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White mica Rb/Sr geochronological records of high-pressure/low-temperature rocks in the Cycladic Blueschist Unit (Syros, Greece), revealed by *in-situ* laser ablation ICP-MS/MS

Christopher J. Barnes[1], Thomas Zack[2], Michał Bukała[1,3], Delia Rösel[2], and David A. Schneider[4]
[1]Institute of Geological Sciences, Polish Academy of Sciences, Kraków, Poland
[2]Department of Earth Sciences, University of Gothenburg, Gothenburg, Sweden
[3]Instituto Andaluz de Ciencias de la Tierra (IACT), CSIC and Universidad de Granada, Armilla, Spain
[4]Department of Earth and Environmental Sciences, University of Ottawa, Ottawa, Canada

In-situ laser ablation ICP-MS/MS is becoming a widespread approach for white mica Rb/Sr geochronology. This technique allows determination of single-spot dates using an initial $^{87}Sr/^{86}Sr$ composition measured from Ca-bearing phases (Rösel & Zack 2022; GGR 46). The dates can be correlated with microstructural position and chemistry of white mica to discern complex tectonic histories. To demonstrate the power of *in-situ* white mica Rb/Sr geochronology, the technique was applied to four high-pressure/low-temperature (HP/LT) lithologies of the Cycladic Blueschist Unit (CBU) on Syros, Greece, which reached ~22 kbar and ~550°C at c. 53-45 Ma (e.g., Laurent et al. 2018; JMG 36). The CBU along the southern coast contains foliated eclogitic blocks that are wrapped by retrograde, foliated blueschists. At the western coast, the CBU possesses non-foliated HP skarn blocks similarly surrounded by retrograde, foliated blueschists. In the eclogite and blueschists, alignment of white mica defines the foliation along with glaucophane, epidote, and titanite. The southern blueschist also bears white mica grains with mineral cleavage oblique to the foliation. In the skarn, white mica are undeformed and sometimes exhibit a radial habit. White mica chemistry is relatively homogeneous in the eclogite (X_{Cel}: 0.33-0.39) and skarn (X_{Cel}: 0.36-0.50) compared to the blueschists from the western (X_{Cel}: 0.26-0.50) and southern (X_{Cel}: 0.33-0.57) exposures. Single-spot Rb/Sr dates are not correlated with microstructure nor chemistry for the eclogite and skarn, yielding weighted averages of 58.1 ± 4.3 Ma (MSWD: 1.3; n: 38) and 43.8 ± 2.8 Ma (MSWD: 1.1; n: 30), respectively. The blueschists show dispersions of dates that correlate with chemical variations, proxied by high-Ti (>1300 µg/g) and low-Ti (<1000 µg/g) domains. For the western blueschist, high-Ti domains yield a weighted average of 44.8 ± 3.4 Ma (MSWD: 0.93; n: 14), whereas low-Ti zones are 35.5 ± 2.9 Ma (MSWD: 1.4; n: 22). For the southern blueschist, high-Ti regions yield dispersed Cretaceous to Eocene dates, predominantly defined by the oblique white mica. The low-Ti domains gave a weighted average of 39.8 ± 2.1 Ma (MSWD: 0.99; n: 19). Altogether, white mica Rb/Sr geochronology records the timing of HP/LT metamorphism in the eclogitic block, followed by HP metasomatism in the skarn, and subsequent retrograde deformation events recorded by the low-Ti mica domains in both blueschist samples. The dates from high-Ti zones of the western blueschist reflect partial retention of the metasomatic history.

The dates from high-Ti domains from the southern blueschist are older than HP/LT metamorphism and are interpreted as partial retention of ^{87}Sr from the blueschist's protolith. The older events in the blueschist, and the metamorphic record of the eclogite, were not recorded by white mica $^{40}Ar/^{39}Ar$ geochronology on the equivalent rocks from the same exposures, which instead preserve the retrograde events (Laurent et al. 2021; GCA 311). These results demonstrate that Rb/Sr geochronology is a dynamic tool when coupled with structural and chemical data to extract metamorphic, metasomatic, deformation, and possibly detrital/magmatic records of white mica in rocks metamorphosed below ~600°C.

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