

Late Pleistocene *Crocota crocuta spelaea* in Bulgaria: distribution and history of research (Carnivora: Hyaenidae)

Късноплейстоценската западна пещерна хиена (*Crocota crocuta spelaea*) в България: разпространение и история на изследванията (Carnivora: Hyaenidae)

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Abstract. The paper summarizes all scattered data from the last 116 years on the distribution of the Late Pleistocene cave hyena in Bulgaria, a part of them unpublished. Data from 24 fossil sites (Middle Pleistocene – Late Pleistocene) in the country are presented. The fossil record in Bulgaria proves the wide distribution of the species in the karst areas of the low-mountain regions of the country. Its Pleistocene localities are concentrated in the Predbalkan Mts. (83%), Strandja Mts. (8%), Western Rhodopes Mts. (4%) and southern Dobruja Plain (4%). They are situated at the altitudes between 136 and 1250 m a.s.l., about 75% of them at 136–400 m a. s. l. All (except one) Bulgarian sites represent former human dwellings, which indicates competition between man and this carnivore for the cave spaces.

Key words. Cave hyena, large carnivores, Quaternary mammals, history of wildlife, Balkans.

INTRODUCTION

The Late Pleistocene western cave (spotted) hyena, *Crocota crocuta spelaea* (Goldfuss, 1823), is one of the iconic Quaternary species of the European megafauna. This impressive carnivore has been subject of a number of special studies in several countries and territories: Crimea (BARYŠNIKOV 1995), Czechia (DIEDRICH & ŽÁK 2006), Jordan (KEMPE et al. 2006), Italy (STINER 2004), Russia (GRIČAN & OVODOV 1978, BARYŠNIKOV & VERESHCHAGIN 1996), and Serbia (DIMITRIJEVIĆ 2011). It is believed that the African spotted hyena migrated into Europe not earlier than 3.5 Ma (ROHLAND et al. 2005). NAGEL et al. (2004) suggested that the species entered Europe much later, ca. 0.5 Ma. In Quaternary Europe it experienced an increase in body size (Bergmann's rule). The earliest fossil record of *C. crocuta* is dated 990,000 years BP (HOLEKAMP & KOŁOWSKI 2009).

In Europe, the Late Pleistocene spotted hyena and the steppe lion, *Panthera leo spelaea* (Goldfuss, 1810), were top predators and often competed for prey in the same way as they do today in the African savannahs (DIEDRICH 2014). In the Far East, *C. c. spelaea* was replaced by an even much more carnivorous cousin – the eastern (supreme) cave hyena (*C. c. ultima* Matsumoto, 1915), which reached southern China and Thailand (SURAPRASIT et al. 2015). This subspecies was more adapted to life in open habitats and was less associated with caves in comparison to the western cave hyena, *C. c. spelaea*.

The Late Pleistocene range of the western cave hyena covered most of Europe, western and northern Asia, Russian Plain, Crimea, Caucasus, Ural Mts. and (?) southern Far East of Russia (GROMOV & BARANOVA 1981). The western cave hyena hunted the same ungulates as the primitive man did. In Europe it also competed with man for the caves as a suitable and reliable shelter and dwelling space.

MATERIAL AND METHODS

I tried to gather all data (published and unpublished) on the former distribution of the Pleistocene western cave hyena (*Crocota crocuta spelaea*) in the present territory of Bulgaria. For each site I present as complete data as possible on the age, years and leaders of excavations, and the reference of the original published information (Table 1). The great majority of hyenid bone/teeth findings (except those from the Borikovska Cave) came from the excavated archeological sites of the prehistoric human cave dwellings.

Thus, many of the finds published in less accessible scattered (often regional) archaeological editions remained unknown to the zoological community. All of them represent a valuable source for elucidating the former distribution of one of the most widespread Pleistocene carnivores in the Balkans.

The chronostratigraphy (Table 1) follows COHEN et al. (2013): (1) Chibanian (Middle Pleistocene, 770,000–129,000 years BP); (2) Late Pleistocene (129,000–11,700 years BP) [BP = before present].

RESULTS AND DISCUSSION

History of evidence

The first published data on *C. c. spelaea* in the Bulgarian literature appeared in 1904 (POPOV 1904). They were assigned to *Hyaena spelaea* by the eminent archaeologist and praehistorian Professor Rafail POPOV (1876–1940). These finds were collected during his excavations in the Malkata (Tonûva) Cave near Belâkovec in the vicinity of Veliko Târnovo, northern Bulgaria (POPOV 1904, ANONYMOUS 1906). These Bulgarian publications appeared a century after the world's first publication on the fossil hyaenid remains (CUVIER 1805).

Both papers give an exhaustive description of the hyenid bones found in the Palaeolithic deposits in the Malkata Cave – mandibles, upper praemolars, distal femur, two humeri, lower praemolars, canines, etc. They also provided measurements of some canines – 5 cm, 6 cm and 8 cm length.

DOCKNER (2006), without any reference, lists two Bulgarian sites – the Devetaškata and Morovica Caves. In the Bulgarian literature the cave hyena was also a subject of special interest concerning the Upper Palaeolithic rock art of Europe (SPASSOV & STOYCHEV 2004). These authors conclude that the exterior of this carnivore was very close in appearance (coloration pattern) to the recent African spotted hyena, *Crocota crocuta crocuta* (Erxleben, 1777). Conclusions about details in head morphology by DOCKNER (2006), based on tomography of skulls, are also similar.

Until 1976, a total of ten localities of *C. c. spelaea* had been known in Bulgaria (NIKOLOV 1977). In 1980 their number increased to 12 (NIKOLOV 1983). After BERON et al. (2006), the fossils of the cave hyena were found in 11 Bulgarian caves. In one site (Tabaškata cave) the hyena fossils were identified as “*Crocota sp.*” (BERON et al. 2006), although they were also dated as Late Paleolithic.

It is worth mentioning that even in the comprehensive encyclopedic work on the Bulgarian caves by BERON et al. (2006), some hyena sites were omitted. For example, HLEBAROV (2004)

Table 1. Localities of fossil bone remains of the cave huena in Bulgaria
Таблица 1. Находница на фосилни костни останки на пещерната хиена в България

No site	localisation (province)	altitude [m a. s. l.]	age	excavation (year/leader)	reference
№ находнице	локализация (област)	височина (м. н. в.)	възраст	разкопките (година/ръководител)	източник
1	Kozarnika Cave (Suhi Peč)	nr. Belogradčik (Vidin)	375	Late Pleistocene, MNQ 18–26 (end of Saalian, Eemian and Weichselian), 1,000,000–700,000 BP	SIRAKOV et al. 2010, BOEV 2001, GUADELLI et al. 2005, 2011, FERNANDEZ 2009
2	Mirizlivka Cave	nr. Orešec (Vidin)	750	Early–Late Pleistocene, Paleolithic	POPOV 1933, 1936, NIKOLOV 1977, 1983, BERON et al. 2006, BOEV 2015
3	Mišin Kamik Cave	nr. Gorna Luka (Montana)	430	Middle Pleistocene, Early MIS 5e, Middle Paleolithic, 135,000–85,000 BP	V. ATANASOV; 1993 / Z. BOEV 2012–2017 / S. IVANOVA ROVA et al. 2016
4	Morovica Cave	nr. Gložene (Loveč)	690	Middle Pleistocene, Paleolithic	POPOV 1913a, 1923, 1929, POPOV; 1955 / N. DZAMBAZOV; 1959 / Museum Teteven
5	Bačo Kiro Cave (Malka Dránovska) (Gabrovo)	nr. Dránovo	335	Late Pleistocene, Middle to Late Paleolithic, 70,000–20,000 BP	GARROD et al. 1939, NIKOLOV 1977, 1983, WISZNIOWSKA 1982, BERON et al. 2006, DOCK- NER 2006
6	Magura (Rabiška) Cave	nr. Rabiša (Vidin)	371	Late Pleistocene, over 50,200 BP; 32,750±500 BP	BERON et al. 2006, IVANOVA et al. 2016
7	Golámata Cave (Podgolskaskata)	nr. Veliko Tărnovo (Veliko Tărnovo)	355	Early Paleolithic	POPOV 1913b, 1921, NIKOLOV 1977, 1983, BERON et al. 2006

Table 1. (continued)
Таблица 1. (продължение)

No site № находище	localisation (province) локализация (област)	altitude [m a. s. l.] височина (м. н. в.)	age възраст	excavation (year/leader) разкопките (година/ръководител)	reference източник
8	Golámska Cave nr. Belákovec (Veľiko Tárnovo)	370	Early Paleolithic	1898, 1899, 1901, 1905 / R. Popov	POPOV 1925a, 1936, POPOV 1925a, 1936, NIKOLOV 1977, 1983, BERON et al. 2006
9	Malkata Cave nr. Veľiko Tárnovo (Veľiko Tárnovo)	355	Early Paleolithic	1897, 1899, 1900, 1905, 1909 / R. Popov	POPOV 1913b, 1925b, 1936, NIKOLOV 1977, 1983, BERON et al. 2006
10	Malkata Cave (Toneva) nr. Belákovec (Veľiko Tárnovo)	370	Early Paleolithic	1899, 1900, 1905, 1909 / R. Popov	POPOV 1904, 1911, 1913b, 1914, 1925a, POPPOV 1913, NIKOLOV 1977, 1983, BERON et al. 2006
11	Leárnite Cave (Leárnicite) nr. Mladežko (Burgas)	260	Middle–Late Paleolithic	2010 / S. Ivanova	IVANOVA et al. 2011
12	Manastira Cave nr. Arbanasi (Veľiko Tárnovo)	392	Middle–Late Paleolithic	2012–2013 / A. GUADELLI	GUADELLI et al. 2014a
13	Toplá Cave nr. Goláma Železna (Loveč)	476	Late Paleolithic, 40,000–10,000 BP	1898 / M. KOJČEV, 1899 / G. BONČEV; 1900 / I. STOANOV	POPOV 1928, MILEVA 1974
14	Redaka 2 Cave nr. Salaš (Vidin)	585	Middle–Late Paleolithic, 44,000–33,000 BP	2008–2013 / A. GUADELLI & N. SIRAKOV	GUADELLI et al. 2014b, 2019
15	Temnata Dupka Cave nr. Karlukovo (Loveč)	250	Late Pleistocene, Epigravettian,	1938 / R. Popov; 1982 / N. SIRAKOV	MIKOV 1926, NIKOLOV 1977, 1983, GUADELLI & DELPECH 2000, BERON et al. 2006, POPPOV 1926, 1931, 1936
16	Tabaškata Cave nr. Loveč (Loveč)	212	Late Pleistocene	1920 / V. MIKOV; 1952–1956 / N. DZAMBAZOV	BERON et al. 2006

No site	localisation (province)	altitude [m a. s. l.]	age	excavation (year/leader)	reference
№ находище	локализация (област)	височина (м. н. в.)	възраст	разкопките (година/ръководител)	източник
17	Mladenova Cave (Mladenova Propast)	311	Late Pleistocene	1964 / I. NIKOLOV	NIKOLOV 1983
18	Devetaškata Cave (Loveč)	298	Late Pleistocene, Middle–Late Paleolithic	1877 / J. BAKER; 1925–1928 / P. PETROV; 1950–1952 / N. DŽAMBAZOV; 1920–1929 / V. MIKOV; 1921 / G. KACATOV; 1980s / S. IVANOVA	MIKOV & DŽAMBAZOV 1960, DORCKNER 2006, ŽALOV 2016
19	Borikovska Cave nr. Mogilica (Smolán)	1250	Late Pleistocene	1962 / D. RAJČEV, G. RAJČEV & T. ČOLAKOV; 1981 / D. RAJČEV	NIKOLOV 1983, BERON et al. 2006, PETROV & STOEY 2007
20	Cave No 5 nr. Lozevo (Šumen)	400	Paleolithic	early 2000s / V. HLEBAROV	HLEBAROV 2004
21	Peš Cave nr. Staro Selo (Vraca)	325	Late Paleolithic	1951–1953 / N. DŽAMBAZOV	BERON et al. 2006
22	Mečata Dupka Cave nr. Stoilovo (Burgas)	136	Late Paleolithic	2011 / S. IVANOVA	IVANOVA et al. 2012
23	Pobiti kamāni nr. Slančevo (Varna)	150	Paleolithic, 25,000–30,000 BP	1935, 1948 / J. PETROK & A. VALKANOV	DŽAMBAZOV 1959, MARGOS 1960
24	Samuilica 1 and 2 nr. Kuningo (Vraca)	350	Paleolithic, 75,000–42,000 BP	1954 / N. DŽAMBAZOV	DŽAMBAZOV 1955

reported on a mandibular fragment with teeth from the Paleolithic layers of the Cave No. 5 (Sumen Province).

Concerning the number of the known sites of this carnivore in the country, until 2006 it was twice smaller than their number presented here (Table 1). New findings of remains of the cave hyena have been made also in the recent years. At present, preserved bone remains of the cave hyena are known from 24 caves. In fact they are spread mainly across northern Bulgaria. Among

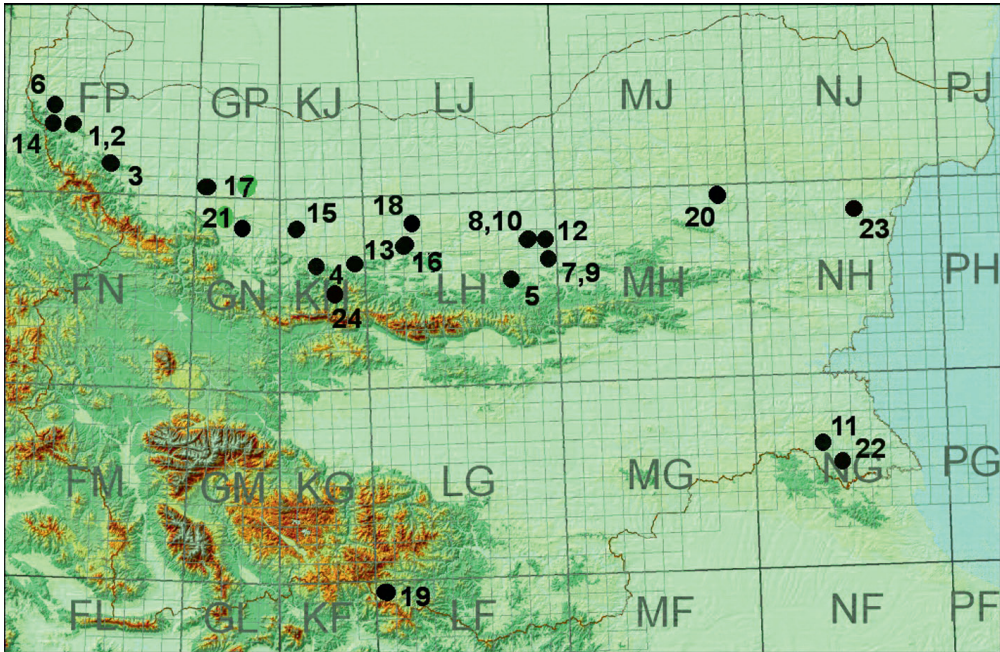


Fig. 1. Former distribution of *Crocota crocuta spelaea* in Bulgaria. Numbers correspond to the list of localities in Table 1; Kozarnika (Suhi Peč) Cave (1), Mirizlivka Cave (2), Mišin Kamik Cave (3), Morovica Cave (4), Bačo Kiro (Malka Drânovska) Cave (5), Magura (Rabiška) Cave (6), Golâmata (Podgolvmeľskata) Cave (7), Golâmata Cave (8), Malkata Cave (9), Malkata (Toneva) Cave (10), Leârnite (Leârnicite) Cave (11), Manastira Cave (12), Toplâ Cave (13), Redaka 2 Cave (14), Temnata Dupka Cave (15), Tabaškata Cave (16), Mladenova Cave (Mladenova Propast Cave) (17), Devetaškata Cave (18), Borikovska Cave (19), Cave No 5 (20), Peš Cave (21), Mečata Dupka Cave (22), Pobiti kamâni (23), Samuilica Caves 1 and 2 (24).

Фиг. 1. Минало разпространение на *Crocota crocuta spelaea* в България. Номерацията отговаря на находищата от Таблица 1; Пещера Козарника (Сухи Печ) (1), Миризливка (2), Мишин камик (3), Моровица (4), Бачо Киро (Малка дряновска пещера) (5), Магура (Рабишка пещера) (6), Голямата (Подголмелската) пещера (7), Голямата пещера (8), Малката пещера (9), Малката (Тонева) пещера (10), Пещера Леярните (Леярниците) (11), Пещера Манастира (12), Топля (13), Редака 2 (14), Темната дупка (15), Табашката пещера (16), Младенова пещера (Младенова пропаст) (17), Деветашката пещера (18), Бориковска пещера (19), Пещера № 5 (20), Пещера Пеш (21), Мечата дупка (22), Побити камъни (23), Самуилица 1 и 2 (24).

them the Redaka 2 Cave showed to be the most abundant Bulgarian site in terms of fossils of the cave hyena and its exploration still continues. Remains of the cave hyena were found in all Early and Middle Paleolithic layers of this cave (SIRAKOV 2020).

Unfortunately among these several dozens of publications, there are no papers dealing in details with *C. c. spelaea* fossils, its taphonomy, osteology, or paleoecology. All of them represent archaeological excavations and list various kinds of finds, incl. fossil bones of mammals (or of cave hyena in particular). Only in the last decade, mammalogists have been involved in some of these complex archaeological studies.

Distribution

Data in the map (Fig. 1) show three major regions that were more attractive for the cave hyena in the Pleistocene of Bulgaria. These regions represent parts of the major karst areas in the country. The Predbalkan Mts. in northern Bulgaria are the largest part of the former range of *C. c. spelaea* in the country. It is a long belt across northern Bulgaria, 14,389 km² in size, at the altitudes of 364–1490 m a. s. l. Nineteen of the total of 24 sites are located there. The northern (Bulgarian part of the) Strandja Mts. and the southern part of the Western Rhodopes revealed only two and one sites, respectively. Nevertheless, findings in these mountain ranges are important, suggesting that the cave hyena was strictly dependent on karst landscapes even in the southern peripheries of its range. Similar rocky landscapes dominated around the Pobiti kamāni site (No. 23, Fig. 1).

Altitudinal distribution of the cave hyena in Bulgaria was confined between 136 and 1250 m a. s. l. Sixteen sites (about 73%) are located at 136–400 m a. s. l. Almost all sites are situated below 750 m a. s. l., with only one exception – the Borikovska Cave (1,250 m; Table 1). This could indicate that climatic conditions in the mountain habitats at higher altitudes were unfavourable for this animal. Caves in hilly landscapes and the foothills of the mountains seem to be most preferred, both in the inland parts of the country and along the Black Sea coast. The large ungulates were much more abundant in the plain open grasslands and hilly areas than on higher and forested mountain slopes.

The cave hyena was not a subject of special research in Bulgaria. Its fossil remains were usually found in the archaeological excavations in the caves inhabited by fossil man and this could also affect the available picture of the cave hyena distribution.

The fossil record of *C. c. spelaea* in Bulgaria proves the wide distribution of the species in the low-mountain rocky regions of the country. Its Pleistocene localities are concentrated in the Predbalkan Mts. (83%), Strandja Mts. (8%), the Western Rhodopes and southern Dobruja (4% each). The sites were confined between 136 and 1250 m a. s. l. All Bulgarian sites represent prehistoric human dwellings, which indicates competition between man and this carnivore for shelter and dwelling.

РЕЗЮМЕ

Статията обобщава всички разпръснати данни от последните 116 години за разпространението на късноплейстоценската западна пещерна хиена в България, част от които са непубликувани. Представени са данни за 22 фосилни находища (среден – късен плейстоцен) от 9 от 28-те области в страната. Фосилната летопис доказва широкото разпространение на вида в нископланинските части на страната. Плейстоценските му находища са концентрирани в Предбалкана (83%), Странджа (8%), Западните Родопи и Южна Добруджа (по 4%). Те са разположени между 136 и 1250 м.

н. в. Около 75 % от тях са разположени между 136 и 400 м н. в. Всички находища (с изкл. на едно) в България представляват някогашни човешки жилища – индикация за конкуренцията на човека с този хищник за убежища и подслон в пещерите.

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