

Water distribution in the continental and oceanic upper mantle

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Nominally anhydrous minerals such as olivine, pyroxene and garnet can accommodate tens to hundreds of ppm H₂O in the form of hydrogen bonded to structural oxygen in lattice defects. Although in seemingly small amounts, this water can significantly alter chemical and physical properties of the minerals and rocks. Water in particular can modify their rheological properties and its distribution in the mantle derives from melting and metasomatic processes and lithology repartition (pyroxenite vs peridotite). These effects will be examined here using Fourier transform infrared spectrometry (FTIR) water analyses on minerals from mantle xenoliths from cratons, plume-influenced cratons and oceanic settings.

In particular, our results on xenoliths from three different cratons will be compared. Each craton has a different water distribution and only the mantle root of Kaapvaal has evidence for dry olivine at its base. This challenges the link between olivine water content and survival of Archean cratonic mantle, and questions whether xenoliths are representative of the whole cratonic mantle. We will also present our latest data on Hawaii and Tanzanian craton xenoliths which both suggest the intriguing result that mantle lithosphere is not enriched in water when it interacts with melts from deep mantle upwellings (plumes).