Comparison of Two Miocene Turbidite Intervals: Taranaki Basin (New Zealand) and Gulf of Mexico Basin (USA)

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In the managing of the exploration and production risk and uncertainties associated with deep water reservoirs, it is frequently beneficial to compare two different depositional systems of similar basin configuration and age. Doing so enables a better understanding of both systems. The Mt. Messenger formation (late Miocene) of the Taranaki Basin, North Island, New Zealand is an overall prograding deep water complex adjacent to an active, submarine volcano-punctuated basin margin. The active margin nature of the Taranaki Basin affords an opportunity to observe basin floor through slope depositional systems tracts in outcrop along the sea cliffs of the North Taranaki coast. This outcrop ties into nearby well and seismic data.

During Mt. Messenger deposition, the basin was in a relatively quiescent tectonic phase following a period of basement overthrusting along the eastern margin. Penecontemporaneous volcaniclastic sediments and intrusive rocks pierce through the basinal sedimentary package and appear to control depositional patterns, at least partially. Erosion of structural uplifts of basement rocks in the central areas of both North and South Islands contributed large volumes of terrigenous material into a north and westward directed distribution system. These sediments were laid down and preserved in a series of unconformity-bounded lowstand systems tracts composed of basin floor fans of thick- and thin-bedded sands and muds, overlain by generally thin-bedded slope fan channel - levee - overbank sands, silts, and muds. Channel-fill sands and conglomerates are observed, but levee - overbank sands, silts, and muds dominate the slope fan interval.

During the Miocene, the Viosca Knoll/Mississippi Canyon area of the Gulf of Mexico was one of passive margin deltaic sedimentation onto a continental slope with intermittently active salt dome growth and adjacent basin subsidence. The upper and middle Miocene in these areas is part of an overall prograding submarine fan complex deposited downslope from the main Mississippi River depocenter to the west and northwest. Information about this interval is exclusively from subsurface well and seismic data.

Within this Gulf of Mexico area the sand-prone intervals generally consist of channel - levee - overbank sands and sheet sands, with associated silts and muds. Overall the section is dominated by muddy debris flows punctuated by intervals of relatively thin sandy turbidite sequences.

Bedded strata within both the Viosca Knoll/Mississippi Canyon and Taranaki sections appear to be highly similar: medium- to fine- grained, thin-bedded turbidites, with Tb/c-e dominating the sand-prone section. Imaging logs from the Mississippi Canyon interval show only a few parasequence - scale boundaries, yet much of the Taranaki cliffs section commonly show low-angle truncations and onlap/downlap. Imaging logs from behind the Taranaki cliffs exhibit these features as well as the regular bedding style of the thin-bedded turbidites.

The Mississippi Canyon Miocene interval appears to have more chaotic seismic facies than the Taranaki Miocene interval. Imaging logs from the Amoco #1 OCS-G9790 well (Mississippi Canyon 217) indicates that much of the section penetrated is consistent with a muddy debris flow interpretation for that chaotic seismic facies. Potentially similar debris flow intervals were neither common nor thick within the Taranaki section. Where observed, they occupy mostly gravelly, lower channel-fill intervals in the slope section.

The greatest difference in sedimentary character between the two systems is within the slope channel complexes: the rather organized turbidite-dominated slope of the Taranaki Basin and the isorganized, debrite-dominated slope of the Miocene Gulf of Mexico Basin. This difference is probably attributable to the different sedimentologic natures of the two depositional areas. During the Miocene the Taranaki Basin was fed by a series of point- or line-sourced systems producing a dominance of turbidites. The Viosca Knoll/Mississippi Canyon area was controlled by salt dome tectonics within the high outfall area of the Mississippi River slope, an area of higher sedimentation and preservation potential, resulting in a mixture of debrites and turbidites.

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