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Mineral distribution in contact-metamorphosed siliceous dolomite at Ubehebe Peak, California, based on airborne imaging spectrometer data

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ABSTRACT

Visible and near-infrared reflectance spectra of minerals in the CaO-MgO-SiO_2-H_2O-CO_2 system and airborne imaging spectrometer data with a spatial resolution of 3.6 m were used to map the distribution of dolomite, calcite, tremolite, serpentine, brucite, and related minerals in the Ubehebe Peak contact aureole. The results are entirely consistent with previously mapped isograds, but the high-spatial-resolution imagery offers a more accurate representation of the complex distribution of metamorphic minerals, and serves to highlight critical relationships between mineralogy and controlling factors such as stratigraphy, structure, and fluid infiltration. Rocks in the aureole are predominantly quartz-poor dolomite and limestone, and these are classified as pure dolomite or calcite, accordingly. Tremolite and serpentine (after forsterite) are largely restricted to stratigraphic units that contain siliceous dolomite, quartzite, or chert. In one area, however, tremolite and serpentine delineate a zone of retrograde hydration attributed to fluid flow along a fault. Wall rocks within 200 m of the contact and inliers of marble in the pluton contain brucite (after periclase), which documents sites of focused infiltration of H_2O-rich fluid. In addition, the imagery reveals local metasomatic zones, marked by grossular-rich skarn and epidote alteration of the adjacent quartz monzonite, as well as large-scale patterns of bleaching, interpreted to define the maximum extent of fluid flow. The degree of bleaching and the intensity of plastic deformation are closely coupled; both effects increase abruptly at the forsterite isograd, which appears to represent a fundamental discontinuity with respect to chemical, physical, and mechanical processes in the aureole.