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URGE: The EuroGeoSurveys Geochemistry Expert Group's Urban Geochemistry projects

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Introduction

Given the fact that by 2050 more than 80% of the European population will be living in cities, the quality of the urban environment is becoming an important issue in the 21st century. Since the industrial revolution, with a peak after the Second World War, the urban environment has been contaminated with many inorganic toxic elements and organic compounds, which are being emitted by a wide variety of human activities (industry, traffic, domestic heating, coal and oil combustion, incineration, construction activities, *etc.*), and often accumulate in urban soil (Johnson *et al.*, 2011).

Although the negative long-term health related hazard of certain elements, such as Pb, has been known since ancient Hellenic times, little or no precautions were taken to protect the workers and the environment. Industries were, and often still are haphazardly distributed within the urban layout. Since, the 1970s a conscious attempt is being made in many countries to develop industrial facilities outside the residential, commercial, and recreational parts of cities. Within the urban structure remain, however, the brownfield sites, and the problems associated with the need of their remediation and redevelopment in order to reduce the pressure on greenfield sites.

Since many health-related problems are linked to the state of the urban environment (Fig. 1a), European citizens want to be aware of the geochemistry of the land their houses are built on. Moreover, it is especially important that the chemical quality of soil in public places, such as schoolyards, parks, playgrounds, kindergartens, recreation areas, and workplaces is known. Estate agents need to know the quality of the land they are marketing, and insurance brokers the potential risks to their customers.

With the frequent occurrence of highly contaminated soil in urban areas, a conscious management of soil excavation, transport, and redistribution within a city is another important issue. Urban soil is generally contaminated to a variable degree, depending on its location relative to a pollution source.

Knowledge about soil contamination, geochemical background concentrations, and detailed spatial element distribution is thus becoming a key issue in urban planning. Hence, the increasing interest to map the current chemical state of topsoil (Fig. 1b), and house dust (Fig. 1c) and to define potential risks to human health (Fig. 1d). This knowledge helps to complete still missing comparable geochemical data sets about urban ecosystems. Additionally, such information is urgently needed by decision-makers, local and regional authorities, planners, house buyers, and town administrations, for finding innovative and practical solutions for sustainable urban development and securing human health at a satisfactory level of risk. In fact, multidisciplinary cooperation takes on a completely new dimension in the tackling of urban problems, caused by contaminating activities, *i.e.*, applied geochemists work alongside public health officers, urban planners, medical doctors, *etc.* Hence, the need for the production of a harmonised urban geochemical database of high quality and integrity for multipurpose use (Figs. 1b, c, d).

Urban geochemistry projects of the EuroGeoSurveys Geochemistry Expert Group

The Geological Surveys of Europe have the task of providing high quality geochemical databases for the management of the environment and mineral resources. They have also a long-standing history in urban geochemical surveys, hence the publication of a textbook '*Mapping the Chemical Environment of Urban Areas*' (Johnson *et al.*, 2011) by members of the EuroGeoSurveys Geochemistry Expert Group. The Group has also published several urban geochemistry case studies in a form of topical publication (Demetriades *et al.*, 2018). Although the results of urban geochemistry surveys, carried out in different European countries, are of good quality, they are, however, incompatible, because of different sampling, sample preparation and analytical methods. In order to produce comparable urban geochemistry data across Europe, a harmonised methodology must be followed. For this purpose, an urban geochemistry manual was written and published in 2015 (Demetriades and Birke, 2015a), and two large bulks of reference samples prepared at the Geoanalytical Laboratories of the State Geological Institute of Slovak Republic. Due to wide interest in the quality of the urban environment, another comprehensive manual was written and published in 2015 (Demetriades and Birke, 2015b), following a request by the European Commission COST Action (TU1206) project 'SUB-URBAN – '*A European network to improve understanding and use of the ground beneath our cities*'. This manual describes the procedure of (i) sampling topsoil, subsoil, house dust, attic dust, road dust or sediment, atmospheric particulates and bio-indicators, including human tissues, (ii) sample preparation, (iii) laboratory analysis, (iv) quality control, (v) data conditioning, and (vi) data processing and map plotting.

EuroGeoSurveys recognising the importance of the urban environment have established an Urban Geology Expert Group in order to tackle all the urban issues from the geosciences perspective. It is, therefore, highly probable that the urgently needed harmonised urban geochemical databases will be developed in the next few years.

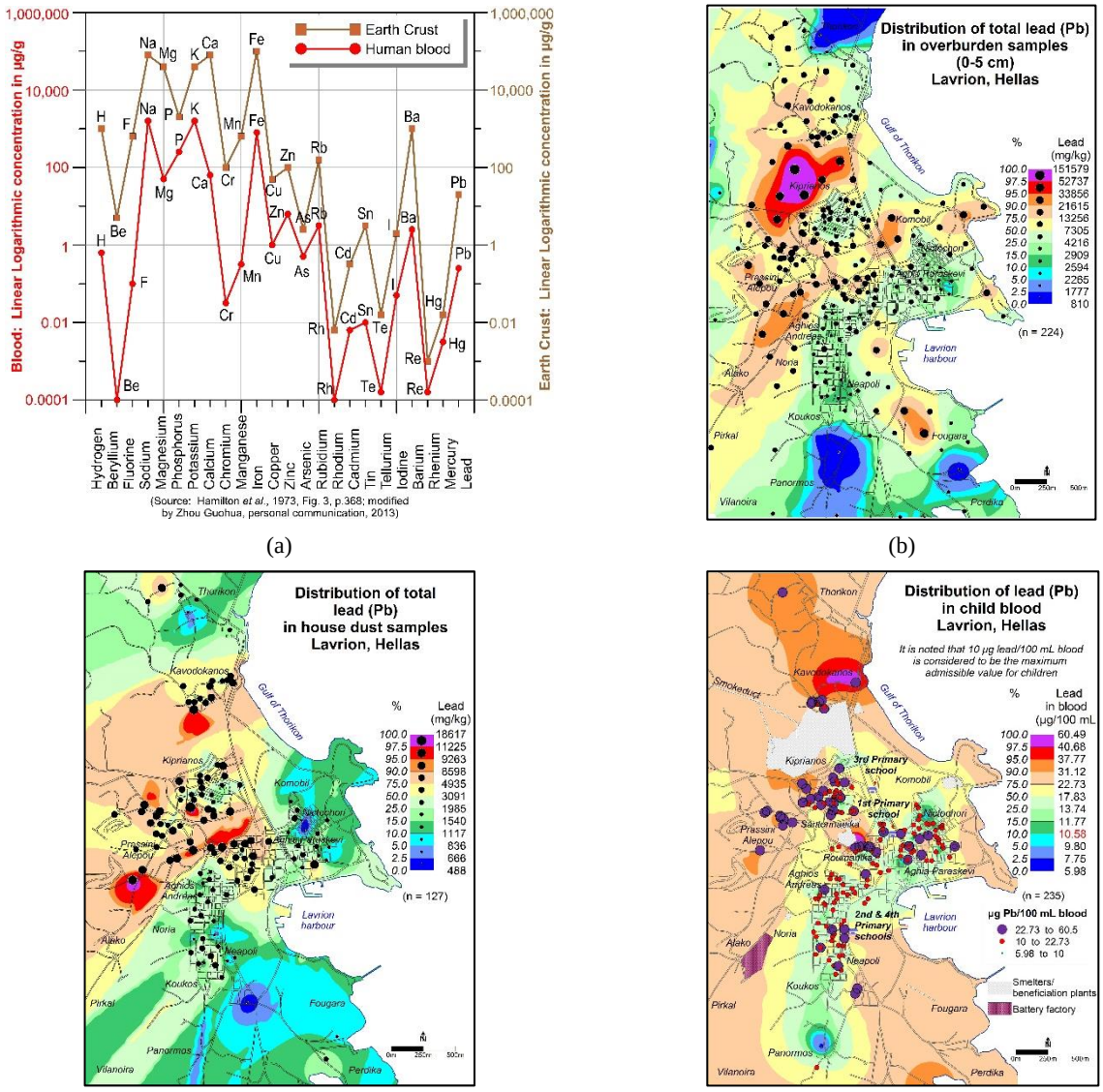

Figure 1. (a) Graph showing relationship between selected element concentrations in Earth Crust and human blood (Demetriades *et al.*, 2018, Fig. 1, p.2); (b) distribution of total Pb in overburden, Lavrion, Hellas (Demetriades, 2011, Fig. 25.8, p.444); (c) distribution of total Pb in house dust, Lavrion, Hellas (Demetriades, 2011, Fig. 25.9, p.445), and (d) distribution of Pb in child blood, Lavrion, Hellas (Demetriades, 2011, Fig. 25.10, p.447).

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