

**First high resolution, century-scale ice core records of hydrogen peroxide from West Antarctica: Contribution of accumulation variability**

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Hydrogen peroxide ( $\text{H}_2\text{O}_2$ ) is a major atmospheric oxidant that is closely linked to chemical feedback mechanisms controlling the composition of the atmosphere.  $\text{H}_2\text{O}_2$  is highly soluble and so is deposited in snow on the large ice sheets and preserved over time. Ice core records of  $\text{H}_2\text{O}_2$  offer the potential to reconstruct past changes in the oxidation capacity of the atmosphere if the processes controlling deposition and long-term preservation are quantitatively understood. The seasonal timing and rate of snow accumulation, as well as the site temperature largely determine the amount of  $\text{H}_2\text{O}_2$  preserved in an ice core.

We present the first high resolution, continuous century-scale records of hydrogen peroxide for West Antarctica. The records, developed using a Continuous Flow Analysis (CFA) system, are from many locations across the West Antarctic Ice Sheet (WAIS), including ITASE (International Trans Antarctic Scientific Expedition) and RIDS (Ross Ice Drainage System) traverse sites, Siple Dome and South Pole. A major advantage of CFA systems is that all high-resolution measurements are exactly co-registered in depth. The use of multiple chemical parameters reduces dating uncertainty to a minimum.

The wide spatial distribution of the core sites and varying depositional environments, such as up to a 5-fold change in accumulation rate and a  $30^\circ\text{C}$  difference in mean annual temperature, allows investigation of the processes that control preservation of  $\text{H}_2\text{O}_2$  – specifically the relationships between  $\text{H}_2\text{O}_2$  concentration and mean annual temperature, latitude and accumulation rate. Accumulation rates were derived from both the seasonal signal of various chemical parameters in the cores and from ERA-40 meteorological model simulations. Mean annual temperatures were taken from ERA-40 simulations as well.

We find high temporal covariance over large distances in  $\text{H}_2\text{O}_2$  concentrations preserved in the ice, although differences in accumulation regimes influence the absolute  $\text{H}_2\text{O}_2$  concentration level. Much of the covariance is likely the result of both shifts in accumulation rate and timing over large regions of West Antarctica and changes in atmospheric chemistry and solar radiation.