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Mesozoic fault activity and diapirism in the Sverdrup Basin: new insights into the tectonic evolution of the NE Canadian Arctic.

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The Sverdrup Basin is a northeast-southwest trending depocentre in the central to north-eastern parts of the Canadian Arctic Islands. It contains anomalously thick (13 km) Carboniferous to Upper Cretaceous strata when compared with surrounding areas (e.g. Arctic Alaska). However, the mechanism for the creation of 13 km of accommodation space is poorly understood, because faults created during the formation of the Sverdrup Basin have been obscured by deformation related to the Eurekan Orogeny.

The current understanding is that the basin was initiated by extensional faulting during the Mississippian as a result of the gravitational collapse of the Ellesmerian Orogen. During the Late Carboniferous to Cretaceous, the basin experienced tectonic quiescence and passive subsidence. This was, interrupted by a period of renewed extension in Early Cretaceous time [1]. Most of these periods were accompanied by the rising of salt diapirs from the Carboniferous Otto Fiord evaporites (Figure 1), some of which formed a salt canopy on Axel Heiberg Island [2]. The latest Cretaceous to Paleogene was characterised by shortening related to the Eurekan Orogeny that masked the previous geological history.

Based on field data collected by CASP and data found in the literature, the presented work shows a balanced cross-section across the Sverdrup Basin. The main objective is to refine the structural evolution of the area. Sequential restorations reveal major thickness variations of Triassic and Jurassic strata across presently inverted extensional faults that support fault activity during Mesozoic time. These cross-sections, additionally, illustrate the growth of diapirs during most of the Mesozoic (Figure 1), which help to explain the accumulation of 13 km of sediments.

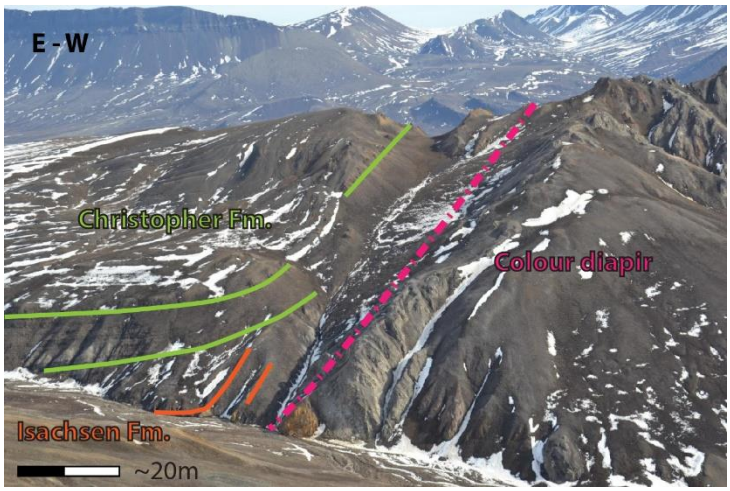

Figure 1: View of the Colour diapir (arisen from the Otto Fiord evaporites) and associated halokinetic folds in the Cretaceous Isachsen and Christopher formations, Axel Heiberg Island.

These newly identified periods of Mesozoic extensional fault activity have implications for hydrocarbon exploration as they may support evidence for poorly-constrained tectonic events in adjacent rift systems of the Arctic or North Atlantic. Additionally, constraining the timing of fault movements and diapirism is important because of the insights it can provide into the palaeogeography of the Canadian margin of the Canada Basin.

References:

[1] Embry and Beauchamp (2008) In: *Sedimentary basins of the world.* University of Toronto, 451–471

[2] Harrison JC and Jackson MPA (2014) Basin Research 25: 1-30