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Controls of Structural Geometries Associated with Rift-Basin Inversion

Rift-basin inversion occurs during a post-extension episode of shortening and can affect the hydrocarbon potential of rift basins by creating late-stage structural traps. Therefore, it is important to understand the development of inversion structures, specifically how the preexisting extensional fault system influenced their formation. The Mesozoic Fundy rift basin in Maritime Canada is part of the eastern North American rift system and presents an excellent opportunity to study inversion structures in both the subsurface and in outcrop. Observed inversion structures include normal faults reactivated as reverse faults, fault-bend and detached compressional folds, and folds associated with restraining bends. Seismic data indicate that inversion-related folds post-date the youngest synrift sediments. The seismic data also show that most inversion-related folds are fault-bend folds that trend subparallel to the preexisting border faults. In addition, the folds are broader where associated with lower-angle faults and tighter where associated with higher-angle faults. Therefore, most inversion-related fold geometries are not indicative of the far-field state of stress during shortening, but rather are controlled by the preexisting extensional fault geometries. However, the geometries of detachment folds and folds associated with fortuitously oriented restraining bends in the border fault system likely reflect the state of stress during shortening and suggest that, in the Fundy basin, maximum horizontal compression was oriented NE-SW. Field evidence supporting this shortening direction includes East-striking sinistral-reverse-oblique faults and NW-trending folds. NE-SW shortening is also consistent with structural analyses by other workers and the current state of stress in eastern North America.

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