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Magmatic anhydrite in granitic rocks: First occurrence and potential petrologic consequences

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ABSTRACT

The Cajon Pass Deep Scientific Drillhole penetrated a minimum of 1 km of Late Cretaceous (?) intermediate plutonic rocks containing magmatic anhydrite, which occurs as both matrix grains and relic microphenocrysts within poikilitic hornblende, plagioclase, and sphene. Phase equilibria of coexisting silicates, oxides, and apatite support petrographic evidence of hypersolidus anhydrite, indicating that intermediate rocks from a mafic-felsic calc-alkalic suite (or suites) crystallized from about 800 to 700 °C at P_{tot} ~6 kb from hydrous and oxidized, sulfate-saturated andesitic to dacitic magma. The occurrence of anhydrite as inclusions within early crystallizing phases and its association with sulfate-enriched apatite indicates that, despite the potentially rapid destruction of matrix anhydrite by subareal weathering, petrologic evidence of the nature of such volatile-rich magma systems can be retrieved. If found to be widespread by future work, such evidence could be useful in understanding the mechanisms of volatile enrichment in explosive sulfur-rich volcanic systems and the potential relative roles of metasomatized lithospheric mantle sources and shallow-level mixing/assimilation processes in Cordilleran arc magma systems.