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Detrital zircon U-Pb and fission-track double-dating of Jurassic to Cretaceous reservoir sandstone units in the Jeanne d'Arc basin, offshore Newfoundland

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Summary

The Newfoundland margin is the type example of a magma-poor rift system and generally developed as a result of Late Triassic to Early Cretaceous lithospheric stretching-thinning, Early to mid-Cretaceous mantle exhumation, and mid- to Late Cretaceous lithospheric breakup processes during the protracted opening of the North Atlantic Ocean. The precise timing, rates, and spatial patterns of tectonic exhumation along modern magma-poor rift margins are uncertain globally, and in the Grand Banks of Newfoundland there remain many questions about how such long-term rift processes affected the filling history of the Jeanne d'Arc basin that currently hosts four offshore oil fields. Ongoing stratigraphic analysis and detrital zircon U-Pb and fission-track double-dating studies of Jurassic to Cretaceous reservoir sandstone units from the Jeanne d'Arc basin will investigate the connections between tectonic exhumation, sediment routing, and deposition along the Newfoundland margin. Specifically, we have targeted syn-rift strata of the Late Jurassic Jeanne d'Arc and Early Cretaceous Hibernia formations and pre- to post-breakup strata of the mid-Cretaceous Ben Nevis and Nautilus formations from the Terra Nova, Hibernia, and Hebron oil fields. This research will test the hypothesis that syn-rift to post-breakup strata contain local, Proterozoic to Paleozoic basement-derived detrital zircon grains with younger fission-track ages that progressively record Mesozoic cooling events related to stretching-thinning, mantle exhumation, and breakup processes along the Newfoundland margin. Based on the evidence for minor Late Jurassic to Late Cretaceous volcanism in the Grand Banks region, we anticipate that the youngest zircon U-Pb populations will identify the maximum depositional ages of reservoir sandstone units, and in combination with the fission-track results, assist in estimating exhumation rates during long-term rift evolution. New sediment routing constraints for the Newfoundland margin will be integrated with published marine seismic and scientific drilling data to build a synthetic rift development model that can be applied to magma-poor margin systems around the globe.