

## Exhalative Mineralization in Devonian Reef Complexes of the Canning Basin, Western Australia

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### Abstract

Lenticular stromatolite-barite-sulfide mounds, interpreted as sedimentary exhalative deposits, are exposed at several localities in Devonian reef complexes of the Canning basin, Western Australia. These mounds, hundreds of meters long and tens of meters thick, occur along contacts between basinal shales (Gogo Formation) and marginal-slope limestones (Sadler Limestone) and adjacent to synsedimentary faults cutting the Gogo Formation. The mounds are limestone buildups, composed of stromatolites intergrown with barite and cut by iron sulfide veins. The iron sulfides (marcasite and pyrite) are weathered to gossans at the surface. They fill fissures that probably formed as a result of contemporary seismic activity and the early compaction of underlying and adjoining shales. The stromatolite-barite-sulfide deposits also occur as allochthonous clasts in penecontemporaneous debris-flow deposits.

Postdepositional compaction of basinal shales in the Gogo Formation commonly amounted to about 75 percent. This resulted in the expulsion of large volumes of fluids along permeable interbeds, shale-limestone contacts, and synsedimentary faults, reaching the sea floor as cool-fluid seepages. The expelled fluids carried dissolved carbonate, barium, iron, and reduced sulfur. They probably nourished chemosynthetic bacteria that mediated the deposition of stromatolites, barite, and iron sulfides, resulting in growth of the stromatolite-barite-sulfide buildups.

There is no known economic mineralization in the exhalative buildups, but some drill holes encountered minor uneconomic veins of epigenetic Zn-Pb mineralization, filling narrow fissures that postdate the exhalative deposits. Economic epigenetic Zn-Pb deposits that have been mined elsewhere in the same general area of the Canning basin were formed during the early Carboniferous or latest Devonian, many millions of years after the exhalative deposits. Both exhalative and epigenetic phases of mineralization are thought to have been sourced through the compaction-driven dewatering of shales. The exhalative deposits are interpreted to have formed over seepages of cool fluids having salinities close to that of seawater, whereas the epigenetic deposits formed from much hotter fluids, probably brines, expelled during subsequent shale compaction.