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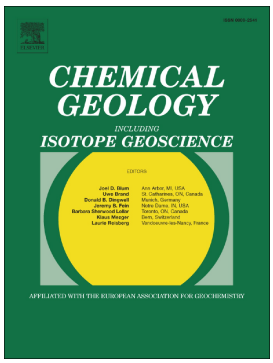

Belingwe komatiites (2.7Ga) originate from a plume with moderate water content, as inferred from inclusions in olivine

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Belingwe komatiites (2.7 Ga) originate from a plume with moderate water content, as inferred from inclusions in olivine.

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Keywords: Belingwe Greenstone Belt; Archean Zimbabwe Craton; olivine; spinel; melt inclusions; water; carbon dioxide; chlorine; mantle; temperature; oxygen fugacity; SIMS; EPMA; LA-ICP-MS; komatiite

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Abstract

Major and trace elements, and volatile components have been measured in melt inclusions in olivine from fresh 2.7 Ga old komatiites from the Reliance Formation of the Belingwe Greenstone Belt, Zimbabwe. Reconstructed compositions of melt inclusions contain 20-23.5 wt.% MgO and up to 0.3 wt.% H_2O; these compositions probably represent those of the erupted lava. In inclusions in relatively evolved (low Fo) olivines, an excess of Na_2O, CaO, Li, La, Cu, Rb, Y, Sc as well as volatile components (H_2O, F, Cl and S) relative to other highly incompatible elements is attributed to assimilation of seawater altered mafic material. No assimilation signature is observed for the most primitive melt inclusions hosted in the magnesium rich olivines. The primary melt composition, estimated using melt inclusions in the most magnesian olivine (Fo93.5), contains up to 27.5 wt.% MgO and ca. 0.2 wt.% H_2O. The presence of H_2O slightly depressed the liquidus temperature to ca. 1513°C. Our results suggest formation of the Belingwe komatiite magma at ca. 7 GPa pressure and ca. 1790 ^oC temperature in a mantle plume. The plume picked up water and probably chlorine through interaction with a hydrous transition mantle zone in the way similar to that previously proposed by Sobolev et al. (2016) for komatiites in Canada.