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## PRELIMINARY GIS AND INTRA - SITE SPATIAL ANALYSIS OF THE FAUNAL REMAINS FROM REDAKA II CAVE

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**ABSTRACT** - Redaka II cave is located at the entrance of village Salash, district of Belogradchik, North-west Bulgaria. The overall length is of 97m. Prospected by I. Krumov the previous years, Redaka II cave had been the subject in 2005 and 2006 of two surveys-tests which permitted to collect fauna as well as small series of lithic artefacts-Middle and Upper Paleolithic. The study of fauna allowed, for the first time in Bulgaria, to highlight a Hyenas den [1]. In 2008 the more systematic excavations were started and we began a preliminary space analysis to be able to distinguish the two sequences of the occupations by the hyena.

We have also carried out a data processing in 3D for a better understanding of the formation of the layers and the development of the archaeological sequence in comparison to that of the presence of hyena. Because this first step didn't solve the problem of the interaction between man and hyena occupations, in our future works we planned to add others criteria like the level of digestion of bones for example.

**Keywords:** Redaka II, Upper Paleolithic, faunal remains, GIS, intra - site spatial analysis

### INTRODUCTION

Redaka II Cave is situated in the northwestern part of the lower Balkans near the Danube plain, approximately 15km from Belogradchik and about 3km from the Serbian border (fig. 1).



**Fig. 1.** Map of Bulgaria with some of the most important Upper Paleolithic sites.

Prospected by I. Krumov, Redaka II cave had been the subject in 2005 and 2006 of two survey-tests (fig. 2). During this two years we collected fauna and a small series of lithic artefacts from the Middle and Upper Paleolithic sequence. This preliminary study allowed us, for the first time in Bulgaria, to highlight a presence of a hyena den [1]. That gave us enough arguments to begin in 2008 more systematic excavations. We started to excavate at the entrance of the cave and since 2013 we have enlarged the surface on about 7,5m<sup>2</sup> and around 175cm of depth from the R [2]. The faunal remains and the artefacts were pointed out in X, Y and Z when possible, and we also measured the orientation and the dip. In this preliminary spatial analysis, we took into account only the 3-dimensional coordinates, geological layer, the archaeological level and the type of artefact- lithic, fauna, ochre, and bone artefact. For a more detailed analysis we created a database including more than 50 criteria in order to identify and to describe the remains.

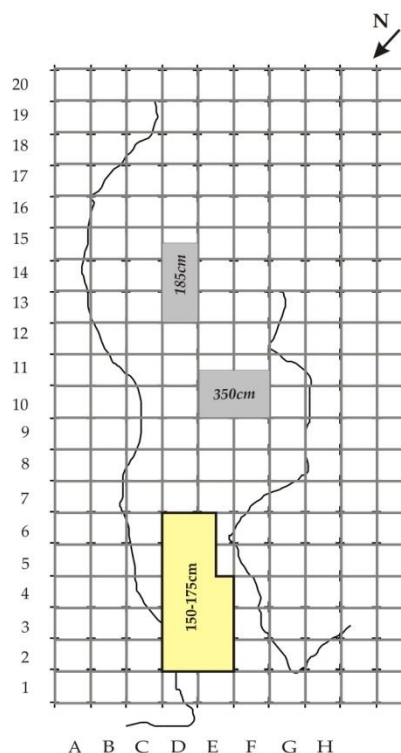
## STRATIGRAPHY

Until 2013 we distinguished 3 or possible 4 geological layers with some different facieses. Layer 3 didn't yield artefacts. There were few bones and flints but we don't exclude perturbations. The first layer with sure archaeological remains is the Layer 4 and we divided it in two- upper and lower parts. At the entrance we recognized another layer that we called 4bc and since 2013, we also try to separate the upper and lower part, but the data are still under study. Then, for the current preliminary analyses we shall use layers 4 and 4bc. We probably reached the upper part of the Middle Paleolithic sequence in squares DE/3 but here we propose to focus only the Upper Paleolithic.

## SPATIAL DISTRIBUTION OF THE ARTEFACTS

We started to collect data for GIS analysis since 2008 and up to now we have more than 4000 artefacts with coordinates and almost the same quantities from sieving. We also took into account all the remains from layers 4 and 4bc.

The spatial distribution of the artefacts of Layer 4 shows more important concentrations of the faunal remains in the squares D2 and E4, which correspond to the areas without big blocks. The same is true for the lithic artefacts. The 4tp seems to be a local facies of 4 in the band 2 and the only one bone tool is from the square E2 (fig. 3).



*Fig.2. Redaka II. Plan of the cave with the excavated areas in 2005-2006 (in grey) and 2008-2013 (in yellow).*

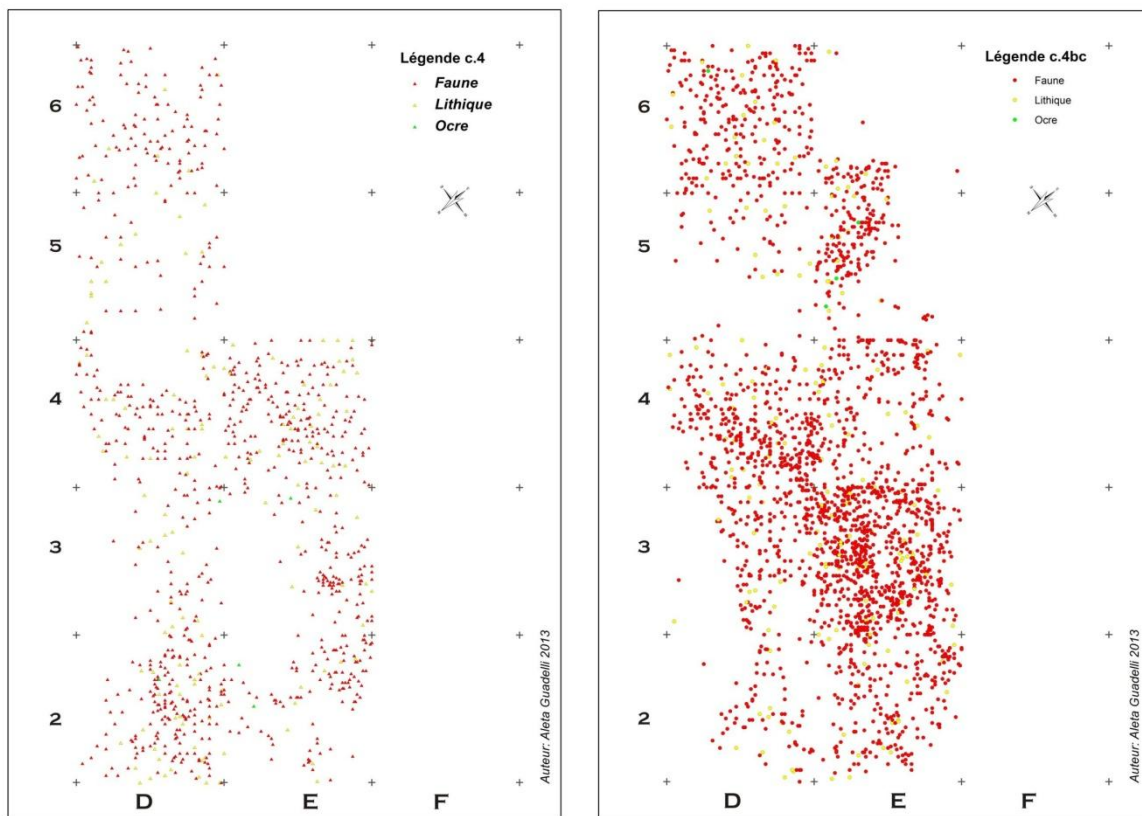


Fig. 3. Redaka II. The distribution of the remains in squares DE/2-6, spit 75-175cm, layers 4 and 4bc.

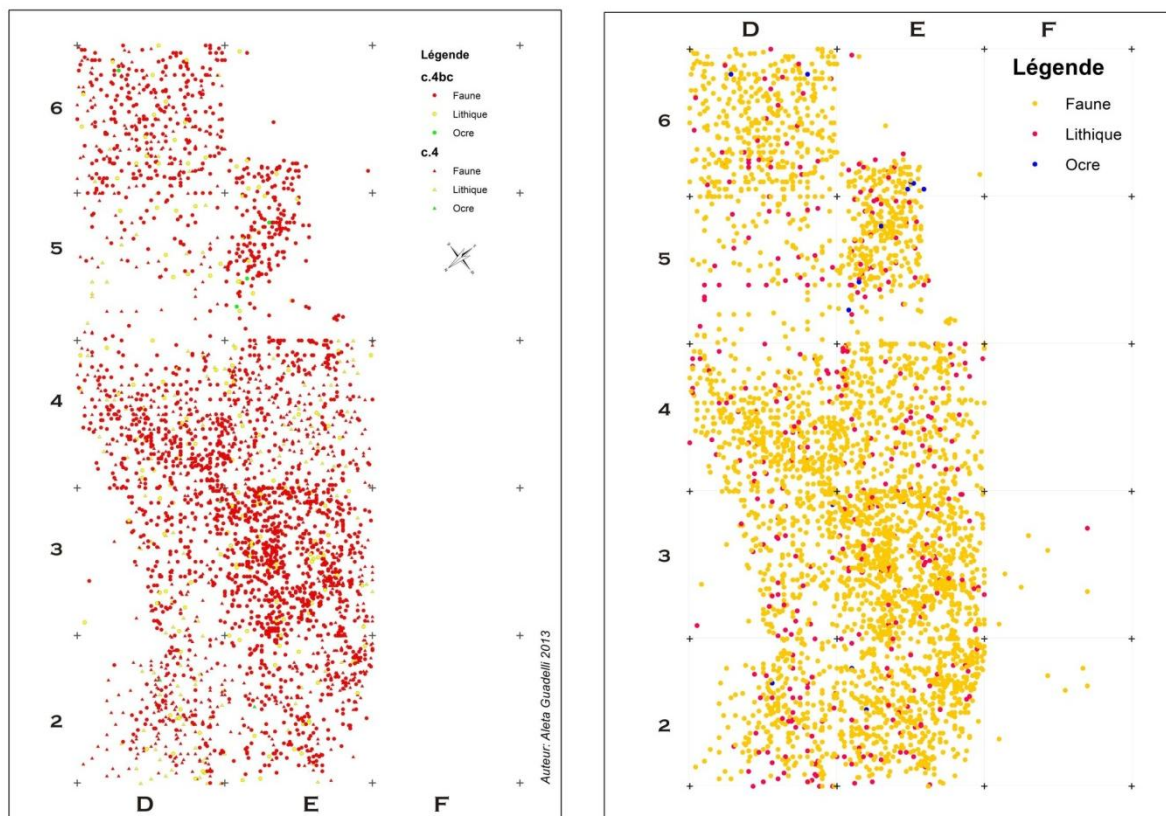


Fig. 4. Redaka II. The distribution of the remains in squares DE/2-6, spit 75-175cm, layers 4 and 4bc and (left) and of all the artefacts from Upper Paleolithic layers by type (right).

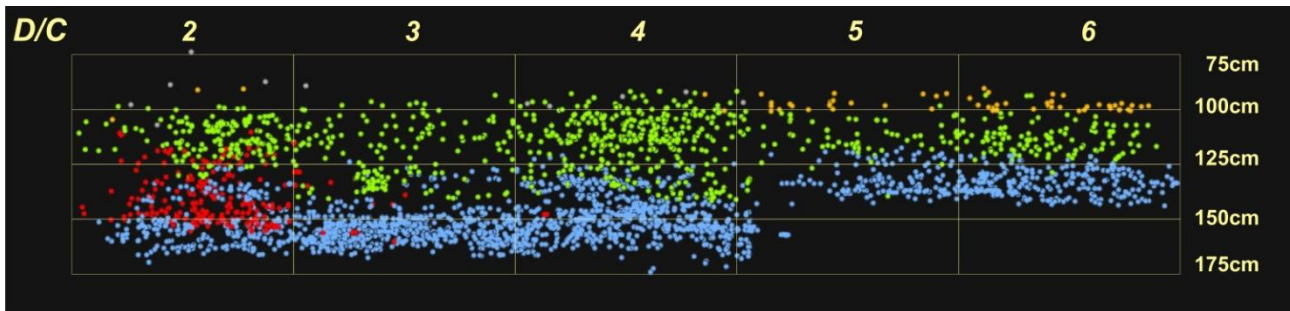
In the facies 4bc artefacts are very numerous (fig. 4). We observed a high concentration of the faunal remains in E3 and D4 and less in E2, E6, E4 and D6. Here, on the contrary of layer 4, the concentrations are not dependent of the limestone blocks but seem to be related to the fireplaces. The lithic artefacts are dispersed without any concentrations and we didn't observe any connections with fireplaces. In the future analyses we'll check out if there are some tendencies for the distribution depending of the typological groups. In 2013 we found only few ochre fragments and stones with red traces located around a Fireplace 3 in E5. The GIS put in light that the awl and two pendants discovered in 2008 and 2009 are related with the same context (fig. 5).



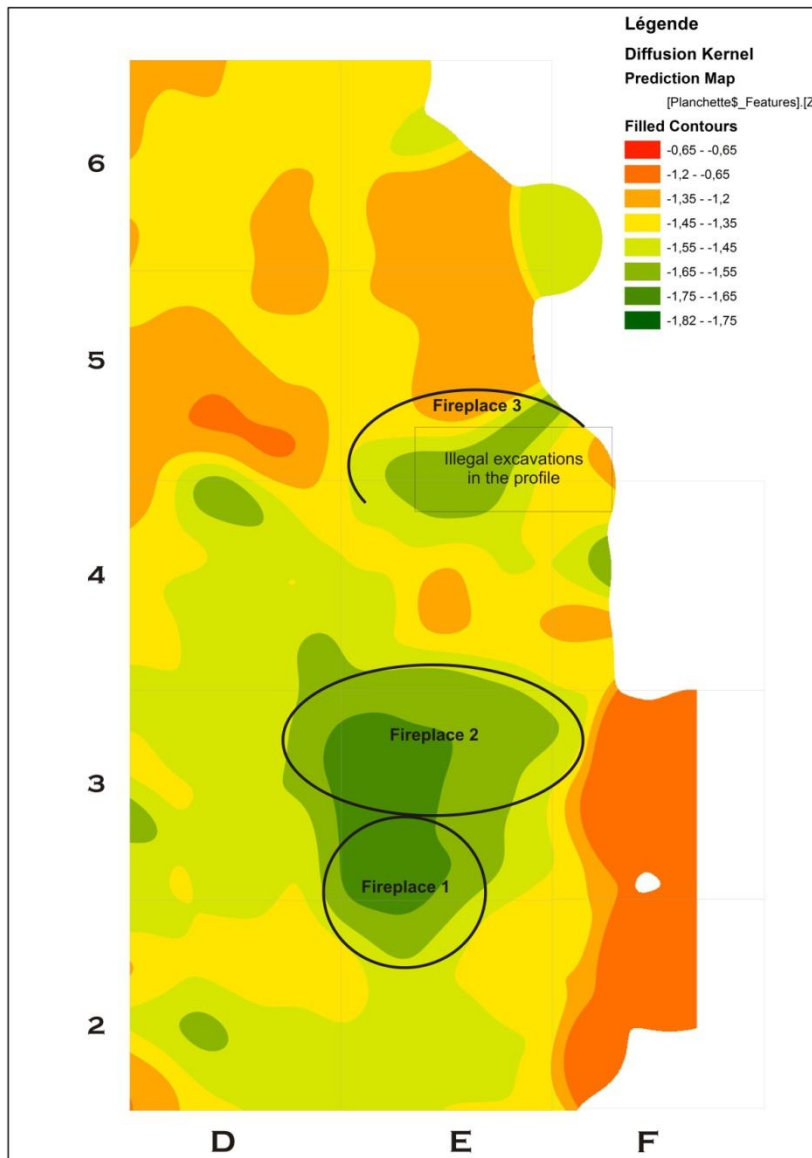
*Fig. 5. Redaka II. Ochre and bone artefacts related to Fireplace 3. A. Guadelli'2008-2013.*

Thanks to the projection of the artefacts we distinguished two layers showing the more important presence of lithic artefacts (fig. 6). The first one is around 115-120cm and the second one around 125-130cm from R. Unfortunately we were not able to distinguish any concentration in the bones, but the future analyses will take into account the anthropic and carnivore traces and the latter

perhaps will help us to solve the a part of our problems in the interpretation. That is to say, to locate the bones associated with the hyena den and those related to the human occupation.



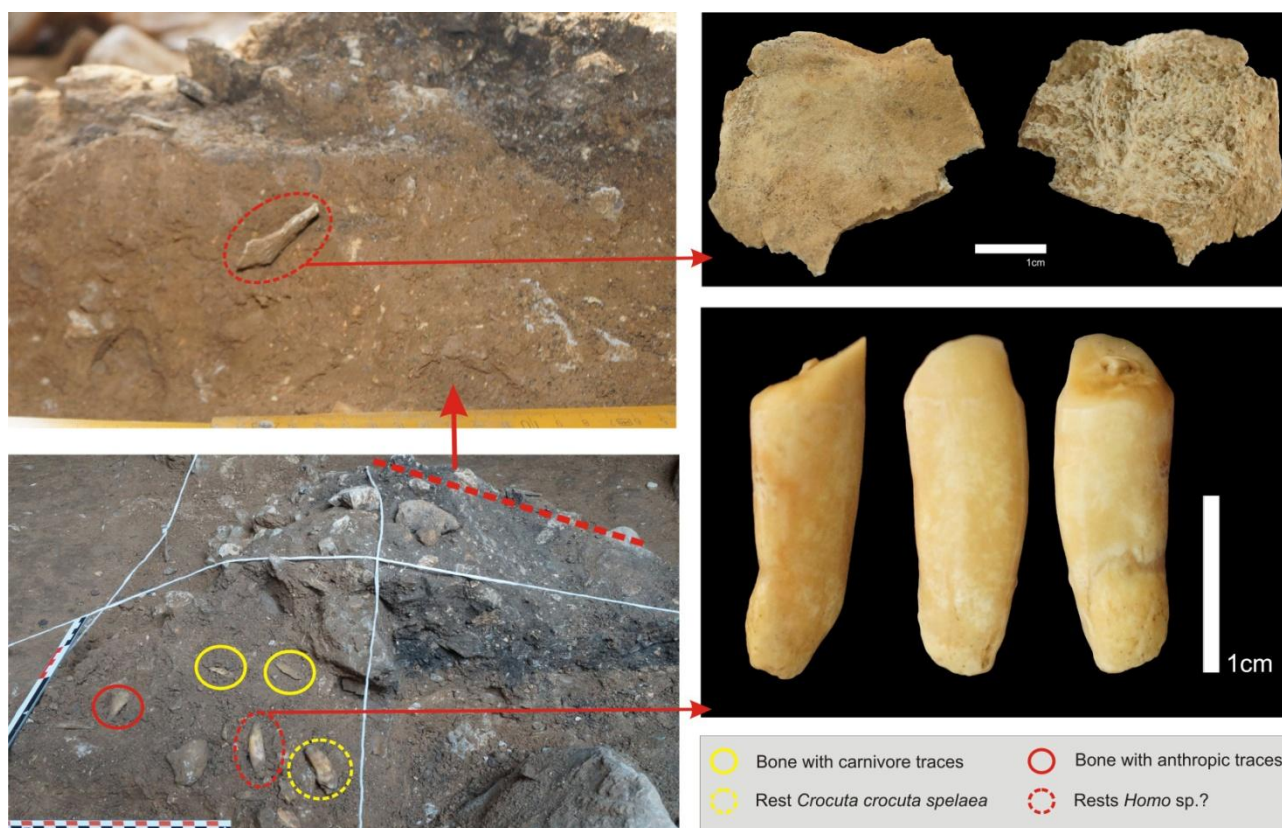
**Fig. 6.** Redaka II. The distribution of the vestiges in squares DE/2-6, spit 75-175cm, layers 3 (in orange), 4(in green)(with 4tp in red) and 4bc (in blue), Projection on the line D/C-2/6, A. Guadelli'2013.



**Fig. 7.** Redaka II. The distribution of the remains in squares DE/2-6, spit 75-175cm, layers 4 and 4bc, Prediction Map of the diffusion- Kernel with the sure fireplaces discovered until 2013. A. Guadelli'2013.

We also carried out a data processing in 3D for a better understanding of the formation of the layers to correlate the archaeological sequence to the presence of the hyena. For this particular point GIS analysis did not really help us to solve the problem. In next researches it will be necessary to add other criteria as the degree of digestion of the bones etc.

Checking different possibilities for a better exploitation of the data, we tried to create a prediction map. We used for first try the lithic artefacts, but probably because of their small proportions we didn't obtain any results. Thanks to faunal remains and data mining with Kernel method, we obtained a very exact prediction map that showed us in 2012 some fireplaces. This year our goal was to confirm if predictions were sure enough (fig.7). Already in 2009 we collected a charcoal in square E4 but we were not sure if it hasn't been dispersed from a more distant fireplace. In 2011 we discovered an illegal "excavations" in the profile so we thought that if there were a fireplace in E5 it should have been completely destroyed. So in 2013 we started to excavate the area without a lot of hope, but in reality the prediction map was very exact and we discovered an important part of fireplace 3. Our experience shows that the prediction map has to be taken into account but supported by more data. It's already known that the prediction models are useful in the archaeological works but we have to be careful to don't over-estimate their use [3]. We'll continue our researches in this direction in Kozarnika and Manastira caves.



**Fig. 8.** Redaka II. Fireplace 2 with human remains and a some bones proving a carnivore activity. A. Guadelli'2013.

Since the beginning of our work we tried to distinguish the human occupations from a hyena den. We first thought that it could be possible, but since the excavation of Fireplace 2 which was intact under a big limestone block, we realised that it is impossible at least in the entrance area. As we see in figure 8, we can find in the same context possible human rests, bones with cut marks, hyena tooth and bones with carnivore traces. This suggests very closed "visits" of the cave by the humans and hyena and probably a re-use of the bones. The scavenging by hyena is already known but we also

observe that *Homo* use the remains- digested bones from hyena as we saw it in two cases. The first is a pendant (fig. 6: 6) made from a digested Bovid incisor and the second one is an awl (fig. 6: 4) probably produced on the bone fragment showing tooth traces of a carnivore.

## CONCLUSION

The presence of Middle and Upper Paleolithic lithic industries in hyena den is not anecdotic because in Western Europe, between 33 and 40 Ka, we observe the same presence. During this crucial period and the so-called replacement of *Homo neanderthalensis* by *Homo sapiens*, it seems that the cavities were occupied mainly by the Hyena; fauna remains from such sites being undoubtedly rich and varied. It seems that the occupations by *Homo* could be related to a food shortage or the bad paleoenvironmental conditions [4].

The date of  $38^{+}170 + 490$  BP (Beta-242745) in layer 4bc of Redaka II, seems to confirm our preliminary hypothesis. If the C14 dating in progress confirm the first one, we will be able to undoubtedly withdraw profitable lesson of this comparison. The bone artefacts support such a date by the exact parallels with Kozarnika cave [5] [6] which is situated at about 20 km from Redaka II. In addition the date of  $25^{+}370$  BP obtained from the upper part of Layer 4 seems to indicate another phase of the Upper Paleolithic occupation in this small cave. It will be interesting to compare the industry of the layers 4 band bc with that of the phase of the contemporary occupation in Kozarnika. Taking into account the existence of, at least one big sized cave close to Redaka II (Kozarnika) with a long archaeological sequence, we might wonder what was the kind of human activities which occurred in a den of such small dimension.

Thanks to this work we already proved that it is not always possible to distinguish human and hyena occupations from same layers and we also demonstrated a re-use of digested bones by humans. More detailed GIS analysis should complete our understanding and knowledge of such sites because it seems that the situation is not so simple as usually presented in literature.

Nevertheless in the studies led for the last 30 years the European Pleistocene hyena dens was often described on the basis of the current African hyena dens. As it was recently mentioned by J. -B. Fourvel [7] "Too much actualism kill actualism" shows that there are still many of studies to carry out for understanding these types of sites with Man-Hyena presence.

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