

Enrichment of water and fluid-soluble trace elements in the Troodos Ophiolite: evidence for a near-trench origin

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The Troodos Ophiolite on the island of Cyprus is a Cretaceous supra-subduction zone ophiolite. It formed by seafloor spreading in the vicinity of a subduction zone, but the exact tectonic setting in which it formed is debated. We determined H₂O contents together with other volatiles (S, Cl and CO₂) and Sr, Nd and Pb isotope compositions of fresh Troodos volcanic glasses, previously measured for major and trace element contents. Glass compositions range from boninite to tholeiitic andesite. The least degassed glasses have H₂O contents of 1.7 to 2.7 wt.%, and H₂O/Ce ratios of 4400 to 33600. The most depleted glasses with low Zr/Yb have the highest fractionation-corrected H₂O contents and H₂O/Ce, and the highest subduction zone input (highest Th/La, Ba/Zr and 87Sr/86Sr). The high H₂O contents, enrichment in fluid-mobile elements, and depletion in Zr, Hf and heavy rare-earth elements are consistent with formation above a subduction zone, very close to a trench in a fore-arc position, likely at water depths of ~ 5000 m. The enrichment in both fluid-mobile (e.g. Rb, Cs) and melt soluble (e.g. Th) elements indicate that the Troodos Ophiolite formed above an already established subduction zone, rather than as the result of subduction initiation, at least as recorded in Izu-Bonin-Mariana fore-arc crust.