Megaslides, Source Rocks, and Mantle Convection

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ABSTRACT

Modern deep-water seismic data from many of the worlds passive margins reveal that a large portion of the slope and deep water basin are comprised of slowly developed, gravity controlled fold and thrust systems or “megaslides” (examples from Orange River, Namibia and Juba Lamu Basin, Somalia). Yet similar clastic sequences in other basins have not developed these features. Mechanisms for megaslide formation, and indeed the controls on clastic margin stability in general will be discussed, including the potential for identification of source rocks, and yet we propose a “basin tectonic specific control on subsidence”, and therefore deformation. A dataset of observations that relates anomalous buoyancy of oceanic crust to convection within the mantle has recently been published (Hoggard et al 2016). We explore the consequence of this for the stability of clastic sequences in passive margin basins, and propose a method of recognizing paleo-residual elevation in basins by observing the stability of the clastic deposits. The implications of the model are developed, challenging models of plate tectonic movement and providing alternative insight on a number of geologic phenomena familiar on passive margins - basin unique unconformities, conjugate basin asymmetry, magmacity of rifting and consequential SDR characteristics are discussed in the context of this model. We propose that the basin specific control on subsidence that determines clastic prism stability on passive margins can be mapped on a global reference framework back through time to provide a predictive tool, such that basin histories on passive margins from rift-inception to the present day can be understood in a coherent framework. This gives an opportunity for a new understanding of hydrocarbon potential to be developed.
References M.J. Hoggard, N. White and D. Al-Attar. Global dynamic topography observations reveal influence of large scale mantle flow. Nature Geoscience, published online May 2016 (DOI 10.10.38/NGEO2709).