(*Stephanoceras*, *Skirroceras*) which are indicative of the upper part of the Lower Bajocian (upper Propinquans Zone, and the Humphriesianum Zone) – see Krobicki & Wierzbowski (2004), whereas the nodular limestones directly overlying crinoid limestones of the Krupianka Limestone Formation in the Czorsztyn Castle Klippe section yielded ammonites of the uppermost Bajocian (Wierzbowski *et al.*, 1999; Krobicki *et al*., 2006). The upper surface of the topmost bed of the red crinoidal limestones is corroded and covered with ferro-manganese crust, very typical feature for this boundary surface, known from several other outcrops in the PKB, both in Polish, Slovakia and Ukrainian part of the region. The overlying nodular limestones correspond already to the Czorsztyn Limestone Formation (red nodular limestone). The lowermost part of the nodular limestones of the Czorsztyn Limestone Formation exposed in the Czorsztyn Castle Klippe yielded the rich ammonite faunas. These ammonites are indicative to uppermost Bajocian, Bathonian, and Callovian up to Oxfordian. The whole uppermost Bajocian up to uppermost Callovian and/or Oxfordian interval does not exceed 2.0 meters, therefore the oldest part of the Ammonitico Rosso type limestones (of the Czorsztyn Limestone Formation) represents very condense sequence (Wierzbowski *et al*., 1999). The whole Cretaceous strata were visible previously (from Berriasian limestones up to Santonian marls), including very characteristic synsedimentary limestone breccias of the so-called Walentowa Breccia Member of the Łysa Limestone Formation (Berrisian in age) which indicates the earliest Cretaceous (Neo-Cimmerian) tectonic movements in this part of the Tethys.

Stop 12 – Wżar Mt (Miocene andesites and panoramic view) (Fig. 44)

(*Jan Golonka, Michał Krobicki*)

The most famous outcrop (artificial one – abandoned quarry) of the Middle Miocene volcanism of the Pieniny Mts occur on the Wżar Mt, near Snozka pass, and is represented by two generation of intrusive dykes and sills. In half of the XX 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-Paleogene rocks of the PKB and Paleogene flysch of the Magura Nappe of the Outer Flysch Carpathians. Andesites occur in the form of dykes and sills. At the Wżar Mt 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 Mt represents the westernmost occurrence of andesites in the Pieniny region. Amphibole-augite and/or augite-amphibole andesites dominate in the Mt 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). The mainly Sarmatian age of first phase of andesite dykes from this quarry, which are parallel and subparallel with the northern boundary fault of the PKB, radiometrically determined as 12.5–12.8 Ma (K-Ar method) (Birkenmajer & Pécskay, 2000; Trua *et al*., 2006). The second, younger generation of dykes follows transversal faults, which cut the older generation (Birkenmajer, 1962) and is dated on 10.8-12.2 Ma (Birkenmajer & Pécskay, 2000; Birkenmajer, 2001). These calc-alkaline andesites interpreted by Birkenmajer (2001) as products of hybridization of primary mantle-derived magma over subducted slab of the North European Plate (Birkenmajer & Pécskay, 1999) connected with collision-related post-Savian tectonic, compression event. The newest results of andesitic rocks investigations indicate partial melting derived from an ancient metasomatized, sub-continental lithospheric mantle. Generation of the calc-alkaline magmas in the upper lithospheric mantle was effect of collision of the Alcapa block with southern margin of the European platform (Anczkiewicz & Anczkiewicz, 2016; see also Trua *et al*., 2006).

These andesitic rocks cut Upper Cretaceous and Paleogene flysch deposits of the autochthonous Magura Nappe (the Szczawnica, Zarzecze and Magura formations), which is the southernmost flysch tectonic unit of the Outer Carpathians – near northern strike-slip–type faults of the PKB. Near the entrance to this quarry contact metamorphism and hydrothermal activity within flysch sandstones are good visible (Birkenmajer, 1958b; Gajda, 1958; Małkowski, 1958; Michalik A., 1963; comp. Szeliga & Michalik, 2003). Two stages of magmatic activity resulted also in chemical variation in composition of surrounding sandstones (Pyrgies & Michalik, 1998). The similar Miocene volcanic activity is widespread within whole Carpathian-Pannonian region and can be use to geodynamic interpretation of syn-orogenic magmatic events of these regions (e.g., Kováč *et al*., 1997; Anczkiewicz & Anczkiewicz, 2016 with references cited therein).

Wżar Mt is one of the geological objects classified for the entry into the European network of GEOSITES (Alexandrowicz, 2006) and mining activity of prospecting and excavation of magmatic ore deposits connected with Pieniny andesites were known since beginning of the XV century (Małkowski, 1958).

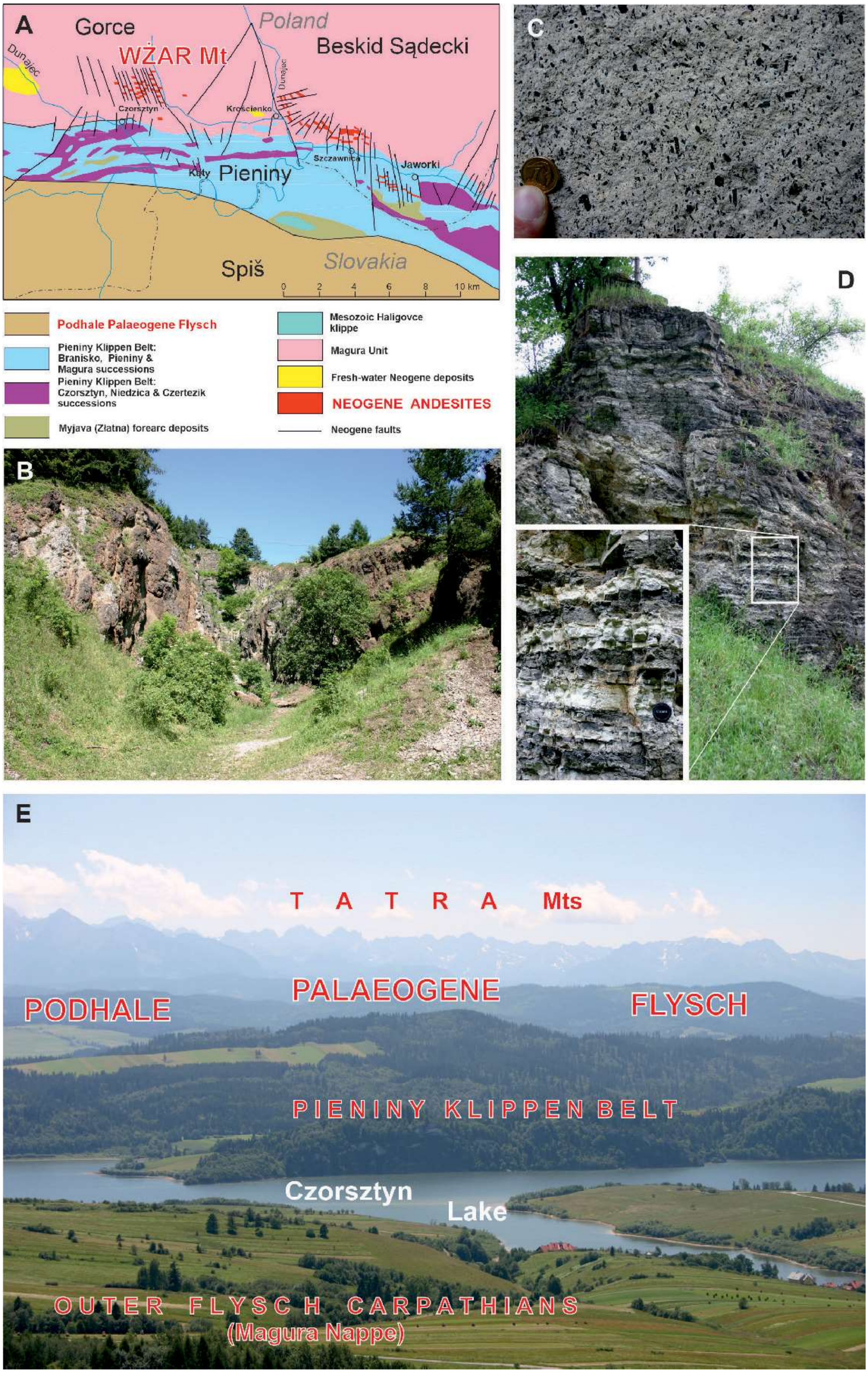

Fig. 44. Geological position of Miocene andesites of the so-called Pieniny Andesite Line: A – geological sketch of the Pieniny Klippen Belt (Polish sector) and surrounding regions (after Birkenmajer, 1979; simplified) with location of Wżar Mt; B – main entrance to abandoned quarry; C – andesites with piroxenes and amphibolites; D – thermally change of flysch deposits of the Magura Unit (Outer Flysch Carpathians) on the contact with andesites; E – general view of Inner Carpathians from topmost part of the Wżar Mt (after Krobicki & Golonka, 2008)

Finally, when looking southward, we can see perfect panorama of Tatra Mountains, Pieniny and Podhale trough with Czorsztyn Lake, and looking northward of Gorce Mountains are visible (see Golonka *et al*., 2005b).

From the Snozka Pass we are descending into Krośnica village across Magura Nappe and going uphill into Pieniny Mountains, which belong to the geological structure known as PKB. The Pieniny Mountains belong to the Polish Pieniny National Park (Pieniński Park Narodowy) and its Slovak equivalent Pieninský Narodný Park. The idea of the National Park was given by Władysław Szafer in 1921 after Poland gain her independence. The Park was established in 1932 in Poland and in 1967 in Slovakia (Kordováner *et al*., 2001b; Tłuczek, 2004). The Pieniny National Park area is 4,356 ha, 2,231 ha on the Polish (Kordováner *et al*., 2001a, 2001b; Tłuczek, 2004). One quarter of this area belongs to special nature sanctuaries, the most important ones are: Macelowa Góra, Trzy Korony, Pieniński Potok valley, Pieninki and Bystrzyk (Kordováner *et al*., 2001b; Tłuczek, 2004). 60% of the park area are forests mainly beech woods, the rest are meadows, agricultural areas and rocks. The Pieniny National Park fulfills its nature preservation role, conducting also scientific research, education and touristic activities (Kordováner *et al*., 2001b; Tłuczek, 2004; see also Museum of Pieniny National Park at Krościenko n/Dunajcem). From the Krościenko we are going to thw Szczawnica spa and farther east to the Jaworki village.

Stop 13 – Obłazowa Klippe – microfacies of the Czorsztyn Limestone Formation (Bathonian-Tithonian, Czorsztyn Succession) (Fig. 45)

(*Michał Krobicki, Magdalena Sidorczuk, Andrzej Wierzbowski*)

The south-eastern part of the Obłazowa Klippe shows a fairly complete sequence of the Jurassic deposits of the Czorsztyn Succession (Birkenmajer, 1963, 1977; Wierzbowski *et al.*, 1999). The best section is exposed at a rock shelter in southernmost part of the klippe, and it shows the contact of the Czorsztyn Limestone Formation with underlying crinoid limestones.

The oldest are grey crinoid grainstones of the Smolegowa Limestone Formation attaining at least 25 m in thickness (Birkenmajer, 1963). The overlying pink to rusty coloured crinoid limestones with some admixture of heamatite-marly matrix, form a single bed about 0.10 – 0.15 m thick, which belongs already to the Krupianka Limestone Formation. The upper boundary of the crinoid limestones represents an omission surface coated with ferro-manganese crusts. Overlying this surface are nodular limestones of the Czorsztyn Limestone Formation. The ammonites collected from the lower part of bed 2 include *Procerites* (*Procerites*) *progracilis* Cox & Arkell, and *Procerites* (*Siemiradzkia*) sp., indicative of the Progracilis Zone – the lowest zone of the Middle Bathonian (Wierzbowski *et al.*, 1999). The nodular limestones are developed in two microfacies types: the filament microfacies occurring in lower and upper parts of the studied deposits of the Czorsztyn Limestone Formation, and the filament-juvenile gastropod microfacies found in the middle part of the deposits. Moreover, the filament – *Globuligerina* microfacies is recognized in the topmost part of the deposits studied – it still shows the presence of the filaments together with fairly common planktonic foraminifers of the genus *Globuligerina* (Wierzbowski *et al.*, 1999; Jaworska, 2000). The younger deposits represented by nodular limestones show the presence of the *Saccocoma* microfacies (Jaworska, 2000). The occurrence of *Saccocoma* microfacies in the Czorsztyn Succession is typical of the Kimmeridgian and Lower Tithonian (Myczyński & Wierzbowski, 1994; Wierzbowski, 1994).

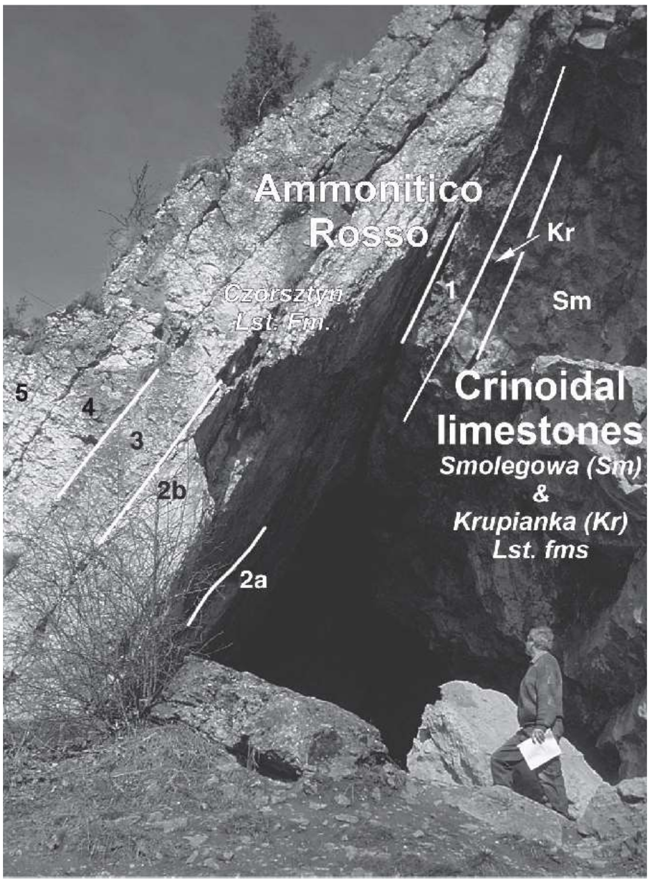

Fig. 45. Obłazowa Klippe: section studied; Sm – white crinoidal limestones of the Smolegowa Limestone Formation; Kr – red crinoidal limestones of the Krupianka Limestone Formation