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In search of a stratigraphic subdivision of the period 8-0 ka in Greenland ice cores

Mat De Jong (1), Harry Seijmonsbergen (2), and Leo de Graaff (3)

(1) Surface and subsurface resources, Haarlem, The Netherlands (mdejong@susures.nl), (2) Institute for Biodiversity and Ecosystem Dynamics (IBED), University of Amsterdam, The Netherlands (a.c.seijmonsbergen@uva.nl), (3) Research Foundation for Alpine and Subalpine Environments (RFASE), Amsterdam, The Netherlands (leowsdegraaff@kpnmail.nl)

The δ18O and [Ca2+] data for the Holocene period from 8 ka to the present (i.e. 0.1 bk2) in the Greenland NGRIP1, GRIP, DYE-3 and GISP2 ice cores have been analyzed with conventional and unconventional stratigraphic techniques in search of potentially meaningful boundaries and units. Pattern matching of the profiles is supported by using graphical display enhancements and maximum entropy-based spectral trend curves. A compound δ18O profile has been generated through stacking of the data of the four ice cores, to facilitate the analysis of the individual profiles and their relevance in the regional context. The proposed stratigraphic scheme addresses the vertical (temporal) patterns of change in the data, taking into account lateral (spatial) variability.
The hitherto poorly resolved trends in the δ18O profiles on a millennial time scale are now better defined and four stratigraphic units are identified (8.1-4.9 ka, 4.9-3.3 ka, 3.3-1.9 ka, 1.9-0 ka), resulting in an improved description and understanding of the general climate change after the Holocene climate optimum over Greenland.
Correlatable higher-order boundaries in the δ18O profiles are identified within these units in the four ice cores. The layers between the boundaries show δ18O patterns which generally are similar in character, the differences tentatively being ascribed to lateral variations in the factors that control the isotope content of the ice rather than to factors of error or uncertainty in the data. The layering forms a series of short-lived low-amplitude aperiodic oscillations on a centennial time scale (in the 100 to 500 years range). The suggestion is that these higher-order stratigraphic boundaries and δ18O oscillations have climatic significance, although their precise nature and cause are as yet unknown.
Equivalent patterns are tentatively identified in ice-core data from the geographically separate Agassiz (Ellesmere Island, Canada) and Renland (East Greenland) ice caps.
Comparison with other high-resolution climate proxies or stratigraphies from the Northern Hemisphere is expected to render support for the here proposed scheme, which has the potential to become a reference framework for the analysis of the dynamics of the long-term and short-term climatic fluctuations for the study period.