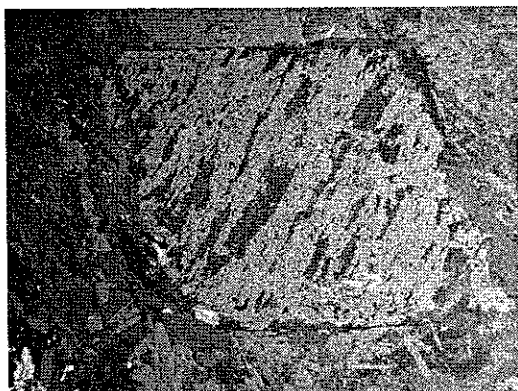


Mineral analyses and identifications were performed in thin section as well as by SEM/EDS. Modes for the pseudomorphs were also estimated using SEM/EDS through the use of backscatter electron imaging and the Area Measurement capability of the Link ISIS software package.

DATA

Data for six representative samples are presented here as examples of the types of pseudomorph-bearing rocks present on Syros.

Sample 13A



This pseudomorph in sample 13A, shown in backscatter, is distinctive because it displays alternating bands of zoisite and phengite/paragonite in a perfect diamond shape. The mica is mostly phengitic. Accessory minerals include titanite and apatite. The estimated mode of the pseudomorph is 64% zoisite, 35% phengite/paragonite and 1% titanite/apatite. The matrix of the rock is fine-grained glaucophane with patches of albite and actinolite.

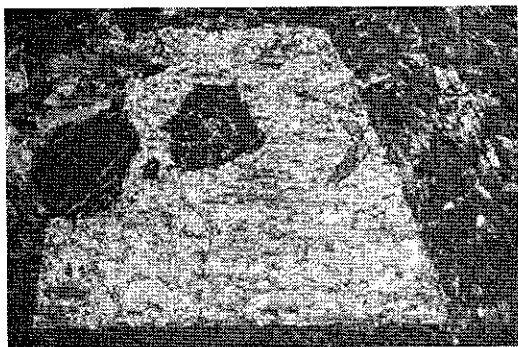
Sample 10A



This pseudomorph in sample 10A, shown in polarized light, is highly disordered with indistinct boundaries between the pseudomorph and the surrounding matrix. The estimated mode of the pseudomorph is 53% phengite/paragonite, 33% clinzoisite/epidote, 13% albite, and 1% titanite. The epidote-group minerals display clinzoisite-rich cores and epidote-rich rims. The matrix of the rock is fine-grained glaucophane with omphacite, clinzoisite, chlorite, albite, actinolite, and apatite.

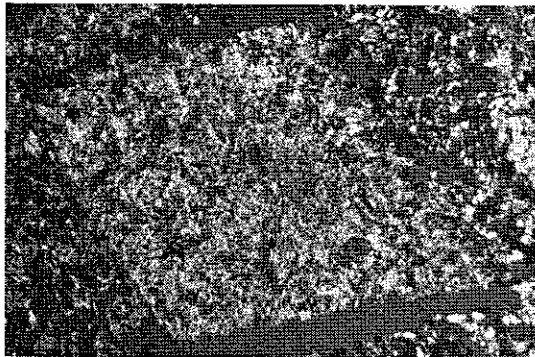
Sample 9C

This pseudomorph in sample 9C, shown in polarized light, is distinctive because it consists almost entirely



of fine-grained white mica and contains no epidote-group minerals. The estimated mode of the pseudomorph is 91% phengite/paragonite, 8% calcite, and 1% titanite/rutile. The pseudomorph also contains large garnets that were overgrown by the lawsonite porphyroblast. The matrix of the rock consists primarily of euhedral fans of chlorite with crystals of phengite and garnet interspersed. Also present are large euhedral crystals of titanite and rutile and some scattered quartz.

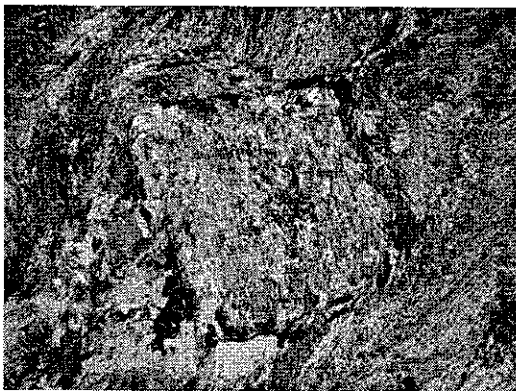
Samples 12B and 6A



This pseudomorph in sample 12B, shown in polarized light, is a graphitic schist sample. It contains pseudomorphs with the mineral assemblage graphite, quartz, albite, chlorite, and phengite. There is no calcium present in the pseudomorph, and instead the pseudomorph is separated from the matrix by hollow area in which only a few remnants of calcite remain. This was a moderately weathered sample.

Sample 6A, a more representative graphitic schist sample, has an estimated mode of 42% quartz + albite + chlorite, 38% clinozoisite, 18% phengite/paragonite, and 4% titanite/apatite. The matrix of the rock contains calcite, quartz, glaucophane, phengite, albite, titanite and apatite. Graphite is present throughout.

Sample 5D



This pseudomorph, shown in polarized light, appeared green in outcrop. It has a distinctive chlorite-rich rim surrounding a second rim composed of almost entirely of pure phengite. Together, these two rims compose approximately 25% of the total area of the pseudomorph. The estimated mode of the center of this pseudomorph is 25% clinozoisite/calcite, 71% phengite/paragonite, and 4% titanite. The phengite in the center of the pseudomorph is intergrown with paragonite on a fine scale, contrasting sharply with the large phengite crystals of the rim. There is a calcite vein at the border of the pseudomorph, and many larger veins of calcite were noted in the outcrop. The epidote-group

minerals display epidote-rich cores and clinozoisite-rich rims. The core of the pseudomorph contains some calcite. The matrix consists mostly of fine-grained glaucophane, which a few small grains of phengite, paragonite, and quartz dispersed throughout.

Sample JBB-8B

This pseudomorph, which occurs in a greenschist sample, was found to contain remnant lawsonite. Also present in the pseudomorph is zoisite, phengite, and a trace of plagioclase. Interestingly, the pseudomorph contains a few small anhedral garnets, approximately 100 micrometers in size, but no garnets could be found in the matrix. The estimated mode of the pseudomorph is 25% lawsonite, 35% zoisite, 38% phengite, and 2% garnet. Present as an accessory mineral is chalcopyrite rich in zinc. The matrix consists mostly of actinolite, with some chlorite, albite, and epidote, and a trace of phengite.

DISCUSSION

It is known that in most cases the migration of aluminum during metamorphism is small (Carmichael, 1969). Hence the preservation of the shapes of the lawsonite prophyroblasts in the rocks on Syros could be due to the limited diffusion of the aluminum component of the lawsonite during the lower pressure event. The pseudomorphs bearing the simplest mineral assemblage, such as sample 13A, reveal that lawsonite breaks down to zoisite, with the leftover aluminum and silicon going to phengite. In this

scenario, approximately two thirds of the aluminum can go to zoisite, and the rest must combine with potassium that has diffused into the pseudomorph from the matrix to form phengite (or, to a more limited degree, with sodium to form paragonite). In samples such as 10A, however, the proportion of phengite is greater than that of zoisite. Perhaps this is due to the migration of calcium out of the pseudomorph, possibly to be accommodated in actinolite, which is concentrated near the pseudomorph. In sample 12B, for example, no calcium even remains in the pseudomorph, and in samples such as 5D, the calcite veins surrounding the pseudomorphs, comprise the only calcium-bearing component of the matrix. In sample 9C, however, very little calcium is present either in the pseudomorph or in the matrix, and no calcium-bearing veins occur near the pseudomorph, so there is some question as to whether this pseudomorph is even after lawsonite.

In some samples, there is also the question of a potassium, or sometimes a sodium, source for the mica in the pseudomorph. For example, in sample 13A, the pseudomorph is high in phengitic mica, but there does not appear to be any phengite in the matrix of the rock outside of a few patches clustered around the pseudomorphs. If phengite is the potassium source for the pseudomorphs, it would seem that there should be some remaining phengite dispersed throughout the matrix of the rock. In sample 9C, there is a similar dilemma over sodium; the pseudomorphs contain substantial paragonite, yet a sodium source in the matrix is limited to the trace amount present in phengite.

Samples such as JBB-8B that contain remnant lawsonite reveal some interesting aspects of the pseudomorphs. For example, the composition of the lawsonite from which the pseudomorphs formed can be ascertained, and has been found to be of nearly ideal composition, with only 0.5 weight percent substitution by ferric iron and 0.3 weight percent substitution by titanium for aluminum. However, in most of the pseudomorphs, the epidote group minerals that have replaced lawsonite are clinozoisite and/or epidote, which have significant ferric iron content. Therefore, there must have been some migration of ferric iron into the pseudomorph from the matrix. Additionally, it is interesting that sample JBB-8B contains remnant lawsonite, yet is a greenschist, which by definition would have experienced a greater overprint than the rocks which retain blueschist assemblages. There is a significant difference between sample JBB-8B and the other samples, however. The matrix of sample JBB-8B consists primarily of actinolite and epidote, and hence, has a substantially higher calcium content than those samples in which lawsonite has undergone complete pseudomorphing. This may indicate that the preservation of remnant lawsonite may be due to bulk composition differences.

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