

P-T-time paths and tectonic significance of eclogite in migmatite

WHITNEY, D. L.¹, ROGER, F.², TEYSSIER, C.¹, REY, P. F.³
AND GORDON, S. M.⁴

¹University of Minnesota, USA (dwhitney@umn.edu)

²University of Montpellier, France

³University of Sydney, Australia

⁴University of Nevada-Reno, USA

Inclusions of high-pressure (HP) rocks such as eclogite are common in migmatite that apparently records lower P equilibration. Eclogite and migmatite protoliths may have been juxtaposed prior to HP metamorphism; e.g. basaltic dikes in granite/gneiss that together experienced continental subduction, such as in the Western Gneiss Region, Norway. There, zircons in eclogite and host migmatite have similar U-Pb ages and REE patterns, and UHP index minerals occur in eclogite and gneiss, documenting a shared history despite differential preservation of HP part of the P-T path. Alternatively, eclogite may be incorporated in partially molten crust during (as deep-seated mafic intrusions) or after HP metamorphism, and eclogite + host migmatite share only the decompression part of a P-T path, such as in the Montagne Noire dome, France. In all of these cases, however, eclogite metamorphism may be closely spaced in time with formation and/or initial crystallization of migmatite, giving information about the extent and role of partially molten crust in different modes and stages of orogeny. Challenges to understanding the significance of eclogite and host migmatite to orogenic processes are relating age to P-T conditions and reconstructing P-T conditions and paths, particularly for host quartzofeldspathic gneiss.

In the Montagne Noire, an eclogite-bearing migmatite dome at an orogen-foreland transition, eclogite P-T conditions of 1.4 GPa, 725°C were estimated using a pseudosection and grt-cpx and Zr-in-rutile thermometry. Grt zoning and inclusions, rutile textures and Zr zoning, P-T results, and petrochronology of zoned zircon (U-Pb+REE) show eclogite metamorphism was nearly coeval with migmatite dome emplacement and that eclogite and migmatite shared only the later part of a P-T path (eclogite zircon cores record a ~360 Ma event not recorded in migmatite/gneiss or granite). These eclogites record HP metamorphism at ~315 Ma and are therefore the youngest in the Variscan orogen. We propose that partially-molten crust included eclogite formed by thickening at the orogen-foreland boundary in response to collapse-driven crustal flow. Eclogite and migmatite were exhumed together from >40 km to <12 km, although only eclogite preserves the HP record.