

Paleobiogeography of the Ancient Pacific

Cathryn R. Newton proposes (1) a pantropic model invoking eastward, trans-Pacific dispersal to explain fossils of Tethyan (Ocean) affinity occurring in Paleozoic and lower Mesozoic rocks of the American Cordillera. The pantropic model is held to be preferable to the displaced terrane and the Hispanic Corridor models.

It is difficult to find convincing arguments for a pervasive longitudinal component in the displacement of most allochthonous terranes. The main exception is the Cache Creek terrane (confused with the Cassiar terrane in Newton's figure 1), which contains Permian faunas of Tethyan (Ocean) affinity that differ from coeval faunas in flanking terranes (2); this situation is difficult to square with the pantropic model. Permian (2) and Jurassic (3) faunas link nearly all the other terranes to the eastern Pacific, where most of them were involved in tectonic interaction with each other and with the craton during the Triassic and particularly the Middle Jurassic, when the Cache Creek ocean basin closed (2, 4).

While it is too speculative to hypothesize a Hispanic Corridor (a seaway linking the Pacific and Tethyan oceans) for the pre-Jurassic world, this is not the case for the Jurassic. Early Jurassic marine strata are known from deep-sea drilling off Morocco and eastern Canada, and drilling off the Blake Bahama plateau shows Callovian sediments resting on oceanic basalt. At the western end of what would have been the Corridor, in eastern Mexico and Venezuela (5), Early and Middle Jurassic marine rocks have been found. The possibility of a marine strait floored by ocean basalt in the Middle Jurassic preceded by a marine connection across the continental crust in the Early Jurassic is not precluded by the present meager geologic evidence.

The Tethyan realm is recognized in the Jurassic as a low latitude, circumglobal biogeographic unit. Within this realm, certain Early Jurassic organisms are restricted to the eastern Pacific and the western end of the Tethyan Ocean, pointing to a Hispanic Corridor as the most viable means of maintaining genetic continuity between these populations [(3), and references therein; (6)]. The work on the bivalve *Weyla* is particularly interesting, but *Weyla* first occurs in the east Pacific, where it lived throughout the Early Jurassic. It did not appear in the western Tethys Ocean until the Pliensbachian, which implies an eastward, not a

westward, migration through the Corridor at that time (6). It spread further eastward into Tethys during the Toarcian. The Hispanic Corridor model is also supported by a quantitative study of bivalve endemism conducted by Hallam (7) showing progressive faunal convergence between the western Americas and Europe from the Early to the Middle Jurassic.

As always, paleobiogeographic, geophysical, and geologic evidence must be in agreement for a hypothesis to be acceptable. Work on the apparent polar wander path for North America indicates a change in absolute plate motion for North America associated with rifting in the central Atlantic and the Gulf of Mexico (8) during the Late Triassic to the Early Jurassic (Carnian to Pliensbachian); active drifting occurred thereafter. This plate reorganization correlates with Late Triassic to Early Jurassic structural deformation on the western margin of North America, culminating in the so-called Dunlap and Ochoco orogenies in Nevada and Oregon, respectively, now known to have occurred in the Pliensbachian (8, 9).

Caution is necessary in using the Indo-West Pacific province as an analog for, and in support of, a Permo-Triassic pantropic model. At the time of Pangaea, the Pacific was some 3000 km wider than it is now, and Fallaw (10) has demonstrated that its effectiveness as a barrier to dispersal declined steadily after the Early Jurassic, when the ocean began to narrow. Modern biogeographic data that would have a more realistic bearing on this problem concern those Indo-West Pacific faunas from the margin of Africa (rather than the western Pacific) that have dispersed to the western Americas. Such a distance begins to approach the width of the Permo-Triassic Pacific, but it is not clear from Newton's report how common such distributions are. It can also be argued that the probability of transoceanic dispersal is much greater in the modern Pacific because the latitudinal temperature gradient is high, the eastern portal of Tethys is closed, and the Panamanian land bridge exists, all of which increase current strength by enhancing gyral circulation (11).

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Newton (1) presents a pantropical model of steady-state dispersal across the ancient Pacific "Panthalassa" ocean to explain the affinities of Permian to Jurassic biotas occurring in the former Tethys and in displaced terranes of Cordilleran North America. This model is built on a number of loosely connected ideas supported with data that do not appear to withstand critical examination. Growing evidence that a series of oceanic and continental fragments originating in the western or central Panthalassa were swept across this ocean, eventually to become accreted to both the eastern and western Pacific margins (2), imparts special meaning to "Tethyan" occurrences within these regions. In arguing against long-distance tectonic displacement of terranes, a call is made for Tethyan province biotas being pantropical in their dispersal, with decreasing diversities across the former Pacific Ocean basin.

In this context, we believe Newton's comparisons between the present Pacific and the Panthalassa are not entirely valid. In the Permian and Jurassic, species diversities appear to have been orders of magnitude less, and Pangaea reconstructions including the Tethys seaway produce a much wider and differently configured ocean than exists today. Also the proposed steady-state, diversity attenuation model rests on Newton's statement (p. 389) that an eastward decrease exists in the proportion of both Permian and Triassic Tethyan faunas found within Cor-

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