

Compression Modified Extensional Structures (CMES) of the Canadian Atlantic Passive Margin

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Abstract

A network of Mesozoic rift basins occupies the continental margin of Atlantic Canada that extends from the Georges Bank in the south to the Nares Strait in the north. These basins including the Flemish Pass, Orphan and Labrador basins and the oil prolific Jeanne d'Arc Basin, were formed by multi stage intra-continental rifting during the Pangea breakup and opening of the North Atlantic Ocean. The basins are segmented by several sets of normal faults and contain the complete suite of structural features typical for extensional regions. Due to the presence of large oil and gas accumulations on the margin, these basins have been covered by numerous 2D surveys collected by industry and research and by more recent large 3D survey (25m by 12.5m bins). These high quality seismic data sets show a series of complex features that cannot be explained strictly by dip-slip extension. Structural features varies from small inversion on fault planes to complexly faulted anticlines and flower structures on the shelf to toe-trust anticlines with repeated trust sheets on the deep slope. A series of examples of these atypical features for a classic passive margin are given in this paper. They are described as compression modified extensional structures (CMES) and are selected from 1) the Flemish Pass Basin, recently drilled by two wells and covered by large 3D seismic surveys; 2) Orphan Basin, a deepwater-rifted area with active exploration, and 3) Labrador Sea, a large area where exploration has yet to return (Figure 1). In absence of plate convergence in the area, oblique-extensional slip, transform faulting, diachronous salt movement, microplate interaction, megaplate realignment, rotation of extensional vector, post-rift gravity detachment and ridge push are used to explain the formation of these structures.

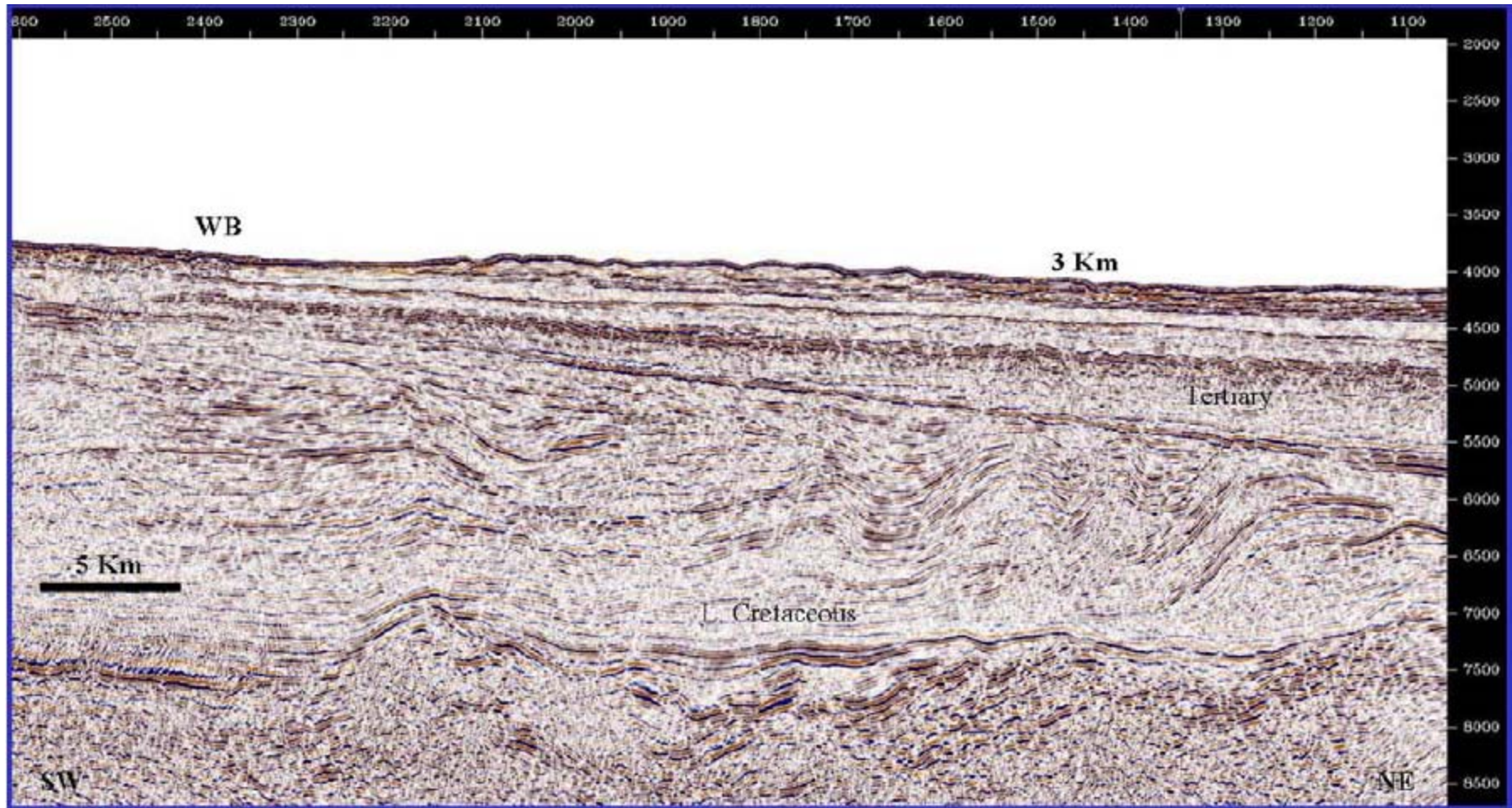


Figure 1. Compressional structures from the Labrador Sea rifted area (data courtesy of GSI).

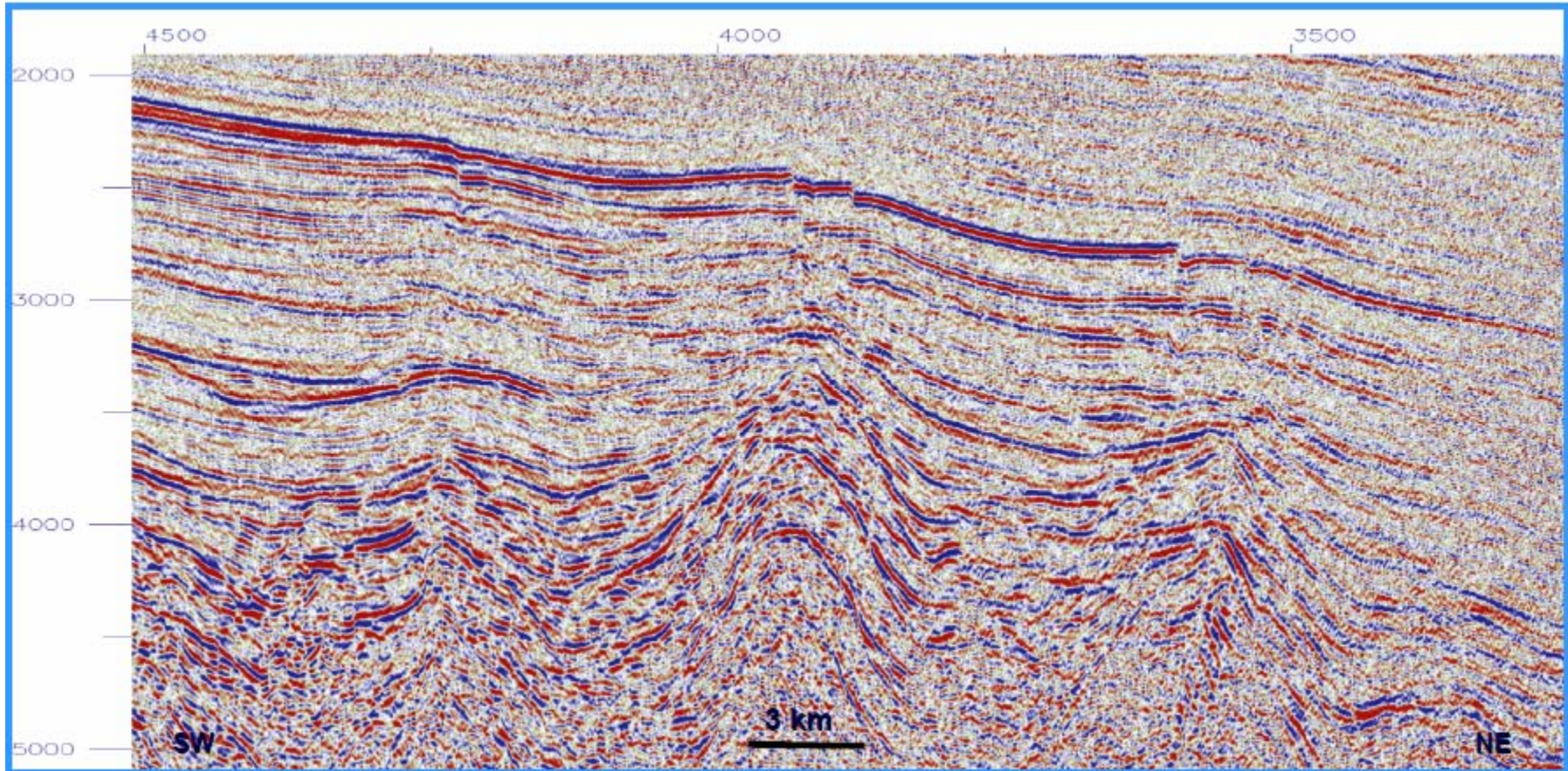


Figure 2. Compressional features in an extensional setting of the Canadian Labrador Sea (data courtesy of GSI).