

Hydroxyl in clinopyroxene from the deep subducted crust: Evidence for H₂O transport into the mantle

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ABSTRACT

Clinopyroxenes in eclogites from the deep subducted crust in the Kokchetav, Kazakhstan, ultra-high-pressure metamorphic terrane were found by infrared spectroscopy to contain up to 3020 ppm OH. These rocks were recrystallized at pressures over 60 kbar and temperatures over 1000 °C, where no hydrous minerals are stable. Infrared spectra of the clinopyroxenes show three hydroxyl absorption bands in the regions 3440–3460 cm⁻¹, 3500–3530 cm⁻¹, and 3600–3625 cm⁻¹. The hydroxyl absorbance increases with recrystallization pressure of the eclogites and with vacancy concentration in the pyroxene structure (Ca-Eskola component). Clinopyroxenes represent about 40–50 vol% of eclogites, such that the bulk eclogites contain approximately 1300 ppm hydroxyl at depths greater than 150 km. Thus, subducted oceanic crust can transport trace amounts of H₂O into the upper mantle, even in the absence of nominally hydrous minerals.