Thin-skinned tectonics and kinematics of the Mercury sub-basin and its vicinity, Grand Banks of Newfoundland.

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Analysis of 2-D and 3-D seismic data suggests that the Mercury sub-basin consists of a highly faulted, left-stepping relay ramp. It is bounded to the west and east by major N.NE-S.SW faults, respectively the Mercury and Murre faults. The Murre fault separates the Mercury sub-basin from the Jeanne-d'Arc basin to the east. The Mercury sub-basin hosts sediments, which range in age from possibly Early Jurassic to Recent. It is plunging generally to the north and is dissected mainly by N.NE-S.SW and NW-SE faults.

The N.NE-S.SW faults were episodically active throughout most of the basin history. They were generated, mostly as dip-slip faults, due to almost E-W extension during an early rifting phase, which dates back to Triassic-Early Jurassic. They were re-activated in an oblique sense due to NE-SW extension during a late rifting phase of mainly an Aptian-Albian age. Local reverse-separation faults and transpressional folds, associated with restraining bends, manifest the oblique motion along the N.NE-S.SW fault system. The later rifting phase also generated NW-SE dip-slip faults. Listric NW-SE faults along with major N.NE-S.SW faults sole-out at common detachment flats, forming linked fault systems. The NW-SE faults represent the dominant extensional ramps of these systems, while the N.NE-S.SW faults serve as oblique transfers.

NE translation along such detachments coupled with flat-ramp geometry generated fault-bend folds. The Flying Foam, the largest of such fault-bend folds, was developed due to NE translation of 10-15 kilometers along a major detachment flat in the Mercury sub-basin. The Mercury fault represents an oblique transfer linked to this detachment flat while the Murre fault constitutes an oblique detachment ramp.

Progressive deformation on the high-angle listric faults along with the flat-ramp geometry resulted in the development of extensional duplexes, stacked detachments and fault riders. Local fault-bend folds were formed due to rolling over these fault riders.

Gravity tectonics during the early stage of thermal subsidence, Albian-Cenomanian time, induced slip along major faults and triggered significant gravity gliding along sea floor surfaces. These surfaces cut deeply into pre-existing structural topography. They extend from unconformities at tops of structural highs across fault degradational scarps and erosional slopes of folds all the way down to basin plains. Large rock masses were removed from the structural highs and moved, along such glide planes, into topographic lows. Listric fans associated with high-angle faults were also developed due to gravity tectonics. In addition, subsidence along major faults resulted in the formation of fault-propagation folds in Late Cretaceous-Early Tertiary rocks and slightly reactivated extensional detachment faults.