Ancient Tides

Tidal Deposits. A Casebook of Recent Examples and Fossil Counterparts. ROBERT N. GINSBURG, Ed. Springer-Verlag, New York, 1975. xiv, 428 pp., illus. $34.80.

Clearly the tidal-flat deposits accumulated in a zone of fluctuating water level, but I do not know—and it may remain forever unknown—if the water fluctuations were the result of astronomic tides, wind tides, storms, monsoon climates, or whatever, or how long the intervals were between wettings. (1)

The currently prevailing view of ancient seas pictures them as extending inland for hundreds of kilometers from the shelf break, with a slope so gradual that tidal energy is completely dissipated and "normal diurnal tides would not have occurred" (*2*). In the modern world, however, tidal height at the shoreline increases directly with distance from the continental slope for at least 400 kilometers (*3*). And Klein, in the volume under review, tentatively suggests that "it is conceivable that most epeiric sea sediments were dominated by tidal processes in both the intertidal *and* the shallow, subtidal, tide-dominated domain." *Tidal Deposits* begins to provide criteria by which one can judge whether tides were important in ancient epicontinental seas, but the issue is far from resolved.

In order to provide the basis for testing ideas on paleotides, *Tidal Deposits* includes case histories for modern intertidal situations (14 examples) and their ancient counterparts (31 examples), all in a standardized format. But, caveat emptor! The term "tidal deposit" is meant only to convey that the deposit is intertidal in position, not to suggest that it has anything to do with tides per se. The purpose of the research is to provide a set of criteria to show what the intertidal deposits would look like *if* tides were in fact the major source of energy for water movement. With this imprint subtracted out, as it were, the factors that remained would indicate the importance of additional processes. The problem is that criteria specifically attributable to tides are not specific enough to exclude other factors, as is stated by Laporte in the quotation that opens this review.

For those interested in deposits of a (strictly) tidal origin, the first step is to determine whether a deposit is intertidal in position. All authors in this book address themselves to this question in one way or another. One looks for rocks that occur between those with a clear indication of supratidal conditions (for example, rocks with soil horizons) and those with evidence of continual marine coverage (for example, rocks with a varied marine fauna). The specific criteria most often relied upon are sedimentary structures characteristic of a "fining-upward" sequence, a complex of algal-related features, proof of intermittent exposure, and evidence for reversals in direction and velocity of current flow. (These criteria are especially usefully summarized in Ginsburg's editorial introductions and in articles by Ginsburg and Hardie, and by Larsonneur in this book and by Klein elsewhere [*4*]).

Surface of levee backslope, showing cemented crust that is locally dolomitic; covered only at spring high water. The pencil in the right foreground is 15 centimeters long. [From R. N. Ginsburg and L. A. Hardie, "Tidal and storm deposits, northwestern Andros Island, Bahamas," in *Tidal Deposits*]

In practice, there is continual interplay between modern analog and ancient deposits, and from these comparisons two types of ancient intertidal carbonate deposits are recognized. The first type includes carbonate with many small-scale sequences having the characteristics outlined in the previous paragraph (this type is dealt with by four case histories). The second type consists of the very widespread thin-bedded, laminated and stromatolitic deposits of the Lower Paleozoic that lack these small-scale vertical changes (seven case histories). Why these two types exist is yet to be determined.

After an intertidal deposit is recognized, the next step is to judge whether it owes its character to tidal forces, storms, "or whatever." Detailed paleogeography is now possible, and deposits can be assigned to paleolatitude and distance from the open ocean. Given continental and oceanic configurations and the extent of shallow seas, it is possible to chart tidal height (certainly correctly within a factor of 2). When the paleogeographic, geological, and paleotidal information is combined, we will undoubtedly see Bay of Fundy situations, together with more normal coasts. In that larger context of paleotidal reconstructions, it will be possible to assess the full importance of *Tidal Deposits*.

For the present, we have 45 mostly isolated vignettes, grouped into six sections with separate editorial introductions. (The vignettes are complemented by more than 300 excellent illustrations, but the book is marred by a very poor index.) The case histories are representative in that they include siliciclastics (22 chapters) and carbonates (23 chapters). Many of the patterns characteristic of modern intertidal deposits have now been recognized in ancient rocks (and vice versa) many times over, and a general classification of types of intertidal deposits has resulted. Thus this book can be said to mark the codification of a new branch of sedimentology. The further maturing of studies of tidal deposits will depend upon their incorporation into the broader study of paleooceanography.

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