

p. 54: Comparison between the isotope 'curve and other records allows no conclusion as to temporal variation of the rate of accumulation, because the present thickness of an old annual layer depends on several parameters not considered here, e.g. the temperatures to which the layer has been exposed since the time of deposition'.

We must conclude that Dr Mörner has not read the 1971 paper prior to criticism.

References

- Dansgaard, W., Johnsen, S. J. Møller, J., and Langway, C. C. 1969. One thousand centuries of climatic record from Camp Century on the Greenland Ice Sheet. *Science* **166**, 377–81.
- Dansgaard, W., Johnsen, S. J., Clausen, H. B., & Langway, C. C. 1971. Climatic record revealed by the Camp Century ice core. In Turekian, K. K. (Ed.): *Late Cenozoic Glacial Ages* (volume dedicated to R. F. Flint). Yale Univ. Press.
- Mörner, N.-A. 1972. Time scale and ice accumulation during the last 125,000 years as indicated by the Greenland O¹⁸ curve. *Geol. Mag.* **109** (1). 17–24.

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Pleistocene chronology

SIR,—Dr N.-A. Mörner, in the *Geological Magazine* (109 (1) 17–24) and in other recent papers, makes use of what he calls an 'astronomical' or 'geological-astronomical' chronology. An occasional reference in the text shows that the scale is one put forward by Kukla in 1969, but the terms are used without qualification in figure captions and table headings, and in most instances in the text. To most geologists, a reference to an astronomical time-scale in connection with Pleistocene dating would suggest the scale proposed by Milankovitch and discussed by Zeuner, but Kukla's scale is a different one. Unless the scale intended is clearly indicated, the use of the Kukla time-scale in figures and tables is likely to lead to confusion.

Dr Mörner appears to reject 'for geological reasons' all radiocarbon dates exceeding about 32,000 years, but he does not make clear what these reasons are.

A simple test of the time-scale advocated by Dr Mörner demonstrates its unsuitability. He shows Würm I extending from 72,000 to 60,500 years B.P. Within this period there are, in different regions, apparently reliable radiometric dates on coral spanning the range 67,000 to 62,000 years. This indicates comparative warmth, a conclusion supported by a number of radiocarbon dates on terrestrial material. Unless this radiometric evidence can be shown to be erroneous, it is not possible to accept the dating of the greatest severity of the early Würm glaciation at about 66,000 years, as required by this so-called astronomical scale. Dansgaard's dating of the Greenland ice-core also suggests that most of the period between 70,000 and 62,000 years B.P. was of more than average warmth.

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