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ENVIRONMENTAL GEOCHEMICAL ATLAS OF ITALY

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INTRODUCTION

In recent years in Europe we witnessed an increasing interest from the public opinion, regarding the environmental issues. National governments and the European Union, in the attempt to address the public concern, started to pay more attention to the laws and policies directed to protect the environment. One of the tools that have proved to be more useful to implement environmental intervention plans, is the basic geochemical cartography.

Researches started in 1998 in the framework of the International Geochemical Mapping Project (IGCP 259), showed that despite the availability from different national organizations of a large amount of earth surface geochemical data, it was difficult to use them, due to lack of uniformity stemming from the use of different sampling procedures and analytical methodologies or incompleteness of datasets. Hence it became evident, both for the scientific community and the politicians, that there was the need for geochemical data coherent and uniform on an international scale.

The IGCP 259 proposed a series of standardized procedures for sampling and analysis (to be conducted in selected laboratories), through which create a geochemical database based on a global sampling grid (GRN, Global Reference Network), that would allow to compare national and regional geochemical datasets.

In 1994 the FOREGS became the European subcommittee of the IGCP 360, (Plant *et al.*, 1996). Each of the 26 nations of the FOREGS project contributed to the Geochemical European Atlas, collecting national geochemical data.

MATERIALS AND METHODS

The Italian Geochemical Atlas addresses the need for a large scale geochemical mapping based on FOREGS standards. In the framework of the GTN (Global Terrestrial Network), Italy has been divided in eight 160 x 160 Km square cells (Darnley *et al.*, 1995). However to improve sampling homogeneity, the sampling grid has been extended to 28 cells.

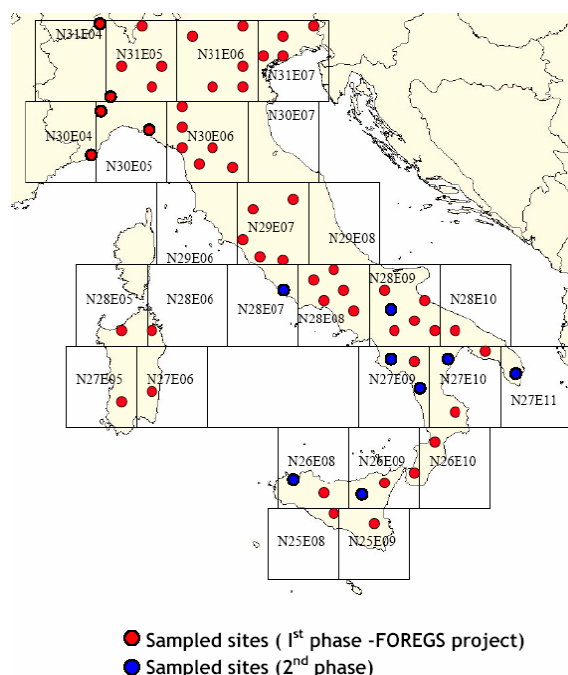


Figure 1 – Sample site map showing GTN cells and samples location divided by sampling phases.

Stream water (W), stream sediments (S), floodplain sediments (F), topsoils (T) and subsoils (C) samples have been collected in two phases in 58 locations, homogeneously distributed along Italy. For FOREGS purposes, we sampled 50 sites

all over Italian territory; these data have been used for the first edition of the Geochemical Atlas of Europe (Salminen et al., 2005). Between April and September 2005, further samples have been collected in eight new sites, to improve sampling homogeneity for the Italian territory. The new sampling sites are located in sub-cells of southern Italy. In both phases we strictly implemented FOREGS sampling and sample handling procedures (Salminen et al., 1998). Every sample site has been documented by two photographs then collected in an appropriate database.

Soil and sediment samples have been dried at 40°C with infrared lamps, crushed in agate mortar, and sieved (< 0.063 mm fraction), before being sent for analysis.

The geochemical data used for the FOREGS project and the new data from sub-cells of southern Italy have been processed using ArcView GIS™, and a new Multifractal IDW method available in the software GeoDAS™ (Cheng et al., 1999, 2000a, 2000b, 2001; Lima et al., 2003; Cicchella et al., 2005)

Stream Sediments Berillio (Be)

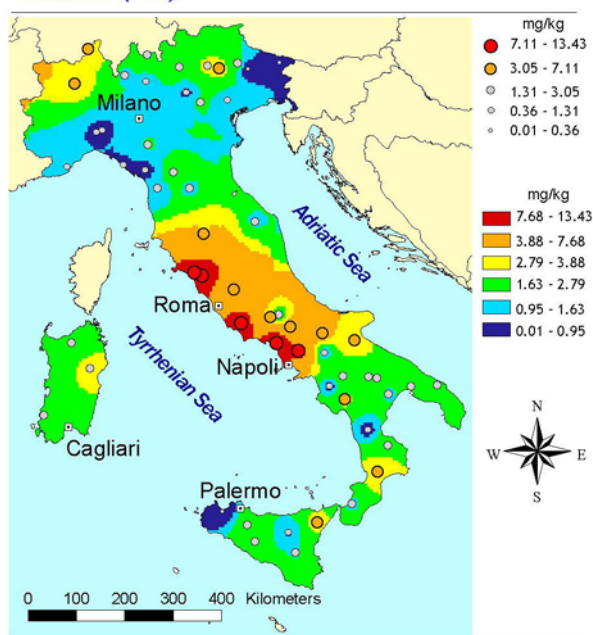


Figure 2 – Map showing Be distribution in stream sediments of Italian territory.

Interpolated map have been overlayed by dots, showing real concentration of elements site by site. Radius of dots is function of element concentrations and they have been classified by mean of a cumulative frequency graph.

A total of 360 maps, showing elemental distributions for the whole Italian territory, have been produced.

Data show that, even, at large scale, some elements distributions are function of the lithologies following the major geo-lithological structures and lineaments. In particular, the Roman-Neapolitan alkaline volcanic province (as defined by Washington, 1906) is very well individuated along the Tyrrhenian sea. Some maps also highlight mineralized areas in southern Sardinia.

REFERENCES

- CHENG Q., XU Y. E GRUNSKY E., 1999. *Integrated spatial and spectrum analysis for geochemical anomaly separation*. In: Lippard S.J., Naess A. & Sinding-Larsen R. (eds). Proceedings of the International Association for Mathematical Geology Meeting, Trondheim, Norway, 1999, 1, 87-92.
- CHENG Q., XU Y. E GRUNSKY E., 2000a. *Integrated spatial and spectrum method for geochemical anomaly separation*. Nature Resources Research, 9, 43-56.
- CHENG Q., LI Q. E XU Y., 2000b. *Self-similarity recognition and geochemical anomaly separation*. In: Proceedings of the GAC/MAC Meeting GeoCanada 2000. Calgary, 29/5-2/6, 2000.
- CHENG Q., BONHAM-CARTER G.F. E RAINES G.L., 2001. *GeoDAS: A new GIS system for spatial analysis of geochemical data sets for mineral exploration and environmental assessment*. The 20th Intern. Geochem. Explor. Symposium (IGES). Santiago de Chile, 6/5-10/5, 2001, 42-43.
- CICCHELLA D., DE VIVO B. E A. LIMA, 2005. *Background and baseline concentration values of harmful elements in the volcanic soils of metropolitan and Provincial areas of Napoli (Italy)*. Geochemistry: Exploration– Environment – Analysis, 5, 1-12.
- DARNLEY A.G., BJÖRKLUND A., BØLVIKEN B., GUSTAVSSON N., KOVAL P.V., PLANT J.A., STEENFELT A., TAUCHID M., XIE XUEJING, GARRETT R.G. & HALL, G.E.M., 1995. *A Global Geochemical Database for Environmental and Resource Management: Recommendations for International Geochemical Mapping*. Final report of IGCP Project 259. 2nd revised edition. Paris: UNESCO, 122.
- LIMA A., DE VIVO B., CICCHELLA D., CORTINI M. E ALBANESE S., 2003. *Multifractal IDW interpolation and fractal filtering method in environmental studies: an application on regional stream sediments of Campania Region (Italy)*. Applied Geochemistry, 18 (12), 1853-1865.
- PLANT J.A., KLAVER G., LOCUTURA J., SALMINEN R., VRANA K. & FORDYCE F. 1996. *The Forum of European Geological Surveys Geochemistry Task Group inventory 1994-1996*. Journal of Geochemical Exploration 59, 123-146.
- SALMINEN R., TARVAINEN T., DEMETRIADES A., DE VIVO B., DURIS M., FORDYCE F.M., GREGORUSKIENE V., KAHILIN H., KIVISILLA J., KLAVER G., KLEIN H., LARSON J.O., LIS J., LOCUTURA J., MARSINA K., MJARTANOVA H., MOUVET C., O'CONNOR P., ODOR L., OTTONELLO G., PAUKOLA T., PLANT J.A., REIMANN C., SCHERMANN O., SIEWERS U., STEENFELT A., VAN DER SLUYS J., WILLIAMS L.,

1998. *FOREGS geochemical mapping field manual*. Geological Survey of Finland, Espoo 1998, 16-29.
- SALMINEN R., BATISTA M.J., BIDOVEC M., DEMETRIADES A., DE VOS W., DURIS M., GILUCIS A., GREGORAUSKIENE V., HALAMIC J., HEITZMANN P., LIMA A., JORDAN G., KLAVER G., KLEIN P., LIS J., LOCUTURA J., MARSINA K., MAZREKU A., O'CONNOR P.J., OLSSON S.Å., OTTESEN R., PETERSELL V., PLANT J.A., REEDER S., SALPETUR I., SANDSTRÖM H., SIEWERS U., STEENFELT A., TARVAINEN T., 2005. *Geochemical Atlas of Europe, Part 1-Background Information, Methodology and Maps*. Geological survey of Finland, Espoo 2005.
- WASHINGTON H.S., 1906. *The Roman comagmatic region*. Carnegie Institute Publication no.57