

The Role of the Evaporite Basin in the Origin of Marine Phosphorite Deposits—A New Theory

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ABSTRACT

Many sedimentary sequences in the world show lateral gradation of phosphorite, chert, carbonate, and evaporite facies. Two classic examples are the Permian Phosphoria Formation and the Jurassic Fernie Group and equivalent rocks of the northern Rocky Mountains, U.S.A., and Canada.

Current theories on the origin of phosphorite facies require no direct relationship with evaporites. This paper proposes that apatite, chert, and dolomite are precipitated by mixing of warm brines from evaporite basins with cold ocean water. This mixing takes place in and at the mouths of marine accessways to Mediterranean-type evaporite ba-

sins, where high-density brines reflux back to the ocean. The mechanism provides conditions favoring the accumulation of prodigious amounts of organic matter—a common feature of phosphorite facies. Reactions in the basin between the evaporite brine and detrital silicate minerals may mobilize Si, F, Cr, Ni, V, Fe, rare earths, and other elements that frequently occur in anomalously large amounts in the phosphorite facies. Phosphorus, which other theories assume is supplied by the ocean, may be supplied by reactions between brine and detrital apatite from igneous or sedimentary sources.

The proposed mechanism may also be responsible for the formation of some sedimentary deposits of barite and iron ore.