B. GEOLOGICAL HERITAGE

B1. GENERAL GEOLOGICAL DESCRIPTION OF THE PROPOSED GEOPARK

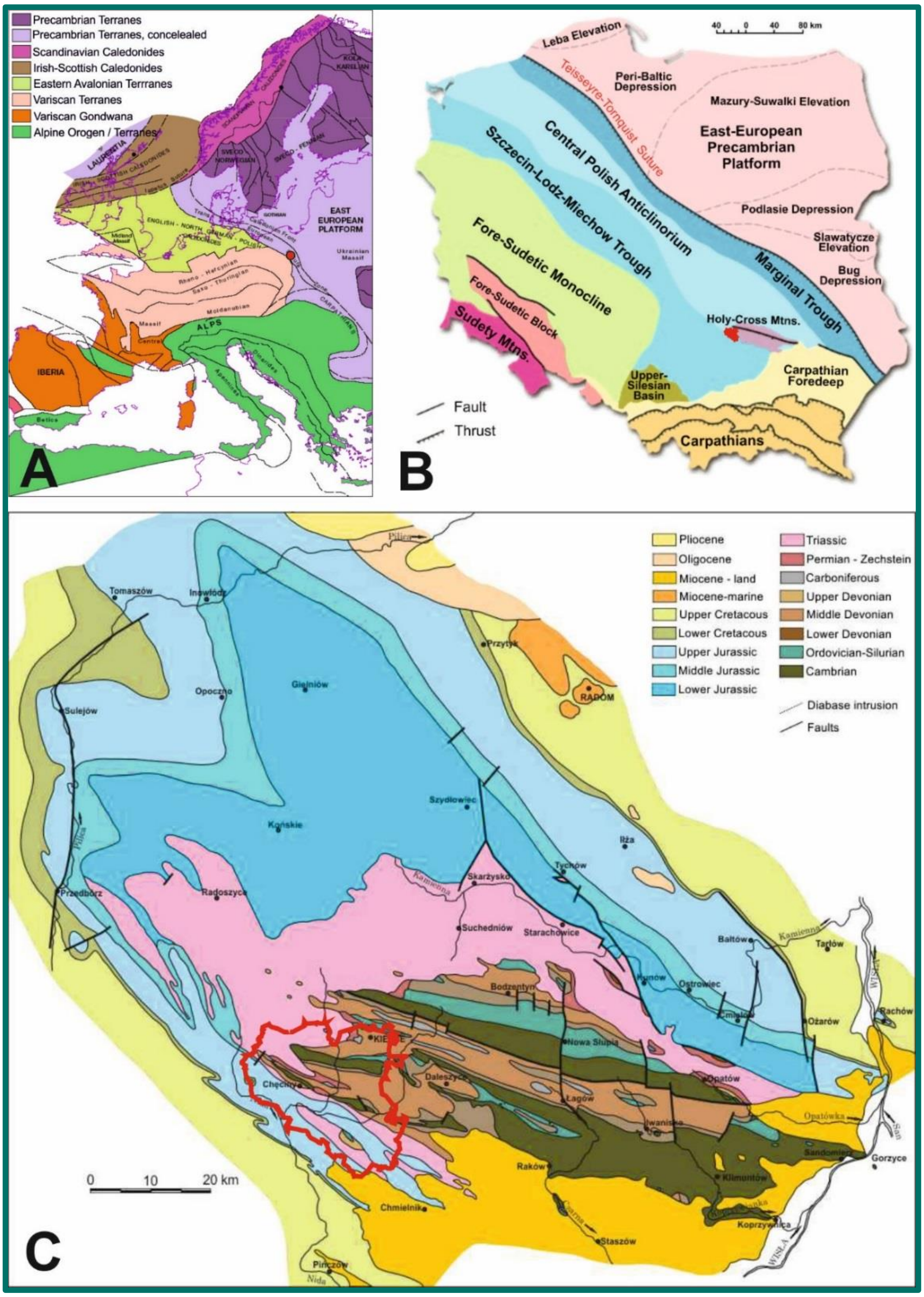


Fig. B1 Situation of the Geopark ,,Geoland Świętokrzyski'' area (marked red point or line) against a background of the geological structures of Europe (A), as well as Poland (B) and Świętokrzyskie (Holy Cross) Mountains (C); source of maps: Polish Geological Institute, European Center of Geological Education; Geochemical Atlas of Europe; modified)

The Świętokrzyskie (Holy Cross) Mountains and the Geopark area are situated in specific place of the geological structure of Europe, because they are located within the great disruption of the earth crust called the Trans-European Suture Zone (TESZ), which is a boundary between three large geological units of the European crust: Variscan West-European Platform, Precambrian East-European Platform and orogenic belt of Alpine structures (Fig.B1). The Świętokrzyskie Mountains region (and the Geopark area) is the only segment of this zone (TESZ) where the sedimentary rocks representing the sequence of all geological period from Cambrian to the Quaternary are outcropped (Fig. B1). Therefore, the geological studies of this region are of fundamental significance for the understanding and reconstruction of the geological history of the European continent (Dadlez, 2001; Konon, 2008; Urban, Gągol, 2008).

In the context of the geological structure of Polish territory the Świętokrzyskie Mountains represent the south-eastern segment of the greater geological unit called Mid-Polish Anticlinorium (Fig. B1). This Anticlinorium is an elongated structure of the NW-SE direction crossing Polish area that is formed of sedimentary Mesozoic rocks. They were deposited within the basin of the similar (to the Anticlinorium) elongation and direction called Danish-Polish Through. During the Alpine tectonic movements, particularly intensive at the Cretaceous-Palaeogene turn, the rocks filled the Danish-Polish Through were uplifted and slightly/partly folded (forming the Anticlinorium), however, the greatest uplift occurred in the south-eastern part of the unit that constituted the Świętokrzyskie Mountains (Karnkowski, 2008; Konon, 2008). Consequently, this part suffered the most effective denudation (erosion) which brought about partial removal of Mesozoic rocks and emergence of rocks of so called Palaeozoic Core of the Świętokrzyskie Mountains. Present-day image of the geological structure of the Geopark, as an element of the Świętokrzyskie Mountains, is the result of these processes.

In the geological terms the Świętokrzyskie Mountains are composed of two regions: northern, Łysogóry Unit, situated within the earth crust block of the same name and southern Kielce Unit being the part of the Małopolska Block (Fig. B2). The Świętokrzyskie Dislocation, which is prominent disruption reaching the deep part of the lithosphere, is the boundary between these regions (Konon, 2008; Urban, Gagol, 2008). The whole "Geoland Świętokrzyski'' Geopark is situated within the Kielce Unit.

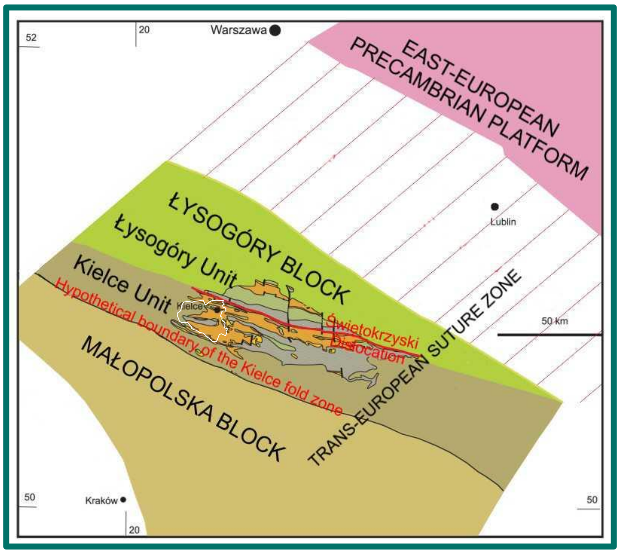
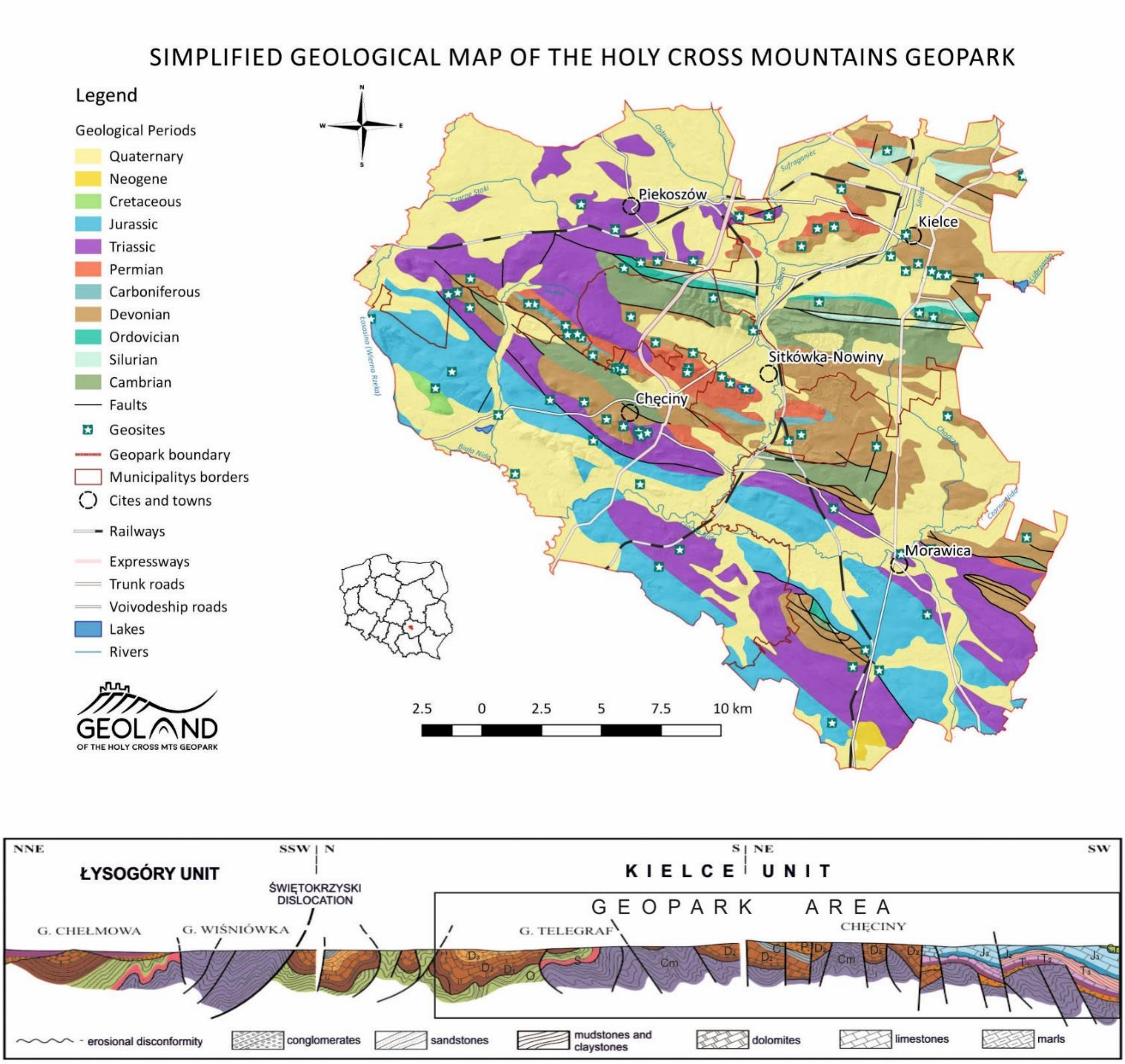


Fig. B2 Location of the Geopark area (white line) on the background of tectonic structures of Central Poland; source of map: Polish Geological Institute, modified

The Palaeozoic Core, situated in the central part of the Świętokrzyskie Mountains is built of the sedimentary rocks that represent all Palaeozoic periods except for Permian and were tectonically modelled during the Caledonian and Variscan tectonic movements. Permian and Mesozoic sedimentary rocks, tectonically modelled during the Alpine movements, comprise so called the Permian-Mesozoic Marginal Zone of the Świętokrzyskie Mountains (Fig. B1) (Lamarche et al., 2003; Mizerski, 2004; Konon, 2008). The area of the ,,Geoland Świętokrzyski'' Geopark covers the western part of the Palaeozoic Core and south-western section of the Permian-Mesozoic Marginal Zone (Fig. B1), however part of the Palaeozoic and Mesozoic structures are masked here by Quaternary (occasionally also Neogene) sediments that occupy depressed and part of sloped morphological elements (Fig. B3). Quaternary rocks represent glacial and fluvioglacial sediments deposited during the Pleistocene South-Polish Glacials as well as fluvial, slope and aeolian sediments deposited during the interglacial and periglacial periods. The youngest, mainly fluvial sediments were deposited in the Holocene (Urban, Gagol, 2008; Urban, 2010).



Cm - cambrian; O+S - ordovician and silurian; D1 - lower devonian; D2 - middle Devonian; D3 - Upper Devonian; C - carboniferous; P - Permian
T1 - Lower Triassic; T2 - Middle Triassic; T3 - Upper Triassic; J2 - Middle Jurassic; J3 - Upper Jurassic; C - Cretacous

Fig.B3 Simplified geological map and cross-section through the Geopark territory

The geological history of the Świętokrzyskie Mountains, and the Geopark within this region, directly determines present-day situation of this area within the European continent and, consequently, is responsible for the morphology, climate, biodiversity and the development of colonisation and economy of this region (Urban, Gągol 2008). Very evident and apparent interrelation between the geological heritage and the development of colonisation, mining and agriculture is the feature distinguishing the Geopark region from neighbouring areas.

B.1.1 Scientific Description of Geology

In the geological history of the Świętokrzyskie (Holy Cross) Mountains region recorded in the lithostratigraphical sequences available in the representative geosites within the area of the Geopark four structural stages – phases of sedimentation separated by tectonic movements, uplift and denudation – have been distinguished (Mizerski 2004; Urban, Gągol 2008; Urban, 2010). From the oldest to the youngest they are as follow:

- **Early-Caledonian (1) and Late-Caledonian (2) stages** that include sequences of the Older Palaeozoic (Cambrian, Ordovician and Silurian), tectonically deformed at the Cambrian-Ordovician turn as well as the Silurian-Devonian turn;
- **Variscan stage (3)** including the Devonian and Lower Carboniferous sedimentary sequences folded, faulted and uplifted during the Late Carboniferous and Permian;
- **Alpine stage (4)** including the Permian and Mesozoic rocks tectonically modified at the Cretaceous and Palaeogene turn and later.

During the subsequent, **Cenozoic stage (5)** of the evolution the present-day image of the geological structure as well as morphology and landscape of the Świętokrzyskie Mountains region (including the Geopark area) have been finally formed.

1) and 2) – Early- and Late-Caledonian structural stage: history of the Baltica palaeocontinent and its amalgamation with the Laurentia

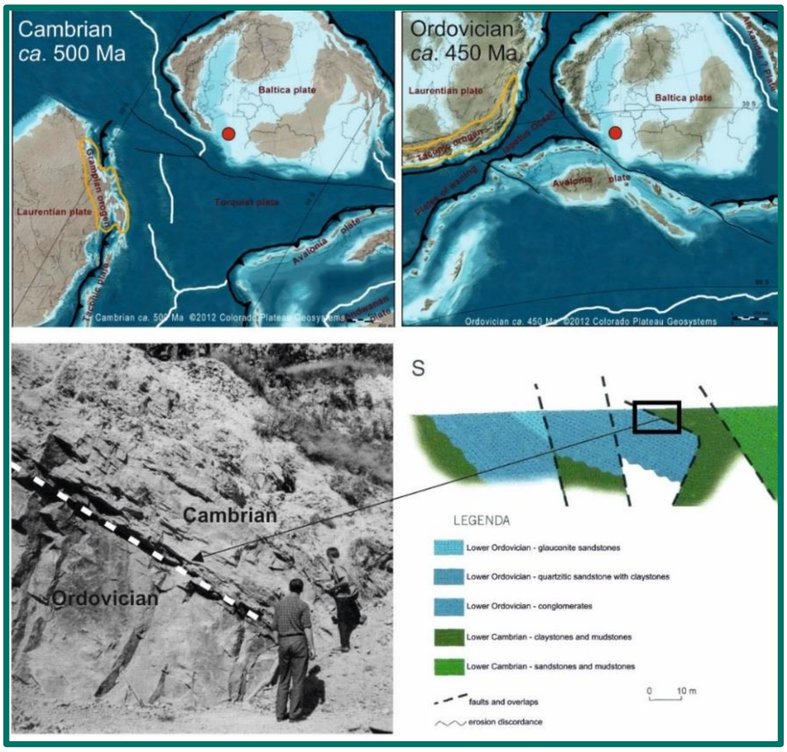


Fig.B4 Cambrian – Ordovician paleogeography of Europe (after R. Blakey, 2012) with location of Geopark area (red point) and the Cambrian – Ordovician sequence in Biesak-Białogon geosite (No. G/KIE/006)

Sandstones, siltstones and clayey shales of the Cambrian Middle Division (ca 500 MA) are the oldest rocks outcropped within the Geopark area. Apart from Middle Cambrian rocks the sequence of the Older Palaeozoic is constructed of sedimentary Ordovician and Silurian rocks represented by sandstones, siltstones, claystones and greywackes with inserts of pyroclastic rocks – bentonites. The sequence of these rocks is the record of marine depositional environment connected with the shelf of the Baltica palaeocontinent (Fig. B4), and its movement form the low geographical latitude of the southern hemisphere to the equatorial latitudes and collision and subsequent amalgamation with the Laurentia palaeocontinent (Bełka et al. 2012). Processes and events connected with the oldest documented (Old-Caledonian) stage of the history of the Geopark area are recorded in the sequence of Cambrian and Ordovician rocks outcropped in the "Biesak-Białogon" Geosite (no G/KIE/006), (Fig. B4). The younger, Ordovician part of this sequence includes also the evidences of global and regional events related to the evolution of the Young-Caledonian structural stage recorded in other sequences of the world. The remains of Ordovician volcanism that are used for the reconstruction and correlation of palaeoclimatic and ecological events are represented in this site with the pyroclastic rock.

The geological sequence of the Silurian rocks that represent the Young-Caledonian structural stage, outcropped mainly in the northern and south-eastern parts of the Geopark area (,,Gruchawka'' Geosite no GEO/KIE/016) includes the record of events (e.g. tectonic movements, marine regression and increased volcanism) associated with the tectonic Caledonian movements at the Silurian and Devonian turn, which brought about the closing of the Iapetus Ocean and the collision of two continents: Laurentia (present-day North America) and Baltica (present-day Eastern Europe). Due to the amalgamation of these continents the new continent of Laurussia (Euro-America) was formed. The destruction of the Young-Caledonian land (partly mountains) finalised the Caledonian stage in the Kielce Unit geological history and began the Variscan structural stage, represented by the marine rock sequence from Lower Devonian to Lower Carboniferous.

3) Variscan structural stage – tropical sea at the shelf of Laurussia, great extinction and Variscan mountains

The Variscan structural stage is represented by the Devonian-Lower Carboniferous sequence, deposited and recording global and regional events in the southern shelf basin of the Laurussia continent. At the beginning of the Devonian fragment of this shelf, including the Małopolska Block with the Kielce Unit, was still situated at the southern hemisphere, close to the equator (Fig. B5). The climate and its further changes were responsible for the depositional environments in this area during the Devonian and Carboniferous.

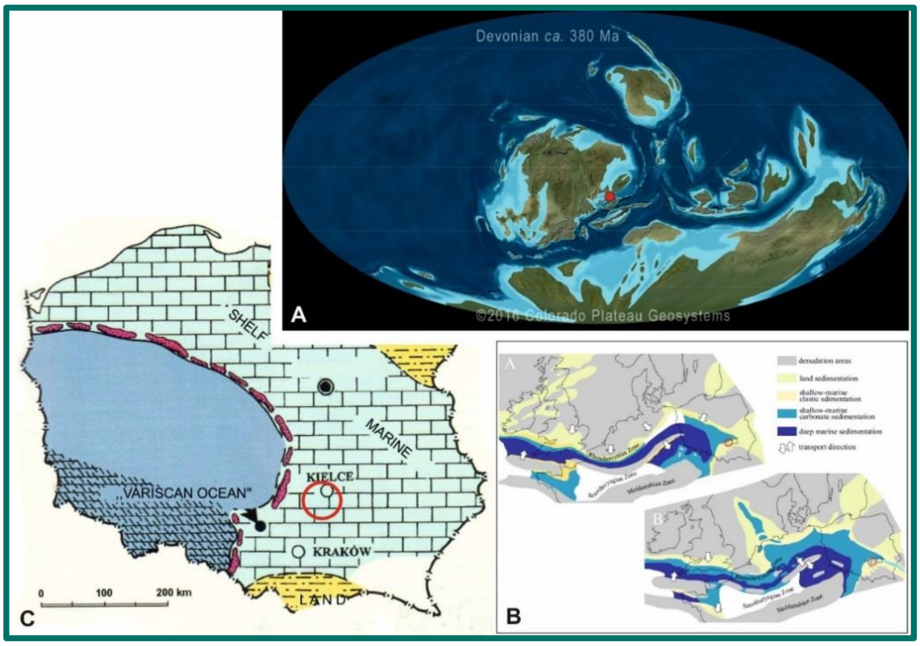


Fig. B5 Paleogeographic position of Małopolska Block (including Geopark area) during the Devonian (A – Upper Devonian global paleogeography after Blakey, 2016; B – paleogeography and main sedimentary zones along the southern Laurussian shelf during the early stage (emsian/eifelian) of Devonian transgression , after Wójcik, 2015; C – simplified paleogeography of Poland during Late Devonian (after Racki et. All, 1999)

The Devonian and the Early Carboniferous make togethers coherent chapter of a depositional history in the Geopark area, since the stratigraphic succession then originated is bouned with the major angular unconformities. They correlate with the late Caledonian and the Variscan orogenies. The succession records a steady sea-level rise since the Early Devonian till the Early Carboniferous, which correspond with global eustatic event (Fig.B6).

The main lithostratigraphical elements of Devonian succession on the Geopark area are presented at Fig. B6.

The global and regional events that controlled the deposition in the Świętokrzyski part of the Laurussia shelf are recorded particularly evident in the sequences outcropped in the central and northern part of the Geopark, at the following representative Geosites:

- Early Devonian (Emsian) terrestrial (fluvial, lacustrine) sequence: G/KIE/012 ,,Świnia Góra’’
- Middle Devonian (Eifelian) lagoon: G/CHE/003 ,,Góra Rzepka’’
- Middle/Upper Devonian (Givetian/Frasnian) carbonate platform with biohermal and biostromal limestones: G/KIE/001 ,,Kadzielnia’’; G/KIE/005 ,,Wietrznia’’; G/KIE/008 ,,Góra Słoneczna’’; G/KIE/011 ,,Góra Cmentarna’’; G/CHE/025 ,,Sowie Górki’’; G/SN/005 ,,Kowala – pomnik przyrody’’; G/SN/007 ,,Kamieniołom Bolechowice’’
- Upper Devonian (Frasnian) pelagic carbonate platform: G/KIE/001 ,,Kadzielnia’’; G/KIE/002 ,,Ślichowice’’, G/CHE/002 ,,Góra Zamkowa – zachód’’; G/SN/006 ,,Kowala-kamieniołom’’
- Upper Devonian (Fammenian) basinal deposits: G/SN/006 ,,Kowala-kamieniołom’’; G/PIE/008 ,,Kamieniołom Ostrówka – Todowa Grząba’’
- Lower Carboniferous basinal deposits: G/SN/006 „Kowala-kamieniołom’’; G/PIE/008 ,,Kamieniołom Ostrówka – Todowa Grząba’’

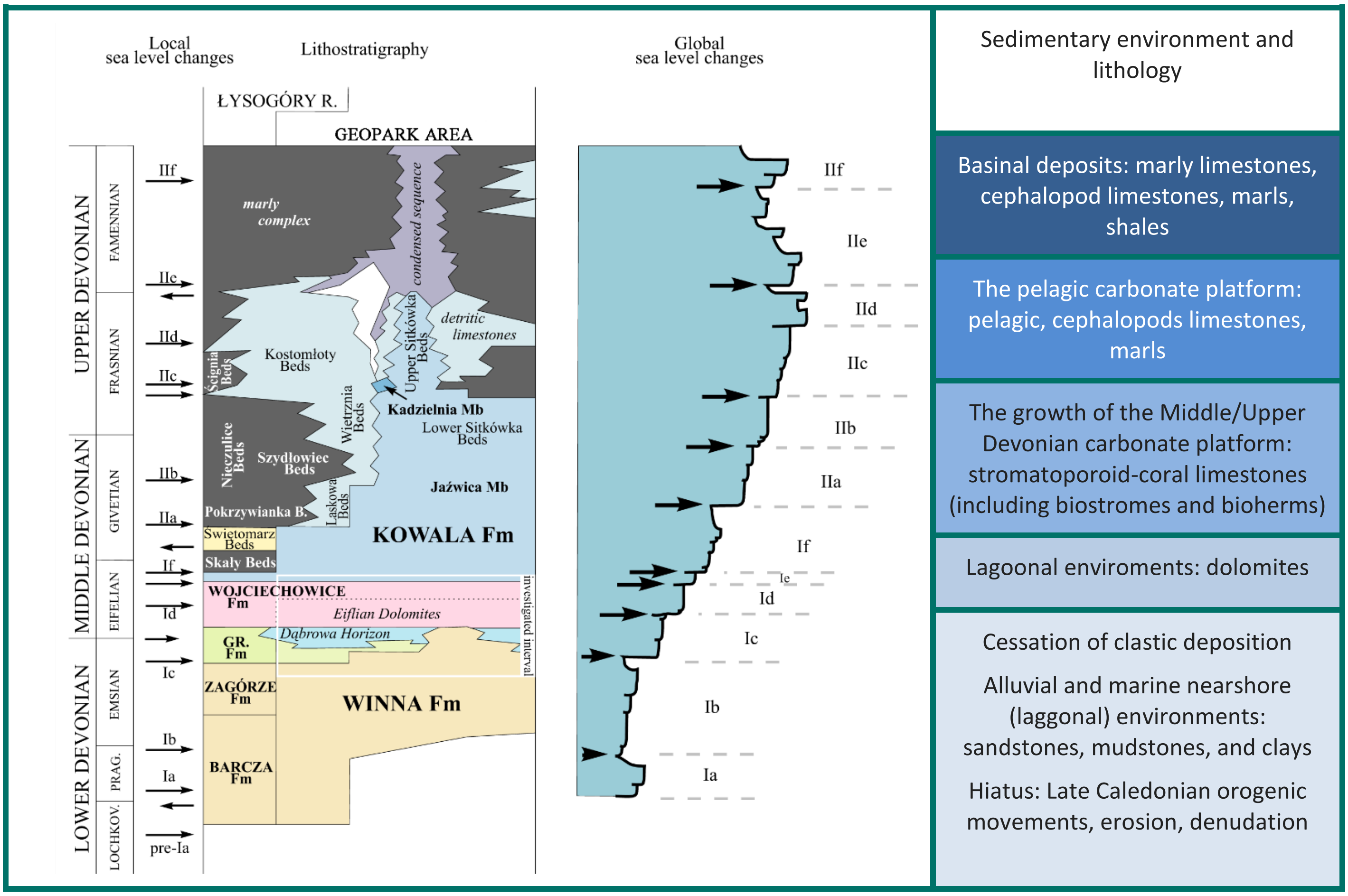


Fig. B6 Devonian lithostratygraphy of Geopark area compared with local and global sea level changes (after Sandberg et. al. 2002; Narkiewicz et al. 2006; Bełka and Narkiewicz, 2008; Wójcik, 2015)

The carbonate rocks of the Stromatoporoid-Coral Limestone-Dolomite Kowala Formation (Givetian-Frasnian) are predominant and most characteristic geological lithostratigraphic unit of the Devonian sequence in the area of the Geopark. The thickness of this formation ranges up to 800 m in the western part of the Kielce Unit and are commonly outcropped (Narkiewicz et. all. 1990). This is why the rocks of the Kowala Formation play principal role in the geological structure, morphology and history of human activity (economy) of the Geopark area (Fig. B7, B8, B9)

Fig. B7 Geosite G/KIE/001 ,,Kadzielnia''

Fig. B8 Geosite G/CHE/010 Góra Miedzianka

Fig. B9 Geosite G/SN/007 Bolechowice quarry

At the Early and Late Carboniferous transition (ca 320 million years ago) the collision of moving to the north Gondwana and northern continent of Laurussia (Euroamerika) generated tectonic movements called Variscan orogenesis, which were the most intensive in the Late Carboniferous and Early Permian. The Variscan movements played the principal role in the tectonic formation of the Palaeozoic Core of the Świętokrzyskie Mountains. These movements are responsible for the development of main structural elements of this region: vast anticlines and synclines as well as system of longitudinal and transversal faults (Konon, 2007, 2008; Urban, 2010). These elements are shown in the cross-section of the western part of the Kielce Unit (including the Geopark area) below (Fig.B10).

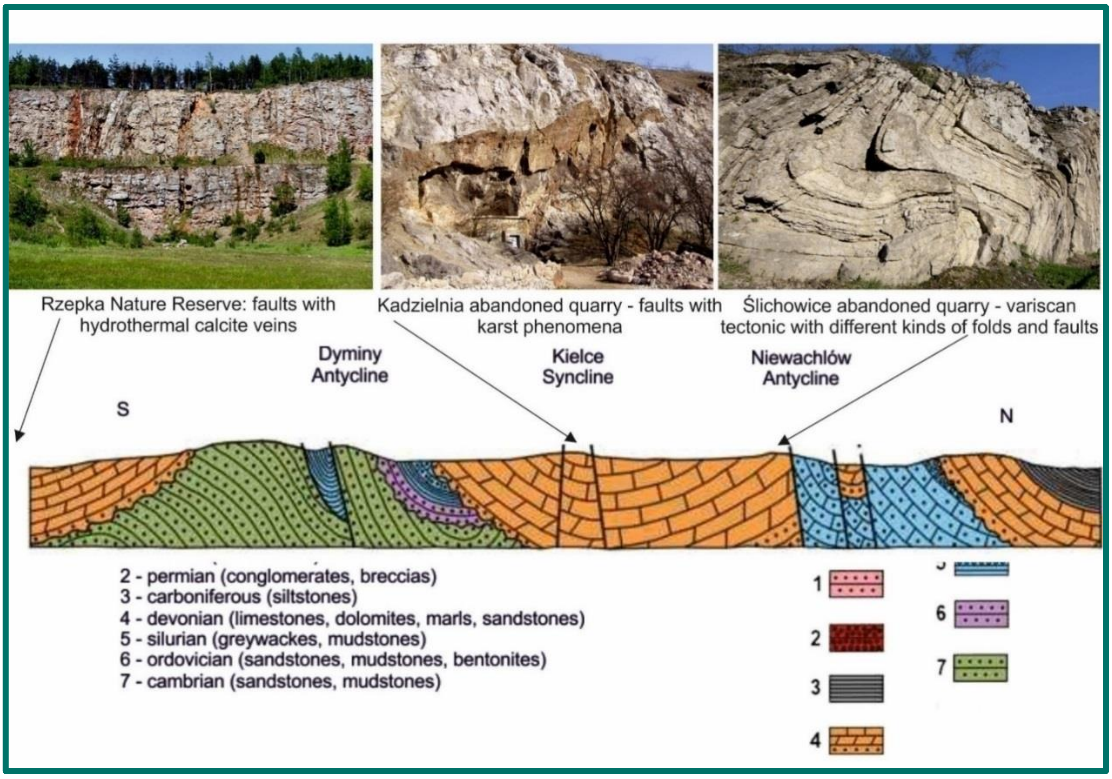


Fig. B10 Cross-section of the northern part of the Geopark area with the examples of a record of the Variscan tectonic movements (after Urban et. al., 2011)

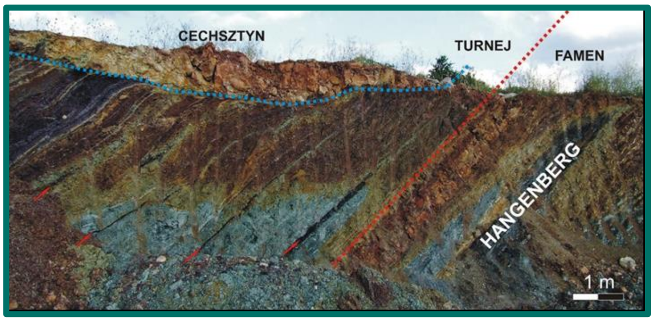


Fig. B11 ,,Kowala – kamieniołom'' Geosite (no G/SN/006) with a sequence of the late Devonian and Early Carboniferous (Variscan structural stage), discordantly overlain with Permian rocks (Alpine structural stage) – blue dotted line indicates Variscan-Alpine unconformity (after Filipiak, Racki, 2005)

The records of collision of the continents and subsequent Variscan movements, such as folds (Fig. B10), faults and joints (Fig. B10) as well as calcite veins lead and copper sulphide minerals, can be observed in numerous Geosites of the Geopark (,,Góra Zelejowa – grań'' no G/CHE/006, ,,Góra Miedzianka" no G/CHE/010), (Rubinowski 1971; Migaszewski et al. 1996).

The denudation (erosion, karstification) of the mountainous land built of tectonically deformed Palaeozoic rocks (up to the Lower Carboniferous) finalizing the Variscan tectonic stage and subsequent deposition (on these deformed rocks) of terrestrial or shallow marine sediments that commenced the Alpine structural stage are perfectly recorded at the Geosite no G/PIE/002 "Jaworznia'' and "Kowala – kamieniołom" Geosite no G/SN/006 (Fig.B11) (Kuleta, 1999; Urban, 2007, 2013).

4) Alpine structural stage – history of the Permian-Mesozoic lands and sea basins as well as tectonic movement at the end of the “Dinosaur Era”

At the Permian seashore

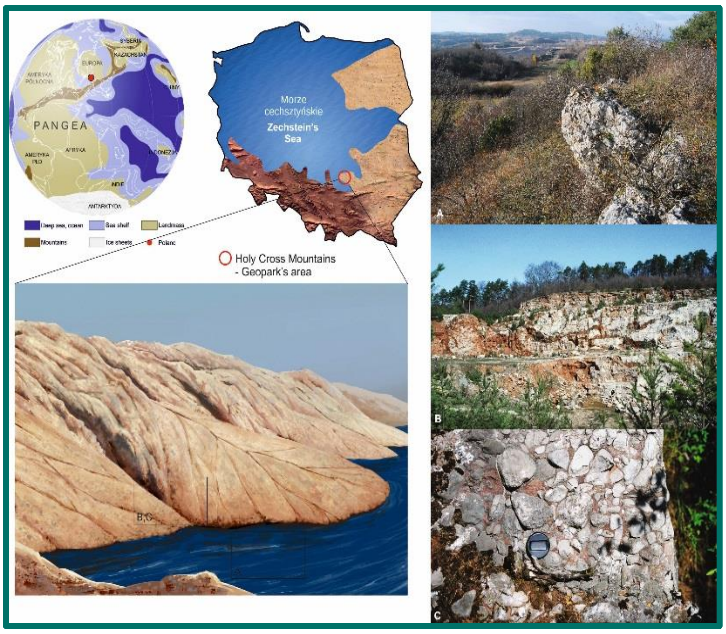


Fig. B12 Paleogeography, reconstruction and geological record of Permian in Geopark area

During the Mesozoic Era the area of the Świętokrzyskie Mountains was situated in the south-eastern segment of the Danish-Polish Through, in which the subsidence predominated and the deposition of thick marine complexes prevailed (Świdrowska et al. 2008). At the beginning of the Late Permian the Variscan mountainous land became seashore of the Zechstein Sea of the German-Polish basin. This seashore was very irregular with numerous gulfs that dissected the land into many mountainous peninsulas (Fig. B12). The landscape of the Permian seashore of the Świętokrzyskie Mountains area resembled in that time the landscape of current Dead Sea region (Migaszewski et al., 1995; Zbroja, 1995; Zbroja et al., 1998; Kuleta, Zbroja, 2006). Such a morphology conditioned natural coexistence of marine and terrestrial depositional systems, which are recorded in geological sequences outcropped in few representative Geosites of the Geopark (Geosites no: G/CHE/015 ,”Zygmuntówka’’; G/PIE/015 “Góra Skałka’’; G/PIE/002 “Jaworznia’’) and composed of breecias, conglomerates, marly limestones and marls (Fig. B12).

At the margins of the Triassic land and within the Triassic marine basin

At the beginning of the Triassic, similarly to the Permian, all continental blocks were combined in one large super-continent of the Pangea. Most water resources was still incorporated into the ice-sheet in the southern part of this continent, which resulted in very low ocean water table, The climate of the Europe area was still hot and arid. These environmental conditions are recorded in numerous sequences of Lower Triassic sediments of the world and also within the Geopark area, which in that time comprised western and north-western marginal zone of large land that partly suffered denudation (Urban 2007, 2013). The deposition of characteristic red (rich in iron oxides) sediments of the Lower Buntsandstein (just commenced) firstly occurred in marine lagoons, swamps and playa basins and then in riverbeds and alluvial plains of braided rivers. Therefore, the lower part of the sequence is formed of series composed of sandstone-siltstone-claystone and even conglomerate interbeddings, while the upper part is represented by red quartzose thick-bedded sandstone series. Sediments of both lower and upper series are characterised by numerous and various depositional structures: wave ripples, horizontal and cross lamination, desiccation fissures and polygons etc. (Fig. B13), as well as vertebrate footprints (Geosite no G/PIE/002 “Jaworznia’’ (Kuleta 1999; Kuleta, Zbroja, 2006; Urban 2013).

Fig. B13 Lower Triassic sandstone with ripplemarks and Middle Triasscic limestone with rich invertebrate fossils

The global marine transgression at the Early and Middle Triassic transition was caused by the thawing of the ice-sheet in the southern

Pangea. The sequence of carbonate and marly-carbonate rocks of so called Muschelkalk is a record of this transgression in the Świętokrzyskie Mountains region (Szulc 2000). The Muschelkalk lithostratigraphic unit in the Geopark area consists of usually thin-bedded limestone-dolomite-marl series that bears fossils of molluscs, crinoids, brachiopods, ammonites as well as marine vertebrates (mainly fish) which is outcropped in southern and north-western parts of the Geopark area (**Geosite no** G/CHE/009 "Kamieniołom w Wolicy") (Trammer, 1975).

In the late Triassic the southern part of the Świętokrzyskie Mountains area was covered by shallow sea, periodically brackish basins alternated with vast and plain lowlands. These different depositional environments are recorded by sandstones, siltstones and claystones with marl, limestone and breccia inserts of fluvial, marsh and marine origin (Geosite no G/CHE/008 ,,Wolica-przekop).

History of the Jurassic "Great Flood"

In warm and humid climate of the Jurassic period the global upraising of water table generated gradual but constant marine transgression. This transgression, were progressing from the Tethys Ocean from the south (Fig. B14), reached the south-western part of the Świętokrzyskie Mountains region in the late Middle Jurassic, therefore the depositional gap (hiatus) within the Geopark area includes the Triassic and Jurassic turn as well as the Early and part of the Middle Jurassic. The Middle Jurassic sequence comprises clayey-siltstone and sandstone series grading upward to marly and carbonate rocks (Świdrowska et al., 2008; Złonkiewicz, 2009). The representative geosites that record the beginning of the Jurassic "Great Flood" are situated in the southern and south-eastern segment of the Geopark area (Geosite no G/CHE/008 "Wolica – przekop'').

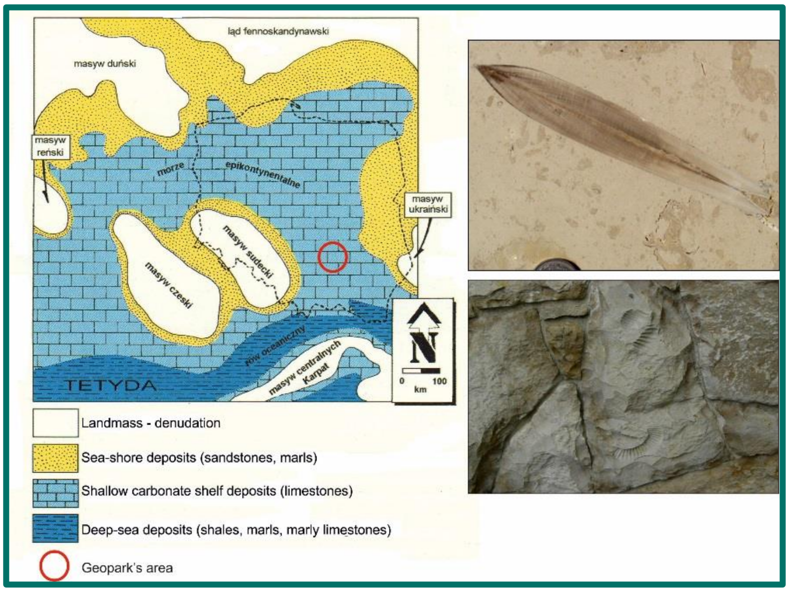


Fig. B14 Paleogeography of Central Europe (including Poland) in Late Jurasscic and geological record of Late Jurassic sea from Geopark area (map afetr Racki et. all, 1999)

The overlying sequence of the Upper Jurassic (Oxfordian, Lower Kimmeridgian) carbonate rocks that ranges a thickness of ca 800 m, is characteristic element of geological structure and morphology of the southern part of the Geopark area (,,Milechowy'' Natural Site). It is composed of light limestones, marly limestones and marls, which are occasionally rich in fossils of invertebrates: ammonites, belemnites, brachiopods, molluscs, sponges and echinoids (Fig. B14), (Złonkiewicz 2009). This series plays significant role in the structural relief of the south-western segment of the Geopark area forming hill ranges in which some short caves and palaeokarst forms occur (Zlonkiewicz 1994, Urban 2010; Urban, Kasza 2010). Upper Jurassic limestones are also stone materials which have been quarried as marbles as well as materials for the construction and road industry (balast, concrete, lime and cement) for several hundred years (Jędrychowski, 2014).

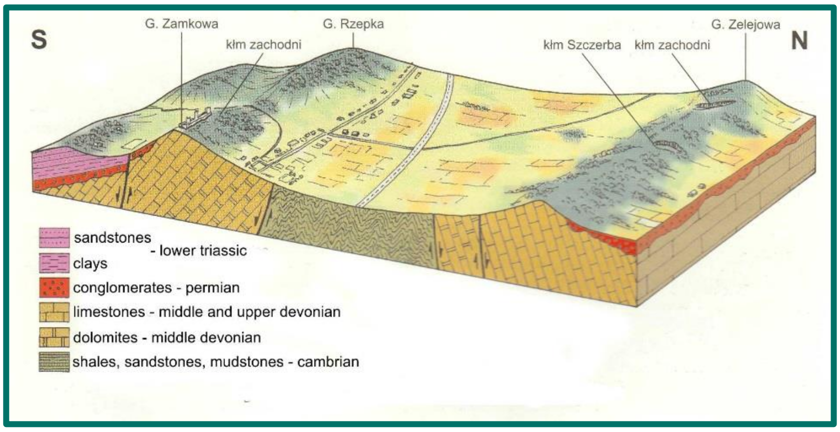
History of the Cretaceous, Great Flood'' and great extinction at the end of the "Dinosaur Era"

The Jurassic decline is a period of the next global marine regression and expansion of lands resulted in hiatuses in geological sequences that are also recorded in the Świętokrzyskie Mountains. The global Late Cretaceous transgression brought about the highest water table in the geological history of the Earth and is usually recorded by thick carbonate depositional sequences. This marine transgression that progressed toward the north-east along the Danish-Polish Trough (Świdrowska et al., 2008), reached the western part of the Świętokrzyskie Mountains (including the Geopark area) in the late Early Cretaceous. This transgression is recorded by relatively thin sandstone series (Geosite no G/CHE/019 ,,Odsłonięcie piaskowców w Bolminie''), which grades upward to the several hundred thick sequence of Upper Cretaceous marl-limestone series that is outcropped practically out of the area of the Geopark (Urban 2010).

5) The Cenozoic period of the geological and geomorphological evolution of the region – emergence of the Świętokrzyskie Mountains, large glaciations and current morphological processes

Since the tectonic movement at the Cretaceous-Palaeogene turn the central part of the Świętokrzyskie Mountains region (including the Geopark area) was a land of hilly or low mountainous relief, which suffered gradual denudation (mostly chemical weathering and karstification as well as fluvial erosion) (Urban, 2010; Urban, Kasza 2010), however Alpine tectonic movements related to the Carpathian orogenesis still affected the area and its morphology, particularly in the Early Miocene (Stupnicka 1972; Jarosiński et al. 2009).

Due to the intensive denudation in a hot and humid climate of the Palaeogene and warm climate of the Neogene thick (ranging several kilometres) cover of the Mesozoic rocks was removed from the present-day outcrop of the Palaeozoic Core of the Świętokrzyskie Mountains (Głazek, 1989). The tectonic processes of the Alpine stage, including uplifting of crust blocks, as well as denudational processes were the principal factors controlling the morphogenesis of the area and producing the Świętokrzyskie Mountains in their present-day sense (relief) (Urban 2014).



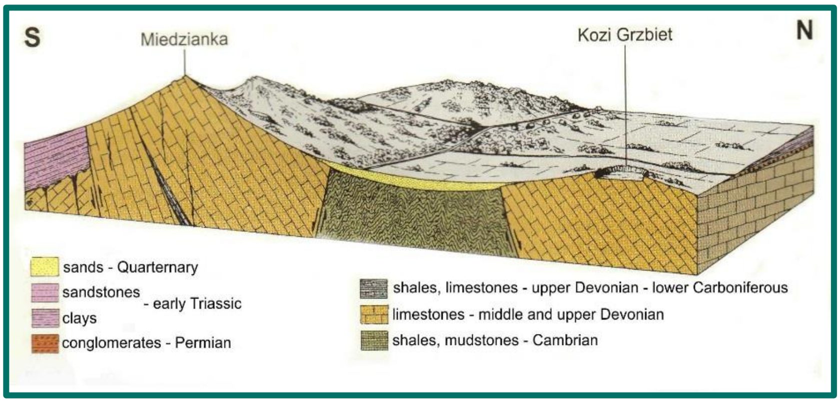


Fig. B15 Structural relief of the Dolina Chęcińska depression (central part of the Geopark) – visible on cross-sections complex geological structure is perfectly reflected in the morphology (draw B. Waksmundzki, source: Góry Świętokrzyskie. 25 najważniejszych odsłonięć geologicznych, Wydział Geologii UW, Warszawa, 2012)

The denudation during the Palaeogene and Neogene instead of the deposition is the principal reason of the lack of typical geological sequences that record a geological history of these periods in the region. Nevertheless, apart from rare gravel-sand-clay sheets of terrestrial sediments devoid of fossils, the Palaeogene-Neogene periods are documented by fills (clays, sands) of karst conduits and dolines developed in Devonian and Jurassic carbonate rocks, such as Chelosiowa Jama-Jaskinia Jaworznicka cave system at the,,Jaworznia'' Geosite no G/PIE/002 (Urban, Rzonca 2009; Urban, 2010, 2013). The selective denudation in hot and then warm climate of the Palaeogene and Neogene produced typical structural relief extremely well expressed in the central part of the Geopark area (Fig. B15), where due the intensive tectonic deformation (folding and faulting) very different lithological types of rocks crop out (Fig. B15), (Urban, 2010, 2014).

Significant global climate cooling at the beginning of the Quaternary (ca 2,6 million years ago) changed the environmental conditions ofmorphogenesis. During last 900 000 years at least eight times ice-sheet expanded the large parts of the northern hemisphere (glacials) and then were melted during the warmer periods of interglacials. Consequently, processes connected with these events played principal role in morphological shaping of Polish territory, including Świętokrzyskie Mountains region. The Świętokrzyskie Mountains and the Geopark area were covered by ice-sheets of South-Polish Glacials (Marks et al. 2016). Sheets of glacial and fluvioglacial clays, silts and sands are the records of these glacials, while other glacial periods are documented by periglacial slope covers as well as fluvial and aeolian sediments (Lindner, Kowalski 1974; Urban 2010). The sequences of karst and cave fills are important records of climate changes, fauna assemblages and prehistoric human (Neandertals) activity (Geosites: "Jaskinia Raj'' no G/CHE/011; "Kozi Grzbiet'' no G/PIE/006 and "Kadzielnia'' no G/KIE/001) (Studies ... 1972; Głazek et al. 1976; Marks et al. 2016). The calcite crystals described for the first time in the Chelosiowa Jama-Jaskinia Jaworznicka cave system ("Kamieniołom w Jaworzni – Chelosiowa Jama" Geosite no G/PIE/002) and then found in many other caves all over the world, have become an important evidence of permafrost and climate fluctuations in the Pleistocene (Žák et al., 2004, 2012).

B.2. LISTING AND DESCRIPTION OF GEOLOGICAL SITES WHITHIN THE PROPOSED GEOPARK

The complete list of geosites is presented in an Annex no 1 to the Application Dossier. Hereafter, the most interesting geosites are presented, in particular, the sites of international and national relevance. The key features responsible for these ranking (relevance) are emphasized in their description. Most of these geosites were evaluated and then selected on the basis of the Polish Database of Representative Geosites which contains the sites proposed to the European List of Geological Sites in a frame of the "Geosites" Project coordinated by IUGS in a cooperation with ProGEO Association (Wimbledon, 1999; Alexandrowicz, 1999, 2006)

NO	CODE	NAME OF GEOSITE	PRINCIPAL STRUCTURAL STAGE	DESCRIPTION
1	G/KIE/001	Kadzielnia	Variscan, Alpinian, Cenozoic stage	Abandoned quarry (partly protected as Nature Reserve) with exposures of the Upper Devonian limestones, marls and shales. Outcrop of typical Devonian bioherm (the largest known in Poland) and facies (fauna assemblages) in its vicinity, useful for interregional paleogeographic analyses. Outcrop of representative profile of Frasnian/Famennian boundary. Site of Cenozoic karst, which can be compared e.g. with paleokarst of Kraków-Częstochowa Upland. Numerous paleokarst forms (26 caves on 2-3 levels) developed mainly in Neogene and Pleistocene, although Permian-Triassic age of sinkholes was also gealousy argued. Karst fills with the Early Pleistocene and Late Pleistocene vertebrates.
2	G/KIE/002	Ślichowice	Variscan	Abandoned quarry with exposure of the Devonian limestones, marls and shales. Ślichowice site is the most illustrative outcrop of fold documenting Variscan tectogenesis in Poland; as an instructive form, the fold is quoted (shown in pictures) in manuals of tectonics and geological guidebooks. Outcrop of representative profile of Frasnian/Famennian boundary.
3	G/KIE/003	Wietrznia - Międzygórz Wschodni	Variscan, Alpinian, Cenozoic	Three abandoned quarries protected as Wietrznia Nature Reserve. One of the best recognized continuous lithostratigraphic sequence ranges from the Middle Devonian (Givetian) to the Upper Devonian (Famennian), in the northern margin of the Polish-Moravian platform with characteristic facies and fossils, used for regional and interregional paleogeographic analyses. Outcrop of representative profile of Frasnian/Famennian boundary. The rocks are abundant with fossils such as corals, brachiopods, goniatites, molluscs, stromatoporoids, crinoids, ostracods, trilobites, foraminifers, conodonts and fish, which have been investigated since the 19th century. These studies resulted in: a) description of new taxa, b) analyses ofanatomy and evolution, c) stratigraphy of the sequence (Givetian-Frasnian boundary), d) reconstruction of the evolution of faunal assemblages and their reaction on theDevonian global events. Numerous outcrops of Post-Variscian, Permian-Triassic and Cenozoic terrestial and paleokarst forms and phenomena unique at the interregional scale.
4	G/KIE/004	Wietrznia - Międzygórz Środkowy		
5	G/KIE/005	Wietrznia - Wietrznia		
6	G/KIE/006	Biesak-Białogon	Early and Late Caledonian	Abandoned quarry protected as Biesak-Białogon Nature Reserve. Unique outcrop of the most probably Caledonian compression – reversed fault formed in the Lower Palaeozoic sedimentary rocks (Cambrian, Ordovician), illustrating scale of tectonic movements in the Małopolska Caledonian massif (Kielce Unit)
7	G/CHE/005	Góra Zelejowa - Kamieniołom zachodni	Variscan, Alpinian	Hill with geological outcrops (including abandoned quarries), karst forms and natural rocky relief. The site with well exposed forms and phenomena representative for geo(morpho)logical evolution of the region: Variscan and post-Variscan hydrothermal forms, Variscan tectogenesis and Cenozoic morphogenesis.
8	G/CHE/006	Góa Zelejowa - Grań		
9	G/CHE/007	Góra Zelejowa -Szpara		
10	G/CHE/009	Kamieniołom w Wolicy	Alpinian	Abandoned quarry protected as ,,Wolica Nature Reserve''. Site representative for the lower part of the Muschelkalk of the Świętokrzyskie (Holy Cross) Mts, located in peripherial part of the Middle Triassic German basin; used in analysis of the peri-Tethys basin development (comparative studies with other regions, especially Upper Silesia and Germany).
11	G/CHE/010	Góra Miedzianka	Variscan, Alpinian	Hills with historical mines and quarries, karst forms and natural crags, partly protected as ,,Góra Miedzianka'' Nature Reserve. Góra Miedzianka is a hill formed of the Frasnian massive limestones, which are strongly disintegrated by faults and contain tectonic scales of the Famennian marls. Calcite veins with sulfide and sulfo-salt minerals of Cu,

				Fe, Zn, Pb and Ni occurring within the limestones, represent original Variscan hydrothermal mineralization. Very irregular ore bodies were mined since the Middle Ages to the first half of the 20th century. It resulted in the occurrence of many kilometers of mine galleries, which partly followed paleokarst conduits (some opened to the surface) and numerous surface remnants of mining. The hill ridge is crowned with the natural limestone crags of high landscape value.
12	G/CHE/011	Jaskinia Raj	Variscan, Cenozoic	Nature reserve “Jaskinia Raj” (since 1968), very well accessible for public (show cave, touristic trails and infrastructures). Raj cave is one of the most important paleontological site of the Late Pleistocene vertebrates and Mousterian Culture (Neanderthals) in Poland that plays significant role in public education of geo(morpho)logy and archaeology; it’s also one of the most beautiful show caves in Poland.
13	G/SN/005	„Kowala” - pomnik przyrody	Variscan	Artificial outcrop (Kowala – pomnik przyrody -,,Kowala – nature monument”) and active quarry (,,Kowala – kamieniołom’’ -“Kowala – quarry”). One of the best outcrop of the Upper Devonian sequence (especially Frasnian biohermal limestones and Frasnian/Famennian boundary) and Devonian-Carboniferous boundary with the sequence of sediments which illustrates evolution and drowning of the northern margin of the Polish-Moravian Middle-Upper Devonian platform, useful for interregional analyses. One of the most important Upper Devonian (Famennian) paleontological sites in central Europe: ,,Kowala Lagerstatte’’
14	G/SN/006	Kowala - kamieniołom	Variscan	
15	G/PIE/002	Jaworznia	Variscan, Alpinian	Hill with abandoned quarry partly protected as “Chelosiowa Jama’’ Nature Reserve. The site is a hill built of the Devonian limestones overlain by the Lower Triassic clastic-clayey series (Buntsandstein). The angular unconformity between the Devonian and Triassic is outcropped in the abandoned quarry. The site represents: 1) sequence of the Devonian shallow marine sediments with emergence remnants; 2) one of the most interesting (in Poland) outcrop of the post-Variscan, Devonian-Triassic unconformity; 2) the most illustrative sequence of karst generations since the Devonian to the Quaternary, useful for interregional studies; 3) one of the longest cave systems in Poland; 4) site of unique cryogenic calcite crystals (CCC) occurrence (such crystals are used for palaeo-climatic interpretations).
16	G/PIE/006	Kozi Grzbiet	Variscan, Cenozoic	Quaternary paleontological site connected with the karst deposits
17	G/PIE/008	Kamieniołom Ostrówka - Todowa Grząba	Variscan	Active quarry and other artificial outcrops. One of the best outcrop of the Upper Devonian- Lower Carboniferous boundary with the sequence of marine sediments which illustrates evolution and drowning of the northern margin of the Polish-Moravian Middle-Upper Devonian platform, useful for interregional analyses; the best exposure of Devonian syndepositional karst in Poland. Important paleontological site of Upper Devonian and Lower Carboniferous fossils.

Fig. B16 Geology in the landscape of Geopark: A – Góra Miedzianka (G/CHE/010); B – Kadzielnia – east wall of the quarry with the view on Zamkowe Hill in Kielce; C – Kadzielnia – central part of the quarry with the Rock of Geologist

B.3. DETAILS ON THE INTEREST OF THESE SITES IN TERMS OF THEIR INTERNATIONAL, NATIONAL, REGIONAL OR LOCAL VALUE

INTEREST: (Str) Stratigraphy, (Sed) Sedimentology, (Gm) Geomorphology, (Pal) Paleontological, (Tec) Tectonic, (Pet) Petrography, (Min) Mining, (Mir) Mineralogy, (Hyd) Hydrogeology and hydrology, (Ar) Archeology

MAIN USE: (C) Scientific, (D) Didactic/educational, (H) Historic-artistic, (S) Sport, (G) Geoturistic, (R) Recreation, (L) Landscape – observation point

VALUE: (1) International, (2) National, (3) Regional, (4) Local

PROTECTION CATEGORY: (N2000) Nature 2000; (R) Nature reserve; (M) Nature monument; (D) Documentary site; (N-L) Nature – Landscape Complex; (L-P) Landscape Park; (P-L) Protected Landscape Area

NO	CODE	GEOSITE NAME	INTEREST	MAIN USE	VALUE	PROTECTION CATEGORY
1	G/KIE/001	Kadzielnia	Str, Pal, Gm	C, D, S, G	(1)	R
2	G/KIE/002	Ślichowice	Tec, Str, Sed	C, D, G	(2)	R
3	G/KIE/003	Wietrznia - Międzygórz Wschodni	Str, Sed, Pal	C, D, G	(1)	R
4	G/KIE/004	Wietrznia - Międzygórz Środkowy	Str, Sed, Pal	C, D, G	(1)	R
5	G/KIE/005	Wietrznia - Wietrznia	Str, Sed, Pal	C, D, G	(1)	R
6	G/KIE/006	Biesak-Białogon	Tec, Str, Sed	C, D	(2)	R
7	G/KIE/007	Góra Hałasa	Pet	R, D	(4)	D
8	G/KIE/008	Góra Słoneczna	Str, Sed,	C, R	(2)	D
9	G/KIE/009	Grabina	Str, Sed, Min	C, D, G, R	(3)	N-L
10	G/KIE/010	Dalnia	Str, Sed	C, G, R	(3)	N-L
11	G/KIE/011	Góra Cmentarna	Str, Sed, Pal	C, D, G	(4)	N-P
12	G/KIE/012	Świnia Góra	Pet	R, G, L	(4)	N-P
13	G/KIE/013	Źródło Biruty	Hyd	R, H, G	(4)	N-P
14	G/KIE/014	Góra Brusznia	Min, Gm	S, H, R	(4)	P-L
15	G/KIE/015	Góra Telegraf	Gm,	S, R, G	(4)	L-P
16	G/KIE/016	Gruchawka	Str, Sed	C, R	(4)	N-P
17	G/KIE/017	Zagórze	Str, Sed	R,L	(4)	N-P
18	G/CHE/001	Góra Zamkowa - wschód	Str, Sed, Gm	R, D,L	(4)	L-P
19	G/CHE/002	Góra Zamkowa - zachód	Str, Sed, Pet	C, D, G,L	(3)	L-P
20	G/CHE/003	Góra Rzepka	Tec, Mir, Pet, Min	C,D,G,L	(2)	R
21	G/CHE/004	Piastowskie piaskowce	Str, Sed, Pet	D	(4)	L-P
22	G/CHE/005	Góra Zelejowa - Kamieniołom zachodni	Gm, Tec, Mir, Min	C, D, G, S, L	(2)	R
23	G/CHE/006	Góa Zelejowa - Grań	Gm, Tec, Mir, Min	C, D, G, S, L	(2)	R
24	G/CHE/007	Góra Zelejowa -Szpara	Gm, Tec, Mir, Min	C, D, G, S, L	(2)	R
25	G/CHE/008	Wolica - przekop	Str, Sed,	C	(2)	N-P
26	G/CHE/009	Kamieniołom w Wolicy	Str, Sed, Pal	C, R	(2)	R
27	G/CHE/010	Góra Miedzianka	Gm, Mir, Tec, Min	C, D, G,L,	(2)	R, N2000
28	G/CHE/011	Jaskinia Raj	Gm, Ar,	C, D, G,	(1)	R

29	G/CHE/012	Jaskinia Piekło	Gm, Min	G, R	(4)	M, L-P, N2000
30	G/CHE/013	Wrzosy - odsłoniecia skalne	Gm, Pet	D	(4)	M
31	G/CHE/014	Urwisko skalne i jaskinia na Czerwonej Górze	Gm,	D	(4)	M
32	G/CHE/015	Kamieniołom Zygmuntówka	Str, Sed, Pet, Min	C, D, G	(2)	L-P
33	G/CHE/016	Jaskinia Piekło Milechowskie	Gm, Pet	C, D, G, R	(3)	R
34	G/CHE/017	Góra Bzowica w Mostach	Gm	C	(4)	L-P
35	G/CHE/018	Kamieniołom Góra Leśna	Str, Tec	C	(3)	L-P
36	G/CHE/019	Odsłonięcie piaskowców w Bolminie	Str, Pet	C	(4)	L-P
37	G/CHE/020	Łysa Góra w Korzecku	Gm, Pet	L	(4)	L-P
38	G/CHE/021	Łom wapieni na Laskowej Górze w Polichnie – Stawkach	Str, Sed, Tec	C	(3)	L-P
39	G/CHE/022	Przełom rzeki Hutki	Gm	R	(4)	L-P
40	G/CHE/023	Sosnówka	Gm, Min	D, R	(4)	L-P
41	G/CHE/024	Grząby Bolminskie	Gm	R,L	(4)	L-P, N2000
42	G/CHE/025	Sowie Górki	Str, Sed, Mir	C, R, L	(3)	L-P
43	G/SN/001	Kamieniołom Szewce,	Min, Pet, Str	C, G, R	(4)	L-P, M, N2000
44	G/SN/002	Góra Żakowa	Min, Gm, Tec	C, R	(2)	R, L-P, N2000
45	G/SN/003	Góra Berberysówka	Min,	D	(4)	P-L
46	G/SN/004	Kamieniołom „Zgórsko"	Str	R,L	(4)	N-P
47	G/SN/005	„Kowala" - pomnik przyrody	Str, Sed, Pal, Mir	C, D, G	(1)	M
48	G/SN/006	Kowala - kamieniołom				N-P
49	G/SN/007	Kamieniołom Bolechowice	Str, Sed, Pal, Min	C, D, G,	(2)	N-P
50	G/SN/008	Ołowianka nad Szewcami	Str, Min	D	(4)	L-P
51	G/SN-KIE/009	Przełom rzeki Bobrzy	Gm	D,R	(4)	L-P, N2000
52	G/SN/010	Wąwóz Jaworzniański	Gm	R	(4)	L-P, N2000
53	G/PIE/001	Moczydło	Min, Tec, Mir	C, D	(2)	R, L-P, N2000
54	G/PIE/002	Jaworznia	Gm, Str, Sed, Pet	C, D, G	(1)	R, L-P, N2000
55	G/CHE-PIE/003	Kamieniołom Stokówka	Min, Gm, Mir	G, S, R, L	(3)	L-P, N2000
56	G/CHE-PIE/004	Stokóweczka	Gm, Mir	R	(4)	L-P, N2000
57	G/PIE/005	Skała w Zajączkowie	Gm	C	(4)	L-P, N2000
58	G/PIE/006	Kozi Grzbiet	Pal, Str	C	(2)	M, P-L
59	G/PIE/007	Zagłębienie krasowe Jaworznia Zagórze	Gm	C	(4)	L-P
60	G/PIE/008	Kamieniołom Ostrówka - Todowa Grząba	Str, Sed, Pal	C, D, G	(1)	N-P
61	G/PIE/009	Góra Rębowa w Wincentowie	Str, Pal	C	(4)	N-P
62	G/PIE/010	Kamieniołom w Piekoszowie	Str	C	(4)	N-P
63	G/PIE/011	Góra Jankowa	Gm, Min	C,R	(4)	L-P, N2000
64	G/PIE/012	Góra Machnowica	Gm, Min, Mir	C,R	(4)	L-P
65	G/PIE/013	Besówka i Besóweczka	Str, Pal	C	(3)	L-P, N2000
66	G/PIE/014	Góra Plebańska	Gm, Str	C	(4)	L-P, N2000

67	G/PIE/015	Góra Skałka	Str, Sed,	C	(3)	N-P
68	G/MOR/001	Wzgórze Kapliczne	Gm	C,L	(4)	P-L
69	G/MOR/002	Kamieniołom w Bilczy	Str	R	(4)	P-L
70	G/MOR/003	Kamieniołom w Brzezinach	Str	R	(4)	P-L
71	G/MOR/004	Kamieniołom w Dębskiej Woli	Str	R	(4)	P-L
72	G/MOR/005	Źródło w Dębskiej Woli	Hyd	R	(4)	P-L
73	G/MOR/006	Góra Gojść	Gm	R,L	(4)	P-L
74	G/MOR/007	Wola Morawicka	Str, Sed	C	(3)	P-L
75	G/MOR/008	Kamieniołom w Łabędziowie	Str	R	(4)	P-L
76	G/MOR/009	Piaskowce w Radomickim Lesie - Diabelski Kamień	Gm	R	(4)	P-L
77	G/MOR/010	Babia Góra	Gm	R	(4)	P-L
78	G/MOR/011	Kamieniołom w Chałupkach	Str	R	(4)	P-L

B.4. LISTING AND DESCRIPTION OF OTHER SITES OF NATURAL, CULTURAL AND INTANGIBLE HERITAGE

The complete list of geosites that present natural biotic features and cultural heritage (including industrial history) is listed in the Appendix no 2 (Natural sites) and Appendix no 3 (Cultural sites) of the Application Dossier. The selected, most important such sites that illustrate the key features of natural-cultural heritage as well as the relationships between these elements and geological heritage are shown hereafter. Most these sites co-exist with the geosites mentioned in the part B.2, which additionally emphasises their values as the sites illustrating interrelations between animate and inanimate nature. This is why in the list of natural biotic sites the geosites with valuable elements of animate nature described in the part B.2. are not described hereafter.

B.4.1. Natural heritage

1) “Milechowy” nature reserve (Nature Site N/CHE/001) – forest nature reserve established in 1978, situated in the western part of the Geopark area. One of the most important site of natural heritage that comprises differentiated forest communities growing on calcareous substrate. Within the reserve the following forest communities occur: mixed broadleaved forest, upland mixed coniferous forest, hornbeam-linden forest, Euro-Siberian steppic woods with oak – the most valuable and most differentiated in floristic terms forest community within the Geopark area (see part A.2.5., point 3). Within the reserve occur also the sites of dry and semi-dry (xerothermic) grasslands and shrubs with numerous species legally protected. Abiotic nature is also very valuable element of the reserve. The reserve area covers hill range of evident structural origin, formed of strong and folded Upper Jurassic limestone-marl complex.

2) “Radomice” nature reserve (Nature Site N/MOR/001) – forest nature reserve of acreage of 27.15 ha, established in 1953 and situated in the eastern part of the Geopark area. It includes valuable forest fragment situated in the picturesque marshy valley located within the Natura 2000 “Dolina Czarnej Nidy’’ area. The reserve is the only natural site of protection of European yew (*Taxus baccata*) – a species rare and vanishing in Polish forests, although it was frequent and permanent component of forests in the past. This species is considered to be the Neogene relict in the European plant communities. Due to hard and springy wood since the prehistoric time it was used to make bow, especially longbows, as well as arrows, wooden parts of rifles and later also tables and other pieces of furniture. A yew tree grows very slowly, therefore in the 15th century Polish king Władysław Jagiełło issued a decree establishing its protection. In folk culture this tree is related to many traditions, religious rites, beliefs and legends. Present-days European yew, as a very rare species is commonly protected in a whole Europe. The Radomice site of this species occurrence is the largest in the whole Małopolska macro-region (covering large part of south Polish area).

3) “Pasmo Zgórskie” proposed nature reserve (Nature Site N/SN/002) – proposed forest nature reserve situated in the northern part of the Geopark area, in the highest segment of the Pasmo Zgórskie (Zgórsko Hill Range) formed of strong sandstones and quartzitic sandstones of Cambrian. Significant hill range height and acid substrate that comprises an area of the occurrence of original hornbeam-oak forests and floristically abundant mixed coniferous forests.

4) Natura 2000 ,,Dolina Bobrzy'' Area (Nature Site N/KIE/059) – special area of conservation located in the northern part of the Geopark along the section of the Bobrza River valley, where Bobrza River meanders among limestone hills of the western segment of the Pasmo Kadzielniańskie (Kadzielnia Hill Range). In this section the river forms picturesque oxbow lakes and other water pools within a floodplain, which is thus convenient place for marshy meadows, riparian forests, and transitional peat-bogs with patches of swampy coniferous forests. The southern slopes of the limestone hills included to this area are occupied by plant communities of dry and semi-dry (xerothermic) grasslands, shrubs as well as hornbeam-oak forest, The water pools of the Bobrza River and old Białogon Lake, situated in the southern part of this area, are among of the most important sites of rare and protected bird species occurrence.
6) Natura 2000 ,,Dolina Czarnej Nidy'' Area (Nature Site N/MOR/003) – special area of conservation located in the eastern part of the Geopark (area of communities: Morawica, Chęciny and Sitkówka-Nowiny). The area covers the section of the Czarna Nida River valley of attractive landscape and interesting nature that include valley floodplain and adjacent areas, also hillslopes. Floristically abundant oxbow lakes, as well as plant communities of marshy shrubs and meadows with some rare species are the most valuable natural elements of this area, however, forest communities, such as riparian forests with patches of hornbeam-oak forests also occur here. The Czarna Nida River valley comprises important wildlife corridor of a national relevance, as well as area of the occurrence of priority habitats and flora and fauna species of European relevance that are listed in the Habitats and Birds Directives (9 priority habitats and 33 bird species).

B.4.2. Cultural and intangible heritage

The largest concentrations of historical objects that constitute a relevance of the cultural landscape are included into the zones of special conservation. Within the area of the Geopark, there are four such zones: Chęciny, Karczówka, Wzgórze Zamkowe (Palace Hill) in Kielce and Białogon. Ethnographic Park in Tokarnia, which exposes the most valuable monuments of rural and small town buildings and economy of the Świętokrzyskie Mountains region, is a special object corresponding with these zones of historical objects' conservation.

1) Chęciny – ruins of the Medieval king castle and historical part of the town (Cultural Sites: C/CHE/001, C/CHE/002, C/CHE/003, C/CHE/004, C/CHE/005, C/CHE/006, C/CHE/007) – key element of the cultural heritage and – with the surrounding area – the symbol of the "Geoland Świętokrzyski'' Geopark. The conservation zone comprises whole urban-landscape (castle and town) system that includes architecture elements built between the 13th and 19th centuries among which the most important are ruins of the medieval castle constructed in the 13th century and partly in the 14th and 15th centuries. This king castle is built of local types of limestones that form the Castle Hill. This castle as well as historical churches and monastery complexes, Central Square with surrounding constructions, synagogue and some other historical buildings in the town are ones of the most attractive touristic elements within the Geopark area. The Chęciny town has long and substantial traditions of lead-silver mining, as well as marble quarrying and processing.

2) "Karczówka" nature reserve and conservation zone (Cultural Site C/KIE/014) – landscape nature reserve since 1953, which covers 26.55 ha of the Karczówka Hill (320 m a.s.l.) that is formed of Upper Devonian limestone and occupied by beech-pine forest. Apart from the nature reserve, the site includes also the zone of conservation of historical post-Bernardine Baroque church-monastery complex built in the 17th century. The Karczówka Hill comprises a unique (in the national scale) site of natural-historical-cultural heritage that perfectly illustrates the relationships between: (a) abiotic elements (outcrops of Devonian limestones bearing calcite and calcite-galena veins), (b) biotic nature (plant communities typical of the calcareous substrate), (c) historical-industrial heritage (numerous remnants of historical ore mining built between Middle Ages and the beginning of the 20th century, which illustrate various and unique for the region mining techniques), (d) historical-cultural and architecture heritage (church-monastery complex with unique Saint Barbara statue sculptured in the 17th century in one block of galena), as well as intangible heritage (legend about a local miner, Hilary Mala, who found and extracted in his mine three large blocks of galena – each were used for statue sculpturing, one of them is just mentioned Saint Barbara statue). The remnants of historical ore mining and Devonian rock outcrops in the Karczówka Hill are accessible by the educational ("geological-ore-mining") trail.

3) Palace Hill in Kielce (Cultural Sites: C/KIE/001, C/KIE/002) – apart from the Chęciny, Tokarnia and Karczówka sites, it is the most important complex of cultural heritage of the Geopark, situated in its northern segment, in the central part of Kielce city. The architectural-landscape complex of the Palace Hill is composed of the following objects: Cathedral Basilica (C/KIE/002) dated back to the 12th century, Palace of Cracow Bishops built in the 17th century (C/KIE/001) and set of constructions owned in the past (and partly nowadays) by the Church. In the past these buildings formed so called

“church town” („urbs Ecclesiae”) that belonged to the Cracow bishops up to the first half of the 18th century and was connected with the “burghers’ town”. The geological structure and consequent structural morphology played significant role in the origin and history of the settlement, because the “church town” was founded at the top of highest hill of ancient Kielce town (280 m a.s.l.) formed of Devonian limestones. The lower, marshy areas formed of Upper Devonian and Lower Carboniferous marls and shales were the places of the “burghers’ town” location.

4) Park Etnograficzny w Tokarni (Cultural Site C/CHE/011) – Ethnographic Park in Tokarnia is an element of the Muzeum Wsi Kieleckiej (Museum of the Kielce Village) founded in 1976, which exposes in an area of ca. 65 ha the most valuable examples of wooden village and small town construction built since the 18th century. Typical settlement complexes from various sub-regions of the Świętokrzyskie Mountains, as well as regions in its vicinity (Kraków-Częstochowa Upland, Sandomierz Upland, Nida Basin) are reconstructed in the Park area. The livestyle, agriculture, craft as well as construction style were very often conditioned by geological structure and relief, which is emphasized in the Park by the distinction of the following sectors: the Świętokrzyskie Mountains region, other upland regions and loess areas. The Park is now the only place in the region where one can get acquainted with the architecture and livestyle of dwellers of villages and small towns in the 18th, 19th and first half of the 20th centuries. Yearly folk ceremonies and other events referring to the local religious, art, culinary and industrial traditions, such as: Bread Day, Agro-touristic Market, Lead Production Day, Summer Reception, Sycamore – at a source of culture, are important aims of the activity of the Park.

5) Podzamcze Chęcińskie (Cultural Site C/CHE/008) – one of the rare remained fortified manor houses from the first half of the 17th century. Restored and accessible for public, Baroque complex is composed of the following elements: Chęciny District Head House, ditch, historical farm buildings, triumph gate, and park. Perfectly outcropped Upper Jurassic massive limestones that served as natural substrate of the main house are the principal element of the geological; heritage of this site. The stones used for the construction of the buildings, which represent various types of local rocks (e.g. “Chęciny marbles”) are also the elements of this heritage. The renovated manor house with new, modern buildings constructed in its vicinity, including Centrum Nauki Leonarda da Vinci (Leonardo da Vinci Scientific Centre), now constitute the Regionalne Centrum Naukowo-Technologiczne (Regional Scientific-Technological Centre), which functions as a scientific-business centre and touristic attraction within the Geopark area.

6) Białogon (Cultural Site C/KIE/015) – present-day industrial quarter of Kielce town (separated settlement in the past), in which historical industrial complex of the Zakłady Białogońskie (Białogon Factory, called also Alexander Metallurgy Factory) and associated with it housing development from the 19th century and wooden church are situated. This site (factory and settlement) is one of the key evidence of industrial traditions of the region, connected with the mining centre developed by Cracow bishops in the 16th-17th centuries and then with the Staropolski Okręg Przemysłowy (Ancient Polish Industrial Centre) existing in the 19th and 20th centuries. Since the beginning of its history Białogon was a place of copper and lead factory where ores extracted in the Kielce and Chęciny areas were processed. The remnants of Alexander metallurgy factory from the first half of the 19th century, in which copper tools and silver coins were produced, is the oldest currently existed industrial construction in this site. In the middle of the 19th century the Białogon factory was one of the largest such companies in the Polish Kingdom.