As our knowledge of the deep structure of major central North American basins has increased, it has become clear that they have experienced long and complicated tectonic histories. A knowledge of these histories is especially important to efforts to formulate exploration strategies for deeper horizons and frontier areas. Regional geophysical and geologic studies of these basins indicate that Precambrian features have often exerted considerable control on basinial development (e.g., Anadarko basin, Embayment, and Permian basin). There are many similarities in the development of these basins, but they all can be shown to have unique tectonic histories.

Late Frasnian and early Famennian marginal-slope deposits of the Canning basin rock complexes include distinctive red open-framework breccias, characterized by red micritic clasts cemented by white calcite spar. They closely resemble the Adnetier Scheck breccias in the Jurassic Adnet Limestone of the Alpine Massif.

Scheck breccias from the Canning basin are largely confined to red stromatolitic and terrigenous marginal-slope sediments having depositional slopes of 10-14°, which were deposited in water depths of some tens to hundreds of meters. Individual breccia beds are locally thin, with concave, locally scourred bases. They are between 10 and 100 cm (4 and 39 in.) thick, and are composed predominantly of irregular red micritic clasts reworked from associated nodular limestones.

Breccias are chaotic and may be inverse-to-normally graded, normally graded, or massive.

The proposed depositional mechanism began with slumping of muddy sediment containing abundant early-cemented nodules. This initiated bimodal density-modified grain flows. Nodules were supported by diverse forces, and deposited by fractional freezing as the depositional slope decreased, producing clast-supported graded sequences. The final sand and mud fractions continued downslope as turbidity currents, leaving behind minor perched mud trapped in the open-framework breccias. Early cementation by radiolitic calcite prevented further sediment infilling.

These Devonian scheck breccias are characteristic components of condensed sequences, as shown by concurrent dating. They represent frequent events; only about one bed of breccia was deposited for every 10 m (33 ft) of section (in about 300,000 years) over a vertical section of about 200 m (660 ft).

Late Quaternary geology of Louisiana-Mississippi continental shelf and upper slope.

A high-resolution seismic-reflection survey was conducted in an area east of the Mississippi River delta along the Louisiana-Mississippi continental shelf and slope. Seismic data showed that the topography and subsurface sediment characteristics of the shelf and upper slope are the result of depositional sequences. These depositional sequences are delta outbuilding over transgressive sediments with intervening periods of erosion during low sea level stands. On the shelf, little evidence of structural deformation caused by faults, diapirs, and shallow gas is present. In contrast, the upper slope has occasional diapirs with associated faulting. The upper slope also has a few faults and scars resulting from down-to-basin sediment movement. Surface sediments over the entire area relate to several depositional periods.

Minsarker (400-joule) profiles reveal at least 7 regressive and transgressive sequences. The oldest recognizable surface is an erosional surface. This erosional surface is overlain by transgressive sediments that downlap onto it near mid-shelf. The late Wisconsin is represented by 3 regressive stages. These stages are the result of fluctuations in sea level. The first two stages are characterized by deposition on the shelf, and the subsequent erosion of these deposits by stream channeling as sea level lowered. This fluvial system constructed a relatively large delta which prograded beyond the shelf-break. The delta construction is a complex set of prograding and onlapping sequences. The third stage of this regressive sequence occurred during the farthest retreat of sea level. This stage was the deposition of sediments on the upper slope, which onlap the previously prograded delta. The regression was followed by a rise in sea level which deposited transgressive sediments on the inner shelf. A sea level fluctuation during this sequence exposed part of the shelf. This paleosurface is possibly the Pleistocene-Holocene boundary. The most recent sequence was the deposition of the St. Bernard delta on the inner shelf.

Role of depositional-depth and source-terrain uplift rates on sedimentation patterns in back-arc basins of western Pacific.

Nine depositional systems occur in deep sea drilling project (DSDP) cores recovered from western Pacific back-arc basins. These include submarine fan, debris flow, silty basinal turbidite, biogenic pelagic silica (pyroclastic, hemipelagia), and pelagic clay deposition systems. Correlation of deposition of these systems to times of basin rifting, associated island arc andesite volcanism, and uplift of source terranes shows that only biogenic carbonates, pelagic clay, submarine fan, and debris flow processes of sedimentation are correlated to specific tectonic processes. Basin subsidence history controlled by heat flow dissipation controls the preservation potential of biogenic carbonates and pelagic clay. Rate of tectonic uplift in andesitic volcanic sources controls the volume and preserved frequency of turbidites on submarine fans and associated debris flow. A time delay in and debris flow sedimentation follows maximum uplift in source terranes is governed by development of marine drainage systems and sediment yield into the back-arc basins.

The other depositional systems are deposited independent of rifting, subsidence, or uplift history because their distribution is controlled more by regional volcanism, wind dispersal, clastic change, laterally-defined biologic productivity, and slope instability. The variety of stratigraphic sequences in back-arc basin DSDP cores can be explained better in terms of all these changing variables coupled with tectonic processes. The combination of depositional depth and source-terrain uplift rate are the only tectonic processes which directly influence specific sedimentation events in this particular domain.