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Iron and titanium geochemistry for paleoclimate reconstruction from Talos Dome ice core (East Antarctica)

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Mineral dust affects the Earth's radiation budget. It can both scatter sunlight back to space (negative radiative forcing) and absorb solar and infrared radiation (positive forcing). Thus, in opposition to the greenhouse gases, the combination of absorption and reflection of solar radiation caused by dust microparticles can lead to a net (longwave and shortwave) negative radiative forcing at the surface and at the top of atmosphere.

Transported from the Southern Hemisphere continental landmasses to the remote East Antarctic plateau (long-term transport), mineral dust travels in the high troposphere and interacts with climate. However, processes occurring during atmospheric transport from source areas to polar ice sheets are responsible for the strong reduction of dust concentration and size in the polar atmosphere. Moreover, concentration and grain size, such as mineralogy and shape of dust and aerosols, influencing the dust radiative effect are still poorly known.

We present here new Synchrotron radiation spectroscopy data, i.e. X-ray Absorption Near Edge Structure (XANES) at the Fe and Ti K edge from Talos Dome dust samples (72°49'S, 159°110'E; 2315 m a.s.l.) spanning the last two climate cycles (ca. 250 kyrs). The analysis allows the reconstruction of dust geochemistry and Fe and Ti coordination state in selected climatic periods. Dust composition changes in time provide an important contribution to the scientific knowledge on palaeoclimate changes in near coastal regions of the Antarctic ice sheet and novel information on possible changes occurred at the source areas.