The ocean-continent transition zone underlying the central Labrador margin, Canada

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The nature of the ocean-continent transition zone on the central Labrador rifted continental margin, and its conjugate off West Greenland, have been studied for several decades. Geophysical studies and deep drilling have increased our fundamental understanding of the tectonic evolution of this type of magma-poor margin globally.

Several elements of the ocean-continent transition zone have been delineated by a refraction survey during a previous experiment on the central Labrador margin, including a zone of extended continental crust under the shelf, a region underlain in part by exhumed and serpentinized mantle, and furthest seaward under the deepest part of the Labrador Sea, is oceanic crust. We show new 2D seismic data and link it to potential field data, and a deep seismic crustal velocity profile, with the results allowing us to: (1) extend the previously defined zones laterally for over 200 km; (2) show that a zone of hyper-extended continental crust some tens of kilometres wide displays complex basement faulting with possible low-angle detachments and polyphase faulting; (3) define a transparent seismic character within the serpentinized basement zone; and (4) determine that the oldest oceanic crust is thin and structured with an age of about 70–65 Ma, similar to the 'proto-oceanic' domain defined on other margins. Therefore, seafloor spreading begins at about magnetic chron 31, earlier than the well-defined chron 27.

These results are compared to earlier studies of the West Greenland conjugate margin, and, other well-studied magma-poor margins. Given this rift occurred in thick, cold cratonic lithosphere, the results are remarkably similar to those rifts in Phanerozoic terrain off Iberia and Newfoundland, suggesting that a long rift history and/or mantle metasomatism may have weakened the cratonic lithosphere prior to the main rifting event.

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