

MODERN RIVER DELTAS¹T. ELLIOTT²

Studies of modern river deltas during the last few years have moved emphatically away from the idea of a single, generalised delta model and have instead stressed their variability. This refreshing view depends upon critical comparisons between deltas using a wide array of factors such as climate, tectonic setting, sediment supply and basin energy. Many aspects of these factors are manifest in the interaction between the sediment-laden river discharge and the processes of the receiving basin such as waves and tidal currents which strive to redistribute the sediment as it enters the basin. This interaction, here termed the delta regime, takes place at the river-mouth/delta-front area and dictates the manner in which much of the sediment is dispersed and eventually deposited. For a delta to form the river must supply more sediment than the basinal processes can rework, and thus it can be argued that both the overall morphology of the delta and the resultant facies patterns are a reflection of the delta regime. Considered in this respect the range of delta types can be expressed in a ternary diagram with river-, wave- and tide-dominated end members since these are the main agents of sediment transport in deltaic areas (Fig. 1). Though, at present, individual deltas can only be positioned qualitatively the diagram provides a framework for comparing deltas in terms of their formative processes.

The delta regime therefore provides the key to understanding many aspects of deltas, but there is one situation, of particular interest to engineering geologists, where this key fails to unravel the entire history of the delta system. Under certain conditions synsedimentary deformation of the deltaic sediments can occur either at surface or at depth, and on a wide range of scales. In many cases the deformation processes are totally unrelated to basement tectonics and are instead generated within the deltaic sediment mass during compaction. Surface features such as downslope-directed slumps and mudflows result from oversteepening of the delta front and/or from the effects of fluctuating, wave-induced bottom pressures which reduce sediment shear-strength values to near-zero values. Subsurface deformation results from deep-seated flowage of overpressured/undercompacted clays in response to differential surface loading by sub-

sequent sedimentation. Features resulting from this deep-seated flowage include clay ridges and penetrative diapirs, large-scale synsedimentary faults termed growth faults, and gravity slide sheets. Conditions conducive to the operation of these deformation processes are met most commonly in rapidly prograding deltas with a high proportion of fine-grained material in their sediment load. Besides disrupting the primary facies pattern imparted by the delta regime, these processes also dramatically affect the subsidence characteristics and general stability of the delta area. Problems encountered in emplacing large-scale oil exploration structures in deltaic areas are often explicable in terms of synsedimentary deformation of the sediment mass.

A more complete and fully referenced statement of this summary can be found in ELLIOTT (1978).

REFERENCE

Elliott, T. 1978 Deltas. In: H. G. Reading: Sedimentary environments and facies — Blackwells (Oxford): 97-142.

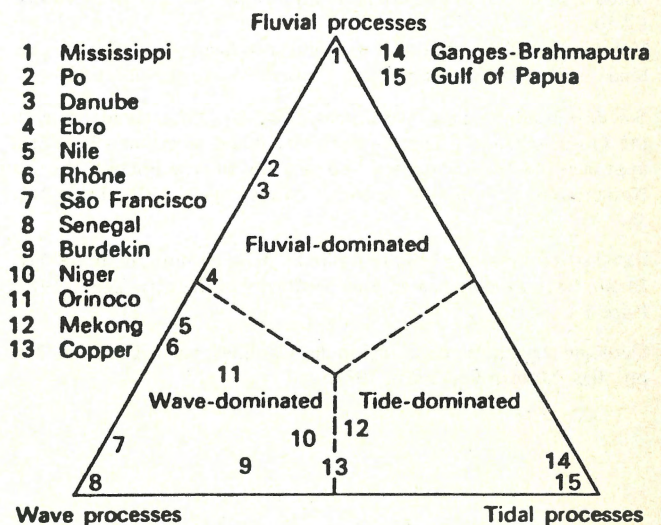


Fig. 1

Ternary diagram of delta types with qualitative positioning of several major modern river deltas (from Elliott, 1978; modified after Gal-
loway, 1975).

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