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A new avenue of sedimentological study of deep-water successions: Reorganization of the lowstand depositional model

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Abstract: A falling-stage deep-water succession is characterized by sandstone-dominated channel-and-overbank deposits and age-equivalent depositional-lobe deposits. In contrast, a lowstand deep-water succession is muddier and is characterized by a thickening-upward pattern of distal overbank deposits. The base of the falling-stage deposits is characterized by a distinct erosional surface compared with the base of the lowstand deposits, which is commonly represented by a gradational contact to the underlying falling-stage deposits.Deep-water channels commonly exhibit meandering patterns similar to fluvial channels, and the channel-fill deposits are encased in muddy overbank deposits. The distribution patterns and volumes of coarse-grained channel-fill deposits developed mainly during falling- and lowstand stages can be estimated from outcrop and seismic data on the basis of several empirical relationships among width, depth, and sinuosity of deep-water channels. Hyperpycnal flows have recently been interpreted to be one of the important mechanisms for developing thick to very thick-bedded, deep-water massive sandstones (DWMSs). DWMSs commonly exhibit sheet-like geometry and abruptly thin out and fine to the downslope direction. These abrupt changes in thickness and grain size of DWMSs are interpreted to be a result of deposition of a sufficient volume of sand particles from precursor hyperpycnal flows, which are subsequently transformed into buoyant plumes with

finer-grained sediment particles associated with residual lower-density turbidity currents flowing to the further downslope direction. Modulation and transformation of turbidity currents into debris flows at a channel-to-lobe transition zone were recognized. The transformation of turbidity currents into debris flows is interpreted to have occurred in response to incorporation of many siltstone clasts and finer-grained sediment particles into the precursor turbidity currents from muddy substrates. The finding indicates that a laterally continuous sandstone body from middle-fan channel to depositional lobe deposits internally contains muddy baffles, which develop heterogeneity of fluid flows in reservoir sands and sandstones.

Key words: sequence stratigraphy, lowstand depositional systems, falling stage, submarine channel, deep-water massive sands, hyperpycnal flow, flow transformation, turbidite, debrite

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