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MTAA-13
PROGRAM AND ABSTRACTS

LOG 180

Implementation of k0-INAA method at the Neutron Activation Analysis Laboratory, LAN-IPEN, São Paulo, Brazil. Application to geological samples

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The present paper presents the results obtained in the implementation of the k0 standardization method at the Neutron Activation Laboratory (LAN-IPEN), São Paulo, Brazil, by using the program k0-IAEA, provided by The International Atomic Energy Agency (IAEA). The k0-INAA method has been used in several neutron activation laboratories all over the world. This method is an important alternative for the comparative neutron activation analysis, which has been used for several years at LAN-IPEN. The efficiency curve of one of the gamma-ray spectrometers used at LAN was determined by measuring calibrated radioactive sources at the usually utilized counting geometries. The thermal to epi-thermal flux ratio f and the shape factor α of the epi-thermal flux distribution were determined for the pneumatic irradiation facility of the IEA-R1 nuclear reactor of IPEN. To obtain these factors, the "bare triple-monitor" method with ^{197}Au - ^{96}Zr - ^{94}Zr was used. The Certified Nuclear Reference Material IRMM-530R Al-0,1% Au alloy, high purity zirconium, Ni and Lu comparators were irradiated. The elements Al, Na, K, Mn, Mg, Dy, Sr, V, Ti and W, which are of great interest in geochemical studies, were analysed. The optimal irradiation and counting conditions were studied. In order to validate the methodology, the geological reference materials basalts JB-1 (USGS) and BE-N (IWG-GIT), granite GS-N (IWG-GIT), SOIL-7 (IAEA) and sediment Buffalo River Sediment (NIST-BRS-8704), which represent different geological matrices, were analysed. The concentration results obtained agreed with certified, reference and recommended values, showing relative errors between 5-10% for most elements. These results indicate excellent possibilities of using this parametric method at the LAN-IPEN for geochemical studies.

LOG 182

A Combined Method of Neutron Activation Analysis and Radiometric Measurements for ^{234}U and ^{238}U Determination in Soil Samples of Low Uranium Concentration

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The relationship between ^{234}U and ^{238}U in a closed system should be constant, since both are part of a secular equilibrium with the latter as the beginning of the chain. This situation differs with respect to natural systems, where the different geochemical behavior of thorium and protactinium, in comparison with uranium, causes some fractioning. The determination of ^{234}U and ^{238}U is accomplished by alpha spectrometry; the method is complex and requires the complete radiochemical separation of radium, as the main interference, and also of all the non-radioactive elements that can influence the process of electrodeposition of the uranium species. The yields are low and ^{232}U is currently used as tracer. Two modifications of the traditional method are proposed in the present work: 1) Use of activation analysis for determination of the ^{238}U content; 2) Measurement of the $^{234}\text{U} / ^{238}\text{U}$ relationship after the isolation and the electrodeposition of the uranium extracted from a lixiviation with 6 M HCl. The possibility of using the second procedure is a direct derivation of the utilization of the first one: since the ^{238}U content is determined independently of the measurement by alpha spectrometry, the use of the ^{232}U is not necessary; consequently, the chemical steps destined to assure similar chemical state for the tracer and the uranium species present in the sample are not necessary. The method was applied to soil samples from sites of the North Peru, near the shore. They were irradiated at the RP-10 reactor, using the pneumatic system. For the alpha measurements, suitable aliquots were attacked with 6 M HCL; uranium was isolated by solvent extraction and anionic exchange and finally electrodeposited in polished stainless steel disks. Uranium concentration range 2 to 50 $\mu\text{g/g}$ and the isotopic composition correspond to natural uranium, with 5 % uncertainty.