The volcanic activity peaked during the deposition of the lower part of the Hradiště Formation in the Early Berriasian to Early Barremian time, although teschenite volcanic rocks are sporadically found also in the underlying Těšín Limestone and the Vendryně Formation.

Stop 5 – Wisła quarry – siliciclastic flysch (upper Cretaceous) (Figs 8, 13, 23–26)

(*Krzysztof Starzec*, *Jan Barmuta*, *Lothar Ratschbacher*, *Saeideh Asal Seyedi*)

The Wisła quarry is located in the central part of the Silesian Unit, i.e., the Godula Subunit (Fig. 23) that is thrust over the Cieszyn Subunit described in the Stop 2. In the quarry, the Upper Cretaceous rocks of the Godula Formation are excavated, which represent the onset of the synorogenic sedimentation in the Outer Carpathian realm (Picha *et al*., 2006).

The Godula Formation represents the middle part of the sedimentary succession of the Silesian Unit (Fig. 24). In the western part of the Carpathians, in the Polish Silesian Beskid and Czech Moravian-Silesian Beskids, this formation constitutes the thickest part of the succession exceeding 3,000 m. However, to the east, its thickness decreases significantly until it is completely wedged out, moreover, the trend of decreasing thickness also occurs in the longitudinal direction, i.e., in most external parts of the Silesian Unit thickness of the Godula Formation reaches only a few hundred meters (Słomka & Słomka, 2001). Słomka (1995) related the wedge-shaped geometry of the Godula lithosome to its depositional development, as deep-sea turbidite fans and slope aprons, that were supplied from the southern Silesian ridge.

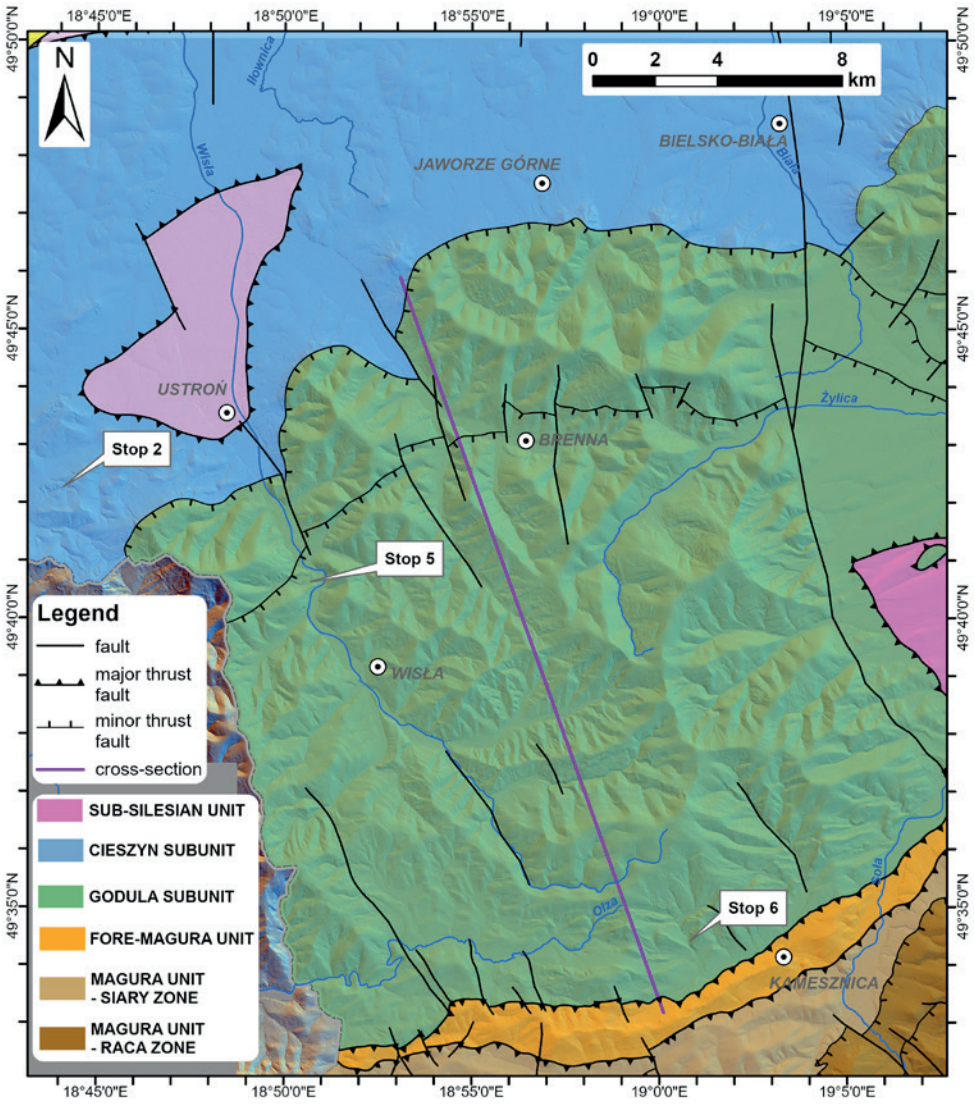

Fig. 23. Simplified geological map of the north-western part of the Polish Carpathians showing location of stops 2, 5 and 6 within the Silesian Unit. Line indicates cross-section in the Fig. 27B

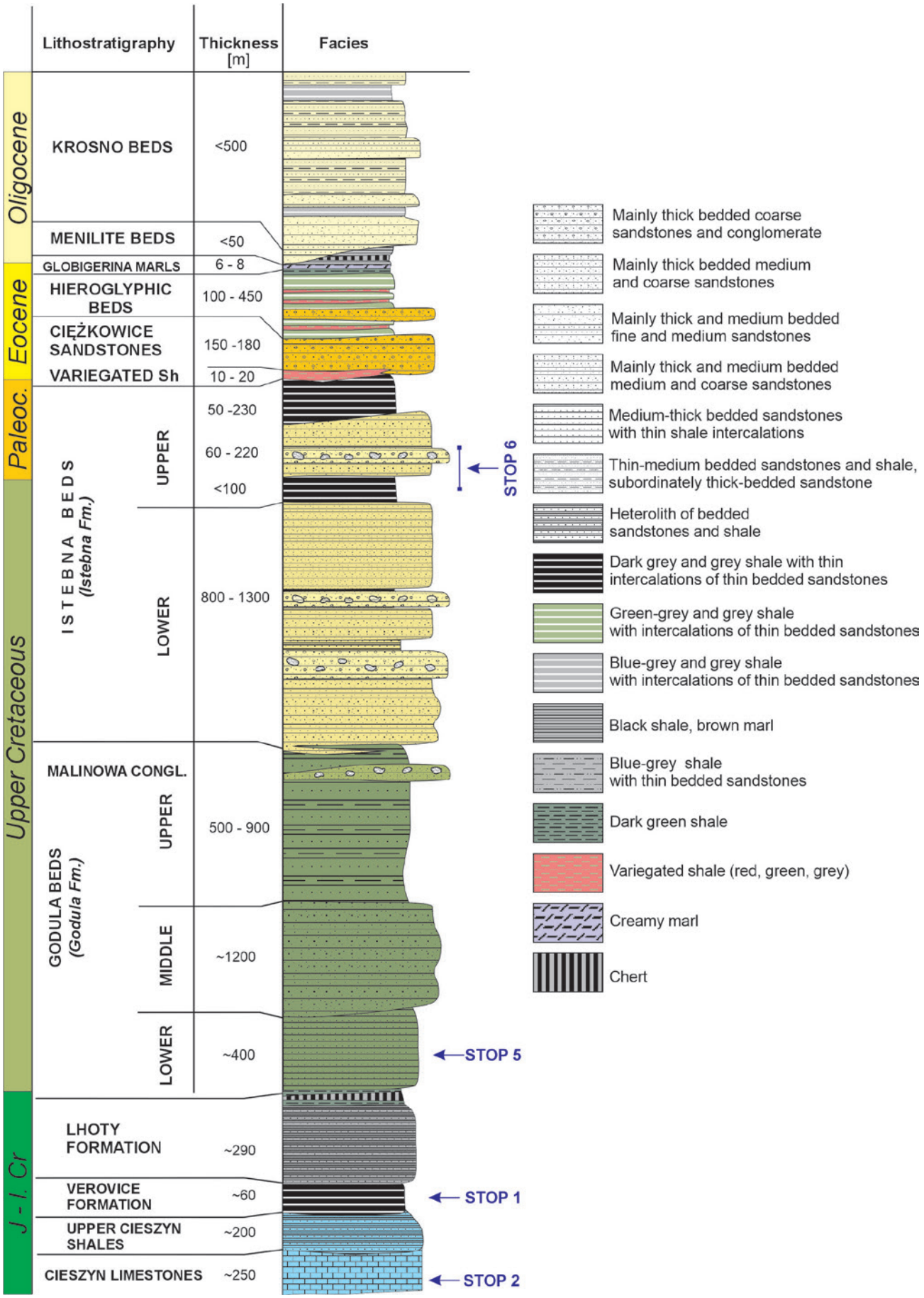

Fig. 24. Scheme of lithostratigraphic units for the Upper Jurassic-Oligocene Silesian Succession in the Silesian Beskid

Picha *et al*. (2006) linked the initiation of the Godula Formation sedimentation with the sudden rise of the Silesian ridge that was a result of compressional stresses associated with the accelerated subduction of the Penninic–Vahic ocean and the early collision of the Inner Carpathians with the fragmented margins of Europe in the early Late Cretaceous. The flysch deposits of the Godula Formation mark the beginning of the foreland depositional regime in the Outer Carpathian basins (Picha *et al*., 2006).

The Godula Formation is a typical turbidite sequence of alternating sandstone and shale layers with an admixture of conglomerates (Słomka, 1995; Maceček, 2021). The proportion of these lithological components is variable which was a basis for lithological subdivisions of this lithostratigraphic unit into three informal members (Fig. 25): the lower member is predominantly composed of thin-bedded, fine- to medium-grained sandstones and shales with a thick Ostravice Sandstones Member at the base (Cieszkowski *et al*., 2016); that is followed by a facies dominated by medium- to coarse-grained glauconitic sandstones and conglomerates in the middle part of the Godula Formation, whereas its most upper part is also thin-bedded succession, although it contains lenticular bodies of coarse-grained sandstones and conglomerates of the Malinowska Skała Conglomerate (Burtanówna *et al*., 1937; Słomka, 1995; Maceček, 2021).

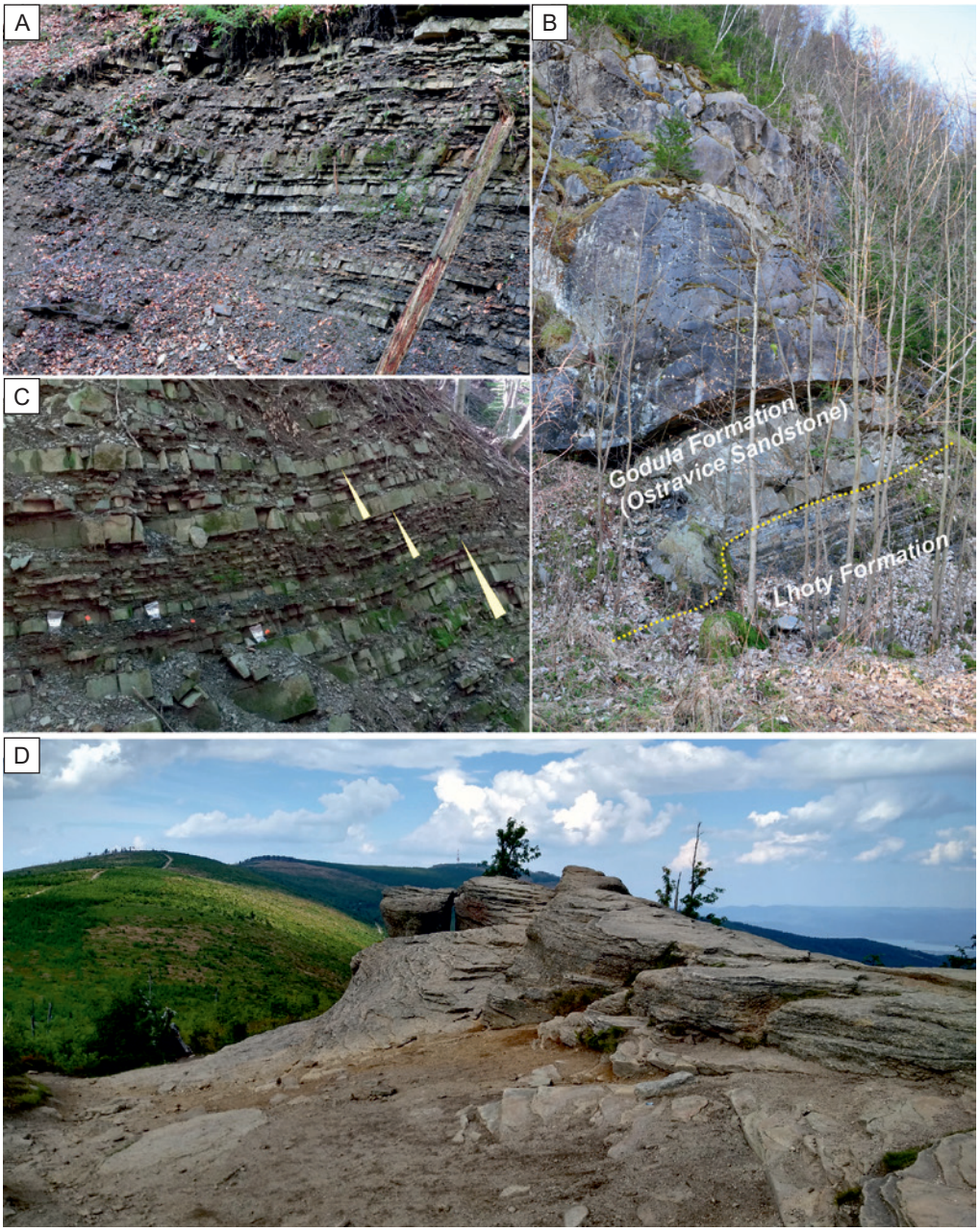

Fig. 25. Variable facies within the Godula Formation: A – thin-bedded sandstone-shale couplets of the upper Godula member; B – the lowermost part of the Godula Formation, i.e. Ostravice Sandstone Member, at the contact with the underlying Lhoty Formation; C – thin-bedded packet of sandstone-shale layers showing thinning upwards sequences; D – thick-bedded conglomerates of the Malinowska Skała member, forming the top of the Skrzyczne range

Rocks outcropped in the Wisła quarry are dominated by thin- to medium-bedded sandstones representing the lower part of the Godula Formation, however, they display significant facies variation. Facies of alternating sandstone and mudstone dominates. It is composed of medium- to fine-grained sandstones that gradually passes into mudstones (shales) (Fig. 26). Sandstone thickness ranges 10 cm to 30 cm, top and bottom layer contacts are flat. They are usually parallel laminated, subordinately cross-lamination occurs in the layers. Mudstones usually are non-calcareous and grey to green-grey. This facies is interbedded by packets of sandstone-dominated facies that comprises mainly medium-grained sandstones, often conglomeratic at the base, occurring in medium- to very thick-bedded layers (Fig. 26). There is a gradual transition between these two facies and they are arranged in thinning upward sequences. The first facies is interpreted as the result of deposition of sandy-clay material from gravity currents of different densities, whereas the second facies represents the deposition from high-density turbidity currents (Słomka, 1995; Maceček, 2021).

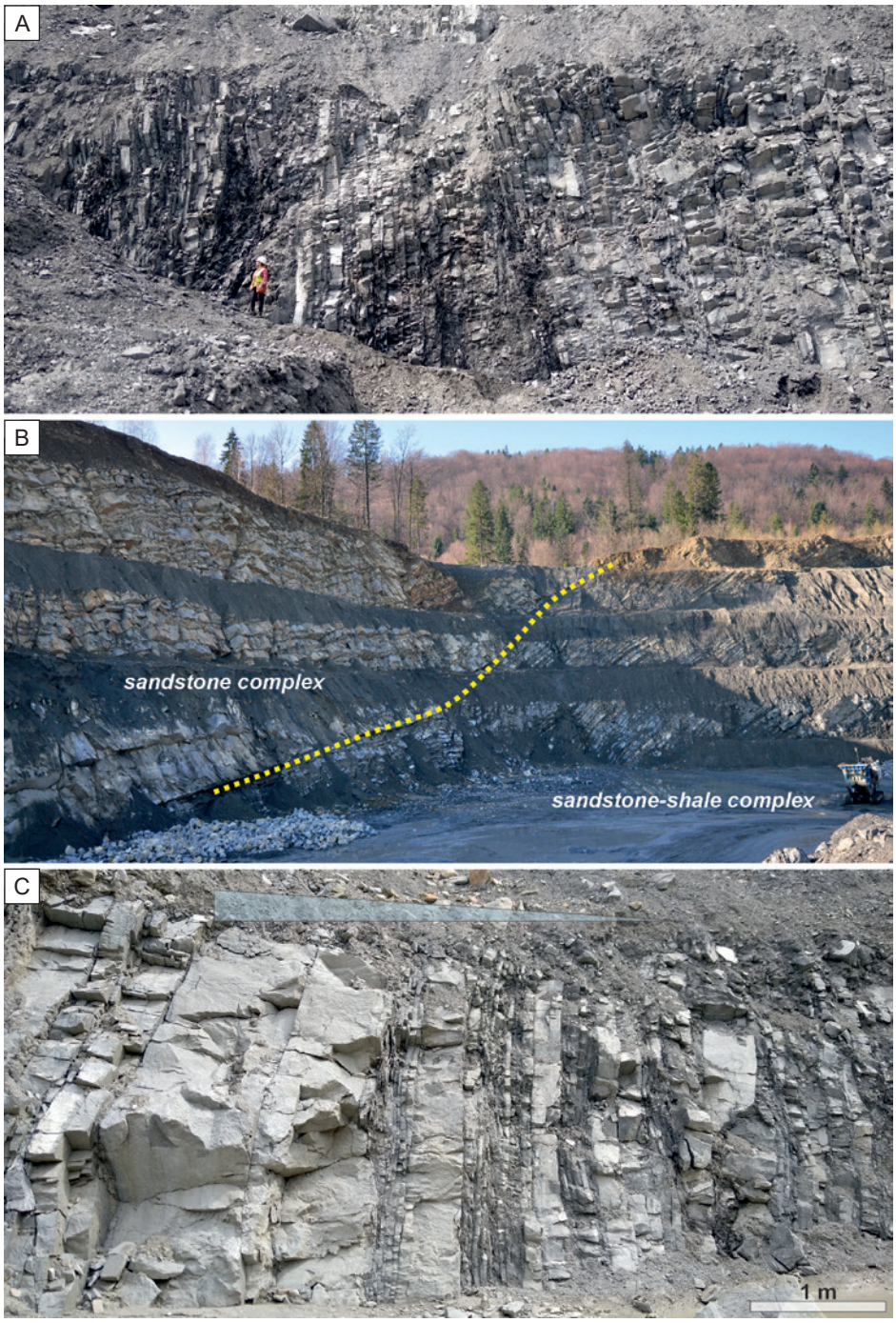

Fig. 26. Wisła quarry: A – sandstone dominated facies of thin-bedded layers; B – border (yellow line) between lower member of the Godula Formation composed of thin-bedded sandstone and shales couplets and overlying sandstone complex representing middle member of the Formation; C – sequence of thinning upward layers within the sandstone-shale complex

In general, Słomka (1995) and Maceček (2021) interpret that the high- to low-density turbidity currents were mainly responsible for the deposition of the Godula succession, subordinately the deposition took place from sandy debris flows and sporadically sediments originated from traction currents and dispersed suspensions. The facies of the Godula Formation are characteristic for deep-water turbidite fans and they represent a spectrum of sub-environments of this type of sedimentation, i.e., channel sediments, depositional lobes, inter-channel sediments, fan margins and non-channelized apron sediments (Słomka, 1995; Maceček, 2021). Thus, they are characterized by high lateral variation that reflects the dynamic depositional environment.

The Wisła quarry is located at the frontal zone of the Godula Subunit. In general view, the Silesian Unit in the westernmost part of the Outer Carpathians exhibits simple, almost homoclinal character (Fig. 27). Namely, the Silesian Unit structure starts with the Jurassic – Lower Cretaceous formations exposed in the northern marginal zone of the Silesian Unit (the Cieszyn Subunit) and continues through the thickest middle part of the Late Cretaceous to Paleocene deposits (the Godula Subunit including the Godula and Istebna formations), to the uppermost complex of Eocene and Oligocene deposits. Strata generally dip gently towards the south at ca. 20° (Fig. 27B). When compared to the imbricated structure of the Cieszyn Subunit, the Godula Subunit is composed of more competent formations and formed only two thrust sheets. Duplication of the lower part of the Godula sequence permits the identification of two thrust sheets within the northern part of this Subunit, of which the northern one is comprised solely of the Godula Formation.

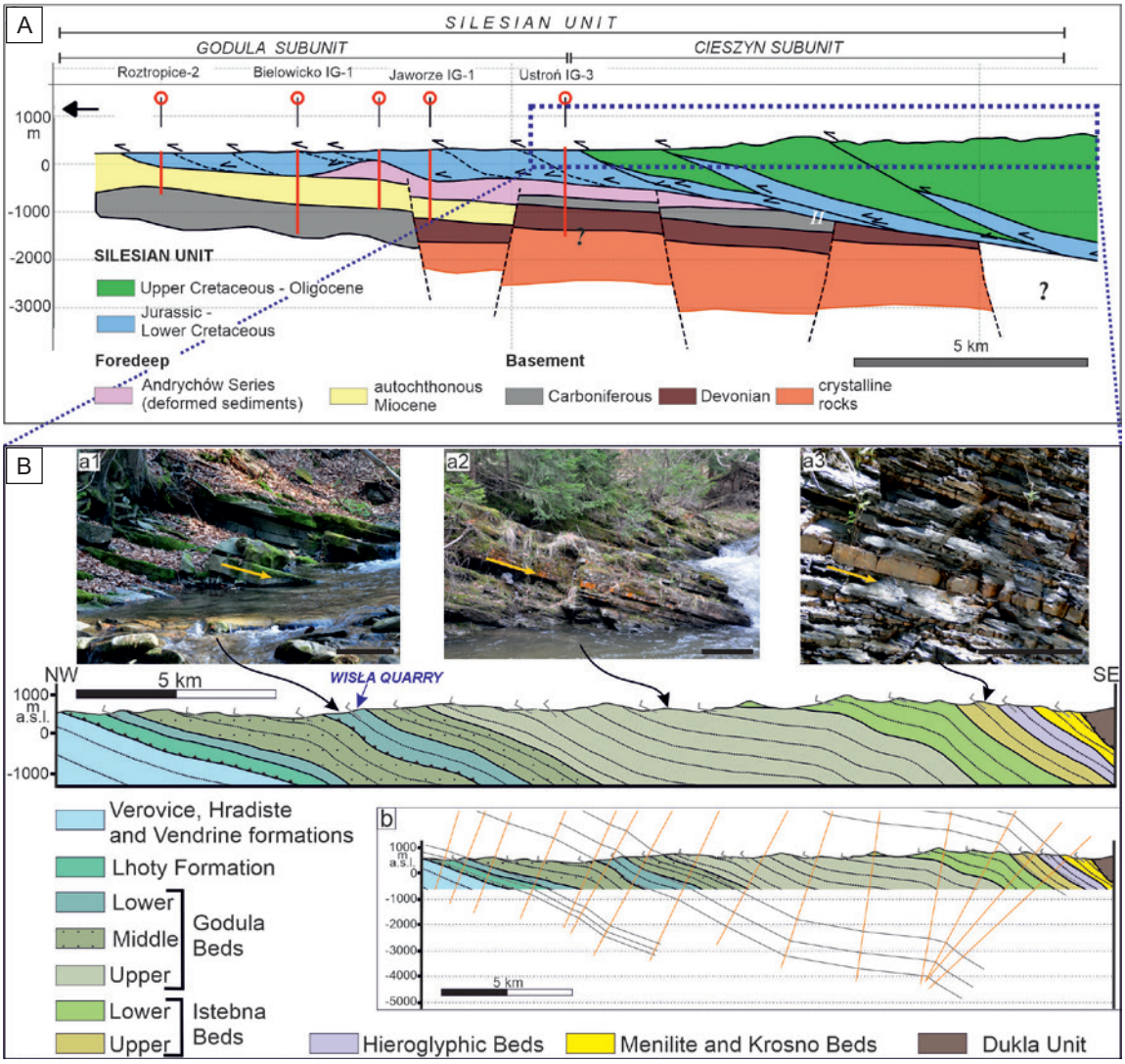

Fig. 27. Cross-sections of the Silesian Unit: A – geological structure of the unit based on surface and borehole data; B – detailed cross-section through the Godula Subunit extrapolated from the surface data, an outcrop-scale homoclinal structure of different parts of the subunit is shown in the photos: (a1) sequence of thin- to medium-bedded sandstones typical of the lower Godula member, (a2) sequence of mainly thin- and medium-bedded sandstone–shale interbeddings characteristic of the upper Godula member, (a3) thin-bedded black shales intercalated with sandstones and siderites typical of shaly interval of the Upper Istebna Beds; (b) geometry of strata approximated with the use of the Move Software by projection from dip data with the kink-band method

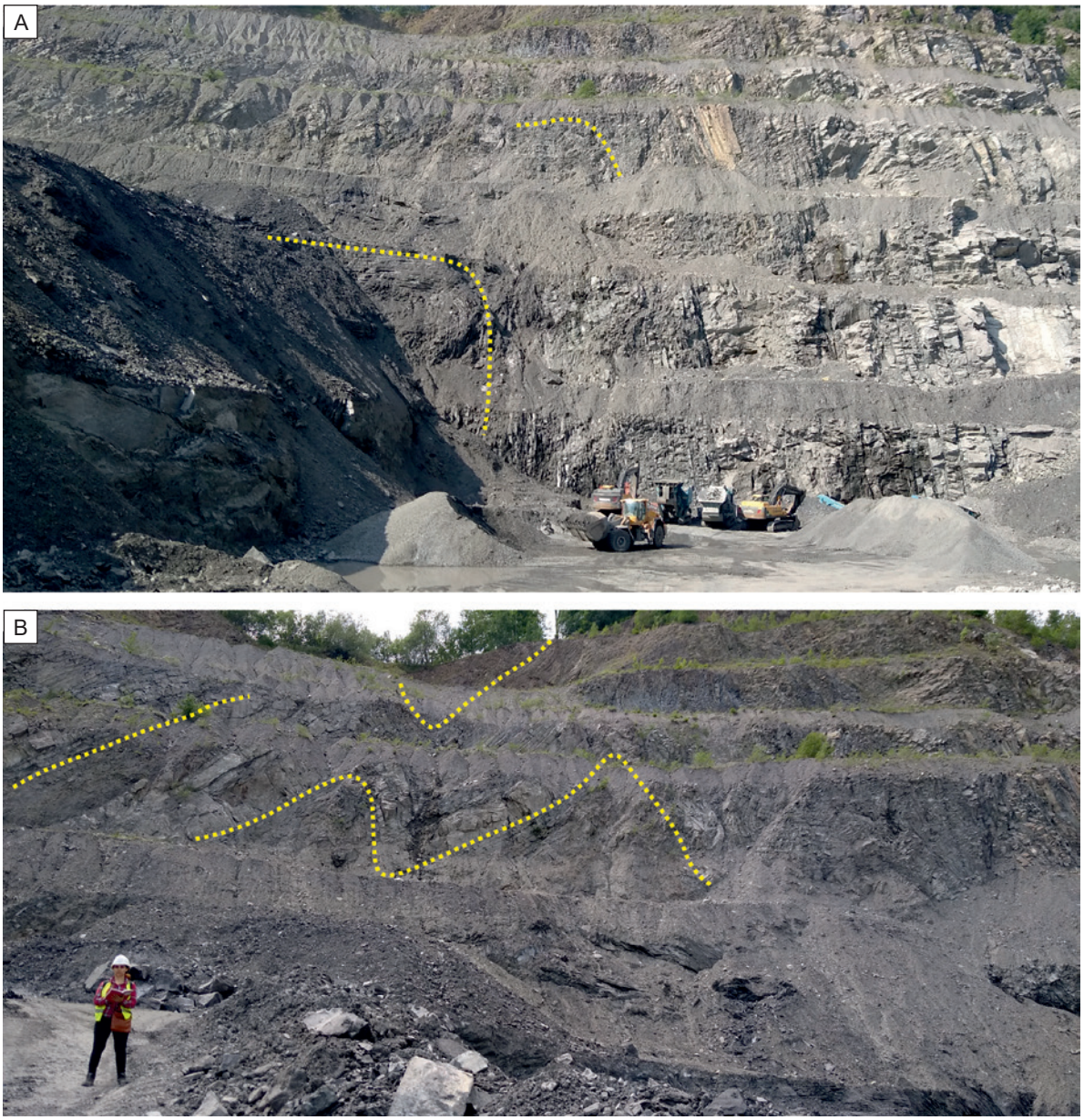

Fig. 28. Tectonic deformations formed at the front of the southern thrust sheet within the Godula Subunit: A – lower part of the Wisła Quarry; B – upper levels of the Quarry

The southern one represents the main part of the Subunit, including its complete succession from the lowermost part of the Godula Formation to the Oligocene in age Krosno Beds, and on the entire length it preserves undisturbed stratigraphic succession. Within the Wisła Quarry meso- and macrotectonic structures are observable that characterized the front of the southern thrust sheet (Fig. 28). For the Godula Subunit, a general decreasing character of the AFT age toward the north can be inferred. It is a typical AFT age pattern related to exhumation due to thrusting (Almendral *et al*., 2015), which supports the map-scale picture of the southern part of the Godula Subunit as a single block rotated due to reverse faulting.

Stop 6 – Janoszka stream in Kamesznica village sandy-to-gravelly debris flow deposits (Upper Cretaceous–Paleocene) (Figs 8, 13, 27–30)

(*Krzysztof Starzec*)

The Stop is located in the Kamesznica village along the Janoszka stream. The sequence of the Upper Cretaceous–Paleocene Istebna Formation is exposed along the stream