Transpression and transtension in the Jeanne d'Arc Basin, Grand Banks

Iain K. Sinclair
Canada-Newfoundland Offshore Petroleum Board

Mapping of the southern Jeanne d'Arc basin was undertaken to determine the structural architecture of the oldest Mesozoic sediments within the basin. The structure at the mid-Jurassic near the Whale Member, the Lower Jurassic top of the Iroquois Formation, and the top of an Upper Triassic/Lower Jurassic basalt were interpreted using mainly 2-D seismic reflection data. Variation in architecture at and between mapped horizons was used to evaluate the tectonic stresses experienced in the pre-Mesozoic basement and transmission of these stresses into the overlying sediments. Correlations at additional younger horizons and previously published maps were used to assist in timing of tectonic events and determination of related stress orientations.

Synchronous sedimentation and normal growth are demonstrated along NE-SW-trending en echelon faults of the Late Triassic to earliest Jurassic rift period. The en echelon extension faults are interpreted to be generally separated by tilted-basement relay ramps or accommodation zones rather than by cross-strike transfer faults.

The NW-SE-trending cross-basin faults, which bound and dissect numerous hydrocarbon-bearing structures, are demonstrated as being initiated at the mid-Aptian and grew through late Albian times rather than having been initiated in latest Jurassic/earliest Cretaceous times with decreasing growth during the mid-Aptian to late Albian.

The NW-SE-trending Spoonbill Fault is identified as the headwall fault limiting extension in the basement below the Jeanne d'Arc Basin during mid-Aptian to late Albian times. Synchronous strike-slip movements of basement blocks along reactivated NE-SW-trending faults are interpreted to result in a number of transpressional and transtentional structures along restraining and releasing fault bends. Low-dipping reverse faults, inversion structures, forced folds (i.e., Cormorant fold), wrench related folds (e.g., Terra Nova arch) and preferential salt diapirism (e.g., Egret ridge) are all recognized as responses to transfer fault movements during mid-Aptian to late Albian times.