

Volcanic glass transformation types and their relationship with the basin's parameters: a case study of the Rupea tuffs (Transylvanian Basin) and Govora tuffs (Dacian Basin)

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Tuff is a type of pyroclastic rock made up of small sized particles (a diameter of less than 2 mm) –vitric ash, crystal ash, lithoclasts. At 25°C and 1 atm. volcanic glass is unstable; this determines the devitrification of the amorphous matter. The pyroclastic deposits show high permeabilities and porosities that allow water circulation, which results in the transformation of the glass into zeolites and clay minerals. Volcanic tuffs in Romania show a riodacitic composition, are of Badenian age and were deposited in the Miocene molasse units in Romania. Usually, riodacitic glass is initially transformed into an aluminosilicatic gel; the next transformation steps are: clay minerals, zeolites, analcime and, finally, potassium feldspars.

The paper is an attempt to qualitatively determine the salinity and pH of the Transylvanian Basin and the Dacian Basin (former parts of the Paratethys Basin) during the Tortonian (depositional moment of the Rupea tuffs and Govora tuffs). The method used is X-ray powder diffraction. The results show different transformation patterns which could be interpreted as the response of the vitrified material towards the basin's parameters.

The equipment used for the X-ray powder diffraction method was the X'Pert Pro MPD Panalytical diffractometer which is equipped with a goniometer, an X-ray tube and a detector slit (a Geiger Muller counter). The scan parameters were: Start Position [2θ]: 3.0167, End Position [2θ]: 119.9937, Step Size [2θ]: 0.0170, Scan Step Time[s]: 30.3662. Data acquisition was realized using X'Pert Quantify software. Data processing using X'Pert High Score software shows that the samples from Rupea include the following mineral phases: quartz, potassium feldspar, clinoptilolite, illite and carbonates. The mineral phases that compose the Govora tuffs are: quartz, potassium feldspar, illite, smectite, kaolinite and carbonates.

Regarding the mineralogical associations in both Rupea tuffs and Govora tuffs, quartz and potassium feldspars are considered to be primary phases, while all other mineral phases represent the result of the diagenetic processes that the volcanic glass has suffered. As the global chemical composition of Rupea and Govora tuffs was determined to be similar, the different subsequent evolution of the volcanic glass is due to basin conditions – salinity, pH, burial ratio.

The zeolitic transformation of the Rupea tuff shows either that the pH was higher than 9 and the salinity and alkalinity of the Transylvanian Basin were higher, or that the dynamics of the solutions was more active than that of the Dacian Basin, or a combination of these two factors. The secondary minerals in the mineralogical association of the Govora tuff are mostly represented by clay minerals; this indicates either a lower salinity of the basin, or a proximal disposition within the basin.

References

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