anhydrite is the mineral buried, when did it lose its large primary porosity, and has it recrystallized since initial formation? By (1) defining the first-formed mineral and its structures, textures, and chemical composition and (2) making analogous studies of ancient subsurface calcium sulfate minerals, we can, hopefully, answer some of these questions.

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FIBROUS ARAGONITE IN SEALED PLIOCENE *Glycymeris yessoensis*: POSTMORTEM

About 300 jointed bivalves of *Glycymeris yessoensis* were collected from a lenticle of an almost unispecific shell bed in the Onma Formation, central Japan. Most of the valves were partly open and completely infilled with the surrounding sandy silt; 5 were sealed and contained only a small amount of aragonite-cemented siltstone. The void in the chamber of the sealed valves is occupied with acicular needles of aragonite overgrown on the inner surface of the valves and on the surface of parasitic boreholes within the shells. The fibrous aragonite on the inner surface of the shells is in optical continuity with the aragonite crystals at both inner and outer structural layers. The fibrous aragonite indicates strong depletion of O^{18} and slight depletion of C^{13} compared with the shell. A cold to temperate open sea comparable with that off the western coast of Hokkaido at present is zoogeographically indicated for the Onma molluscan fauna. These isotopic depletions differ from that of aragonite cement generally found in grapestone clusters, reef rocks, and beachrocks, all of which are typically tropical. The textural evidence suggests that precipitation of the aragonite postdated the partial infilling by sediments, but took place when the sediments were plastic; hence a freshwater origin of the aragonite is excluded. A plausible interpretation is aragonitic growth from a solution trapped and warmed within the chamber during an early stage of fossilization. Aragonite cementation may occur in a localized space such as a shell chamber in nontropical seawater.

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MORPHOLOGY AND VERTICAL SEDIMENTARY SEQUENCES IN HOLOCENE TRANSGRESSIVE SAND BARRIERS

Studies of the barrier ridges and beaches along the presently transgressing mid-Atlantic coastal area have been used to formulate morphologic and vertical sequence models for transgressive beaches. Each type of barrier is a response to the topography being inundated in the ongoing transgression as well as to wave and current conditions. Four major types of sand-gravel barriers may be identified in coastal Delaware: (1) bay-mouth barriers, (2) beach against highlands, (3) estuarine barriers, and (4) spit complex.

The bay-mouth barriers, between enclosed lagoons and the open Atlantic Ocean, are characterized by a vertical transgressive sequence of sedimentary environments identical with the horizontal sequence in the direction of the transgression. In the beach against highland barrier, beach-bern system impinges on low-lying Pleistocene highlands (20–30 ft) which are being eroded and provide a partial source of sediment to the beach system. Estuarine barriers occur as long arcuate shorelines of large estuaries such as Delaware Bay. A barrier of sand and gravel is formed with small width (30 ft) and thickness (< 10 ft) but extreme length (50–75 mi). The internal structure of these thin but extremely long sand barriers is complex and mainly comprised of washover features. A modified version of the estuarine barriers is found in places near the leading edge of transgression on the landward shorelines of lagoons. The spit complex intrudes into the open marine and bay area. The spit-dune-barrier-marsh tract includes all of the expected coastal environment sediments of a normal barrier-lagoonal area in addition to typical spit-accretion sand and gravel. However, vertical sequences are disrupted and not in order.

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GEOCHEMISTRY AND DEPOSITION OF LOWER SALINA GROUP, SOUTHWESTERN ONTARIO AND MICHIGAN

Calcite, dolomite, insoluble residue, and clay minerals of lower Salina (A_1 and A_2) and upper Niagaran rocks of southwestern Ontario and Michigan were analyzed. Analysis of variance, trend surface analysis, and factor analysis were carried out on the above constituents, as well as on color and oil and gas production. Dark units contain more carbonate and calcite than light units. Light units contain more dolomite than dark units. Dark units typically contain a 13.4 Å clay, whereas light units more typically contain a 10.8 and 9.4 Å clay. Light units are associated with proposed marine outlets from the Salina basin. Light/[dark + light] ratios show very good correlation with reported oil and/or gas production. Dark carbonate units (suggesting a restricted lagoon) lie behind (east of) the known reef arc. High-dolomite-content light units may be related in origin to a shallow-water, subaerial environment currently termed "supratidal."

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DEVONIAN CARBONATE COMPLEXES OF CENTRAL EUROPE

The carbonate complexes in the Rhenish trough of the Variscan geosyncline (central Europe) range from late Givetian to early Frasnian and are restricted to the external and internal shelves and isolated submarine volcanic rises. On the western part of the external shelf (southeast margin of the Old Red continent), the carbonates form a widespread shelf-lagoon facies on deltalike clastic deposits (Belgium, Aachen, Eifel); in the eastern part they are isolated reef complexes and shelf-margin reefs on locally higher exposed platforms (Bergisches Land, Sauerland). On the internal shelf (northwest margin of the "Mitteldeutsche Schwell") the carbonates overlie crystalline rocks (borehole Sarr 1) or clastic Devonian strata (Giessen). The Middle to Upper Devonian carbonates generally are 350–400 m thick, and at Balve (Sauerland) they are more than 1,000 m. In the internal part of the trough the carbonates form isolated submarine volcanic rises on submarine ophiolites (Lahn-Dill syncline, Elbingerode in the Harz Mountains).

Carbonate sedimentation starts everywhere with a widespread carbonate bank (Schwelm facies). This bank is the foundation for the subsequent younger true reefs. The well-bedded bank carbonates are commonly dark and fine grained. The potential reef builders—stromatoporoids and tabulate and rugose corals—built flat, widespread biostromal structures in a muddy environment rather than wave-resistant structures. Within the bank, 8 subfacies can be distinguished.

Overlying the bank, isolated and locally restricted true reefs (Dorp facies) show mostly atoll-like features. At the western margin of the Old Red continent