perature deposits. Present data do not preclude association of these suites with high-temperature or mechanically concentrated uranium deposits.

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Diagenesis in Volcanogenic Rocks of Great Valley Sequence, Northern California—Isotopic and Chemical Data

Diagenesis of volcanogenic sandstone and mudstone of the 8,500 m thick Great Valley sequence (Tithonian to Hauterivian) involved extensive mass transfer during burial in the outer-arc basin.

The clay mineral assemblage of mudstone is characterized by (1) disappearance of discrete smectite at a relative stratigraphic depth of 6,600 m, and (2) a gradational increase of illite/smectite with increasing stratigraphic depth over the lowermost 4,500 m of strata. $\delta^{18}O$ for illite/smectite changes with descending stratigraphic position from 21.9 to 15.5 ppm and is temperature dependent. Potassium and sodium enrichment and uniform aluminum composition in the clay-size fraction of the mudstone relative to the whole rock indicates that the dominant reaction was: smectite + potassium $\rightarrow$ illite/smectite + silica. Authigenic quartz with $\delta^{18}O \cong$ 21.6 ppm throughout the sequence indicates that this reaction is temperature triggered. Calcite derived from primary biogenic carbonate acquired $\delta^{18}O$ values from $+0.2$ to -10.5 ppm PDB during successive mobilizations as temperature increased with burial.

In sandstones, the sequence of mineral authigenesis is: (1) chlorite cutans ($\delta^{18}O$ = 13.2 to 13.9 ppm) around framework grains formed during shallow burial; (2a) precipitation of radiating pore-fill chlorite ($\delta^{18}O$ = 11.1 to 13.3 ppm) as iron and magnesium were released from mudstone by illitization of smectite at temperatures as low as 60°C, or (2b) precipitation of calcite ($\delta^{18}O$ = -4.2 to -10.8 ppm PDB) as calcium was released from nearby shales and albitized plagioclase; (3) late replacement of framework grains by chlorite ($\delta^{18}O$ = 6.5 to 13.0%) or by calcite ($\delta^{18}O$ = -8.3 to -12.7 ppm PDB) at more elevated temperatures.

Prehnite, laumontite, and quartz veins ($\delta^{18}O$ = 17.2 to 20.5 ppm) are found only in the most basal strata, and were derived from the ophiolitic basement. These phases do not imply zeolite-grade burial metamorphism of the basal sediment.

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Organic Facies of Mid-Cretaceous Black Shales in Deep North Atlantic

The mid-Cretaceous black shales of the deep North Atlantic consist of alternating layers of sediment rich in total organic carbon (TOC) that contain abundant amorphous types of organic matter, and sediment poor in TOC that contain mostly woody and coaly types of organic matter. The amorphous materials are derived mostly from marine organisms in the eastern North Atlantic off Africa, in the Caribbean, and on the Demarara Rise off Surinam, and from higher land plants in the western North Atlantic and off Europe. Marine amorphous material is important off Africa because this was an area of upwelling and highly productive surface water. Amorphous marine organic matter was deposited across the entire North Atlantic basin in the Cenomanian in response to an ocean-wide upwelling event connected with the opening of the equatorial Atlantic. The difference between the TOC-rich and background TOC layers reflects deposition of the former under reducing conditions, which allowed the preservation of labile amorphous materials of marine and terrestrial origin, and of the latter under oxidizing conditions, when all that was preserved was refractory organic material.

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Submarine Carbonate Cementation and Pisolith Growth in Silurian Reefs of Northern Indiana

Peloidal grainstone and pisolite fill crevices on the flanks of several Silurian reefs in northern Indiana, producing intersecting dikes and veins. Internal dike structures and cross-cutting show that the cycle of crevice formation, sediment trapping, and lithification was repeated several times during the life of the reefs. Significantly, where younger dikes cut across older dike material, their walls have sharp boundaries and matching wall structures, showing that each earlier crevice sediment became lithified before the next fracturing event occurred.

The grainstone clasts appear to have been mechanically swept into the crevices and initially lithified by the precipitation of sparry calcite cement around the grains. Most of the crevice fill now consists of calcite or dolomite pisoliths, however, some exhibit concentric structure, suggesting concretionary growth. Other pisoliths exhibit radial structure in which blades of cloudy calcite encroach on peloids and fossil fragments of the grainstones, suggesting growth by replacement. Petrographic evidence thus favors in-situ growth of the pisoliths, and suggests that lithification of the grainstone was completed by this process.

Evidence favoring vadose cementation of the grainstone, or favoring vadose origin of the pisoliths, is absent, and fresh-water phreatic cementation is considered unlikely. However, the repeated alternation of cementation events with marine reef sediment-producing conditions strongly suggests that initial grainstone cementation and pisolith growth occurred under shallow-water marine conditions.

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Diagenesis in Monterey Formation, Pismo Syncline, Coast Ranges of California

A predictive model of diagenesis, involving hydrocarbon migration, for the Monterey Formation in the Pismo syncline, Coast Ranges of California, includes (1) diagenetic history, (2) lithofacies relations, and (3) tectonic setting. The diagenetic reactions control mineral-