

Svalbard Warm Arctic Palaeoclimate Laboratory – sedimentology as a tool to forecast the future

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The Svalbard archipelago, currently located at c. 78-80 degrees N in a high Arctic climate, contains a unique record of terrestrial to coastal response to a warm Arctic climate from the Paleocene to Eocene. More than 500 drill cores, originally obtained for coal exploration, provide densely spaced data points through a paralic succession particularly from the Paleocene but some also spanning the PETM (Paleocene-Eocene thermal maximum). The Palaeogene “Central Tertiary Basin” in Svalbard formed as a foreland basin in response to the Eurekan orogeny (Piepjohn et al. 2015). At the time of deposition Svalbard was located at c. 75 degrees north in a world with pCO₂ levels rising from c. 400ppm to between 1000-2000 ppm, and global temperatures 8-10 degrees warmer than present (IPCC AR6 Technical Summary). The Van Mijenfjorden group comprise 1900 m of clastic sediments from terrestrial to marine environments recording tectonic and climatic changes from the Palaeocene to Eocene of Svalbard, with the terrestrial to paralic formations providing unique insight into land surface characteristics and changes in a warm world Arctic, characterized by extreme seasonality (midnight sun and polar night) and with no modern analogues.

The terrestrial landscape was characterized by low-gradient hills and valleys and extensive forested peat- and wetlands. The high-resolution grid of data across the basin allows for detailed studies of response of wetlands to terrain, shoreline position, coastal palaeo-geomorphology and changes in drainage patterns. We present case studies from the Paleocene Firkanten Formation showing current work to understand the accumulation, stability and demise of peatlands in a warm Arctic setting. We show how the palaeo-peat (coal)-record is in itself a high-resolution palaeoclimate record of atmospheric dust, charcoal from forest fires and possibly of other proxies. And we discuss the potential for using the Palaeogene Foreland basin in Svalbard as a terrestrial palaeoclimate laboratory for a future warm Arctic.

References

Piepjohn, K., von Gosen, W., Tessensohn, F. *et al.* 2015: Tectonic map of the Ellesmerian and Eurekan deformation belts on Svalbard, North Greenland, and the Queen Elizabeth Islands (Canadian Arctic). *Arktos* 1, 12. <https://doi.org/10.1007/s41063-015-0015-7>