Crocuta crocuta spelaea remains from a Late Pleistocene hyena cave den site near Hochdahl in Neandertal (NW Germany)

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Summary

In this article, cranial, mandibular and dental remains of the Ice Age spotted hyena *Crocuta crocuta spelaea* (Goldfuss 1823) are described. They belong to an old collection of material from the Devil's Chamber Cave (Teufelskammergrotte) near Hochdahl in the Neandertal valley (NW Germany) of Late Pleistocene age (Weichselian). These are the few remains of a hyena den cave close to the Feldhof Cave where the first Neandertal human skeleton was found. In addition to the hyena bone material some hyena prey remains of *M. primigenius, C. antiquitatis, B. priscus, E. ferus przewalskii* and *U. spelaeus* were excavated in the 19th century. All show clear nibbling and chewing marks and prove that the Devil's Chamber Cave was a hyena den. The site was completely destroyed by quarry activities in the past century. The few remains are important for our understanding of the ecology and distribution of the Ice Age spotted hyenas in the cave-rich Sauerland region. Hyenas and Neandertal men, which must have lived in the same valley during the same Weichselian period, and which both used small caves, could have got into contact and possibly also into conflict with each other. From other sites in Sauerland, such as the Perick Caves, it is known that hyenas have taken bone rubbish from palaeolithic sites.

Samenvatting

In dit artikel worden schedel-, onderkaaks- en gebitsresten van de grottenhyena *Crocuta crocuta spelaea* (Goldfuss 1823) beschreven. Het materiaal behoort tot een oude collectie uit de Duivelskamergrot (Teufelskammergrotte) bij Hochdahl in de Neandertal vallei (NW Duitsland) van een Laat-Pleistocene ouderdom (Weichselien). Dit zijn de weinige overgebleven resten van een hyenalegergrot dichtbij de Feldhof Grot waar het eerste menselijke Neandertal skelet gevonden is. Behalve het hyena botmateriaal werden er enkele hyena prooiresten van *M. primigenius, C. antiquitatis, B. priscus, E. ferus przewalskii* and *U. spelaeus* opgegraven in de 19de eeuw. Deze tonen alle duidelijke knaag- en kauwsporen en bewijzen dat de Duivelskamergrot een hyenaleger was. De locatie is volledig verwoest door groeve-werkzaamheden in de vorige eeuw. De weinige overblijfselen zijn belangrijk voor het begrijpen van de ecologie en verspreiding van de grottenhyeana's in de grottenrijke Sauerland regio. Hyena's en Neandertal mensen, die gedurende dezelfde Weichselien periode in dezelfde vallei geleefd moeten hebben, en die beide gebruik maakten van kleine grotten, kunnen met elkaar in contact zijn gekomen en raakten mogelijk ook in conflict met elkaar. Van andere sites in Sauerland, zoals de Perick grotten, is bekend dat hyena's botafval meenamen van paleolithische locaties.

Introduction

The bones from the Devil's Chamber Cave (= "Teufelskammergrotte") were found 100 m from the Feldhof Cave (= "Feldhofer Grotte" in Schaffhausen, 1866), where the first human Neandertal skeleton was found by Fuhlrot in 1856. For the Devil's Chamber Cave, which was discovered at the same time, he listed "common cave animals" such as "*Rhinoceros tichorhinus* Fr." (= *Coelodonta antiquitatis* Blumenbach), "*Ursus spelaeus* Blb." (= *Ursus spelaeus* Blumenbach), "*Hyena spelaea* Gdf." (= *Crocuta crocuta spelaea* Goldfuss), "*Equus* sp." (= *Equus ferus przewalskii* Poljakov), and "*Bos* sp." (= *Bison priscus* Bojanus). Also others described some Ice Age mammals from Neandertal, which partly seem to be found in the Devil's Chamber Cave (see Koenen, 1892). At present, it is not clear if and how much animal bones from Neandertal are left in collections. Part of the Devil's Chamber Cave remains of *Crocuta crocuta spelaea* (Goldfuss, 1823) were found in the collection of the Löbbecke-Museum and Aquazoo Düsseldorf, but this seems not to be the complete collection, which was gathered in the past century and which was donated by Heinersdorf to the Löbbecke-Museum. The horse and bison remains, which were possibly mentioned by Schaffhausen (1866), are lacking. It might very well be that the rest of this material, and material from other collections from Neandertal as well, is stored in different museum collections or might even be lost, like some other collections from the Sauerland caves.

With the "European Ice Age Spotted Hyena Project", the macromammal material of the Devil's Chamber Cave became important.

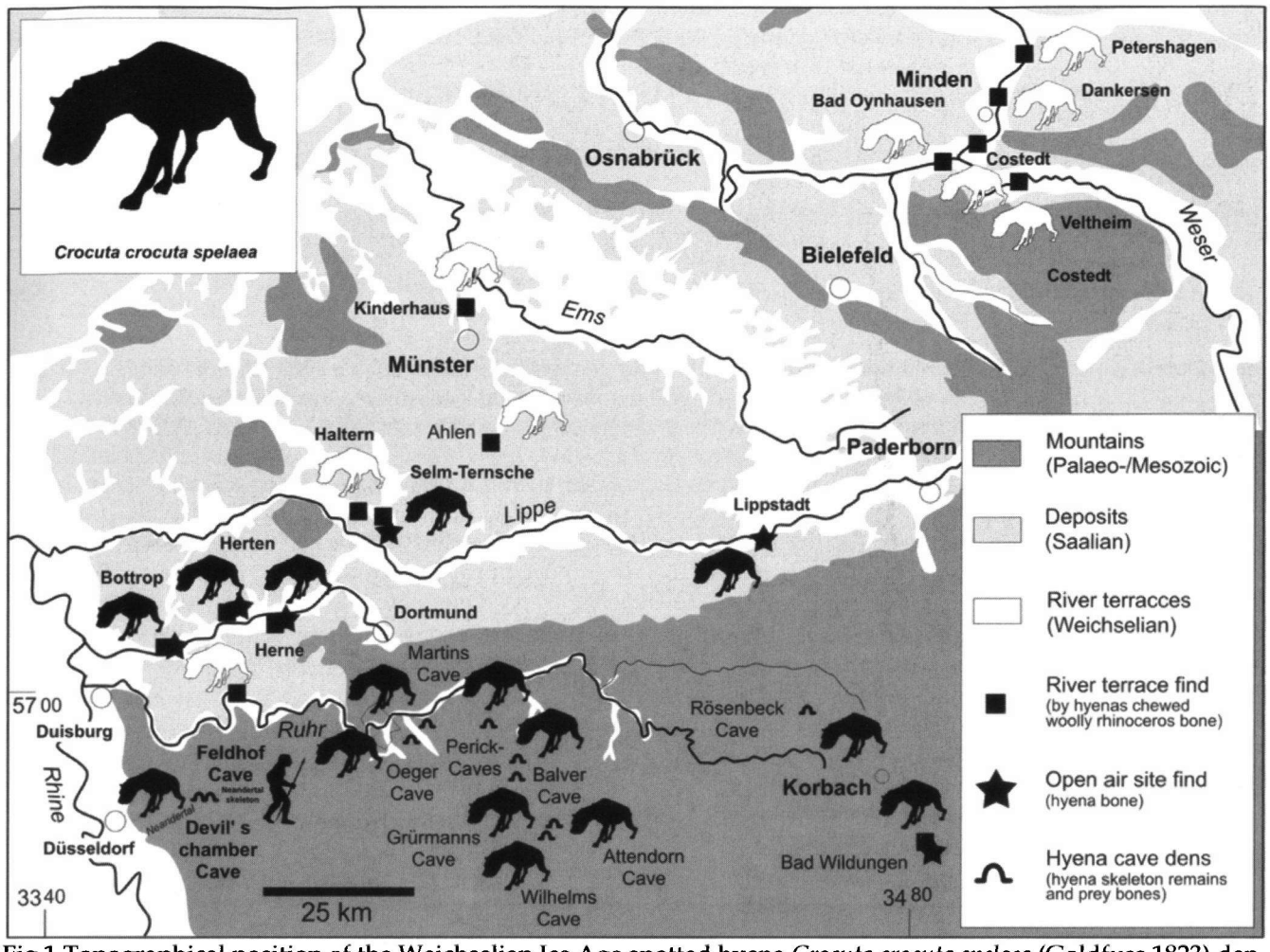

Fig 1 Topographical position of the Weichselian Ice Age spotted hyena *Crocuta crocuta spelaea* (Goldfuss 1823) den site Devil's Chamber Cave (= Teufelskammergrotte) in Neandertal (NW-Germany) and recently discovered hyena sites in northwestern Germany.

Topographische positie van de Duivelskamergrot (= Teufelskammergrotte) in Neandertal (NW-Duitsland) met een leger van de Weichselien grottenhyena *Crocuta crocuta spelaea* en onlangs ontdekte hyena legers in noordwestelijk Duitsland.

Before the re-discovery of this old material in 2005, other hyena prey deposit sites in the cave-rich region of Sauerland (north-western Germany) were studied (Diedrich, 2005b, e), in order to show the impact on taphonomy by the Ice Age spotted hyenas at their prey deposit sites in the Rhenish Massif mountain area.

The Devil's Chamber Cave material is the first material of a hyena bone deposit and shelter site from Neandertal that is presented. The material allows for a comparison with other deposit cave den sites such as the Perick Caves hyena den (Diedrich, 2005a-f) to get a more complete and detailed picture of the palaeoecology of the most important Ice Age carnivore, the Ice Age spotted hyena *Crocuta crocuta spelaea*. Finally, the influence of hyenas on bone destruction, even those of cave bears, is important for the interpretation of animal prey deposit sites and of archaeological human sites. At the latter, the hyenas were feeding on or taking away bone rubbish left by the Middle Palaeolithic Neandertals or by modern human groups of the early Late Palaeolithic (Koenigswald, 2002; Diedrich, 2005b).

The here described and partly figured hyena material belongs to the collection Heinersdorf from the Löbbecke-Museum. The material was still unprepared, and was prepared for this study for the company Paleologic. One hyena tooth root was not impregnated by nitro-based lacquer for future geochemical analyses.

Comparitive *C. c. spelaea* material was used from different collections. Skull and postcranial material was most similar to that of the large collection of Perick Caves, including three skulls and many lower jaws, which will be

redeposited at the Perick Caves (Heinrich's visitor cave) at Hemer for a future presentation (see Diedrich, 2005e).

Palaeontology

Systematics

Family Hyaenidae GRAY 1821
Genus *Crocuta* KAUP 1828
Species *Crocuta crocuta* ERXLEBEN 1777
Crocuta crocuta spelaea (GOLDFUSS 1823)

Material

Twenty-two remains, namely two skull fragments, one lower jaw, one lower jaw fragment, and eighteen teeth from the Devil's Chamber Cave (= "Teufelskammergrotte") in Neandertal near Hochdahl close to Düsseldorf (cf. Schaffhausen 1866). The cave was originally situated 100 m west of the Feldhof Cave (Neandertal skeleton cave, see Fuhlrot, 1856). The cave cadastral number is 4707/03 (Zygowsky, 1988). The cave was completely destroyed by quarry activities during the past century. All material is ascribed to adult to very old male and female hyenas.

All Devil's Chamber Cave bone material still bears the old catalogue collection numbers 2033-2048. The hyena material that is stored in the Löbbecke-Museum (Düsseldorf) bears the numbers 2043-2047a-c, 2048a-o.

Description

A left maxillar bone with intact P1-3 (no. 2046, fig. 2.2) is present. All teeth, especially the P3, are heavily worn and can therefore be ascribed to a very old individual. The distance between P1 and P3 measures 5 cm, which corresponds to the male skulls such as one from Heinrich's Cave (belonging to the Perick Caves, coll. Museum Natur und Mensch Bielefeld no. Heinr-1a/b. The right premaxillary/maxillary (no. 2045, fig. 2.1) is larger and has a much larger distance between C and P2. It also has a wide alveolus for the canine, which is 1.9 cm in diameter and corresponds to the size of female canines. This fragment must be ascribed to an adult female hyena.

The left lower jaw (no. 2043, fig. 2.13) lacks all incisors and the M1. The teeth are less used and indicate an individual age of an early adult animal. The smaller height at the middle of the jaw (4.1 cm in-between P4/M1) and small appearance fits to the smaller male lower jaws. The right jaw fragment (no. 2044, fig. 2.3) with its large M1 fits to a female.

One second incisor (no. 2047f, fig. 2.6) could belong to an upper jaw, but these are very similar to the lower incisors. The two upper third incisors (nos 2047d-e, figs. 2.7-8) are from adult males, because of the small diameter of their roots.

All three canines (nos 2047a-c) are small in size and their largest diameter is only 1.7 cm (nos 2047a-b, figs. 2.4-5). Two of them correspond to the sizes of male canines, but the third is rootless and too incomplete for analysis.

From the upper jaw the right P1 (no. 2048b, fig. 2.9) could belong to an older female, as does the right P2 (no. 2048a, fig. 2.10). The right upper P3 (no. 2048c, fig. 2.11) is from an adult animal, possibly from a female. The large upper P4 is represented with at least three teeth, only one of which is nearly complete: a left P4 that can be ascribed to an adult female (no. 2047, fig. 2.12). The others consist of fragments from adult to very old animals.

Six lower jaw teeth are present, three of which are only half. Two of the nearly complete ones, a right and a left P3 (nos 2047b, j, figs. 2.14-15), are from older to very old adult males, as is a right P4 (no. 2047l, fig. 2.16).

Discussion

The remains of the Devil's Chamber Cave show hyenas of different age and sex, but juveniles are not represented by the scarce material. This seems to be the result of anthropogenic selection at collecting. In the previous century, mainly the "good and complete" teeth and jaw remains were collected, whereas postcranial material and incomplete rootless teeth often were not selected. This can also be observed in many collections of cave bear remains. Luckily, this is not the situation in the Perick Caves, as more than 120 bone and teeth remains, including three skulls of a hyena population consisting of at least eigth animals were found there, which are preserved in five different museums (Diedrich, 2005e).

The male to female ratio of 9:6 (Fig. 3) was calculated on the basis of fifteen jaws and teeth from the Devil's Chamber Cave. The Ice Age spotted hyena *Crocuta crocuta spelaea* is generally slightly larger than the living *Crocuta crocuta*, based upon comparative skeletal mate-

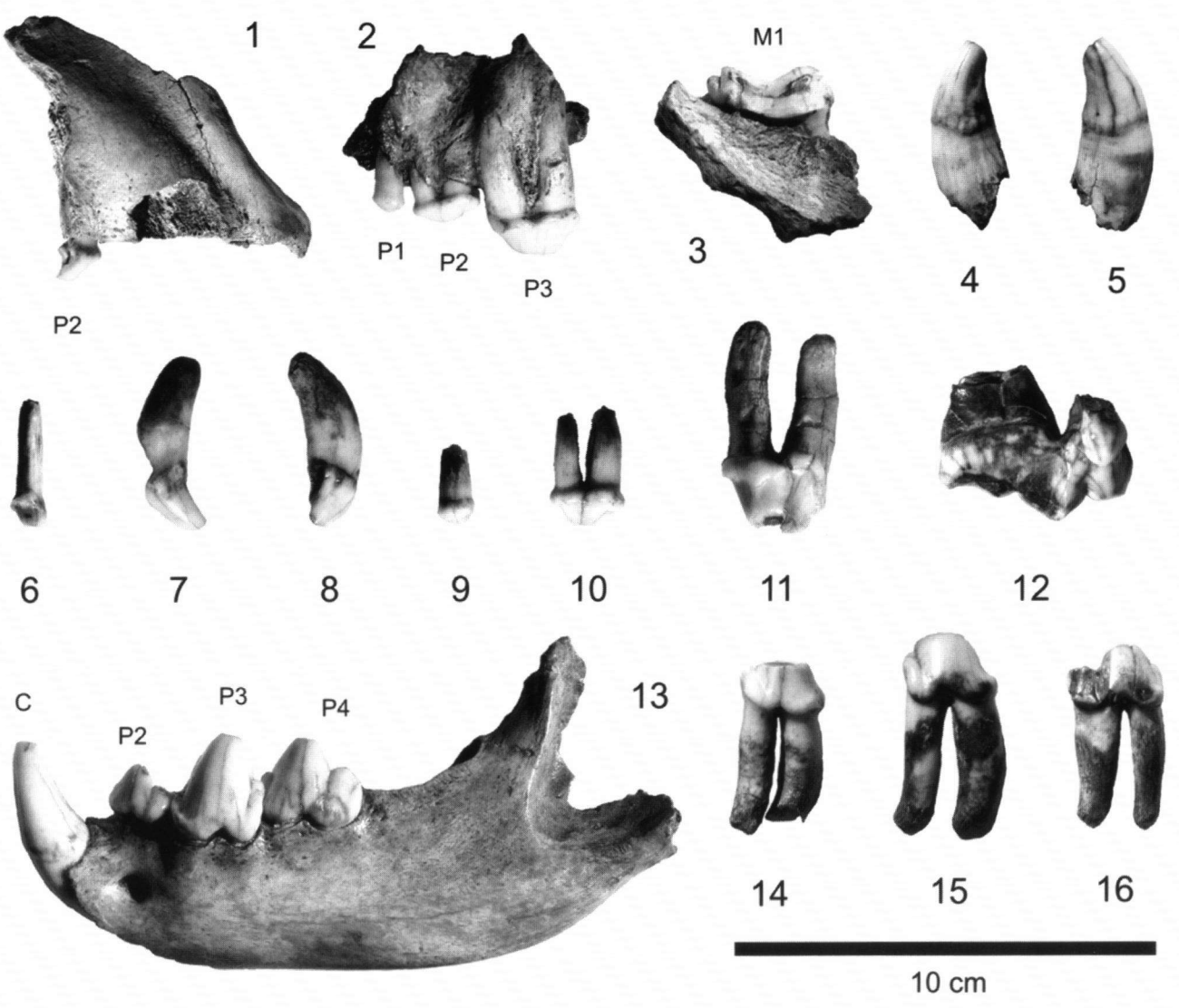

Fig 2 Cranial, mandibular and dental remains of *Crocuta crocuta spelaea* from the hyena den at Devil's Chamber Cave near Hochdahl in Neandertal (NW-Germany). 1. Fragment of a right premaxillar and maxillar bone with half a P2 of an old adult female (no. 2045). 2. Fragment of a left maxilla with P1-3 of a very old male (no. 2046). 3. Fragment of a right mandibula with M1 of a very old female (no. 2044). 4-5. Two canines of adult males (no. 2047a,b). 6. I1-2, probably from the upper jaw, of an old individual (no. 2047f). 7. Left upper I3 of an adult male (no. 2047d). 8. Right upper I3 of a very old male (no. 2047e). 9. Right upper P1 of an old female (no. 2048b). 10. Right upper P2 of an old male (no. 2048a). 11. Right upper P3 of an old female (no. 2048c). 12. Left upper P4 of an old female (no. 2047l). 13. Left mandibula of an adult male (no. 2043). 14. Left lower P3 of a very old male animal (no. 2047j). 15. Right lower P3 of an old male (no. 2047b). 16. Right lower P4 of an old male (no. 2047l). 1-3, 13 lateral view; 5, 7-10, 15 buccal view; 6, 11-12, 14 lingual view.

Schedel-, onderkaaks- en gebitsresten van *Crocuta crocuta spelaea* van het hyena-leger in de Duivelskamergrot bij Hochdahl in Neandertal (NW-Duitsland). 1. Fragment van een rechter premaxillare en bovenkaaksbeen met een halve P2 van een oud volwassen vrouwtje (nr. 2045). 2. Fragment van een linker bovenkaak met P1-3 van een zeer oud mannetje (nr. 2046). 3. Fragment van een rechter onderkaak met M1 van een zeer oud vrouwtje (nr. 2044). 4-5. Twee hoektanden van volwassen mannetjes (nr. 2047a,b). 6. I1-2, waarschijnlijk van de bovenkaak, van een oud dier (nr. 2047f). 7. Linker bovenkaaks-I3 van een volwassen mannetje (nr. 2047d). 8. Rechter bovenkaaks-I3 van een zeer oud mannetje (nr. 2047e). 9. Rechter bovenkaaks-P1 van een oud vrouwtje (nr. 2048b). 10. Rechter bovenkaaks-P2 van een oud mannetje (nr. 2048a). 11. Rechter bovenkaaks-P3 van een oud vrouwtje (nr. 2048c). 12. Linker bovenkaaks-P4 van een oud vrouwtje (nr. 2047l). 13. Linker onderkaak van een volwassen mannetje (nr. 2043). 14. Linker onderkaaks-P3 van een zeer oud mannetje (nr. 2047j). 15-16. Rechter onderkaaks-P3 en P4 van oude mannetjes (nrs 2047b, 2047l). 1-3, 13 zij-aanzicht; 5, 7-10, 15 wangzijde; 6, 11-12, 14 tongzijde.

rial from the collection of the National Museum Prague. In the living species, the males are slightly smaller in size. This is unusual for carnivores, in which the males are generally larger. This remarkable sexual dimorphism is also present in *C. c. spelaea*, as shown with the skulls (fig. 3). To quantify this, three skulls from the Perick Caves (one juvenile, one very old female (cf. Diedrich 2004) and one old male (all in Staatliche Naturhistorische Sammlungen, Dresden (no. Sundwig-14) and two adult to old female skulls from the open air site Bad Wildungen-Biedensteg (Stadtmuseum Bad Wildungen, no. Bi-52/45, Bi-10at, see Diedrich, 2006) were compared. The skulls of adult females are 30 cm in length, whereas those of adult males are around 27 cm. Also the teeth and lower jaws of males are smaller. The direct comparison of the findings from the Devil's Chamber Cave with the cranial material of the other mentioned caves and freeland sites allowed for a sex differentiation in most cases.

Only seven incomplete or heavily worn teeth could not be analysed.

Most teeth and jaws from Devil's Chamber Cave are heavily worn and indicate adult to very old animals (see Figure 2). The high number of hyena remains proves that the cave was used as a prey deposit site, where *C. c. spelaea* not only deposited prey remains but also used as a shelter for the protection of their young. The carcasses of old to very old hyenas were also dragged into the caves, as all other prey remains. The Ice Age spotted hyenas are cannibalistic, similar to the living *Crocuta crocuta*, as is shown by cranial and postcranial bones from the Perick Cave site (see Diedrich, 2005e). Old dead hyenas were eaten and remains of them were stored together with other animal carcasses in the caves.

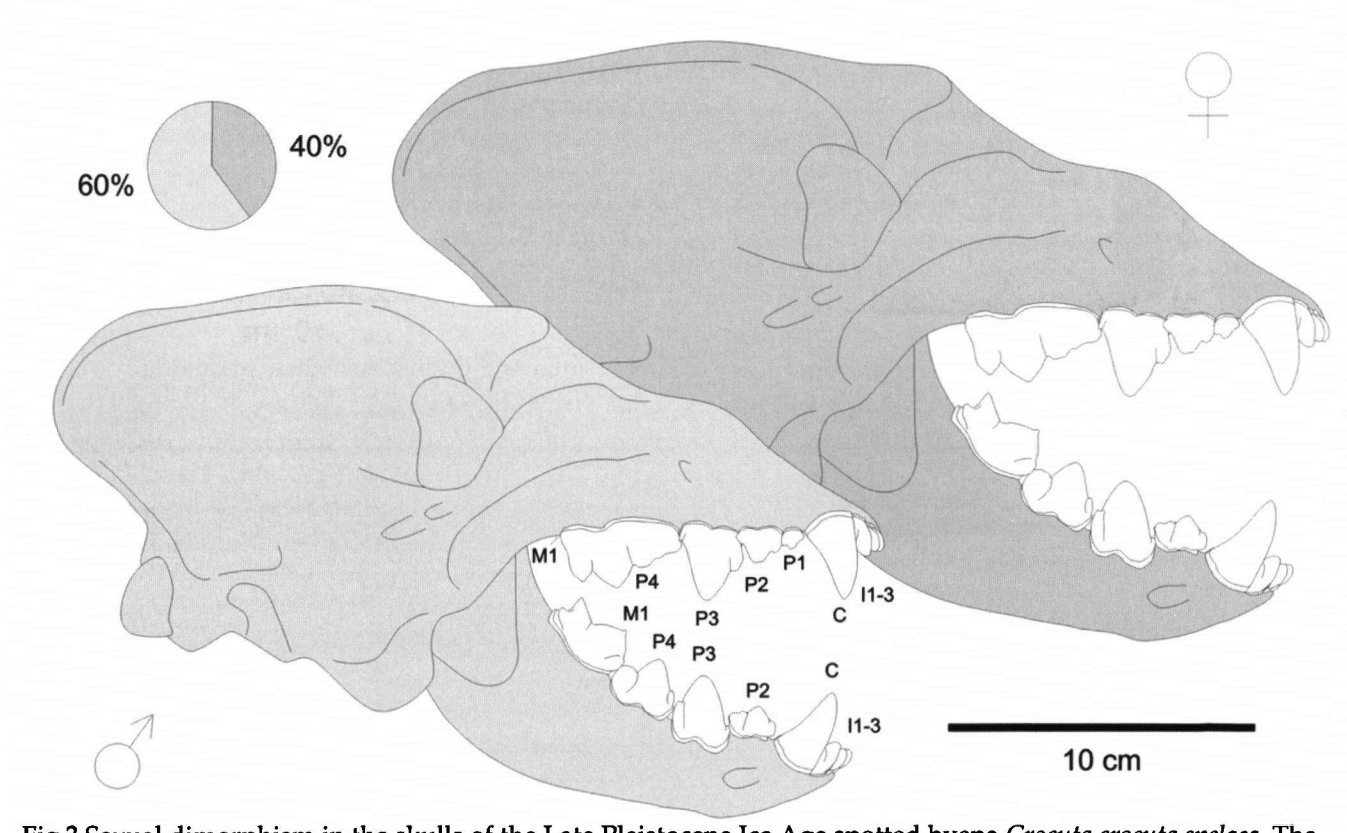

Fig 3 Sexual dimorphism in the skulls of the Late Pleistocene Ice Age spotted hyena *Crocuta crocuta spelaea*. The males are slightly smaller (total length about 27 cm) than the females (total skull length about 30 cm), based on skulls from the Perick caves, Martin's cave and Bad Wildungen-Biedensteg freeland site (all Weichselian).

Geslachtsverschil in de schedels van de Laat-Pleistocene grottenhyena *Crocuta crocuta spelaea*. De mannetjes zijn wat kleiner (totale schedellengte ongeveer 27 cm) dan de vrouwtjes (totale schedellengte ongeveer 30 cm), gebaseerd op schedels uit de Perick grotten, Martin's Grot en het Bad Wildungen-Biedensteg leger in de open lucht (allemaal Weichselien).

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