

ACTIVATION ANALYSIS OF NICKEL ORE BY FAST NEUTRONS

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The aim of the present work was to apply fast neutrons activation analysis for determination of the elemental content of nickel ores of Drenica basin. Since fast neutrons can be produced by small accelerators, the quantitative analysis can be performed directly at the place of ore production. So obtained informations can be used for the improvement of their exploitation and processing or as the basis for the automatization of production.

The determination of percentage of the ore components is based on the measurement of radiation intensities of activated isotopes.

The percentual content of elements, was compared with that of iron from the equation:

$$m_x(\%) = m_{Fe}(\%) \frac{\theta_x M_x A_x K_x \eta_x (1 - e^{-\lambda_x t_1}) e^{-\lambda_x t_2} \sigma_x}{\theta_{Fe} M_{Fe} A_{Fe} K_{Fe} \eta_{Fe} (1 - e^{-\lambda_{Fe} t_1}) e^{-\lambda_{Fe} t_2} \sigma_{Fe}}$$

where A_i are the activities of the isotopes formed, M_i the atomic weights, θ_i are the isotopic abundances of given isotopes in nature, K_i the branching ratios of measured transitions, η_i are efficiencies of the detection system, σ_i are the fast neutron cross-sections, t_1 the irradiation times and t_2 the time interval after irradiation.

The ore samples were irradiated in a neutron flux of about 10^9 n/s/cm² and its activity was measured after 1 min by means a scintillation detector with multiscaler. Three differential discriminators placed between the amplifier and multiscaler formed three windows so that only those pulses which correspond to the photopeaks of measured radioisotopes were accumulated. From the decay curve obtained in this way the elemental content of the ore can be determined. One of the decay curves

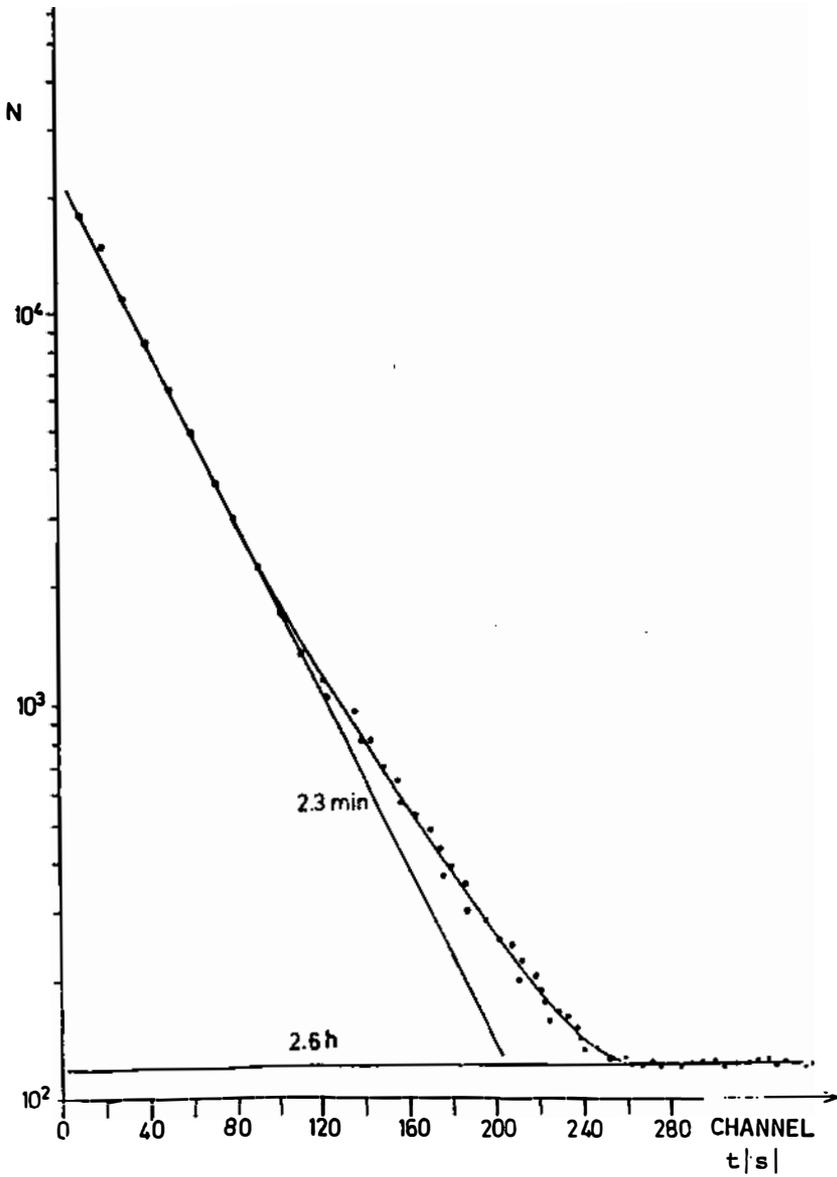


Fig. 1. Decay curves of ^{28}Al ($^{28}\text{Si}(n,p)^{28}\text{Al}$) lifetime 2.3 min; and ^{56}Mn ($^{56}\text{Fe}(n,p)^{56}\text{Mn}$) lifetime 2.6 h.

thus obtained indicating the percentage of Si in the ore, is presented in Fig. 1.

The advantage of this method is its simplicity and time saving, since it does not require any standard for irradiation and activity measurement.

The percentage of Si , Mg and Ni in the Drenica nickel ore, containing $(13.7 \pm 0.3)\%$ of Fe , were determined by this method. According to the obtained results the analysed ore sample contained $(22.3 \pm 1.1)\%$, $(6.84 \pm 0.50)\%$ and $(2.50 \pm 0.20)\%$ of Si , Mg and Ni , respectively. Given errors do not include the corresponding errors of the cross-sections.