Sedimentological Data From the Tanquary High: New Constraints for the Extensional History of the Sverdrup Basin and the North East Canadian Arctic

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ABSTRACT

The Sverdrup Basin is a Carboniferous to Late Cretaceous extensional basin exposed in the NE Canadian Arctic, on the flank of the Amerasia Basin. It contains up to 13 km of Carboniferous to Late Cretaceous marine to continental sediments. These strata are anomalously thick when compared to surrounding areas in the Arctic and its currently understood extensional history. There is significant uncertainty regarding the key tectonic events that controlled the evolution of the Sverdrup Basin. The main reason for this uncertainty is that shortening related to the latest Cretaceous to Palaeogene Eurekan Orogeny overprinted any structures related to the earlier basin development and direct observations of potential Carboniferous to Late Cretaceous faults are difficult, if not impossible. The prevailing view is that the basin was initiated as a result of rifting during the early Carboniferous to the early Permian, with a second rift event occurring during the Late Jurassic to the Early Cretaceous. Accordingly, most of the Mesozoic is interpreted to be dominated by tectonic quiescence. However, this fails to explain the creation of accommodation space for 13 km of sediments, particularly during the Triassic, which in places comprises up to 4 km of strata. Based on sequential restorations of structural cross-sections derived from published maps and from our field data we identified syn-sedimentary Triassic and Jurassic extensional faults in the Sverdrup Basin across which strata change their thickness. However, a lack of published works documenting thickness variations at the basin scale prevented us from estimating the timing of deformation in more detail. This work presents sedimentological data from the Tanquary High, a basin-scale basement high located at the margin of the Sverdrup Basin, where significant thickness changes of Carboniferous to Cretaceous sedimentary units have been mapped and are likely to be related to syn-sedimentary faults. Stratigraphic sections were logged in the field in order to quantify these thickness variations and to identify major stratigraphic trends. Our results support two previously unidentified phases of extensional faulting. These newly recognised periods of fault activity help to constrain the yet enigmatic geological evolution of the Amerasia Basin and the Arctic Ocean.