Tectonic interpretation of the Neoproterozoic-lower Paleozoic Franklinian margin of the northwestern Canadian Arctic

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GeoConvention 2012:Vision

Summary

We integrate new data from northwest Victoria Island with a synthesis of the Franklinian margin to infer the geometry of the rifted margin during the breakup of Rodinia.

Two fault trends at Victoria Island are postulated to have been active in the Neoproterozoic. (1) North and northwest-striking syn-magmatic fault zones host dykes of the Franklin magmatic event that indicate fault activity at ca. 720 Ma (Bedard et al.; Heaman et al.). (2) Cambrian strata overlie different stratigraphic intervals of the Shaler Supergroup across east-northeast-striking faults, indicating post-Shaler, pre-Cambrian stratigraphic separation > 100 metres. The distribution of facies and Cambrian strata themselves are suggestive of deposition within paleotopographic lows, similar to patterns on the mainland to the south.

Underlying the Sverdrup basin, northwest of Victoria Island, Neoproterozoic and Cambrian facies define a shelf (Arctic Platform) and slope (Deep Water Basin). We interpret the NE trend of the old shelf-shope break to parallel the overall trend of the rifted margin. The Deep Water Basin probably overlay extended continental crust. We propose that the orthogonal change in trend of the shelf-slope transition near Prince Patrick and Melville islands reflects a NW-trending transfer zone that has been truncated by the present continental margin formed during Cretaceous opening of the Arctic Ocean. Banks Island was thus part of the Neoproterozoic-lower Paleozoic Arctic Platform, which was truncated by rifting in the Cretaceous, and therefore likely has a counterpart somewhere across the Arctic Ocean.

We relate the northwest-striking faults on Victoria Island that were active at 720 Ma to a transfer zone that separated the Arctic Platform on Banks and Victoria islands from the Deep Water Basin underlying the Sverdrup Basin to the northeast. The east-northeast-striking faults on Victoria Island are similarly correlated to the overall trend of the Franklinian margin.