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Mid- to Late-Holocene climate variability inferred from XRF and image colour analyses of laminated lake sediment near Kangerlussuaq, South-west Greenland

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The area of southern West Greenland between 66°N and 68°N contains approximately 20000 lakes. There is a strong climatic gradient between the present day ice sheet margin and the coast. The zone immediately adjacent to the ice sheet is continental with low precipitation (<170 mm) and a mean annual temperature of –6°C. There are often large areas of bare rock, as well as aeolian deposits on the drier, south-facing slopes, and more luxuriant vegetation is associated with damper hollows and lake outflows. The rocks are dominantly gneisses and granites. Lake G (SS1220) is located 20 km northeast of Kangerlussuaq (lat. 67°03', long. 51°13', altitude 338 masl, maximum lake depth 17 m). The lake is an oligotrophic, dimictic freshwater (conductivity ∼230 µS cm–1) system due to an outflow that drains the lake on the north side. The lake sediment consists of tightly laminated calcareous gyttja. Dating control is provided by 10 AMS 14C dates. Here we present XRF data and colour information extracted from digital images and provide a preliminary interpretation of their palaeoenvironmental significance.
The sediment sequence was divided into three zones: Zone 3 c. 5200 – 2450 cal. yr BP, Zone 2 c. 2450 – 840 cal. yr BP and Zone 1 c. 840 – 280 cal. yr BP. Zone 3 is characterised by a high organic content and elevated conductivity* (until 4300 cal. yr BP) and a low detrital minerogenic content probably suggesting warm and dry conditions prevailed to about 4300 cal. yr BP. From 4300 yr BP, locally wetter conditions may have prevailed. Zone 2 shows periodically changing redox conditions, low detrital minerogenic content and increased conductivity suggesting variable thermal straitification, intensity of hypolimnetic anoxia driven by greater climate variability. Zone 1 coincides with the onset of the Little Ice Age and is characterised by increased detrital minerogenic matter, decreasing organic matter and increased salinity likely suggesting drier and colder conditions reflecting changing regional aeolian activity.