

# ACTIVATION ANALYSIS – USEFUL TOOL FOR MULTIELEMENT ANALYSIS IN GEOCHEMICAL AND COSMOCHEMICAL RESEARCH

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Activation analysis is a method of multielement analysis based on the conversion of stable nuclei to radioactive nuclei via nuclear reactions induced by irradiation of an analyzed sample with suitable radiation, and measurement of radioactivity of the reaction products.

Neutron activation analysis (NAA) employing irradiation with neutrons occupies a dominant position among other variants of activation analysis, particularly in determination of trace elements. Its main advantages are high selectivity and sensitivity, the virtual absence of an analytical blank, an inherent potential for accuracy and the possibility to perform simultaneous determination of a large number of elements nondestructively in the instrumental variant of the method (INAA). Determination of some elements can be hindered by macroactivities produced by activation of major elements, particularly in analysis of geological samples. Here, photon activation analysis (PAA) utilizing irradiation with high energy photons is a useful and complementary method to NAA. In PAA, the matrix effect does not hinder determination of trace elements to such extent as in the case of NAA, and higher penetration of high energy photons and lower activities produced allow also analysis of larger, more representative samples. It also allows determination of several elements with a better sensitivity than NAA.

The lecture/workshop will provide an introduction to principles of activation methods and their applications focused on the area of geochemical and cosmochemical research. A brief summary of principles of radioactivity and nuclear transformations, and review of sources of neutrons and high energy photons utilized in NAA and PAA, respectively, will be given. Classification and practical aspects of methods of activation analysis will be presented. The possibilities (suitability, sensitivity, interferences) of NAA and PAA for analysis of various minerals, rocks and extraterrestrial materials will be discussed and illustrated by several case studies.