A Classification Scheme for Turbidite Fan Systems in Deep-Lacustrine Basins: Examples from the North Falkland Basin

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Abstract

Lacustrine basins and deep-lacustrine sedimentary environments are becoming more widely recognised as globally significant systems. Their size, geometry and varying fluid-fill compared to marine basins (fresh vs. saline water), make deep-lacustrine environments unique, intriguing and potentially contrasting sedimentary systems. While deep-marine systems have received much attention and robust classification systems of their morphological features exist, the same cannot be said of deep-lacustrine settings. This is most applicable to deep-lacustrine turbidite fans, which transport a large proportion of the coarse-grained material into these settings. Through detailed mapping of 3D seismic data, integrated with well data, from the Transitional and Early Post-Rift units of the North Falkland Basin, this study documents and characterises a suite of deep-lacustrine turbidite fan systems. Examples from 11 contrasting systems are provided, including: the Rhea, Isobel Deep, Isobel, Mackerel, Liz, Bleaker 20, Bleaker 15, Sea Lion, Casper, Beverley and Zebedee. Seismic-based features have been identified, at a range of scales, including: ‘systems’ (c. 5-15 km in width), ‘forms’ (c. 2-10 km), and ‘elements’ (c. 0.1-2 km). The elements scale includes a diverse suite of intriguing morphologies that we classify as: feeders, feeder-lobe transition zones (FLTZ), sinuous and anastomosing lobe axis deposits, flow deflection, stranded lobe fringe areas, flow constriction/lobe to terminal mouth lobe transition zones (LTTZ) and terminal mouth lobes. These morphologies are linked to a particular suite of bed-scale sedimentary processes that occur within the fan system. Where

possible, this link between seismic-based interpretations and sedimentary processes has been validated using available core data. Through this analysis, a generic classification scheme for deep-lacustrine sedimentary systems is proposed that establishes a descriptive and interpretative hierarchy. This is important as their size, geometry and fundamental sedimentology potentially produces a suite of internal morphological features that may be unique to deep-lacustrine basins. The enhanced ability to identify, describe and characterize deep-lacustrine systems and internal morphological features is important to future hydrocarbon industry as these basins typically host high-quality source rocks, excellent turbidite reservoir sandstones and competent sealing lithologies. Consequently deep-lacustrine systems have recently become favourable targets for the hydrocarbon exploration worldwide (e.g. Bohai Bay Basin in China).