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Peristerite exsolution in metamorphic plagioclase from the Lepontine Alps: An analytical and transmission electron microscope study

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ABSTRACT

Transmission and analytical electron microscopy were used to examine relationships between microstructures and compositions in greenschist- and amphibolite-facies metamorphic plagioclase (albite and oligoclase) from the Lepontine Alps (Switzerland and Italy). Two kinds of exsolution microstructures related to the peristerite miscibility gap ($\sim An_{1-25}$) were observed: lamellae, in bulk compositions ranging from a few mole percent anorthite to $\sim An_{10-15}$, and tweeds, in bulk compositions from almost pure albite to $\sim An_{15-18}$. Lamellae are typically 15 to 35 nm thick. Individual lamellae in crystallographically homogeneous or tweedy areas commonly have highly irregular spacings or end at dislocations or subgrain boundaries, suggesting formation by heterogeneous nucleation. Tweeds are characteristically diffuse, and probably formed by spinodal decomposition. Many tweeds have one exsolution direction that is consistently sharper or coarser than the other. Tweeds and lamellae may be intergrown in patches with irregular, curving boundaries, some of which define narrow stripes several micrometers long. Exsolution directions in these tweeds are approximately parallel and perpendicular to the lamellae. The perpendicular direction is usually less diffuse or more regular than the parallel direction, and may continue between widely spaced individuals in patches of lamellae. Tweeds in these intergrowths appear to be slightly more sodic than adjacent areas with lamellae.

Except near fractures and in areas with high dislocation densities, differences in microstructures within a single grain almost invariably reflect differences in composition. Microstructural variability within single grains, and among different grains from the same hand sample, was so large that it was impossible to identify systematic relationships between microstructures and metamorphic grade.