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Dating of the ice core from south-east dome, Greenland

Content

In May 2021, a 250-meter-long ice core (SE-Dome II ice core) was drilled from the Southeastern Greenland Dome (67°11'30.14328"N, 36°28'12.77075"W, 3160.7 m a.s.l.), where is one of the highest accumulation areas in Greenlandic domes (Iizuka et al., 2021). The high accumulation enables past environmental reconstructions with a high-time resolution. The ice core arrived in cold rooms of Hokkaido University, Japan in November 2021. After the ice core arrival, we conducted the initial analyses and dating of the SE-Dome II ice core.

The SE-Dome II ice cores were stored at -50 °C. We conducted stratigraphical observations, density and electrical conductivity (DEP) measurements in the cold room (-20 °C). A high-resolution density profile was measured at 1 mm intervals by the X-ray transmission method (Hori et al., 1999). The spatial resolution of the density profile was 1 mm. We conducted electrical conductivity measurements at 250 kHz via the continuous dielectric profile (DEP) method (Fujita et al., 2016). The resolution of DEP was 20 mm. After physical analyses, we measured hydrogen peroxide concentrations of the melted samples with depth intervals about 50 mm.

The ice core dating was performed by an annual counting method based on the hydrogen peroxide depth profile. Since atmospheric hydrogen peroxide is mainly produced by photochemistry, it is well pronounced that the hydrogen peroxide minima correspond to mid-winter (e.g., Gfeller et al., 2014; Wheatley et al., 2012). Therefore, we counted the minima as mid-winter. In addition, the record of volcanic events identified by the DEP profile was used for determining time horizons. Following the NEEM's volcanic chronology (e.g., Sigl et al., 2013), major eruptions (VEI > 5) recorded in the SE-Dome ice core were identified. Melting events such as the summer of 2012 revealed by stratigraphical observations and density measurements were also used as time markers in the SE-Dome II ice core. A high-resolution density was used to calculate the accumulation rate.

The hydrogen peroxide profile has 222 minima, showing that the 250 m ice core covers the last 222 years (1799-2020). The DEP profile provides time horizons corresponding to eruptions of Katmai (1912), Galunggung (1822) and Tambora (1815). The dating from the hydrogen peroxide profile was in perfect agreement with the DEP time makers without a year's gap. The extreme melting events across the Greenland ice sheet were found in 2012 and 1889, supporting the timescale from 1799 to 2020 is succeeded without a year's gap.

In the presentation, we will report the seasonal level timescale of the SE-Dome II ice core with improved accuracy of dating and will estimate the accumulation rate from 1799 to 2020.

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