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Structural Control of Deltas: Are Deltaic Sediments Predictable?

Deltaic sediments are commonly described in terms of dominant control: fluvial processes, tidal currents or waves. Intermediate types are recognised in this classification, but most sedimentological deltaic models are expressed in passive (autocyclic) ways. Deltas are easily fitted into a sequence stratigraphic framework, with sea level ('global', or at least 'regional') as the main external control. Control of prodelta and slope sedimentation by relatively shallow syndepositional deformation (slumping and diapirism) is also recognised. However, more deep-seated tectonic processes must be taken into account; evidence from active margins shows that even very large deltas are susceptible to external (allocyclic) control by contemporaneous structural deformation.

In the Miocene-Pliocene delta of the Amur on Sakhalin, sand distribution is counter-intuitive, with dispersal patterns controlled by transtensional deformation. In the cases of the Pliocene-Recent delta of the Colorado River (North America) and the Cretaceous delta in the southern part of the Antarctic Peninsula the dominant control was basin shape and pre-existing topography. In all three cases, the deltaic sediments appear abruptly and are clearly compositionally different from pre-existing sediments, suggesting profound tectonic control. Similar processes can be inferred for the delta of the Orinoco and for many of the deltas on the island of Borneo.

The field and review evidence that we present here shows that the traditional triangular classification is not adequate to capture the full range of delta architectures possible. We propose a new classification including the possibility of syndepositional structural control.