Geochemical mapping of a paleo-subduction zone beneath the Troodos Ophiolite

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Ophiolites occur worldwide and have been the aim of many researches over the past decades. They enabled us to study oceanic crust in detail and formed our view of the seafloors worldwide. One of these well-studied regions is the Troodos Ophiolite on Cyprus. Many ophiolites formed in a 'supra-subduction zone' environment. Field observations like the presence of a sheeted dyke complex overlain by pillow lavas indicate the formation at a spreading-centre. Trace element systematics like enrichment in fluid-soluble elements relative to rare earth elements (REE) indicate the formation above a subduction zone.

We present major and trace elements together with isotope analysis of fresh volcanic glass from representative traverses through the pillow lava sequence. We use microanalytical techniques to avoid alteration effects. Using carefully selected glasses from all parts of the ophiolite allows us to reveal geographical differences in the geochemistry.

Troodos glasses range from boninitic, to tholeiitic picrite-basalt-andesite-dacite composition. All glasses show characteristic subduction-related features like enrichment in large ion lithophile elements (LILE), U and Pb. Glasses from the northern part of the ophiolite display arc-back-arc signatures and are more evolved in composition (andesite-dacite), whilst glasses from the southern margin are more primitive in composition (tholeiitic-boninitic) and display higher contributions of subduction input, i.e. higher Pb/Ce and more radiogenic Pb isotopic signature.

We find that the Troodos Ophiolite formed by NW-SE directed spreading above an eastward-dipping subducting plate. The orientation of the spreading axis relative to the subduction zone, together with the lack of systematic temporal evolution in the composition of magmatism indicate that the Troodos Ophiolite does not represent fore-arc crust formed during subduction initiation. Our model proposes that the Troodos Ophiolite probably formed at a back-arc spreading centre that propagated into arc – fore-arc crust.