Replacement of igneous pyroxene and feldspar by hydrous metamorphism of volcanic pillows, Slate Creek complex, northern CA

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Subgreenschist/greenschist facies pillow basalts of the Slate Creek volcanic arc complex, northern California, USA, have relict phenocrysts of plagioclase and high-Ca pyroxene that were progressively replaced from pillow interiors toward pillow rims [1-3]. Relict high-Ca pyroxene grains are preserved in pillow interiors, have augitic compositions ($Wo_{40-45}En_{40-45}$ Fs_{15-20}) and in some cases, thin fringes of actinolite. The augites show a textural progression from pillow core-to-rim: (1) unreplaced augite; (2) augite with minor chlorite; (3) relict islands of augite in a composite pseudomorph with chlorite +/- secondary pyroxene ($Wo_{50}En_{25-30}Fs_{25-30}$); (4) complete pseudomorphs composed mostly of chlorite. Of three pillows sampled in detail, two (6-3-A, 6-4-B) show the complete range of textural stages over the length of a single thin section (~4 cm). At the third pillow (6-2-B), the textural transition occurs over ~10 cm.

All of the plagioclase feldspar analyzed in this study is albite (no original igneous feldspar compositions were detected). Similar to pyroxene, feldspar shows stages of textural replacement from interiors toward rims of pillows: (1) albite +/- minor sausserite (fine-grained aggregate rich in epidote); (2) albite + sausserite; (3) albite + sausserite + white mica; (4) white mica + sausserite +/- albite. Minor K-feldspar occurs with white mica in stages (3) and (4). Similar to pyroxene, the textural transition occurs over a single thin section at the margins of pillows 6-3-A and 6-4-B, whereas at 6-2-B, the transition occurs over ~10 cm.

The spatial scales of replacement textures of both pyroxene and feldspar indicate that a locally variable parameter controlled reaction progress during pseudomorphic replacement. Shifts from anhydrous albite and pyroxene to hydrous white mica and chlorite, respectively, suggest that greater ingress of water enhanced replacement reactions at the pillow rims. The abundant K-rich phases in plagioclase pseudomorphs are consistent with metasomatic K-enrichment of pillow rims, possibly during seafloor alteration prior to regional metamorphism in the Sierra Nevada.

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