

## Mesozoic extensional tectonism on the northern Grand Banks as expressed at the Hibernia Oilfield

Iain Sinclair

*Hibernia Management and Development Corporation, St. John's, Newfoundland*

The Grand Banks region, offshore eastern Newfoundland, experienced multiple episodes of rifting during the Mesozoic. Extension of the continental crust resulted in widespread deformation, dominated by growth of normal faults. These faults, in turn, controlled subsidence of numerous sedimentary basins and rotation of intra-basin structures. Episodic rifting culminated in the staged breakup of Pangaea and seafloor spreading along new segments of the North Atlantic Ocean. Each rift episode evolved under unique stress conditions characterized by changing fault orientations and slip directions. Mesozoic extension created the Hibernia structure on the western margin of the Jeanne d'Arc Basin while subsidence during the subsequent passive episode resulted in maturation of Upper Jurassic source rocks and expulsion of the oil trapped in the faulted Hibernia anticline.

The first Mesozoic episode of extension is interpreted to have generated a series of northeast-trending, en echelon

faults adjacent to the Hibernia Oilfield. The second rift episode spanned the Late Jurassic to Early Cretaceous and resulted in linkage of these en echelon faults into a single, albeit geometrically complex, normal fault. Numerous smaller faults trending north to south also formed during this time of basin margin uplift and deposition of coarse-grained sediments (i.e., the Jeanne d'Arc and Hibernia reservoir facies). The youngest episode of extension occurred late in the Early Cretaceous and caused the highest degree of deformation observed, both in terms of fault offset and block rotation. Normal faults, trending northwest-southeast, grew throughout the Jeanne d'Arc Basin, synchronous with deposition of the "Avalon" reservoir sandstones. Additionally, there is evidence of oblique-slip re-activation along the basin margin at Hibernia. The age limits and the character of faulting (thin versus thick-skinned extension) associated with this culmination of structural deformation, however, remain subjects of continuing study.