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Heterogeneity in tectonometamorphic systems; insights from Rb–Sr mica ages from the Cycladic Blueschist Belt, Syros, Greece

Clare E. Bond (1), Robert. A. Cliff (2), Robert W. H. Butler (1), and John E. Dixon (3)

(1) Aberdeen, Geology and Petroleum Geology, Aberdeen, United Kingdom (clare.bond@abdn.ac.uk), (2) School of Earth and Environment, University of Leeds, Leeds, LS2 9JT, UK, (3) School of Geosciences, University of Edinburgh, The King's Buildings, James Hutton Road, Edinburgh, EH9 3FE, UK

Heterogeneity in tectonometamorphic systems is well documented. This heterogeneity impacts on the interpretation of geochronological data used to determine the tectonic evolution of metamorphic terrains. An outstanding question in our understanding of these systems is whether metamorphism and the causative tectonics is best viewed as a series of punctuated events or as a continuum? We address this question through examination of the timing of exhumation of the Cycladic Blueschist Belt, Greece. The cause of scatter, beyond analytical error, in Rb–Sr geochronology was investigated using a suite of 39 phengite samples, drilled from specific microstructures in thin sections of calcschists and metabasites from the Cycladic Blueschist Belt on Syros. The majority are from samples that have well-preserved blueschist facies mineral assemblages with limited greenschist facies overprint. Peak metamorphic temperatures are below the closure temperature for white mica so crystallization ages are expected to be preserved. This is supported by the coexistence of microstructures of different relative age; in one sample phengite from the dominant extensional blueschist facies fabric preserves an age of 35 Ma while post-tectonic mica, millimetres away, has an age of 26 Ma. In the North of the island phengite Rb–Sr ages are generally between 53 and 46 Ma, comparable to previous dates from this area. South of the Serpentinite Belt phengite in blueschist facies assemblages associated with extensional fabrics linked to exhumation have ages that range from 42 Ma down to c. 30 Ma; two rocks with greenschist facies assemblages gave phengite ages that overlap with the blueschist samples, suggesting blueschist facies phengite is preserved in these rocks. Two samples yielded ages below 27 Ma. The data are consistent with a model of deformation that is continuous on a regional scale, despite local heterogeneities. The results suggest that micro-sampling techniques linked to detailed microstructural analysis are critical to understanding the timing and duration of deformation in tectonometamorphic systems.