

## Nuclear and Related Techniques in Environmental Studies

Octavian G. Dului<sup>1,2</sup>, Daler Abdusamadzoda<sup>1,3</sup>, Djamsheid A. Abdushukurov<sup>3</sup>, Wael Badawy<sup>1,4</sup>, Otilia A. Culicov<sup>1,5</sup>, Marina V. Frontasyeva<sup>1</sup>, Inga Zinicovscaia<sup>1,6</sup>

<sup>1</sup>Joint Institute for Nuclear Research, Dubna, Russian Federation

<sup>2</sup>University of Bucharest, Faculty of Physics, Romania

<sup>3</sup>Institute of Water Problem, Hydropower and Ecology, Dushanbe, Tajikistan

<sup>4</sup>Radiation Protection & Civil Defence Department, Cairo, Egypt

<sup>5</sup>National Institute for R&D in Electrical Engineering ICPE-CA, Bucharest, Romania

<sup>6</sup>Horia-Hulubei National Institute for R&D in Physics and Nuclear Engineering, Magurele (Ilfov), Romania

Environmental studies, as an active field of scientific investigation, have been very actual since 60', when the influence of an accelerated industrialization and urbanization showed a negative influence on environment and by consequence, on the human society.

Among the different aims, environmental studies have essential contribution to pollution control and mitigation. Consequently, a more high precise and accurate analytical techniques such as Instrumental Neutron Activation Analysis, Graphite Furnace Atomic Absorption Spectroscopy or Gamma-ray Spectroscopy were used in conjunction with advanced statistical methods of data analysis. Such kind of investigations were systematically performed in the past decades at the Frank Laboratory of Neutron Physics of the Joint Institute for Nuclear Research in Dubna, Russia, as well as in partner research centres.

A significant amount of work was assigned to biomonitoring performed by analysing the content of presumably contaminating elements *e.g.* V, Cr, Mn, Co, Ni, Zn, As, Sb, Sn, Ba, Cd, and Pb in both vascular evergreen and rootless plants as well as lichens collected from a great diversity of environments beginning with pristine Antarctica islands, going through Egyptian densely populated areas, Black Sea euxinic sediments and Moldavian orchards up to Central and Western Tajikistan high montane valleys.

Associated with INAA determinations, Alpha, Beta and Gamma ray radiometric measurements were helpful in identifying the presence of Th and U enriched afloriments in central Tajikistan or the age of recent Black Sea sediments. In the last case it was possible to establish an absolute geochronology of the recent, 1000 y old sediments and to evidence a continuously accumulation of the presumably contaminating elements in the past 150 years, a testimony of the industrial development of Central and Eastern countries, where the environmental pollution has been completely neglected.

At the same time, INAA trace elements distribution and the corresponding Discriminant Analysis allowed determining the location of the different types of wine according to the vineyards they were picked up.