Geophysical Modeling and Structural Mapping within Fold and Thrust Belts

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Fold and thrust belts are important and well-known petroleum provinces worldwide. However, it is also well known that seismic imaging in these regions can be very poor, especially in foreland basin-type settings. Gravity and magnetic data are often acquired in an attempt to aid structural mapping and improvement of seismic data resolution.

The observed gravity and magnetic anomalies are analyzed by developing geological models based on real world examples. The responses from these models have been calculated and enhanced using various field transformations, providing meaningful discussion of the limitations and the benefits of each data set.

Gravity and gravity gradiometry data highlight the morphology and character of the shallow fold and thrust belt, which are obviously important for identifying prospective hydrocarbon traps. Magnetic data tend to allow better definition of basement-related geometries, which are typically obscured on seismic data by the shallow allochthonous thrust sheets and their associated detachment surfaces. Observations suggest that these magnetic data are more sensitive to basement structure, though mineralization of shallow faults and high magnetic mineral concentration within sedimentary layers can also contribute to the bulk magnetic signal.

By identifying both the shallow and deep features in this tectonic setting, it is possible to look at the genetic link between the two and the role that basement morphology plays during compressional deformation. This is particularly important in settings where basement has had an extensional phase prior to the development of the compressional fold and thrust belt above it.

AAPG Search and Discovery Article #90090©2009 AAPG Annual Convention and Exhibition, Denver, Colorado, June 7-10, 2009