

Trace element analyses in a Gregoriev ice core in Kyrgyz Tien Shan for the period 1800-2007AD

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Trace elements contained in ice cores provide various information with respect to environmental changes in the past. However, recent studies dealing such trace elements in ice cores, which were drilled in Asian regions, have been limited to decadal time scale.

In September 2007, a 87-m long ice core was drilled at the Gregoriev Ice Cap, Tien Shan Mountains, Kyrgyzstan. Age scale was given by counting the seasonal variation of pollen species validated with the 1963-tritium horizon up to depth of 67m, and by radiocarbon dating in deeper part. This core was estimated to cover over the past ten thousands years.

In this study, we analyze 53 species trace elements (e.g. Ti, Mn, Ni, Zn, Cd, Sn, Pb, REE) up to depth of 59.7m. We provide the longest continuous data with respect to trace elements in Asian ice cores.

We find that some anthropogenic elements (Ni, Cu, Zn, As, Cd, Sb, Sn, Pb) show different variation from those from the other regions in Asia whereas Ni, Cu, As Sb and Pb show similar variation. Sn concentrations increased slowly since the 1960s and decreased slowly since the 1980s. Cd concentrations exponentially increased since the second half of the 20th century presumably because of the increased fossil fuel consumption and the industrial expansion in this region. Cd concentrations gradually decreased since the 21th century because of the controlled industrial emissions in the Europe and North America. However, industrial expansion of the surrounding area (central Asia), might cause increase of Cd again.

Most of anthropogenic elements (Cu, As, Cd, Sn, Pb) show low concentration compared with the other Asian ice cores, while Antimony was contained in high concentration level (about twice) presumably because of the indigenous product in Kyrgyzstan and neighboring Kazakhstan.

Keywords: ice core, trace elements, anthropogenic elements, Grigoriev ice cap