HAL
open science

ON THE D.C. ELECTRICAL CONDUCTIVITY AND ACIDITY OF POLAR ICE CORES

C. Hammer

▶ **To cite this version:**

C. Hammer. ON THE D.C. ELECTRICAL CONDUCTIVITY AND ACIDITY OF POLAR ICE CORES. Journal de Physique Colloques, 1987, 48 (C1), pp.C1-651-C1-651. 10.1051/jphyscol:1987193 . jpa-00226459

HAL Id: jpa-00226459

https://hal.science/jpa-00226459v1

Submitted on 4 Feb 2008

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

JOURNAL DE PHYSIQUE
Colloque C1, supplément au n° 3, Tome 48, mars 1987

ON THE D.C. ELECTRICAL CONDUCTIVITY AND ACIDITY OF POLAR ICE CORES

C.H. HAMMER

Department of Glaciology, Geophysical Institute, University of Copenhagen, DK-2200 Copenhagen, Denmark

Abstract : The electrical conductivity method, ECM is a method, which has proven to be a powerfull tool in glaciology, as it serves to indicate ice layers of high acidity in polar ice cores (1) : such layers are often associated with deposition of acid products from volcanic eruptions. The ECM technique has also been applied to infer seasonal changes in ice acidity as well as to indicate layers of low acidity and alkaline ice (1), (2) and (3).
Presently a controversy exists concerning the precision of the method, especially for ice core acidities in the range of neutral to approximately 3μeq.H+/kg ice (4). In this paper an attempt is made to discuss both the cause for this controversy and to present data, which suggest, that the ECM is a quantitative method if applied correctly.
The paper is divided into two parts :

1) Acidity, pH and ECM
2) Some electrical conduction experiments on polar ice cores.

The second part should help to solve the problem of d.c. electrical conduction of polar ice. Among the experiments are e.g. the measuring of activation energies of low and high conductive layers in the Byrd ice core ; the temperature range from -7°C to -43°C.
Finally the conduction mechanism will be discussed in terms of the mobility of charge carriers in ice, electrical field and charge transfer at the electrodes.

References
(1) Hammer, C.H., Journal of Glaciology (1980).
(2) Hammer, C.H., The Journal of Physical Chemistry (1983).
(3) Hammer, C.H. et al., AGU Monograph (1985).
(4) Wolff and Peel, Nature (1985).

COMMENTS

T.H. JACKA

Is the dating of the conductivity measurements carried out by counting $\delta^{18}(O)$ annual layers, or by matching the conductivity measurements themselves to known past events such as volcanic eruptions, and by counting annual layers detected by the conductivity measurements?

Answer :

The dating is performed by crossdating seasonal variations of $\delta^{18}(O)$ and continuous conductivity data. We have not yet used the volcanic events to change to timescale ; when more ice cores (dated in this way) becomes available, we will compare the dating of the cores in order to remove subtle years. In the latter case we will use the volcanic events to adjust the dating if necessary. This will be important, when comparing different cores by time series analysis.

Article published online by EDP Sciences and available at http://dx.doi.org/10.1051/jphyscol:1987193