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Marine Faunal and Floral Similarities between the Tethys and Western North America: Tectonic and Pantropical Models

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Abstract: All of the Cordilleran region of western North America making up the eastern Pacific rim, as well as portions of South America and most of the western Pacific rim, are composed of numerous displaced terranes. While some workers regard these terranes as having always existed marginally to the American craton, stratigraphic, paleontologic, volcano-tectonic, and paleomagnetic records of some oceanic terranes contrast greatly with those of the craton. This convinced many workers that such terranes are exotic to North America. These Cordilleran terranes bear Permian to early Mesozoic Tethyan fossils suggested to have originated in the Panthalassa Ocean, far from North America, perhaps even closer to the western Tethys itself. According to this theory, some terranes were conveyed upon Pacific plates across Panthalassa by the process of seafloor spreading. Most, if not all of these plates, have been consumed along subduction zones and some small disrupted melange terranes are viewed as representing vestiges of former ocean seafloor. Island chains and larger continental fragments, if conveyed across the seafloor of the ancient Pacific, must have contained fossilized remains of organisms from distant endemic centers.

The process responsible for the creation and dispersal of Permian-Triassic terranes was the breakup of Gondwana, a process that also initiated movements of terranes across the Tethys. During the early phases of the Gondwana breakup, two hypotheses account for the occurrences of Permian and Late Triassic Tethyan fossils in displaced terranes of western North America: **Pantropical dispersal** and long-range, **tectonic dislocation.** A third hypothesis called the **Hispanic Corridor** is applicable to the Jurassic. It relates to the tectonic fragmentation of Pangea which eventually produced a marine epicontinental seaway connecting the eastern Pacific with the western Tethys and allowing exchanges of biotas.

At special levels, each model must be tested against patterns of endemism, diversity, and commonality for numerous taxa from different Cordilleran displaced terranes, the craton of North America, the western Pacific rim and different biogeographic provinces within the former Tethys region itself. In addition biogeographic models must consider the paleoecology and larval ecology of the various organisms. Tropical reef-adapted invertebrates and calcareous algae restricted to shallow shelves, especially species with limited dispersal abilities, are preferable for this kind of study.

The pantropical model is cited as having the advantage of a modern Pacific analog. However many uncertainties remain on reconstruction of ocean currents during the Permian and early Mesozoic and whether distances across the vast Panthalassa Ocean were analogous to those of the modern Pacific. Open oceans have convincingly been demonstrated as effective barriers to migration. Today faunal patterns show a marked west to east diversity attenuation across the Pacific which is not clearly reflected among the distribution of Permian and Triassic species. For many reef-adapted groups, a high degree of species similarity exists between Cordilleran terranes and the Tethys, but a degree of endemism also is apparent. Examples of disjunct patterns such as occurrences of fossil species from only one part of the Tethys and Cordilleran terranes and only between terranes of the eastern and western Pacific rim need to be examined critically in light of pantropical models.

For some examples, the tectonic dislocation model is reasonably supported by paleomagnetic data on longitudinal motions of Pacific terranes. These data help to reconstruct and plot possible terrane trajectory paths across the ancient Pacific during the Mesozoic. Dating the amalgamations of some terranes into super-terranes, volcanic episodes, and accretion of terranes to the craton also provides additional time constraints. However the tectonic dislocation model suffers from lack of precision in locating terrane positions with respect to the craton.

One major problem in assessing both models in the lack of coeval tropical fossils of late Triassic age from the craton of North America. This lack of paleontological control is due largely to a major unconformity above Permian or Lower Triassic rocks. Much of the Upper Triassic record is missing, but there also may not have been shallow carbonate environments favorable to reefs and reef organisms along the eastern Pacific craton.

The Hispanic Corridor hypothesis can be used to explain the occurrence of Tethyan fossils in western North America only during early or middle Jurassic time onward, when the opening of the seaway is thought to have occurred. This hypothesis also suffers from lack of precision in dating when the first marine waters reached the Pacific and when the first waves of faunal exchange began.

The tectonic dislocation hypothesis implied not only simple dislocation by dynamic evolution ary processes as well. If one accepts the premise of a Panthalassa with tectonic dislocation and long-range dispersal of terranes as islands, both disjunct and temporally changing patterns of endemism and diversity should emerge. This is, as dislocated terrane fragments are dispersed across Panthalassa, they should carry disrupted fossil records from former endemic centers. At time passes, however, their living biotas should reflect changing temporal patterns of diversity and paleogeographic affinities and these would be recorded in the successive sedimentary record. To test this pattern it is important to sample and analyze fauna and flora of suspected Cordilleran terranes at different stratigraphic levels. With regard to endemism and diversity, tectonic dislocation should produce patterns quite different from those of simple pantropical dispersal.