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Water contents in pyroxenes of intraplate lithospheric mantle

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Water contents of clinopyroxene and orthopyroxene in mantle peridotites from various xenolith occurrences in intraplate settings (both oceanic and continental) were determined by Fourier Transform Infrared Spectroscopy (FTIR). The localities are as follow: Sal Island (Cape Verde Archipelago); Baker Rocks and Greene Point (Northern Victoria Land, Antarctica); Panshishan and Lianshan (Subei Basin, Eastern China). They represent well-known localities where detailed petrographical and geochemical studies have already been carried out or areas which are currently under investigation. The water incorporated in these pyroxenes is low (cpx, 37-399ppm; opx: 9-166ppm)(or very low as in Greene Point, Antarctica; cpx, 5-16ppm; opx: 9-16ppm) and, among each population, no clear correlation with melting parameters (MgO contents) in single mineral is evident. Results are compared with the available literature data on water contents in mantle pyroxene which includes peridotites from on-craton (hosted by kimberlitic-type magmas) and off-craton (hosted by alkaline basic magmas), as well as subarc mantle settings. The “relatively dry” (cpx: 140-528 ppm; opx: 38-280 ppm) sub-arc mantle xenoliths (Peslier et al., 2002) are shown to be wetter than the intraplate (off-craton) xenoliths. Cratonic mantle pyroxenes are only represented by a few determinations on garnet peridotites and eclogite from Kaapvaal and Colorado Plateau. They record the highest water contents (cpx: 342-1012 ppm; opx: 180-491 ppm) so far measured in mantle pyroxenes from various tectonic settings. Despite the limited data set, the indication that the cratonic mantle is strongly hydrated is compelling. Rehydration for the Colorado Plateau craton may be due to the Farallon plate subduction (Li et al., 2008), while for Kaapvaal Craton it might be related to young (<100Ma) metasomatic enrichments (Griffin et al., 2003a; Kobussen et al., 2008). If this is the case then the Archean mantle water content needs to be determined; this may be solved by analysing highly depleted unmetasomatized lithologies. However, assuming that the water content was initially very low, it is hard to believe that metasomatic events, similar to those observed in the intraplate settings studied in this work, would be able to produce a significant water content. According to literature and our own data it appears that water rehydration may substantially occur at convergent margins.