rowing invertebrates, trilobites, nautiloids, pelmatozoans, brachiopods, gastropods, rostroconchs, and archaeoscyphiid sponges.

Thrombolite mounds are circular in plan, up to 2 m in diameter and thickness, with an estimated depositional relief of 0.3 m at most. Individual mounds commonly coalesced form circular and linear patch reefs, or banks with grooved margins. Large archaeoscyphiid sponges and *Pulchrilamina* (encrusting sponge?) contribute in a minor way to the framework in scattered horizons. Rare small mounds are composed of an intergrowth of thrombolites and *Lichenaria* corals.

Large thrombolite *Lichenaria-Renalcis* reef complexes, up to 12 m thick, with an estimated depositional relief of up to 1.5 m, occur in the lower part of the St. George. One particularly well developed complex is composed of vertically superimposed reef stages composed of *Lichenaria,* thrombolites, and the "calcareous alga" *Renalcis.* The framework is surprisingly complex, with abundant cavities and a demonstrably uneven growth surface. Cavity walls are commonly coated by algalaminites and internal sediments are burrowed. Some cavities are sediment conduits. *Renalcis* occurs as free-standing heads of varying shapes, as encrusting walls on small thrombolite mounds, and as manes in cavities under corals.

These bioherms span a critical time gap in the development of reefs, the transition period from algal-dominated bioherms of the Precambrian and Cambrian to the metazoan-dominated bioherms of the Middle Ordovician and remaining Phanerozoic.

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Early Guadalupian (Permian) Bank Margin Erosion Surfaces, Guadalupe Mountains, Texas

Two basin-sloping erosion surfaces occur in the early Guadalupian carbonate rocks on the western Guadalupe Mountains escarpment. Their longitudinal profile resembles a slump scar. Each truncates (with 20 to 40° dips) 70 to 100 m of flat-lying bank-top strata, and then flattens basinward. The younger surface, previously unreported and virtually inaccessible because of sheer cliffs, sharply truncates about 70 m of upper Grayburg shelf strata at its headwall. It flattens basinward and appears to more gradually truncate the uppermost part of the Getaway (also Grayburg) bank. Initiation of the characteristic high-angle foreslope deposits of the Goat Seep and Capitan "reef" began at this 70-m-high headwall. Early Goat Seep foresets, contrasting with later Goat Seep and Capitan, have little rock equivalent in a gentler-dipping toe-of-slope section. The older erosion surface is the regional unconformity at the base of the Brushy Canyon Sandstone. At its headwall (the Brushy Canyon pinch-out) about 100 m of Cutoff and Victorio Peak Formations are truncated abruptly.

The two Guadalupian erosion surfaces somewhat resemble the closely associated late Leonardian basin-sloping (5 to 10°) surface that truncated 200+ m of Victorio Peak bank in pre-Cutoff time. We believe all formed in a submarine environment. Conceivably they are "half-channels" with their south or southwestern side eroded or kilometers away. We believe they were formed by shelfward retreat of the depositional bank margin. The erosion agent and mechanism are enigmatic. We believe the Victorio Peak and probably the Grayburg were rock when eroded, but we are uncertain regarding pre-erosion lithification of the Cutoff Formation.

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Hydrocarbon-Trapping Structures in Southern Canadian Rockies Segment of Cordilleran Foreland Thrust Belt

The hydrocarbon reservoirs consist of upper Paleozoic platformal carbonate rocks in northeasterly verging, imbricate, listric thrust-fault wedges, and in related flexural-slip folds. They formed in Maestrichtian to early Paleogene time, after these rocks had been buried under more than 5 km of Late Jurassic to Paleogene molasse. Both the generation and entrapment of the hydrocarbons result from subduction of the floor of the Cordilleran miogeocline.

Palinspastic reconstructions of the foreland thrust and foldbelt, based on balanced structure sections that take into consideration the deep crustal structure as outlined by seismic refraction, magnetic, gravity, and geomagnetic depth sounding data, show that: (1) there has been about 200 km of net horizontal convergence between the Mesozoic magmatic arc of the eastern Cordillera and the autochthonous cover on the North American craton; (2) the convergence is expressed at a shallow level, in the eastern, more external zone, by horizontal compression and vertical thickening within supracrustal rocks that overlie an unbroken basement of cratonic continental crust; but at deeper levels, in the western, more internal zone, it involved the subduction of the former basement of the miogeocline; (3) the Cordillean miogeocline is a northeasterly tapering wedge of craton-derived sedimentary rocks that accumulated outboard from the edge of the continental craton, on oceanic or tectonically attenuated continental crust; (4) the foreland thrust and foldbelt is a shallow subduction complex that was tectonically prograded northeastward as the miogeoclinal, platformal, and exogeoclinal supracrustal rocks were scraped off the underriding slab and accreted to the overriding slab; (5) subsidence in the migrating foredeep was due to flexure of the lithosphere under the weight of the encroaching subduction complex, and of the molasse itself.

The first of two main pulses of subduction occurred outboard from the craton, during Late Jurassic and Early Cretaceous time. It involved outward verging thrusting and folding on either side of the uplifted core of the miogeocline, and it produced a thick wedge of molasse that covered the western craton. The hydrocarbon reservoirs formed during the second pulse, in Late Cretaceous and early Paleogene time, as the cratonic cover rocks were deformed and accreted to the growing subduction complex, while the continental craton moved under the detached miogeocline.

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