shoal sediments (lower Trenton Group) were preserved through toponomic processes, whereas those in lagoonal (basal Trenton Group) and offshore (middle and upper Trenton Group) sediments were preserved through diagenetic processes (diagenesis also obliterated morphological details resulting in a bias towards simple forms). These processes resulted in ichnocoenoses restricted respectively to surface crawling traces for the former and infaunal dwelling and feeding traces for the latter. It is suggested that substrate consistency and rates of deposition were the most important controlling parameters.

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Carbonate-Clastic Facies Changes, Pennsylvanian-Early Permian, Northwest Arizona-Southern Nevada

Successive facies changes in Chesterian through Wolfcampian strata illustrate five distinct carbonate to clastic transitions. These result from differing combinations of depositional environment, climate, sea level changes, and differential subsidence. Comparative stratigraphy of successive facies change across the craton-miogeosyncline boundary, combined with analysis of sedimentary structures and lithology, enhances interpretation of the causes of these facies changes.

A Chesterian to Morrowan transgressive facies change illustrates a carbonate to clastic transition resulting from shallow marine to subaerial environments, wherein the climate was tropical and marine current energy was low. A Morrowan to Atokan regressive facies change closely resembled the underlying transgressive facies change and results from similar circumstances, except that this transition has the addition of eolian quartz silt units and diagenetic overprints resulting from periodic emergence during the regression.

A subsequent Atokan transgression illustrates a contrasting facies change. Sandstones change to carbonates more gradually. Rocks containing equal amounts of carbonate and quartz sand occur commonly. Fewer varieties of carbonate texture and fossil species occur in corresponding facies than in the Morrowan transition. Cross-bedding of similar style occurs in sandstones as well as in carbonates. The facies change results from a broad shallow marine environment in which there was an eastern detrital source in the eastern Grand Canyon region. These environments existed in conditions resulting from more open marine conditions and/or greater aridity than during the Morrowan sequence.

The distribution of Desmoinesian strata is more easily explained by reciprocal sedimentation rather than by facies. Virgilian facies appear to result from a combination of the factors involved in the Morrowan and Atokan strata. Beginning in Wolfcampian time faulting and attendant differential subsidence control the distribution of clastic and carbonate facies.

Carbonate buildups along the upthrown side of faults serve as clastic sediment traps. Also erosion may occur on the upthrown side of faults. Both of these result in abrupt facies changes in Wolfcampian sequences.

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Distribution and Preservation of Carbonate Cements in Pleistocene Limestones of Hogsty Reef Atoll, Southeast Bahamas

Four shallow cores taken in Hogsty Reef Atoll, southeast Bahamas, reached the early Pleistocene at a depth of 30 m (98 ft) (below sea level). Unlike other banks of the Bahamas, Hogsty Reef Limestone consists of carbonate grains and cements that have maintained their original mineralogy. Five types of cements were found in the Pleistocene limestones of Hogsty Reef: (1) micritic magnesian calcite which predominates in all four cores; (2) bladed magnesian calcite which occurs in several thin (< 1 m) intervals, where it is associated with (3) fibrous aragonite, which also is found in Holocene cemented crust; (4) blocky low magnesian calcite, which occurs in several thin intervals underlying subaerial exposure horizons; and (5) an unusual type of blocky magnesian calcite cement, which consists of clear anhedral crystals, 25 to 100 microns in size, which contain less than 10% $MgCO_3$. This cement is found together with bladed magnesian calcite and aragonite.

Preservations of the cements and grains original mineralogy may be attributed to a minor influence of fresh water resulting from the semi-arid climate of the southeastern Bahamas and the unlikely formation of a permanent freshwater lens during periods of emergence.

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A Basin Plain Sand-Layer Geometry Classification: A Predictive Tool

The areal distribution of sand layers in the basin plains of 13 modern deep ocean basins has been studied. Fundamentally, sand-layer distribution is controlled by the volume of sand input in single events relative to the basin plain size and by the areal distribution of basin entry points on the ocean basin floor. Although tectonic setting and sea level position may play a role in rate of basin infilling, these factors are relatively unimportant in the control of sand-layer geometry. A basin plain sand-layer classification has been devised. The classification is comprised of a hierarchy with three ranks or categories. The first category describes the distribution of basin entry points as being one of the following; radial, semiradial, longitudinal, or lateral. The second category separates basin plains with similar entry point distributions on the basis of the extent of sand coverage on the flat basin floor. Sand coverage is classified as either overall or partial. The final category further separates basin plains according to the general shape of sand bodies on the basin floor—either wedge, sheet, or axial. The classification has application to the study of both modern and ancient deposits. If the distribution of sand layer characteristics is known, it may be possible to locate probable basin entry points and to predict the size of the drainage area relative to the size of the flat basin floor. Alternatively, if the approximate size of the drainage area relative to the basin plain area and the distribution of basin entry points are known, it may be possible to predict the nature of the sand distribution on the basin plain.

Inherent in each basin plain type is a specific distinctive areal distribution of sand layer characteristics and particular manifestations of proximal/distal relations. For example, a basin with sand layer geometry classified as radial fill, overall coverage, and wedge-shaped (the Hispaniola-Caicos plain) would have its thickest sand and lutite (or shale) layers located around the periphery of the basin plain. The highest frequency of sand layers would probably be found in the basin plain center and the ratio of drainage area to basin plain area would be relatively large (greater than 3).