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Characterization of Saharan mineral dust transported to the Colle Gnifetti glacier (Southern Alps, Switzerland) during the last centuries.

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The Southern Alps act as a barrier to the southwesterly dust-laden winds from the Sahara, and the Colle Gnifetti saddle (45°55'N, 7°52'E, 4455 m asl in the Monte Rosa Massif) satisfactory conserves the history of climatic conditions over the last millennium (Thevenon et al., 2009). Therefore, the Colle Gnifetti glacier is a suitable site for i) studying the composition of past Saharan aeolian dust emissions, and for ii) comparing modern dust emissions with preindustrial emissions.
The mineral aerosols entrapped in the ice core have been analyzed for their physical (grain-size by image analysis), mineralogical (by X-ray diffraction), and chemical composition (by ICPMS and by mass spectrometry for Sr and Nd isotopic ratios). The mineral dust characteristics are then compared with present day Saharan dust samples collected at the high altitude research station Jungfraujoch (46°55'N, 7°98E, 3580 asl) and with documented potential dust sources.
Results show that i) the increases in atmospheric dustiness correlate with larger mean grain size, and that ii) the dust emissions increase after the industrial revolution, probably as a large-scale atmospheric circulation response to anthropogenic climate forcing (Shindell et al., 2001; Thevenon et al., 2009). However, geochemical variations in aeolian mineral particles also indicate that the source areas of the dust, which are now situated in northern and north-western part of the Saharan desert (Collaud Coen et al., 2004), did not change significantly throughout the past. Therefore, the mineralogy (e.g. illite, kaolinite, chlorite, palygorskite) and the geochemistry of the paleo-dust particles transported to Europe, are relevant to assess past African dust sources.

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