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Criteria for Recognition of Diverse Dolostone Types from Host Rocks for Mississippi Valley–Type Ore Deposits

Dolostones are the favored host rocks for low-temperature lead and zinc ore deposits, probably because these dolostones formed in evaporitic environments. Sulfate concentration, providing a local sulfur source, probably enhanced the chances of ore formation. Reduction of sulfate by organic reducing agents, commonly gas or oil, is the most likely intermediate step. If this is so, the presence of the sulfide ores in apparently sulfate-free dolostones may indicate a former sulfate abundance. Orebodies are commonly associated with solution-collapse breccias, many of which are attributed to evaporite solution. The nearly complete, subsequent removal of the evaporites renders proof of the supposition difficult. In the big southeast Missouri breccia-hosted ore deposits, evidence in favor of former evaporitic conditions is conclusive.

Most randomly selected dolostones have minute solid inclusions of gypsum or anhydrite that can be released by solution of the enclosing carbonate. Greatly enlarged and readily recognizable crystal aggregates can be cultured from the insoluble residues. In the Lockport Dolostone of southern Ontario, gypsiferous vugs are common. Chloride ions are so abundant in the Lockport that serious corrosion problems arise when structural steel is encased in concrete using crushed-stone aggregate derived from this source. Fluid inclusions within sphalerite in Mississippi Valley–type ore deposits typically indicate ore precipitation from strongly hypersaline and even saturated brines. Geologic evidence supports the growth of white sparry dolomite gangue contemporaneously with such sphalerite.

We conclude that most ancient dolostones are formed in association with evaporitic facies and/or hypersaline brines.

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Modern Exploration Strategy in Frontier Areas, Case History from Upper Egypt

Exploration of a frontier area in southern Egypt was begun in November 1976. Using current technology, including detailed ERTS photography, aeromagnetics, and geologic field studies, two basins later known as the Eastern Nile basin and the Western Dakhla basin were delineated. Preliminary stratigraphic studies suggested the presence of Late Cretaceous and early Tertiary marine rocks in these basins.

Acquisition of reconnaissance seismic data began in February 1977. This effort confirmed basin configuration and depth and defined areas of greatest potential. Concurrently, additional surface work described Jurassic rocks and suggested the presence of previously hidden Paleozoic sediments in the western basin. A synthesis of geochemical data indicated that petroleum source rocks were available for hydrocarbon generation.

The first well will be spudded in early 1979.

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Secondary Carbonate Porosity, Zelten Field, Libya

Zelten field is located in the center of the Sirte basin, Libya. Hydrocarbon production at depths of 5,000 to 5,300 ft (1,500 to 1,600 m) below sea level is from the Zelten Member of the Ruaga Limestone of Paleocene and early Eocene age. Fifteen carbonate facies are easily recognized from this producing unit, but most of the production is from two highly porous facies: (1) *Discocyclina* foraminiferal grainstone and packstone and (2) coralgal wackestone. Core porosity ranges as high as 40%.

Primary interparticle and intraparticle and secondary leached matrix and moldic porosity occur in the Zelten reservoir. High primary porosity was preserved in the grainstones by slight amounts of early cement which prevented compaction. In the packstones and wackestones porosity was preserved by the presence of porous carbonate mud which inhibited cementation. This primary porosity was enhanced by extensive secondary porosity formed by subsequent freshwater leaching during a period when most of the carbonate bank was subaerially exposed.

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Lower Cretaceous Shelf-Margin Carbonate Facies, Northwestern Gulf of Mexico

Lower Cretaceous carbonate sediments accumulated on a broad shallow-water shelf which completely encircled the Gulf of Mexico. Along the edge of this shelf, biogenic growth climaxed with a complex of rudist reefs, banks, bars, and islands. The shelf-margin trend has been recognized offshore north of Yucatan; along the east coast of Mexico in the Golden Lane and Poza Rica trend in the subsurface, and outcrops in the Sierra Madre Oriental; through Texas and Louisiana parallel with and approximately 100 mi inland from the present coastline; and offshore of Florida along the west Florida Escarpment. These shelf-margin deposits are best known from the subsurface Golden Lane and Poza Rica trend, the outcrop in the Sierra Madre Oriental, and the subsurface of south Texas, where it is commonly referred to as the Stuart City trend.

Five major depositional environments have been recognized from the carbonate rocks of the south Texas Stuart City trend: shelf lagoon, shelf margin, upper shelf slope, lower shelf slope, and open marine. The shelf-lagoon facies include miliolid wackestone, mollusk wackestone, toucasid wackestone, and mollusk-miliolid grainstone. These facies accumulated under generally low-energy conditions in water depths from 0 to 20 ft (0 to 6 m). In contrast, the narrow band of shelf-margin carbonate beds is made up of algae-encrusted miliolid-coral-caprinid packstone, coral-caprinid boundstone, requienid boundstone, and rudist grainstone, all of which accumulated in moderate-energy to high-energy waters less than 15 ft (5 m) deep. Seaward of the shelf margin, the upper shelf-slope environment comprises the caprinid-coral wackestone and coral-stromatoporoid boundstone facies, and the lower shelf slope comprises the intraclast grainstone, echinoid packstone, and