NEW DATA ON THE CAVE HYENA (*Crocuta crocuta spelaea* GOLDFUSS 1832) FROM MUIERII CAVE (BAIA DE FIER, GORJ DISTRICT, ROMANIA)

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Abstract. A new approach on the representatives of the Pleistocene *Crocuta* genus is presented in this paper. The main morphological and dimensional data are here discussed and reinterpreted on the basis of new information. We underline the defining characteristics of the subspecies *C. crocuta spelaea*, thus allowing a good differentiation from the other subspecies.
We remark the presence of an archaic feature (the existence of a well represented metaconid at the lower carnassial) at Baia de Fier fossils. We accept and reconfirm the existence of the subspecies *C. c. intermedia* during Medium Pleistocene. We analyze certain features that could be defining from the chronostratigraphic point of view.

Key words: Mammalia, Hyaenidae, Taxonomy, Pleistocene.

Rezumat. Noi date asupra hienei de peşteră (*Crocuta crocuta spelaea* GOLDFUSS 1832) din Peştera Muierii de la Baia de Fier (Gorj, România). O nouă privire asupra reprezentanţilor genului *Crocuta* din Pleistocen este abordată în această lucrare. Principalele date morfologice şi dimensionale sunt luate în discuţie şi reinterpretate pe baza noilor cunoştinţe. Caracterele definitorii ale subspeciei *C. crocuta spelaea* sunt subliniate permiţând astfel o buna diferenţiere faţă de celelalte subspecii.
Este remarcată prezenţa unui caracter arhaic (existenţa unui metaconid bine reprezentat la carnasiera inferioară) la fosilele de la Baia de Fier. Este acceptata şi reconfirmată existenţa subspeciei *C. c. intermedia* în timpul Pleistocenului mediu, şi se analizează unele caractere ce pot fi definitorii din punct de vedere cronostratigrafic.

Cuvinte cheie: Mammalia, Hyaenidae, Taxonomie, Pleistocen.

INTRODUCTION

The sub-family Hyaenidae is currently represented by two genera, *Hyaena* BRISSON 1762 and *Crocuta* KAUP 1828, whose evolution from Miocene to Pleistocene gave many forms, whose phylogeny we are going to discuss. After SOERGEL (1936) and ARAMBURG (1958), the Würmians hyena forms are, from the size point of view, very close to the current spotted hyena. On the contrary, our opinion is that the fossil species is different from the actual one by its heavy skeleton, its massive canines and premolars and its thick dentition. The fossil forms have distinct archaic features (the relatively high frequency of the metaconid on the lower carnassial, the symmetry of the two lobes at the same tooth, the large difference between the size of the premolar 4 and that of the molar 1) that we no longer encounter in actual taxa.

Although hyenas are not exactly rare in the caves of Romania, they have a considerable palaeo-environmental importance.

Location

Pestera Muierii (Muierii Cave) is geographically located in the Getic Depression of Oltenia, on the territory of the commune Baia de Fier, Gorj County, at the entrance of the Galben river quay, on its right side.

Muierii Cave belongs to the karstic zone Polovragi-Cernadia, situated in the south of Parâng and Căpăţânii Mountains. Peştera Muierilor is located at the altitude of 500m and it looks like a multilayered cavity.

Research history

Between 1924-1929, with some breaks, C.S. NICOLĂESCU-PLOPŞOR undertakes a series of research works which, after the discovery of some white objects made of quartzite and of several manufactured silexes (pointes à main), whose shape and technique reminded of the musterian industry from the Ohaba Ponor, led to the conclusion that the cave played the role of a shelter for the Paleolithic man. Also at this stage, skeleton samples from *Ursus spelaeus*, *Canis lupus* and *Equus caballus fossilis* were discovered. At this stage, the first two floors of the cave were identified: the first floor, with the Main Gallery, and the second floor, with the Musterian Gallery.

Between 1951-1957, the cave was studied by a complex team of researchers (C.S. Nicolăescu-Plopşor, Margareta Dumitrescu, T. Orghidan, J. Tanasachi, Val. Puşcariu and others). Most of that year's diggings ere focused on the Musterian Gallery. The same year the third floor was discovered, the "Bears' Gallery", which is the paleontological treasure of the cave.

The filling deposit

The filling deposit of the galleries in Muierii Cave is made of calcareous degradation materials, in the surface levels, and, in the deeper levels, it is made of materials transported and deposited by infiltrated streams, also of remains from bones and vital activities of animals that lived in the cave, as well as from human contributions.

The testing made in 1951 at the cave's entrance revealed, under the holocene detritus layer, a stratum of argil and sand, with calcareous detrital elements, which goes on until it reaches the calcareous bed.

In the Musterian Gallery, the filling material is represented by a sandy yellow-brown argil, mixed with elements of calcareous gravel, the whole formation having the thickness of 0,5m. In the Bears' Gallery, the skeleton material is covered by the calcareous crust or by a fine yellow-orange, yellow-grey argil, which, near the bottom of the gallery, lies straight on the calcareous bed.

The guano deposit also covers considerable surfaces, sometimes with thickness of tens cm.

The Quaternary mammal association at Baia de Fier

The large mammal fauna at Baia de Fier was researched by Gh. Bombiță, who published in 1954 the paper *Mammals in the glacial of the caves at Baia de Fier*, which comprises the elements discovered in 1951. The list of the species contains: *Felis spelaeus* (*Felis leo spelaea* GOLDFUSS), *Felis pardus* (*Felis pardus spelaea* KOCH), *Felis silvestris* SCHREBER, *Hyaena crocuta spelaea* GOLDFUSS, *Canis lupus spelaeus* GOLDFUSS, *Canis vulpes fossilis* GOLDFUSS, *Ursus spelaeus* BLUMENBACH, *Mustela martes* LINNAEUS, *Gulo spelaeus* GOLDFUSS, *Lutra vulgaris* LINNAEUS, *Sus scrofa* LINNAEUS, *Bos taurus* LINNAEUS, *Capra ibex fossilis* NEHRING, *Equus caballus fossilis* LINNAEUS, *Castor fiber* LINNAEUS, *Rhinoceros tichorhinus* CUVIER, *Mammuthus primigenius* BLUMENBACH.

The species of large mammals in Peştera Muierilor were attributed to the last glacial Würm cycle, being located on two stratigraphic levels: the lower, musterian one (*Ursus spelaeus, Hyaena crocuta, Felix leo* LINNAEUS, *Felix (Linx) pardina* TEMMINCK, *Felix pardus* LINNAEUS, ***Canis lupus spelaeus, Canis vulpes fossilis,*** *Bison priscus* BOJAN, *Saiga tatarica* LINNAEUS, *Capra ibex* LINNAEUS, *Rupicapra tragus* GRAY, *Mustela martes* LINNAEUS) and the upper, aurignacian one.

The second, ochre-reddish level pleads, through its fauna content, for the cooling of the climate: *Ursus spelaeus*, *Felix leo*, *Hyaena crocuta*, *Canis lupus spelaeus*, *Felix (Linx) pardina*, *Felix pardus*, *Canis vulpes fossilis*, *Bison priscus*, *Saiga tatarica*, *Mustela martes*, *Cervus (megaceros) euriceros* ALDROW.

The paleontological material belonging to micromammals that resulted after diggings at Baia de Fier comes from the Musterian Gallery and from the entrance area of the cave.

In the Musterian Gallery, an association of *Cricetus cricetus*, *Arvicola terrestris* and *Microtus arvalis* was identified, with the age attributed to the end of the isotopic stage 5 (RĂDULESCU & al., 1999).

From the sequence that covers the levels with Upper Paleolithic industry (Aurignacian) at the cave's entrance (NICOLĂESCU-PLOPŞOR & al., 1957), TERZEA (1972) determines *Chionomis nivalis*, *Microtus agrestis*, *Cricetus cricetus*, *Ochotona pusilla*. RĂDULESCU et al. (1999) also mentions *Sicista subtilis*, *Microtus arvalis* and *Arvicola terrestris*.

The whole of the data regarding this sequence suggests the equating of this stratigraphic sequence to the upper side of the isotopic stage (RĂDULESCU et al., 1999).

The presence of man in the glacial of Muierii Cave (Baia de Fier)

Also from the upper level comes a human skull, found together with a mandible, a scapula and a tibia.

Due to its features and morphometric characteristics, the skull was first attributed to *Homo sapiens fossilis*, then to *Homo sapiens sapiens*, who still keeps some Neanderthal features.

Dated through the method of radioactive carbon, the age of the skull was established at approximately 29 000 years.

In 2004, AGATA OLARIU and EMILIAN ALEXANDRESCU, making team with a group of Swedish experts, used the AMS method and determined the age of the mandible at 30150 plus or minus 800 years.

SOFICARU et al. (2006) also attributes to the human samples the age of 30 000 years.

TAXONOMY

The species of the *Crocuta* genus that evolved across the Middle and Late Pleistocene in Eurasia and Africa were regrouped by KURTEN (1956) in *Crocuta sivalensis* (FALCONER & CAUTLEY, 1868) from India's Villafranchian (Sivalik zone) and *Crocuta crocuta* (ERXLEBEN, 1777) with 4 subspecies: *crocuta, spelaea* (GLODFUSS, 1823), *ultima, ultra*, plus *intermedia*, confirmed by BONIFAY (1971) and accepted by us.

DESCRIPTION

UPPER DENTITION. **The upper premolar 3 (P3)** is a tooth usually higher than the anterior-posterior diameter. The protocone covers almost the entire surface of the tooth; the anterior and posterior cusps are poorly developed, while the cingulum that borders the interior collar is vaguely expressed. VIRET (1954) considered that characteristic for the *Crocuta* genus was the interior widening of the posterior lobe and the presence of a little short talon at the level of the cingulum, features also observed in the samples at Baia de Fier.

The morphology of the upper carnassial (Fig. 1). This tooth displays several characteristics that allow generic and specific determination.

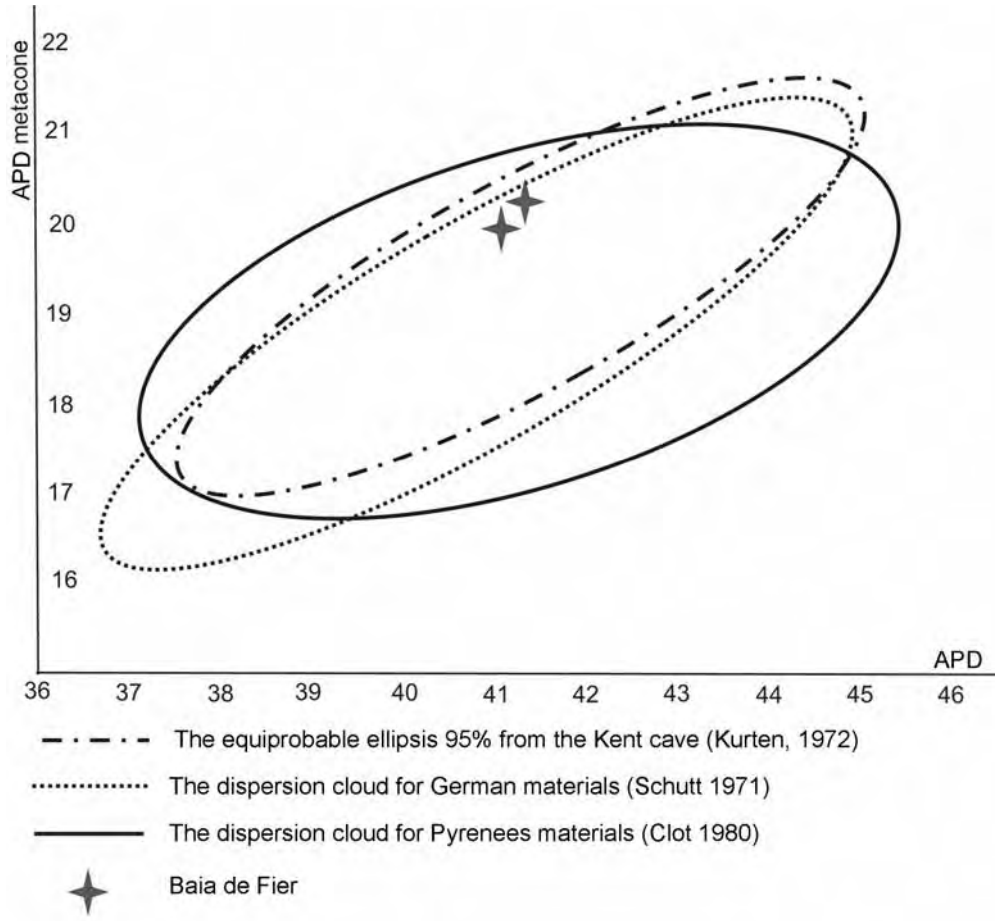

Figure 1. Upper carnassial diagram for ADP metacon/ADP M_1.
Figura 1. Diagrama carnasierei superioare pentru DAP metacon/DAP M_1

1. **Wide development of the posterior lobe** (the metacone), which in the teeth at Baia de Fier is double compared to the anterior lobe.
2. **Position of the interior talon**. After HAGMANN (1899) and EHRENBERG (1938), the interior talon is located upfront at *spelaea* and it makes an obtuse angle with the longitudinal axis of the tooth. Its positional changes had been reported by several authors for *intermedia* forms (from Lunel-Viel BONIFAY, 1971) and *spaelaea* at which it is sometimes pushed backwards (HERLE, 1910). For a more objective evaluation of the talon position, we measured on the two teeth from Baia de Fier, the angle formed by the long axis of the tooth with the line that links the anterior margin of the parastyle to that of the talon and we obtained the values 91^0 and 93^0. These values fall inside the area peculiar to those known in references, *i.e.* $88^0 – 98^0$ with the mean value 93^0, 54' (Gerde), $87^0 – 103^0$ with the mean 93^0 87' (Bouhadere) (CLOT, 1980).
3. **Absolute size**. The anterior-posterior diameter corresponds to the arithmetical means given by various authors; these figures vary, for important samples, between 40.6 and 41.6 (CLOT, 1980). Pieces at Baia de Fier are nevertheless somewhat stronger (41. 3 and 41. 7) while the mean for those in the Kent cave is 40. 06, and for the 28 würmians pieces in Germany is 40.3 (SCHUTT, 1971). The mean for the ant. DT is 22.3 while in other deposits in Europe, it varies between 21.3 in grottoes from Pyrenee Mountains (CLOT 1980) and 22.62 at Kent cave (KURTEN 1972). In picture 1, pieces at Baia de Fier are represented, in the diagram, the anterior-posterior metacone diameter/ anterior-posterior diameter (APD), compared to other pieces in Europe. It is obvious that these values are inside the probability ellipsis of 90% designed for *spelaea* by Kent (KURTEN 1972) and inside the dispersion cloud for materials in Germany (SCHUTT 1971).
4. **The shape of the posterior root** after SOERGEL (1937) seems, in würmians forms, more elongated in the anterior-posterior zone than in the rissian forms. At Baia de Fier, the index of high tooth root/ APD is 75.5, positioned at the inferior side of the variation domain of rissian forms with means between 73.9 and 79.6 (CLOT 1980), compared to rissians at Lidental with the mean 94.9 (SOERGEL, 1936). If this criterion was also proved for other rissian forms, it could become an important chronological index.

LOWER DENTITION (Figs 1 & 2)

The canine (Fig. 2) is relatively small and it has two edges slightly pearled on its tongue surface, the anterior and the posterior ones. The diastema, which separates it from the premolars, is short and we remarked it at all pieces we studied. At the basis of the anterior edge the burelet is not very well marked, being reduced to a little protuberance.

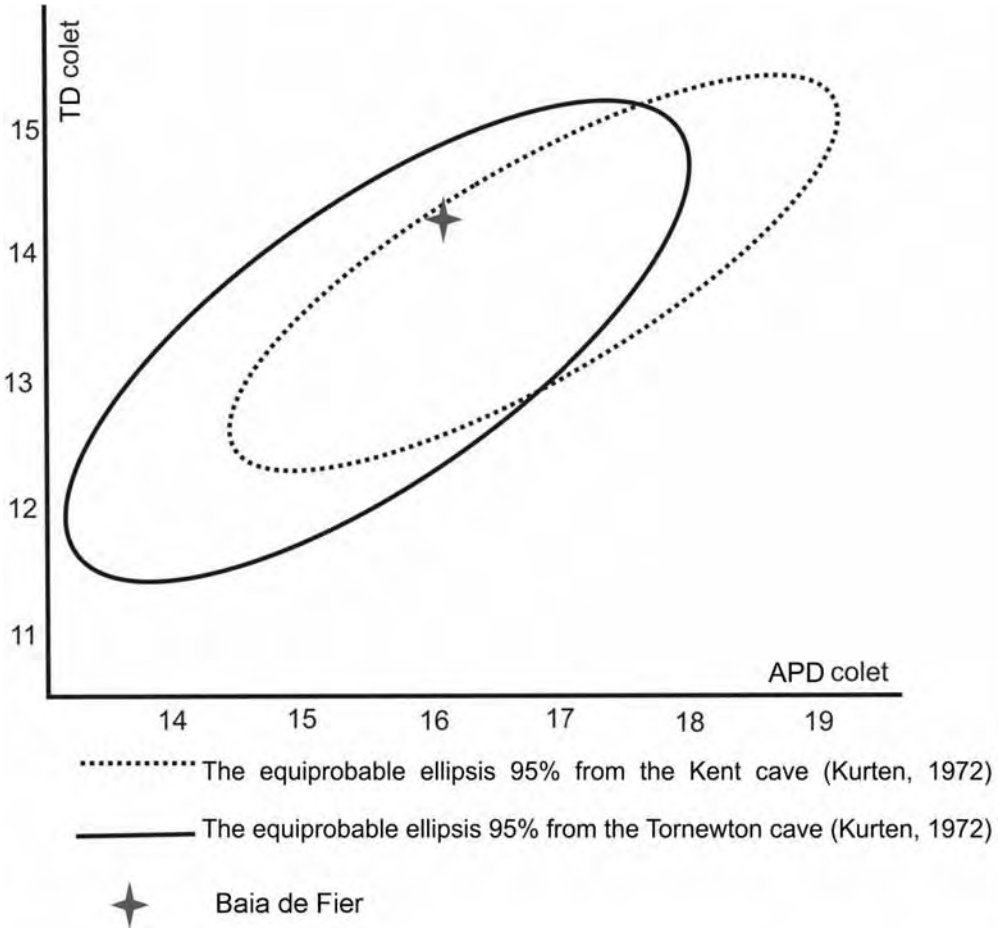

Figure 2. Lower canine diagram of collar dimension.
Figura 2. Diagrama caninului inferior în funție de dimensiunile coletului

In picture 2 you can see the dimensions of the collar as compared to those in Kent and Tornewton Cave after KURTEN (1972) and Gerde (CLOT 1980). The only canine at Baia de Fier that we had at our disposal is found in the common part of the two equiprobable ellipses of 95%.

Premolar 2 is robust, with a large protoconid followed by a little denticle, and the lingual and labial edges are almost parallel, but their posterior side is thicker than at the *Crocuta c. intermedia*. The anterior denticle is not well developed both with nowadays *C. c. crocuta* and with *C. c. spelaea*, compared to *Hyaena* genus.

Premolar 3 has a very high protoconid which does not present, as with *Hyaena* genus, a very developed parastylid. The metric (dimensional) values are between 22.9 and 25.0, values that are common with würmian *spelaea*, compared to interglacial forms 21.5 - 21.75 (3 English Riss-Würm sites, KURTEN, 1963) or 21.24 (Lunel-Viel, BONIFAY, 1971).

KURTEN (1975) represented in a diagram (Fig. 3) anterior-posterior diameter for P2 depending on APD for P3 from materials in Kent and Tornewton Caves. This graphic, completed with data from France (BONIFAY 1971, CLOT 1980) and those at Baia de Fier, gives us the possibility to observe the positioning of our pieces inside the 95% ellipsis of würmian forms at Kent as well as the largest part of würmian forms in France, while interglacial forms, even if some of them overlap, most of the times they are outside it.

Premolar 4 is especially interesting, due to its dimensions, larger than at the rissian form and also due to its morphology. This tooth has a small paraconid, but always distinct from the protoconid. We mention that this is a *spelaean* feature that evolved towards reduction during Pleistocene. The hypoconid, or posterior denticle, is also well developed, the index Anterior-Posterior Diameter **hip.**/APD varying between 31.2 and 33.7 for the 5 pieces that were measured. The protoconid is high and bent backwards more that at premolar 3, it does not present external cingulum and its anterior side is well marked, these two characteristics are defining for the separation of *Hyaena* and *Crocuta* genera.

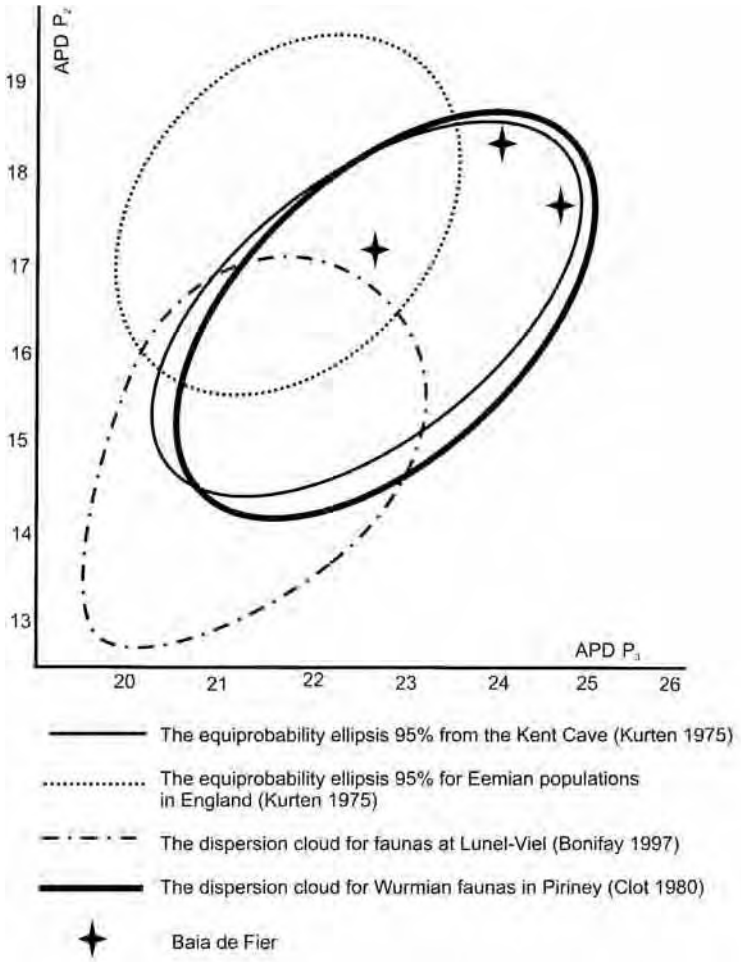

Figure 3. Diagram of APD P_2 in relation with APD P_3.
Figura 3. Diagrama DAP P_2 în funcţie de DAP P_3

Morphology of the lower carnassial (Fig. 4): just like its superior equivalent, it allows a subtle identification at the level of the *genus* and the species. With materials at Baia de Fier, it is characterized through:

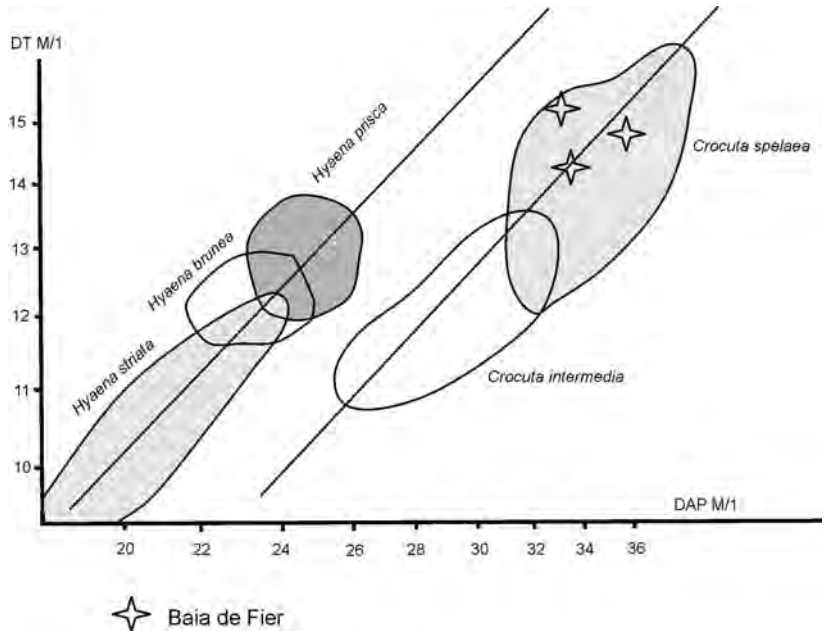

Figure 4. Dividing of *Hyaena* and *Crocuta* genus on the basis of lower carnassial dimension after BONIFAY, 1971
Figura 4. Separarea genurilor *Hyaena* şi *Crocuta* pe baza dimensiunilor carnasierei inferioare după BONIFAY, 1971

1. The talonid, reduced to a simple burelet, like it was represented by BOULE (1902, Fig. 2) while with *Hyaena* it is well developed.
2. The difference between the APD of the paraconid and the APD of the protoconid varies between 2.5 and 3.8 with a mean of 3.05; these values are in the interval of variation of the *Crocuta spelaea* from Gerde where, on 21 pieces there have been registered values from 1.1 to 4.5 with a mean of 2.82.
3. The cutting posterior lobe may present at the lower side a little tuber with a conic and sharp shape, the metaconid. At our samples it is extremely small and united to the protoconid.
4. Because the molars at Baia de Fier are not worn out, the basal anterior-external burelet is strongly outlined.

CONCLUSIONS

It is not possible to establish a specific barrier for Mindel-Riss to Würm populations, due, on one hand to the relatively short geological period, on the other hand to the fact that there are no major morphological transformations.

The value repartition for the lower carnassial is in the same dispersion cloud from *Crocuta* genus (according to KURTEN's data, 1956), while *Hyaena* genus is on another line (Picture).

At the same time we remark that the Medium Quaternary form and the Upper Quaternary one are easily distinguished with respect to size and they can be good fossil indicators; therefore we agree with the separation of *Crocuta crocuta spelaea* from *C. c. intermedia* proposed by BONIFAY (1971).

Crocuta c. spelaea from Baia de Fier together with *C. c. intermedia* are distinguished by size, but they are both stronger than the current spotted hyena.

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Picture 1. *Crocuta crocuta spelaea* (Baia de Fier), mandible sin with C-P_4, outer view
Foto 1. *Crocuta crocuta spelaea* (Baia de Fier), mandibulă stângă cu C-P_4, vedere labială

Picture 2. *Crocuta crocuta spelaea* (Baia de Fier), mandible sin with P_3-M_1, outer view
Foto 2. *Crocuta crocuta spelaea* (Baia de Fier), mandibulă stângă cu P_3-M_1, vedere labială