

THE RAMZOVÁ TECTONIC ZONE: THE CONTACT BETWEEN LUGICUM AND SILESICUM

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ABSTRACT

The contact of the two great geological units at NW edge of the Bohemian Massif – Lugicum and Silesicum is by many authors laying on the Ramzová “overthrust”. This is thought of equivalent of the Moldanubian “overthrust”. On this tectonic zone is often putting a boundary between the West Sudetic and East Sudetic Systems. Appearances to dispute about tectonical character of this zone was made a trench near Habartice, 3 km north from Hanušovice. Detailed mapping and trench prove, that on contact of marbles of Branná Group and migmatites of Staré Město Group is up to 50 m of cataclasites. This tectonic zone on the contact between Lugicum and Silesicum is very probably steeply dipping to west and it has character of left-handed horizontal movement. Quartz, graphite, limonite and locally ankerite or dolomite, rarely chalcocopyrite occur often on the crushed zones. This tectonic zone is not only important geological border, but also a significant infiltration and collector structure.

KEYWORDS: Ramzová “overthrust”, Lugicum, Silesicum, Staré Město Group, Branná Group, tectonics

INTRODUCTION AND HISTORICAL REVIEW

The Lugicum and Silesicum, or the West Sudetic and East Sudetic Systems (further WSS and ESS), belong to the main geological units of the Bohemian Massif. Many of geologists who have studied this region consider the Ramzová “overthrust” as the border between these units. In the present paper we study the character of this significant regional tectonic border and its development through time. We will also consider whether it should be termed an overthrust, line, zone, or fault. Finally, we will describe the history of its description.

Much work has been done in this area, resulting in a great variety of opinions on these wide-ranging problems. An exhaustive discussion about this past research is beyond the scope of the present work. We therefore give a brief summary of the most significant contributions.

Kretschmer (1897) was the first to comment on the phyllite and marble overthrusts of the Branná Group. Suess (1912, 1935) interpreted this structure to be a fault (Ramsau Überschiebung), and theorized that the Variscan nappe of the Moldanubian system thrusts over the Moravian system, while the equivalent Lugicum system has been thrust over the Silesicum. Suess noted that both units differ in their lithological and tectonic contents. Furthermore, he believed that the Silurian in the Lugicum is folded by Caledonian orogeny, while Devonian Rheinisch development is

significant in the Silesicum, which was folded and metamorphosed by the Variscan orogeny.

In contrast, the opinion of Bederke (1925, 1929) was that the WSS and ESS had been initially folded together and metamorphosed by the Caledonian orogeny, while the East Sudetic System was subsequently affected by the Variscan orogeny. Bederke (1925) originally defined the border between the WSS and ESS on the eastern edge of the Orlice-Snieznik Unit (OSU), and thereafter on the Ramzová line. Likewise, Svoboda (1961) considered the border between the WSS and ESS on the boundary of the orthogneisses, through he located this border on the Ramzová overthrust (Svoboda et al., 1964, 1966; Svoboda and Chaloupský et al., 1961).

Also other „official“ regional partitioning of the Bohemian Massif placed boundary between WSS and ESS on the Ramzová overthrust – e. g. (Svoboda et al., 1964, 1966, Suk et al., 1984, Mísař et al., 1983). Consistent opinions are presented in many publications by Mísař (among other Mísař 1960).

Many of the Polish authors deal with the problem of the border of Lugicum and Silesicum (e.g. Oberc, 1957, 1960, 1967, 1968, Don, 1990, Don and Żelaźniewicz, 1990, Cymerman, 1993, 1997, 2000, Mazur et al., 1997, Oberc-Dziedzic and Madej, 2002). Polish authors locate usually the boundary between Lugicum and Silesicum on the Ramzová line.

The position of the Velké Vrbno Group or Dome is solved variously by different authors. On the West it is limited by the Nýznerov fracture zone and on the East by the Ramzová overthrust. According to Květoň (1951) and Skácel (e. g. 1977, 1979, 1989; also Schulmann and Gayer 2000) it belongs to the East Sudetic System (Silesicum). According to Kröner et al. (2000) it belongs to the „transition zone“ between Lugićum and Silesicum together with the Staré Město Group. Also Zrůstek (1961) has not decided on which side of the Velké Vrbno Dome the boundary between WSS and ESS is situated. According to Cymerman (1997) the Ramzová overthrust is a strike-slip fault with right-handed horizontal movement and it represents a border of two terrains. In a similar way, Aleksandrowski and Mazur (2002) propose a border of two terrains there: Moravian terrain and Brunovistulicum terrain. The Moravian terrain incorporates both the Velké Vrbno Dome and the Branná Group and is embedded between Moldanubian terrain and Brunovistulicum one.

OVERVIEW OF GEOLOGY

The easternmost part of Lugićum - Orlice-Sniežnik „Dome“ – converged tectonically with Silesicum on the Ramzová overthrust. The core of the Orlice-Sniežnik Unit is built up by orthogneisses and further to the east substituted by mica schists of the Stronie Formation, or mica schists of the equivalent of the Hraničná Unit (Skácel 1979) and the Staré Město Group. Eastward the Staré Město Group is bordered by the Ramzová Tectonic Zone (RTZ). To the east from the RTZ there occur rocks of Silesicum: the upper and lower part of the Branná Group (Cháb et al. 1994) and the Keprník Unit.

The Staré Město Group is a very unhomogeneous rock complex (metasediments, meta-volcanites and granitoids) situated to the north of the Bušín Fault and to the west of the Ramzová line. Opletal ed. (1999) and Pecina ed. (1999) determined 6 nappe slices in this area, which are separated by longitudinal overthrust faults. Obliquely cutting-off of individual scales causes their changeable thickness from zero through tens of metres to several kilometres. These faults are characterized by tecton contacts with alternation of rocks, by boudinage and locally by bodies of ultrabasic rocks. Opletal and Pecina (2000), Aichler et al. (2002) and Opletal (2003) described these phenomenons in the Staré Město Group.

All guiding tectonic borders to the west from the RTZ have the same character:

1. the orthogneisses of the core of OSU versus mica schists of the Stronie Formation,
2. the mica schists of the Stronie Formation versus (gabbro-) amphibolites of the Staré Město Group, and other contacts in the Staré Město Group,
3. amphibolites with pearl gneisses,
4. pearl gneisses with amphibolites with intercalations of acid metavolcanites,

5. amphibolites with mica schists,
6. mica schists with gneisses.

The partial overthrust accompanied by mylonitization or/and boudinage exists in individual slices as well. Tecton contacts were described in Silesicum (Cháb and Opletal 1984) but ultrabasic rocks are not involved with them. Oberc (1960b) referred already to such “transitions”.

The RTZ proceeds on the 1 : 50 000 map sheets Králíky (Opletal et al., 1989), Šumperk (Koverdynský et al., 1999), Bělá pod Pradědem (Opletal et al., 1999) and Jeseník (Žáček et al., 1999). It is possible to split this zone to three separate parts: the southern, middle and northern ones.

1. The southern part of RTZ is 36 km long – from the Bušín Fault on the south to the Sudetic Marginal Fault on the north. From the village Hanušovice the crushed zone proceeds to Habartice, Vikantice and continues to Branná, Ostružná and Ramzová. The RTZ can be mostly traced in the field following the intensive tectonic crushing of rocks. The contact between the Velké Vrbno Group and the Branná Group was drilled through by inclined exploratory boreholes at the locality Vápenná – Lesní (Fojt, Kopa and Skácel 1978). On the contact lies the cataclastic zone, which is affected by a weak ankerite-siderite metasomatism. The RTZ is broken by many transverse faults of the NW - SE direction on its whole length (Vocilka 1982, Pouba and Misař 1961 and Buday et al. 1995). They are represented from the south by: the Bušín Fault, the Temenice Fault, the Pleče Fault, the Klepáčov Fault, the Petříkov Fault, the Bělá Fault and the Sudetic Marginal Fault. The deep foundation of these faults is indicated by the occurrence of mineral waters to thermal springs and locally Tertiary basalts.

2. The middle part of the RTZ is 20 km long – from the Sudetic Marginal Fault to transverse fault near the village Otmuchów. This part is thickly covered by Cenozoic sediments. Kölbl (1930) has been presumed, that the Ramzová overthrust ends on the Sudetic Marginal Fault near Vápenná. In contrast Oberc (1957, 1960, 1967, 1968 and others) speaks about its continuation far to the north to Poland – all the way East of Strzelin. In the Oberc's (1972) study geological cross-section from environs of Javorník is published. A subhorizontal overthrust is marked in this cross-section and it is ended by a younger fault. Skácel (1963) described a dislocation zone with thickness 20 m and with dip angle 60° to W – NW observed in the mine adit “Melchior” near Javorník in Silesia. He says that there go beyond to “coupling of Nýznerov fracture zone with the Ramzová overthrust and disappearing of the rocks of the Velké Vrbno Dome”.

3. The northern part of the RTZ 35 km long – reaches from the village Otmuchów to environs of Strzelin. Continuation of the RTZ is questionable here not only

because it is thickly covered by Cenozoic sediments. The Devonian sequences occur there also westerly of the Ramzová overthrust. By the opinion of Bederke (1929), the RTZ continues along tectonic zone of Niemcza, while Oberc (1968) locates the RTZ to the east from the Strzelin Massif. Oberc-Dziedzic et al. (2002) present, that granitoids of the Strzelin Massif intruded on the tectonic border between West- and East Sudetes. According to Oberc-Dziedzic and Madej (2002) the border of WSS and ESS on a Foresudetic Block has the character of a flat overthrust accompanied by mylonitization.

Point of view at character of the RTZ are following:

- A) a nappe plane - most frequent opinions from Suesse (1912) to present
- B) a fault which has character:
 1. of a thrust fault,
 2. of a strike-slip fault,
 - a) right-handed – according to Cymerman (1997), there is a border of Lusatian and Silesian terrains
 - b) left-handed (Franke, 1969, 1973; Opletal et al., 1996; Opletal and Pecina, 2003)

While the contacts of individual slices in the Staré Město Group have character of an overthrust, the RTZ has quite different development than overthrust faults. According to Opletal et al. (1996, 1999), Aichler ed. (1999) and Opletal and Pecina (2000) the RTZ represents the contact between Lugicum and Silesicum. The zone steeply dipping to the west underwent the final left-handed horizontal movement accompanied with a „cold“ cataclastic crushing. The crushed zones with quartz and graphite are often limonitised and locally include ankerite or dolomite, rarely chalcopyrite.

The Vacetín „overthrust“ in the Svinov-Vranov Crystalline Complex probably represents an equivalent of the Moldanubian and of the Ramzová „overthrust“. According to Němečková et al. (1997) last movement in the Vacetín tectonic zone has the character of a left-handed strike-slip.

NEW EARTH WORKS

The tectonic zone with crushing on the contact of the Staré Město Group with the Branná Group has been mapped by Opletal et al. (1999) . It matches to the Ramzová line („overthrust“, fault, RTZ). Three test pits and a trench 18 m long has been realised in the crushed zone near Habartice, 5 km north from Hanušovice. Technical works mostly confirmed our presumptions (see Fig. 1). The zone with cataclastic breccias locally accompanied with graphite, quartz and limonite is observed here. The tectonic zone has a different intensity of crushing. The most intensive crushing is at the contact where the breccia contains graphite (see Fig. 2). The zone of intensive crushing is

cca 30 m wide. Than it alternates to crushed zones with slightly and strongly crushing to distance 50 m from the contact. Intensity of cataclastic deformation than decreases, however also migmatitized gneisses are slightly crushed in a distance of about 70 m. We expect that this tectonic zone has a young development fixed to the post Cretaceous, so called Saxony, tectonics.

Domečka and Opletal (1976) described similar tectonic zones at the contact of the Nové Město Group and the Stronie Formation in the Orlické hory Mts. and Kočandrle and Opletal (1984) described this one at place where the fault between the “Orlice and Sub-Orlice” nappes (according to Pauk 1953) was expected to proceed.

CONCLUSIONS

1. The Ramzová Tectonic Zone represents an important border of two different geological units of the Bohemian Massif – Lugicum and Silesicum. It is probably a continuation of the equivalent Moldanubian “overthrust”. In present however the RTZ has not in its outcrop the character of a thrust fault. The RTZ is a horizontal movement very probably of a left-handed character. The RTZ has the character of about 50 m broad tectonic zone accompanied with cataclastic deformation.
2. The RTZ has been active for a long time – at least from the Variscan orogeny to recent, which has been also supported by the study of Schenk et al. (2003). Its importance is indicated by its length (55 km on the territory Czech Republic, whole length about 90 km).
3. According to Čurda in Müller ed. (1999) this tectonic zone is a significant infiltration and collector structure. At its crossing with the Bušín Fault are situated drilled well with draw water up to 70 l/sec⁻¹. This significant hydrogeological structure would have to be protected as an infiltration zone.

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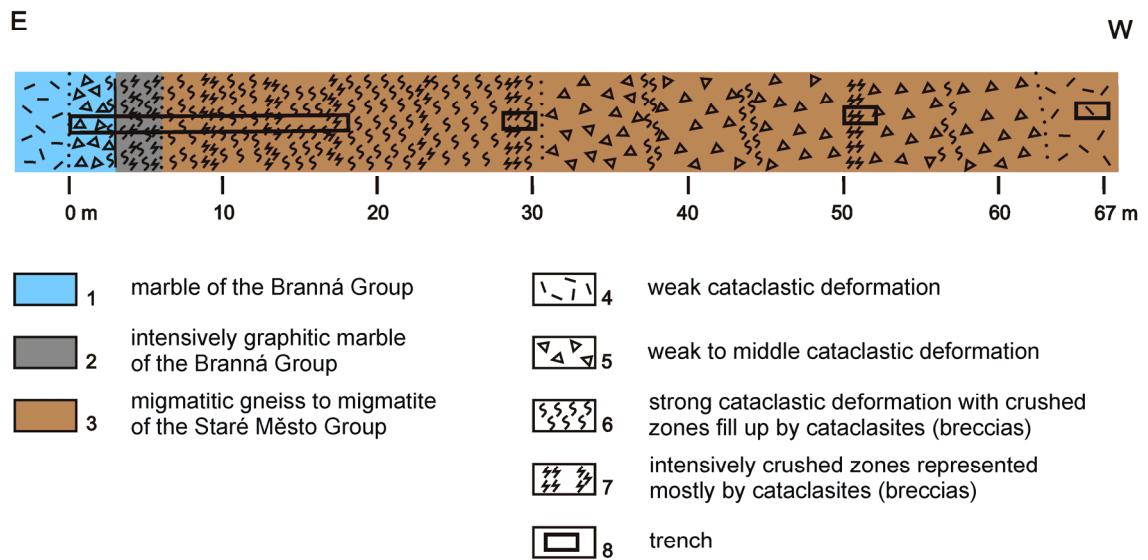


Fig. 1 Cross-section of the Ramzová tectonic zone near the village Habartice.



Fig. 2 The tectonic zone with graphite at the contact of the marbles of the Branná Group. Stone chip of marble in tectonic breccia.