Geophysical Research Abstracts
Vol. 15, EGU2013-6577-1, 2013
EGU General Assembly 2013

Evaporite Detachment Characteristics and their controls on Fold-Thrust Belt Style: an Example from the Amadeus Basin, Central Australia

Lachlan Richards (1), Rosalind King (1), Alan Collins (1), Guillaume Backé (2), and Chris Morley (3)

(1) Centre for Tectonics Resources and Exploration (TRaX), School of Earth and Environmental Sciences, University of Adelaide, Adelaide 5005, South Australia, Australia (lachlan.richards@adelaide.edu.au), (2) BP International Ltd, Sunbury Business Park, Chertsey Road, Sunbury-on-Thames, Middlesex TW16 7LN, United Kingdom, (3) PTTEP, 27th Floor, ENCO Building, Soi 11, Vibhavadi-Rangsit Road, Chatuchak, Bangkok, Thailand, 10900

Although there is a wealth of information on the structural styles in fold-thrust belts, specifically with regards to the nature of the stresses (far-field, near-field, or a combination of both) associated with the tectonic regime, the precise nature by which detachment zones control deformation is largely unknown.

Field observations of ancient and exhumed analogues at sites located in Australia, Pakistan, and Canada, as well as sample analysis are used in this work to document salt detachment characteristics (thickness, lithology, dip and dip direction, strain patterns, temperature of deformation and thrust front propagation rates). The use of analogues is justified as the most prominent examples of active fold-thrust belts are located in inaccessible, typically deepwater, environments and onshore examples generally lack surface outcrop of the detachment zone itself.

'Classic' structural techniques, such as constructing cross-sections and field observations are used in this project to determine the thickness, lithology, dip and dip direction of salt detachments. In addition, "modern analytical techniques such as, electron backscatter diffraction, electron microprobe analysis with calcite-dolomite thermometry and ^{18}O stable isotope analysis, and piezometric calculations" are used to characterise further fold-thrust belt properties, such as crystallographic preferred orientation and strain pattern, temperature of deformation, and palaeopressure. By integrating 'classic' and 'modern' techniques it is possible to characterize a range of salt detachment properties and develop our understanding of their control on structural style and deformation.

Initial work in the Neoproterozoic Amadeus Basin, central Australia has focused on microstructural analysis and seismic interpretation. The Amadeus Basin is bounded to the north by 400-300Ma Alice Springs Orogeny and to the south by the 570-530Ma Peterman Orogeny. The main deformation pattern observed in the Basin at present-day is mostly related to these two major events of crustal shortening and is compatible with a NW-SE trending compressional tectonic regime.

Seismic interpretation of 2D data confirms the structural style observed at surface, with multiple occurrences of salt-cored anticlines and diapirs. The pervasive salt member observed both in the field and on seismic data corresponds to the main detachment surface in the basin, the Gillen Member of the Bitter Springs Fm. (775Ma-710Ma). This member consists of a basal dolomite sequence covered by a thick succession of halite, capped by dolomite and gypsum. $^1/_4$ core samples collected from nine wells penetrating the detachment layer contained significant, highly crystalline, pure halite with subordinate primary anhydrite and gypsum. Microstructural analysis of these samples has been fundamental in explaining the mechanisms by which the detachment has accommodated the deformation and the cause of the subsequent fold-thrust belt style. As an example, the Amadeus Basin works well in demonstrating the utility of combining these techniques in characterizing the properties of salt detachments.