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HYAENA BREVIROSTRIS, A CURIOUS FRAGMENT FROM THE BOTTOM OF THE NORTH SEA

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ABSTRACT

A fossil fragment of the right maxilla and premaxilla of a large terrestrial carnivore, collected in 1983 somewhere West of the Brown Ridge in the southern part of the North Sea, is described and identified, through a process of elimination, as *Hyaena brevirostris* Aymard, 1846, of Early to Middle Pleistocene age.

INTRODUCTION

Some time during the year 1983 one of our correspondents, Skipper K.W. Tanis (Breenstraat 12, 3252 LC Goedereede), collected a heavily mineralized fossil fragment which forms the subject of the present paper. He did so when trawling for flat-fish along the bottom of the southern part of the North Sea to the West of the Brown Ridge (Fig. 1). It is a pity that, at that moment, no more exact note was taken of the location of the fossil find. In view of its state of preservation and its colour it might be quite possible that it came from some part of the so-called Deep Water Channel, where some Early Pleistocene and even Pliocene deposits probably crop out along the sea floor. Mr Tanis brought the fragment, which is inscribed in his private fossil collection under the number 031, to our attention in 1994 hoping that we might be able to give an opinion regarding its identity.

DESCRIPTION

The fossil (Fig. 2 A-D; Fig. 3 A-D) consists of part of a right maxilla, with some of the adjoining premaxilla, of a large and heavy terrestrial

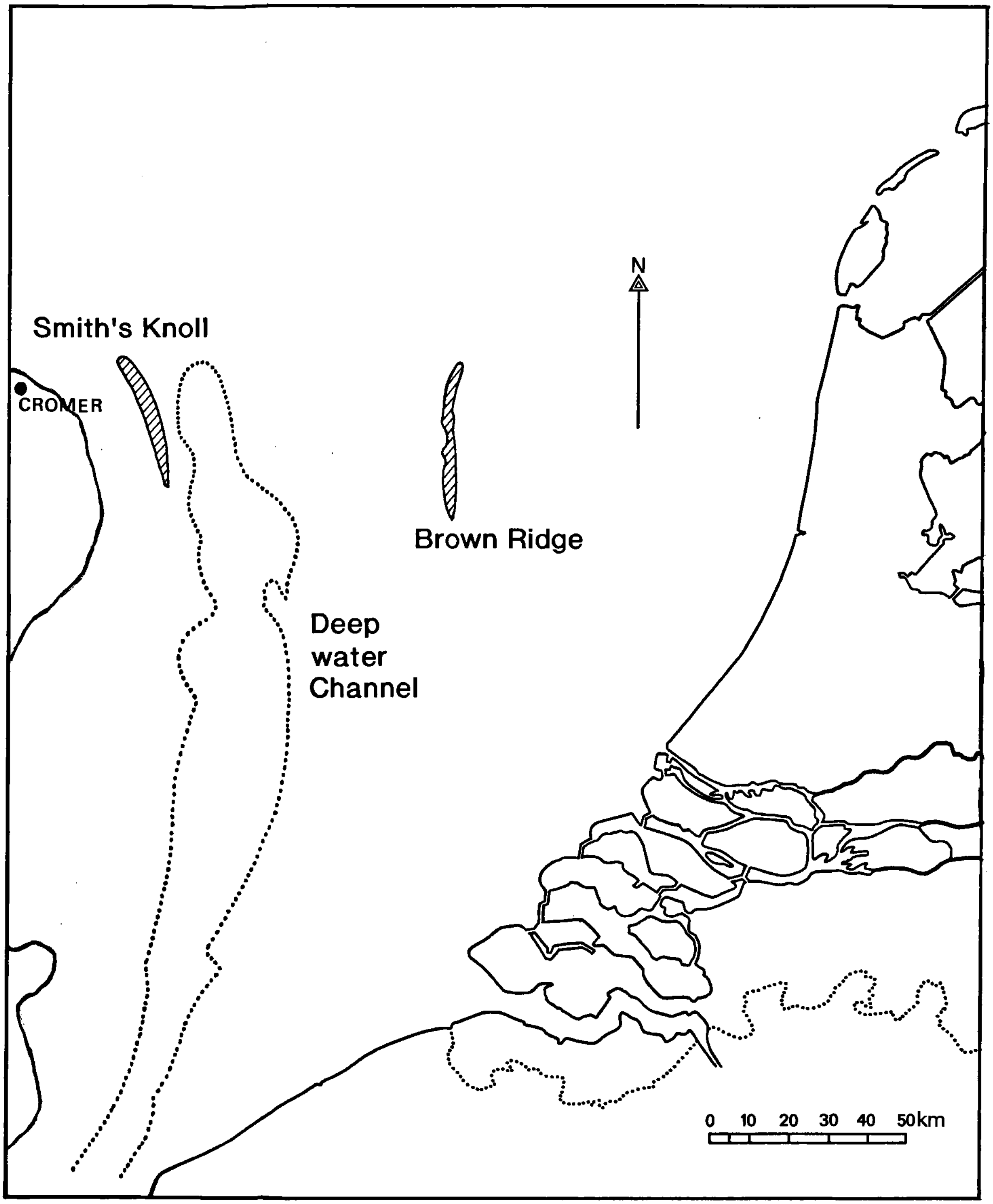

Fig. 1. The southern part of the North Sea basin with the Brown Ridge and Deep Water Channel.

carnivore (as will be shown in the discussion following upon this description). It contains the right upper canine which, in comparison to the surrounding bone structure, is not particularly large, although quite sturdy and robust. No distinct enamel ridges are observable between the tip of the tooth and its base, although a ridgelike feature may be recognized by touch. Small wart-like concretions that probably originate from the erstwhile surrounding sediment adhere to the enamel all around.

Other recognizable parts of the dentition are a fragment of an almost circular root of a third right upper incisor (which, itself, has broken off nearly flush with the palatinal plane), and, some 18 millimetres behind the canine, an oval root-stump of what we presume to be the first premolar. These few remains of the dentition stand at the border of a roughly oval-shaped area showing slight irregularities. Among these is an antero-posteriorly running shallow groove. The area represents a small part of the animal's hard palate. Seen from its internal plane of fracture, the most striking features are formed by a set of conchoidal surfaces (Fig. 2A; Fig. 3A) that can be recognized as part of the right maxillo-turbinal and nasal turbinal superficies. At their lower border the only 4 mm thick section of the hard palate can be observed. In front this is pierced by the distal half of the right nasopalatine duct or foramen incisivum, which has an anteroposterior diameter of 10 mm. Remains can be seen of the palatine suture between premaxilla and maxilla, which runs between the base of the canine and the posterior edge of the nasopalatine duct over a distance of 21 mm.

From in front, the concavity of the palate can be observed while the canine juts out, describing an angle of some 135 degrees with the fairly straight, weathered and broken premaxillary edge. This edge itself is no longer complete but shows that the premaxilla must have been short, blunt and hardly protruding beyond the connecting line between the canines. Some 20 millimetres of the root of the right third incisor lie bare as a result of the breaking away of the compact outer bony cover above it.

Viewed externally from the buccal side, the axis through the canine is directed anteriorly; it describes an angle of 132 degrees with the preserved fragment of the jaw's upper edge between P^1 and C. A small nutritional foramen pierces the external maxillary compacta at 10 mm vertically above the emplacement of P^1. It should be noted that this single-rooted premolar has very probably been peg-like in appearance and that it has been protected at its buccal side by a low bony excrescence or embankment of the maxillary edge. A shallow, sagittally and backwards directed concavity of the external maxillary compacta exists between the mesial base of the canine and the root of the third incisor (Fig. 3D).

Dimensions of the 32 mm long canine, measured at its base, are: diameter in a mesiodistal direction 25.6 mm, and at right angles to this measurement, therefore in a linguo-vestibular direction, 24.7 mm. The root-stump of the third incisor has a mesiodistal diameter of 7.8 mm and a linguo-vestibular one of 7.6 mm. The root-stump of the first premolar measures 10.6 mm in a mesiodistal direction and 7.5 mm in a linguo-vestibular one. The measurable distance of the medial line of fracture of the palate is 83 mm. Maximum height of the fragment, measured at right angles to the palatal plate at its back, is 53 mm. The distance from the point of the canine to this highest point above the palate, at the back, is 126 mm. Colour and hue of the fossil fragment, according to the revised Munsell scale (Oyama et al., 1967) is 10 YR 3/2 to 2/2 (brownish black).

DISCUSSION AND IDENTIFICATION

This very incomplete fragment still displays a few characteristic features that may aid an attempt at identification. The first, and perhaps most important one of these, is the indisputable fact that the entire animal to which this small maxillary/premaxillary piece belongs, must have attained a very considerable size. The form and aspect of the sole preserved tooth, the canine, moreover indicates that it was a carnivore.

We are therefore looking at a fossil scrap of some large carnivore. In accordance with what is known about fished-up fossil remains from the southern North Sea basin, such objects may date

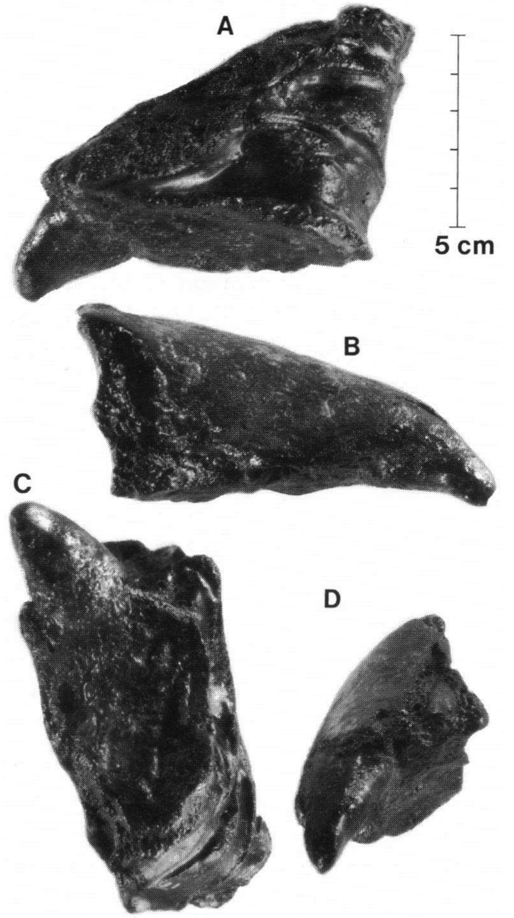

Fig. 2. Fragment of right maxilla and premaxilla, with canine, of *Hyaena brevirostris* Aymard, 1846; North Sea, West of the Brown Ridge, coll. Tanis no. 031; A. Internal aspect of part of nasal concha and plane of fracture through hard palate with half of nasopalatine duct; B. External aspect of fragment seen in profile with canine at right; C. Palatal aspect of fragment with maxillo-premaxillar suture between canine and caudal end of foramen incisivum; D. Frontal aspect of fragment with canine and stump of third incisor; note shallow sagittal runnel between these two elements.

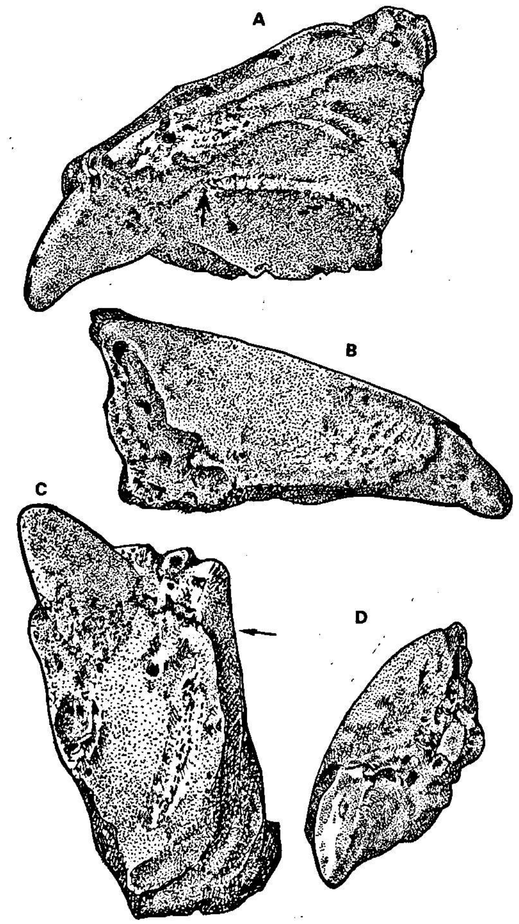

Fig. 3. Artist's rendering of A - D of Fig.2, on the same scale. Arrows in A and C indicate caudal point of foramen incisivum where maxillo-premaxillar suture in fragment ends. Arrow in D points down the sagittal shallow runnel mentioned in Fig.2.

back to (presumably) Upper Pliocene, or to Early, Middle, or Late Pleistocene, as well as to Holocene times. Since the North Sea basin has evidently been dry land during several periods but was, alternatively, inundated again, mammalian fossils collected by fishermen may either represent marine or terrestrial animals.

In our case, that of a large-sized carnivore, the only marine mammals of sufficient size to be considered at all would be Walrus species and full-grown Hooded Seals. It will be clear that this, already because of the absence of any tusk-like tooth, is out of the question as regards *Odobenus* species. *Cystophora cristata* can also be precluded in view of the completely different anatomy of the proximal maxillary parts and its rather small canines.

A terrestrial carnivore is therefore indicated. Several species of an adequate size have been described from the southern part of the North Sea and from its immediate surroundings (e.g. Hooijer, 1962; Stuart, 1982; Bosscha Erdbrink, 1983a, 1983b). Among these are Felidae such as

Cave Lions (*Panthera leo spelaea*), large Early Pleistocene Leopards (*P. gombaszogensis*), Sabre tooths (*Homotherium latidens*), Ursids such as the Early Pleistocene *Ursus etruscus*, the Brown Bear *Ursus arctos* (amongst which we also count the frequently mentioned spurious species "*deningeri*"), the Cave Bear *Ursus spelaeus*, and the Bear-Dog *Agriotherium* sp. (syn. *Hyaenarctos*) , and finally Hyaenids (Early Pleistocene *H. perrieri* and *H. brevirostris*, and the more modern Cave Hyaena *Crocuta crocuta spelaea*).

The three large cats can be ruled out, either because their canines are flat, extremely large, and serrated, as in the Sabre tooths; or because these teeth are relatively longer, more slender and distinctly more oval-shaped in cross-section than in our specimen, usually with a clear vertical enamel keel running from the tip backwards to the enamel-dentine border.

Among bears and bear-like forms canines may be encountered that are less slender and less oval in cross-section than those of the Felidae. Nevertheless, a vertical enamel keel from the tip to the distal enamel-dentine border is nearly always present in *Ursus*. Another difference from the situation in our fossil consists of the fact that, in every Ursid species, the first premolar (when present at all) always follows immediately behind the canine in the upper dentition, without there being any appreciable diastema (as is, for instance, illustrated in the several plates of the upper dentition of each species in Erdbrink, 1953). In *Ursus spelaeus*, the Cave Bear, the first premolar tends to be absent altogether save in a very few cases.

The Pliocene Ursid *Agriotherium* (syn. *Hyaenarctos*) has been recorded (two isolated upper first molars of an *Agriotherium* sp.) from the neighbourhood of Waldringfield in the Crag of East Anglia by Flower (1877) (see also Stuart, op. cit.). The identical situation, no appreciable diastema between P^1 and $C^{sup.}$, seems to exist in this animal, at least according to the description given by Falconer and Cautley (see Murchison, 1868, pp. 321-327 and Plate XXVI) of the type specimen of *A. ("Ursus") sivalense* from the Siwalik Hills in India, probably an ubiquitous Eurasian-North American species (see Erdbrink, 1953) with a range comparable to that of the recent Brown Bear. An accompanying figure in the present paper (Fig. 4a, a partial, enlarged reproduction) of upper dentitional elements shows the alveolus of a P^1 right behind the distal base of the large, blunt canine.

Yet another difference between the described fossil and the members of the Ursidae with which it is compared here, is encountered when the course of part of the suture between premaxilla and maxilla, between the lingual base of the canine and the foramen incisivum, is considered. This course is very typically illustrated for *Ursus* in the case of a recent American Black Bear, *Ursus americanus* (Fig. 4b; Fig. 5e), specimen number ZMA 24.412 in the collection of the Zoological Museum of Amsterdam University. *U. americanus* was selected by us because it probably displays most likenesses with the Early Pleistocene *Ursus etruscus*. The sutural part starts at the lingual side of the canine, curves gracefully back in a caudal direction and then recurves frontally to reach the foramen incisivum exactly at its most caudal point. Comparison with the several plates accompanying descriptions of the existing species of *Ursus* in Erdbrink, 1953, shows that this is a common feature, shared with *U. arctos*, *U. spelaeus*, and even with the Giant Panda. The situation in *Agriotherium* (Fig. 4a) is not clear, probably owing to complete synostosis. In our fossil fragment (Fig. 2C, Fig. 3C, Fig. 4d), the course of this part of the suture is quite different, as it forms a more or less direct connection (along a sinuous line) between the lingual base of the canine and the distal middle half of the indicated situation of the nasopalatine duct.

Still one more morphological difference between the Ursidae and the fossil under consideration can be found in the form of the surface of the nasal concha. In the Ursidae this is a single large concave plane, extending deeply backward. In the fossil, on the other hand, as is described above and figured (Fig. 2A; Fig. 3A; Fig. 5b) it is distinctly divided into a maxillo-turbinal and a naso-turbinal part, both of which lie quite in front.

These several differences taken together suffice, we think, to indicate that the fossil fragment cannot be ascribed to either an Early Pleistocene form such as *Ursus etruscus* (which did not attain a sufficiently large size), a Pliocene *Agriotherium* sp., or to Middle Pleistocene, Late Pleistocene or

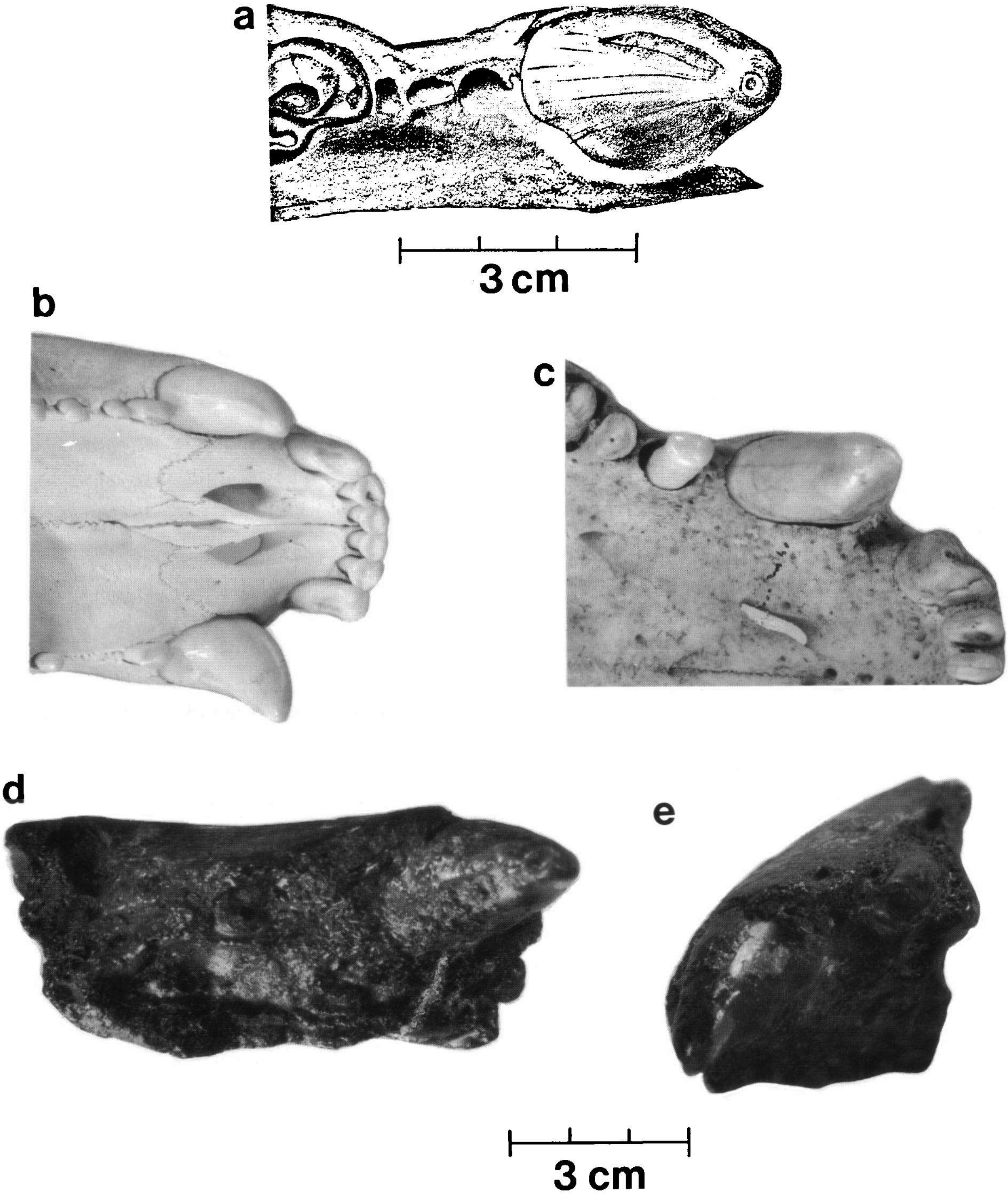

Fig. 4. a. Reproduction of partial palatal aspect of type specimen of *Agriotherium sivalense* (after the illustration in Murchison, 1868); b., c. Partial palatal aspects of, respectively, recent *Ursus americanus* (ZMA 24.412) and *Hyaena hyaena* (ZMA 1.023) to show emplacements of first premolar and course of maxillo-premaxillar suture between canine and foramen incisivum; d. The same aspect as b and c, in the described fossil fragment; e. Frontal aspect (as in Fig. 2D), slightly turned upwards to improve the view of the shallow sagittal runnel running up the snout (b - e on the same scale).

even Holocene Bears such as *Ursus spelaeus* or *Ursus arctos.*

This process of elimination brings us to the last-mentioned possibility, namely that the fossil fragment belongs to one of the three Hyaenas mentioned. For purposes of comparison we have figured part of the skull and dentition of a large recent *Hyaena hyaena* from the collection of the Amsterdam Zoological Museum, number ZMA 1.023 (Fig. 4c; Fig. 5d). As can be seen, this specimen possesses single-rooted, peg-like first upper premolars, which stand apart from their respective canines by diastemata of approximately 3.5 mm. The canines themselves measure some 21 mm in a mesiodistal, and 15 mm in a labiolingual direction, while their length (or height) is 23 mm. There are no visible or palpable traces of any enamel ridge running from their tips backwards to the enamel-dentine border. The first premolars are surrounded, at their bases, by distinct bony outgrowths from the maxillary edge.

A diastema between P^1 and the upper canine appears to be a common feature of *Hyaena* and *Crocuta.* In the latter case the reader may ascertain this fact, for instance, by consulting plate 14 in Pales and Garcia (1981; "*Hyaena crocuta*"). In the case of a fossil *Hyaena brevirostris licenti* (Pei, 1934) we may perhaps refer to a previous paper by one of us (Erdbrink, 1968, Pl. 6, c) in which it is clearly visible that a considerable diastema between the two teeth is present. In the redescription of the type specimen of *Hyaena brevirostris* Aymard, 1846, from Sainzelles, France, by Boule (1893, p. 91) it is stated (and confirmed by the accompanying figure, Pl. 1) that P^1 is absent in this complete skull (Pl. 4, c). However, the tooth is present in another specimen, part of a snout, which Boule encountered in the same collection, that of the town of Le Puy. He states that it exactly resembles P^1 of other hyaenas. Although it may imply that a diastema P^1-$C^{sup.}$ also exists here, such is not explicitly affirmed.

A second feature of importance is the course of the suture between maxilla and premaxilla along the distance from the canine to the foramen incisivum in our present specimen (Fig. 2C; Fig. 3C; and Fig. 4d). In ZMA 1.023 this suture is largely obliterated as a result of synostosis, but a few remaining traces (Fig. 4c) still show that its course is nearly identical with the one in our fossil. In *Crocuta* (Pales and Garcia, op. cit., plate 15) the suture is almost alike, viz. a nearly direct line between the lingual face of the canine and the posterior part of the distal side of the incisive foramen.

A third feature, that of the configuration of the distal limit of the nasal concha, is morphologically identical in our fossil and in ZMA 1.023 (Fig. 4e; Fig. 5d). In the recent specimen the maxilloturbinal and nasal turbinal superficies, although notably smaller than in the fossil, are placed in an absolutely comparable manner.

Finally, the recent *Hyaena hyaena* displays the same shallow, sagittally and posteriorly directed concavity of the maxillary surface between the mesial base of the canine and the root of the third incisor, running up alongside the distal edge of the nasal aperture; a feature, however, that is also present, although less distinct, more vertically directed and less distantly prolonged upward, in the figured type specimen of *Agriotherium sivalense* (Fig. 5a).

From these morphological arguments we think that it can be gathered that the fossil fragment described in this paper can be identified as a Hyaena. While the Pleistocene Cave Hyaena, *Crocuta crocuta spelaea* (Goldfuss, 1810) is recorded from the floor of the North Sea as well as from the Cromer Forest Bed (Newton, 1883), and a theoretical presence of the Early Pleistocene *Hyaena perrieri* Croizet et Jobert, 1828, cannot be ruled out, the extremely large size of our fossil provides the final clue in this case. Both Boule (op. cit., p. 94) and Kurtén (1956, p. 38; "A *Hyaena* of medium size") agree in that *perrieri* is a distinctly smaller form than *brevirostris,* which had attained the size of a male lion. The two Pleistocene European Spotted Hyaenas, *Crocuta crocuta* ssp. and *Crocuta crocuta spelaea,* each larger in size than the recent African *C.c. crocuta* but belonging to the same single cline (as has been convincingly argued by Kurtén, 1957, p. 9 and fig. 3), still do not attain the enormous size reached by Aymard's *Hyaena brevirostris.* This is illustrated for many dental, cranial as well as for other skeletal aspects and measurements in several figures (1-10) and tables (1-9) in the already cited 1956 paper by Kurtén. In the case of the presently described fossil fragment it may suffice to compare the (admittedly very few) measurements

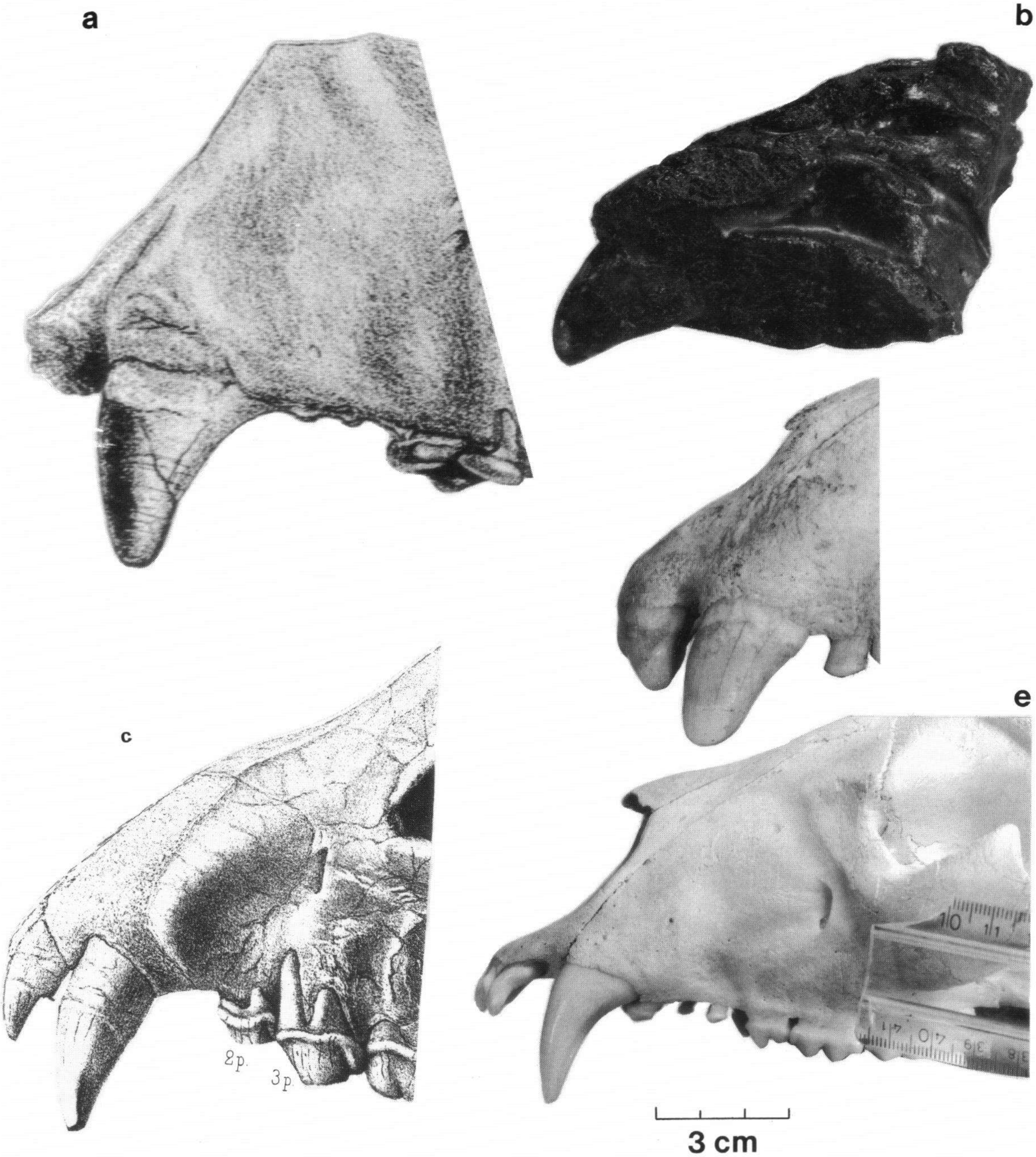

Fig. 5. a, c - e. Profile aspects of a. *Agriotherium sivalense* (after Murchison, 1868); c. *Hyaena brevirostris* (type specimen, after Boule, 1893, pl. 1); d. *Hyaena hyaena* (ZMA 1.023); e. *Ursus americanus* (ZMA 24.412); b. internal aspect of fossil fragment (as in Fig. 2A). a, b, d, e all on the same scale, c on 3/4 of this scale.

with those given by Boule (op. cit., pp. 92-93) of the type and (presumed) cotype specimens from Sainzelles; its mesiodistal length of the Csup. at the enamel-dentine border is 24 mm, and the length of the first premolar 8 mm. In our case these two measurements read 25.6 and 10.6 mm, respectively, so that it can be presumed that our specimen has been even slightly larger than the two from Sainzelles.

While this argument alone is already sufficient, in our opinion, to identify the present fossil fragment in the Tanis collection as a *Hyaena brevirostris brevirostris* Aymard, 1846, the observation made by us in its description, namely that the premaxilla must have been short and blunt, only strengthens such a conclusion. It is in perfect accordance with the circumstance that the short and blunt snout displayed by the skull of the type specimen caused its describer to give it its specific name *brevirostris*.

Regarding its possible stratigraphical age we can only refer to Kurtén (1956 and 1957), who has shown that *H. brevirostris* existed during the Early and the beginning of the Middle Pleistocene up to the Cromerian in W. Europe. During or immediately after the Cromerian the species appears to have been superseded by *Crocuta crocuta*, perhaps because this latter species (if actualistic argumentation should be permitted) hunted in packs while *Hyaena* seems to be more of a solitary hunter.

Hyaena brevirostris, although always a relatively rare fossil, is known from East Anglia, viz. the remarks made by Kurtén (1956, pp. 40-41): "The remains of *H. brevirostris* from the Forest Bed are all fragmentary and badly battered, but they are identifiable from the gigantic size of the canines and rami and the large anterior premolars. Finds from Mundesley, Palling, and Bacton apparently represent this species....." etc. This statement, on the fragmentary and badly battered state of the fossils, agrees well with our presently described fossil. Stuart (op. cit., p. 43, fig. 3.34) even figures a right mandibular fragment, probably from Bacton.

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