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Scanning X-ray fluorescent elemental microanalysis with synchrotron radiation in geochemical research

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The traditional XRF analysis with high limits of detection is limited in application for geochemical researches. Use of synchrotron radiation considerably expands its opportunities [1].
Since 1985 in BINP analytical works with syncrotron radiation from storage ring VEPP-3 are carried out. A plenty of methodical and research works with geochemical samples has been executed. The range of energy excitation 15 - 50 keV is now accessible, that allows to determine the following elements in geological samples weight from 1 mg: P, S, Cl, K, Ca, Ti (LD=50 ppm, St.dev.=5 ppm); V, Cr, Mn, Fe, Co, Ni (LD=5 ppm, St.dev.=0.5 ppm); Cu, Zn, Ga, Ge, As, Se (LD=0.5 ppm, St.dev.=0.05 ppm); Br, Rb, Sr, Y, Zr, Nb, Mo (LD=0.1 ppm, St.dev.=0.03 ppm); Ru, Rh, Pd, Ag (LD=0.05 ppm, St.dev.=0.01 ppm); Cd, In, Sn, Sb, Te, I (LD=0.1 ppm, St.dev.=0.03 ppm); Ba, La, Ce, Nd, Sm (LD=1.0 ppm, St.dev.=0.15 ppm); Pb, Bi, Th, U (LD=1 ppm, St.dev.=0.1 ppm). The analysis is carried out in some stages with use various energy of excitation (usually – 15-18, 22 - 25 and 40-45 keV).
The first instrument of scanning X-ray fluorescent elemental microanalysis with synchrotron radiation from storage ring VEPP-3 (scan.XRFA-SR) was founded in BINP SB RAS in the 1988 and applied to study the spatial distribution of elements in geological samples [2]. Scan.XRFA-SR was used in paleoclimate reconstructions based on high-resolution sediments and tree-rings analysis [3, 4, 5]. Unique opportunities of XRF SR allow to carry out scanning microanalysis with spatial resolution ~10 micron. The set of analyzed elements and range of concentration are determined by selection of energy of excitation and time of measurement in a point. In recent years, has been studied many different geological samples: diamonds, xenolith, ferromanganese nodules, bottom sediments.
Studies have demonstrated the unique ability of scanning XRFA-SR: a simultaneous analysis of more than 30 chemical elements with a spatial resolution of 10-50 microns.
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