

STOP 2

Marek CIESZKOWSKI

Location: Cisownica Hill, abandoned quarry

Tectonic unit: Silesian Nappe, Cieszyn Subunit

Formation: Cieszyn Beds, Cieszyn Limestones

Age: Late Thitonian – Berriasian

Passing through a morphological step that marks the northern boundary of the Godula Nappe the route enters a hilly region comprised of soft rocks belonging mainly to the Cieszyn Subunit and partly Sub-Silesian Nappe. The route follows towards the or northwest in the direction of Cieszyn to Goleiszów. The Jasieniowa quarry is located south-east of the town of Goleiszów. The trail to the quarry begins at Zielona Street and leads uphill through the forest. This trail provides a fine view of northern slope of Beskid Śląski and its foothills. From here we can see a distinct connection between geology and morphology. Toward the north and north east the area present soft morphology of low hills built of the Cieszyn Subunit of the Silesian Nappe. Hills around are build of the Cieszyn Limestones and broad valleys of Cieszyn Shales and shelly Verovice Beds. Towards the south steep cliff exposes frontal part of the Godula Subunit and marks the boundary between the Upper Jurassic – Lower Cretaceous and Upper Cretaceous deposits, which build mountains of the Silesian Beskid. Between Andrychów and Cieszyn several deep boreholes penetrated the Carpathian flysch, and reaching Middle Miocene deposits of the Carpathian Foredeep at the depth ranging from 1 to 2 km, and next platform substratum.

The pass through the woods traverse the hill from north and leads to entrance roadcut to the quarry of the Cieszyn Limestones. Along the roadcut are exposed thin and medium bedded turbiditic limestones intercalated by marly shales. The light grey limestones, white after weathered, are graded, with parallel and cross laminations. The thicker turbiditic beds display T_{abcde} Bouma intervals, while thinner T_{bcde} or T_{cde} . The limestones and shales are rich of trace fossils of varies size and shape. On basal surface of the beds sole marks are frequent. The uppermost part of Cieszyn Limestones is visible higher up in the main quarry. Here the limestone layers start be thicker and a few of them are thick or even very thick. These limestones are graded, coarse grained or even conglomeratic. Coarse detritic material of basal parts of limestone layers consists of carbonate detritus rich of organic fragments. It is possible to distinguish here remnants of algae, crinoids and echinoids, as well as aptychi and fragments of shells of lamellibranches, bivalves and gastropods. In the composition these detritic limestones arrive also quartz grains, fragments of dark Tithonian limestones, and Carboniferous coal.

The clastic material comprising the detrital material was derived from adjacent shallow water calcareous platform (Peszat 1968). Presence of quartz grains and fragments of Tithonian limestones and Carboniferous coal indicate that the erosion in source area reached already the basement of Jurassic calcareous rocks. The age

of Cieszyn limestones in the Jasieniowa quarry was estimate on the base of examination of foraminiferal, nannofossil and palynomorph assemblages.

STOP 3

Marek CIESZKOWSKI

Location: Ustroń, abandoned quarry
Tectonic unit: Silesian Nappe, Godula Subunit
Formation: Godula Beds
Age: Coniacian – Campanian

From the town of Żywiec, the route leads north and crosses the Godula Subunit, southern subunit of the Silesian Nappe. North of Żywiec Soła River cuts the Istebna and Godula beds and forms a gorch between the Beskid Śląski and Beskid Mały mountain ridges. Dams located there on the river origin Żywiec and Porąbka artificial lakes. Near dams the Godula Beds (Early Senonian) are exposed on both slopes of the Soła river valley, in some places dipping steeply toward the south. The route continuing by Szczyrk and Wisła to Ustroń cross the whole sequence of the Godula Beds. Along the mountain road from Szczyrk and to Wisła we see several outcrops of different lithofacies of the Godula Beds, from thick bedded to thin bedded sandstones. They crops out also in several exposures along the Wisła River as well as in a few natural outcrops and quarries in the town of Wisła. In southern part of Wisła, at the fork in the road turn left in direction of Czarna along the Czarna Wiselka Creek is cropped out basal part of Istebna Beds. There occur debris-flow like conglomerates of Istebna Sandstone type with the rounded olistolites of Godula Sandstones inside. One of the best exposures of the Godula Beds is located in abandoned quarry in southern part of town of Ustroń. Following along Grabowa and Topolowa streets, and next the path crossing margin of the forest we arrive in discussed quarry, which was used as a as a rubbish dump. Now the dump is partly reclaimed, but unfortunately some very interesting exposures partly disappeared here under the rubbish.

In the quarry the lowermost part of the Godula Beds is exposed. It consists of the thick- and very trick-bedded sandstones that represent siliciclastic turbidites and fluxoturbidites. The sandstones are usually medium- or coarse-grained, and occasionally conglomeratic. In lowermost level of the quarry, which is covered now under rubbish stratum, even coarse conglomerates have been cropped out. The thick sandstone layers of the Godula Beds are often amalgamated. In some cases inverse gradation is possible to observe there. On the lower surfaces of the sandstone layers numerous current marks are visible. They indicate transport direction from the west and southwest. Very distinctive features are the flame structures mainly inclined in a downcurrent direction, connected with a load structures. There in some layers occur also the dish structures. In the sandstone

complex the intercalation of autochthonous grey or grey-greenish shales are here very rare.

The sandstones are composed mainly of quartz with admixture of feldspar, muscovit and glauconite. Conglomeratic sandstones and conglomerates contain also fragments of igneous and metamorphic rocks, as well as clasts of limestones, marls and shales which resemble those found beneath the Godula Beds. In the wall of the quarry of special interest are large, flat olistoliths of the Lower Cretaceous flysch deposits, mainly dark shales with occasional thin bedded sandstones, derived from the Lgota Beds. The olistoliths lie on top part of the submarine slump deposits.

The age determinations based on the micropaleontological data of foraminifera, dinocyst and calcareous nannofossil assemblages, prove that the sedimentation of the Godula Beds started no earlier than in the Early Coniacian (Ślącza, Kaminski 1998, Cieszkowski et al. 2003). So far, the base of the Godula Beds was dated to the Lower Turonian on the basis of benthic foraminifers (Bieda et al. 1963, Olszewska in Słomka 1995).

REFERENCES: see Cieszkowski M., 2004: The Outer Carpathian – general geology. Special Papers, This issue.

STOP 4

Marek CIESZKOWSKI

Location: Brenna

Tectonic unit: Silesian Nappe, Godula Subunit

Formation: Godula Beds

Age: Coniacian – Campanian

This stop is alternative to the quarry of Godula Beds at stop 2 in Ustroń. While in Ustroń are visible thick bedded sandstones of lowermost part of the Godula Beds, along the creek in Brenna the higher part of the Godula Beds sedimentary sequence is cropped out. Towards the top of section, the thick bedded sandstones pass into a lithofacies of thin and medium bedded sequence of sandston-shally flysch. The siliceous, glauconitic sandstones are fine or medium grained, with visible gradation and parallel or cross lamination. Intercalated them, argillaceous shales are dark green or grey. The thicker turbiditic beds display T_{abcde} Bouma intervals, while thinner sandstones often present T_{cde} . As it was visible along the passed part of route, in some parts of the Godula Beds sedimentary sequence, the thick bedded sandstones arrive again.

STOP 5

Marek CIESZKOWSKI

Location: Żywiec, right bank of Soła River

Tectonic unit: Silesian Nappe

Formation: Cieszyn Beds, teschenites

Age: Kimmeridgian-Tithonian

In the southern part of the town of Żywiec, in the right bank of Soła river (above estuary of Koszarawa creek) Cieszyn Beds crop out. This famous outcrop has been described several times (e.g. Ślącza, Kamiński 1998, Ślącza, Słomka 2001). Cieszyn Beds occur here in the eastern flank of the Żywiec tectonic window, and are strongly folded and faulted. Steeply dipping axes of irregular synclines and anticlines somewhere are even vertical. The Cieszyn Beds are represented here by the Cieszyn Limestones developed as calcareous flysch that consists of thin, medium and occasionally thick-bedded calciturbidites. Those are detrital and pelitic limestones and intercalated by marls or marly shales. Limestones are usually graded, with parallel and cross lamination. The thicker turbiditic beds display T_{abcde} Bouma intervals, while thinner T_{bcde} or T_{de} . Occasionally small sole marks occur there. In some places within light colored limestones are visible dark sills of teschenites.

The Cieszyn Limestones display moderate diverse trace fossil assemblages dominated by *Chondrites targioni*, *Thalassinoides* and *Helminthopsis*. Other trace fossils (e.g. *Glocerichnus*, *Lorenzina*, and *Paleodictyon*) are rare. Upper part of turbidites is bioturbated up to 6,5 cm from the top. On the layer bottoms the trace fossils are occasional. All these features, together with overall relatively light color of marly shales, indicate well-oxygenated environment.

The lithofacies of the limestones near Żywiec indicate a more proximal position of submarine fan than at other outcrops, situated northwest of Żywiec at northern margin of the Silesian Nappe. The Cieszyn beds cropping out in the area surrounding Żywiec comprise several debris flow and submarine slump deposits (cf. Słomka 2001). Their thickness in the particular outcrops is 2.5-5.0 m. Debris flow include numerous fragments and pebbles of organodetrital and pelitic limestones, marly shales, carboniferous and metamorphic rocks. Pebbles are randomly arranged in a mass of structure less hard marly silt.

The teschenites are basic rocks that were formed during the initial opening of the Silesian basin. The principal rock type consists of plagioclase, augite, biotite, and chlorite. They form sills and dykes within the Cieszyn Limestones and the Upper Cieszyn Shales. The syenite sills are subordinate. In the Moravia (Czech Republic) teschenite display also forms of pillow lavas. In order to provide more exact age of this important magmatic event ^{39}Ar - ^{40}Ar dating of teschenite association rocks were conducted in the vicinity of Cieszyn town (Lucińska-Anczkiewicz 2000). The age obtained for teschenites is: 122.2 ± 0.9 , 122 ± 1.5 , 122 ± 1.1 , and for syenite is 120.4 ± 1.5 . It corresponds to boundary between

Barremian and Aptian to Hauterivian according to G. Odin (Intern. Stratigr. Chart, 2000). Similarity of ages of the teschenites and more evolved syenite indicates fast magma evolution. The occurrence of teschenites in Poland is limited to the western part of Polish Outer Carpathians. Furthest occurrence towards the east is near the town Sucha Beskidzka, where their fragments were recovered in a deep borehole. East of Sucha, the teschenites type of rocks is not seen again until Eastern Carpathians.

In the exposure in the right bank of Soła river the teschenite sills is contact with the beds of graded limestone, and contact zone a few centimeters thick is visible. The host rocks consist of thin to medium bedded laminated and/or graded detrital limestones alternating with marly shales. A few steps upstream the next teschenites layer concordantly folded with the host rocks crop out. It is probably the prolongation of the same layer. When the water level of the Sola River is low, is possible to observe some more teschenite intrusions within the Cieszyn limestones cropping out on the riverbed.

Further up the river (around 200 m) the olistostromy is cropping out. There are exposures of thick bedded, graded Cieszyn limestones in contact with the dark marls (Lower Cieszyn Shales). Closer inspection of the marls shows that they in reality represent a sedimentary breccia that consists of densely packed angular fragments of marls, sandy marls or sometime limestones. The marly layers represent slump deposits with blocks of rounded limestones from the shallow water calcareous platform.

This observation, together with the measured current directions, suggest that the Cieszyn limestones belong to a local fan that was made of material derived from an internal source of the southern flank of the Silesian basin. The slump structures also suggest mass movement from the south. Late Jurassic and Early Cretaceous tectonic activity (Krobicki, Słomka 1999) caused that the southern part of the Silesian Basin became uplifted. The Cieszyn beds have been eroded and redeposited as a submarine slumps and debris flows.

The Tithonian-Lower Cretaceous rocks with teschenites flank from the East Żywiec tectonic window where the Sub-Silesian Unit crops out. The southern border of the window is built of the Fore-Magura Unit and the Magura Nappe and the western side is flanked by the Lower and Upper Cretaceous and Paleogene rocks of the Silesian Nappe. Southeast of Żywiec, deep borehole was drilled. It penetrated the basal thrust plane of the Carpathians at a depth of 3561 m and bottomed in metamorphic Precambrian rocks of Northern European Platform.