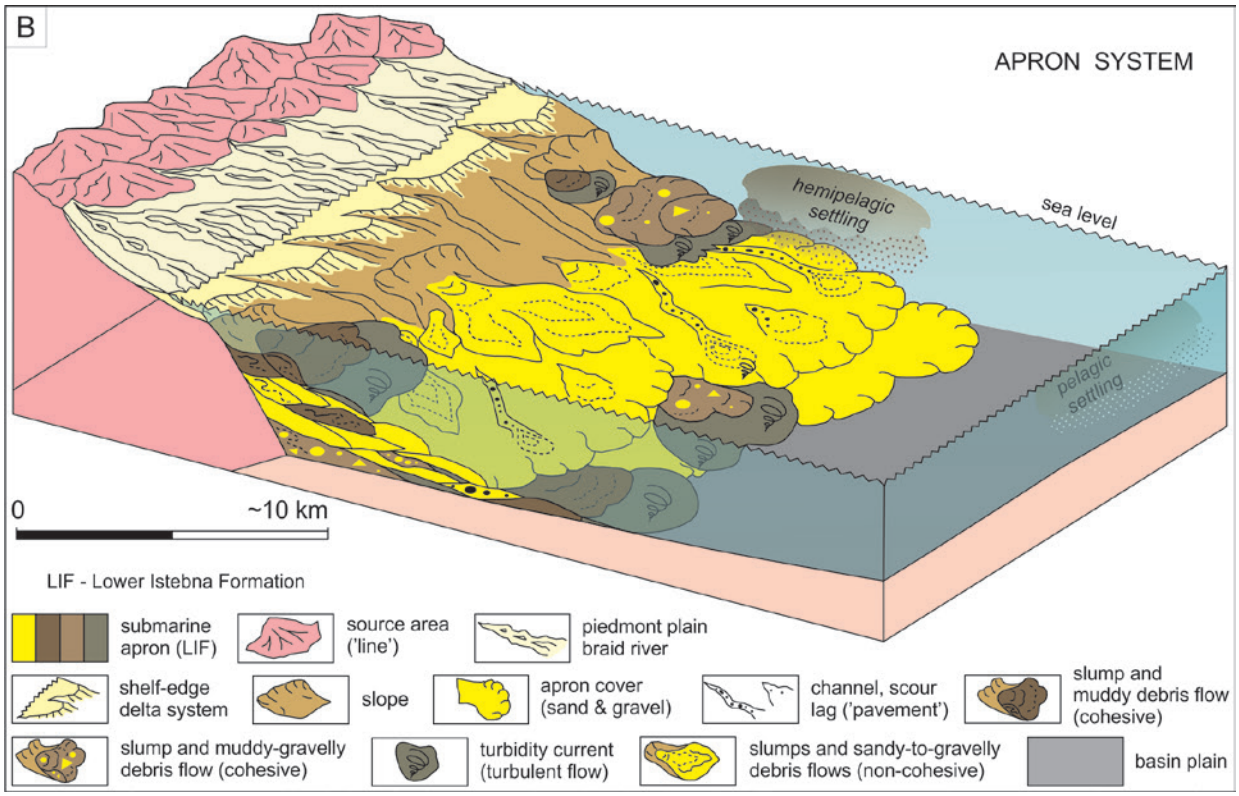

Fig. 33. Sedimentation model of the depositional system for the Istebna Formation – line-supplied slope resedimentation apron (after Strzeboński, 2022, with permission of author)

These gneisses together with schists, phyllites, pegmatites, milky or dark quartzites, pinkish granites, and sporadically dark limestones, represent the rocks inventory of the basement upon which the Carpathian basins, developed during Mesozoic and Cenozoic times. This, so far poorly known basement is customarily called the "Protocarpathians" (Gawęda & Golonka, 2011). The Protocarpathian exotic material plays a key role in palaeotectonic reconstructions. Data from the felsic crystalline clasts imply that the Silesian Ridge was an eastern prolongation of the Brunovistulia microcontinent (Gawęda *et al*., 2019).

Stop 7 – Klubina quarry – siliciclastic flysch (upper Eocene) (Figs 8, 13, 31–34)

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

The abandoned Klubina quarry is located in Slovak part of the Outer Carpathians, about 7 km south the Polish/Slovak border. This area belongs to the highest tectonic unit in the Western Carpathians, i.e., the Magura Unit (Nappe). The Unit forms a continuous belt along the Western Carpathian arc from the Vienna Forest in Austria to the Western Ukraine (Picha *et al*., 2006). The sedimentary succession of the Magura Unit includes mostly flysch type deposits that evolved during the Late Cretaceous and Paleogene at the convergent stage of the Carpathian area development (Picha *et al*., 2006).

Rocks exposed in the quarry represent the youngest (Late Eocene) stage of sedimentary infill of the Magura Basin. They are assigned to the Kýčera Member of the Zlín Formation of the Rača Subunit (Staňová *et al*., 2009), i.e., one of the large thrust units within the Magura Unit. The Zlín Formation is regarded as an equivalent of the muscovite sandstone facies of the Magura Formation distinguished in the Polish part of the Magura Unit. The Kýčera sedimentary succession in the Quarry is a representative of the entire belt of the Magura Unit, along which the youngest synorogenic flysch deposits are more or less similarly developed. These deposits mark the last phase of the Magura Basin evolution. Rocks making up the sedimentary succession in the quarry form a sandstone-mudstone sequence, although with distinctive domination of the first lithology (Fig. 34). The sandstones occur mostly in thin to thick layers, very thick beds are also quite often present, some of them shows amalgamation structures. Most sandstone beds have flat or slightly wavy bases, very often with flute casts or tool marks.

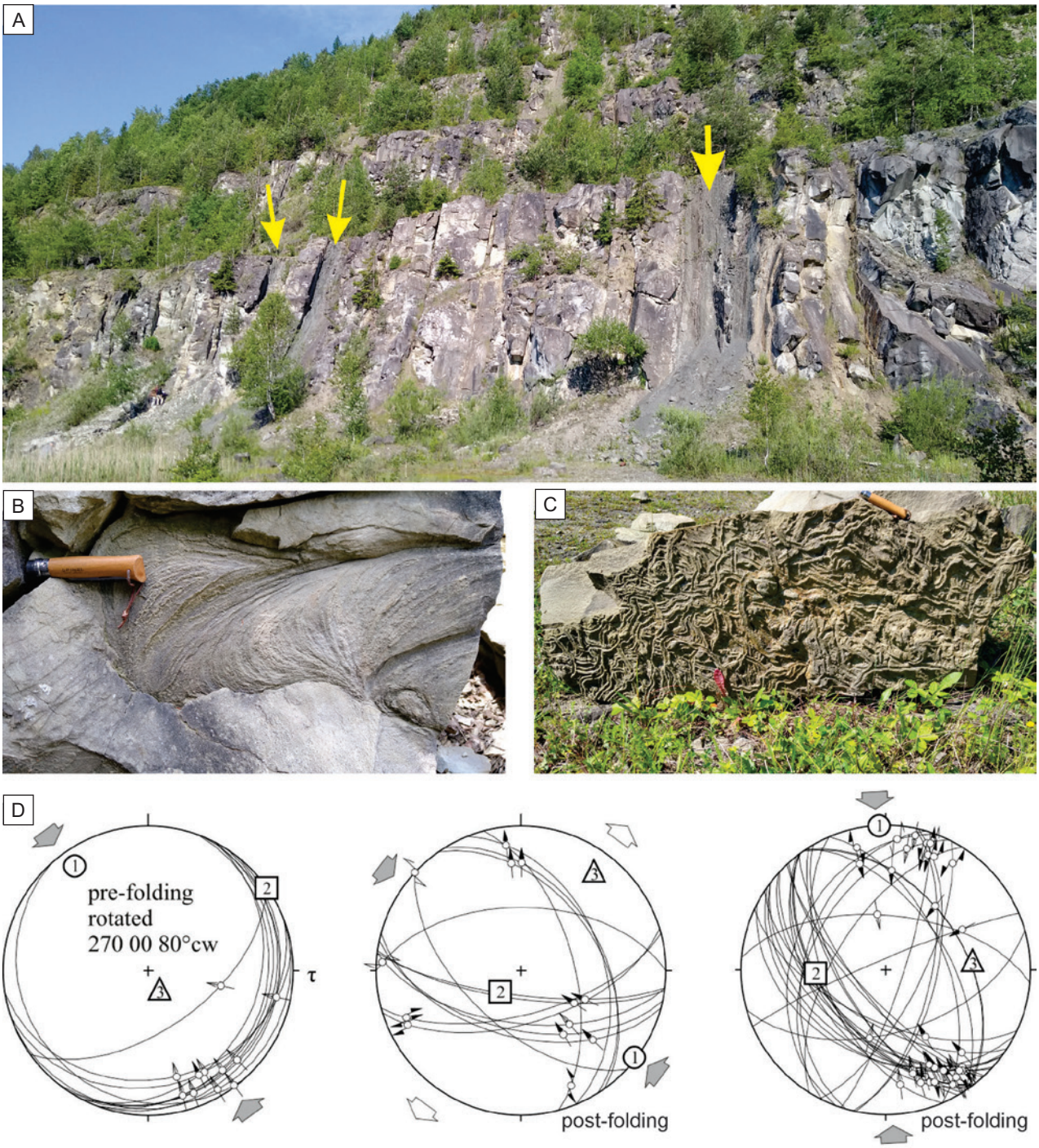

Fig. 34. General view of the Kýčera Member sequence in the Klubina quarry: A – bottom level of the quarry showing a sequence of turbidite deposits dominated by sandstone layers, thicker intervals of mudstone with very thin sandstone intercalations are marked with yellow arrows; B – *Zoophycos* trace fossil within the sandstone bed; C – sinusoidal trace fossils of *Scolicia* on the bottom surface of sandstone layer; D – Schmidt's lower hemisphere stereonet plots for faults measured in the quarry

They are characterized by massive structure or normal grading as well as parallel lamination. The Tb-d divisions of the Bouma sequence are visible within the beds, but more often they show only normal grading interval at the base and a thin laminated mudstone at the top. Trace fossils are quite abundant on layer surfaces or inside them, mostly *Zoophycos*, *Scolicia*, *Taphrhelminthopsis* can be encountered (Fig. 34B, C). Mudstone occur as thin interbreedings between sandstone layers or sometimes they form thicker intervals (Fig. 34). The proportion of mudstones and sandstones varies both vertically and laterally, thicker shale intervals occur in upper levels of the quarry. The Kýčera Member

represents a depositional environment of the submarine turbiditic fan and is interpreted either as a channel system (or upper parts of lobes) alternating with interchannel areas (Starek & Pivko, 2001) or lobe system alternating with interlobe deposits (Staňová & Soták, 2007).

Performed structural observations in the Klubina quarry evidence of two reverse faulting phases (DF1 and DF2) with axes of maximum compression directed to NW (DF1) and N (DF2). These findings correspond with the results of Beidinger and Decker (2016), who described similar stress regimes in the adjacent Czech Outer Carpathians for the Oligocene – Miocene times (Fig. 34D). The rotation of the axis of maximum compression is interpreted as an effect of anticlockwise rotation of this segment of the Outer Carpathians.

Stop 8 – Wżar Mount (Miocene andesites and panoramic view) (Figs 12, 35, 36)

(*Jan Golonka*, *Michał Krobicki*)

The most famous outcrop (artificial one – abandoned quarry) of the Middle Miocene volcanism of the Pieniny Mountains occur on the Wżar Mount, near Snozka pass, and is represented by two generation of intrusive dykes and sills. In half of the 20th century several pioneer researches were done both geologically, mineralogically/petrographically and geophysically (e.g., Wojciechowski, 1950, 1955; Birkenmajer, 1956a, 1956b, 1958b; Kardymowicz, 1957; Małoszewski, 1957, 1958; Gajda, 1958; Kozłowski, 1958; Małkowski, 1958). The Neogene volcanic activity in Carpathian–Pannonian region was widespread. The Pieniny Andesite Line is an about 20 km long and 5 km wide zone, which cut both Mesozoic-Palaeogene rocks of the PKB and Palaeogene flysch of the Magura Nappe of the Outer Flysch Carpathians. Andesites occur in the form of dykes and sills. At the Wżar Mount two generations of andesitic dykes occur (Youssef, 1978). Numerous older dykes are sub-parallel to the longitudinal distribution of the PKB structure and younger are perpendicular to the first and are represented only by three dykes (Birkenmajer, 1962, 1979; Birkenmajer & Pécskay, 1999). Spatial distribution, temporal relationships, and geochemical evolution of magmas contribute to interpretation of the geodynamic development of this area (e.g., Birkenmajer, 1986; Kováč *et al.*, 1998; Golonka *et al*., 2005a, 2005b).

The Wżar Mount represents the westernmost occurrence of andesites in the Pieniny region. Amphibole-augite and/or augite-amphibole andesites dominate in the Mount Wżar area. Numerous petrographical varieties were distinguished, based mainly on the composition of phenocryst assemblages (Michalik M. *et al*., 2004, 2005; Tokarski *et al*., 2006).

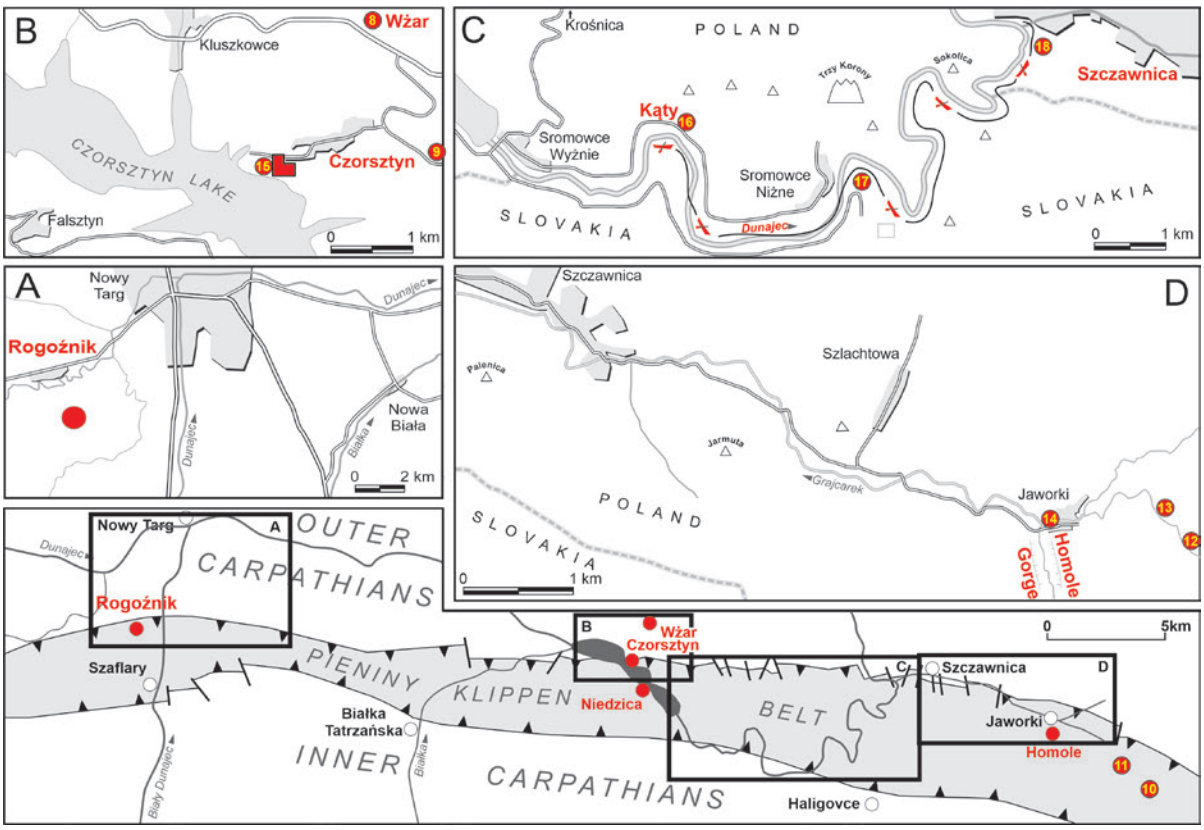

Fig. 35. Polish part of the Pieniny Klippen Belt and locations of visited outcrops – stop points