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Faunal Similarities Across Pacific Among Mesozoic and Cenozoic Invertebrates Correlated with Plate Tectonic Movement

The degree of invertebrate faunal similarity across the Pacific Ocean basin generally increased during the Jurassic, Cretaceous, and Cenozoic as the Atlantic widened and the Pacific narrowed. The paleontologic data source is the *Treatise on Invertebrate Paleontology,* which includes mostly marine genera. The faunal similarities are expressed by the Simpson coefficient, C/N_1, C being the number of taxa occurring in both the American area and the Indopacific-Asian area, and N_1 being the total number of taxa occurring in the area having the smaller number. Genera which occur in Europe and Africa in addition to the two trans-Pacific areas were eliminated to reduce the effect of trans-Altantic migration, the easier route.

Simpson coefficient values for post-Triassic time intervals when correlated with ocean basin widths estimated from paleogeographic maps, yield a correlation coefficient of 0.956 for the Atlantic and -0.942 for the Pacific. Atlantic widths were used in addition to Pacific widths because paleogeographic control is better in the Atlantic.

The data indicate that the closing Pacific basin had a strong effect on trans-oceanic dispersal. Anomalously high similarity values in the Cretaceous may have been caused by accretionary tectonics around the Pacific margin. The results support the orthodox plate tectonic model rather than expanding earth hypotheses.

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Formation of Diagenetic Alteration Zones by Leaking Reservoir Hydrocarbons over Three Oil Fields in Oklahoma

Examination of rotary-drill well cuttings from 105 wells within and adjacent to the Eola, Velma, and Chickasha oil fields in southern Oklahoma has revealed diagenetic mineral zonations within Permian sandstones overlying the fields. Permian sandstones which are usually red on outcrop are altered to white over the fields, owing to a change in cementing materials from limonite, hematite, and carbonates to ferroan calcite, ferroan dolomite, and, in some places, pyrite. Bleaching and mineralization were restricted to sandstones and were brought about by the reduction of iron oxides by hydrogen sulfide associated with petroleum and/or generated by a reaction between hydrocarbons and sulfate ions. Hydrogen sulfide reacted with iron oxide to form pyrite, and with oxygen in ground water to form sulfur.

Pyrite cement occurs in zones that overlie pre-Permian faults, oil productive areas, and zones that are elongated along structural trends. Zone boundaries are nearly vertical and extend to the surface. Average pyrite content of mineralized sandstone is 3%. Pyrite occurrences show that petroleum-bearing fluids were introduced into Permian rocks by vertical movement along high-angle normal and reverse faults that cut reservoirs at depth and that intersect unconformities at the base of the Permian section.

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Deposition on Pacific Shelf Edge: Zone of Contrasts

Pacific-style continental margins, such as in western North America, are marked by large contrasts in shelf-edge sedimentary deposits and processes. The United States Pacific shelves are generally much narrower than Atlantic-style shelves, and the source areas exhibit more relief. The result is a generally high rate of sedimentation in humid areas, and fluctuating (areal and seasonal) patterns and rates in semiarid areas.

Sediment shed from the adjacent landmass is discharged onto the U.S. Pacific continental shelf at point sources; intervening zones of the shelf edge between point sources are commonly sediment starved. Where submarine canyons intercept the shelf, sediment bypasses the shelf and slope to fan and basin environments. Spillover from channelized transport in canyons results in local sedimentary accumulations at the shelf break.

Major sediment sources of the northwestern United States and the Gulf of Alaska feed directly onto swell- and storm-dominated shelves. On narrow unprotected shelves, the sediment has a short residence time in submarine deltaic deposits before remobilization and dispersion to outermost-shelf and upper-slope environments. In these environments, prograding sequences of shelf-edge sedimentary deposits form, commonly with a high potential for preservation in the geologic record. On broad or protected shelves, however, prodelta deposits have a longer life expectancy, and only a small amount of sediment escapes to the shelf edge.

The high seismicity and active tectonism that characterize the strike-slip and underthrusting regimes of western North America are important in forming sedimentary sequences on the outer shelf–upper slope. Failure of rapidly accumulating mud, rich in organic material on the outer shelf of the Gulf of Alaska and northern California, is triggered by large-magnitude earthquakes and local uplift. Repeated failures over long periods result in unique sedimentary packages that have potential for becoming both source beds and stratigraphic traps for hydrocarbons.

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Large Submarine Slump Off Eureka, California

Repeated seismic-reflection surveys of the northern California continental margin off Eureka delineate a large slump zone measuring 10 × 15 km in area. The zone lies on a structural plateau of low slope (1 to 2°) in water depths of 450 to 650 m. The area is immediately west of the Eel River, which has an annual suspended-sediment load of nearly 24 million T/year.

High-resolution (3.5-hKz, 1-kJ, uniboom) acoustic-reflection records show a rhythmic, hummocky surface topography and back-rotated broken beds within the upper 80 m of the sediment mass. Numerous west-dipping failure planes with a spacing of approximately 400 m occur within the slump mass. A history of repeated failure within the region is indicated on deep-penetration (160 kJ sparker) seismic-reflection records that show additional failures bounded by flat-lying, undisturbed acoustic reflectors to depths of 500 m below the sea floor.

Analyses of 3-m-long gravity cores in the slump zone show that the sediment is overconsolidated, composed dominantly of silt, is gassy, and enriched in plant and wood debris. Radiographs of split cores show contorted bedding in some areas of the slump zone that suggests a degree of plastic deformation.

The Eureka area is a seismically active region lying immediately north of the Mendocino Ridge and has an expected earthquake frequency of one event greater than magnitude 6 per decade. In addition, some areas of the sea floor are undergoing local uplift; there is evidence that this activity,