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VERTICAL DISTRIBUTIONS OF LOW MOLECULAR WEIGHT DICARBOXYLIC ACIDS IN THE H15 ICE CORE FROM ANTARCTICA (ABSTRACT)

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An ice core (120 m long, *ca.* 400 years old) was taken in 1991 from Site H-15 in Antarctica (69.05′S; 40.47′E, altitude: 1057 m). Thirty six ice sections were analyzed for low molecular weight dicarboxylic acids and related compounds using capillary gas chromatography and mass spectrometry. A homologous series of α, ω-dicarboxylic acids (C_2-C_{12}) and ω-oxocarboxylic acids (C_2-C_5, C_7, C_9) were detected as well as pyruvic acid (C_3) and α-dicarbonyls (C_2, C_3). Dicarboxylic acids were the most abundant compound class (0.15-10 ng/g-ice, av. 1.6 ng/g-ice). Oxalic (C_2) was found as the dominant diacid species (0.08-2.9 ng/g-ice, av. 0.68 ng/g-ice), followed by azelaic (C_9) acid (0.013-2.7 ng/g-ice, av. 0.30 ng/g-ice). The relative abundance of azelaic acid suggests that the dicarboxylic acids are derived by photochemical oxidation of unsaturated fatty acids, which contain a double bond predominantly at the C-9 position and are emitted from sea surface microlayers to the atmosphere by a bubble bursting mechanism and transported over the Antarctic ice sheet.

Concentrations of the diacids were low (less than 1 ng/g-ice) in the period of 1630s-1850s, started to increase in the early 1900s, and reached a maximum (10 ng/g-ice) in 1990s with a sub maximum in the 1930-1950s. The trend of increased concentration in the 20th century appears to be consistent with the historical trend of sea surface temperature in the Southern Hemisphere, and suggests that the sea to air emission of unsaturated fatty acids and the subsequent transport over the Antarctic have been enhanced. This is likely caused by a possible sea ice retreat off the coasts of Antarctica. Further, the relative abundance of azelaic acid in the total diacids showed a sharp increase after the 1970s from around 10% to over 30%. This result may be involved with a possibility that the oxidizing capability of the Antarctic troposphere has recently been increased, probably due to ozone depletion in the stratosphere, which has been reported over Antarctica since the early 1970s.

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