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# Exhumation History of the Western Gneiss Region Revealed Through Symplectite Thermobarometry

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The Western Gneiss Region (WGR) of Norway, part of the Caledonian Orogenic Belt, is one of the largest and best studied examples of exhumed ultra-high pressure (UHP) continental terrains in the world. This makes it an ideal candidate for studying the poorly understood processes that facilitate and control the exhumation of UHP continental material. Although the WGR is often considered the type example of the eduction model of UHP exhumation (Andersen et al., 1991), validation of exhumation models requires robust estimates of pressure and temperature across the full range of retrograde conditions which follow peak metamorphism. However, such constraints are often difficult to obtain as there is commonly overprinting of early-stage exhumation records during later stages of exhumation.

UHP assemblages in the WGR are primarily preserved within numerous mafic eclogite enclaves, making them ideal candidates for studying processes and conditions that occur during exhumation from UHP conditions. In this study, we present detailed Electron Probe Micro-Analyses (EPMA) combined with Scanning Electron and Optical Microscopy characterization from a suite of mafic eclogite samples from the Stadlandet Peninsula of Western Norway. Our analyses focus on diopside–plagioclase (± amphibole) symplectite, which form from breakdown of omphacite during exhumation. Spatial variations in the compositions of minerals within these symplectites reflect a detailed record of P-T conditions during exhumation (Boland & van Roermund, 1983; Joanny et al., 1991; Waters, 2002). We used a novel technique of high resolution, low voltage EPMA, combined with secondary fluorescence corrections, which permits the analysis of individual symplectite lamellae with widths down to 1µm. Retrograde P-T pathways were then constructed from these data using the hornblende-plagioclase thermometer and clinopyroxene-plagioclase-hornblende barometer (Waters, 2002).

P-T estimates from the symplectites fall in the range 470-720°C and 3-16 kbar. Combining the P-T arrays with existing peak P-T estimates indicates a two-stage exhumation path, with a steep initial isothermal decompression from depth followed by a more gentle cooling trajectory at lower pressures. The inflection in the exhumation path is estimated to be around 10-15 kbar at 650-700°C. The path shape is usually interpreted to record an initial rapid buoyancy driven

exhumation from UHP to the base of the crust or lithosphere, followed by a second stage of slow exhumation to crustal depths. This confirmation of two-stage exhumation paths helps to constrain models of exhumation for the WGR, which in turn provides insights into how UHP terrains exhume globally.

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