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Lower Cretaceous Volcanic Rocks Close to Gulf Coast (Sierra Madre Oriental) Southwest of Veracruz Port

Outcrops in two areas in the east and west fronts of the Sierra Madre Oriental allow the study of Lower Cretaceous sedimentary and volcanic rocks. In the Fortin-Zongolica area Berriasian-Valanginian sedimentary rocks composed mainly of sandstone, siltstone, and limestone are associated with penecontemporaneous dacitic and andesitic volcanic rocks which were deposited in a shallow marine environment. In the Tehuacan area a section of sedimentary rocks formed by sandstone, shale, and limestone is associated with andesitic pillow lavas and volcaniclastics; the terrigenous fraction contains scattered primitive rudist shells. Correlation of the volcanic rocks is not certain but they may be in part equivalent with the rocks exposed in the Fortin-Zongolica area.

Elsewhere in central Mexico there are other evidences of Upper Jurassic–Lower Cretaceous andesitic volcanic rocks. These, together with the Tehuacan-Fortin-Zongolica volcanic rocks, could form an east-west volcanic arc extending across central Mexico.

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Dolomitization in Upper Red River Formation (Upper Ordovician), North Dakota

The upper Red River Formation (Upper Ordovician) in North Dakota contains four porosity zones which are divided into two different styles of syndepositional dolomitization.

The "D" zone is the base of the upper Red River and comprises two regularly interbedded, primary facies: mottled, partially dolomitized, porous mudstone and wackestone overlain by impermeable, organic wackestone and packstone. The burrowed wackestone represents very shallow-subtidal to low-intertidal deposition. The organic packstone is a product of an intertidal to supratidal pond or an evaporite flat.

Overlying the "D" zone are three repetitive depositional sequences, each consisting of basal wackestone-packstone, overlain by dolomitized mudstone (porosity zones "A," "B," and "C") and capped by nodular anhydrite. Each sequence represents a sabkha environment, progressing from subtidal wackestone-packstone through supratidal dolomite to anhydrite. Intercrystalline porosity resulting from syndepositional dolomitization is common to both the "D"-zone burrowed wackestone and the laminated dolomitic mudstone of the other three zones. Sedimentary structures and dolomite petrography indicate syndepositional origin of the dolomite. In all four porosity zones, limited post-burial dolomitization has resulted in porosity occlusion.

Dolomitization of the "D" burrowed facies occurred within the sediment body without subaerial exposure; the burrows are preferentially dolomitized, and the pervasiveness of the dolomitization was controlled by proximity of an underlying impermeable bed, resulting in a mottled texture in the burrowed facies. In contrast, dolomite in the sabkha sequences results from supratidal exposure, and the duration of exposure controlled the amount of dolomitization. Little preferential dolomitization is present in the supratidal dolomite.

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Geothermal Investigation of Northern North Sea

A regional study of geothermal gradients in the northern North Sea (59 to 62°N) has been carried out. True formation temperatures (T_f) are estimated by extrapolation of maximum temperatures (BHT) recorded during logging. The method also requires data about mud circulation time (t) and the time since cessation of circulation (Δt). The estimation of T_f is made difficult because of the following factors: the frequent use of only one thermometer (tool failure happens); the recording of BHT on one log run only while more logs have been run to the same depth; inaccurate or lack of Δt values; and the circumstantial work which is necessary to find t values in old well data. Because of the latter factor, an average value of t is sometimes used. No great errors normally result. If extrapolation of BHT's is precluded (only one value exists), T_f may be estimated from a mean correction line based on nearby wells.

Both total and interval geothermal gradients are calculated. The magnitude of the total gradients is largely dependent on the formation in which the wells have terminated. Differences of more than 5°C/km (0.3°F/100 ft) due to varying interval gradients have been observed. A general pattern of interval geothermal gradients is recognized: high Tertiary gradients (30 to 40°C/km = 1.7 to 2.2°F/100 ft); low Cretaceous gradients (10 to 30°C/km = 0.5 to 1.6°F/100 ft); and high Jurassic gradients (40 to 100°C/km = 2.2 to 5.5°F/100 ft).

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Making Public Lands Private

Most earth scientists are fully aware of the vital role development of our public lands and waters plays in building and sustaining our nation's economy and security. Since homesteading and gold-rush days our country has relied heavily on development of natural resources from the public domain to provide the energy, minerals, and timber essential to the industrial base, and to the comfort and well-being of our citizens.

Unfortunately, the public and their elected representatives do not seem to have this awareness. This is evident from the fact that more than 20 federal laws enacted in the last 10 years limit, impede, delay, or prohibit development of natural resources from federal lands. The principal victim of this legislative and regulatory onslaught is the oil and gas industry, although mining and timber industries have not escaped.

The currently accelerating implementation of the RARE II program, the Wilderness Act, the Coastal

Zone Management Act, the OCS Lands Act Amendments, the Marine Sanctuaries Act, and the Alaskan (D-2) land withdrawals, brings the magnitude of these attacks on our resource base into sharp focus.

Potential federal land and sea withdrawals, currently under consideration, total over 600 million acres (240 million ha.), an area larger than the states of Arizona, California, Colorado, Idaho, New Mexico, North Dakota, Utah, and Wyoming combined. This is equal to about one quarter of the entire land mass of the lower 48 states.

As earth scientists we have an obligation to alert the public to this threat and the very serious consequences it poses for our nation. In addition, we should make a concerted effort to increase our elected representatives' and agency administrators' awareness of this acute problem.

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Regional Hydrocarbon Source Rock and Thermal Maturity Evaluation of Ogaden Basin, Ethiopia

Maturity-level analyses utilizing vitrinite reflectance techniques on samples from several wildcat wells drilled in the Ogaden basin of Ethiopia showed a well-defined oil floor roughly coincident with the top of the Pliensbachian stage of the Lower Jurassic. Reflectance values obtained above and below this horizon show a marked increase. The sedimentary section within the proper thermal maturity range for oil has a thickness of 11,900 ft (3,570 m) in the Tenneco 1 Bodle wildcat in the southwestern part of the basin.

The best oil source rocks are within the Upper Jurassic Uarandab shales and Upper to Lower Jurassic Hamanlei carbonate rocks and evaporites. Oil source rocks occur locally in a clastic section near the base of the Lower Cretaceous.

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Source Rocks in Gulf Coast Area—Their Identification and Exploration Significance

No abstract available.

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Dolomite Nonstoichiometry; Its Relation to Carbonate-Rock Fabric

Nearly 300 samples of carbonate rocks representing all pre-Tertiary periods (except Cambrian) were analyzed for their dolomite stoichiometry by X-ray peak displacement. These samples represent a wide variety of fabric types (0 to 100% micrite, and boundstone), and a wide variety of depositional environments (shelf edge, subtidal shelf interior, shore zone, and deep marine). The percent calcium carbonate in the dolomite lattice ranged from 48.67 to 57.93, and was fairly uniformly distributed over the range 50.0 to 56.0%. There does not appear to be any clear relation through time and over wide geographic areas between the percent calcium carbonate in the dolomite lattice and (1) facies; (2) total percent dolomite; (3) degree of recrystallization; (4) spar-crystal size; (5) total fossil content; (6) percentages of gastropods, brachiopods, bryozoans, and echinoids; (7) percent insoluble residue; and (8) percent visible porosity (in thin section). There does appear to be a trend to more nearly stoichiometric dolomite (50% calcium carbonate) with increasing age, but this generalization has many exceptions. Results from samples of geologically related suites do show systematic facies-related patterns, but the trends vary and even reverse from suite to suite. We conclude that dolomite nonstoichiometry may be a useful parameter in facies analysis of geologically related (time and space) sets of samples, but it shows no unambiguous facies-related trends over the geologic record.

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Mississippian Non-Supratidal Dolomite, Ste. Genevieve Formation, Illinois Basin

In a subsurface area of 140 sq km along the La Salle anticline, southeastern Illinois, a 5 to 12-m sequence of shallow-marine, subtidal carbonate mudstone and wackestone in the upper Ste. Genevieve Limestone (Meramecian) has been altered in patches to porous (25 to 40%), oil-productive, microcrystalline dolomite. Information from about 150 wells (46 cored) shows the dolomite to occur in lens-shaped bodies up to 12 m (38 ft) thick, 0.5 to 2.5 km across, by 1 to >5 km long, in places probably interconnected, and markedly oriented east-west to northeast-southwest. The dolomite interfingers with carbonate mudstone/wackestone, which it closely resembles in primary and bioturbate structures, preserved and inferred megafossils, and clay and detrital silt content (<7%). Muddy calcareous sediments were the precursors. There is no direct evidence of either deposition or dolomitization under supratidal conditions.

Typical dolomite consists of sharply terminated, clear, 5 to 20-μm rhombs. In cathodoluminescence these have roundish, dully luminescing cores with successive dark and bright, rhomb-shaped overgrowth zones which clearly indicate fabric evolution and progressive reduction of porosity. Bulk isotopic compositions are relatively heavy (mean δC^{13} and δO^{18} are +2.3 and +2.4 parts per thousand versus PDB); Sr^{++} is 100 to 350 ppm. A later generation of coarse, iron-rich dolomite has similar δC^{13} but much lower δO^{18} (mean −6.0 parts per thousand) and locally filled molds, fractures, and veins.

Dolomite and carbonate mudstone/wackestone underlie a swarm of elongate lenses of ooid grainstone and sandy ooid-pellet packstone/grainstone that have similar orientations and areal dimensions. Many dolomite lenses directly underlie carbonate-sand bodies. Muddy parts of carbonate sands are commonly altered to microcrystalline dolomite with similar fabrics, isotopic and Sr^{++} compositions, and cathodoluminescence.

These observations suggest that dolomitization may have begun in marine pore water, but continued in a hydrologic system of partly meteoric origin. Dolomiti-