

## Technical development at Nishina Memorial Cyclotron Center for studies in the field of earth and environmental sciences

K. Sera<sup>1</sup>, S. Goto<sup>2</sup>, T. Hosokawa<sup>2</sup>, Y. Saitoh<sup>2</sup> and S. Murao<sup>3</sup>

<sup>1</sup>Cyclotron Research Center, Iwate Medical University  
Tomegamori, Takizawa, Iwate 020-0603, Japan

<sup>2</sup>Nishina Memorial Cyclotron Center, Japan Radioisotope Association  
348-58 Tomegamori, Takizawa, Iwate 020-0603, Japan

<sup>3</sup>National Institute of Advanced Industrial Science and Technology  
1-1-1 Higashi, Tsukuba, Ibaraki 305-8568, Japan

### Abstract

Nishina Memorial Cyclotron Center (NMCC) was established by Japan Radioisotope Association in 1990 and has been opened for any researcher in Japan as a nationwide-common-usage facility of Positron Emission Tomography (PET) and Particle Induced X-ray Emission (PIXE) since 1993. After solving some basic problems coming from the machine size, a three-detector measuring system for the vacuum PIXE and a two-detector-measuring system for the in-air PIXE were established. We also developed computer programs to derive quantitative elemental concentration. These programs are designed to be operational for the data handling and analysis such as programs for X-ray spectrum analysis; for determining efficiency curves of semi-conductor detectors; for evaluating a X-ray transmission curve through X-ray absorbers; and for calculating theoretical ionization cross sections. Moreover, a standard-free method of quantitative analysis was developed and applied to various kinds of biological samples. The method makes it possible to perform quantitative analyses of untreated samples, samples of extremely small quantities (nearly 1  $\mu\text{g}$ ), and living biological specimens. Furthermore, two original methods were developed mainly for geological materials. One is “powdered -internal-standard method”, which allows us to perform quantitative analysis of inorganic powdered samples such as soils, sediments and crushed rocks. The other is “specially designed absorbers” which enable us to carry out highly sensitive analyses for rock/ore samples that contain distinguished quantity of specific elements such as Fe and Zn.