

BARITE DEPOSITS FROM THE SOUTHERN CALIFORNIA CONTINENTAL BORDERLAND: BACTERIALLY MEDIATED, FAULT-ZONE RELATED, SEEP DEPOSITS

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Barite was dredged from four locations and collected by submersible from one location in the southern California Borderland. The borderland consists of block-faulted continental crust that comprises part of the broad San Andreas plate boundary. The fault-bounded basins are anoxic and partially filled with hemipelagic and turbidite sediments. Barite occurs along strike-slip and basin-margin faults at water depths of about 500 to 1800m. Submersible observations at one site showed a series of mounds up to 10-m high composed of friable, white barite associated with diffusely venting milky fluid; the mounds support large benthic colonies, including tube worms (Lonsdale, 1979). Barites at the dredge sites are brown, greenish, and white, and range from porous and vuggy to massive and cut by banded barite veins. Samples at two sites contain fossil worm tubes. Chemical analyses show 94-98 wt. % BaSO₄, with low total REEs (45 ppm), and Sr contents ranging from 2 to 10,000 ppm. Sulfur isotopes range from +21.6 to +67.4‰. Sample textures, occurrences, and compositions indicate that barite formed by circulation of low-temperature hydrothermal fluids along faults and that precipitation occurred both below the sediment water interface and on the seafloor. The high sulfur isotopic values are due to extreme Rayleigh fractionation during bacterially mediated closed-system sulfate reduction, probably driven by flux of methane- or hydrocarbon-bearing fluids through the sediments. The near-seafloor precipitates have sulfur isotope values near that of seawater (+21‰). Those that precipitated below the sediment-water interface have higher values, suggesting that the fluids were relatively reduced with molar dissolve barium in excess of dissolve sulfate.