# Prodelta Hyperpycnites: Facies, Processes and Reservoir Significance - Examples from the Lower Cretaceous of Russia

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## Abstract

Current depositional models enhance the importance of delta front sandstones as the main clastic reservoir related to marine littoral deltas. In contrast, prodelta deposits are considered poor or non-reservoir deposits composing a narrow fringe of fine-grained sediments mainly accumulated by fallout from the buoyant plume (hypopycnal flow). Controversially, growing evidences show that most prodeltas are characterized by low gradient and extensive clastic wedges composed of fine-grained sediments. These deposits can extend for hundreds of kilometers from the coast, and are mostly composed of meter to decameter thick coarsening and thickening upward successions of fine-grained heterolites (sand-silt couplets). This basinward extension is possible because the seasonal occurrence at river mouth of sustained muddy hyperpycnal flows during floods, allowing the transfer of a huge volume of clastic sediments farther offshore. According to their direct linkage with fluvial discharges, muddy prodelta hyperpycnites often content abundant phytodetritus, which enhances their potential as unconventional resources of oil and gas. Fine-grained heterolites are often characterized by abundant clean sandstones forming thin levels interbedded with shales. These last characteristics together with their wide areal extension could result in important conventional clastic reservoirs especially in shallow oilfields. Early Cretaceous (Aptian) Karabashskiy Oil & Gas discovery in western Siberia provides an example of the importance of prodelta hyperpycnites as a large conventional reservoir. Main reservoirs are shallow marine fine-grained heterolithics deposits of the Leushinskaya and Vikulovo formations, interpreted as prodelta hyperpycnites. Trace fossils are locally abundant, with an association considered typical of prodelta settings. Individual beds are internally graded and centimeter to decimeter thick. Sedimentary structures include HCS, planar lamination, climbing ripples, wave bedding, lenticular bedding and lofting rhythmites. Most beds are disposed over a basal erosional surface and display internal evidences of multiple waxing-waning cycles related to velocity fluctuating muddy hyperpycnal flows. These deposits are stacked forming cycles of different hierarchical orders, probably reflecting seasonal and periodic changes in the associated deltaic activity.