Evidence for multiple styles of sediment gravity flows constructing a prodelta-to-shelf depositional environment: Coaledo Formation, southwest Oregon

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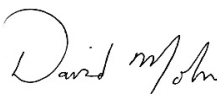
Abstract

Previous depositional models for marine storm beds focus mainly on generation by combined flow, but this mechanism alone does not account for both volume and distance of sand transport necessary to explain the deposits. Recent studies have shown that sediment gravity flows (SGFs) serve as efficient conduits for clastic sediment transport from deltaic systems and into marine sedimentary basins. The majority of sediment is moved during river floods via hyperpycnal flows, which have a higher density than that of the water in the receiving basin and produce fine-grained deposits called hyperpycnites. Phenomenal exposure of the Lower Coaledo Formation along the southwest Oregon coast provides a superb opportunity to refine, revisit, and grow process-based interpretations for storm beds that construct a prodelta-to-shelf depositional environment. The Lower Member of the Coaledo Formation preserves world-class examples of small and large-scale hummocky cross-stratification (HCS) formed under conditions of wave-dominated combined flow. While storm-generated waves aid in reworking sand to produce a suite of bedforms, we propose the storm beds of the Coaledo were deposited from hyperpycnal flows. In-depth stratigraphic and sedimentological analysis of the fabric, texture, grain size, and sedimentary structures of the Coaledo identified three different styles of sediment gravity flows: (1) hyperpycnal flows (2) subaqueous debris flows, and (3) slumps of previously deposited delta-related sediment. Two types of hyperpycnites are expressed in the stratigraphy: (A) wave-influenced hyperpycnites and (B) non-wave-influenced hyperpycnites. The occurrence of aggrading wave ripples and HCS suggest influence from storm events. However, hyperpycnites composed of planar laminated beds with fine-grained leafy detritus are interpreted to have been deposited during a period of stormless activity. In other words, fluvial flooding and hyperpycnal flows can occur independent of marine storm events. Tidal rhythmites are also present and are associated with flood and ebb cycles that cause the velocity of sediment in the river to decrease as the tide comes in and increase as the tide goes out. The occurrence of gravity-driven processes confirms that prodelta-to-shelf settings have relatively steep slopes capable of triggering sliding releases and maintaining conditions for sediment gravity flows to persist. Process-oriented analysis coupled with 3D outcrop models are used to constrain a depositional model for the Coaledo storm deposits.

Supervisor's Signature_  ____