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CHANGES OF ATMOSPHERIC METHANE CONCENTRATION PARALLEL TO CLIMATIC CHANGES

(Abstract)

by

B. Stauffer, H. Oeschger and J. Schwander

(Physikalisches Institut, Universität Bern, Sidlerstrasse 5, CH-3012 Bern, Switzerland)

Measurements on ice-core samples showed that atmospheric methane concentration changed with the large climatic cycles during the last two glaciations (Stauffer and others, 1988; Raynaud and others, 1988). The methane concentration is lower in cold periods and higher in warm periods. In this paper we discuss the results of CH_4 measurements of samples from periods of minor climatic change, like the climatic optimum 8000 years B.P. and the Younger Dryas period about 10 000 to 11 000 years B.P.. The data are interpreted in terms of the present understanding of methane sources and sinks.

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HOLOCENE PALEOENVIRONMENTAL RECONSTRUCTION FROM DEEP GROUND TEMPERATURES, CANADIAN ARCTIC ARCHIPELAGO: A COMPARISON WITH CLIMATIC INFERENCES FROM THE $\delta^{18}O$ RECORD OF ICE CORES

(Abstract)

by

Alan E. Taylor

(Permafrost Research Section, Geophysics and Terrain Sciences Branch, Geological Survey of Canada, 1 Observatory Crescent, Ottawa, Ontario K1A 0Y3, Canada)

The $\delta^{18}O$ record from ice cores serves as a proxy paleoclimatic temperature record, through the association of isotopic ratio to air temperatures at time of precipitation. Climatic change may be preserved also as a signal in ground temperatures, not as a proxy indicator of past climate but as a direct consequence of the effect of past air temperature variations and associated physical processes at the ground surface. In the Canadian Arctic Archipelago, $\delta^{18}O$ records are available from the Devon and Agassiz ice caps, and precision ground temperatures to depths of up to 1000 m are available from 40 petroleum exploration wells, about one third of which are suitable for paleo-environmental reconstruction. There is an opportunity to compare these two methods of looking at the paleo-environment, and to show how complementary they are to each other.

Geothermal analysis is predicated on the fundamental hypothesis that the terrestrial heat flow, which arises largely from the decay of radioactive elements within the crust, does not vary measurably in the upper few km. But at many wells, the heat flow, calculated as the product of the measured temperature gradient and rock thermal conductivity, does vary systematically with depth in the well. While more random variations may be attributed to measurement errors, and corrections may be made for such known effects as local topography, the residual coherent "long wavelength" variation may be ascribed to effects arising from climate change.

Can we, then, determine whether a particular temperature history is consistent with the geothermal record, or ideally, invert the geothermal data to reveal a record of past surface temperatures? Attempts with varying success at paleoclimatic reconstruction from ground temperatures have been reported in the literature (e.g. Lane, 1923; Hotchkiss and Ingersoll, 1934; Birch, 1948; Cermak, 1971; Vasseur and others, 1983; Lachenbruch and others, 1986) and from temperature profiles in ice sheets (e.g. Paterson, 1968; Weertman, 1968; Budd and Young, 1982).

In this study, standard techniques in geothermics (e.g. Jaeger, 1965) have been used (1) to show the effect of any hypothesized surface paleotemperature model upon subsurface temperatures, or (2) on the hypothesis that the variation in heat flow is attributed to paleoclimatic effects, to derive a surface temperature model at each well that minimizes the

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