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The Problem of the Svratka Anticline

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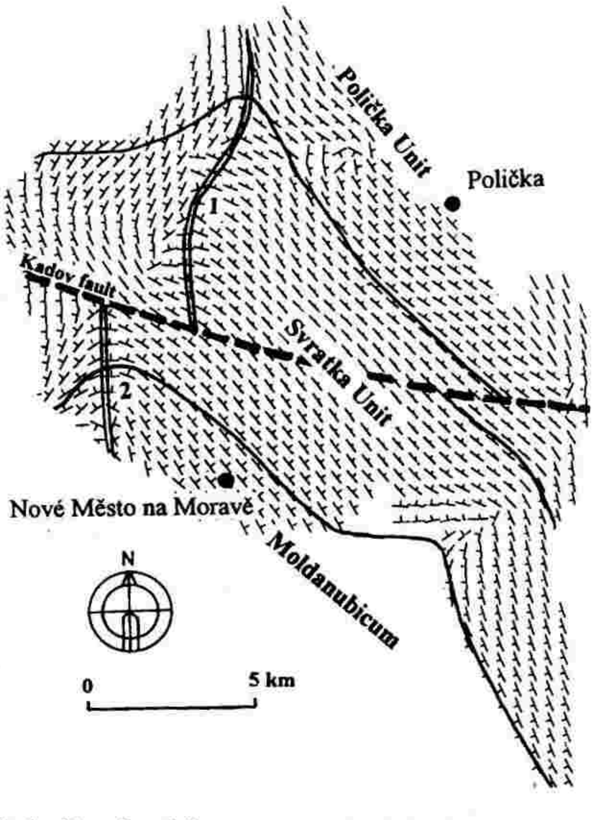

Fig. 1. Map of spatially averaged directional data (foliation) of the Svratka Unit. Rosiwal's (1) and Zrůstek's (2) anticline are two parts of one large anticlinal structure.

The term Svratka Anticline (Die Anticlinale von Swratka) was used for the today's Svratka Unit by Rosiwal (1895). The Svratka Unit is a metamorphic complex consisting of polyphase migmatitic rocks and mica schists with some inclusion of skarns, amphibolite bodies and metasediment intercalations (marbles). It comprises a large deformed intrusion of granites with small apophyses. The Svratka Unit is in contact with the Moldanubicum in the SW and the Polička Unit in the NE.

The dominant small-scale fold system can be recognised almost in the whole unit. The folds are tight to isoclinal and overturned to the SW with axes trending in a NW-SE direction. The study of these small-scale folds and perianticlinal structure in the geological map led Rosiwal (1895) to regard the Svratka Unit as a large isoclinal structure and to correlate the Polička Unit and the Moldanubicum as two opposite limbs of the large fold with the Svratka Unit in the core. This idea was accepted also by Beneš (1962), but there are some arguments opposing this view:

1. Considered perianticlinal structure is developed only in the NW part of the Svratka and Polička Units while it is not developed in the central and eastern parts.
2. The axes of dominant small-scale folds are trending in a little different direction than the axis of the large anticline. It indicates that these two structures are not equivalent.
3. Foliations dipping to the W or NW in the NW part of the unit is younger than the NE-dipping foliation in the central part. Asymmetrical structures connected with younger foliation indicate transtensional slipping, however, the old NE-dipping foliation is without asymmetrical structures.
4. Not only one perianticlinal structure is present. The second one is situated of the NW boundary with the Moldanubicum (Zrůstek 1967). The Moldanubicum is in the core and the Svratka Unit in the envelope of this second anticline. The anticipated perisynclinal structure was not found.

It is possible to interpret these facts by combination of several tectonic events:

1. Origin of the old foliation in the Svratka and Polička Units (preserved in the NE limb of the large fold)
2. Origin of the Svratka anticline by combination of the old foliation and the young one during extensional dextral transtensional slipping in the NW part of the units.
3. Movement along the E-W-striking Kadov fault leading to duplication of the anticlinal structure (Melichar 1995). Consequently it was possible to misinterpret two parallel parts of the same NE-dipping limbs as two opposite limbs of the isoclinal large-scale anticlinal structure (Fig. 1).

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Emplacement Mechanisms of the West Carpathian Cover Nappes

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Rauhwackes / rauhwackised tectonic breccias, which occur at the soles of the superficial nappes were investigated at ca. 50 localities in various tectonic positions: under the Silica, Muráň, Drienok, Choč and Krížna nappes. This rock type was considered as a lubricant horizon, accommodating the thrusting of these nappes.

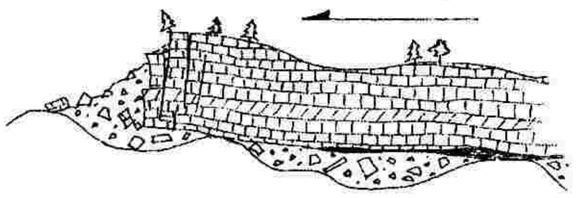

Fig. 1. Formation of the mélange in front of the leftwards advancing nappe body.

Rauhwackes of this origin usually appear as a continuous layer of thickness up to 200 m, separating (or connecting) the overlying nappe from its substrate. The uppermost part is frequently accompanied by the Werfenian shales, that are regarded as the décollement horizon of related nappe. At a certain scale of observation, rauhwacke appears as more or less polymict breccia with a recrystallised calcitic matrix (this need not be obvious from a hand specimen!). Size of rock fragments varies over several orders of magnitude, ranging from silt fraction to boulders of 40 m in diameter. Since this clastic material is derived from various stratigraphic levels of both footwall and hangingwall, it probably accumulated somewhere close to the nappe front in a manner shown on the sketch above. Levelling of the basal relief and erosion of the nappe front produced debris, that was pushed forwards and continuously overridden by the advancing thrust.

Dominant deformation mechanisms operating in the "protorauhwacke" at the time of thrusting was cataclasis and hydraulic fracturation. Cataclasis caused a rapid grain size reduction which resulted in the granular flow. This was very effectively supported by the fluid overpressure, as inferred from rock textures as well as from fluid inclusions. Very soft behaviour of calcitic matrix shows also newly formed idiomorphic quartz, which, at temperature >400°C (measured in fluid inclusions) remained microstructurally intact, without any need to deform internally.

One can consider the rauhwacke horizon as a vast hydrothermal system with well defined chemical and mineral alterations: **Dedolomitisation** occurs when the sulphate-rich fluid attacks the dolomite, leaching-out Mg^{2+} cation, following the overall reaction:

$$CaMg(CO_3)^2 + SO_4^{2-} - MgSO_4 + CaCO_3 + CO_3^{2-}.$$

Dedolomitisation took place in an immense extent, since dolomite seems to have represented a major volume component of rauhwacke. Massive **dissolution of quartz** and subsequent replacement by calcite takes place in a certain phase of rauhwackisation. Sometimes even large blocks of quartz-bearing rock (as e. g. gneiss, arkose, rhyolite) are completely calcitised. **Newly formed euhedral quartz** often grows in the calcitic matrix. Usually it encloses crystals of gypsum, anhydrite, calcite, pyrite, feldspar and clay minerals, fluid inclusions were found as well. Crystal-size distribution appears as negative-exponential, maximum size normally reaches 2 mm, exceptionally 6 mm (along the Z axis). Often the surface of a new quartz is affected by later etching. Euhedral **authigenic feldspar** (mostly albite) is often referred from limestones that have undergone anchizonal metamorphism. In rauhwackes, both albite and K-feldspar was found, often forming the so called Roc Tourné twins. Besides submicroscopical **illite** and **chlorite**, newly formed trioctahedral **K-Mg mica** (?phengite) was found in two samples. They both represent completely dedolomitised tectonic breccia, which might explain the source of Mg. Distortion of euhedral columns along the basal planes or even bending of separate sheets indicates the pre- or rather syntectonic growth of mica. Neogenesis of **pyrite** might have been supplied by Fe^{2+} released from dolomite in a course of dedolomitisation. Authigenic pyrite (now usually hematite pseudomorphs) appears as pyritohedra, sometimes combined with cubes and/or octahedra. Crystal faces show dense striation, which is typical if precipitated from a supersaturated solution.

All the newly formed minerals are occasionally affected by cataclasis and thus must have precipitated synkinematically. In case of quartz and pyrite, their later replacement indicates changing kinetic equilibria, caused by variations in pH and redox potential. Neogenesis of feldspar and mica requires a