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# MINERALOGICAL INVESTIGATION OF THE OLD EPISCOPAL BASILICA IN ARCHEOLOGICAL LOCALITY OF STOBI

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A b s t r a c t: In these paper are presented the mineralogical characteristics of the mosaics that decorate the central nave of the Episcopal Basilica in the ancient city of Stobi. Investigation was carried by XRD-Shimadzu 6100. Based on the obtained results was concluded that it was built with samples of calcite marble, dolomite marble, sandstone, aleurolite and serpentinite. With these researches it is confirmed that the used in moulding decoration in the Old Episcopal Basilica in Stobi takes origin from Macedonia.

**Key words**: episcopal basilica; calcite; marble; serpentinite

## INTRODUCTION

Stobi, one of the most researched locality in Republic of Macedonia, is in the middle of the Vardar region between the river of Crna Reka (Erigon) and the Vardar river (Agious) and it is assumed that it takes area about 20 hectares. According to the oldest historical information met in the records of Roman historian Titus Livius, Stobi originates from Hellenistic period, 197 B.C. (Wiseman, 1971, 1973, 1978). According to archeological data from the researches, this city settlement is raised 3–2 century BC although many ceramic findings show on a much early period (7–5 century B.C.) (Mikulčić, 2003; Project elaborat, 2004). Because of its perfect position on the road "Via Ignacia" that leads from Danube to the Aegean, this city settlement represented significant strategic, military, economical and cultural centre (Aleksova, 1997; Boškov G. (ed.), 2007). Old Episcopal Basilica was the first church that was built in the ancient city of Stobi (Radošević, 1973).

In the researched part of Stobi, many architectonic objects are found and studied till now and they represent profane and sacral constructions with public function, ancient theater, palaces, baths, streets, forum parts of city palisade, main entrance of the city and the casino where the artifact that we are talking about is found (Boev et al., 2008). The church was built literally in the shadow of the ancient theater, which at that time, in the first half of the fourth century, was still active and served to perform various the atrical performances. It is the period when in the Roman Empire all religions were equal and in Stobi at the same time worked pagan temples, theater, Jewish synagogue and the oldest Christian church.

Christianity was declared equal to others in the year 313 A.D., with the publication of the Edict of Milan by the Roman emperors Constantine I and Licinius. Then immediately they began to form episcopal centers throughout the Roman Empire and build the temples of the new religion. Stobi, in the first quarter of the century, was founded bishopric which was led by Bishop Budij – one of the participants of the First church council held in Nicaea in 325 A.D. Probably even then was built the Old Episcopal Basilica in which Bishop Budij mess. After the construction of this church in Stobi began the era of mass baptism and the acceptance of the Christian religion (Virginia R. Anderson-Stojanović, 1992). The old church, already in the second half of the fourth century was remodeling and extended to the east in order to be able to accommodate more pilgrims. The interior of the old episcopal church was lavishly decorated with floor mosaics and wall paintings that visually and symbolically transferred to biblical messages to the believers (Anderson-Stojanović, V. R. 1992; Errington, R. M. A., 1994). In the first decades of the

fifth century, the Old Episcopal Basilica was completely degraded, and then demolished, in order in the same place to build a monumental church that would mark the triumph of Christianity in the ancient town of Stobi. Thus, the small church built behind the grandiose theater has played a key role in the turbulent period of the formation and establishment of the Christian religion.

## ANALYTICAL METHODS

A great number of samples were collected from three phases for research. Based on macroscopic examination ten different samples were separated from the first phase, one sample from the second phase and six samples from the third phase. The investigation was carried out with X-ray method (XRD). It is known as the best method for the identification and quantification of minerals. X-ray researches were made on the diffractometer Schimadzu 6100. Was used CuKα = 1.54178 A, the voltage of the generator 40 kV, and the current was 30 mA, $2\theta = 2^{o}$/min. The most intense registered maxima in the studied powder diagrams were compared with the corresponding maxima in the diagrams from JCPDS cards.

## RESULTS AND DISCUSSION

The mosaics that decorate the central nave of the church were carried out in three successive stages made of different ateliers for mosaic. Tesserae analyses come from the mosaics of all three phases. On the pictures are shown fragments of mosaic that tesserae removed for analyses and they are named according to the phases of the mosaic.

### *First phase*

The decoration of the first phase was designed as a grid of rectangular fields filled with geometric motifs. Among them, at the entrance to the nave of the church are also mosaic inscriptions with “Christological” messages (Figures 1–3). The first mosaic field is filled abbreviation IHTIS, which translated from Greek means fish, but actually it is an acronym meaning "Jesus Christ, God's Son, Savior". In the next field is written another message which states: "With prayer, charity, fasting and repentance from a pure heart, save from the death".

**Fig. 1.** First phase


**Fig. 2.** First phase

**Fig. 3.** First phase

X-ray diagrams of the samples from the first phase are given in Figures 4–14.

The most intense registered maxima in the studied powder diagram (Figure 4) was compared with the corresponding maxima in the diagram of calcite sample JCPDS cards 047 1743 and 00 003 0596. The comparison has shown that the X-ray

powder patterns of the natural calcite taken from the JCPDS card are practically identical with the studied diagram.

Figure 5 shows the X-ray diagram of the sample 2. This diagram was compared with the JCPDS standard cards of antigorite JCPDS 00 006 0056, olivine JCPDS 01 070 2503 and magnetite JCPDS 00 002 1035. Based on the mineralogical and petrological characteristics, the sample is determined as serpenitnite.

X-ray diagram of the sample 3 is given in Figure 6. This diagram was compared with the diagram of calcite JCPDS 00 003 0596 and 00 047 1743.

Obtained X-ray diagram on Figure 7 was compared with the diagram of calcite JCPDS 00 003 0596. The comparison shows that they are practically identical.

X-ray diagram of the sample 5 given in Figure 8 was compared with the diagram of calcite JCPDS 00 003 0596.

Figure 9 shows the X-ray diagram of the sample 6. This powder diagram was compared with the diagram of calcite JCPDS 00 004 0637. The comparison shows that they are practically identical.

Obtained X-ray diagram on Figure 10 was compared with the diagrams of calcite JCPDS 00 005 0586 and quartz JCPDS 00 001 0649.

X-ray diagram from Figure 11 was compared with the corresponding maxima in the diagrams of calcite JCPDS 00 005 0586 and quartz JCPDS 00 046 1045. The comparison has shown that the X-ray powder patterns of the natural calcite and quartz taken from the JCPDS cards are practically identical with the studied diagram. Based on the mineralogical composition, structural and textural characteristics, the sample is determined as sandstone.

Figure 12 shows the X-ray diagram of the sample 9. This diagram was compared with the corresponding maxima in the diagrams of quartz JCPDS 00 033 1161, calcite JCPDS 00 001 0837 and plagioclase JCPDS 01 083 1370.

X-ray diagram of the sample 10 is given in Figure 13. This diagram was compared with the diagrams of quartz JCPDS 00 046 1045 and kaolinite JCPDS 00 001 0257.

The comparison has shown that the X-ray powder patterns taken from the JCPDS cards are practically identical with the studied diagram. Based on the mineralogical composition, structural and textural characteristics, the sample is determined as aleurolite.

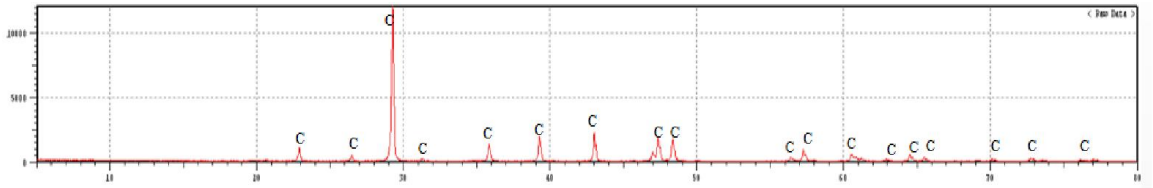

**Fig. 4.** X-ray diagram of sample 1 (first phase, C – calcite)

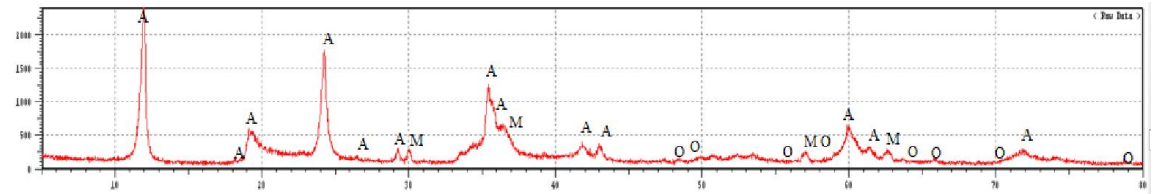

**Fig. 5.** X-ray diagram of sample 2 (first phase, A – antigorite, O – olivine, M – magnetite)

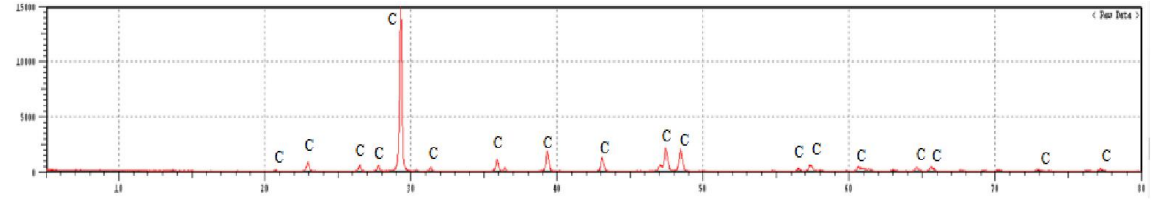

**Fig. 6.** X-ray diagram of sample 3 (first phase, C – calcite)

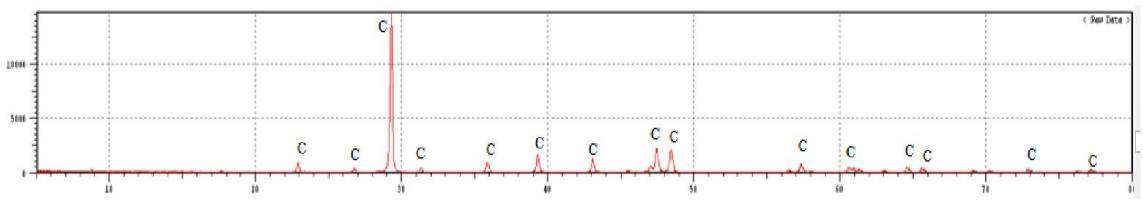

**Fig. 7.** X-ray diagram of sample 4 (first phase, C – calcite)

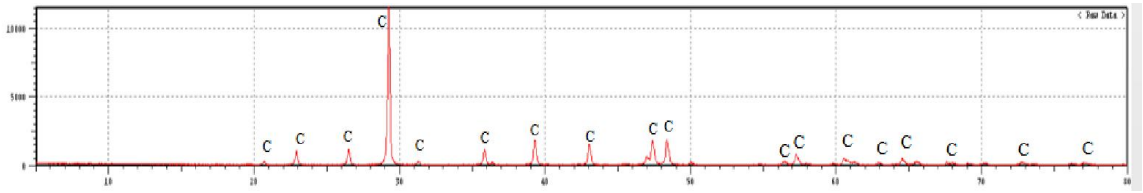

**Fig. 8.** X-ray diagram of sample 5 (first phase, C – calcite)

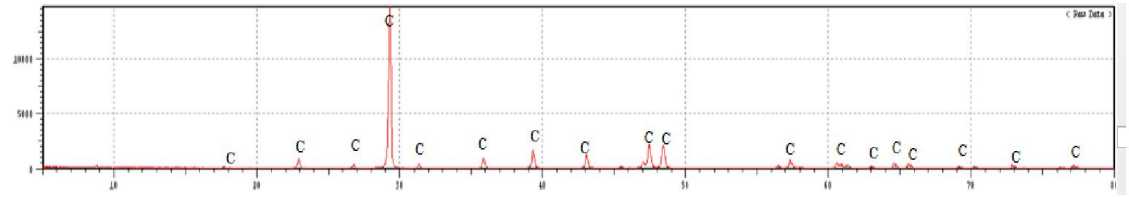

**Fig. 9.** X-ray diagram of sample 6 (first phase, C – calcite)

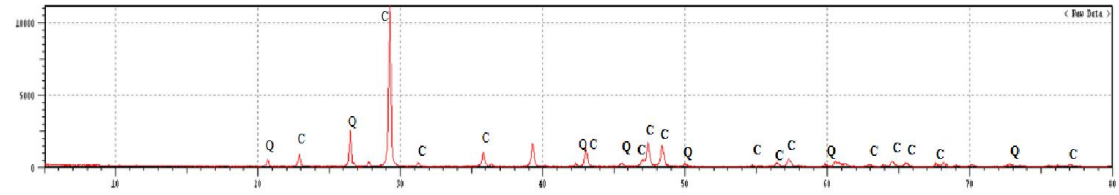

**Fig. 10.** X-ray diagram of sample 7 (first phase, Q – quartz, C – calcite)

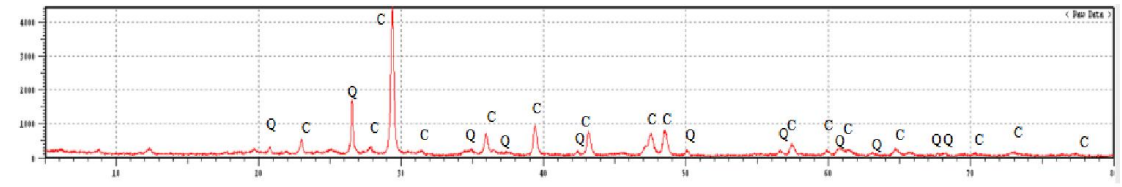

**Fig. 11.** X-ray diagram of sample 8 (first phase, Q – quartz, C – calcite)

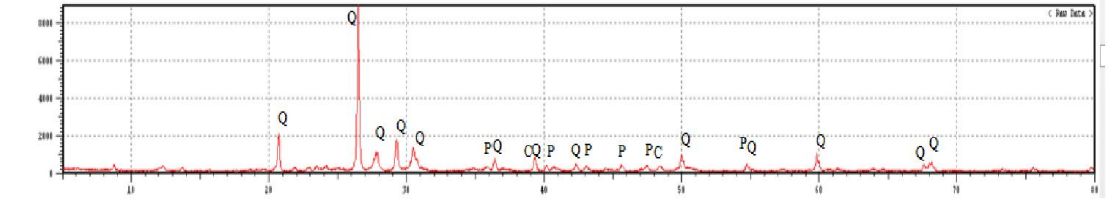

**Fig. 12.** X-ray diagram of sample 9 (first phase, Q – quartz, C – calcite, P – plagioclase)

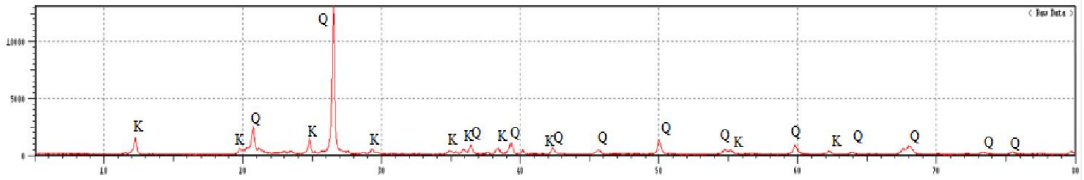


**Fig. 13.** X-ray diagram of sample 10 (first phase, K – kaolinite, Q – quartz)

*Second phase*

The mosaics of the second phase also have a dominant geometric decoration (Figure 14). In the central part is represented a kantharos which symbolizes the source of life, and above it is derived inscription that says: "The Holy Church of God was renewed when bishop was holiest Eustace". This article reveals the name of another bishop who served in the church in Stobi.

X-ray diagram of samples from the second phase is given in Figure 15. The comparison on this diagram with the diagram of dolomite JCPDS 00 036 0426 has shown that they are practically identical.


**Fig. 14.** Second phase

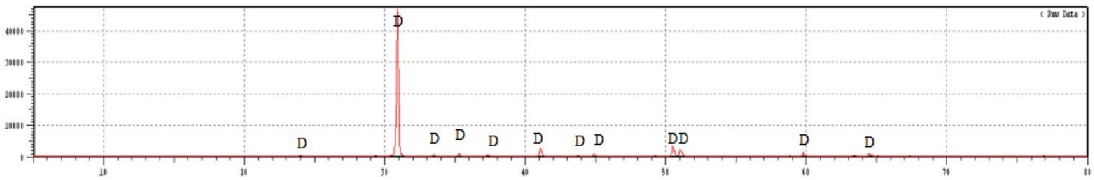


**Fig. 15.** X-ray diagram of sample 1 (second phase, D – dolomite)

*Third phase*

After remodeling the church, the space of the old altar and the remains of the collapsed apse, last mosaics were placed performed in two different techniques – tessellatum and sectile, where from the mosaics in opus sectile are preserved only prints on marble slabs in the mortar, and mosaics in opus tessellatum today are presented in their original place (Figure 16).

X-ray diagrams of the samples from the third phase are given in Figures 17–22.

X-ray diagram of the sample 1 (third phase) was compared with the diagram from calcite JCPDS card 00 005 0586. The comparison has shown that the X-ray powder patterns of the natural calcite taken from the JCPDS card are practically identical with the studied diagram.

Figure 18 shows the X-ray diagram of the sample 2 (third phase). This diagram was compared with the diagrams of calcite JCPDS 00 005 0586, ilite JCPDS 00 026 0911 and kaolinite JCPDS 00 058 2030. Based on the mineralogical composition, structural and textural characteristics the sample is determined as aleurolite.


**Fig. 16.** Third phase

X-ray diagram of the sample 3 (third phase) is given in Figure 19. This diagram was compared with the diagrams of plagioclase JCPDS 01 083 1370, quartz JCPDS 00 005 0490 and calcite JCPDS 00 005 0586. Based on the mineralogical composition, structure and texture characteristics, the sample is determined as sandstone.

Figure 20 shows the X-ray diagram of the sample 4 (third phase). This diagram was compared with the diagrams of plagioclase JCPDS 01 083 1370, quartz JCPDS 00 033 1161, calcite JCPDS 00 005 0586 and plagioclase JCPDS 01 083 1370. Based on the mineralogical composition, structure and texture characteristics, the sample is determined as sandstone.

Figure 21 shows the X-ray diagram of the sample 5 (third phase). This diagram is compared with the X-ray diagram of dolomite taken from the card JCPDS 00 034 0517.

X-ray diagram of the sample 6 (third phase) is given in Figure 22. This diagram was compared with the diagram of calcite taken from the JCPDS card 00 005 0586.

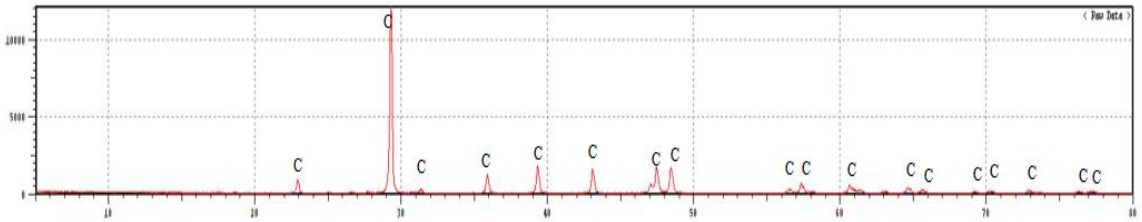

**Fig. 17.** X-ray diagram of sample 1 (third phase, C – calcite)

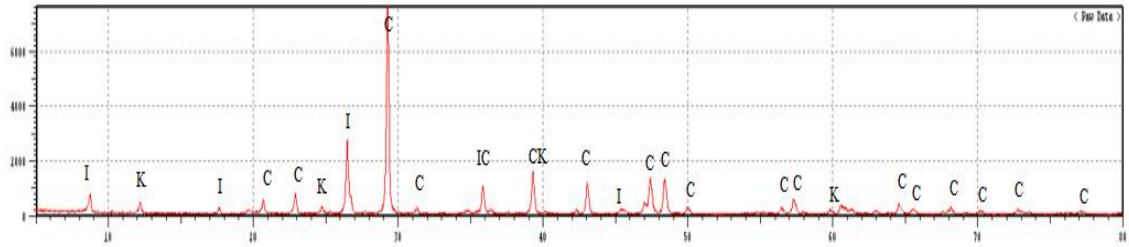

**Fig. 18.** X-ray diagram of sample 2 (third phase, C – calcite, I – ilite, K – kaolinite)

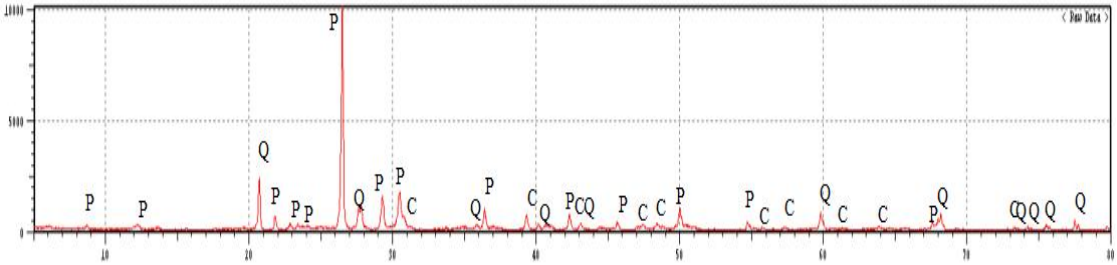

**Fig. 19.** X-ray diagram of sample 3 (third phase, C – calcite, Q – quartz, P – plagioclase)

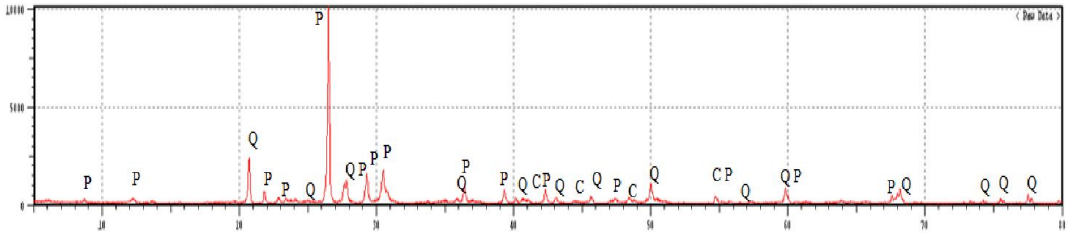

**Fig. 20.** X-ray diagram of sample 4 (third phase, C – calcite, Q – quartz, P – plagicolase)

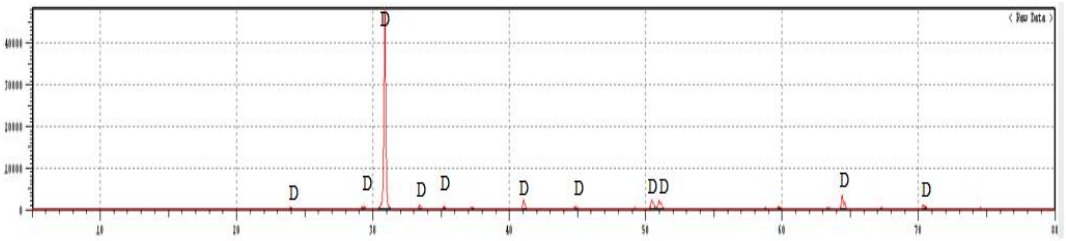


**Fig. 21.** X-ray diagram of sample 5 (third phase, D – dolomite)

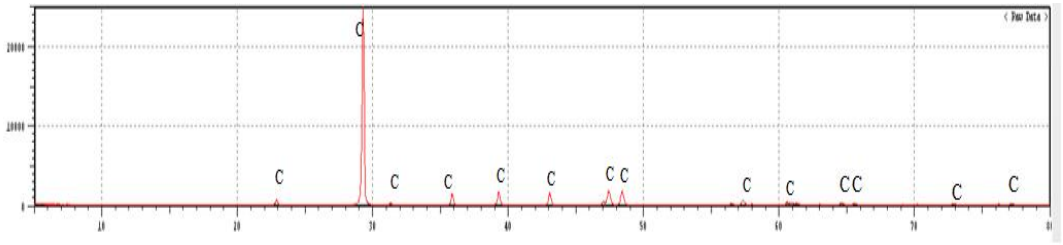


**Fig. 22.** X-ray diagram of sample 6 (third phase, C – calcite)

## CONCLUSION

The researches of the powder patterns that were taken on the moulding examples from the locality of Stobi using the method of X-ray diffraction, confirmed the presence of calcite marble, dolomite marble, sandstone, aleurolite and serpentinite. The mosaics that decorate the central nave of the church were carried out in three successive stages made of different ateliers for mosaic.

*First phase*

Sample 1 – calcite marble, sample 2 – serpentinite, sample 3 – calcite marble, sample 4 – calcite marble, sample 5 – calcite marble, sample 6 – calcite marble, sample 7 – sandstone, sample 8 – sandstone, sample 9 – sandstone, sample 10 – aleurolite.

*Second phase*

Sample 1 – dolomite marble

*Third phase*

Sample 1 – calcite marble, sample 2 – aleurolite, sample 3 – sandstone, sample 4 – sandstone, sample 5 – dolomite marble, sample 6 – calcite marble.

With these researches it is confirmed that all samples which were used in moulding decoration in the Old Episcopal Basilica in Stobi takes origin from Macedonia.

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Р е з и м е

## МИНЕРАЛОШКИ ИСПИТУВАЊА НА СТАРАТА ЕПИСКОПСКА БАЗИЛИКА ОД АРХЕОЛОШКИОТ ЛОКАЛИТЕТ СТОБИ

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**Клучни зборови:** епископска базилика; калцит; мермер; серпентинит

Врз основа на извршените минералошки испитувања, во примероците од Старата епископска базилика од археолошкиот локалитет Стоби е одредено присуство на калцитски мермер, доломитски мермер, песочник, алевролит и серпентинит. Мозаиците коишто го красат централниот кораб на црквата се изведени во три последователни фази изработени од различни мозаичарски ателјеа.

Вкупно се испитани 17 примероци, од кои 10 од првата фаза, 1 од втората фаза и 6 од третата фаза.

*Прва фаза*

1 – калцитски мермер, 2 – серпентинит, 3 – калцитски мермер, 4 – калцитски мемер, 5 – калцитски мермер, 6 – калцитски мермер, 7 – песочник, 8 – песочник, 9 – песочник, 10 – алевролит.

*Втора фаза*

1 – доломитски мермер.

*Трета фаза*

1 – калцитски мермер, 2 – алевролит, 3 – песочник, 4 – песочник, 5 – доломитски мермер, 6 – калцитски мермер.

Со овие испитувања е констатирано дека за декорација на Старата епископска базилика во Стоби е користен материјал кој потекнува од територијата на Република Македонија.