

Electrical conductivity of partially molten CI-chondritic mantle at high pressures

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In a primitive Earth scenario, large scale impacts are believed to be responsible of the formation of magma oceans. Such catastrophic events have produced a temperature increase above the mantle liquidus up to a few hundred kilometers depth or more. At present day, the Earth's mantle may also undergo small degree of partial melting at greater depths, but this time the temperature should be just above the solidus. Such partial melting is expected to produce major chemical segregation between the different Earth's reservoirs, which could affect the physical properties of the mantle.

Electrical conductivity is highly sensitive to the presence of melt, and it is one of useful tool to detect melting and its distribution within the mantle. Electrical conductivity of partially molten materials can be accurately determined at high pressures and temperatures using multi anvil apparatus. Our experimental goals are two folds. First, we aim at tracking the onset of melting *in situ* by using electrical conductivity. This will help not only to synthesize samples with well controlled degree of partial melting, but also to refine the sequence of crystallisation of a chondritic mantle for mantle depth up to ~700 km. Second, we aim at determining the effect of partial melting on electrical conductivity in a wide range of mantle pressures. It will therefore provide new clues to localize regions where mantle undergoes melting.

Our preliminary results on chondritic material at shallow mantle conditions (5 GPa) show that, at increasing temperature, electrical conductivity values increase considerably as soon as we reach the solidus temperature, indicating the onset of melting. Cross sections of the recovered samples were investigated using scanning electron microscope and electron microprobe. We aim at determining the solid-liquid phase relations at temperatures intermediate between solidus and liquidus and reconstruct the sequence of phase crystallization.

Water content of the oceanic lithosphere at Hawaii from FTIR analysis of peridotite xenoliths

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Although water in the mantle is mostly present as trace H dissolved in minerals, it has a large influence on its melting and rheological properties. The water content of the continental mantle lithosphere is starting to be well constrained thanks to the abundance of mantle xenoliths [1,2], but that of the oceanic mantle lithosphere is mainly inferred from MORB glass data. Using Fourier transform infrared (FTIR) spectrometry, we determined the water content of olivine (Ol), clinopyroxene (Cpx) and orthopyroxene (Opx) in spinel peridotite xenoliths from Salt Lake Crater, Oahu, Hawaii, which are thought to represent fragments of the Pacific oceanic lithosphere that was refertilized by alkalic Hawaiian melts [3,4]. Only Ol exhibits H diffusion profiles, evidence of limited H loss during xenolith transport to the surface. Water concentrations (Ol: 9-28 ppm H₂O, Cpx: 246-566 ppm H₂O, Opx: 116-224 ppm H₂O) are within the range of those from continental settings [1,2] but are three times higher than those from Gakkel ridge abyssal peridotites [6]. The Opx H₂O contents are similar to those of abyssal peridotites from Atlantic ridge Leg 153 but ten times higher than those from Leg 209 [5].

The calculated bulk peridotite water contents (50 to 110 ppm H₂O) are in agreement with MORB mantle source water estimates [7] and lower than estimates for the source of Hawaiian rejuvenated volcanism (~525 ppm H₂O [8]). The water content of Cpx and most Opx correlates negatively with spinel Cr#, and positively with pyroxene Al and HREE contents. This is qualitatively consistent with the partitioning of H into the melt during partial melting, but the water contents are too high for the degree of melting these peridotites experienced. Melts in equilibrium with xenolith minerals have H₂O/Ce ratios similar to those of OIB [9].

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