

## THE FLYSCH-ZONE AND THE KLIPPEN-ZONES OF THE EASTERN ALPS: HOW DO THEY MATCH WITH THE CARPATHIANS?

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Even a cursory glance at the geological map clearly shows, that the Flysch-Zone along the northern rim of the Northern Calcareous Alps and the Central Carpathians must play a common role in the Alpine-Carpathian belt. Despite the congruencies – rootless nappes and units dominated mainly by flysch formations at the frontal position of the orogeny - we see striking disagreements – the width, the internal structures and the age, thus showing considerable differences in the paleogeography and tectonic history on both sides.

To clarify the interconnection between the external tectonic units of the Eastern Alps and the Outer Carpathians in detail is made extraordinarily difficult, as the Neogene of the Vienna Basin interrupts the continuity at the surface. This presentation will summarise some important results, impressions and ideas from the point of view of an Alpine geologist looking toward the East, trying to find satisfactory correlations between both sides. It takes into account the many substantial progresses, which have been made during the last decades based on both national investigations and international cooperation.

The narrow stripe of the Flysch Zone of the Eastern Alps in its Eastern section includes three major tectonic units: From bottom to top the **Inneralpine Molasse**, the **Helvetic System** *sensu lato* and the predominant **Rheno-Danubic Flysch**, widely considered to be part of the Penninic realm. The predominant formations of the Alpine Flysch Zone are Cretaceous up to Eocene in age. However, Uppermost Triassic to Lower Cretaceous sediments in the so-called **Klippen Zones** display remnants of its original basements.

When trying to compare particular units and formations with the Carpathians we have to consider, that many of the formations are diachronous and become younger toward the East, thus giving evidence of the shifting of the facies from West to East.

The **Inneralpine Molasse** with its Upper Eocene to Oligocene sediments suggests a comparison with the **Stanice-Hustopece Formation** in the Stanice Unit.

The **Helvetic System**, displayed in the **Gresten Klippen Zone** and – with reservation – in the Hauptklippenzone (Wienerwald), represents slices of the Southern European Continental margin. It thus should find its continuation in the **Subsilesian System**. Facial congruencies in the Upper Cretaceous and Tertiary are evident, but Jurassic Gresten-like facies are unknown there. From this point of view the comparison with the Pieniny Klippen Zone, dominating the discussion for a very long time, became obsolete.

The **Rheno-Danubic Flysch**, being homogenous in the Western section, splits up into at least three nappes in the Wienerwald area, different in facies and stratigraphic range. It is the **Greifenstein Nappe**, which has the closest relationship with the Main Flysch Nappe in the West and the **Magura Nappe (Raca Unit)** in the Carpathians and this can be taken as one of the very few well-established links. Accordance can be traced into the Carpathians at least up to the Western Beskides in Poland. A possible connection between the **Laab Nappe** and the **Bilé Karpaty Unit** of the Magura Group is under consideration. The **Kahlenberg Nappe** and its pre-Cretaceous basement in the **St. Veit Klippen Zone** with its picritic volcanism has no equivalent in the Western Carpathians.

The **Ybbsitz Klippen Zone**, exposed in front of the northern border of the Calcareous Alps, comprises a Jurassic pelagic sequence along with strongly tectonized mafic/ultramafic rocks, draped with a Cretaceous Flysch with an abundance of chromite, represents a dismembered ophiolite suite. Facies and tectonic setting refer to a South Penninic origin and has absolutely no equivalent in the Western and Northern Carpathians. But far to the East, in the East and South Carpathians, an analogous – if not homologous - development is evident in the **Sinaia Flysch**, particularly in the **Severin Nappe**. This comparison deserves a closer examination.

From these aspects, the **Pieniny Klippen Zone** in the Carpathians has no comparable equivalent in the klippen zones of the Eastern Alps. Its overall facies, particularly the evidence of the exotic “Andrusov ridge” seems – in the authors opinion – to refer to frontal Austro-Alpine units.