Granitoids in the mantle section of the Oman ophiolite were sediments recycled during subduction

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Current models for the Oman-UAE ophiolite indicate that it formed by fore-arc spreading during the initiation of subduction. Thus the mantle section of the ophiolite represents a sub-arc mantle wedge. This study reports granitoids of tonalitic to granitic composition which intrude the depleted harzburgites of the Oman mantle wedge. A detailed field, petrological and geochemical examination shows that these granitoids are the product of the mixing of melts derived from both mafic and metasedimentary sources which have interacted with their harzburgite host. The character of the protolith was quantified using a melting model based upon a MORB-type basalt similar in composition to the Oman Geotimes lavas [1] and the MUQ global sediment composition [2] both with an amphibolite/ granulite facies mineralogy. Model compositions of the basaltic and pelitic end-members bracket the observed granitoid compositions and mixing of these calculated melt compositions indicates that the measured granitoid compositions represent between 10-40% mixing of a metasedimentary melt with a melt of the mafic source. The calculated residual mineralogy of the pelitic and basaltic sources suggests that partial melting was at relatively high temperatures ca. 900 ºC, but at low pressure, at depths of no more than 35-40 km.

The results of this study support the subduction initiation model of the Oman ophiolite inasmuch as the granitoids must have been emplaced into the mantle wedge from below, a most probable setting for the melting of a sediment-basalt mix is in the upper part of a subducting slab and the high temperature/ shallow melting of the protolith can only have been driven by the high temperatures of the overlying mantle wedge. The subduction phase of the Oman ophiolite was short-lived and may have lasted only 3 Ma [3] and it is likely that, given the relatively rapid 'jamming' of the Oman subduction zone, very little sediment was returned to the deep mantle. However, this study also shows that even in the early stages of subduction sediment-recycling is an important means of refertilising highly depleted sub-arc mantle.

[1] Ishikawa, *et al* (2005) *EPSL* **240**, 355-377 [2] Kamber *et al* (2005) *GCA* **69**, 1041-1058 [3] Searle *et al* (2014) *GeoArabia*, **19**, 135-174.