

# ROCKS OF THE CARPATHIANS AND THE CARPATHIAN FOREDEEP IN THE ARCHITECTURE OF CRACOW

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**Abstract:** In the architecture of Cracow the rocks of the Carpathians and the Carpathian Foredeep have been used for a thousand years. Those from the Carpathians, represented mainly the Istebna and Godula sandstones, have been applied since Pre-Romanesque times till today, initially as a construction material, now in decorations. Granites from the Tatras and andesites from the Pieniny have the tradition of use as decorative materials and road stones from the turn of the 20<sup>th</sup> century. The rock materials of the Carpathian Foredeep include the Pińczów limestone and alabaster. The former, one of the oldest architectural stones, was used mainly in sculptures, often executed with unusual fineness. The latter, representing in the past a stone for sculptures and decorations, currently is not used in architecture.

**Key words:** Cracow, architecture, Carpathian sandstone, andesite, granite, Pińczów limestone, alabaster

## INTRODUCTION

In Cracow, which is situated in the centre of the Polish part of the Carpathian arc and close to its N margin, architectural stones from the nearest vicinity of the town have been utilized since the very beginning of its history. Mostly they represent rocks from the Carpathians and the Carpathian Foredeep. They were applied as building and decoration stones, in sculptures, sepulchral art and pavements. They can be found in town fortifications, civil buildings and churches, as outer and inner facing panels, as cobblestones of Cracow streets and places, in bridges and overpasses, in monuments and tombstones. Along with several stones from the Silesian-Cracow Monocline, namely white Jurassic limestone, black Devonian „marble” from Dębnik, yellowish Triassic diplopora dolostone and hematite-bearing Permian porphyry, all of them imparted a unique, unmimicable beauty to Cracow. Without going out of the town, it is possible to become familiar with numerous, diversified rocks used in the Cracow architecture, i.e. to identify their mineral composition, texture and structure, enclosed fossils or ichnofauna. It is also possible to follow the processes of destruction and degradation of stones under the environmental anthropopression.

## THE ROCKS OF THE CARPATHIANS

The earliest stones of the Cracow architecture included the Outer Carpathian Istebna and Godula sandstones, while the other sandstones were of minor importance. The Pre-Romanesque and Romanesque structures of Wawel, the so-called quadrilateral building (currently under the surface of the arcaded courtyard) and the Rotunda of Virgin Mary (also called the Saints' Felix and Adauctus rotunda) as well as the so-called first cathedral (Boleslaus the Brave's cathedral) and the next, Ladislaus Herman's cathedral, were erected of the two rock types mentioned (Tyrowicz 1977). The walls of the two cathedrals, their columns, bases and capitals were just made of those Carpathian sandstones, carefully worked to shape. Only have the foundation stones of the first cathedral survived but are not exposed today to the public, while St. Leonard's crypt is the best preserved and accessible element of the other.

During Romanesque times, Carpathian sandstones were often used as complementary materials beside the dominant blocks of the Jurassic limestone. The sandstone blocks, made cornerstones, and were also used to construct portals and window frames. The examples can be seen in the outer walls of the churches of St. Andrew, St. Adalbert and Our Saviour, and in the oldest framework parts of the Cracow towers, e.g. on Gródek and of St. Florian's.

For the next time, the Carpathian sandstones were used much later, in the Renaissance. Just of these rocks have been erected two the most beautiful chapels attached to the currently standing Wawel cathedral, the Sigismund and the Vasa chapels, as well as numerous architectonic details cut for other Wawel buildings. In later years, the abutments of the outer stairs of the city Cloths Hall were also made of the Carpathian sandstones.

The same sandstones were used again at the end of the 19<sup>th</sup> century, being more popular in the Cracow region (Małopolska) than they are today (Peszat 1976). Their numerous applications can be seen in burghers' houses (foundations, capital walls, plinths, forethresholds, door frames, cornices), in industrial (bases, plinths) and railway constructions (stations, tunnels, bridges, overbridges, cross-headings), road structures (bridges, culverts), in churches and fortifications. At those times there were 50 large quarries working and providing annually some 20,000 m<sup>3</sup> of blocks (Bolewski 1954). Currently, the Carpathian sandstones do not play the role of the construction material any longer, and are used as decorative materials: cut or broken facing and floor panels

with the diversified surface texture, sometimes curb stones, and sporadically as building pebbles obtained from Carpathian rivers.

### **Istebna sandstones**

The most widely used in architecture are Istebna sandstones (Campanian-Paleocene), particularly those from the lower part of their profile. Within the area of the Carpathians there are almost 300 quarries of these rocks, mostly abandoned. After the years of slump we can see renaissance in the quarrying of the Istebna sandstones.

The Istebna sandstones from the quarries in Dobczyce and Siepraw were used as cornerstones of the towers and frames of the Gothic windows in the apse of the chancel in St. Andrew's church, reconstructed in the 19th century with the sandstone from Targoszyn. Similar sandstones can be found in the walls of St. Adalbert's and Our Saviour's churches, and also in the portal of St. Francis's church and the pillars of St. Katherine's church. The sandstones from Bugaj were used in the pillars of the portal of the Dominican fathers' church, and similar sandstones in the entrance portal leading into the Wawel courtyard as well as in the portals of the city fortification gates. They can also be recognized in numerous wayside shrines throughout Cracow.

In not so distant times the sandstones in question were applied in the plinths of the Polish Academy of Art and Letters building (Sławkowska St) and the portal of the former Municipal Savings Bank (Szpitalna St). When the railway line from Cracow to Lvov was being built, these sandstones were selected as important construction stones, in Cracow being witnessed in the bridge over the Vistula at the end of Starowińska St and the overbridges in Lubicz and Grzegórzecka streets. For the last 200 years, the Istebna sandstones have also been the most often applied stones in sepulchral masonry, exemplified by tombstones of the old part of the Rakowice cemetery. In the last years, part of the new building façade of the Academy of the Fine Arts, the plinths of the „Bagatela” theatre building and the façade of the airport building in Balice were constructed of the Istebna sandstones from Sobolów. After the recent floods, the old Vistula embankments, made of dolostones, have been overbuilt with blocks of the sandstones from Poznachowice.

### **Godula sandstones**

Greenish because of their glauconite content, the Godula sandstones (Cenomanian-

Senonian) have been quarried mainly within the Silesian Beskids, the most intensively those from the middle part of their profile. The Godula sandstones from the vicinity of Wieliczka were used in the churches of St. Andrew, St. Adalbert and Our Saviour. Of the sandstones from Barwałd the church of Dominican fathers in Cracow was erected, however some sources suggest rather the Lgota sandstones and indicate those from the Żarek hill quarry near Kalwaria. The Godula sandstones from Straconka can be found within the J. Słowacki theatre, in the plinths of the old Academy of Agriculture building (Mickiewicza Av.) and the former Sobieski secondary school building. Other places where the Godula sandstones can be seen include the side façades of two Polish Academy of Sciences buildings (Reymonta St) as well as the B-5 building and the stairs leading into the C-3 building of the Academy of Mining and Metallurgy. Besides the facing panels of the driveways into the tunnel under the Grunwaldzkie roundabout and the overbridge in Warszawska St, many streets of Cracow have their curbs made of the Godula sandstones.

### **Other Carpathian sandstones**

Other Carpathian sandstones are rare in the Cracow architecture. For instance, the Ciężkowice sandstone from Bogoniowice near Ciężkowice was used in construction of the Polish Railways headquarters (Matejki Place). Also the Krosno sandstones, although formerly exploited in 125 quarries in the Carpathians, can be sporadically found. Polished facing panels of the ash-grey-blue Krosno sandstone from the Mucharz quarry can be seen in the façade of the Japanese Centre of Art and Technology (Konopnickiej St); they also have been used in the building of the Municipal Waterworks (Senatorska St). The Magura sandstones were in the previous years brought to Cracow to construct some curbs and pavements; they also found use in the outer staircases of the city Cloth Hall.

### **The Pieniny Clippen Belt andesite**

Another Carpathian stone material used in Cracow is represented by andesite (Miocene). Its two generations occur as hypabyssal veins between the vicinities of Czorsztyn and Szczawnica within the Magura Nappe and the Grajcarek Unit. Quarrying began after the World War One from the initiative of professors J. Morozewicz and S. Małkowski, seniors of Polish petrography; currently the andesite is not exploited. It was

used, among others, as a building stone, pavement blocks and curb stones, also as tombstones (some 5% of the stones quarried) and polished facing panels. The latter, exploited in the Wzar hill quarry, were also used in Warsaw in the years 1929-30 in the façade of the Bank of Domestic Economy that was renovated after the World War Two with the andesite from the Under the Beeches quarry (Bober & Kozłowski 1963).

In Cracow the andesite from the Pieniny was used mainly in 1930s as curb stones, exceptionally as paving stones (Kozłowski 1958). Such curb stones have been placed along the streets of St. Anne, Szewska, Bernardyńska, Dunajewskiego, Krowoderska, Sereno Fenn, St. John and others. Only exceptionally has the andesite paving been preserved, among others in Stolarska St and at the front of the Main Railway Station. Polished with pedestrian's shoes, the andesite reveals characteristic porphyritic texture and rather numerous skialites and black xenoliths, composed of large grains of amphiboles and pyroxenes (Kardymowicz 1951).

### **The Tatra granite**

Granite of the crystalline basement of the Tatras (Carboniferous-Permian) has limited applications in the Cracow architecture, and if it does it is mainly in the form of pebbles. The most spectacular is the façade of the famous Ark church in Nowa Huta, faced with the matched in size in colour pebbles from the valleys of the Dunajec and the Poprad rivers. The amount of the pebbles is estimated at about 2 millions stones! Another unusual application of the Tatra granite is represented by sculptures of animals, whose bodies have been made of large, naturally shaped pebbles of this rock. These sculptures, authored by B. Chromy, are situated at the front of the new building of the Academy of Agriculture (Mickiewicza Av.) and in the Detius Park. Equally unique is a 26-tonne fragment of a huge block of the Tatra granite, originating from the moraine in the Biała Woda valley. It has been placed on the Cracow Błonia meadow, commemorating successive pilgrimages of Pope John Paul II to his homeland. Another block of the Tatra granite makes a basis of commemorative plaque of Professor W. Goetel, the late Rector of the Academy of Mining and Metallurgy, placed in the A-0 building of this university. One of the infrequent examples of application of the Tatra granite in the form worked to shape architectural elements can be seen in twin columns in the central projection of the Cloth Hall, opposite Szewska St (Tyrowicz 1977).

## THE ROCKS OF THE CARPATHIAN FOREDEEP

In addition to the rocks from the Carpathian themselves, in the Cracow architecture also some rocks from the Carpathian Foredeep were utilized; these are the Pińczów limestones and gypsum rocks.

### **Pińczów limestone**

The occurrence of this *Lithothamnium* limestone (Lower Badenian) is associated with the NE margin of postorogenic sea, filling in the foreground trough north of the Carpathians. Diversified lithologically sediments of this trough, whose thickness reaches 50 m, extend in the form of a wide arc from the vicinity of Miechów to NE toward Pińczów and Sandomierz, then to E toward Biłgoraj and further toward Lvov and the Podole area (Peryt & Peryt 1994). These limestones contain an admixture of quartz grains and clays as well as the fragments of bryozoans, molluscs, brachiopods, corals, barnacles, crabs, crayfishes, echinoids, crinoids, and others. They are calcarenites or calcilutites of various degree of recrystallization, with the calcitic, contact cement.

This rock was applied in Poland in the 10<sup>th</sup> century and in the Cracow architecture in the 12<sup>th</sup> century (Penkala 1986, Fijałkowska & Fijałkowski 1966). The Pińczów limestones were widely used in the Renaissance, and beside the *stricte* architectonic values also their unusual features of a sculpture stone were appreciated. The oldest, currently working region of their exploitation is situated in the Pińczów.

One of first places, where the Pińczów limestone was used in a masonry, is the large, Gothic window situated between two towers of St. Mary's church, and also the dodecahedral rosette from the portal of the Wawel cathedral. To the same period is dated one of the finest portals in Cracow, with floral ornamentation and dragons hiding among the plants, from the church of Dominican fathers, and also the Gethsemani chapel of St. Barbara's church, a masterpiece of Wit Stwosz's workshop. The most spectacular applications of the Pińczów limestone are represented by Renaissance canopies over the sarcophagi of kings Ladislaus Jagiełło and Casimir the Great in the Wawel cathedral, and also by the carved masks ornamenting the attic of the Cloth Hall building. Another characteristic element of the Cracow landscape can be seen outside the church of Saints Peter and Paul in Grodzka St: these are figures of twelve apostles, curved in the Pińczów limestone. The current statues are replicas of the original ones, dating back to the beginning of the 18<sup>th</sup> century. The original figures, stored by the side

of the church, exemplify the rate of processes damaging the stone structure of the town. Two lions executed also in the Pińczów limestone and guarding the entrance into the Town Hall tower in the Main Market cannot be omitted in the end.

### **Alabaster gypsum**

This forgotten today, beautiful architectural stone, was quarried in Łopuszka (Garlicki 1962), and currently is mined in the Ukrainian part of the Carpathian Foredeep (Acagorcjan 1983). Its applications in Cracow date back to the period before the World War Two, i.e. when this region belonged to Poland, but quarrying of the alabaster there began much earlier, at least in the 16<sup>th</sup> century. The stone was being broken from an almost horizontal bed, with a thickness of up to several tens of metres, in a wide belt of outcrops from the vicinity of Lvov to Chocim, and the most famous quarries were situated in Kołokolin and Żurawno (Nowak 1938). The most popular was a white, rich in veins variety of the alabaster, known as the "*Russian marble*", "*Polish marble*", or "*Lvov marble*". These rocks can be easily cut, take an excellent polish, and give optically „warm” surface. The rock find its use as wall panels and architectural details: railings, cornices, fireplaces, banisters, etc., but, first of all, in sculptures. It cannot be used for outside decorations or, because of its low hardness, floor panels.

As an architectural stone, the alabaster has been applied in Cracow in few places, for instance in the interiors of the old building of the Jagiellonian Library (Mickiewicza Av.), where it makes wall panels of the staircase, cornices, handrails and banisters (Rajchel 2000). The rock is pale yellow with darker veinlets and stains or may be developed as breccia, and originates from the mentioned quarry in Żurawno (Podole). To the beginning of the 17<sup>th</sup> century date back the alabaster statues of Krzysztof and Jerzy Zbaraskis, decorating their family chapel by the church of Dominican fathers, as well as the statue of St. Hyacinthus of the Odrowąż family in the same church. Of the similar age is the bas-relief of St. Mary with the Child in the church of Corpus Christi, executed in the alabaster of Żurawno. The alabasters of the Podole region were also used in 1930s to erect altars in the Carmelite Order church in Rakowicka St.

### **CLOSING REMARKS**

The stones used in the architecture of Cracow for a thousand years were quarried mostly from deposits situated not far from the town. Over hundreds of years they have shaped a unique architectonic image of the former capital of Poland. A significant role

have been played by the described rock materials from the Carpathian Mountains and the Carpathian Foredeep. Unfortunately, incompetence of the present town officials has resulted in an uncontrolled import of foreign stones, indiscriminately used in the strictly historical part of the city, in the places least suitable for such a purpose.

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