Hyperpycnal Flow Deposits: Examples from the Mississippian and Cretaceous of the Alberta Basin

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Hyperpycnal flows are produced by high-density fluvial discharge events resulting in relatively slow moving and long-lived turbulent sediment gravity flows, which may extend offshore for considerable distances. The hyperpycnal process means that fluvially-derived material and associated interstitial fresh water is transported into the marine environment by turbulent flows (Mulder et al, 2003). The resulting deposits differ greatly from classical turbidites and the recognition and classification of these unconventional deposits in the subsurface can be challenging, but has important implications for reservoir geometries. Many hyperpycnal deposits have been previously interpreted as tempestites.

The hyperpycnite facies model proposed by Mulder et al. (2003) emphasizes the formation of coupled inverse and normally graded structures resulting from a waxing and waning hyperpycnal flow. In delta-front sandstone beds these waxing and waning flow events may result in rippled-parallel laminated-rippled successions (Olariu et al. 2010).

Other criteria used for recognizing hyperpycnites are: grain size variation within beds; limited burrowing, reflecting fluvial influence and high sedimentation rates; dewatering structures; and associated cross bedding, indicating bedload transport and wave reworking. The importance of hyperpycnal mud plumes has also been invoked to explain mud deposition in relatively nearshore marine settings (Bhattacharaya and MacEachern, 2009).

In this core display examples of hyperpycnal flow deposits will be presented from:

- Tide-dominated delta deposits of the Middle Bakken formation (Mississippian) of eastern Alberta.
- Deltaic deposits of the Bluesky formation (Albian) northwestern Alberta.
- Prodelta deposits of the Fish Scales formation (Cenomanian) southern Alberta.

References

Bhattacharya, J. and J. MacEachern 2009

Hyperpycnal rivers and prodeltaic shelves in the Cretaceous seaway of North America. Journal of Sedimentary Research, V. 79, p. 184-209.

Mulder, T., Syvitski, J., Migeon, S., Faugeres, J. and Savoye, B. 2003

Marine hyperpycnal flows; initiation, behavior and related deposits. A review. Marine and Petroleum Gology 20, p. 861-882.

Olariu, C., Steel, R. and A. Petter 2010

Delta-front hyperpycnal bed geometry and implications for reservoir modeling: Cretaceous Panther tongue delta, Book Cliffs, Utah AAPG Bulletin, V. 94, No 6, p. 819-845.