Dating ultra-high-pressure metamorphism in Norway: spatial vs. analytical resolution and why it matters

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Precise determination of the timing of peak metamorphism and exhumation is key to understanding the origin of ultra-high-pressure (UHP) metamorphic terranes. The Western Gneiss Region of Norway, one of the world's largest UHP terranes, formed during subduction of Baltica beneath Laurentia during the Devonian Scandian orogeny. Subsequent exhumation was associated with regional extension. Within this broad framework, the specific times, durations, and mechanisms of both UHP metamorphism and exhumation are widely debated, with particular data sets used to support a variety of tectonic models. We present results from a U-Pb (zircon) study of eclogites and their host rocks from the island of Harøya in the Nordøyane UHP domain. Our objective is to determine the time(s) of metamorphism within a single, well mapped area in order to test the hypothesis that UHP conditions were maintained for ≥10 Myr and that subsequent exhumation was relatively slow. Seeking analytical precision, we first tried CA-TIMS analysis at MUN. Unfortunately, the zircon populations are dominated by grains preserving inherited Proterozoic cores with very thin metamorphic overgrowths; consequently the TIMS data are mainly discordant. More recently, we had an opportunity to do LA-ICP-MS analysis at the LaserChron Center, University of Arizona (Tucson), on the same separates. The improved spatial resolution proved illuminating. Concordant analyses obtained from both cores and rims are consistent with the data obtained from the same samples at MUN. Data were also obtained from a newly resampled coesite-eclogite that had resisted previous efforts to extract zircon. Although both LA-ICPMS and TIMS lower intercept results have lower analytical precision than could have been obtained from concordant TIMS data, both methods yielded metamorphic ages from eclogites and their host rocks spanning the range ca. 415–400 Ma. The broad age range obtained from the geographically restricted study area supports tectonic models indicating a protracted episode of Scandian subduction and UHP metamorphism, followed by exhumation and cooling in the lower crust during lithospheric extension.

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