Hydrogeochemical characteristics in the basin area of the ”Rovni” accumulation - influence of the natural radionuclides

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The hydrogeochemical prospecting covered 110 km^2 of basin surface area of ”Rovni” accumulation. Among the water flows the most significant rivers are Sušica and Jablanica, which are mostly cut in into the limestones of Mesozoic in age. The area incoporated in the eco-geochemical research is built of Palaeozoic and Mesozoic sediments, and Quaternary material. According to geological-structural characteristics of the terrain, of special significance is the presence of pyroclastic material (tuff, volcanic breccia) as well as limestones (T_2^2) and bauxite ore bodies within. Average values of natural radionuclides content in bauxite are: 2.24 g/t for ^{238}U, 14.82 g/t for ^{232}Th and 0.14% for ^{40}K [1]. Hydrogeochemical research of radioactive elements in bauxite were conducted for all four seasons. Average uranium content for all four seasons varies within the interval 0.21-0.26 μg/l; Ra <0.05-0.09 Bq/l and Rn 0.1-4.7 Bq/l [1] Regarding the presence of Sb, Cu ore occurences, Fe, Cu mineralization (pyritization, limonitization) in the basin area, natural radionuclide contents were determined as well as pH, Eh, Ep, microelements, gases, mineralization and anion-cation composition. Presence of natural radionuclides in water is negligible and it doesn't affect the quality of water in the future accumulation [1]. All results are presented in tables, charts and geochemical maps. Geoecological map of the basin area presents the geoecological state in the living environment before the dam construction, and it also enables making a base for evaluation of accumulation degradation during a multiyear period of exploitation.

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[1] Gordanić V. (1992) Ecological-geochemical researches of radioactive and other elements of the ”Rovni” accumulation in the area of sanitary protection, fund of expert documentation of Geoinstitute, Belgrade, Serbia.

Early detection of osteolytic lesions in multiple myeloma using natural Ca isotopes

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Real time monitoring of bone metabolism in multiple myeloma (MM) would help clinicians detect MM onset earlier than is currently possible. A biomarker detecting incipient or asymptomatic bone destruction would help evaluate the efficacy, timing, and duration of bone-specific therapies. Naturally occurring Ca isotope ratios in serum may be such a biomarker.

Natural changes in the Ca isotope composition of blood provide quantitative information on short-term changes in net bone mineral balance (BMB), information unavailable from conventional biochemical measures of bone metabolism. Net bone gain or loss cause blood and urine to be respectively enriched or depleted in light Ca isotopes. Based on studies of bed-rest induced bone loss [1,2], a net bone mineral loss rate of about <4%/year is detectable.

Osteolytic lesions occur in >80% of MM patients and should cause negative shifts in BMB detectable by Ca isotopes. Patients with MGUS (Monoclonal Gammopathy of Undetermined Significance) progress to MM at a rate of 1-2% per year, often with the onset of osteolytic lesions. In a pilot study, Ca of blood from patients with MGUS was isotopically heavier than Ca in blood of patients with MM (n=19, p=0.01, Mann-Whitney test). This difference is consistent with osteolytic lesions in MM patients. Ca isotopes may be used in the clinic to detect bone disease early, monitor its progression, and evaluate which patients are at highest risk for rapid deterioration.

[1] Morgan *et al* (2012) *PNAS* **109**, 9989-9994. [2] Skulan *et al* (2007) *Clin Chem* **53**, 1155-1158.

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