Chemical composition, optical properties and sources of Saharan mineral dust at Izaña, Tenerife (Spain)

S. WEINBRUCH[1], K. KANDLER[1], N. BENKER[1], M. EBERT[1], U. BUNDKE[2] AND L. SCHÜTZ[3]

[1]Institute of Applied Geosciences, Technical University Darmstadt, Schnittspahnstr. 9, 64287 Darmstadt, Germany (dh6d@hrzpub.tu-darmstadt.de)
[2]Institute for Atmosphere and Environment, Johann Wolfgang Goethe University, Georg-Voigt-Str. 14, 60325 Frankfurt, Germany
[3]Institute for Physics of the Atmosphere, Johannes Gutenberg University, Becherweg 21, 55099 Mainz, Germany

Mineral dust from large desert areas influences the global radiation balance significantly. As this influence cannot be quantified precisely, information on chemical composition and optical properties of mineral dust is needed to improve climate models.

Samples from two strong homogeneous dust plumes from the Sahara were collected at Izaña (Tenerife, Spain) in July and August 2005. Size, aspect ratio and chemical composition of more than 21700 individual particles were studied by scanning electron microscopy and energy-dispersive X-ray microanalysis. The mineralogical phase composition of about 200 particles was determined by transmission electron microscopy. The size distribution was measured with an optical particle counter. Single scattering albedo, asymmetry factor and apparent soot content were measured by polar aerosol photometry.

In all samples, the aerosol was dominated by mineral dust with an average composition (volume %) of 64 % silicates, 6 % quartz, 5 % calcium-dominated particles, 14 % sulfates, 1 % hematite, 1 % soot and 9 % carbonaceous material. The presence of sulfates as surface coating on many particles was detected by scaling the X-ray signal of sulfur with particle size, and an average coating thickness of 60 nm was obtained. The aerosol calcium concentration is correlated with the calcite content of soils in the source regions. The highest calcium concentrations in the aerosol were observed for northern Morocco and northern Algeria as source region. The single scattering albedo was 0.95 and the asymmetry factor 0.74 – 0.81 (for solar wavelengths).

From these data, the complex refractive index of the aerosol was derived. For visible light, the average value was $1.59 - 7 \cdot 10^{-3}i$ which is in good agreement with previous literature data. The imaginary part of the complex refractive index decreases with decreasing hematite and soot contents from $-2.5 \cdot 10^{-2}i$ to $< -10^{-3}i$.

The structure of the Hawaiian plume conduit from high-precision isotopic studies of Mauna Loa lavas

DOMINIQUE WEIS[1], J.MICHAEL RHODES[2] AND MICHAEL O. GARCIA[3]

[1]PCIGR, Earth and Ocean Sciences, University of British Columbia, 6339 Stores Road, Vancouver BC, V6T-1Z4 Canada (dweis@eos.ubc.ca)
[2]Dept. of Geosciences, University of Massachusetts, Amherst, MA 01003, USA
[3]Dept. of Geology-Geophysics, University of Hawaii, Honolulu, HI 96822, USA

The Earth's two largest volcanoes are located adjacent to each other and astride the long-lived Hawaiian mantle plume. Mauna Loa is thought to sample the plume core; Mauna Kea, a less central part. The shield stage of Mauna Kea was well sampled (3200 m, 600 kyr) and geochemically characterized by HSDP2. Here we present results from a systematic high-precision isotopic study of a comparable portion, potentially up to 500 kyr, of Mauna Loa's shield history.

Older Mauna Loa lavas (>60 ka), sampled along the submarine southwest rift zone, including the Mile High-Section, do not define Pb-Pb isotope lines. For the younger lavas (<60 ka), the slopes of the Pb-Pb lines increase with age. In contrast, older HSDP2 Mauna Kea basalts form Pb-Pb lines, where slopes decrease with age [1, 2]. In both volcanoes, the older lavas have higher $^{3}He/^{4}He$ [3]. The older Mauna Loa lavas (high $^{208}Pb^{*}/^{206}Pb^{*}$, lower $^{87}Sr/^{86}Sr$ and $^{143}Nd/^{144}Nd$ and higher Nb/Y) also define separate binary isotope trends compared to the younger lavas, on the less enriched side of the trends defined by Koolau (i.e. recycled oceanic crust and sediment component). This indicates the presence of another component in the source of older Mauna Loa lavas.

Our large-scale isotopic study of Mauna Loa shield basalts confirms the apparent bilateral asymmetry of the plume conduit, originally based on distinctly higher $^{208}Pb/^{204}Pb$ for a given $^{206}Pb/^{204}Pb$ [4, 5]. The Mauna Loa source is also systematically more heterogeneous in all isotopic systems by a factor of 1.5 than the Mauna Kea source. This is maintained throughout the long magmatic history of these volcanoes. Yet older lavas from both Mauna Kea and Mauna Loa sample a more heterogeneous plume source (Loihi-like?) than younger shield lavas. Implications for the structure of the Hawaiian plume conduit, the mantle source and geophysical constraints will be discussed.

References

[1] Eisele *et al*. (2003) *Geochem. Geophys. Geosyst.* **4**.
[2] Nobre Silva *et al*. (2006) *Eos Trans. AGU* **87**, V13B-0672.
[3] Kurz *et al*. (2004) *Geochem. Geophys. Geosyst.* **5**.
[4] Tatsumoto (1978) *Earth Planet. Sci. Lett.* **38**, 63-87.
[5] Abouchami *et al*. (2005) *Nature* **434**, 851-856.