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# Trace-element characteristics of rutile in HP-UHP rocks from the Western Gneiss Complex, Norway: implications for element mobility and provenance studies

Florentina Enea (1), Simon Cuthbert (2), Craig Storey (1), and Horst Marschall (3)

(1) School of Earth and Environmental Sciences, University of Portsmouth, Portsmouth PO1 3QL, UK (craig.storey@port.ac.uk), (2) University of the West of Scotland, Paisley PA1 2BE, UK (simon.cuthbert@uws.ac.uk), (3) Woods Hole Oceanographic Institution, Woods Hole, MA 02543-1050, USA (hmarschall@whoi.edu)

Trace element compositions of rutiles from the Western Gneiss Complex of the Norwegian Caledonides, a giant HP-UHP terrane representing a transiently subducted continental margin. Trace element characterisation (V, Cr, Zr, Nb, Mo, Sn, Sb, Hf, Ta, W and U) was used to fingerprint the geochemical features of rutile in both mafic and pelitic source rocks that span a range of P-T conditions from 550°C, 1.6GPa to 850°C, 4.5GPa. The results provide the first large-scale use of the Zr-in-rutile geothermometer in the WGC, and this method is shown to be more reliable than exchange thermometers based on the major phases in these rocks. On Nb versus Cr plots, which have been used to discriminate mafic from pelitic rutiles in other HP terranes, WGC rutiles that equilibrated below 650°C successfully discriminate mafic from pelitic HP and UHP rutiles. However, those equilibrated above 650°C show mafic eclogite rutile compositions overlapping into the pelite field. This indicates trace element mixing above 650°C due to mobility of fluids or melts and their migration from the predominant felsic host rocks into the eclogite bodies. This finding is supported by distinct trace-element differences between hydrothermal vein rutiles in HP versus UHP eclogites from the WGC, and is also consistent with previous studies of Sr isotopic compositions in WGC eclogites. In addition, the results have implications for the the use of Nb/Cr plots to discriminate mafic from pelitic rutile in sedimentary provenance studies, as some rutiles of mafic eclogitic origin will tend to be misrepresented. Extremely niobian rutiles (up to 118,000 $\mu$g/g) were found in enigmatic eclogites enclosed within a large, mantle-derived, orogenic peridotite massif. The reasons for this are not yet fully understood, but suggest either metasomatism after Scandian tectonic emplacement into the subducted continental crust by fluids sourced from the nearby felsic gneisses, or by deep mantle (carbonatitic?) fluids during the long mantle residence time of the peridotite host. In this respect, we note their similarities to niobian rutiles from xenolithic eclogites in kimberlites such as those from the northern Slave Craton.