

## *Chasmaporthetes lunensis* (Hyaenidae, Carnivora) from the Early Pleistocene of Crimea

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**Abstract**—A maxillary fragment of the extinct hyena *Chasmaporthetes lunensis* (Del Campana, 1914) is described from the Early Pleistocene locality of the Taurida cave (Crimea, Late Villafranchian, 1.8–1.5 Ma). The species was a typical representative of the Villafranchian faunas of Eurasia. This is the first record of the genus *Chasmaporthetes* in the Pleistocene of Crimea.

**Keywords:** *Chasmaporthetes lunensis*, Late Villafranchian, Taurida cave, Crimea, premolars

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The genus *Chasmaporthetes* Hay, 1921 combines the Neogene and Pleistocene species of relatively large but lightly built hyenas, which are called “hunting hyenas” because of their long, thin limbs. It is assumed that, unlike many other hyenas, *Chasmaporthetes* were active hunters, well adapted to running.

Specialization for active predation is also reflected in the structure of the dental system of these hyenas. All the cheek teeth of representatives of the genus *Chasmaporthetes* are of the trenchant (hypercarnivorous) type. The premolar teeth are more slender than in other Plio-Pleistocene hyenas, have shearing blades on the main cusps and strongly developed posterior accessory basal cusps. *Chasmaporthetes* are characterized by a narrow carnassial tooth m1 without a metaconid; its short talonid does not have a basin (unlike other hyenas) and consists of a single shearing blade, which is formed by a hypoconid [1–3].

The genus *Chasmaporthetes* existed since the Late Miocene (Turolian) till the Early Pleistocene (1.4–0.8 Ma). Its range included a significant part of Eurasia (*C. lunensis* (Del Campana, 1914); *C. borissiaki* (Khomenko, 1932); *C. bonisi* Koufos, 1987; *C. exitelus* Kurtén et Werdelin, 1988; *C. gangsriensis* Tseng, Li et Wang, 2013); Africa (*C. nitidula* Ewer, 1955; *C. australis* Hendey, 1974); and North America (*C. ossifragus* Hay, 1921) [1, 4]. This is the only genus of Hyaenidae that entered North America [4, 5].

Members of the genus *Chasmaporthetes* were most widespread in the Villafranchian. *C. lunensis* was widespread in Eurasia since the Late Pliocene till the Early Pleistocene. In Spain, this species was found in the Pliocene Layna and Villarroya localities [6–8] and the Early Pleistocene La Puebla de Valverde locality [9]. In France, *C. lunensis* is known from the Pliocene Etouaires locality and from the Lower Pleistocene Senez, Roccaneyra, Saint-Vallier, and Pardines localities [10, 11]. In Italy, the Early Pleistocene remains of *C. lunensis* were found in the Olivola, Val di Magra, and Inferno localities [10, 12]; in Germany, they were found in the Erpfinden locality [13].

Outside Europe, *C. lunensis* was found in Turkey in the Pliocene localities Gulyazi [14] and Çalta [15]. Materials on *C. lunensis* from the Pliocene and Pleistocene of Eurasia were described in detail by M.V. Sotnikova [2, 16] from the localities of Beregovaya (Russia, Transbaikalia), Odessa catacombs (Ukraine, MN15; subspecies *C. l. odessanus* Sotnikova, 1994), Shamar (Mongolia, MN16), and Kuruksay (Tajikistan, MNQ17). *C. lunensis* is also present in several Chinese Pliocene localities [1, 17]. In addition to *C. lunensis*, *C. kani* Galiano et Frailey, 1977, *C. progressus* Qiu, 1987, and *C. bielawskyi* (Schaub, 1941) were also distinguished in Asia (see [17]), but at present they are justifiably considered as synonyms of *C. lunensis* [18].

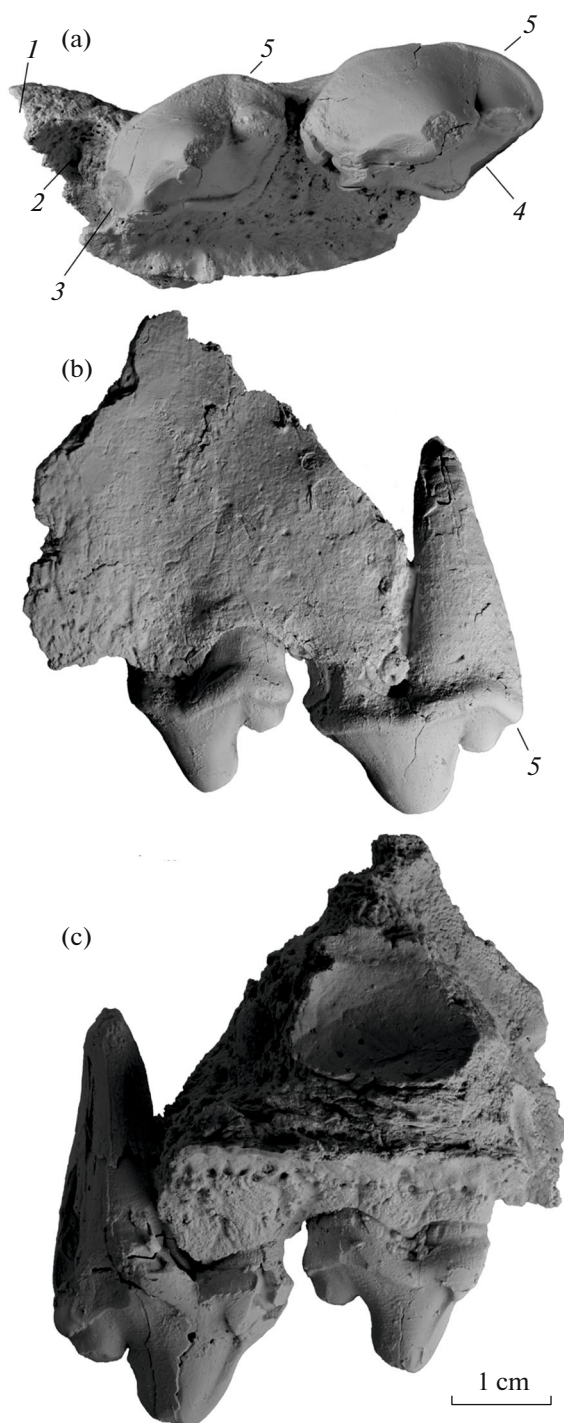
*Chasmaporthetes* records are rare in Eastern Europe. Since that the new materials from the Taurida cave in Crimea are of special interest. The cave is located 15 km east of Simferopol near Zuya village of the Belogorsk district. Based on the composition of the vertebrate fauna, the bone layer was dated as the Early Pleistocene (Late Villafranchian, Psekupsian Faunal Assemblage, 1.8–1.5 Ma) [19]. The excavations in the cave yielded numerous bones of carnivores, including Hyaenidae. The overwhelming

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**Fig. 1.** *Chasmaporthetes lunensis* (Del Campana, 1914), specimen PIN, no. 5644/110, left maxillary fragment with P2–P3: (a) occlusal view, (b) labial view, (c) lingual view; Crimea, Taurida cave; Lower Pleistocene. Designations: 1, distal margin of the C1 alveolus; 2, distal part of the P1 alveolus; 3, wear facet from occlusion with p2; 4, wear facet from occlusion with p3; 5, cingulum.

majority of hyena remains (to date, more than 100) belong to a giant hyena *Pachyrococa brevirostris* (Gervais, 1850), and a single 2021 find, i.e. the maxillary fragment described below, belongs to *C. lunensis* (Fig. 1).

This is the first record of *Chasmaporthetes* in the Pleistocene of Crimea [see 20].

The studied specimen is stored at the Borissiak Paleontological Institute of the Russian Academy of Sciences (PIN), Moscow. The measurements were carried by calipers with an accuracy of 0.1 mm. The greatest anteroposterior length (L) and the greatest labiolingual width (W) were measured on the teeth.

A left maxillary fragment (specimen PIN, no. 5644/110) preserved complete two-rooted premolars P2–P3 and parts of the alveoli of single-rooted teeth—canine C1 and anterior premolar P1 (Fig. 1). The distal margin of the C1 alveolus closely adjoins the P1 alveolus. The width of the preserved part of the P1 alveolus is 11.9 mm; and the reconstructed width of P1 is 12.2–12.4 mm. The distal margin of the P1 alveolus adjoins the P2 alveolus without a diastema.

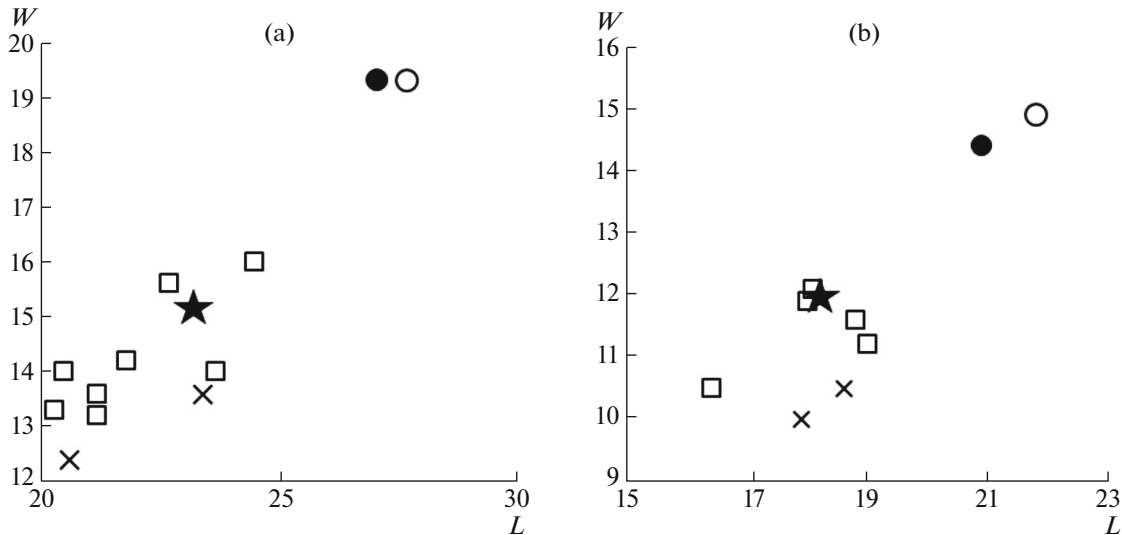
Premolars P2–P3 have a high conical main cusp, a reduced anterior accessory cusp displaced lingually, and a strongly developed posterior accessory basal cusp, as well as a strong continuous cingulum and a distally displaced basal lingual prominence (protocone prominence), which are characteristic of *Chasmaporthetes*.

The main cusps of P2–P3 are compressed labiolingually, convex labially and nearly flat lingually, and slightly inclined posteriorly. The main cusp on P2 is much shorter and lower than on P3. The anterior and posterior shearing blades are well expressed. The base of the anterior shearing blade is displaced lingually from the axis of the tooth. The anterior accessory cusps are strongly reduced and flattened, displaced lingually (they are distinguishable from the lingual side of P2 and P3 by the presence of corresponding folds at the base of the main cusps). The posterior accessory basal cusps are high, strongly compressed labiolingually, and separated from the main cusps by deep notches. The cingulum is especially pronounced along the lingual side, and on the labial side it is distal to the main cusp. The protocone prominence does not have its own apex; its surface is even and inclined lingually. The margin of the protocone prominence is clearly outlined by the lingual cingulum.

The teeth measurements (in mm) of specimen PIN, no. 5644/110 are as follows: P2: L, 18.2; W, 12.0; and P3: L, 23.2; W, 15.2.

The mesial edge of P2 is clearly displaced lingually relative to the axial line of the P1–P3 tooththrow and has a wear facet from occlusion with p2. In the distal part of the protocone prominence of P3, the wear facet from occlusion with p3 is clearly marked. This indicates a small excursion (mobility) of the mandible, which is necessary for a tight fit of the premolars when they are occluded.

Specimen PIN, no. 5644/110 shows the characteristic features of *Chasmaporthetes*, including the labiolingually compressed main cusps with developed anterior and posterior shearing blades on the upper premo-



**Fig. 2.** Comparison of the sizes of upper premolars P2 and P3 of *Chasmaporthetes* and *Pachycrocuta* (L, length; W, width; in mm): (a) P2, (b) P3. Designations: asterisk, *C. lunensis* (Del Campana, 1914), specimen PIN, no. 5644/110, Taurida, Crimea, Russia; square, *C. lunensis*, various localities of Eurasia [6, 11]; oblique cross, *C. borissiaki* (Khomenko, 1932), Moldova and France [1]; circle, *P. brevirostris* (Gervais, 1850), Taurida, Crimea, Russia: without filling, specimen PIN, no. 5644/104; with filling, specimen PIN, no. 5644/162.

lars. The dimensions and structure of P2–P3 in specimen PIN, no. 5644/110 correspond to those of *C. lunensis* (see Fig. 2). The reduction of the anterior accessory cusps is characteristic of *C. lunensis*, in contrast to *C. exitelus* and *C. nitidula* [1, 2]. The structure of the premolars corresponds to the shearing specialization of a pair of carnassial teeth P4/m1.

The ratio of the number of the remains of *Chasmaporthetes lunensis* and *Pachycrocuta brevirostris* in the Taurida cave is close to 1 : 100. It can be assumed that the former species was a relatively rare element of the mammalian fauna in the Early Pleistocene of Eastern Europe. The presence of *C. lunensis* corresponds to the age interval of 1.8–1.5 Ma established for the Taurida faunal assemblage based on the analysis of its composition [19]. *Chasmaporthetes* find described above is one of the latest record in Europe.

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