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Chemical microstructure of Franciscan jadeite from Pacheco Pass, California

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ABSTRACT

The chemical microstructure of five jadeitic pyroxenes from three Franciscan quartzose metagraywacke samples was investigated by backscattered electron imagery, element mapping, and electron microprobe microanalysis. These clinopyroxenes are neoblastic, subhedral grains or subradial aggregates replacing albite. For each compositionally zoned Cpx grain, a series of up to five parallel, polished sections were cut essentially normal or parallel to the crystallographic *c* axis. Five investigated grains, single and subradial aggregates, were examined quantitatively and three-dimensional chemical sections of the grains were constructed. Chemical zoning progresses from the Na-Cpx core to rim in four distinct regions (Q, L, Acm, and T). Region Q consists of microcrystalline blebs of quartz and jadeite ($x$jd = 0.95) and has a bulk composition of nearly pure albite. Very rarely it contains albite. L is jadeite ($x$jd = 0.80) that contains lawsonite inclusions. Acm is acmite-rich Cpx ($x$jd = 0.65), and T consists of TiO_2-bearing jadeite (1–2 wt% TiO_2, $x$jd = 0.95). Isolated Cpx grains and prismatic aggregates display the same chemical architecture regardless of crystallographic orientation. The earliest growth stage, Q, represents a volume-for-volume replacement of pre-existing albite by nearly stoichiometric jadeite plus quartz. As prisms grew, diffusion from the lithic matrix progressively enriched outer Na-Cpx zones in Fe^{3+}, Ca, and Mg. Terminal stages of high-pressure growth are represented by TiO_2-bearing jadeitic pyroxenes, possibly reflecting a temperature increase or relatively long-term annealing under the same conditions in the presence of titanite and rutile. The core Q and rim T regions represent a jadeite plus quartz assemblage and confirm our earlier notion that the jadeite zone of Franciscan metamorphic rocks was subducted to depths where the assemblage jadeite and quartz was stable, at pressures of more than 10 kbar.