Isotopic constraints on the fluid enhanced eclogitisation of granulites in the Bergen Arcs, western Norway.

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The large-scale enhancement of eclogitisation due to fluid infiltration is a rare occurring event, and not documented in many locations around the world. Arguably, one of the best examples of this process is found in the Lindås Nappe, on Holsnøy Island, western Norway. The conversion of granulite to eclogite on Holsnøy Island (c. 450 Ma) is progressive and can be tracked through multiple stages of deformation which span over a wide pressure-temperature (*P–T*) conditions of 15.2–15.7 kbar 680°C, to a peak of 21–22 kbar and 660-690 °C and initial amphibolite facies retrogression at 16–17 kbar and 680–700 °C.

Average whole-rock $\delta^{18}O$ values for the granulite, peak eclogite and retrogressed eclogite are +6.5 , +6.5 and +7.2 ‰, respectively, which show a general positive shift, and so do the average δD values (-68.0,-52.1,-35.9 ‰, respectively). Calculated $\delta^{18}O$ fluid signatures based on omphacite in the eclogite and retrogressed eclogite are both +7.9 ‰, respectively, while those based on phengite are +8.6 ‰ and + 9.1‰, respectively. δD fluid signature based on phengite are -20.8 ‰ and – 27.8 ‰, respectively. These values point towards a metamorphic fluid that has infiltrated the granulite slab during burial.

The average εNd values for the granulite, eclogite and retrogressed eclogite are -6.5, -6.9 and +2.6, respectively. However, such a significant shift in εNd value cannot be explained by the isotopic signature of the fluid. Initial analysis of garnet grains show a general depletion of REE from core to rim in the peak eclogite, while garnets in the retrogressed eclogite show an enrichment of the light rare earth element and a depletion of heavy rare earth elements. We speculate the change in isotopic composition reflects leaching of Sm from the matrix, leading to an altered rock dominated by the isotopic of relict garnets.