Deformation of Metamorphic (Tornaic?) and Non-Metamorphic (Bódva) Mesozoic Sequences in the Central Part of the Rudabánya Hills (NE Hungary)

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The examined area is situated in Rudabánya Mts. between Perkupa and Szalonna villages on the Csipkés and Dunna-tető Hill. According to the previous investigations the studied area is part of the Bódva Nappe, and was separated into two tectonic units (Less et al. 1988). In the lower unit the first formation on the surface is an Upper Jurassic sequence, built of black shale and marl with subvolcanic bodies (Telekesoldal Fm.). The upper tectonic unit, which is built up by an overturned Bódva type Triassic sequence on Csipkés Hill and in the borehole Perkupa P-74, was thrusted upon the above mentioned Jurassic rocks (Péró et al. 2002, 2003). The oldest light-grey, Lower Anisian platform carbonate of Steinalm Limestone Fm. is situated in the uppermost position. The Middle to Late Anisian is represented by a pinkish-grey, micritic, pelagic limestone (Dunnatető Limestone Fm.). The youngest Triassic formation is a Late Anisian to Late Carnian dark-grey, black cherty limestone, and a pink limestone with red cherts (Bódvarákó and Bódvalenke Fm.). According to the previous studies the Triassic sequence represents the overturned limb of a recumbent fold, which is thrust over the Jurassic rocks (Less et al. 1988, Péró et al. 2002, 2003). There is another Bódva type sequence on the Dunna-tető Hill, which is built up by the same formations as the overturned one, but here the stratigraphical younging is normal.

The upper tectonic unit is shown as the part of the non-metamorphic Bódva Subunit on the geological maps (Less et al. 1988). According to new observations and mapping results there are two Triassic sequences on the slope of Dunna-tető Hill. One of them is the above mentioned normal younging Bódva-type sequence, with an age of Early Anisian to Middle Carnian based on conodont investigations (Kovács et al. 1989, Kovács unpublished results, 1982).

In the course of field works another type of sequence was observed in some outcrops, and trenches in a narrow zone on the slope of Dunna-tető Hill. It contains Upper Ladinian (Longobadian) brownish-grey banded limestone (Szentjánoshegy Limestone Fm.?), Carnian dark-brown shale (Tornaszentandrás Shale Fm.?), lower-Norian light-grey cherty limestone (Pötschen Fm.), Middle to Upper Norian purplish-red and yellowish-white banded limestone with red cherts (Nagykő Limestone Fm.?). These rocks macroscopically have a close similarity to the rocks of the metamorphic Torna Unit s.s.

This sequence is foliated. The foliation and the bedding are parallel, or intersect each other at an oblique angle (Fig. 1a). In some places the foliation has been folded. The foliation can be noticed not only macrocopically but also microscopically on thin sections (Fig. 1b). The original texture of the limestone can be recognised, but the radiolarians are flattened, and arranged to one direction.

The metamorphic grade of some of these foliated rocks was investigated by Kovács and Árkai (1986, 1989). According to the illite crystallinity and the Conodont Colour Alteration Index the samples from Dunna-tető Hill have been anchimetamorphosed. The formations were thought to be a member of the Bódva Nappe, and the anchimetamorphic grade was considered as a result of a local tectonic zone.

The age determinations are based on unpublished conodont investigations of Sándor Kovács. On the basis of these it is possible, that there are two individual sequences on Dunna-tető Hill. The pink limestone with red cherts (Bódvalenke Limestone Fm.) covers Late Anisian – Middle Carnian, while the brown, banded limestone (Szentjánoshegy Limestone Fm.?) sedimented already in the Late Ladinian.

On the western slope of Dunna-tető Hill in the Dunnatető Limestone a few small-amplitude folds can be recognised. The folds are open, rounded hinge. According to stereographic constructions the axis dips to WSW. The fold hinges from small-scale folds corresponds to fold axes constructed from scattered dip measurements of the Bódva unit rocks. The measured small-scale folds, according to geological sections constructed, are likely parasitic-folds of a large-amplitude fold.

To summarize the old and new data it is possible, that there is a Torna-type sequence on the Dunna-tető Hill, too. However, the exact relationship of metamorphic and non-metamorphic sequences has not clarified, yet. On the basis of the geological sections constructed so far, the anchimetamorphic rocks can either be in a tectonical window, or a nappe outlier above the Bódva Nappe.

The boundary of the upper two tectonic units (metamorphic and non-metamorphic Triassic) and the footwall Jurassic sequence was detected by mapping. The tectonic boundary can be approximated with a flat dipping 350/10º surface. The vergency of this overthrust is southern. The fault plane seems to be planar, expect for few locations, where small-scale folds of a Jurassic conglomerate slightly deformed the thrust.

We have detected the following tectonic phases so far:

1. Development of layer-parallel or low angle foliation in the Torna? Unit under anchimetamorphic condition.
2. The Bódva Nappe thrusts upon the Torna Unit. (Or the Torna Unit thrusts upon the Bódva Nappe?)

3. At the same time, or after it, the two units became folded. (development of small-scale folds and folded foliation)
4. The two units together thrust upon the Jurassic sequence.
5. At the time of overthrusting or after it, it is possible to have one more deformation phase with a compression of ENE–WSW that slightly refolded the previous existed structures.

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Tertiary Rotations Detected in the Fruška Gora (South Pannonian Basin) by Paleomagnetic Measurements

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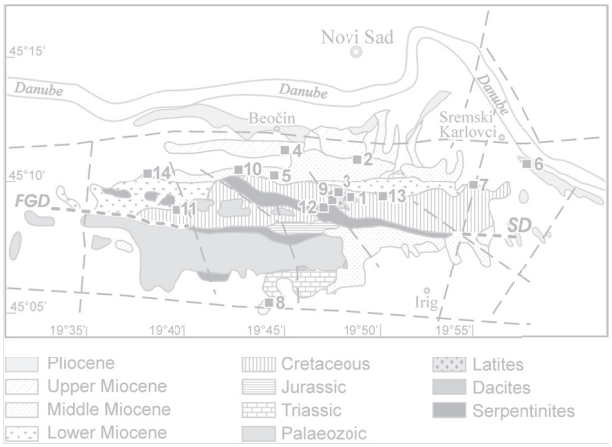
Fruška Gora, is an inselberg, in the South Pannonian basin, which originally belonged to the Vardar ophiolite zone. The uplifted horst is partly covered and surrounded by Miocene and younger sediments. As paleomagnetic measurements carried out in the western and central South Pannonian basin revealed a co-ordinated counterclockwise rotation during the latest Miocene possibly early Pliocene, we decided to find out if Fruška Gora also participated in this rotation. Thought this was our primary task, we also sampled older rocks in order to trace possible pre-Miocene movements.

Of the 16 sampled localities, 14 gave statistically meaningful results. Some of them are relevant to the Miocene and later tectonic history indicating that Fruška Gora rotated in co-ordination with the Medvednica–Hrvatsko Zagorje area and with the Slavonian Mountains close to the end of Miocene i.e. was probably driven by the rotation of the Adriatic microplate (Márton et al. 2003).

Upper Cretaceous flysch and Oligocene (Knežević et al. 1991) latite intruding it shows clockwise rotation. Since our results represent one of the blocks of the Fruška Gora horst and the different blocks came into contact only after the Cretaceous (Dimitrijević 1997), the clockwise rotation can be interpreted in two ways. It can signify the emplacement of the block, which is north of the Srem dislocation zone or can be of regional significance. In the latter case, the Fruška Gora en block must have been displaced relative to the rest of the Vardar zone after the intrusion of the latite, during the Oligocene or early Miocene.



■ **Fig. 1.** Paleomagnetic sampling localities (1–14) in the Fruška Gora. Key: SD: Srem dislocation zone; FGD: Fruška Gora dislocation zone.