

## Tectonic constraints of travertine occurrence in the Podhale Flysch (Inner Carpathians)

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The occurrence of travertines in the Podhale Flysch has been documented a long time ago (Halicki and Lilpop, 1932). Only a few appearances of these rocks were noted in later reports. During fieldwork in the entire Podhale area, the authors have documented about 50 localities with travertines. Their number is variable due to the erosion of the existing exposures and the creation of new ones. According to pollen analysis, these rocks have developed from the Early Holocene times until present.

Travertines are formed when the environment contains  $\text{Ca}^{+2}$  ions mostly with  $\text{HCO}_3^-$  anions and minimal quantities of  $\text{CO}_3^{-2}$  anions. Precipitation of travertines is induced by disturbances in the system, resulting from turbulent flow and/or decrease of partial pressure. In turn,  $\text{Ca}^{+2}$  ions appear as the result of leaching of calcium carbonate by thermal waters from the flysch rocks or their basement.

The Podhale Basin is filled with flysch shales and sandstones, mainly of Oligocene age, lying on the Nummulitic Eocene. The thickness of the entire complex is estimated at 4÷2.5 km. The contact of the Podhale Flysch with the Tatra Mts. is sedimentary, whereas with the Pieniny Klippen Belt – tectonic in nature. Steep bedding dips gradually become gentler near the Pieniny Mts. Dip values significantly increase again in the zone of the peri-

-Pieniny flexure. Further to the south, an uplifted zone of gently dipping beds with occurs, followed by the axial zone. The southern limb of the basin is isoclinal with a narrow belt of tectonic deformations near the Tatra Mts. These parallel tectonic zones are cut by large transversal Białka and Biały Dunajec fault zones (Mastella, 1975). The structure of the Podhale Basin was formed in the course of block movements in the basement from the Late Oligocene to Middle Miocene times.

Travertines precipitate near fissure springs linked with small faults and breccia zones or seepages occurring in their elongations. From tectonic viewpoint, exposures with travertines occur in two belts concordant with the Białka and Biały Dunajec faults. The belt of travertine occurrences is less distinct in the zone of beds with gentle dips in the eastern part of the basin, continuing in the axial zone in the western part of Podhale.

### References

- HALICKI, B., & LILPOP, L., 1932: Czwartorzędowe trawertyny w Gliczarowie i na Podhalu. *Posiedz. nauk. Państw. Inst. geol.*, 33, 97 – 98. (In Polish.)  
MASTELLA, L., 1975: Tektonika fliszu we wschodniej części Podhala. *Rocz. Pol. Tow. geol.*, 45, 361 – 401. (In Polish.)