

Correlation of sedimentary and tectonic evolution on Svalbard (Barents Shelf), North Greenland and Ellesmere Island (Canadian Arctic) in the last 650 million years

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The comparison and correlation of the large sedimentary basins and tectonic events of Pearya (i) (a terrane at the northern margin of Ellesmere Island), on Ellesmere Island (ii), in North Greenland (iii) and on Svalbard (iv) (Barents Shelf) show the succession of several phases of different and similar development of the involved continental plates since late Neoproterozoic times until today.

Until the Late Devonian, the geological evolution of Pearya/Svalbard (i, iv) on the one hand and Ellesmere Island/North Greenland (ii, iii) on the other hand took place separately:

The deposition of Vendian diamictites (tillites) and thick sedimentary successions on Svalbard (iv) and Pearya (i) indicate a close connection of both plates in the Late Neoproterozoic and Early Paleozoic. This is supported by the deformation and metamorphism of the Caledonian and M'Clintock orogenies in the Ordovician in both areas. Another similarity is the intrusion of post-tectonic granites in Devonian times.

In contrast, Ellesmere Island (ii) and North Greenland (iii) represent the passive northern continental margin of Laurentia to the same time, which is characterized by the deposition of the sediments of the Franklinian Basin. The several kilometres long basin is separated in a northern deep-water trough and a shelf area in the south.

The Ellesmerian and Svalbardian deformation at the boundary Latest Devonian/Earliest Carboniferous is dominated by extended compressive movements which affected the infill of the Franklinian Basin as well as the Caledonian Orogen and the post-Caledonian Old Red-basins on Svalbard.

After the Ellesmerian/Svalbardian deformation and the resulting docking of Pearya/Svalbard (i, iv) against the northern margin of Laurentia (ii, iii), the evolution in all four areas continues almost identical since Viséan times. The development of the Sverdrup Basin (i, ii), the Wandel Hav Basin (iii) and the Spitsbergen Central Basin (iv) was initiated by a phase of extensional tectonics and the formation of fault-bounded basins with the deposition of red-beds and evaporites. The main basin evolution was dominated by a carbonaceous platform sedimentation from the Late Carboniferous until Permian times. The Mesozoic is in all four areas characterized by the deposition of clastic, mostly marine sediments.

Due to the plate-tectonic re-configuration of the Arctic during the break-up of Laurasia and the formation of the Arctic and North Atlantic oceans, all four areas were affected by a succession of compressive and lateral movements of the Early Tertiary Eurekan Deformation (i, ii, iii) and the formation of the West Spitsbergen Fold-and-Thrust Belt (iv). This very complex intracontinental deformation between the North American, Greenland and Eurasian plates took place before the separation of Greenland and Svalbard and represents the last tectonic events which affected all four areas. As a result of the opening of the Arctic Ocean, Pearya (i) remained situated at the northern margin Ellesmere Island and became part of the North American plate (ii, iii). Since the termination of the Eurekan Deformation in the Late Eocene/Early Oligocene, the geological evolution of Pearya, Ellesmere Island and North Greenland (i, ii, iii) on the one hand and Svalbard (iv) on the other hand is again different.

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