

In general the subvertically arranged Jurassic–Lower Cretaceous basinal facies display the tectonics of the diapir character originated in the strike-slip zone between two plates. The ridge facies are often uprooted and display thrust or even nappe character.

The origin of the Gorge is related to the neotectonic movements during the Neogene time. Following the Serravalian formation of the Outer Carpathian fold-and-thrust belt, the plate boundary was covered during the Neogene by at least 600–900 m of sand, silt and clay, which were deposited in the Orava–Nowy Targ Depression east of the Gorge (Chrustek & Golonka, 2005). The Dunajec River valley reached the mature stage during the latest Miocene–Pliocene time. This stage is indicated by numerous meandering bends of the river. The vertical uplift of the Pieniny Mountains followed the meandering stage of the Dunajec River. Faulting and uplifting played a tremendous role during the Neogene tectonic evolution. Dense and regular fault net is one of the characteristic features of the Carpathians. Brittle, mainly strike-slip faults combined with other dynamic tectonic boundaries allowed the propagation of individual, detached blocks to the realm of the future Carpathian region (Golonka *et al.*, 2006). At least some of the faults were still active during the Quaternary (Baumgart-Kotarba, 1996, 2001; Zuchiewicz *et al.*, 2002). The studies on the 1995 earthquake (Baumgart-Kotarba, 2001 and references therein) show the good agreement of focal model with the trends of vertical crustal movements. The recent vertical movements in the area are up to +0.5 mm per year (Vanko, 1988; Vass, 1998). During the

fault-related uplift the Dunajec River cut through the competent, Jurassic–Early Cretaceous cherty limestones, forming the magnificent cliffs of the Gorge. Most recently description of age and origin of the Dunajec River Gorge with the review of structural and geomorphological features of the Pieniny Mountains was published by Birkenmajer (2006, 2017).

The boat trip launches from Sromowce Kąty village within the Pieniny Klippen Belt (Fig. 48). The harbor is easily accessible by car or bus. Many travel companies offer the rafting trips combined with the coach transportation. The coaches bring tourist to the starting point and pick them up at the final destinations in Szczawnica or Krościenko.

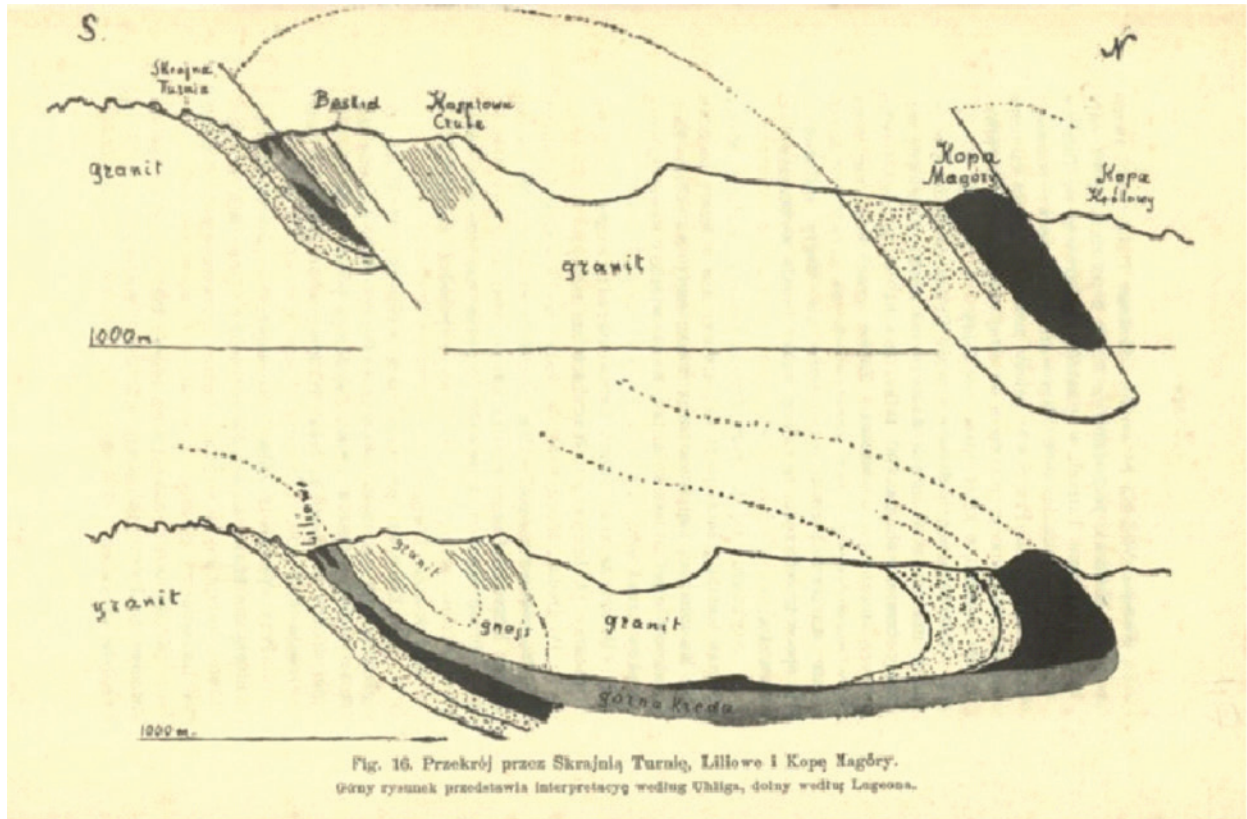
## Stop 18 – Szczawnica (“Orlica”) – history of the discovery of nappes in the Carpathians (Figs 35, 50–52)

(Michał Krobicki)

As a representative of the young French school of alpine tectonics, 33 years old Maurice Lugeon took part in a seven-day geological field trip to the Pieniny and Tatra Mountains (from 11 to 18 July 1903) as a part of the 9th International Geological Congress organized in Vienna.



Fig. 50. Two prominent scientists – specialists of the Pieniny Klippen Belt geology (after Krobicki, 2023)



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**Perspektywy badań geologicznych,  
hydrogeologicznych i poszukiwań złóż w Małopolsce  
w 120-lecie teorii płaszczowinowej w Karpatach**

Viktor Uhlig Maurice Lugeon

Partnerzy:

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Fig. 51. Different interpretations of tectonic position of the Tatra Mts structures: upper cross section – Uhlig’s idea and lower cross section – Lugeon’s idea; lower position – circular of the 88<sup>th</sup> Polish Geological Society Meeting (after Krobicki, 2023)

The trip was led by the famous Victor Uhlig – an Austrian professor of geology at the Vienna University, author of synthetic studies of the Tatra and Pieniny geology (Uhlig 1890a, 1890b, 1891, 1897, 1903; Sokołowski, 1954b). In these two people, different concepts of origin of tectonic structures within Tatra and PKB clashed. V. Uhlig proposed adopting the autochthonism of fold structures, both for the Tatra Mountains and for the PKB (Limanowski, 1904, 1905; Świdorski, 1923; Sokołowski, 1954a, 1954b), while M. Lugeon preferred their nappe style of tectonic structure (Lugeon, 1902a, 1903), even though he had never been to Poland before the aforementioned trip! This alpine geologist, mapping complex structure of the Alps of the Swiss-French borderland, he was a staunch supporter new, nappe interpretation of their structure. Relying only on the perfect geological maps of V. Uhlig, he came to the conclusion

about a similar, as the Alps, tectonic style of the Polish Carpathians, including the Tatra and the Pieniny mountains (Limanowski, 1905). Already on the first day of this field trip (August 11, 1903), passing from Nowy Targ to Czorsztyn village and seeing isolated klippen of the Pieniny Mountains in the landscape very similar to Chablais region in the French Alps that was the object his doctoral thesis in 1895. In 1902 year, he published a note in which he presented tectonic analogies between the geology of the Alps and the Carpathians (Lugeon, 1902a, 1902b), and then extended this thesis in more detail the following year (Lugeon, 1903). The most likely in the vicinity of today's PTTK hostel "Orlica" in Szczawnica, in August 12, 1903, decisive observations and discussions took place about his suppositions as to the nappe genesis also of this part of the Alpine orogen (Krobicki, 2022).

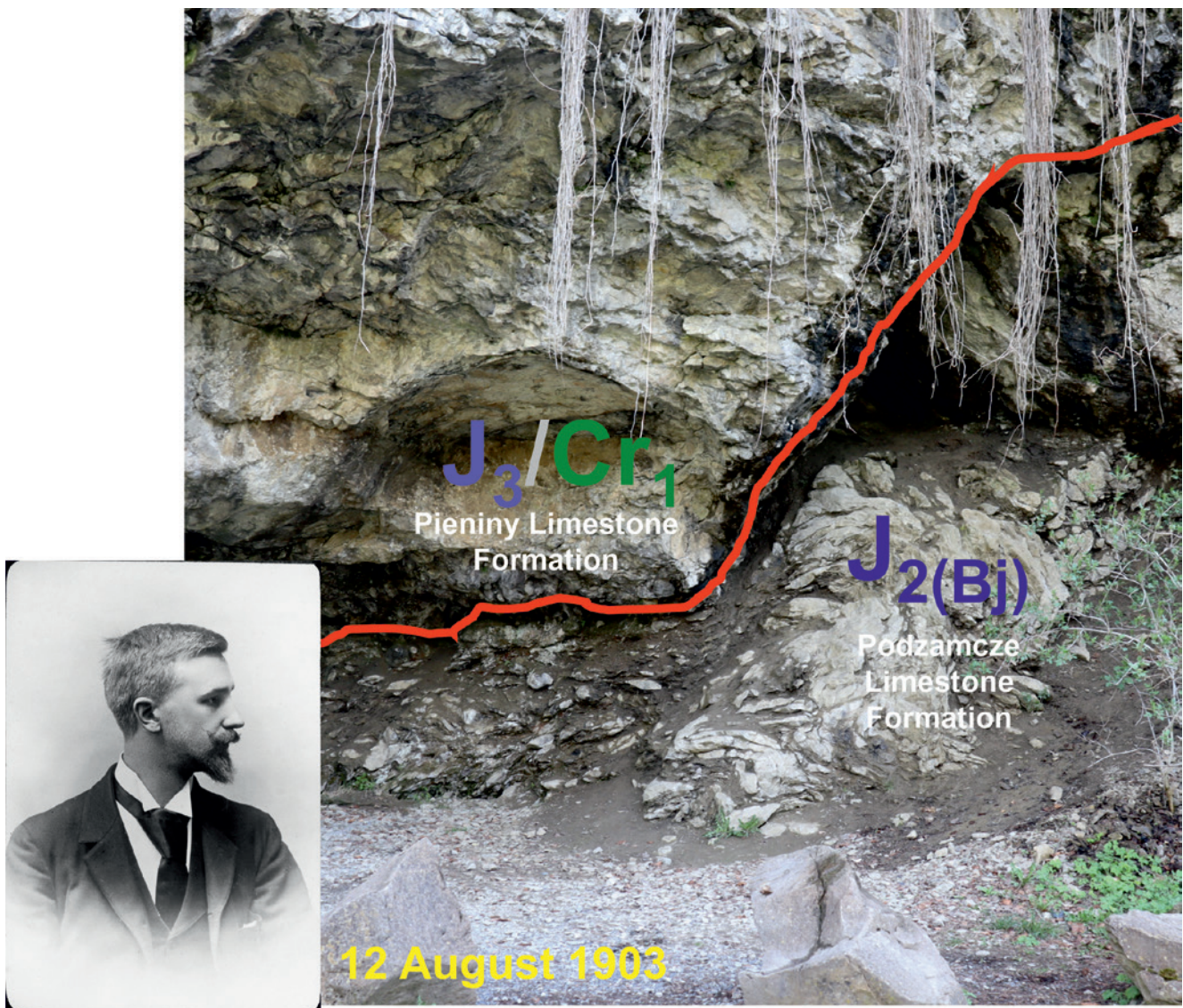


Fig. 52. Ziblikiewicz's cave in Szczawnica Niżna, along so-called Pieniny road nearby of Orlica hostel – tectonic contact between of nappe character; 120 anniversary of Maurice Lugeon visit of this place during International Geological Congress (Vienna'1903) with tectonic contact between two nappes?/thrust sheets? (after Krobicki, 2023)