Mechanical and petrophysical properties of the Alum Shale Detachment in the Khao Kwang Foreland Fold and Thrust Belt, central Thailand

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ABSTRACT

The Alum Shale Detachment within the Khao Kwang Foreland Fold and Thrust Belt (KKFFTB) has been used as an example to define the nature of the deformational mechanisms present within detachments. Primarily deformation within the detachment is brittle, although there are areas of ductile deformation within the higher strain zones. Electron Back-Scatter Diffraction (EBSD) analysis show strain partitioning from pure shear to simple shear, which is in support of macrostructural observations. The structure of this detachment can be separated into three structural zones: 1) Structural Zone 1 is characterised by metre-to-decametre-scale thrusts, decimetre-scale fault-propagation folding and no intrusions; 2) Structural Zone 2 is characterised by metre-scale thrusts and metre-scale intrusions; and 4) Structural Zone 3 is characterised by the simplest structural geometries; decimetre-to-metre-scale thrusts and minimal intrusions. Bedding, cleavage and shear planes are all parallel, strike E-W and dip moderately to the S, throughout the detachment. The deformational intensities observed within fringe complexes on the micro-scale are intrinsically linked to the decrease in deformational intensity from Structural Zone 1 to Structural Zone 3.

Electron Back-Scatter Diffraction (EBSD), Source Rock Analyser (SRA) and Total Organic Carbon (TOC) analysis have constrained the temperature of deformation during the Indo-Sinian Orogeny (IO) between 150 °C to 200 °C. A structural evolution of the system has defined six stages based on interpreted structural analysis, Calcite Stress Inversion Technique (CSIT) and X-Ray Diffraction (XRD) analysis. These stages are: 1) E-W normal fault stress regime during the Asselian; 2) E-W strike-slip fault stress regime with episodic periods of an E-W thrust fault stress regime that occurred in the late Permian; 3) intrusions were emplaced, causing contact metamorphism and temperatures up to 334 °C. 4) A hydrothermal event occurred, causing at least two generations of veining; 5) formation of the Alum Shale Detachment, and subsequently, the KKFFTB occurred during the IO from the Late Triassic (250 Ma) to the Early Jurassic (190 Ma) and; 6) an ENE-WSW thrust fault stress regime occurred after the IO (190 Ma).

The Alum Shale Detachment has been defined as a thin-skinned type 2a detachment after Morley *et al.* (2013), and shows a faulted structural style (Rowan *et al.* 2004), based on analysis undertaken herein.

KEYWORDS

Structural Geology, Shale detachment, Khao Khwang Fold-Thrust belt, Thailand, Petrophysical properties, mechanical properties.

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