The Jurassic rocks of the Rudabánya Hills have been studied since the middle of the 19th century. However, our knowledge on their tectonic position, the number of the tectonic units, the history of their deformation, their exact age, their Triassic basement, and anyway, the correct order of the formations are not satisfying, yet. On the other hand, the Jurassic age of these formations was generally accepted only about 15 years ago, based on the works of Grill, Kozur and Dosztály.

The previous researchers divided the Jurassic rocks into two sequences by right of lithological and palaeontological data (Grill and Kozur 1986, Dosztály 1994). The Telecesvölgy Formation (TV Fm.) starts with red and green clay marl, containing limestone olistoliths and redeposited beds. This sub-unit likely has latest Triassic age, according to the Conodont fauna of the olistoliths and redeposited limestone beds. Although the contact or transition is not clearly outcropping, the green and red marl is followed by grey crinoideal limestone and marl with no exact age, and finally, by black shale, with Bajocian – Bathonian radiolarian fauna (Grill 1988). The first method gives a wide age interval for magma intrusion; the other one may reflect the Early Cretaceous metamorphic event thus the exact formation age of the rhyolite remains poorly constrained.

In our work we made field works and measurements, thin sections, illite Kübler index measurements and radiolarian investigations, and re-examined several borehole material. The rocks of the TO Fm. have a bedding-parallel foliation (S_1), in the olistostromes foliation is connected to strong layer-parallel shortening (flattening of clasts). Rarely the bedding and the foliation intersect each other at an oblique angle. In this case, the foliation is an axial plane cleavage (S_2), connected to closed folds. The bedding-parallel foliation was overprinted by a folding phase, resulting in small-scale kink folds (F_3), at the transition of brittle-ductile deformation field. The effects of such ductile phases cannot be determined neither on the members of the TV Fm., nor on the Triassic rocks of Bódva series (Middle Triassic platform carbonate, red, basin facies limestones and chert from Middle Anisian to Middle Norian).

According to the radiolarian investigations, and the illite Kübler index data, measured on the rocks of TV Formation correspond to the diageneric zone (Árkai 1982, Árkai and Kovács 1986), and contains poor Middle-Jurassic (Bajocian – Upper Bathonian) radiolarian fauna with the dominance of Nassellarians (deeper water) (Do-
sztály 1994, Oszvárt pers. comm.). In contrast with it, the rocks of TO Formation suffered ductile deformation, in most cases show amphibitamorphic illite Kübler index values (árkai 1982, árkai and Kovács 1986), contains Bajocian radiolarian with the dominance of Spumellarians (shallower water) (Dosztály 1994, Oszvárt). We specially investigated the contact of the carbonate-dominated and elastic-dominated latest Triassic to Jurassic formations, and the relationship of the two (latest Triassic–) Jurassic formations. In some borehole (P-74, Szet-4, Rb-658) we found, that the transition between the Hallstatt Limestone of the Bódva series and the red and green marl of the TV Formation is continuous, so we have indication that the Bódva series being the original Triassic basement of the TV sequence. The illite Kübler index (IK) data, measured so far (árkai 1982, árkai and Kovács 1986, and this study) confirm it, because both Triassic and Jurassic sequences have only diagenetic IK values. The relation between the Bódva-type Triassic and TO Jurassic is always tectonic – both in field and boreholes – and there is a considerable difference not only in the metamorphic grade, but also in the style of deformation. So the Jurassic TO Fm. cannot be related to the Bódva-type Triassic sequences, in contrast to previous interpretation (Grill 1988, Less et al. 1988). Superposition of the two latest Triassic–Jurassic formations was in fact penetrated by the borehole Rb-658, in which the TO Fm. is in upper position. The reinterpretation of Szet-4 borehole and its surroundings suggests their superposition, too (Fig. 1.).

We suggest that the TV Formation is the original Jurassic cover of the Triassic carbonate rocks of the Bódva series. The TO Formation is supposed to be a nappo, overlying the Bódva nappe (including TV Fm.). Because the upper “Telekessoldal nappho” is very probably slightly metamorphic, this juxtaposition would only be possible after metamorphism. This overthrust supposed to be a relatively early event, and was followed by several smaller-scale thrusts. We have not direct field data on the vergence of the main nappe emplacement so far. The most frequent dip directions of the formations are W or NW, so the transport direction can be from E to W (hinterland-dipping) or from W to E (foreland-dipping). The vergence of the younger reverse faults and fault propagation fold is to E or SE. This event can be connected to the deformation of the Alsótelekes gypsum-anhydrite body, located somewhat to the S (Zelenka et al. 2005).

There are normal faults among the observed brittle structures, too. Part of them supposed to be active even in the Middle and Late Triassic, causing considerable thickness variations of basinal formations. They can be more than 100 m thick, but in some outcrop it appears only as neptunian dykes in the underlying platform limestone (Steinalm Fm.) and as a few condensed beds. Some of them are reactivated during the Miocene.

According to our investigations and geological sections constructed (Fig. 1.) so far, the following deformation phases can be detected. The first S_{0,-1} foliation of the TO Fm. was most probably formed due to deep tectonic burial (e.g. thrusting) under anhemitamorphic conditions, representing the first D_{1} event. The S_{2} axial plane cleavage of the D_{2} folding phase can be observed only in few outcrops. The last phase of ductile deformation (D_{3}) is represented by kink folds (F_{1}), can be seen in the outcrops and borehole materials of the silicified slate of TO Fm. This kind of deformation could occur at shallower crust depth, at the transition of brittle-ductile deformation field. The influence of these ductile phases cannot be observed on the rocks of Bódva series (including TV Fm.). During the D_{3} deformation event the anchitamor-
morphic „Telekesoldal nappe“ thrust over the Bódva nappe. In the D phase, characterized by NW-SE compression, SE verging reverse faults and fault-propagation folds were formed (Fig. 1). The alternating dip values measured on the rocks of Bódva series and those of TO Fm. are probably the reason of a late folding phase (F5), characterized by open folds with long wavelength. The semi-vertical dipping of the Late Triassic basinal limestones can be formed by movements along SE verging fault-propagation folds (F5). The ongoing NW-SE compression resulted in SE verging thrusts. Among them, an uncertain unit of Gutenstein Dolomite, Steinalm Limestone and Early Triassic marl thrust upon the Bódva Unit. During this thrust the ramp fault might have not reach the surface, but connected to roof thrust of duplexes. The juxtaposition of Aggtelek Unit and Bódva Unit can be related to this phase, but it is more likely to be an older structure. Younger transpressive strike-slip and normal fault movements (D1–D3), connected to Darnó Zone, juxtaposed the Mesozoic formations of Rudabánya Hills and the Paleozoic rocks of Úppony and Szendró Hills. Parts of these movements are Tertiary in age, indicated by the involved Szahogy Conglomerate and Pannonian sediments (Szentpétery 1997). This model can be extended to the major part of Rudabánya Hills, because it has a great similarity to the previous investigations made in other part of the Rudabánya Hills (Fodor and Koroknai 2000, Kövér et al 2005).

Acknowledgement

The study was supported by the grant OTKA 48824 (Hungarian Research Found) and the Aggtelek National Park.

References


Multiple Magmatic Fabrics in Episodically Emplaced Granites in Transtensional Setting: Tectonic Model Based on AMS Study and Numerical Modeling

Zuzana KRATINOVA1, Karel SCHULMANN2, Jean-Bernard EDEL3, Urs SCHALTEGGER4 and Josef JEZEK5

1 Institute of Petrology and Structural Geology, Charles University, Prague, Czech Republic
2 Centre de Geochimie de la Surface, EOST, Université Louis Pasteur, Strasbourg cedex, France
3 Institut Physique du Globe, EOST, Université Louis Pasteur, Strasbourg cedex, France
4 Département de Mineralogie, Université de Geneve, Geneve, Switzerland
5 Institute of Applied Mathematics, Faculty of Sciences, Charles University, Prague, Czech Republic

The three successive sigmoidal sheet-like granite intrusions (Thannenkirch, Brézouard, Bilstein granites – BBT Complex) in the Central Vosges Mts. (France) separates medium to high grade (~700 to 800°C, >9 kbar) gneiss and granulites to the north from low-pres-