Serpentine dehydration recorded by garnet peridotites and chlorite harzburgites from Cima di Gagnone

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De-serpentinization of the oceanic lithosphere liberates large fluid masses from subducting plates. It is scarcely documented in nature because few rocks are exhumed from beyond the antigorite breakdown: harzburgites from the Betic Cordillera (Spain) are the only known case [1]. The garnet (grt) lherzolites from Gagnone (Central Alps) have long been considered as serpentinized oceanic mantle subducted to 2.5GPa-800°C [2]. It is a unique case in the Alps, where the subducted oceanic mantle consists of lower grade antigorite serpentinites. Here we present a trace element study of the Gagnone grt lherzolites and chlorite (chl) harzburgites, to test their origin from serpentinites and to characterize residues from serpentinite dehydration. The foliated grt peridotites contain olivine (ol), ortho and clinopyroxene (opx, cpx), Ca-amphibole (amph) and poikiloblastic grt. The chl harzburgites are texturally similar to the Betic harzburgites [1]. Cpx from grt lherzolites shows LREE-depletion (La_N/Sm_N 0.42) and highly variable M- to HREE spectra, from flat (Sm_N/Lu_N 1.3) to HREE depleted (Sm_N/Lu_N 119). The flat patterns resemble those of cpx from Alpine-Apennine ophiolitic spinel-lherzolites: they represent oceanic mantle precursors prior to subduction equilibration with grt, reflected by the HREE depletion. In spite of this heterogeneity, all cpx are enriched in Sr, Pb, B, Li, likely inherited from oceanic alteration. Amph both occurs along the grt foliation and after cpx. It shows LREE depletion (like cpx) and heterogeneous HREE contents always > 1 chondrite, impliying disequilibrium with grt. Amph may thus be a re-equilibrated eclogitic phase, or a retrograde phase that mimics cpx. Ol from grt lherzolites and harzburgites is enriched in Li and B, similar to ol from alpine serpentinites and Betic harzburgites. We confirm that the Gagnone grt peridotites and chl harzburgites originate from increasingly serpentinized oceanic mantle subducted beyond the antigorite stability. Different from orogenic grt peridotites of wedge origin, they do not record significant metasomatism by crust-derived agents.

[1] Tromsdorff V. *et al*. (1998), *CMP* **132**, 139-148 [2] Evans B.W., Tromsdorff V. (1978) *EPSL* **40**, 333-348.

Constraining the potential source strength of various soil dust sources contributing to atmospheric PM10 concentrations in Europe

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Introduction

Crustal material typically make up 5-20% of the mass of ambient PM10 samples. Despite the importance of crustal material in total PM10 mass, the sources are still poorly understood and not well-represented in emission inventories. Crustal material may originate from distinctly different sources e.g., wind erosion of bare soils, agricultural land management, resuspension of road dust. To make progress in our understanding of the crustal material source strengths, we present a methodology to check first order estimates of the various source strengths using the chemistry transport model LOTOS-EUROS.

Methodology

We have implemented a simple and therefore transparent emission functions for wind erosion, resuspension by traffic and agricultural activities. The wind erosion emission function is based on well known relations used for desert dust. For resuspension by traffic we have compiled emission estimates for different types of roads and conditions. Maps of road type and vehicle kilometres driven are combined with the estimated emission factors to derive the emission strength over Europe. For agricultural land management we have defined a simple cropping calendar with agricultural activities associated with specific emission strengths for resuspension

Results

The modelled annual average contribution of crustal material to PM10 is about $2\mu g.m^{-3}$ over Europe. Concentrations exceeding $3\mu g.m^{-3}$ are modelled in densely populated area and over relatively dry and arid environments. Lower values of $0.2\mu g.m^{-3}$ are simulated over rural area. The contribution by wind erosion is generally less than $0.1\mu g.m^{-3}$ and is less important than the other modelled crustal material sources. Traffic resuspension contributes $0.3\mu g.m^{-3}$ in rural area, and up to $5\mu g.m^{-3}$ or more in cities. The presently modelled contribution by agricultural activities is $2\text{-}3\mu g.m^{-3}$ and exceeds that of traffic resuspension over rural area.