Saharan dust transport and high latitude glacial climatic variability at millennial time-scale

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High-frequency oscillations related to Heinrich Events (HE) and Dansgaard-Oeschger (D/O) cycles have been pointed out by recent studies in the Alboran Sea which reveal a rapid coupling between the atmospheric and marine systems in the Mediterranean region (Cacho, *et al.*, 1999; Sánchez-Goñi *et al.*, 2002). In order to infer the underlying mechanisms of this millennial-scale climatic variability, the lithogenic fraction of the IMAGES core MD 95-2043 from the Alboran Sea is analysed. We compare these new results with marine and pollen records from the same site focussing on the time period between HE5 and HE3. End-member modelling of grain-size distributions and geochemical proxies allow descriptions of the sediments as mixtures of fluvial and eolian inputs that fluctuate with a millennial cyclicity. We show solid evidence that intensity of northward transport of Saharan dust occurred in parallel to intervals of strengthened atmospheric circulation in high northern latitudes (Moreno *et al.*, 2002). We interpret these D/O oscillations in the context of two different atmospheric scenarios driven by changes in the atmospheric pressure gradient between high and intermediate latitudes of the North Atlantic region. The role of the tropics in the generation of millennial-scale climate change is also discussed.

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The solubility and speciation of sulfur in silicate melts: development of the conjugated Toop-Samis-Flood-Grjotheim (CTSFG) model

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A termochemical model for calculating sulfur solubility in simple and complex silicate melts has been developed in the framework of the Toop-Samis polymeric approach (Toop and Samis, 1962; Ottonello et al., 2001) combined with the Flood – Grjotheim theoretical treatment of silicate slags (Flood and Grjotheim, 1952). The conjugated Toop-Samis-Flood-Grjotheim (CTSFG) model allows one to compute sulfide and sulfate content of silicate melts whenever fugacity of a gaseous sulfur species is provided. "Electrically equivalent ion fractions" are used to weigh the contribution of the various disproportion reactions of the type:

$$MO_{(melt)} + {}^{1}/_{2}S_{2\,(gas)} \Leftrightarrow MS_{(melt)} + {}^{1}/_{2}O_{2\,(gas)} \qquad (1)$$

$$MO_{(melt)} + {}^{1}/_{2}S_{2\,(gas)} + {}^{3}/_{2}O_{2,gas\}} \Leftrightarrow MSO_{4\,(melt)} \qquad (2)$$

Eqs. 1 and 2 account for the oxide-sulfide and the oxide-sulfate disproportions in silicate melts.

Electrically equivalent ion fractions are computed over the appropriate matrixes (anionic and cationic) in the Temkin notation for fused salts. The extension of the anionic matrix is calculated in the framework of a polymeric model previously developed (Ottonello et al., 2001) and based on a parameterization of acid-base properties of silicate melts. Model activities follow the raoultian behavior implicit in the Temkin notation without adjustable parameters. Moreover, the CTSFG model calculates the oxidation state of the system (i.e. oxygen fugacity), provided an analytical determination of either sulfide/sulfate or ferrous/ferric ratios in the melt. The model is based on a large amount of data available in literature and shows a high heuristic capability with virtually no compositional limits, as long as the structural role given to each oxide holds.

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