FERAY, DAN E., Department of Geology, Texas Christian University, Fort Worth, Texas

FACTORS INFLUENCING SEDIMENTATION IN THE SHALLOW NERITIC ENVIRONMENT

Sedimentation in the shallow neritic environment is influenced by the interplay of numerous factors. Both type and thickness of the sediment differ depending upon the relative significance of these factors. The chief factors to be considered are *tectonics*, *physiography*, *climate*, *biological activity*, and *associated energy relationships*.

The tectonic intensity of the source area and depositional site of the sediments, although primary factors, may be surpassed in significance by the factors of climate and biological activity. Variation of intensity of uplift and deformation of the source area provide primary control on the composition of the source area and the sediment derived therefrom. Sediments range from mature to immature, and from fine to coarse terrigenous clastics. The same variation of tectonic activity provides variations in physiography of the source area and accompanying energy relationships. Physiographic variations may produce both local and regional climatic variations as a third order factor.

Climate and its influence on and control of vegetation will control weathering, resulting soils, and erosion. Thus climate may be the primary factor in the type and amount of sediment derived from the source area.

Tectonic intensity of the depositional site controls the thickness of the sedimentary sequence, with climate and biological activity providing the influence modifying the type and character of the sediment deposited. Wave and current energy related to storms modify the sediment type and distribution.

FERM, JOHN C., and EHRLICH, ROBERT, Louisiana State University, Baton Rouge, Louisiana

TECTONIC CHRONOLOGY OF PENNSYLVANIAN BORDERLANDS

Pennsylvanian sedimentary rocks that are exposed in the eastern United States were deposited as a broad undulating blanket from highly deformed borderlands—Appalachia on the east and Ouachita on the south. These rocks were universally involved in borderland folding. Two separate sedimentological investigations of essentially undeformed rocks closely adjoining the borderland indicate that regionally distinct segments affected depositional patterns at various times during the Pennsylvanian, and that other segments were not active until latest Pennsylvanian or Permian time.

The first study indicates that the Ouachita deformed belt, now buried beneath Gulf Coastal Plain sediments, was one of the earliest Pennsylvanian tectonic welts and provided the major source of sediments for the Black Warrior basin of northern Alabama and Mississippi. Contrasts in mineral composition of these sediments as compared with correlative sediments in northern Arkansas indicate that this tectonic welt probably plunged northwestward, with the deepest portions of the structure thus being exposed at the southeastern terminus. Exposed Appalachian structures in the southeast are definitely post-early Pennsylvanian and did not affect Pennsylvanian sedimentation in this area.

A second study of paleogeographic patterns in Allegheny and late Pottsville sediments of Pennsylvania, Ohio, West Virginia, and Kentucky shows that major source areas lay to the south, probably related to a tectonic highland paralleling the present Pine Mountain fault. Major structural deformation in the classical fold area of Pennsylvania and northern West Virginia is clearly post-Pennsylvanian and Permian.

FLORES, ROMEO M., Louisiana State University, Baton Rouge, Louisiana

GENETIC TYPES OF SOME SANDSTONES IN THE ALLEGHENY FORMATION OF OHIO

Sandstones between the Middle Kittanning and Lower Freeport coal beds in the Allegheny Formation of southeastern Ohio are divisible into three genetic categories based on gross external morphology of the sand body, proportion of major mineral components, grain size, and homogeneity of cross-bed orientation. The following types are continuously arrayed in east-west trending bands along a northeast-southwest outcrop:

1) Thin, lenticular, discontinuous sand bodies with quartz content about 58 per cent. Among all other constituents, feldspar averages 15 per cent, muscovite 25 per cent, chlorite-biotite 60 per cent. Sands are predominantly fine to medium grained and cross-bedding is randomly oriented.
2) Thick, less widespread, partly continuous, elongate sand bodies in which quartz averages 54 per cent. Among all other constituents, feldspar averages 25 per cent, muscovite 30 per cent, chlorite-biotite 45 per cent. Sand is medium grained and cross-bedding is weakly oriented.
3) Thick, widespread apron or sheet sands in which quartz averages 62 per cent. Among all other constituents, feldspar averages 35 per cent, muscovite 30 per cent, chlorite-biotite 35 per cent. Sands are predominantly medium to coarse grained and cross-bedding is oriented in a northwest-southeast direction.

Type 1, found in the southern part of the area, is believed to represent a meandering, relatively near-shore portion of a fluvial system. In contrast, Type 3, found in the northern part of the area, probably represents sand distribution beyond the area of well-developed channels, perhaps near distributary mouths. Type 2, found between areas of Types 1 and 3, presumably reflects an intermediate situation.

FRAKES, LAWRENCE A., Department of Geology, University of California, Los Angeles

LANDSLIDE FACIES AND THE PALEOSLOPE IN THE CATSKILL DELTA

Non-red arenaceous strata of the Middle and Upper Devonian Fort Littleton Formation constitute the marine portion of the northern flank of the Catskill delta in Pennsylvania and New York. Lithostratigraphic units within the Fort Littleton thicken and become coarser toward the source in the south-southeast; laterally equivalent lower redbeds of the Catskill Formation occupy successively lower stratigraphic positions in the same direction. Submarine landslide deposits in the upper several hundred feet of the Fort Littleton below the redbeds consist of transported load-structures and angular blocks up to twelve feet long. The base of the landslide facies roughly marks the position of the foot of the paleoslope, that is, the juncture of rocks deposited on unstable slopes with undisturbed strata of the floor environment. Like the base of the Catskill facies, the landslide facies occurs at progressively lower positions toward the south-southeast and, in turn, is laterally equivalent to the distal floor facies, which is devoid of landslide structures. Regional variation in stratigraphic position of the base of the landslide facies establishes the fact that the foot of the paleoslope migrated north-northwestwardly through time.

In strata of the landslide facies, directional-current structures show transport from south to north whereas rocks of the floor facies display evidence of paleocurrents moving from east to west, suggesting that gravity-driven paleocurrents were deflected by velocity loss from northwardly to westwardly flow at the foot of the paleoslope. Distinctive siltstones were deposited by the deflected currents against the foot of the paleoslope.

The landslide facies is characterized by landslide deposits, reddish and greenish colors, subgraywackes, conglomerates, good fissility, fragmental fossils, ripple marks, and load-structures whereas the floor facies is defined by brown and gray colors, graywackes, poor fissility, sole marks, and trace fossils.

FREDERICKSON, A. F., University of Pittsburgh, Pittsburgh, Pennsylvania

INTRODUCTION TO SYMPOSIUM ON GEOPHYSICAL AND GEOLOGICAL PROPERTIES OF THE CRUST AND MANTLE

New petroleum is found with ideas.

The explorationist must think in terms of scale and context. This symposium focuses attention on some very large scale features of both the upper mantle and crust. Deep-seated inhomogeneities and regional discontinuities periodically will leave their imprint on the upper crustal rocks on land and under the sea—perhaps even in the deepest ocean basins. By recognizing these major features and trying to understand their behavior, we will develop the context into which smaller-scale features must be fitted. By drilling these features we will find the petroleum of tomorrow. It is, therefore, timely that we lay the groundwork needed to develop these ideas that will lead to our discoveries of the coming decade.

GLAESSNER, M. F., University of Adelaide, Adelaide, Australia

THE CAMBRIAN FRONTIER

Precambrian fossils are no longer to be considered oddities of questionable scientific or practical value. New discoveries, new techniques, and the impact of radiometric dating on Precambrian stratigraphy make it possible to set out for the first time the sequence of fossils through Early, Middle, and Late Precambrian time. They fall into four major classes: microfossils (appearing first), stromatolites (including index fossils of economic importance), megafossils (rich faunas in Late Precambrian, with at least 25 taxa representing 6 phyla of soft-bodied organisms at one locality in Australia), and trace fossils (possibly the earliest remains of animals). These occurrences can be related to the history of the biosphere and to modern studies of biochemical evolution. Placed in proper relation to the geotectonic framework of sedimentation they support the view that the search for oil should be extended beyond the Cambrian frontier into at least Late Precambrian sedimentary basins. Considerations of the definition of the base of the Cambrian and of events at that time also support this view.

GOODELL, H. G., Department of Geology, Florida State University, Tallahassee, Florida

ENVIRONMENTAL GEOMETRY: ITS EFFECT ON AND INTERACTION WITH SEDIMENTATION

Environmental geometry is defined as the three-dimensional shape of a locus of sedimentation as delineated by its bathymetry below a base level. Most depositional loci can be considered as open systems that exist within the framework of a larger system. Their geometry is thus nested within a hierarchy of geometric shapes, the largest of which is delineated by oceanic boundaries. Within any locus of deposition at any level in the nest of loci, the distribution, and often the rate of application of energy are functions of (1) the geometry of the locus and (2) the relative position of that locus in the geometrical hierarchy. Therefore, the characteristics of sediments within a locus of known bathymetry can often be predicted from environmental geometry alone. However, the relative importance of environmental geometry as a parameter which produces sedimentary patterns depends upon the rate of deposition at any one hierarchical level and is most effective at low to medium rates of sedimentation. Since the geometry of the depositional loci at all levels of the nest is interdependent, influences on sedimentary patterns exist between all levels but are most effective between adjacent levels. Multiple non-linear regression provides, in environmental studies, a powerful tool that permits the analysis of the inter-level geometric effects on sedimentation. Examples are presented from estuaries, bays, lagoons, and the continental shelf.

GORMAN, DONALD R., Geology Department, Bradley University, Peoria, Illinois

THE STRATIGRAPHY OF THE AMSDEN FORMATION OF WYOMING

The Amsden Formation was studied in 1) western Wyoming, 2) the Wind River Mountains, and 3) the Big Horn Mountains area. Thirteen sections were measured in detail and representative samples collected for petrographic analysis.

Based upon the range of percentage of clastic quartz and clasticity, the Amsden Formation is divisible, in ascending order, into: *Subunit 1*—the Darwin Sandstone and, where present, the overlying siltstone/shale; *Subunit 2*—a quartz-poor, predominantly carbonate sequence; *Subunit 3*—many thin, quartz-poor, cyclic pairs of carbonate/non-carbonate beds; and *Subunit 4*—many thin, quartz-rich, cyclic pairs of carbonate/non-carbonate beds.

The greater amount of clastic quartz in the Wind River Mountains compared with areas to the north and west suggests a source area south of the Wind River Mountains. The clasticity and percentage of clastic quartz, in conjunction with lithologic curves, indicate that shallow water environments persisted in the area of the Wind River and northern Big Horn Mountains, whereas the central and southern Big Horns and western Wyoming areas were deeper water environments. *Subunits 1* and *2* represent a general transgression, and *Subunits 3* and *4* a general regression. The presence of many diastems and clastic/carbonate pairs of cyclic sediments in the Wind River Mountains and northern Big Horn Mountains sections and their absence in the deeper water environments suggest many minor oscillations in sea level during both the transgressive and regressive phases.

GORSLINE, D. S., VERNON, J. W., and SCHIFFMAN, A., Department of Geology, University of Southern California, Los Angeles, California

PROCESSES OF SAND TRANSPORT IN THE INNER MARGINS OF THE CONTINENTAL SHELF