



First ^{14}C dating of the bat guano used for the ancient drawings of Magura cave, NW Bulgaria

Първи данни за радиовъглеродната възраст (^{14}C) на прилепното гуано, използвано за рисунките в пещерата Магура, СЗ България

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Introduction

The first written evidence on the Magura cave belongs to Marinov at 1887 (in: Popov, 1965). The popularity of the cave is mostly due to the “ancient paintings” laid on the cave walls by fossilized bat guano having a plastic consistency similar to clay, and of course – the beautiful karst forms. The cave is formed in the organogenic limestones of the Magura Formation of Late Tithonian–Berriasian age (Nikolov, Tzankov, 1996). The origin of the cave is associated with both the Levantian (Romanian) denudation surface and a paleo-river (Popov, 1965). Latest data of geochemical, mineralogical-petrological, structural-tectonic, hydrogeological, and hydrochemical nature provide Kunov et al. (2012) and Arnaudov and Kunov (2013). Very interesting are the results from the micro-biological researches (www.helictit.info/?act=articles; Ivanova et al., 2013; Mitova et al., 2013a, b; Tomova et al., 2013a, b). These studies were made in the s.c. “Gallery of paintings”. The “drawings-applications” are probably of prehistoric age, which has raised numerous speculations on their age ranging from 3000 to 12 000 years BP or more, some of which being too arbitrary and unjustified. The so called “drawings” excite anyone seen them in place, or in publications and of course numerous specialists from different branches of science.

Methods

In the Laboratory of Organic Analysis of the Institute of Organic Chemistry of the Bulgarian Academy of Sciences were determined the contents of two samples of guano weighting 6 mg each-one with particle sizes between 0.2 and 0.5 mm (the contents of both samples, respectively organic and inorganic part are in wt.%). The first, taken from one of the paintings

of the “Solar Room” contains: C 34.93 and 10.58; H 7.69 and 2.33; N 9.58 and 2.97; S – not found; in total organic compound is 30.29, inorganic – 69.71. In the second sample (taken at a depth of 20 cm in the floor of the “Solar room”) the contents in the organic part of the sample and in the entire sample, respectively, are: C 31.96 and 8.66; H 6.99 and 1.90; N 5.51 and 1.49; S – not found; in total organic compound is 27.00, inorganic – 72.90. Two samples weighting 5 mg were sent to ISOTOPTECIHZRT (Debrecen, Hungary), specialized in AMS ^{14}C analyses.

Results and discussion

The archaeologist Todor Stoychev (National Archaeological Institute and Museum of BAS) has a great merit for the studies in the cave, because of the extensive research and interpretations of the “drawings” (Stoychev, 1994). He determines the age of the so-called “Solar calendar” at 5000 years BP.

Our brief reflections here relate primarily to the age of the paintings. We are well aware that our two analyzes are only an attempt and step forward to clarify an important point. We believe that skepticism about the application of carbon dating is not justified.

What show the results in Table 1? Both samples have similar ages, the sample from the floor (sample Mg 3/13) is somewhat younger. The calibrated calendar age of the drawing (sample Mg 2/13) is about 3660 and 3950 years BC. With adding to them 1950 years AC, the age of the material (bat guano) used for the drawing belonging to the group of the “Solar Calendar” becomes nearly 6000 years BP. Accuracy requires saying that this “date” is the closest relative to the upper age limit of the “drawing”. It is difficult to detect layers in the drawing. However, if such layering was present, inevitably we would have noticed variations and greater differences in the results.

Table 1. AMS radiocarbon determination

AMS ¹⁴ C Lab Code	Sample	Conventional ¹⁴ C age (yrs BP) (± 1σ)	Calibrated calendar age (cal BC) (1σ)
DeA-3295	Mg 2/13 insoluble organic C (0.10 mg C*)	4996 ± 114	3950–3660
DeA-3296	Mg 3/13 insoluble organic C (0.04 mg C*)	4888 ± 80	3780–3530

Conclusion

Our results show that the bat guano used for the “drawings – applications” is not older than 6000 BP and this age is the upper limit of the drawings. To solve the problem on age of the “drawings – applications” is possible based on the ¹⁴C dating method. However, this will require analysis of more samples that are representative for the drawing groups of different probable ages. Determining appropriate, in this context drawings, should be done with the collaboration between historians, archaeologists, geologists and geomorphologists. Hopefully, this will be supported also by the eventual discovery of artifacts that used to belong to the ancient “painters”.

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