Heavy metals in road dust and vegetation from the urban area of Messina (Italy).

G. DONGARRÀ[1], G. SABATINO[2], D. VARRICA[1],

1 Dip. Chimica e Fisica della Terra, Univ. of Palermo
   dongarra@unipa.it; danielavarrica@libero.it
2 Dip. Di Scienze della Terra, Univ. of Messina,
   sabatino@labcart.unime.it

Nowadays it is recognised that, since the middle of XX century, human activities have greatly modified the chemistry of the atmospheric aerosol. Urban areas are strongly impacted by the inputs of trace metals due to particle emission processes. As pollution-derived elements may have adverse health consequences, it is critical to attain a knowledge on the nature and extent of heavy metal pollution. This work discusses how the traffic related air pollution affects the chemical composition of airborne particulate matter over the town of Messina (Italy), by using oleander leaves and urban road dust as means of survey. 26 samples of *Nerium oleander* L. leaves and seven size fractions of roadway dust have been analysed for major, trace elements and Platinum Group Elements. Insights about the natural or anthropogenic origin of the observed heavy metals have been deduced from the enrichment factors (EF).

The lithophile elements (e.g. Ca, Ti, Sc, Na, Th, U, Sr, Mg, Al, rare earth elements) resulted mostly geogenic, being the EFs for these elements less than 3. On the other hand, the elements of environmental concern (e.g. Pb, Sb, As, Br, Zn, Cu, Pt, Pd and Au) showed elevated enrichment factors. Most of these elements are produced by mechanical separation of particles from different parts of vehicles, although some of them may form volatile compounds capable of atmospheric transport. Pt and Pd enrichments are due to the mechanical strain and chemical deterioration of the catalytic converters. These two elements are employed in car engines to remove carbon monoxide, residual hydrocarbons and nitrogen oxides from exhausts. Antimony in airborne samples from urban areas is attributed to abrasion of tires and asbestos-freebrake linings It is also employed in alloys for motor bearing due to its stabilizing properties. Zn and Cu can be emitted by diesel-soot, as these elements are used as additives to oil. They are also emitted from tyres and brake-lining materials. In spite of the phasing out of lead from gasoline, this element is still present in airborne particulate matter, suggesting that it may be derived from processes other than fuel combustion. Bromine has both natural and anthropic sources. A positive correlation between grain size data and heavy metals content has been observed, which indicates the anthropic rather than natural origin for most trace elements. The element distribution maps, showing a decrease of the heavy metal content immediately farther inland, do confirm that local sources play a great role in the heavy metal pollution.

Models for genesis of Kamchatka arc magmas: new insights from U-series

ANTHONY DOSSETO[1] AND BERNARD BOURDON[2]

Laboratoire de Géochimie et Cosmochimie, Institut de Physique du Globe de Paris; 4, place Jussieu 75252 Paris cedex 05, FRANCE. (dosseto@ipgp.jussieu.fr[1], bourdon@ipgp.jussieu.fr[2])

The aim of this study is to describe arc magma genesis using U-series data from Central Kamchatka Depression (CKD) basalts and basaltic andesites (Dosseto and Bourdon, 2002). Thus, we have investigated several models for slab dehydration and mantle wedge melting. The samples show the unusual feature of $(^{230}Th/^{238}U)$ activity ratios both higher and lower than 1. $(^{226}Ra/^{230}Th)$ and $(^{231}Pa/^{235}U)$ are both higher than 1 and range respectively from 1.04 to 2.72, and from 1.22 to 1.56. $(^{230}Th/^{232}Th)$ ratios exhibit high values and range from 1.83 to 2.25. Arrays in activity ratios have been attributed to mixing between evolved and primitive magmas with distinct U-series signature.

Following the suggestion that dehydration reactions occur over a wide range of depth, we have attempted to reproduce the observed activity ratios by continuous fluid addition. Melting has been assumed to occur (1) at the end or (2) during the dehydration process. ^{226}Ra and ^{238}U excesses over ^{230}Th can be reproduced, but only if U and Ra mineral/fluid partition coefficients are ten times higher than those determined experimentally. On the other hand, if dehydration occurs as two discrete events, the U-series data can be explained using published mineral/fluid partition coefficients (Keppler, 1996).

Models for arc magmas production have also been investigated. Melting by equilibrium porous flow seems the possible mechanism for explaining CKD data but high $^{187}Os/^{188}Os$ ratios in Kamchatka magmas (Alves, 1999) suggest rapid melt extraction and then preclude this model (Bourdon et al., 2002). On the other hand, a dynamic melting model, following fluid addition episodes, can account for the U-series disequilibrium in CKD magmas. We conclude that the best scenario to describe magma genesis under the Central Kamchatka Depression is to assume that the wedge is metasomatized following two fluid additions; the first older than 100ka ago; the second, younger than a few ka. Magma production then occurs following a dynamic melting model and melts migrate rapidly to the surface (several meters per year). $^{231}Pa-^{235}U$ data suggest differentiation time scales around 50ka for the most evolved rocks.

References

Alves, S., (1999), PhD thesis, University Paris 7.
Bourdon, B., Turner, S. and Dosseto, A., (2002), submitted.
Dosseto A. and Bourdon B., (2002), submitted.
Keppler, H., (1996), *Nature* **380**. 237-240.