Biostratigraphy and Paleoecology in High Energy, Bathyal Sedimentary Settings: Studies in the Main Pass Area, Louisiana Offshore, Gulf of Mexico

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The Main Pass area is an intersection of depositional environments, each of which leaves its own paleontologic imprint in the sedimentary record while mixing with and frequently obscuring others. High energy scouring, reworking, slumping and multiple sedimentary sources often obscure the succession of events that characterize the depositional and biostratigraphic history of the area.

Paleontologic methods, such as water mass tracking and multivariate analysis of faunal succession, separate the biostratigraphic imprints of provenance and depositional energy as well as a history of water column changes that alter the depth associations of foraminiferal species. The separation of these factors allows for a minutely detailed understanding of sedimentary regimes and their dominance or recession over time, helping to characterize the types and qualities of potential reservoirs.

Beneath regional unconformities in Main Pass representing the major datums are foraminiferal abundance peaks. The foraminiferal faunas of these events are, in part, characterized by cold-water benthics, usually assumed to be of deeper water affinities than those of the surrounding stratigraphic section. Another faunal characteristic of these events is the occurrence of cooler surface water planktonic species often associated with upwellings. The shoaling of deep currents prior to or concurrent with lowstand is considered to be the cause for both of these characteristics. Extensive, longer term faunal changes are associated with probable changes in the source of deep and intermediate currents in the Gulf of Mexico.

The interpretation of depositional energy regimes as determined by faunal response is tied directly to sedimentary setting, and yields more detailed information than estimates of paleobathymetry do. That the distribution of extant foraminifera was determined primarily by environmental energy was recognized by Uphaw and Stehli (1962) and Leutze (1972). Core data and interpretation of Main Pass seismic and electric logs were used to corroborate the environmental interpretations of the faunal abundances as described below.

Figure 1 contains eight foraminifera abundance curves. These are derived from foraminiferal paleontologic data from an eastern Main Pass well spanning the early Pliocene and late Miocene. Curves 1 and 2 are total foraminiferal diversity; these predetermined statistics are provided for reference. Curve 8 is planktonic species abundance. Curves 2 through 7 are abundances for total foraminiferal faunal components separated by Q-mode factor analysis. They are arranged vertically from lowest amount of variance explained (3) to the greatest (7). The position of regional unconformities are indicated by arrows (^) at the base of curve 7.

Curve 3 is dominated by species redeposited from the Florida platform. They are common in slumps and slides along the platform edge and in levee sediments along channels traced back to the platform. The contribution of this component to the sedimentary record is local and relatively constant, becoming obvious only when not overshadowed by riverine deposition. Curves 4 and 5 are regarded as representing redeposited species from riverine dominated and high energy neritic sediment sources, respectively. Curve 4 usually corresponds to the abundance of species carried by scouring sands of Mississippi River origin. The species of curve 5 are present in the scour surfaces of major unconformities and at the base of channels.

The species represented by curves 6 and 7 are usually regarded as in situ, consisting respectively of moderately energy tolerant neritic species and energy intolerant species usually associated with bathyal water depths and conditions. These faunal components alternately represent, in relative abundance, the lowest energy sedimentation (condensed sections) or the highly productive periods prior to apparent lowstands.

These are only a part of the depositional and paleoenvironmental features that can be segregated from high-energy sediments. Information on depositional pathways, freshwater incursion and other surface water environmental changes related to eustacy can be obtained by extension of the same statistical techniques.

REFERENCES

Leutze, W.P., 1972, Stratigraphic utility of some Miocene and younger arenaceous foraminifera: Gulf Coast Association of Geological Societies Transactions, v. 22, p. 147-155.

Upshaw, C.F. and F.G. Stehli, 1962, Quantitative biofacies mapping: American Association of Petroleum Geologists Bulletin, v. 46, no. 5, p. 694-699.

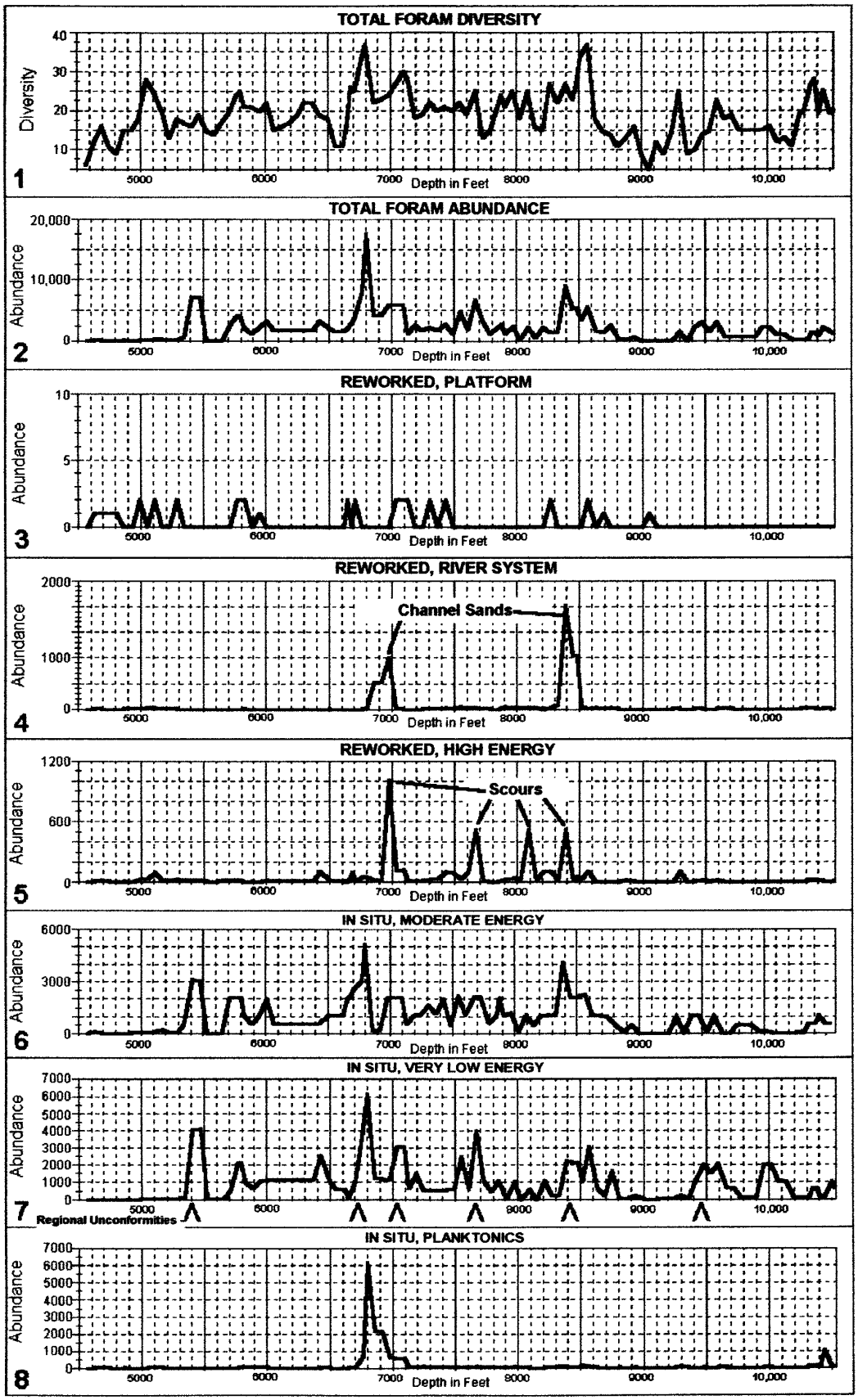

Figure 1. Example well for environmental statistics.