A unified model for the opening of the Canada Basin

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Summary

The timing and mechanism for opening of the Canada Basin have been widely debated for many years. Jurassic, Lower Cretaceous and Middle Cretaceous ages have all been proposed for the timing of opening, and wiper, complex rift and strike slip mechanisms have been suggested as opening mechanisms. Historically, a key issue has been the recognition of a different “breakup” age along the margins of the Canada Basin (e.g. Embry & Dixon 1990, Embry & Dixon 1994, Lane 1997).

A new model that makes use of recently acquired long-record seismic reflection data from the Canadian Beaufort Sea can reconcile these differences. Even in the most distal areas covered by the new data, a syn-rift megasequence can be identified. This strongly suggests that the seismic database is everywhere underlain by stretched continental crust; nowhere is oceanic crust evident. A major transform fault is proposed to separate attenuated continental crust beneath the Canadian Beaufort Sea from oceanic crust believed to be present beyond the 3 km isobath; this transform fault can be drawn as a small circle from the pole of rotation for the Arctic Alaska plate. A spreading ridge offset by transform faults can be drawn along the gravity low that bisects the basin using a similar model of small circles. In the unified model, rifting ended on the conjugate Alaska & Banks Island Margins when seafloor spreading in the Canada Basin began in the Hauterivian (133 Ma). In contrast, to the south of the transform fault, the plate motion during seafloor spreading was accommodated by continued continental rifting in the Canadian Beaufort Sea. The top syn-rift / base post-rift boundary in the Beaufort Sea therefore marks the end of seafloor spreading in the Albian/Cenomanian (100 Ma). The average spreading rate along the margin of the Chukchi Borderland is c.40 mm/a (1400 km in 33 Ma)

The model reconciles the difference in “breakup” age noted by many authors in the North American Arctic. The model is also consistent with published paleomagnetic studies and is supported by new subsidence analyses in and around the Canada Basin. In many ways the model is similar to the present-day situation in the Russian Arctic, where seafloor spreading in the Eurasia Basin is accommodated by active continental extension in the Laptev Sea.

References

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