

Sr-Nd Signature Of Potential Source Areas For Dust In East Antarctica: Preliminary Results

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Insoluble microparticles (dust) deflated from Southern Hemisphere continents can be transported long range and reach Antarctica, where they are archived in the ice mass.

Vostok and Dome C ice cores have revealed that the dust flux to East Antarctica was high during glacial periods, and the isotopic (Sr-Nd) signature of mineral aerosol suggested a South American origin for dust (Basile, 1997). Particles reaching the East Antarctic plateau are log-normally distributed around 2µm (Delmonte et al., 2002). The possible isotopic fractionation of Sr in function of size make it necessary to redefine the isotopic signature of the PSA for the fine (<5 µm) fraction.

Here we present new results of Sr-Nd signature of the fine fraction of some samples from Potential Source Areas. They evidence a similar signature between New Zealand, the Dry Valleys and South America. On the opposite, South Africa and Australia are distinctly different, being much more radiogenic in Sr.

The main isotopic fields are similar to those defined by Basile et al. (1997) from analysis of bulk samples, but here is defined an isotopic field also for New Zealand and the Antarctic Dry Valleys. South America, New Zealand and the Antarctic Dry Valleys are all young orogenic environments marked by volcanic activity, and their similar isotopic signature could be anticipated by their similar tectonic context. Mineralogical analysis will be helpful for distinguishing these three regions. A possible contribution of all these three sources cannot be excluded but seems very unusual from studies on volcanic tephra in Vostok ice core (Basile et al., 2001).

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Measuring D/H ratio of femtograms of Hydrogen by ion microprobe : limits and applications

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D/H ratio measurements on hydroxylated minerals has been a key point to study the water-rock interactions and the behaviour of water in the solid Earth. Since more than 10 years the use of ion microprobe allows to obtain in situ measurement on the scale of single crystal, and to test their internal homogeneity (Deloule et al, 1991). The detection limit for water content measurement in silicate by conventional ion probe were estimated from a few hundred to one thousand ppm (Deloule et al, 1996), suggesting a higher limit for isotopic ratio determination. However the development of large high sensitivity high resolution ion probe improved this limit detection, with a background level measured on terrestrial minerals and glasses standards lower than 10 ppm of water. This low instrumental background level rises up additional questions on samples preparation and instrumental set up, and on the interpretation of water contents measured in the first hundreds of nanometers below the surface versus atmospheric water absorption and diffusion processes.

D/H ratios of five Martian meteorites were measured on nominally anhydrous minerals such as on feldspar (Fd), pyroxene (Px), olivine (Ol) and maskelinite (Mk). A 13 kV, 10 nA O⁻ primary beam was focused onto the sample to a 30 µm diameter area, and the positive secondary ions measured at a mass resolution of 2000. Amphibole and pyroxene standards were used for instrumental mass fractionation corrections. The water contents, roughly calculated from the H⁺ secondary beam intensity for samples and standards, were estimated to range from 400 ppm to up to 10 000 ppm. The δD values measured on those Martian meteorites range from -170 to +100, with variable distributions.

The preservation of a magmatic water reservoir with a low δD value on Mars has several implications. This low δD value is similar to the value of carbonaceous chondrites and in the same range that the primitive value of Earth [9]. It implies an asteroidal source for the Martian water. The preservation of a distinct magmatic water reservoir shows that the Martian mantle was not completely degassed and had a limited interaction with the surface water when the peridotite were formed.

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