Scientific Annals, School of Geology, Aristotle University of Thessaloniki Proceedings of the XIX CBGA Congress, Thessaloniki, Greece	Special volume	421-428	Thessaloniki 2010

THE CURRENT STATE OF CONSERVATION OF ROMANIAN STONE MONUMENTS

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Abstract: The paper deals with aspects concerning the conservation degree of Romanian stone monuments, of different periods affected by natural and anthropogenic causes, with consequences on the historical development of the region. There are discussed main phenomena related to their present state, the stone from monuments restored/preserved, respectively, the recently discovered ones, on which no interventions have been performed. The analysis of these stones was achieved, through a correlation between the destruction and alteration factors, specific to the Romanian region and their casuistics and consequences of the degradation and deterioration phenomena. Also, for their analysis the nature and characteristics of the stone have been considered, along with the procedures of manufacturing, restauration, identifying some anomalies and inadequate interventions, already notorious.

Keywords: indigenous stone, conservation state, old Romanian monument, restoration and preservation

1. Introduction

Since ancient times, stone as construction material was preferred over other natural materials, due to some advantages such as: resistance to exogenous factors, availability, good workability, favoring the development of human communities. In Romania, the main sources of stone were mainly from quarries in the region of the Carpathian and Dobrogea Mountains, specific to orogenic rocks, then from the plateau areas of Moldova, Transylvania, Oltenia, Muntenia, Dobrogea Central and South soft rocks, especially sedimentary (Sandu et al., 2009).

In the paper, a number of monuments from different periods and in different states of conservation, from the entire territory of Romania, have been selected (Fig. 1). Thus, the paper presents a number of phenomena determining their present state, differentiated in some monuments restored/preserved and others on which there are no interventions.

There are also discussed the main factors of deterioration and degradation of these lythotypes, specific to Romanian territory, with their consequences and casuistics. The nature and characteristics of the stone have been analysed, along with the manufacturing technologies and the restoration principles and procedures.

2. The indigenous stone used in monuments

2.1. At the manufacturing of the monument

The rocks used in architectural historical buildings belong to three main categories of hardness (Mihailescu and Grigore, 1981; Sandu et al., 2009): *hard, compact or rocky* (granite, granodiorit, syenite, porphyry, andesite, gabrou, basalt, quartzite, crystalline schists, crystalline limestones and marbles, travertine, sandstones); s*oft, consolidated* (clay, marl, gypsum) and *detritic, non-consolidated* (sand, gravel, ballast).

Hard rocks were generally used as split stone, carved and brut in several constructions mainly underground (foundations, tunnels, cellars, galleries), but also on the ground, especially nearby quarries. During the work, the stone was used both as apparent, highly processed through molding, highlighting its natural features and as stone inside the masonry. Some rocks in this category (marbles and other natural limestones, travertines, sandstone) were used for ornamental elements, cladding and sculptures.

Consolidated *soft rocks* were used primarily to obtain ceramic products (bricks, tiles, tubes for feed pipes and sewage) and plastering. Their manu-

facturing technology involved thermal processes, leading to the improvement of the physical-mechanical properties, so that allowed their use with hard rocks or in wet aggressive systems.

The non-consolidated detritic rocks were used for preparing mortars, concretes, plasters, decorative cast frames, road building and access roads, the pavements and some foundations. They required a

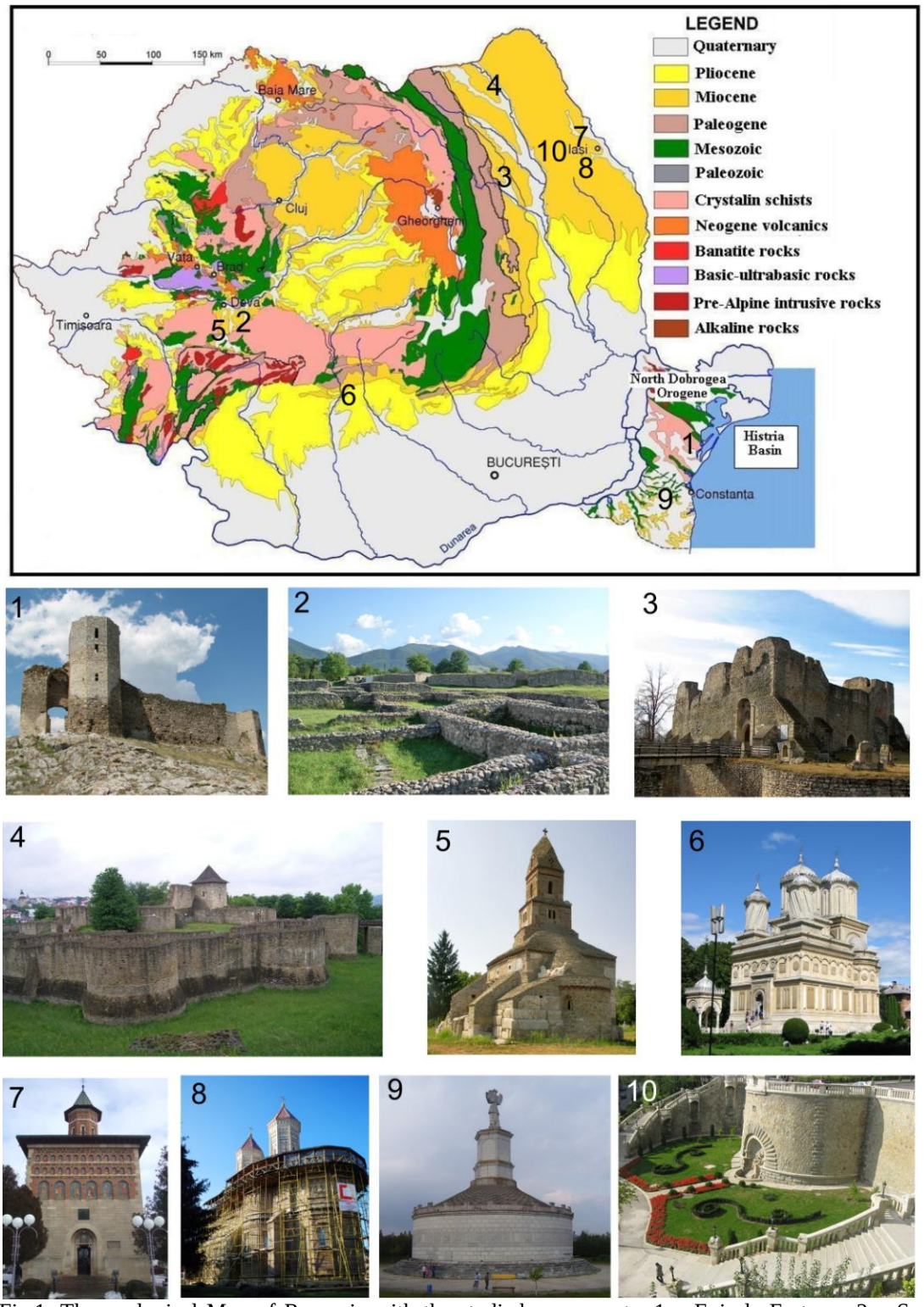

Fig.1. The geological Map of Romania with the studied monuments: 1 – Enisala Fortress, 2 – Sarmisegetuza, 3 – Neamt Fortress, 4 – Suceava Fortress, 5 – Densus Church, 6 – The Cathedral of Curtea de Arges, 7 – St.Nicolas Church Iasi, 8 – The Three Saints Hierarchs Church in Iasi, 9 – Tropaeum Traiani, 10 – Râpa Galbenă (Elisabeta Esplanade) .

specific binder (at the beginning the hydrated lime and later, the cement) which allowed them to become more resistant to environmental factors by monolitization.

2.2. During restoration

In the interventions of restoration of the monuments in Romania two appproaches were adopted: that of architect André Lecomte de Nouy (who restorated monuments such as the Cathedral of Curtea de Arges, Three Hierarchs and St. Nicholas of Iaşi) today considered an inappropriate intervention, the other approach was the one accepted by universally recognized rules today (minimal intervention on the material, opportunity, compatibility, readability, reversibility).

The stone used in restoration in an inappropriate way, without respecting a set of technological rules, has brought great damage to monuments or simply has not survived in the work. According to current principles of restoration, the new stone must be compatible to the original material, in terms of strength, density, color etc. Therefore, the stone chosen to achieve this condition, in terms of geochemical, physical-structural, mechanical but also hydrous characteristics, has to correspond to the original. In general, the restoration simply replaced broken or damaged stones, touching the strength, but also the aesthetics of the monument (Sandu, 2008; Sandu et al., 2006). The most difficult problem that arose in this regard was the exhaustion of old quarries; therefore finding new sources of stone resembling to the old one became difficult, leading to the increase of the costs.

3. Deterioration and degradation of monuments

Generally speaking, stone monuments from the Carpatho-Balkan region were affected, besides the environmental agents (humidity, temperature, air currents, precipitation, air pollution, microbiological organisms etc.) and some risk factors specific to Romania, from the *calamity* or *cataclysms group*, such as: earthquakes, landslides, floods, storms, hail, fire, lightning, explosions, drought and freeze, but also from the *entropic catastrophe* group like those provoked by vandalism, wars or revolutions, accidents, leading to lack of materials, damage, collapse or demolition, cracking, erosion, exfoliation etc. Their deterioration and degradation occur also because of some *endogenous factors*, related to: material, technology implementation and defects. Besides those, the shape and structural complexity of the monument, its age and state of preservation (Sandu, 2008; Sandu et al., 2006) have to be considered.

The stone degradation of the old monuments in Romania was determined by the buildings morphology (sculptures, facades, cornices, balconies, frames of windows) and also the mode of exposure (position towards the cardinal points, towards the weather phenomena, the fundation system influenced by soil or surface/ underground waters). The alteration and destructions are specific to the typology of stone and monument, being influenced by agents or exogenous factors only to a certain extent, their effects depending on the nature, intensity and duration of their action and how to interfere or overlap. All stones and their derivatives, no matter how strongly they were, submitted to continuous alteration and destruction: the first affects their physical state and the second, their chemical nature. The stone type and all the characteristics of its environment determined the specificity, rate and duration of these processes. Some stone materials remained unaffected over the years, while other materials were strongly affected (wood, by rotting, created voids or niches in walls, floors etc., reducing the ensemble strength). Few works of art are homogeneous in terms of component materials (Sandu et al., 2009).

The most important processeses to which old stone monuments were subjected, especially those abandoned, are: stealing, demolition/collapse, fracturing, grinding or splitting/erosion, cracking, fragilization, coming off, desagregation and others. They generated specific effects, commonly seen in some stones, like for sandstone and limestone "powdering weakening" and "separation through plates"; old cracks for marble and gemstones. There are often noticed a series of other processes, like monolitization, fouling of organic products resulting from "aero-foil" processes of the smog and soot or of metabolic products (micetes, algae, lichens, mosses, insects, birds etc.). Grinding by errosion processes have severely weakened the stone. Cumulative effects, such as iridescent, fouling or efflorescence deposits forming the so-called *patina*, continously altered them in an evolutive process. Crystallization of salts caused the surface powdering, cracking and even total disintegration, leading to losses of material through shrinkage, detachments, swelling etc., effect encountered at most part of the monuments. A specific case in Romania is the presence in the oldest monuments of iron ox-

ides in sandstones and crystalline limestone, derived from sedimentary pyrite, which under the influence of microbiological factors moved the iron oxides and gypsum, the early processes leading to alteration by acid-basic disolution, coupled with redox processes. Some damage and degradation were also due to inadequate maintenance and treatment, both during the work and in the preservation/restoration processes or after vandalism.

The degradation of buried stone in the foundations of buildings or archaeological sites, was due to the underground and surface water with high chemical and physical loading, but also to microbiological activity and soil processes (related to the excavation, processing soil subsidence and landslides, earthquakes, crop plants and trees). Generally, the stone used as such, shaped or sculpted, finished by polishing, provoqued micro-destructions, with evolutive decay. The placement of the stone in bulding, sometimes by foreign craftsmen unaware of the environmental aggression or of the inappropriate functions for the structure (for filling or resistance), without taking into account the durability and compatibility led to a number of evolutive processes, some of there errors becaming notorious. Different stones had different behaviors and deterioration-degradation rates, depending on the aggressiveness of the environment and anthropogenic factors. However, one of the most aggressive environmental factors, often met in Romania, remains the humidity. The moisture or humidity content is defined by two terms: humidity in the environment, measured by relative humidity (RH), humidity of a material, measured in percent by weight (moisture content). The two types of humidity can be correlated through the term *hygroscopicity*. This is the *reversible humidity* of a material, which is exchanged with the environment. Because stone is a hydrophilic material, sudden and large variations in environmental conditions (humidity, temperature, rainfall and rising water surface), have generated a series of destructive processes of structural and chemical alteration, coassisted or not by the microbiological heat or radiation, especially light. All types of water that affect majorly the behavior of a stone can generate different alteration and destruction ways. Water acted directly (through hydrogels, cristalohidrates, selective dissolution of minerals, recrystallization) on the stone, but also through the materials found in contact (soil, mortar, plaster, metals, organic materials), when their mobile chemical load has made its mark. The behavior of the stones according to the alteration is directly related to the phenomena of hydrous transfer (Sandu, 2008; Sandu et al., 2009).

The use of stone in the architectural buildings reports another phenomenon with serious consequences for the conservation of historical monuments: the "removal" of the stone from archaeological sites or abandoned buildings and their use in a new work (e.g. Church of Densus stone raised in 1280 with stones taken from the Dacian fortress Sarmisegetuza but also from different camps or Roman tombstones). The positive part of this example is that although several elements have been preserved (we refer here to the tombstones, altars, capitels), probably in other circumstances, they would have been destroyed. The phenomenon is similar to transhumance of objects or monuments in other areas of museum sites. It is known that after a transfer, the monument loses a number of elements and economic functions. So in our case, somewhere similar to the great museums of the world, who gathered artifacts from other places, it was allowed a better preservation of them, but with diminished patrimonial value (Sandu et al., 2009).

4. Conservation state of representative monuments

4.1. Non-restored or partially restored monuments

Many old monuments recently discovered or those keeping few original elements (only the foundations and partially the walls) have not yet been studied, either because of the lack of financial resources or because of scientific and historical reasons. The best case for some of them, was after 1860, when archaeological excavations were performed. Some of them were abbandoned, in an unnatural way because of the lack of protection systems, others have been robbed, for new buildings. After The Second World War, with the introduction of modern laws concerning the protection of cultural heritage and archaeological values, a number of inventories and preventive measures have been taken. Among these, it is worth mentioning: the ruins of medieval fortress Enisala of Dobrogea, Sarmisegetuza of Transylvania, the fortresses of Neamț and Suceava in Moldova.

Enisala medieval fortress is located at 2 km from the Enisala town on a limestone hill dominating the Babadag and Razelm lakes area (Mănucu-Adameşteanu, 1980). The history of the city and the nearby settlement is illustrated also by the

names they used to have: Vicus Novus, translated to New Village, and the Slavic name Novoe Selo, which the Turks changed into Yeni - Sale. The fortress is situated in an archaeological complex with numerous archaeological remains coming from the Neolithic to the Middle Ages. The archaeological excavations have been begun in 1939 and continued with minor interruptions, during 1970-1998. Medieval period corresponds to two levels of living. First, prior to fortification building, was dated on archaeological material from the late XIIIth – XIVth century. The second level corresponds to the period raising the walls. The fortress was built for military purposes, defense and surveillance of roads on water and on land, in the second half of XIVth century. Based on construction techniques, archaeological material and historical realities has been hypothesized that only interested in raising a fortress in the system of fortifications in northern Dobrogea, directed towards the sea for naval traffic control, were Genovese merchants who were holders of the monopoly of navigation on the Black Sea. Between 1397-1418, during the reign of Mircea the Old, the city was part of the defensive system of the Romanian Country, and after the conquest by the Ottomans in 1419/1420 there was installed a Turk military garrison. The city was abandoned after Turkish domination advancing beyond the mouths of the Danube (1484). The Fortress has a polygonal irregular plan (Fig. 1.1), following the sinous relief of the Jurassic massive on which lies and from which career has been excavated the needed construction material. Enclosure walls, towers and bastions, partially preserved and restored, are conserved on a height of 5 to 10 m. A particular architectural element is the main gate bastion, of oriental origin, with double arch frequent in the Middle Ages and used by Byzantine builders to various buildings in the Balkans but also in Romania. Since the city is abandoned for a long time, many elements of the building structure are lacking, many were stolen, others were totally degraded and lost. A series of photographs of archaeological discharge, partial structural ordering and reintegration, were made and reflect the overall integrity of the monument to be included in the museums circuits.

Sarmisegetuza was the most important Dacian military, religious and political center. Build on the top of a 1.200 m high mountain, the fortress was the core of the strategic defensive system in the Orastie Mountains, comprising six citadels, of which the most important is Sarmisegetusa Director and Ulpia Traiana Sarmisegetusa (Daicoviciu, 1984; Glodariu, 1988). Sarmisegetuza Director is the name of the capital of pre-Roman Dacia, from which the most remarkable is Big Rounded Sanctuary and The Andesito Sun. Most of the archeologists assert that the city was raised in between the 3rd and the 2nd century BC, while others sustain that it would be at least 600 years older. One of the reasons of this dispute could be the striking resemblance of the Big Rounded Sanctuary with those of Stonehenge. It seems that the same architect has conceived them both, the only difference being that the one from Orastie is smaller. At about 40 km away from Oraştie Mountains, in the county of Sarmisegetuza, in the South-West of the Hateg Depression, there are the ruins of the other fortress bearing the same name, capital of Roman Dacia, also called Ulpia Traiana Sarmisegetuza, founded by the governor Terentius Scaurianus between 108–110. For two centuries, it represented the political and administrative center of the province of Dacia. The sieges of the governor, of the administration, of the financial system, of the military, economic and religious centers were situated inside the fortress. During the rule of Emperor Hadrian (117-138), Sarmisegetuza was called Colonia Ulpia Traiana Sarmisegetuza, and then during the period 222-235, to its name was added the epithet of metropolis.

In these, stones from geological formations developed in Hateg Depression were used, mainly of Cretaceous age sedimentation, but also crystalline limestones and marbles, coming from the nearby areas, were used. To all these, andesite slabs used mostly in sanctuaries, but also to some pavements for access roads, are added. The last years operations were focused onto archaeological dowload, coherent ordering and reintegration of stone blocks in their original building shape, with remaking of pavements and acccess routes, allowing a better highlighting of the structure and monuments disposal within the complex (Fig. 1.2).

Neamț Fortress was rumored to have been built, in the XIIIth century, by the Teutonic Knights, against Tatar incursions. In 1476, after defeating the Moldavian armies in the Battle of Valea Albă, the Ottoman Empire Sultan Mehmet IInd forced Steven the Great to retreat here (Fig. 1.3). The place was battlefield between Turkeys and Moldovians, the garrison being almost totally destroyed (Giurescu, 1976; Iijima and Dumbrava, 2005).

The building material for the walls, but also for

some annexes is represented by blocks of limestone, shale and especially so-called type Kliwa sandstone, the Cretaceous and Oligocene. All these materials came from nearby quarries, opened in deposits of the Carpathian Flysch.

In 1866, the fortress was declared a historical monument. Reinforcement of the wall works, made between 1968-1972, led by renowned architect Stefan Bals, aimed at the preservation and maintenance of the monument as it is, without reconstruction of missing parts. In the absence of certain information, some terraces were performed just useful to visiting in good condition. In the past years some walls have been raised, especially the inside ones, the shape of cavity. The stone used in the restoration process was purchased from the same sources with the original one.

Suceava Fortress (Fig. 1.4) was built by the prince Petru I Muşat, by the end of the XIVth century, with thick walls and semicircular bastions. The plan of the stone fortress is square-shaped (Iijima and Dumbrava, 2005). Excavations uncovered ceramic plates and disks used for interior and exterior decoration, for secular and religious aims. Following the destructions caused by Turkish and Polish incursions, Stephen the Great fitted the fortress with an inner courtyard with semicircular bastions and a new stone ditch, adapting the old fortresses to the new military technique program. It is essential to remind that the first excavations were carried out by the end of the XXth century by C.A. Romstorfer (Giurescu, 1976; Daicoviciu, 1984; Glodariu, 1988).

The fortress was built with stone, extracted from local quarries, near the town, such as sandstone and limestone whose geological age is placed in the Sarmatian age. Inside the walls, there are also blocks of sandstone and limestone coming from the mountain area of Carpathian Flysch.

The fortress was restored especially in the outer walls, which were largely reunited, using stone coming from the same sources with the original stone.

4.2. Restored Monuments

Regarding the interventions of restoration of some stone monuments in Romania, we encounter three totally different situations: very old monuments built of stone coming from other monuments, monuments restored according to the old principles, through total demolition and reconstruction following the initial plans – André Lecomte de Nuoy and restored monuments according to the modern principles, accepted worldwide.

4.2.1. Old monuments built of stone coming from other monuments

Typical example for Romania is the ***Church of Densus*** (Fig. 1.5), where it is considered that on the setting of the present day church, there was once a Dacian temple dedicated to Zamolxis, upon which the conquering Romans built a temple dedicated to the god Mars. After the Roman administrative withdrawal, the temple became in the IVth century AD, a Paleo-Christian church. Its present form dates from the beginning of the XIIth century and is considered the oldest church in Romania and South East Europe.

Observations on the building material show that it comes from stones taken from Dacian fortress of Sarmisegetuza but also from various Roman camp or tombstones. These stones were used fully or partially shaped by carrying out an original architectural system, which kept intact the old stone ornamentation.

4.2.2. Monuments restored after now outda-ted principles

The Cathedral of Curtea de Argeş (early XVIth century) is one of the most famous churches in Romania (Fig. 1.6), restored by an old principle of André Lecomte de Nuoy. It resembles a very large and elaborate mausoleum, built in Byzantine style, with Moorish arabesques (Dragut, 2000).

Building material consists of native stone, brought from the nearby quarries. The sleek and shaped stone facade and also the foundation blocks, are made of numulitic limestones, which come from the Albesti quarries near Campulung Muscel, are of Eocene age and following diagenesis processes have taken appropriate structure and texture to be processed and even carved. Inside the church there also marble columns (e.g.: crystalline limestones) probably from Greece.

It is known that the founder was Prince Neagoe Basarab (1512-1521), Prince Ioan Radu completed the work in 1526. Along the years, the cathedral was submitted to several restoration works: Prince Şerban Cantacuzino in 1681, Joseph, the first bishop, in 1804. The present form was given both by the French architect André Lecomte du Nouy and the Romanian architect Nicolae Gabrilescu, whose restoration works were completed in 1885

and in 1886 it was reconsecrated. The cathedral is faced with pale grey limestone, easily chiselled but hardening on exposure. The interior is of brick, plastered and decorated with frescoes.

St. Nicholas Church of Iaşi, built between 1491-1492 by Stefan cel Mare and rebuilt in the late XIXth century (between 1890 - 1904) by French architect André Lecomte du Nouy, is the oldest religious edifice in Iasi which has been preserved until today (Fig. 1.7).

The exterior architecture gathers in the most harmonious way, the stone, brick and tiles, disposed in polychrome enamel discs. The initial building material was used only partially in the restoration, since the church have been entirely demolished, the wall stone being largely replaced by brick. The inside of the church belongs, entirely to the last restoration.

The Three Saints Hierarchs Church in Iasi was built between 1637-1639 by Vasile Lupu (Fig. 1.8). The church became renowned for the extraordinary lacery in stone which adorns the facades, from bottom to the top of the derricks. One can count over 30 non-repeating registers of decorative motives. Western architectural elements (Gothic, Renaissance) are combined with the Eastern style, of Armenian, Georgian, Persian, Arabian or Ottoman inspiration, in a totally bold conception, whose result is a harmonious ensemble. The effusive scenery makes the church resemble a shrine of architectonic proportions, especially conceived to protect the Saint Parascheva's relics (1641). After the 1882 restoration, the original fresco was detached, some fragments still being kept today in the monastery's museum.

Although in the restoration process led by Lecomte du Nouy in a fashion of the time, the church was demolished and part of its annex buildings (which were removed) and the most of the church's original materials from its structure, were reused at the rebuilding of the edifice involving other materials.

Native stone quarry near Iasi is found in the thick walls, but exterior plaques, blocks from the wall base and ornaments are numulitic limestone. These limestones come from the same quarries from Albesti near Campulung Muscel, where limestone for Curtea de Arges was extracted. The sculptured stone plaques are mainly new, there were kept just a few old stone cladding, but they are carved on the rear face. It is known that many elements, as the huge horologe in the gate's tower were taken to Paris after restauration in 1882.

4.2.3. Monuments restored after modern principles

Tropaeum Traiani Adamclisi (Fig. 1.9) is a monument built in 109 inside Roman Civitas Tropaensium, in Inferior Moesia (Dobrogea), to commemorate Roman Emperor Traian's victory over the Dacians, from 102, in the Battle of Tapae. Before Traian's construction, an altar existed there, and its walls were inscribed the names of 3,000 legionaries and auxiliaries (servicemen) who had died in 92. Traian's monument was inspired by the Augustus mausoleum, and was dedicated to the god Mars Ultor in 107/108 AD. On the monument there were 54 metopes depicting Roman legions fighting against enemies; most of these being preserved in the museum nearby.

The original monument disintegrated a long time ago. The present edifice is a reconstruction dating from 1977 entirely made of different stone from initial one (neosoic age calcars).

The nearby museum contains many archaeological objects, including parts of the original Roman monument. From the original 54 metopes, 48 are in the museum and 1 is in Istanbul.

Rapa Galbena or **Elisabeta - Esplanade** from Iaşi (Fig. 1.10) has been included on the list of historical monuments since 2004 and restored in 2007. The construction was completed in1906. The area is affected by many springs keeping the humidity in the monument, needing periodical restorations. The main part in the degradation of stone of this monument was played by the air pollution (exhaust), ground waters (chemical charge, especially nitrates) and abusive use of sodium chloride during the winter, which led to massive erosion. A first technical solution adopted in 1906 for the collection of the springs was a special sewage discharge into Bahlui river.

Stone is the main element used in construction. It came from multiple sources, from the beginning. Some came from the quarries that valued the sarmatian deposits from Moldavia, and other, especially older blocks, came from the quarries of the Carpathians Flysch. At the last restoration in 2007, were preferred rocks coming from Tg.Ocna (siliceous sandstone, yellowish, with a high amount of iron oxides, which gives a reddish color). Deposits from which this sandstone (called Kliwa sandstone) comes from, have an Oligocen age.

5. Conclusions

This paper focused on a number of Romanian old monuments, from different periods, describing

their state of conservation due to natural and anthropogenic causes, as consequences of the specific social-historical development in the area. Thus, the study shows the main phenomena related to their present state, differentiated in monuments restored/preserved and the ones less known, on which the preservation-restoration has not been performed. There are presented the stone types and procedures used in restauration during time, identifying some anomalies and inadequate interventions, which have become of notoriety.

Acknowledgments

This work was supported at "Al.I.Cuza" University of Iasi by projects CNMP PN II 31-059/2007 and CNCSIS IDEI cod 423.

References

Daicoviciu H., 1984. Colonia Ulpia Traiana Augusta Dacica Sarmizegetusa, Ed. Sport-Turism, Bucureşti, 198 p.

Drăguț V., 2000. Encyclopedic Dictionary of Romanian Medieval Art (Dicționar enciclopedic de artă medievală românească), Ed. Meridiane, Bucureşti, 166-169.

Giurescu C.C., Giurescu D.C., !976. Romanians History (Istoria Românilor), vol. II, (1352-1606), Ed. Ştintifică si Enciclopedică Bucuresti, 154-192 pp.

Glodariu I., 1988. Dacs Fortresses and Settlements in the Orastiei Mountains (Cetăți și așezări dacice în munții Orăștiei), Ed. Sport-Turism, Bucureşti, 159 p.

Iijima B., Dumbrava V., 2005. Stefan der Große – Fürst der Moldau. Symbolfunktion und Bedeutungswandel eines mittelalterlichen Herrschers. Leipziger Universitätsverlag, Leipzig, 203 p.

Mănucu-Adameşteanu Gh., 1980. Medieval Necropola of Enisala, Preliminary Report (Necropola medievală de la Enisala. Raport preliminar), Peuce, VIII, Tulcea, 473-496.

Mihailescu N.St., Grigore I., 1981. Mineral Resources for construction materials in Romania (Resurse minerale pentru materiale de constructii in Romania), Ed.Tehnica, Bucuresti, 380 p.

Sandu I., Brânzilă M., Sandu I.G., 2009. Scientific Conservation of the Stone Monuments (Conservarea stiintifica a monumentelor de piatra)**,** "Al.I.Cuza" University Press, Iaşi, 314 p.

Sandu I., 2008. Degradation and Deterioration of the Cultural Heritage (Deteriorare si Degradarea Bunurilor de Patrimoniu Cultural), Vol. I and II, "Al.I.Cuza" University Press, Iaşi, 462 and 538 p.

Sandu I.G, Sandu I., Dima A., 2006. Modern Aspects Concerning the Conservation of Cultural Heritage (Aspecte moderne privind conservarea stiintifica a patrimoniului cultural), vol.III.Ed. Performantica, Iaşi, 502 p.