New insight into the three-dimensional architecture of deep-water facies: The product of a multidisciplinary approach

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Traditional deep-water fan models depict concentric facies belts including: (1) an upper- or inner-fan comprised of sand-rich channels, (2) a mid-fan area associated with distributary lobes, and (3) a distal, fringing facies belt dominated by thin-bedded, fine-grained, low-density turbidites.

An underlying assumption of these models is that the disbursement of coarse sediment beyond the confinement of inner-fan channels is driven by unconfined turbidity currents sustained by low concentration plumes of fine-grained sands, silts and muds. Deposition of this cloud of suspended material is thought to form the fringing, fine-grained, distal-fan facies belt depicted in many models.

Modern sea-floor and sub-surface imaging tools reveal a broad range of sediment distribution patterns. Mounded, channel-form, dendritic, digitate, and linear course-clastic termination patterns have been observed in deep-water deposits from a wide variety of depositional settings, including the Gulf of Mexico, North Sea, Congo, Amazon and Campos Basins. In some settings, mud-rich leveed channels are observed to debauch coarse clastic deposits hundreds of kilometers away from coeval shelves. These systems do not appear to be associated with distally fringing, fine-grained low-concentration turbidites. Instead, dip-parallel facies belts predominate with high net-to-gross, course clastic sediments often persisting to the ultimate termination of these depositional systems. Occasionally, inverse depositional patterns may develop, as in the case of coarse-grained terminal lobe deposits that develop downdip of fine-grained leveed channels.