

Sandstone provenance of the COST G-2 well, Georges Bank; relevance to the SW Scotian Basin

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The Georges Bank is a large (~250 km) shallow bank, in a chain of banks along the continental shelf of eastern North America. It formed during rifting of North America and northern Africa in the Late Triassic and Early Jurassic. In the existing literature, the Mesozoic to Cenozoic stratigraphy of Georges Bank Basin is interpreted to be similar to the southwestern Scotian Shelf. Nevertheless, the sources of clastic sediments deposited on the bank during this time have not been previously studied. Both Georges Bank and the SW Scotian Basin could have been sourced by the same rivers, either local rivers draining Maine or rivers coming from the Canadian Shield and Appalachians through the Bay of Fundy.

This study aims to determine the source of the sandstone, and hence river patterns, by analyzing the modal composition and chemical variations of detrital minerals in the COST G-2 well at different stratigraphic levels. Modal composition was determined by counting stable detrital grains from back-scattered electron images for samples from the Late Jurassic to Late Cretaceous.

The data show two distinct mineral assemblages, which might indicate either potential sources or the effects of diagenesis with increasing depth. The first assemblage, including Early and Late Cretaceous samples, contain major amounts of tourmaline, zircon, staurolite, and apatite with minor monazite, xenotime and andalusite. The second assemblage from a Late Jurassic sample contains zircon, hornblende, orthopyroxene, garnet, and tourmaline, with minor amounts of monazite.

Chemical fingerprinting of stable detrital minerals, such as tourmaline, garnet, and zircon; less stable detrital minerals, such as micas; and detrital lithic clasts are used to identify potential sediment sources. Late Jurassic and earliest Cretaceous tourmaline chemistry suggests a granitic and/or metapelitic and psammitic source, with tourmaline types 1 and 4 dominating. Towards the Late Cretaceous, tourmaline type 4 predominates with minor type 1 and 3, indicating metapelitic and psammitic source rocks with a small influence from granitic and meta-ultramafic sources.

Understanding the principal sediment sources and river pathways at the COST G-2 well in Georges Bank will be useful in understanding the dispersal of coarse clastic sediments from the shelf to the slope in the southwestern part of the Scotian Basin. Furthermore, detrital petrology influences diagenesis and reservoir quality in oil and gas reservoirs. Future work will involve the comparison of the findings to equivalent formations in the Scotian Basin.