Wedge Geometry and Detachment Strength in Deepwater Fold-Thrust Belts

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ABSTRACT

Deepwater fold-thrust belts (DWFTBs) have been classified into three groups according to the present-day stress regime and tectonic setting. Near-field stress-driven DWFTBs are usually associated with passive margins. They are thin-skinned gravitational deformation with thick salt or overpressured shale detachments. DWFTBs formed by far-field stresses are primarily associated with continent convergent zones and active margins. Mixed near- and far-field stress-driven DWFTBs have aspects of both thin-skinned and thick-skinned tectonics. Detachment strength is the primary control on the first-order wedge geometry of a DWFTBs and is controlled by lithology and overpressure. Based on analysis of fault strength calculated from critical taper measurements it is found that detachments beneath different classes of DWFTBs are not analogously weak. Near-field stress-driven DWFTBs at passive margins generally have smaller wedge-taper angles and weaker detachments. Far-field stress-driven and mixed near- and far-field stress-driven DWFTBs at continent convergent zones or active margins generally have larger wedge-taper angles and stronger detachments. Differences in the way overpressures are generated, and dissipated between the different types of DWFTB are thought to be primarily responsible for the systematic variations in shale-prone basal detachment weakness found in this study. Clear lithology-related differences in DWFTB critical taper are shown between shale (higher taper) and salt (lower taper) dominated basal detachments.