant effect on stability, have still to be resolved

References

[1] Pawley et al. (1995) *Contrib. Mineral. Petrol.* **122**, 301-307.