

Celestine discovered in Hawaiian basalts

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ABSTRACT

We report here the first occurrence of celestine (SrSO_4) in recent oceanic basalts. Celestine was found in moderately altered accidental volcanic blocks from Ka'ula Island, a rejuvenated tuff cone in the northern Hawaiian Islands. This occurrence is novel not only for the presence of celestine but also for the absence of barite, the sulfate mineral most commonly found in oceanic hydrothermal deposits. Celestine was found lining vesicles and partially fillings voids within the matrix of several high Sr (2200–6400 ppm) Ka'ula basalts. High-quality wavelength-dispersive microprobe analyses of celestine are reported here for near end-member celestine (>90%). The Ka'ula celestine deposits are compositionally heterogeneous with large variations in Ba content (0.9–7.5 wt%) within single mineral aggregates. The most likely source of the Sr for celestine in the Ka'ula basalts was the host basalt, which contains ~1200 ppm. This is about 10 times higher than normally found in mid-ocean ridge basalts and 4 times greater than commonly observed in Hawaiian basalts. Hydrothermal alteration by S-bearing fluids related to the eruption that transported these accidentally fragments probably mobilized Sr in the blocks. These S-rich solutions later precipitated celestine during or following the eruption. We were unable to confirm the origin for the Sr via Sr isotope measures because the Ka'ula celestine was too fine grained, friable, and widely dispersed to be concentrated for Sr isotope analyses. Future studies of basalts from active volcanoes on oceanic islands, especially for basalts with elevated Sr contents (>1000 ppm), should be aware of the possible presence of celestine in moderately altered lavas.

Keywords: Hawaii, volcanic rocks, celestine, hydrothermal alteration, strontium