that is, alteration products of crude oil. This interpretation is
further supported by microscopic examination revealing
fracture-infilling by bituminous material. Finally, uranium
was provided by ground waters rather than by concentration
due to the oil-pyrobitumen transition.

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Clastic Lacustrine Sedimentation in Triassic of Southwestern
Colorado

Very fine sandstone and mudstone facies of the Upper
Triassic Dolores Formation of southwestern Colorado provide
evidence for shallow lacustrine deposition coeval with clastic
lacustrine systems of the Dockum Group in Texas. Dolores
and Dockum lakes had frequent water-level fluctuations;
however, Dolores lakes were filled primarily by shoreline se­
quences, in contrast to the delta-filled Dockum lakes.

Typical Dolores shoreline sequences fine upward, are
laterally continuous over 3 km, are 5 to 15 m thick, have sharp
nonerosional planar bases, and grade upward from very fine
sandstones into mudstones. The very fine sandstones contain
wavy, 1-cm thick bedding; low-angle trough and planar
tabular cross-bedding; and isolated symmetrical channels. The
overlying silty mudstones are commonly intensely bioturbated.
These fine-grained shoreline deposits suggest that weak
longshore currents distributed sand away from distributary
mouths, and/or that sediment was transported by flow across
the low-gradient, lake-margin plain.

Frequent subaerial exposure of these shoreline sequences is
documented by abundant desiccation-cracked and rain-
textured mudstone drapes, and by well-developed caliche pro­
files. During low stages of Dolores lakes, distributary channels
locally prograded across and sometimes incised into the
shoreline sequences. These symmetrical channels, 8 to over 50
m wide, commonly contain basal mudstone-clast/caliche-­
pebble conglomerates and were abandoned episodically as indicated by alternating beds of very fine sand­
stone and mudstone. Lake-edge distributary channels contain
fillings of wave-reeffed, wavy-bedded to rippled very fine
sandstone.

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Cenozoic Radiolarian Paleogeography of Eastern Pacific

Along the east Pacific margin two dominant factors in­
fluence the distribution of planktonic radiolarians: east
boundary ocean currents and the physiography of the southern
California borderland. The east boundary current system is
mainly wind driven on the surface and geostrophically con­
trolled at depth. It is stratified into distinct water masses owing
to differences in salinity, temperature, and current direction.
The California borderland is a unique geomorphic province of
successive basins and ridges with local circulation patterns.
These factors influence present-day radiolarian assemblages
but have also influenced such assemblages during the
Cenozoic.

Nassellarian and spumellarian radiolarians reflect the
temperature and depth of the water masses at the time of
deposition. The California borderland serves as an environ­
ment similar to, yet distinct from, the boundary currents.
Thus, this area seemingly has isolated species and increased
their chance for allopatric speciation. These borderland
species would eventually have been dispersed into the
equatorial region.

Samples studies are from the DSDP Sites 33, 77, 173, 289,
468, and 469, where deposition was influenced by east bound­
ary currents, and from the U.S. Geological Survey dart-core
samples from the southern California borderland, to trace the
development of the water masses through time. Once the
dynamics of the water masses is determined, speciation and ex­
tinction events may be more easily postulated. Whereas
previous investigations have dealt with present-day circulation,
this study is the first attempt to map the influence of the
dynamic current systems through time.

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Shelf Break on Modern Passive Margins: Structure, Sedimen­
tation, and Progradation

The time-integrated structural-stratigraphic configuration of
the shelf-to-slope break of many modern margins records the
interplay of tectonics, submarine erosion and/or deposi­
tional processes. A simple process-response model may be us­
ed to help interpret the variations of shelf-break configuration
and progradational patterns of passive continental shelves.
The key factors are (a) the amount and nature of the sedimen­
tary flux (F) provided to and across the shelf, and (b) the depth
at which particles come to rest (H), which is largely a function
of the local hydrodynamic and boundary layer conditions and
of the grain size and density of the particles being transported.
By maintaining factors F and H as constants, we can evaluate
the role of structural displacement and importance of the
relative position of the shelf surface to sea level in the develop­
ment of the shelf-to-slope configuration.

In places where a shelf subsides, or when there is a
demonstrable eustatic rise while an ample sediment supply is
provided, a sediment layer may accumulate over much of the
shelf; excess seaward-transported sediment will accumulate at
and beyond the shelf break. If a shelf remains relatively stable
or if there is an appreciable eustatic drop in sea level, much of
the sediment can bypass the shelf and will accumulate beyond
the shelf break, on the slope, rise, and abyssal plain. As
equilibrium is attained, we can expect that D (shelf depth) ≤
H on a continental shelf, and D > H on a continental slope.
Thus, in this example, H becomes coincident with the depth at
the shelf break.

The model is tested at shelf-slope interfaces on the Tuscany
and Ligurian margins in the western Mediterranean, and on
the Iberian margin in the eastern Atlantic. Seismic profiles in­
dicate that the structural-stratigraphic configuration and pro­
gradational patterns at shelf breaks observed on subbottom
profiles are variable. We correlate this variability with age and
tectonic development of a margin, and thus with the successive
structural stages through which a passive margin evolves.

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Past and Potential Mass Movement on Continental Slope Off
Northeastern United States

Although evidence of mass movement is common on con­
tinental slopes, the importance of mass movement as a
geologic process in most slope areas remains unknown, and
questions concerning the likelihood of future events are still
largely unanswered. Accordingly, the U.S. Geological Survey