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Vein-hosted glaucophane and phengite in a greenschist facies host: differential preservation or compartmentalized overpressure?

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Four sets of subvertical glaucophane + quartz ± phengite veins exposed in the footwall of a major extensional detachment on southern Evia (NW Aegean Sea) record mode-I brittle fracturing under variable principal stress directions. The veins display systematic cross-cutting relationships with a prominent youngest vein set spaced 5-10 cm apart transecting all other veins. Interlayered epidotite and quartzite host the veins and promote a pronounced rheological control on fracturing, with veins preferentially hosted in epidotite layers and terminating abruptly as pressure solution seams or shear bands at contacts with the ductily deformed quartzite. The vein-hosted minerals do not exhibit recrystallization or dissolution-reprecipitation microstructures. Epidote in the veined layers is present both as euhedral crystals and as retrograde pseudomorphs after an earlier stubby prismatic mineral. Vein-hosted glaucophane and phengite are systematically oriented at fixed angles (normal and oblique) to vein walls. Phengite is compositionally homogeneous with elevated Si content (3.41–3.52 apfu). Glaucophane from all veins shows a homologous concentric compositional zoning with core chemistry intermediate between glaucophane and magnesioriebeckite, glaucophane-rich mantles, and rims of magnesioriebeckite or winchite. Phengite yields consistent single-grain total-fusion $^{40}Ar/^{39}Ar$ dates with a weighted mean of 22 ± 1 Ma (*n:* 22), whereas the low-K glaucophane produced equivocal and dispersed dates. Phengite (*n*: 44, 20) and glaucophane (*n*: 8, 42) *in-situ* $^{87}Rb/^{87}Sr$ isochrons from two samples yield mutually indistinguishable dates of 24 ± 6 Ma and 25 ± 4 Ma, within uncertainty of the $^{40}Ar/^{39}Ar$ dates. The uniform mineral chemistry, compositional zoning, and geochronology indicate that the veins likely formed over a short time without major shifts in ambient pressure-temperature conditions. Contrary to the apparent mineralogically-defined high pressure-low temperature paragenesis of the veins, dates obtained from pristine high-Si phengite support crystallization in the latest Oligocene to earliest Miocene, coincident with regional extension in the Aegean and widespread greenschist-facies retrogradation. We accordingly propose that the vein-hosted glaucophane and phengite crystallized during exhumation under ambient greenschist-facies conditions and record cm-scale thermal, barometric, or chemical perturbations related to fracturing in a rheologically heterogeneous medium.