Comparison of Sediment Gravity Flow Deposits Around the Devonian Reef Complexes of Alberta and the Late Pleistocene-Holocene Great Barrier Reef of Australia

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Abstract

The Late Pleistocene-Holocene Great Barrier Reef (GBR) shelf complex in NE Australia is regarded as the most extensive mixed siliciclastic-carbonate depositional environment. Recent investigations (Puga-Bernabéu et al., 2014) along the shelf margins provided new insight into the controls of sediment mass transport of both siliciclastic and carbonate packages. Along the GBR, carbonate mass wasting events are controlled by sea level fluctuations, changes in carbonate production and shelf physiography. These findings are in contrast to some of the well-established sequence stratigraphy paradigms.

The Devonian Duvernay carbonate complex of Alberta is comparable to the modern Great Barrier Reef shelf with the exception of the water mass stratification characteristics of Devonian time along the NW Canadian coastline. To no surprise, the Devonian Duvernay shelf deposits contain abundant sediment gravity flow beds and sediment packages similar to what is observed in the modern equivalent depositional environment. In particular, in close proximity to Devonian reefal structures, carbonate mudstones are interbedded with black organic-rich shale beds.

Here we present key findings of the Puga-Bernabéu et al. (2014) study and compare these with sedimentological features of the carbonate gravity flow deposits in the Duvernay Formation. Sedimentological evidence shows that many similarities exist between these two depositional environments. However, in contrast to the GBR off reef deposits, the majority of the Duvernay shelf basin was dominated by organic-rich fine-grained mud (i.e. black shale). This study examines the details of these interbedded light brown carbonate and black shale units that were the result of periodic or cyclical influx of carbonate reefal debris (incl. muds) into an anoxic shelf basin. These carbonate mass flows resulted in a temporary introduction of oxygen into an anoxic environment, which led to marked bioturbation (abundant large invertebrates) of the uppermost black shale deposits.