Rifting and magmatism in cratonic lithosphere: the rifted margin off northern Labrador, Canada

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High quality seismic reflection data from the offshore northern Labrador rifted margin allows imaging of the extended and rifted crust both along and across the continental margin. We describe these in conjunction with available seismic velocity and gravity data. The margin formed within cold, thick cratonic lithosphere. Both basement and a discrete, high-amplitude, deep reflection about 10 km below basement are observed. The deeper reflection can be correlated with the crust-mantle boundary as measured on previous wide-angle seismic data in the region, where the crust has been thinned to about 10 km. This reflection, termed here the L-reflection, disappears where the crust is greater than about 14 km thick.

We suggest that the L-reflection is the equivalent to other top mantle detachments found elsewhere on magma-poor rifted margins, such as the S-reflector off Iberia. However, here the reflection occurs below thicker crust than elsewhere, possibly because of the occurrence of colder, more brittle crust. There is some evidence to support a zone of exhumed serpentinized mantle seaward of the thinned continental crust, including previous wide-angle seismic velocity results and the low reflectivity of basement in this zone. A gravity model across the margin is also consistent with this possibility, and it is supported by north-south correlations, linking the central Labrador margin where more data is available with this northern Labrador region.

A crustal cross-section across this margin and its conjugate off West Greenland at the end of rifting in Late Cretaceous/Paleocene time shows marked asymmetry, with a wider zone of crustal thinning on the Greenland side. This asymmetry is reversed to the south of the study region, as determined in previous studies. These crustal thinning profiles are comparable to those observed on other margins where the rift formed within cratonic lithosphere. While the attributes of this margin are mainly those of a magma-poor system, at the continent-ocean boundary, thick igneous crust creates a magma-rich zone in Paleocene time, when there was a hot spot in the Davis Strait to the north. Thus, this margin exhibits characteristics of both magma-rich and magma-poor systems.

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