The variability of the mineral and chemical composition sediments of intramontane Sącz Basins

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Introduction: Sediments of intramontane basins are a result of various geological processes and, therefore, have a specific mineral and chemical composition [2].

The study area comprises the Sącz Basin, built of Neogene sediments covering an area of approx. 70 km^2. The samples (sandstones and clay rocks) collected from the Biegonice Formation profile, exposed as a result of the floods in 2001 in the Kamienica Nawojowska trough.

Methods: The samples represent blue, yellow and black loams. Their digestion was made according to the EPA-3051 method.
The mineral composition was established using the XRD method on the basis of the ICDD catalogue. In order to identify clay minerals, additional X-ray patterns of the samples glycolated and those calcined at a temperature of 560°C were analysed.
The contents of main elements (SiO_2, Al_2O_3, CaO, Fe_2O_3, K_2O and MgO) were determined using the XRF method, and the contents of minor and trace elements with the ICP-MS method.

Results: The main elements make up approximately 99% by weight. The dominant is silica (SiO_2) ranging from 63 to 73 wt.% (average 69 wt.%).
The contents of the remaining main oxides (those of Al, Ca, Mg and Fe) are 19, 1, 2 and 8 wt.%; respectively, being slightly below the expected values [1]. Sulfur occurs, however, in significantly higher amounts (0.43-0.41 S wt.%) than its natural background (0.02% for sandstones and 0.22% for clay rocks).
The group of trace components with a total of approximately 0.074 wt.% includes Ag, As, B, Br, Cr, I, Ni and Pb, distinguished as the elements occurring in amounts higher than those reported by other authors [1]. In the group of 15 next trace elements (Cd, Ni, Se, Ag, As, Cs, Cu, Ga, Rb, Sn, W, Y, Zn, Zr and Ti), their contents show no significant differences with the values considered as the natural contents.
The amounts of Cd and Hg in the sandstones are 10 times higher and in the clay rocks two times higher than the expected values [1]. Selenium shows the highest differences between the expected and the determined contents, being more than 100-fold higher in the sandstones and 6-fold higher in the mudstones. Generally, higher amounts of trace elements are associated with the clay fraction (particle size <63μm) than with the sand fraction (2-0.02 mm).
In all the samples quartz is the dominant mineral, being always accompanied by illite, chlorite and smectite. Mixed-layer chlorite-smectite and smectite-illite minerals are frequent components, while calcite, dolomite and hematite occur in some samples. Feldspars have also been identified: a potassium variety (microcline?) and a plagioclase (albite?). Kaolinite has been found in blue loams overlaying a coal inset; this mineral confirms the terrigenous nature of these sediments [3].

Discussion: The results help in characterizing marine and terrigenous sediments of the intramontane Sącz Basin.
Significant differences between the contents of both major and trace elements depend on the grain size of sediments. The most diversified is the chemical composition of clay rocks.
Among detrital minerals quartz and feldspar, being accompanied by clay minerals (illite, chlorite, smectite and their mixed-layer varieties). Just these clay minerals due to their sorption capacity of exchangeable cations are responsible for the geochemical differentiation of the rocks building geological subunits.

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