Water in the 2.7 Ga Belingwe komatiite magma inferred from the melt inclusions in olivine

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Komatiites are ancient volcanic rocks that result from high-degree mantle melting (commonly over 30%) under extreme P-T conditions. Their compositions may be key indicators of the composition and physical conditions of the Archean mantle.

Remarkably fresh 2.7 Ga old komatiites from the Reliance Formation of the Belingwe Greenstone Belt (Zimbabwe) were examined in this study. Major and trace elements and volatile components were determined for a set of melt inclusions in olivine. Reconstructed compositions of the komatiite melts yield ca. 20.3-23.5 wt.% MgO and up to 0.3 wt.% H_2O in the magma at the time of its emplacement. The primary komatiite melts of the Reliance Formation. were calculated to contain up to 28 wt.% MgO and 0.2 wt.% of H_2O and require high liquidus temperatures of ca 1520 °C, which convert to an even higher mantle potential temperature (~1730°C). The initial H_2O content (0.2 wt%) in Belingwe komatiite primary melt is at least factor of 6 higher than expected, considering its Ce (1.6 ppm) and K_2O (0.022 wt%) contents.

The data suggest that Belingwe komatiites were generated deep in the Archean mantle plume: ca 7 GPa according to [1]. As was proposed for the Abitibi komatiites, Canada [2], this plume may have entrained H_2O when it traversed a hydrous transition zone.

[1] *Lee et al., (2009) EPSL,* ***279****, 20-33.[2]Sobolev et al. (2016) Nature,* ***531****(7596): 628-632*.