

Supplementary Materials

XANES iron geochemistry in the mineral dust of the Talos Dome ice core (Antarctica) and the southern hemisphere potential source areas

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Here we report the Student t-test for Sources Talos Dome (TD) mineral dust samples and the relationship between two datasets. It is clear that the possibility to obtain a reliable statistical analysis is limited by the differences in the single dataset consistency (Table SM1 in the main text). However, the Student t-test of Sources (table 1), shows that the Pampa and the Australia samples, characterized by deflation surfaces with soils more weathered (and high energy mean value of the Fe K-edge: 7,126.57 eV and 7,126.7 eV, respectively) are clearly different by Antarctica, Terra del Fuego and Patagonia, that present mainly, less weathered surfaces. Terra del Fuego and Antarctica and Tierra del Fuego and Patagonia exhibit larger distributions of the Fe K-edge energy respect to South America sources that partially overlap the energies distributions (fig. 1). More difficult is the interpretation of the Patagonia-Antarctica because the Student t-test demonstrates that the two groups are very similar almost with no differences. It is also true that the two mean energies are very close (7,125.53 eV and 7,125.60 eV, respectively), respect to Tierra del Fuego (7,124.74 eV).

Table SM1: Student t-test of sources

	Antarctica	Tierra del Fuego	Patagonia	Pampa	Australia
Antarctica					
Tierra del Fuego	2.1249 0.06928				
Patagonia	3.1175 0.7586	2.0551 0,06333			
Pampa	0.3192 <0.05	5.07450 <0.05	3.8723 <0.05		
Australia	9.7279 <0.05	5.5721 <0.05	4.6338 <0.05	1.5239 0.1488	

For the climatic periods the comparison is clearer because the Holocene is different respect to Termination I and MIS 2 periods, as expected. The comparison between Termination I and MIS 2 do not present any possibility to discriminate. This appears clear also looking at Fig. 4 where the distributions of the Fe K-edge energy of the two climatic periods are very similar.

Table SM2: Student t-test of TD dust samples

	Holocene	Termination I	MIS 2
Holocene			
Termination I	3.764 <0.05		
MIS 2	4.529 <0.05	1.288 0.227	

The Student t-test between the climatic periods and the single PSA presents, as discussed in the text, a clear overview of the possible transport along the Southern Hemisphere (Table SM3). In the last 25,000 years, during the MIS 2 only Patagonia and Terra del Fuego are the main PSA, excluding also Antarctica. During the Termination I, South America and Antarctica represent the main sources for the dust reaching Talos Dome with a small contribution from the Tierra del Fuego, probably covered by ice during most part of the deglaciation. The Holocene is not easy to interpret, due to the decrease of the iron K-edge energy vs. time. Only Tierra del Fuego seems compatible to Holocene samples, but it cannot be the only source. Possible contributions from Antarctica, whose dataset presents a very low variance respect to other less weathered PSA cannot be ruled out.

Table SM3: Student t-test of TD dust samples vs. sources

	Holocene	Termination I	MIS 2
Antarctica	3.146 <0.05	0.044 0.966	2.208 <0.05
Tierra del Fuego	0.034 0.974	2.051 0.086	1.307 0.239
Patagonia	3.208 <0.05	0.094 0.927	1.387 0.193
Pampa	12.453 <0.05	6.157 <0.05	15.249 <0.05
Australia	11.235 <0.05	5.17 <0.05	14.209 <0.05

Red = samples considered different; Blue = samples with small but significant differences (p close to 0.05); Black = similar samples.

Supplementary figures of the Fe K-edge XANES discussed in the text.

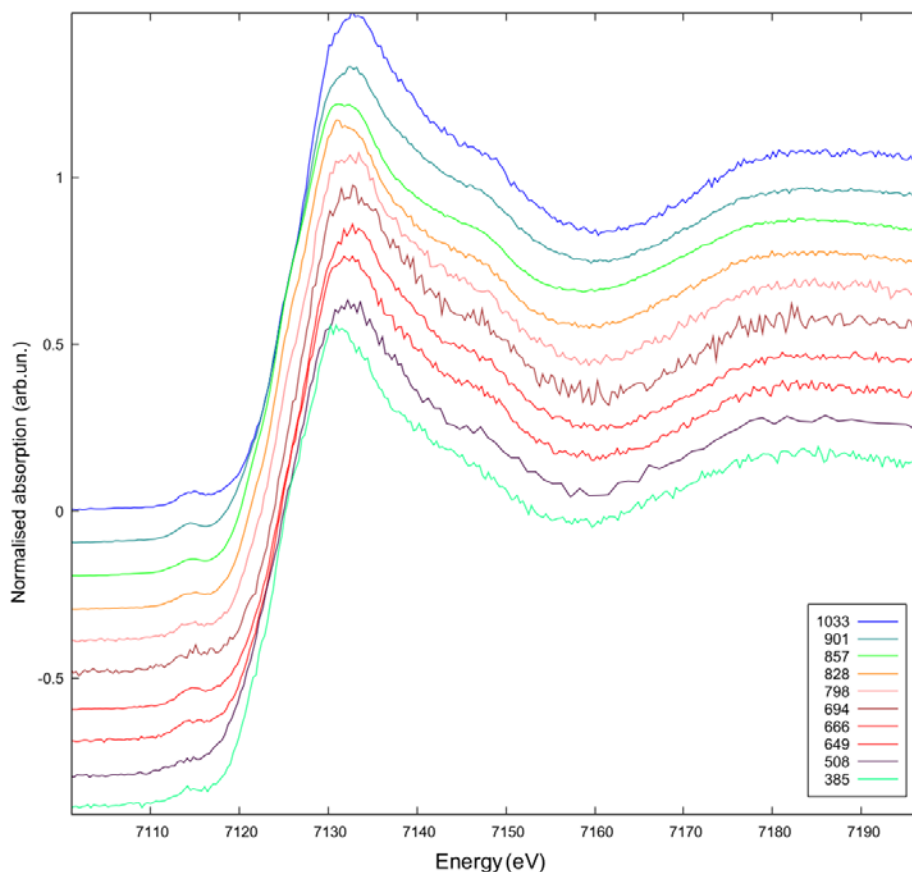


Fig. SM1: Comparison of XANES spectra at the Fe K-edge for some representative spectra of the TD ice core. The numbers in the inset refer to the sample depth and in specific Holocene (from 385 to 694 m depth), Termination I (798 and 828 m depth) and MIS2 (from 857 to 1,033 m depth).

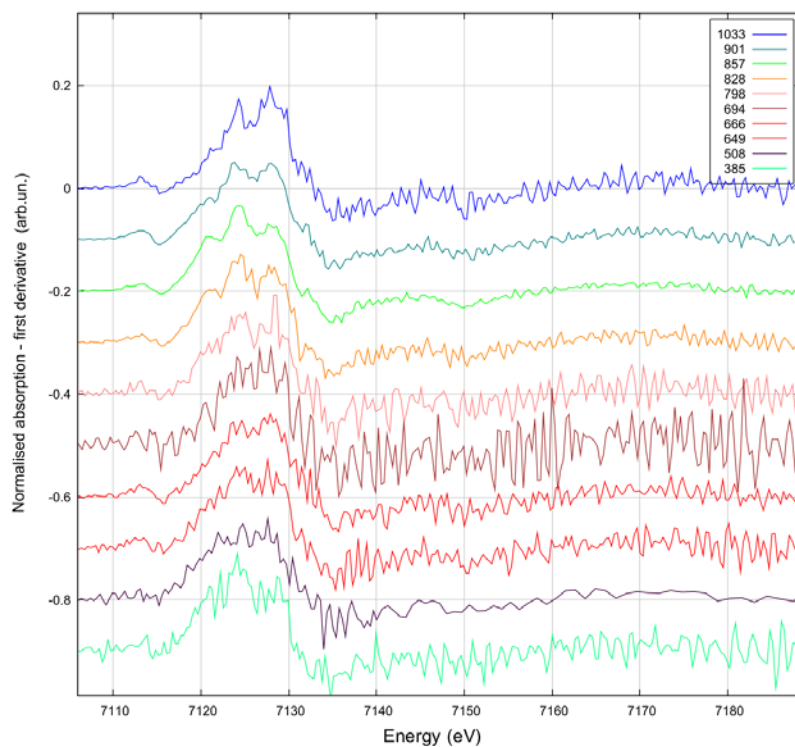


Fig. SM2: Comparison of the first derivative of the XANES spectra at the Fe K-edge for the representative spectra of the TD ice core in Fig. SM1. The numbers in the inset refer to the sample depth and in specific Holocene (from 385 to 694 m depth), Termination I (798 and 828n depth) and MIS2 (from 857 to 1,033 m depth).