important in recognizing individual environments of deposition; equally important is the association of the environments to one another. This relationship must be understood for correct paleogeographic reconstruction of ancient deltaic deposits. The manner in which a sequence of marine and deltaic deposits might accumulate in a segment of a basin with resulting stratigraphic relationships of associated environmentally determined facies, is illustrated.

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ORIGIN AND VARIATION OF FESTOON OR TROUGH CROSS-STRATIFICATION WITH PARTICULAR REFERENCE TO SEDIMENTS OF THE SYDNEY BASIN, AUSTRALIA

Recent papers on the origin and classification of cross-stratification by Allen have revived and stimulated interest in the use of cross-stratification as a tool for the interpretation of paleocurrents and environment of deposition. Cross-stratification has been described throughout the geological literature in numerous articles. Relationships between individual sets of large-scale cross-strata of relatively small size (5–30 cms. thick) have been frequently observed in outcrops that are sufficiently well preserved to allow a reconstruction of the pattern of the sets in three dimensions. However, descriptions of the stratification patterns of large (1–3 m. thick) cross-stratified units are rare. This is understandable since such units outcrop over large areas, and the outcrops required for the measurement of these units occur very infrequently.

Large cross-stratified units are well preserved along the coastline of eastern New South Wales in the vicinity of Sydney where sandstones of Triassic age, forming part of the Triassic-Permian Sydney basin, outcrop in horizontal or nearly horizontal attitudes along the rocky cliffs and headlands. At many localities it is possible to measure the areal extent of individual sets of cross-strata, enabling the construction of diagrams showing the cross-stratification pattern in three dimensions. Large individual sets of cross-strata commonly appear to be planar in random sections or in surfaces of small areal extent, but where they can be seen preserved over large areas, they are generally trough-shaped. The shape and distribution of the troughs may lend support to the theory that they have been formed due to migration of very large-scale linguoid or lunate asymmetrical ripples as suggested by Allen.

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RESIDUAL GRAVITY ANALYSIS OF THE MID-CONTINENT GRAVITY HIGH

The high speed computer has many uses in the geophysical industry. Early techniques of analysis of data which required much of the time of the geologist and geophysicist are now routinely done by the computer. New techniques which were impossible by desk calculator are now possible through the speed of these machines.

Important advances have been made possible by the computer in the analysis of gravity data. A new technique of gravity analysis involving the fitting of non-orthogonal polynomial surfaces to a collection of gravity data by the principle of Least Squares has been developed. This was suggested by Simpson (1954), Grant (1957), and others using surfaces of 2nd, 3rd, and 4th order to fit the gravity data. For small areas and small amounts of data these low-order surfaces were sufficient. More recent work by Haubrich (1960) developed the technique to the 7th order on the IBM 650. In modern usage, for large areas and several thousand data, high-order surfaces up to the 15th order are used. The use of these larger areas, and high-order surfaces, allows better geologic interpretation of an area as a whole rather than trying to fit together several small pieces. And, in fact, through the use of several polynomial surfaces of varying order, the small geologic or structural features may be separated from the large so-called regional features.

As an example of the use of this technique, we may examine the Mid-Continent gravity high in Iowa, Nebraska, and Kansas. The polynomial analysis shows a detailed correlation of the gravity residuals with both basement geology and Paleozoic structure. This area is an example of Precambrian structure controlling Paleozoic deformation. Features such as the Abilene anticline in Kansas, the Thurman Redfield structural zone in Iowa and other Paleozoic structures are directly tied to Precambrian fault zones along which later adjustment has taken place. Paleozoic synclines and basins reflect Precambrian structural lows. It is apparent in this area as in many others that this relationship of old zones of weakness to younger movement is the norm rather than the exception.

Unfortunately, the lack of drill holes makes study of the basement geology difficult. This leaves the task to geophysical methods. The use of the computer and new techniques of analysis improves our efforts but it is only through a combination of the geophysical methods, computers, and all available geologic information that we can get the most nearly accurate answer.

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DEEP-WATER SEDIMENTARY STRUCTURES, PLIOCENE PICO FORMATION, SANTA PAULA CREEK, VENTURA BASIN, CALIFORNIA

The Pliocene Pico Formation, according to paleogeographic and paleoecologic interpretations, was deposited in marine waters at least 300 m. deep. Sedimentation of mud, sand, and some gravel was largely the result of bottom-following underflows generally traveling west. Resulting sedimentary structures—some viewed in stilled-stages of development—are: stratification with eroded and deformed contacts, internal stratification, graded bedding, small-scale cross-stratification, disturbed bedding, fossils with preferred orientation, imbricated clasts and shells, ripple marks, flame structures, pull-aparts, load pockets, load waves, and many others.

Ideal graded bedding is generally rare, but most sandstones display grading superposed on other structures such as internal lamination. Thin but persistent strata with signature sedimentary structures imply infilling on a nearly horizontal sea floor by bottom-contact currents tending to level the accretional surface. Eroded and deformed contacts at the base of beds imply vigorous current impact and drag. Larger disruptions such as deformed or disturbed zones, several beds thick, may result from current drag rather than from gravity-induced downslope slumping. Accordingly, some penecontemporaneous folds are less reliable indica-