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ANALYSIS OF URANIUM BY TRLIF, RIMS AND ICP-MS

Laser spectroscopy (Resonance Ionisation Mass Spectrometry-RIMS, Time Resolved Laser Inuced Fluorescence-TRLIF, Time Resolved Laser Induced Chemiluminecence-TRLIC,) and Inductively Coupled Plasma Mass Spectrometry (ICP-MS) can be very efficient for elemental and isotope composition analysis of various samples, as well as for the determination of the molecular and valence forms of uranium (speciation analysis) [1-5].
A series of reference materials measurements with various isotope compositions ranging from depleted and natural to enriched uranium by RIMS have been previously reported by our collaboration [1,2]. For samples of depleted uranium the $^{235}U/^{238}U < 0.003$ ratio was determined with <7% precision (2σ errors) for the total uranium concentrations not exceeding ~80 fg per sample [1].
Without mineralization, the limit of uranyl detection (LOD) by TRLIF in blood plasma has been determined $0.1 ng/ml$. After mineralization, a lower LOD ranging $0.008 ng/ml - 0.01 ng/ml$ has been evaluated. The limit of uranyl detection in urine in our TRLIF experiments was up to $0.005 ng/ml$. Such LOD are sufficient to allow for studies the dinamics proccesses and behaviour of the of uranium in biologicas objects [3,4]. However, actinides in various valence states do not all exhibit luminescence properties and for such cases the TRLIC methods can be applied [2,5].
A high concentration of uranium we detected by ICP-MS in the bones of dinosaurs $(122 mg/kg)$, South mammoth $(220 mg/kg)$, prehistoric bear $(24 mg/kg)$ and archanthropus $(1.5 mg/kg)$ compared to surrounding soils $(3.7 mg/kg - 7.8 mg/kg)$ and standard bones $(< 0.01 mg/kg)$ was established. The standart $^{235}U/^{238}U = 0.007$ ratio was detected for all samples, but the $^{234}U/^{238}U$(detected $1.6 \cdot 10^{-4} \div 5.8 \cdot 10^{-5}$) ratio differ from secular equilibrium value $^{234}U/^{238}U (5.5 \cdot 10^{-5})$.

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