explained by a relatively simple progradational cyclic model without invoking major sea level fluctuations.

A typical cycle contains 3 major components: (1) shelf-bar **stones; and (3) interbar siltstones. Shelf-bar sandstones, 1 to 6 m (3 to 20 ft) thick, are typically overlain by carbonate grainstone/ packstone facies 1.5 to 6 m (5 to 20 ft) thick, which are** grainstone/packstone facies, 1 to 6 m (3 to 20 ft) thick, which are in turn overlain by siltstones, 1 to 6 m (3 to 20 ft) thick, thus completing the cycle, 4 to 18 m (13 to 59 ft) total thickness.

Shelf-bar sandstones in the Holder Formation (Virgilian) are lenticular concavo-convex sand bodies, 2.5 to 6 m (8 to 20 ft) thick, with flat depositional bases. Average grain-size (4 ϕ - 0 ϕ) and maximum clast size (12 mm, 0.5 in.) increases upward. Seaward dipping (W - NW) accretion foresets, up to 0.6 m (2 ft) thick, and bimodal trough cross-stratification, 10 to 30 cm (4 to 12 in.) thick, characterize lower sandstone facies. Hummocky cross stratification, 7 to 9 cm (2.8 to 3.5 in.) thick, 1.2 to 2.5 m (3.9 to 8 ft) wavelength, is common along accretion foreset surfaces and the tops of many of these sets are rippled and burrowed. Syndepositional deformation structures are common. Missourian and Virgilian shelf-bar sandstones were rapidly deposited by storm-induced currents and were modified by fair-weather tidal oscillatory flow and biological processes.

In contrast with Virgilian shelf-bar sandstones, Wolfcampian bars are thinner, 1.5 to 2 m (5 to 6.5 ft) thick, coarser grained, and locally have erosional bases. Bimodal through cross-stratification is well-developed at the expense of seaward dipping accretion foresets which if present, are poorly developed. Hummocky cross-stratification and burrows are rarely present, whereas ripples and syndepositional deformation structures are common. Average grain size coarsens-upward crudely. These Wolfcampian shelf-bars were deposited in shallow water subject to strong tidal currents, which winnowed finer sediments, produced distinct bimodality in sedimentary structures, and prevented the bars from achieving significant depositional relief.

Carbonate units, 1 to 5 m (3 to 16 ft) thick, decrease in micrite and increase in abundance of allochems upward in the vertical sequence. Sedimentary structures are similar to those of the associated siliciclastic shelf-bars, indicating a change in sediment-supply without significant change in hydrodynamic conditions. Carbonate units are thinner, 1 to 2 m (3 to 6.5 ft), become less important volumetrically in Wolfcampian sediments as compared with those in Virgilian rocks.

The spectrum of high energy siliciclastic shelf-bar sandstones, and the presence of fan-deltaic and fluvial deposits in overlying sediments (Wolfcampian) suggests that the shelf adjacent to the Pedernal uplift continuously prograded into the Orogrande basin. Shifting clastic influx along depositional strike caused drastic local changes in shoreline configuration, longshore currents, and subsequent clastic and carbonate sediment distribution patterns.

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Conodont Paleoecology of Lower Triassic Thaynes Formation

The Lower Triassic (Smithian) Thaynes Formation represents a broad spectrum of paleoenvironments. Samples arranged along a generalized depth-salinity environmental gradient from tidal flats to a relatively deep, commonly dysaerobic, basin yielded a conodont fauna of 30 form elements. Association and similarity analysis were used to group the conodont elements into eight conodont entities, reflecting both biologic association (multielement apparatuses) and ecologic association (biofacies). Simple chi-square tests and discriminant analyses, using the eight conodont entities, and indicate presence of three distinctive conodont biofacies related to the generalized environmental gradient. The restricted inner shelf biotope was characterized by a conodont fauna dominated by *Parachirognathus*. The outer shelf biotope was distinguished by a diverse conodont fauna including the distinctive form *Furnishius*. The biotope farthest offshore consists of a low diversity conodont fauna composed primarily of species of *Neogondolella*. Some early Triassic conodonts such as *Neospathodus* and *Ellisonia triassica* are ubiquitous, and provide the foundation for a inter-basinal conodont zonation. Early Triassic conodont biotopes can be arranged along a generalized environmental gradient that probably reflects changes in hydrographic factors (e.g., salinity, temperature, and energy) which affected the distribution of conodonts.

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Dominant Distributions and Niches of Polycystine Radiolarians in Modern Oceans

Approximately 400 to 500 relatively common polycystine radiolarian "species" live in the modern oceans. About 200 species live in shallow (0 to 200 m; 0 to 656 ft), temperate and tropical waters (the "upper warm water sphere"); 40 to 50 in high latitude (poleward of subtropical and polar convergences) shallow waters; 150 to 200 in deep (greater than 200 m; 656 ft) waters, most of which appear to be tropical submergent (shallow in high latitudes and diving as tropical submergent or tropical avoidant forms); and about 40 to 50 eurybathyal forms. In general, spumellarian "family groups" of the warm water sphere (surface to subsurface) include the beloids, collosphaerids, saturnulids, artiscids, phacodiscids, spongasterids, dictyocoryids, spongurids, pylonids, lithellids (loosely coiled), and stylodictids; with the spongotrochids, spongopylids, tholonids, lithellids (tightly coiled), and orosphaerids being dominantly intermediate and deep water (cold water sphere) forms. In general, nassellarian family group of the warm water sphere and transition-central waters include the lophophaenids; sethoperids, sethophormids (complex), carpocanids, eucyrtidids, pterocoryids, cannobotryids, spyroids, and artostrobids (not robust). Plectopyramids, artostrobids (robust), sethoperids, sethophormids (simple), and theocalyptrids dominate in either the transition-central (lower warm water sphere) or cold water sphere.

Polycystine radiolarian species and family level groups appear to fit into four basic broad "nutrition niches:" nannoherbivore-carnivore; bacterivore; detritivore, in association with symbiotic algae; and, perhaps an osmotrophic niche. At the family level these groups dominate the following oceanic habitats: nannoherbivore-carnivore the broad shallow warm water sphere, with algal symbiotes dominating the subtropical anticyclonic gyres, eastern equatorial, and shelf subregions; bacterivores in subsurface and deeper (nutricline and deeper); and, detritivores and perhaps osmotrophs the deep ocean.

A positive relationship exists between the degree of eutrophism in the epipelagic region, and underlying mesopelagic and deeper radiolarian standing crops. Radiolarians are usually sparse in waters overlying the continental shelves. However, those radiolarians harboring symbiotic algae (collosphaerids, artiscids, spyroids, spongasterids, dictyocoryids, etc) are more tolerant of shelf waters. Radiolarians harboring symbiotic algae are also dominant in the oligotrophic subtropical anticyclonic gyres and the eutrophic eastern tropical regions. Acantharian and diatom bloom conditions exclude polycystine radiolarians from these bloom areas (many nearshore areas and the photic zones poleward of polar convergences).

These modern day dominant patterns of radiolarian distribution appear to have been initiated in the early Neogene and