transgression following Middle Ordovician erosion. The transition into the overlying Upham Member of the Second Value is gradational, but can be locally abrupt. The massive, finely crystalline dolostone was originally coral (tabulate and rugose forms) and crinoidal wackestone-packstone. Fossils are poorly preserved by chalcedony replacement. The transition from the relatively shallow-marine sediments into the deeper water strata of the Aleman Formation occurs over several meters. The very finely crystalline, cherty dolostone hosts rynchonellid and dalmanellid brachiopods and bryozoan colonies. Ribbon cherts developed around clusters of fossils. The Aleman changes sharply into chert-free, thin to medium-bedded Cutter. The argillaceous dolomicrite is nonfossiliferous except for conodonts, isolated brachiopods, and a *Favosites*-type coral horizon. Tidal channels, intraclasts, and cyclic bedding indicate peritidal deposition during Cutter deposition. Erosion preceded Fussleman (Silurian?) deposition.

Conodont faunas represent shallower conditions than the Montoya faunas of Sweet, but compare favorably for correlation. *Panderodus* and *Belodina* faunas characterize the shallow-marine Second Value Formation; deeper water *Plectodina* and *Phragmodus* characterize the Aleman; and very shallow-water *Rhipidognathus* characterizes the Cutter. Ages for the Second Value, Aleman, and Cutter Formations are late Eden-early Maysville, Maysville-early Richmond, and middle-late Richmond, respectively.

Dolomitization interrupted early silica replacement of shells, matrix, and sulfates. Mosaic dolomite and epitaxial rims on dolomite cement virtually destroyed all effective porosity.

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Depositional Environments and Oil Shale Genesis in Eocene Green River Formation: Retrospect and Prospect

Geologic studies of oil shale were pioneered by W. H. Bradley in 1929. His basic model for the genesis of oil shale called for a deep stratified lake in which anaerobic conditions in the hypolimnion ensured the preservation of organics and accounted for the finely laminated character of the oil shale. Until recently, studies involving the depositional environment and genesis of oil shale were based on the stratified lake model.

In 1973 Eugster and Surdam presented an alternate model (playa lake model) that accounted for the origin of oil shale in a shallow lake fringed by broad mud flats or playas. The playa lake model accounted for observed shallow-water sedimentary structures and evidence of a low topographic gradient. This abrupt change in basic concepts was not readily accepted by many workers. Views have polarized, primarily because of the variety of depositional conditions that existed in separate but geographically related basins of deposition.

This polarization will not be resolved until a more adequate and comprehensive model is developed. It must account for most of the pertinent observations, including preservation of organic matter, sedimentary structures, carbonate deposition and diagenesis, vertical and lateral facies relationships, and paleontology of the Green River Formation, all of which are critical to an understanding of oil shale genesis.

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Diagenetic Carbonate Concretions from Late Cretaceous Active Margin Slope Deposits, Southern California—Origin and Use in Paleoenvironmental Reconstruction

Fine-grained rocks of Late Cretaceous, West Coast, active margin strata have generally been ignored in paleoenvironmental analyses because of the highly fragmented and apparently homogeneous nature of outcrops. Recent studies on Holz Shale (Ladd Formation, Santa Ana Mountains) fine-grained slope strata have shown that diagenetic carbonate concretions which occur in this unit are useful for understanding primary sediment fabric and hence paleoenvironments. Usefulness of concretions to such paleoenvironmental studies can only be evaluated, however, after their diagenetic history is fully understood.

Holz Shale concretions most commonly occur as ellipsoids 0.05-1.5 m (0.2-5.0 ft) in diameter. Concretions generally consist of amorphous shale clay and quartz sediment cemented by calcite. Organic materials such as mollusk valves and terrestrial plant material commonly served as concretion nuclei. On the basis of this association with preserved organic materials and the abundance of pyrite preserved within concretions, it appears highly probable that decomposition of organic materials by sulphate-reducing bacteria was an important factor in the formation of these concretions. Lack of compaction of trace fossils within concretions, bending of strata around concretions, presence of septarian structures, and pene-contemporaneous slumping of concretions in surrounding sediments indicate an early diagenetic origin where original sediment fabrics were preserved.

Many other Late Cretaceous, deep-marine, active margin, fine-grained strata on the West Coast contain similar concretions. If these concretions prove to have an early diagenetic origin like those in the Holz Shale, they may be the key to a better understanding of depositional mechanisms of these widespread deposits.

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Paleoenvironmental Analysis of Late Cretaceous Active Margin Continental Slope Deposits, Southern California

Extensive active margin, continental slope and upper fan deposits are not commonly preserved in the rock record. The Holz Shale (Ladd Formation, Black Star Canyon, Santa Ana Mountains) represents such a sequence where shale and mudstone strata are dissected by numerous coarse-grained channel-fill deposits. Channels preserve evidence of filling primarily by conglomerate debris flows, high-density turbidites, and classic Bouma low-density turbidites; slumping and traction-current mechanisms were less important. Associated with channels are submarine chutes, pebbly mudstones, and poorly developed levee facies. Interbedded turbidites, contourites, and hemipelagic sediments dominate interchannel strata. Hemipelagic sediments exhibit sedimentologic textures that range from biologically dominated (homogenous, bioturbated) to physically dominated (fine-scale, planar-laminated, anaerobic) fabrics. This variation in texture and associated diagenetic information indicates that the anaerobic/aerobic boundary was generally at some depth below the sediment-water interface, but at times migrated up into the overlying water column.

Foraminiferal assemblages within hemipelagic sediments are dominated by agglutinated forms which indicate deposition at bathyal depths. Macroinvertebrates include (1) the interchannel paleocommunity, dominated by the bivalve *Inoceramus* and the deposit-feeding trace fossil *Chondrites*, and (2) the submarine channel paleocommunity, comprised mainly of the trace fossils *Thalassinoides* and *Ophiomorpha*.

Previous studies have demonstrated that these active margin environments included a narrow continental shelf. Abundance of terrestrial plant material, paucity of displaced shelf faunas, well-rounded conglomerate clasts, and the coarse-grained texture of these deposits suggest that one or more of the Holz Shale submarine channels was receiving sediment directly from terrestrial environments.

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Dedolomitization in Tectonic Veins and Stylolites: Evidence for Rapid Fluid Migration During Deformation

Jurassic through Tertiary thrust-belt deformation of the Mississippian Madison Group has introduced complex fracturing, stylolitization, and carbonate vein mineralization. Host rocks are dominantly dolostone and dolomitic limestone. Tectonic veins are mineralized first by dolomite and then by multiple calcite phases. Dolomite and some generations of calcite which line veins are highly luminescent, while host-rock dolomite is non-luminescent. Both vein-lining dolomite and host-rock dolomite have been corroded and replaced by subsequent generations of calcite mineralization. These textural relationships suggest that fluids associated with thrust-belt deformation were in part extraformational and had not equilibrated with host-rock dolomite.

Because thrust-belt deformation moved from west to east with time, the isotopic composition (^{18}O, ^{13}C) of vein and stylolite mineralization can be used to evaluate fluid migration during deformation. In three sections located along an east-west transect in the southern overthrust belt, calcite vein mineralization displays a wide range of isotopic compositions that are distinctly depleted relative to the host-rock composition. These