universität wien

DIPLOMARBEIT

Titel der Diplomarbeit

Intaspezific variation between *Crocuta crocuta crocuta* (Erxleben, 1777) and *Crocuta crocuta spelaea* (Goldfuss, 1823) from Central Europe

Verfasserin

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angestrebter akademischer Grad

Magistra der Naturwissenschaften (Mag.rer.nat.)

Wien, 2012

Studienkennzahl lt. Studienblatt:	A 443
Studienrichtung lt. Studienblatt:	Diplomstudium Paläobiologie (Stzw)
Betreuerin/Betreuer:	Univ.-Prof. Mag. Dr. Doris Nagel

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1 Introduction

During the Ice Age the spotted hyena was very common in Europe. Due to the fact that all of their remains were found in caves, the spotted hyena got the name "cave hyena". Regrettably, there are only few findings of fossil hyenas in most European caves. Most of the findings were located in the Tornewton cave in Great Britain and in the Teufelslucken cave in Roggendorf near Eggenburg in Austria.

In Great Britain the cave hyena is documented since 110.000 years. The cave hyena disappeared from Europe about 20.000 years ago. Furthermore, in Austria there is a good record of the fossil cave hyena between 60.000 and 20.000 years ago. The Teufelslucken cave was dated of around 40.000 years ago.

Unfortunately, there is not much known about their behaviour and biology. Most of the scientists were interested in their systematically position. The question was if the cave hyena was a close relative of the modern spotted hyena *(Crocuta crocuta spelaea)* or a different species *(Crocuta spelaea)*. The fossil hyena was bigger than their modern relatives. There are only a few differences in the skull and dentition.

A former genetic study from Rohland et al (2005) has analysed the mtDNA sequences from different Eurasian Pleistocene cave hyenas *(Crocuta crocuta spelaea)* and recent african spotted hyenas *(Crocuta crocuta crocuta)*. They also analysed mtDNA from extant stripped *(Hyena hyena)* and brown hyenas *(Parahyena brunnea)*.

Their results suggested three migration waves from Africa to Eurasia for spotted hyenas. The first migration of spotted hyenas started less than 3,5 million years ago reaching Asia. The second migration probably took place between 1,3 to

1,5 million years ago, reaching Europe for the first time. Probably at this time the separation of the African spotted hyenas into a northern and a southern population took place. The third migration of spotted hyenas from the northern population took place less than 36.000 years ago, reaching Asia and Europe (Fig.1.1) .

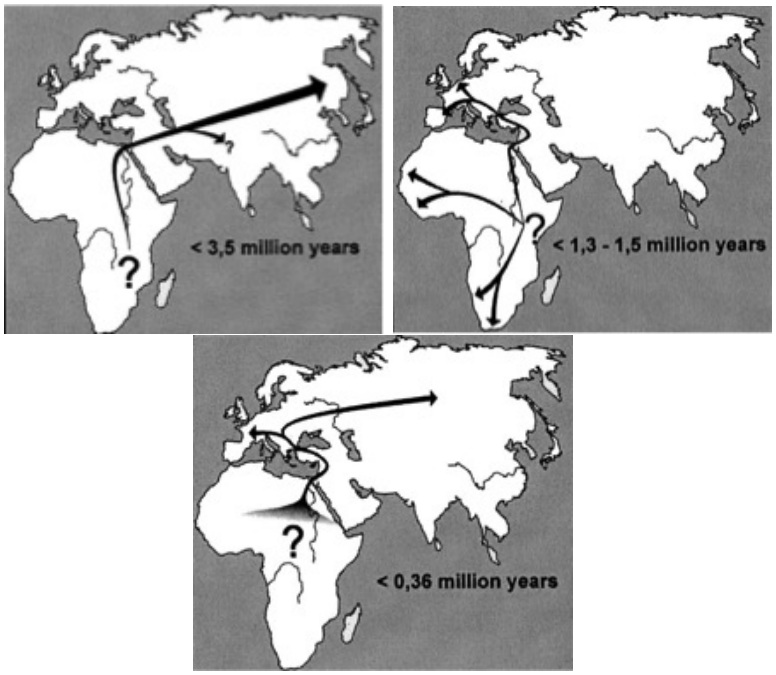

Abbildung 1.1: Migration waves of spotted hyenas from Africa to Asia and Europe (Rohland et al 2005)

Furthermore this study showed that the recent spotted hyenas could be divided into a Northern and a Southern Population in Africa.

On account of this, the material from the Teufelslucken cave in Austria, from four caves in Germany (Irpfelhöhle, Villa Seckendorff, Oberhein/Ketsch and the Aufhausener cave), from the Slouper cave in the Czech Republic and from the Čertova pec cave in Slovakia was measured. The measurements were taken from the skulls, the teeth, and the postcranium and evaluated statistically. The statistics were made in SPSS 5.

2 Pleistocene

The Pleistocene is characterized by glacial and interglacial cycles. Strong glacial pulses were recorded in the ocean, in the oxygen isotope record. Furthermore, the pollen record showed that in northern Europe there was an extension of the cold steppe. This was also recognizable in other parts of the world. For example in Africa there was an increase in grass and C4 plants according to an increase in aridity (Cerling (1992)). The Pleistocene is divided in three sections: the Early Pleistocene was between 1.8 million years to 0.87 million years ago. This period is defined by the border of the Matuyama-Bruhnes-Border. This border characterised a turnover in the magnetic field of the earth. The Middle Pleistocene is characterized by the beginning of larger glacial changes and lasted till 130.000 years before now. These glacial phases were interrupted by warmer periods, the so called Interglacials. Furthermore, during these warm periods the forest dispersed again throughout Europe. The last Interglacial, the Eem or Riss/Würm-Interglacial and the Würm-glacial or Weichsel-glacial were parts of the Late Pleistocene (Agustì and Antòn (2002); von Koenigswald (2010)).

Exceptional position of Central Europe

In central Europe several dramatic climatic changes took place, which also influenced the faunal compositions during the glacial and interglacial periods effectively. In comparison to other continents, which were in the same geographical range, central Europe was more affected by these climatic and faunal changes, unlike North America and Siberia (von Koenigswald (2010)).

But what are the diffrences during the glacials in Central Europe and the rest of the World? Why has central Europe been in such a unique position?

Central Europe was covert with massive inland glaciers. In North America for

example, the Laurentice Ice Sheet ranged from the Pacific to the Atlantic Ocean and in the northern part this sheet reached as far as Greenland. In Europe the ice sheet covered Scandinavia and went to the south of Finland until it reached the border to Russia. In the East the ice sheet covered the British Islands, and was sometimes fused with the northern part of the North Sea and the ice of Scandinavia.

During the various glaciations the inland glaciers in central Europe differed in their dimensions. At the peak of glaciation, the Alps were covered with ice and the valleys were filled with ice tongues. These massive glaciers with their huge white surface of ice reflected the solar radiations and sent the warmth back into space. This process produced further cooling. Furthermore, much water was bound in the glaciers which led to a decline of the water level in the oceans of about 100 to 120 meters. Therefore numerous offshore zones fell dry.

The decline in the water level changed the outline of Europe and the northern part of the Mediterranean Sea fell dry. The shape of the costal outline was very similar to the one today. But the North Sea was widely covered with ice. It sometimes fell dry in the southern part. The Atlantic was also covered with pack ice up to the Iberian Peninsula.
Due to the massive ice sheets in the Northern part of Central Europe and the retreat of the costal line, Central Europe was embossed in cold winters with major dryness (continental climate). During the interglacials the sea level rose which created a buffer in the North and Baltic Sea, which allowed a maritime effect in Central Europe. These two influences created the unique compositions of the fauna and flora during the different glacial and interglacial periods. Moreover the difference between the temperature and the humidity during the glacial and interglacial played a major role (von Koenigswald (2010)).

2.1 The early Pleistocene

The most characteristic mammal of the early Pleistocene was an arvicolid rodent, *Allophaiomys pliocaenius*, with ever-growing molars and absent roots. This mammal also had a unique Holartic dispersal. Its rapid spread is related to the expansion of steppe and cooler conditions around 1.8 to 1.6 million years

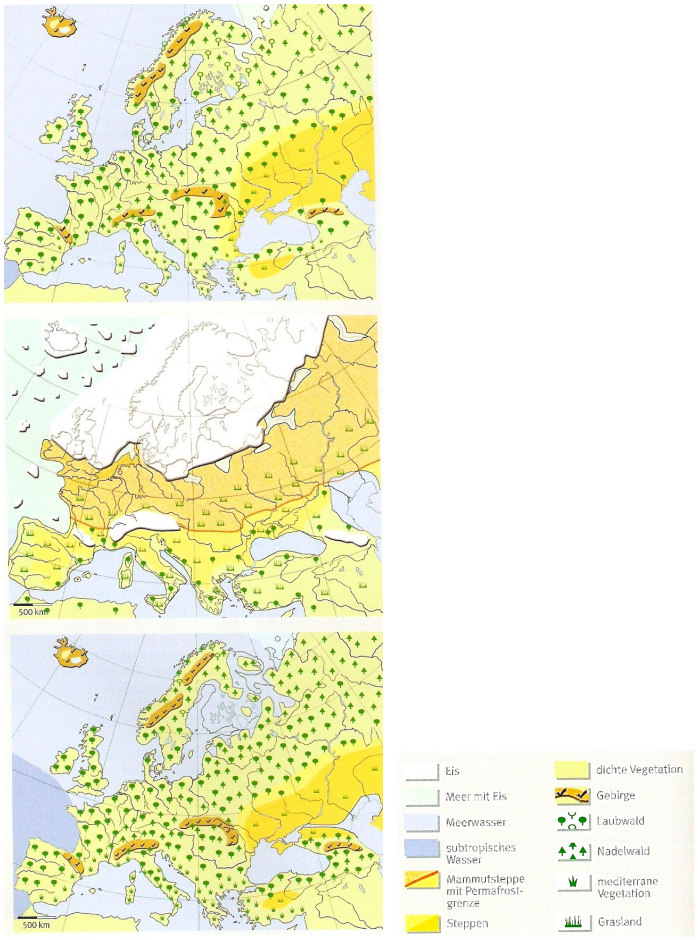

Abbildung 2.1: Europe during three different stages in time. A: Holocene, B: Würm glacial and C: Riss/Würm-interglacial (von Koenigswald (2010)).

BP.

The early Pleistocene fauna of Europe includes various African elements like the hippo *(Hippopotamus major), Equus stenovis, Dama nesti, Canis etruscus, Ursus etruscus, Pachycrocuta perrieri, Panthera sp.* and *Homotherium cernatidens.*

But some African elements were very rare like the slender giraffid, the large ostrich, also small mammals like gerbils and arvicolides.

The early Pleistocene ends with a warm interglacial. In this time the forests spread again and temperate elements entered Europe while some steppe-adapted animals were replaced. The temperate elements like *Elephas antiquus*, which inhabited the interglacial stages, were replaced by the cold adapted *Mammuthus*

in glacial periods.
Numerous relatives of *Mammuthus* and *Equus stenonis* evolved and diversified at the end of the early Pleistocene. Also the first wild boars *(Sus scrofa)* emerged with the appearance of the forests and at this time the red deer appeared in Europe for the first time. Another immigrant was *Ovis antique*, which was the first mouflon in Europe.

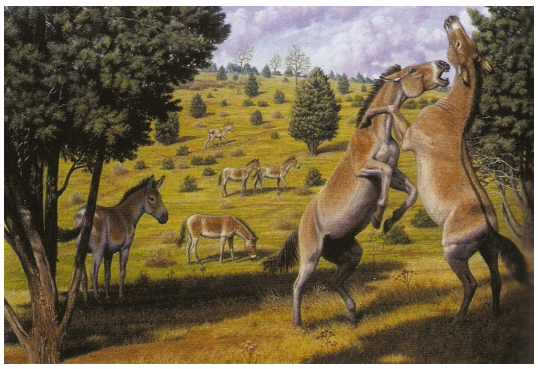

Figure 2.2: This picture shows a herd of horses *(Equus altidens)* (Agustì and Antòn (2002))

Furthermore, among the carnivores there were also some changes. First the Eurasian bears evolved in two directions. The Asian branch was omnivorous, which led to today's brown bears *(Ursus arctos)*. This lineage entered Europe in the late Pleistocene. Moreover, the foxes spread again in the early Pleistocene. The second branch evolved into more robust forms, which were completely herbivorous.

There were also some immigrants during the early Pleistocene like the tragelaphines bovides later followed by the leopard *(Panthera pardus)*, the spotted hyena, which replaced the large and heavy *Pachycrocuta brevirostris*, and a giant baboon named *Theropithecus oswaldi* which was found in Spain. This baboon was dated to be between 1.4 and 1.2 million years old. Around this time, the first evidence of human occupation in Western Europe took place (1.2 million years) ((Agustì and Antòn (2002)).

Figure 2.3: This picture shows the wild boar *Sus scrofa, Bison voigtstedtensis* and *Eucladoceros giulii* (Agustì and Antòn (2002))

2.2 The middle Pleistocene

The middle Pleistocene is marked by low temperatures and the extension of the ice sheets over large parts of the Northern Hemisphere (900.000 years ago). Furthermore, it is characterized by a large glacial with a duration of about 100.000 years and short warm interglacial periods, which last about 20.000 years. Those cycles altered. At the maximum extension of the ice sheet, the ice covered all of Northern Europe: all of Scandinavia, parts of the United Kingdom, Netherlands, Germany, Poland, the Baltic countries and Russia.

In some sequences the Northern Atlantic was partly covered with ice. As a consequence, the sea level dropped in some regions by 150 meters. Furthermore, new land bridges between the continents and islands were formed e.g. between Eurasia and North America (Beringia).

At this time (during the glacial) the flora was dominated by the typical *Artemisia*-steppe. During the interglacial there were temperate and warm-temperate forests predominant.

The characteristic mammal fauna of the middle Pleistocene was represented by *Elephas aniquus, Stephanorhinus hemitoechus, Bison schoetensacki, Sus scrofa, Crocuta crocuta, Macaca sylvana.* Also *Bos primigenius* was common at this time.

Some genera disappeared, like the large sabertooth cats (genus *Megantereon*) and were replaced, in Europe, by leopards, lions and lynx. But the genus *Megantereon* survived and flourished in South America and evolved into *Smilodon* at the end of the last glaciations 12.000 years ago.
Generally spoken, the steppe animals were more robust and larger in the middle Pleistocene and therefore better adapted to the cold environment (Agustì and Antòn (2002)).

Figure 2.4: The picture shows the *Hippopotamus amphibius, Dama vallonetensis* and *Stephanorhinus etruscusi* (Agustì and Antòn (2002))

2.3 Mediterranean islands

During the glacial periods the lowering of the sea level in the Mediterranean Sea lead to a complicated migration pattern. A number of islands became connected or closer to the neighbouring landmasses. But in the following interglacial cycle these islands became disconnected again because of the increasing sea level.

When the sea level dropped mammals succeeded in colonizing an island but when the sea level rose again this population became isolated and they evolved under new conditions.
Insular faunas began to appear throughout the Mediterranean islands for example on Corsica, Sardinia, Sicily, Malta, Crete and Cyprus and also the Balearics Islands. These faunas were characterized by numerous endemic species. Some key characters are a poor diversification and a lack of large carnivores. The islands could not support large herbivores and carnivores at the same time, because the resources were limited.
Typical for insular faunas is dwarfism for large mammals like hippos, elephants

and deers. Others, like small mammals, developed larger body dimensions.

Another surprising feature of endemic faunas on islands was, that they were composed of the same elements, but this elements originated from different regions. The islands were not inhabited in the same time span. Species on Mediterranean island were deer, hippo, elephant and for the small mammals murids, arviculids, which were very common and dormice, which were rather rare.
The insularity triggered important skeletal modifications. The large mammals not only shrunk, there were strong modifications in the skeletal elements. For example the skull and limb anatomy in hippos, deers and elephants changed. Furthermore, the metapodials and phalanges were shortened.
For this reason, the body is lower to the ground and the mammal had a solid foot construction (Agustì and Antòn (2002)).

2.4 The late Pleistocene

This period includes the last interglacial – glacial cycle, which is perhaps the best known epoch in the earth history, because of its detailed geological and palaeontological record.
The Riss-glacial ended about 130.000 years ago. The last interglacial phase, the Riss/Würm-Interglacial, was between 130.000 and 116.000 years ago. The climate was rather similar to the present day maybe slightly warmer than today. In the middle latitudes the summer temperatures were about two degrees warmer and the global sea level was also higher than today. Furthermore, the glaciers in Northern Europe were less developed. The dominant vegetation in this part of the late Pleistocene was mixed forests, dominated by oaks.
The conditions chanced rapidly because of a new glacial pulse between 115.000 years and 75.000 years ago. At this time sequences of stadial (cold period) and interstadial (temperate) stages of the glacial phase alternated.
Between 75.000 and 60.000 years BP another rapid cooling took place with a long cold period. The glaciers covered most of Scandinavia. Northern and Central Europe were covered with tundra followed by a new succession of stadials and interstadials.
The mid-latitude ice sheet reached its largest extension between 21.000 and

17.000 before today. It covered Fennoscandia, the Baltic countries, Poland, the northern part of Germany, Great Britain and Ireland. As a consequence of this the sea level dropped between 100 and 120 meters and the Mediterranean Sea and Black Sea were reduced in size.
In the cold phase the temperatures were about 20 °C lower than today. Most of Europe was covered by tundra and cold steppe. Only some parts in southern Spain and Italy were partly forested. Numerous species of the last interglacial came to an end.
The first cold pulse, 70.000 years ago, led to the extinction of hippos, and *Elephas antiquus*. The place of the latter was taken by the perfectly adapted woolly mammoth, *Mammutus primigenius*, and woolly rhino, *Coelodonta antiquitates*, which replaced the *Stephanorhinus kirchbergenis*. Other species also succeeded in inhabitating the cold steppe like the horse, bison *(Bison priscus)*, saiga antilope *(Saiga tatarica)*, and animals which lived like the reindeer *(Rangifer tarandes)*: the musk ox *(Ovibos moschatus)*, elk *(Alces alces)*, *Ibex (Capra ibex)* and the chamois *(Rubicapra rubicapra)* today. Not to forget the small mammals, typical for the Pleistocene steppe tundra, like the marmots, musliks, jirds and lemmings. Furthermore, the lineage of the giant deer persisted during the last glaciation.
Among the carnivores, most of the middle Pleistocene species survived or were represented by more robust and larger "cave" variations, like the cave hyena and the cave lion.
The cave hyena was more robust than their living relative, the spotted hyena. And is a subspecies of today's living spotted hyena.
The cave lion, *Panthera leo spelaean*, differed from the African lion in being bigger, more robust and according to cave paintings, lacking the typical mane in males. Nevertheless, genetic investigation revealed a similar result as seen in cave hyenas: the cave lion is a very close relative to todays *Pantera leo* and probably only a subspecies.
An impressive example of increasing size and robustness is the cave bear, *Ursus spelaeus*. This large bear was a vegetarian with a huge fossil record in numerous caves in Western and Eastern European. It evolved from a moderate sized bear, *Ursus deningeri* (Agustì and Antòn (2002)).

2.5 The last mass extinction

At the last glacial period, 14.000 years ago, the ice sheet retreated. About 10.000 years ago a new interglacial began, the Holocene. The temperatures suddenly increased by about 5 to 7 °C. Sea levels rose up to 120 meters, to the present level.
In Eurasia the steppe tundra disappeared, which was occupied by mammoth and the woolly rhino. Coniferous trees and the taiga extended throughout Europe and Eastern Asia. Some cold adapted mammals found refuge in the northern tundra like the reindeer and the lemming. Others related to the South, turn into dry steppe, like in Central Asia, which is the home of several rodent species, horses, bisons and antelopes. Others escaped in the Arctic region of North America like the musk ox.
At this time the megafauna of the late Pleistocene became extinct. The megafauna extinction is hard to explain. Maybe the reduction of the natural habitat and the loss of food resources or the spread of the modern humans played a major role (Agustì and Antòn (2002)).

2.6 Climate curve and timescale from Austria

The investigation of the palaeo-climate by analysing deep-sea drilling cores and the ice–drilling cores were most important in reconstructing the climate. Changes at the polar ice caps and in the stored ice in the glaciers on mountains were marked by fluctuations of the "heavy" oxygen isotope (^{18}O). The higher the concentration of ^{18}O in the Ocean, the bigger is the stored water in form of ice.
These "Global Ice Curves" are important indicators for a climate curve because they can be correlated with the Milankovich – Curve.
The classification of these climatic curves is marked by numbers, beginning with the warm interval in the Holocene (isotopic stage 1). Stages with warm climate get an uneven number; stages with growing ice get an even number. Smaller fluctuations are distinct with letters (a, b, c, ...)

However the ice curves cannot be directly correlated with the glacier devel-

oping in the Alps, because they behave differently than the ice masses in the Polar Regions.

The stored ice masses in the Wurmian were much higher than today. Otherwise the temperatures in summer were higher than today. Predominately the Polar Regions were covered with ice, whereas the glaciers in the Alps were rather ice free. The climatic curve showes that in the glacials, the warm intervals are periodically with hot summers and cold winters
The fluctuation between colder and warmer phases from the Middle Pliocene to the Holocene is depicted in Fig. 2.5 (Doris Döppes and Gernot Rabeder (1997))

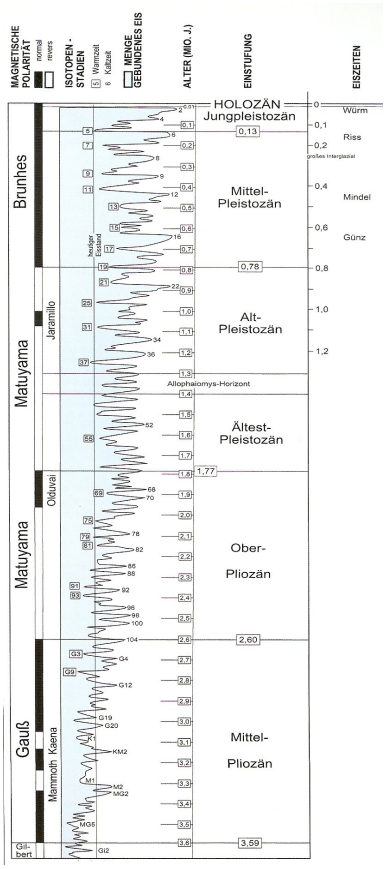

Figure 2.5: Climate curve from the Middle Pliocene to the Late Pleistocene (Godfrid Wessely (2006))

3 Systematic and Taxonomy

The Hyaenidae are classified as Suborder Feliforma (Kretzoi, 1945) together with the Viverravidae, Nimravidae, Felidae, Viverridae, Herpestidae and Nandiniidae (M.C. McKenna and S.K. Bell (1997))

Systematic of the hyenas

Order Carnivora Bowdich, 1821
- Family Hyaenidae Gray, 1821
  - Genus †Tongxinictis Werdelin and Solounias, 1991:71
  - Subfamily †Ictithriinae Trouessart, 1897:320
    - Genus †Herpestides de Beaumont, 1967:81
    - Genus †Plioviverrops Kretzoi, 1938:114
    - Genus †Icitherium Wagner, 1848:375
    - Genus †Thalassictis Nordmann, in Gervais. 1850:120
    - Genus †Hyaenotherium Semenov, 1989:94
    - Genus †Miohyaenotherium Semenov, 1989:129
    - Genus †Lycyaena Hensel, 1863:567
    - Genus †Tungurictis Colbert, 1939:67
    - Genus †Proticitherium Kretzoi, 1938:113
  - Subfamily Hyaeninae Gray, 1821
    - Genus †Palinhyaena Qui, Huang and Guo, 1979:200-221
    - Genus †Ikelohyaena Werdelin and Solounias, 1991:71
    - Genus †Hyaenictis Gaudery, 1867:7236-724
    - Genus †Leecyaena Young and Liu, 1948:273-291
    - Genus †Chasmaporthetes Hay, 1921:636
    - Genus †Pachycrocuta Kretzoi, 1938:118
    - Genus †Adcrocuta Kretzoi, 1938:118
    - Genus Crocuta Kaup, 1828

Genus Hyaena Brunnich, 1771
Genus Parahyaena
Subfamily Protelinae Geoffroy Saint-Hilaire, 1851
Genus Proteles Geoffroy Saint-Hilaire, 1824

(after M.C. McKenna and S.K. Bell (1997))

3.1 Phylogeny of the Hyaenidae

The summary give herin is mainly after Agustì and Antòn (2002).
The hyaenids were probably desendend from the Viverrids.*Protictitherium* was the first representative of the hyenids and made its appearance in the middle Miocene. This primitive hyena was a generalized civet-like carnivore with an omnivorous/insectivorous dentition. Its diet consisted probably of small mammals, birds and insects. Another feature were the retractable claws.
Another small form during that time, *Plioviverrops*, had adapted its dentition on more insectivoral food with well-developed cusps on the molars. Other than Protictitherium, it didn't have retractable claws.

Figure 3.1: This picture shows two *Protictitherium crassum* with a killed hipparion, which is the kill of a large sabertooth cat (Agustì and Antòn (2002))

The larger scavenging hyenas belong to the family of the Percrocutidae. This is a hyena-like family, which belong to the feliformes (e.g. *Percrocuta, Dinocrocuta* and *Allohyaena*). This percrocutids were mainly an Asian group, which

immigrated later into Europe. This group also coexist with the small, hyenid genera, like *Protictitherium* and *Plioviverrops*. The percrocutides are supposed to be scavengers (Agustì and Antòn (2002)).

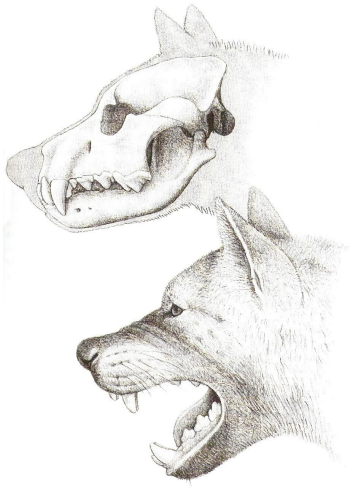

Figure 3.2: Reconstructed head and skull of *Dinocrocuta gigantea* (percrocutid) (Agustì and Antòn (2002))

The middle Miocene *Percrocuta* had no bone-cracking adaption whereas *Dinocrocuta*, from the late Miocene, had a bone-cracking adaption. *Percrocuta* got a maximum length of about 1,50 meters. Dinocrocuta was much bigger than *Percrocuta* and could have reached an estimated maximum weight of about 380 kilograms. It was assumed that it also had the characteristic body of a modern hyena with a sloping back and longer front limbs than hind limbs.

In the late middle Miocene new slender hyaenids entered Europe, with species like *Thalassictis montadai* and *Thalassictis robusto*. These wolf-like hyenas had an unspecialised dentition and the post cranial skeleton showed moderate cursoriality. This hyena was adapted to the more open woodland. *Thalassictis* was larger than *Protictitherium* with about 20 to 30 kilograms and coexisted with *Protictitherium* and *Plioviverrops*. The latter probably originated in Western Europe (Agustì and Antòn (2002)).

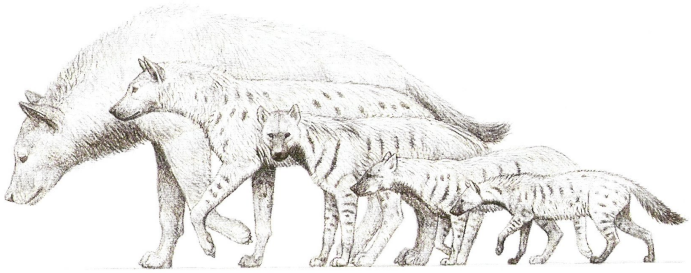

Figure 3.3: This picture shows hyena representatives of the late Miocene in Europe (Agustì and Antòn (2002)).

Protictitherium, Plioviverrops and *Thalassictis* survived into the early Vallesian and *Proticitherium* was still common in Africa. Moreover, the new cursorial canid-like hyenas, like *Ictitherium* and *Hyaenotherium*, which are closely related to *Thalassicits*, evolved. This new eco-type, *Ichtitherium*, was more omnivorous than *Thallasicits*, was larger and had less reduced premolars than *Hyaenotherium*.

The hyena-like percrocutids, like the genus *Dinocrocuta*, persisted into the early Vallesian and coexisted with the slender true hyenids. Furthermore, it was larger than *Percrocuta* from the middle Miocene and already had the dental adaption for bone-cracking.

In the Vallesian two new cursorial hyaenids evolved. One of them is the very large form *Adcrocuta*, which weight about 70 kilograms and is the first representative of the modern bone-cracking hyenas. The other was a meat-bone eater called *Hyaenictis*.

In the Greek-Iranian Province *Protictitherium* survived the Valesian-Crisis. In the Turolian new types of hyenas evolved. Next to the wolf-like hyenids, like *Thalassicts, Ictitherium, Hyaenotherium* and *Hyaenictitherium* were the cursorial types, like *Hyaenictis* and *Lycyaena*, which appeared in Eurasia and northern Africa.
But the common hyenids from Spain to Iran was still the mongoose-like *Plioviverrops* and the large bone-cracking *Adcrocuta*.

Throughout the Messinian Crisis, the spread of the modern canids affected the

dog-like hyenids. Only *Ictitherium, Lycyaena* and *Thalassictis* persisted. Also *Plioviverrops* and the large *Adcrocuta* were not touched by this faunal change. Furthermore, the percrocutids survived in northern Africa until they became extinct during the Messinian Crisis.

At the beginning of the early Pliocene only one Miocene genus had survived, the mongoose-like *Plioviverrops*. The first modern bone-cracking forms evolved, which are considered to be the ancestors of the modern spotted hyena, *Crocuta crocuta* and the striped hyena, *Hyaena hyaena*.

A new representative of the cursorial type, *Chasmaportetes lunensis*, also known as the hunting hyena, originated in the early Pliocene. Its dentition was secodont. All molars and premolars were equiped with sharp cutting blades. *Chasmaportes lunensis* had the largest distribution of all hyenids. It was known from Eurasia to Africa and North America. *Chasmoportetes lunensis* was the only hyena which crossed the Bering Strait, to settle in North America during the late Miocene and Pliocene (Agustì and Antòn (2002)).

Figure 3.4: This picture after Agustì and Antòn (2002) shows the reconstructed head, musculature and skull of *Chasmaportetes lunensis*

In the late Pliocene the last representative of the cursorial type, *Chasma-*

portetes lunensis, got extinct. Also the slender bone-cracking *Pachycrocuta/Pliocrocuta perrieri* was replaced by the more robust form *P. brevirostris*, also known as the short-faced hyena. This large hyena reached the size of an adult lion and was a more active hunter than the modern spotted hyena, *Crocuta crocuta* (Boule (1893), Björn Kurtèn (1956), Kurtèn (1957), Björn Kurtèn (2009)). It already had the characteristic body composition with strong anterior limbs and shorter posterior limbs. It also had a short skull, high massive cheek-teeth and enormous canine teeth - an adaptation for bone cracking.

Pachycrocuta brevirostris persisted into the early Pleistocene. But in the late Pleistocene the more robust forms, like the cave hyena, *Crocuta crocuta spelaea* appeared (Agustì and Antòn (2002)).

Today only four members of the hyenids still exist: *Proteles, Hyaena, Parahyaena* and *Crocuta*.

Proteles cristata (Sparrmann, 1783)

The aardwolf is the smallest one of the four hyenas and has a very interesting specialisation in its food habits. In contrast to other hyenas, which have a generalized to bone-cracking diet, the aardwolf has adapted his feeding habits on termites only.

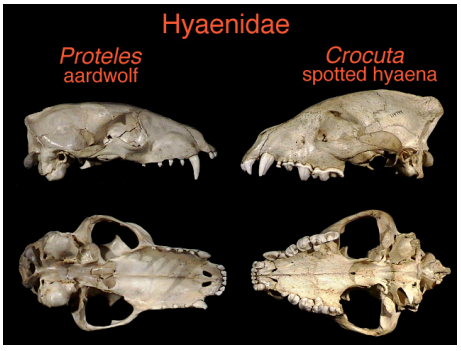

Figure 3.5: This picture shows the diffrences between the dentition of *Proteles* and *Crocuta* (www.hyaenidae.org (2012))

It is distributed in Africa south of the Sahara. It's ears, teeth and tongue and other structures are adapted to this kind of foraging. *Proteles cristata* did not have the typical dentition, which is suspected for a hyena. The canines are very strong and also the jaws. The other teeth especially the cheek teeth are reduced in size. (Kruuk (1975), www.hyaenidae.org (2012)).

***Hyaena hyaena* (Linnaeus, 1758)**

The striped hyena is distributed in Asia and North and East Africa. It is a typical scavenging hyena, which also eats fruits, insects and reptiles. The spotted hyena is slightly bigger than the striped hyena. Moreover, it lives solitary in large territories (Kruuk (1975)).

***Parahyaena brunnea* (Thunberg, 1820)**

The brown hyena with its longer legs and longer coat, than the striped hyena, is better adapted to the desert. It is a solitary animal, like the striped hyena, and eats fruits, eggs, carrion and small animals. It inhabits the South West Arid Zone of Africa. The brown hyena spends 80 % of its night active. Which means that this hyena is a nocturnal animal. In the darkness the brown hyena searches for food and travels long distances for it. (Kruuk (1975), www.hyaenidae.org (2012)).

3.2 Genus Crocuta (Kaup, 1828)

***Crocuta crocuta crocuta* (Erxleben, 1777)**

The spotted hyena is distributed in Tanzania, Kenya, Zambia, Zimbabwe, Mozambique, South Africa, Botswana, Namibia, Congo, Sudan, Central African Republic, Cameroon, Nigeria, Burkina Faso, Ivory Coast, Mali, Senegal, and Sierra Leone. Although spotted hyenas occur throughout sub-Saharan Africa. Furthermore, their density varies widely among different habitats (www.hyaenidae.org (2012)).

The spotted hyena, *Crocuta crocuta crocuta*, is the largest representative of the extant hyenas. Most of the people think that hyenas are only scavengers, but in fact they hunt 70% to 90% of their food by themselves. It has been recorded that the spotted hyena eats almost every animal, from fish, bird or reptile to large herbivorous animals, like wildebeest, gazelle, zebra and others. Their preferred food depends on the area in which they live and which animals are available. Usually they hunt solitary or in small groups, from two up to five individuals, but sometimes even up to 20 individuals. For each prey they have a unique hunt strategy (Kruuk (1975)).

Led by a dominant female, they live in large groups, called clans. A clan can consist of up to 90 individuals. They live in a strength hierarchy, where females dominate over males.
The cups are fed with very fatty milk sometimes up to one and a half year. Usually the females stay in their natal clan where the cubs of the alpha female enjoy a high rank, even the male ones, till they become adolescent. Than the males have to leave their natal clan between the age of two to six, to join another clan. Where they start lowest in rank.
Up to now, there are many studies about the recent spotted hyena, mostly about their unique urogenital system and their hierarchical structure within the group (Holekamp et al. (1997), Engh et al. (2000), Boydston et al. (2001), Cunha et al. (2003)).
The nativity is very complicated, because the cubs have to go through the penis-like vagina of the female spotted hyena. Often the first birth is dead or also the mother of the cub dies due to the big wound, which is left behind after the nativity on the pseudo-penis. Female spotted hyenas only have two teats so triplets are very rare. Singletons and sometimes siblings were born. Approximately 60 % of first births are stillborn (www.hyaenidae.org (2012), H. Hofer and M.L. East (1993), Sofia A. Wahaj, Ned J. Place, Mary L. Weldele, Stephen E. Glickman and Kay E. Holakamp (2007)).
The female spotted hyena invests a lot of energy in raising their cubs. Unusual like in most carnivores, only the mother of the cubs take care of them. The young spotted hyenas are weaned of by about one year, maybe it takes some

time longer. Even though the cubs were born with their full set of teeth and open eyes. After weaning it takes also some month before the subadult hyenas can hunt alone. Moreover, their mother helps them to get access to food (www.hyaenidae.org (2012)

Not much is known about their complicated social life. So can a female and a male form some kind of couple, hunt and eat together but still the female mates with another male (pers. comm. Martina Trinkel). Again not much is known about some morphological features, like tooth replacement. These facts would help better to compare the fossil forms with the extant ones and give us some insight into the behaviour of the cave hyena.

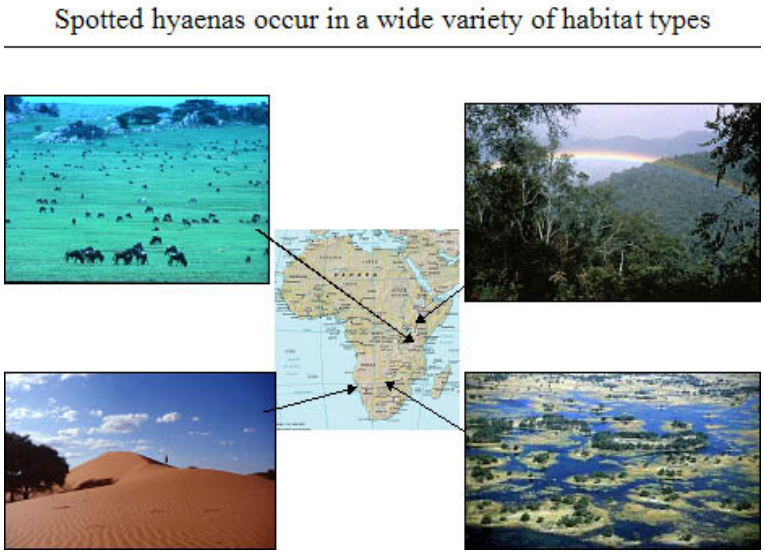

Figure 3.6: Habitat of *Crocuta crocuta* (www.hyaenidae.org (2012))

Crocuta crocuta spelaea (Goldfuss, 1823)

Synonymlist see Werdelin and Solounias, 1991. During the Ice Age the spotted hyena was distributed in Europe and Asia. Due to the fact that the remains of them were found in caves, it got the name cave hyena, *Crocuta croucta spelaea*. Unfortunately, there are only a few caves with lots of remains. Most of the material was found in England in the Tornewton cave and in Austria in the Teufelslucke. For distribution of various sites see Dockner Martin (2006).

According to a genetic study from Rohland et al. (2005), there were three emigration waves from Africa to Eurasia. *Crocuta crocuta spelaea* is known in Great Britain from the last interglacial, 110.000 years before present. In this time the climate was warmer and more humid than today, so even hippos migrated to Europe.

The cave hyena disappeared from Europe before the last glacial maximum 20.000 before present, since there are no Radiocarbon dates younger than 30.000 a BP. Many remains from prey, such as woolly rhino, mammoth, reindeer, horse and others were found in cave hyena dens. It is logical to assume that not only the young hyenas lived in the caves. Also the adult and senile hyenas used the cave as a permanent resting place, lived and died there since a considerable amount of fossil bones and teeth of different wear stages have been found there. Fossils of probably prenatal age up to very old ones were recovered. Additionally, bones from deceased hyenas were found with biting marks from other ones. That is one difference between the extant and extinct hyena. Only the cubs from the recent spotted hyena hide in a cave or burrows, while their mother is hunting. The adults never go into the caves; mostly the entrance is too small.

4 Localities and Material

4.1 Teufelslucke

Excavation History (1874 – 1931)

Up to now the material from the Teufelslucke was sufficiently studied about its systematically placement within the family of Hyaenidae. Moreover, after the excavations in the 20th century a monography was published about the excavation in the Teufelslucke and the fossil material found there, with contributions from different authors: (Ehrenberg et al., 1938), (Sickenberg, 1933), Kernerknecht ((Ehrenberg et al., 1938)). The following is a summary of the previous work

After the discovery of the Teufelslucken cave, many visitors collected bones privately and they are lost for further investigations. For this reason Dr. E. Frischauf, chairman of the Krahuletz – Gesellschaft, estimated that not even half of the material from the cave is preserved now in the museums.

In 1874 Johann Krahuletz began to explore the Teufelslucken cave. He was so fascinated that he decided to start excavation on his own. From 1876 to 1878 Johann Krahuletz began to explore the cave. His first excavation led him to the left branch of the cave near the entrance. First of all he found some Holocene bones from pigs, sheep, caprines and poultry. Most of these bones from the first layer showed signs of gnawing marks from foxes.

An overall result from the excavation of Johann Krahuletz showed that the cave was used as a den for several carnivores. Further investigations proved the cave hyenas as sole bone collector. There were only very few bones from the cave bear *(Ursus spelaeaus)*. This was very unusual, because in other caves of

Austria this animal is very common. Krahuletz suggested that the cave hyenas brought their prey into this cave to share it with their young.

The cave hyenas left gnawing marks on most of the bones as well as many coprolites, which were found in the cave. Furthermore these bones showed no signs from water or any other mechanical transportation. Based on these observation and the discoveries he made, Krahuletz supposed that the cave hyenas lived in the caves and the bones were acculated by them.

An overview of the amount of findings from the second excavation of Johann Krahuletz (1887 – 1889):

- mainly bones and teeth from cave hyenas (*Crocuta crocuta spelaea*)
- some bones and teeth from cave bears (*Ursus spelaeus*)
- *Canis lupus, Canis vulpes, Cervus elephas, Cervus tarandus, Elephas primigenius, Rhinoceros tichorhinus, Insectivora, hazel dormice*
- 3 stone tools (e.g. lanceheads), tools from reindeer and deer

The successor of Johann Krahuletz was Dr. Josef Bayer, Director of the Prehistoric Department of the Museum of Natural History in Vienna. He continued the excavation at the Teufelslucken cave in April 1929 and he managed the next three excavations from April 1929 until May 1931.

During this excavation time at least three depredations took place. Furthermore a second entrance was artificially opened (Ehrenberg et al., 1938).

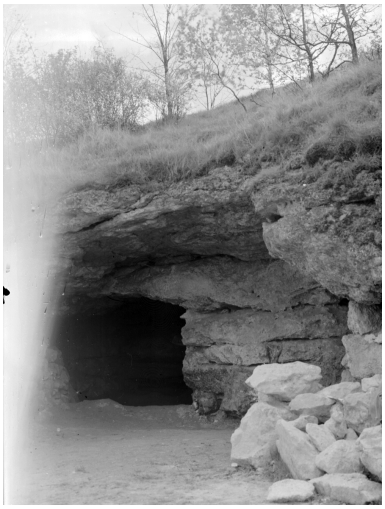

Figure 4.1: This picture shows the Teufelslucken cave during the excavations of Ehrenberg and A. Stift-Gottlieb (picture from Johannes Tuzar, Krahuletz-Museum)

Material

Most of the fossil material studied herein is from the Teufelslucken cave. This locality is situated in the northeastern part of Eggenburg near Roggendorf, more precisely on the northern slope of the Königsberg. The Königsberg has a very steep entrance to the cave (Ehrenberg et al. (1938)).

Figure 4.2: Teufelslucke in Roggendort near Eggenburg as it looks today

The cave was known long before Johann Krahlutz began to excavate between 1874 and 1889 for the first time. Josef Höbart also explored and excavated the Teufelslucken in 1926. Furthermore, A. Stifft-Gottlieb led the earliest excavations between 1929 and 1931 ((Ehrenberg et al., 1938))

For the time being, mainly the prehistoric remains were of main interests but it is not exactly known if these stone tools really originate from the Teufelslucken. The animal remains were first described and published by Sickenberg (1933) and later by Ehrenberg et al. (1938),und S. Kernerknecht (1940), Berg (1966).

Kernerknecht (Ehrenberg et al. (1938), und S. Kernerknecht (1940)) worked on the a stratigraphy in the cave and distinguished three horizons:

1. uppermost humus layer
2. fossiliferous light yellow-brownisch clay, with quartzose sand
3. brighter quartzose sand without fossils

The fossils were found in the first two horizons. The Rodentia, Lagomorpha, Microchiroptera, Insectivora and the remains of birds were found in the first horizon and are therefore probably of Pre- or Holocene age.

The fossil remains from mammoth, cave hyena, bison, woolly rhino and *megaceros* probably came from the middle layer.

The smaller mammal remains came from owls pellets (Ehrenberg et al. (1938)). Many bones of herbivores carry the typical gnawing marks of hyenas. The proximal and distal ends are missing. Bones were cracked open to get access to the nutritious marrow inside. Feeding tests by Zapfe (1966) proved this feature as typical for th extant *Crocuta crocuta*.

Radiocarbon dating in Vienna at the Vienna Environment Research Accelerator (=VERA 2536) suggests an age of 40.000 years before present (40.000 + 920/-830a BP). The Fauna is related to the last Würm period, just before the last glacial, around 20.000 years before present.

Material from the Teufelslucken stored in the Krahuletz-Museum in Eggenburg:

All the material is from *Crocuta crocuta spelaea*.

Table 4.1: Abbreviations for the caves

NHMW	Natural History Museum in Vienna
Ho	Höbarth Museum in Horn
AH	Aufhausener cave
TL	Teufelslucke
Slouper	Slouper cave
Čertova	Čertova pec cave
Irpfel	Irpfel cave

Upper P_4, sin: Inventory No: 1416, 877, F/3314 – F/3321, F/3614 – F/3619, 946, F/3101/1 – F/3101/5

Upper P_4, dext: Inventory No: 516, 916, 2577, 1621, 1323, F/3300 – F/3313, F/3319, 496, 2079, F/3104/6 – F/3104/8, 1744

Upper P_3, sin: Inventory No: 550, 2445, 1529, 334, F/3103/1 – F/3103/3, 270, 302, 659, 926, 2870, 2024, 1360, 745, F/3322 – F/3329, F/3350, F/3350

Upper P_3, dext: Inventory No: 892, 98, 893, 1322, F/3330 – F/3343, 908, F/3496 – F/3497, 728, 949, 1622, F/3103/4 – F/31039

Upper P_2, sin: Inventory No: 1634, 1632, F/3487 – F/3492, 921, 301, 148, 2339, F/3096/1

Upper P_2, dext: Inventory No: 147, 528, 1062, 1450, 2875, F/3484 – F/3486, F/3096/2 – F/ 3096/6, 1626

Caninus superior, sin: Inventory No: 616, 732, F/3402 – F/3403, 32, 2442, F/3108/1 – F/3108/5

Caninus superior, dext: Inventory No: 490, 398, 896, F/3399 – F/3401, 542, 518, 1196, 2545, F/3108/6 – F/3108/13

Mandible and Mandible fragments sin: Inventory No: 2520, 540, 684, 941, 812, 475, 403, 867, 785, 943, 1219, 1895, F/3556, F/3558, F/3561, F/3562, F/3565, F/3567, F/3571, F/3574, F/3575, F/3576, F/3578

Mandible and Mandible fragments dext: Inventory No: 1415, 488/1, 2041, 2038, 488/2, 1220, 942, 722, 467, 513, 726, 726/1, 786, F/3557,

F/3559, F/3560, F/3563, F/3564, F/3566, F/3568, F/3569, F/3572, F/3573, F/3577, F/3579

Lower m_1, sin: Inventory No: 228, 901, 585, 988, 2088, 2083, 511, 784, 1748, 639, 510, 2754, F/3378 – F/3398, 2832, F/3620, 1924, 960, /F/3095/1 – F/3095/3

Lower m_1, dext: Inventory No: 966, 564, 873, 934, 878, 1425, 1530, 509, 57, F/3361 – F/3380, F/3619, 947, F/3095/4 – F/3095/6

Lower p_4, sin: Inventory No: 66 (99), 743, 2675, 1431, 2409, 951, 2889, F/3356 – F/3360, F/3457 – F/3468, 1526, 930, 600, 89..

Lower p_4, dext: Inventory No:96, 683, 643, 1047, 1925, 876, 2876, 64, 2097, 3040, 3043, F/3351 – F/3355, F/3440 – F/3456, 1743, 27, 865, 1008, 734

Lower p_3, sin: Inventory No: 985, 875, 508, 1429, 736, F/3434 – F/3439, 929, 526

Lower p_3, dext: Inventory No: 744, 1623, F/3425 – F/3433, F/3493, F/3493

Lower p_2, sin: Inventory No: 2885, 807, 1754, F/3344 – F/3347, F/3476 – F/3483

Lower p_2, dext: Inventory No: 550, 417, 740, 2869, 2912, 996, F/3348, F/3349, F/3469 – F/3475

Caninus inferior, sin: Inventory No: 355, F/3416 – F/3424, 1320, 206, 1998, 2586, 730, 1117, F/3107/1 – F/3107/14, 503

Caninus inferior, dext: Inventory No: 2866, 944, 2438, 1922, 2491, 28.., F/3404 – F/3415, 2345, 761, 1319, 945, 2549, 731, 1851, 628, F/3102/1 – F/3102/11

Maxilla and Maxilla fragments, sin: Inventory No: 514, 1318, 723, 1081, F/3581, F/3584, F/3585, F/3589, F/3590, F/3592, F/3593, F/3595, F/3597

Maxilla and Maxilla fragments, dext: Inventory No: 724, 1045, 847, F/3580, F/3582, F/3583, F/3586 - F/3588, F/3591, F/3594

Skull: Inventory No: 1218, 1478

Juvenile Mandibles and Fragments, dext: Inventory No: 1822, 1458, 3033, 2627, F/3498 – F/3502

Juvenile Mandibles and Fragments, sin: Inventory No: 348, 783, 672, 2392, 218., 3016, 2050, 1740, 825, 2492, F/3500 – F/3505

Lower dp_4, sin: Inventory No: 262, 2679, 1111, 1756, F/3511 – F/3515, F/3517

Lower dp_4, dext: Inventory No: 739, 1330, 2105, F/3516, F/3518 – F/3525

Lower dp_3, sin: Inventory No: 2731, 2852, 3074, 3119, F/3537 – F/3546

Lower dp_3, dext: Inventory No: 41, 1333, 1346, F/3528 – F/3536

Juvenile Maxilla and Fragments, dext: Inventory No: 2069, 1817, 2144, F/3506, F/3507, F/3509, F/3656

Juvenile Maxilla and Fragments, sin: Inventory No: 1639, 1453, 1742, F/3509, F/3510, F/3505, F/3506, 2314

Upper dp_4, sin: Inventory No: F/3598 – F/3601

Upper dp_3, sin: Inventory No. 1326, F/3549 – F/3553, F/3548

Upper dp_3, dext: Inventory No: F/3354, F/3355, 454, 323, 1325, 454

Humerus sin and dext: Inventory No: 255, 123, F/3125/1

Tibia sin and dext: Inventory No: 2219, 122, 164 and F/3621

Ulna sin and dext: Inventory No: 1?893, 1670, 115, 1670, F/3626, F/3627 and 814, 1892, F/3623 – F/3625

Radius sin and dext: Inventory No: 2173, 169, F/3628 – F/3631, 2218 and F/3622

Metacarpale II, sin: Inventory No: F/3130, 1986, 2248, F/3083/2, F/3083/3

Metacarpale II, dext: Inventory No: 419, 2145, 1280, 2807, 2393, 2798, F/3632 – F/3638, F/3083/1

Metacarpale III, sin: Inventory No: F/3130/6 – F/3130/8, F/3091/2 – F/3091/5

Metacarpale III, dext: Inventory No: 2064, F/3130/9, F/3130/10, F/3091/1, F/3091/6

Metacarpale IV, sin: Inventory No: F/3639, F/3640, 756, 1721, F/3093/1 – F/3093/3, F/3092/1 – F/3093/3

Metacarpale IV, dext: Inventory No: 34, F/3641, F/3642, F/3130, 189, 208, 1900, F/3093/4, F/3093/5, 192, F/3092/4 – F/3092/7

Metacarpale V, sin: Inventory No: F/3645 – F/3647, F/3132, F/3130/1, 317, 1835, 1512, F/3084/5 - F/3084/9

Metacarpale V, dext: Inventory No: 37, F/3643, F/3544, F/3232, F/3084/1 – F/3084/4

Metatarsale II, sin: Inventory No: 1830, 678, F/3081/7 - F/3081/9

Metatarsale II, dext: Inventory No: F/3081/1 – F/3081/6

Metatarsale III, sin: Inventory No: 1508, 2628, F/3648, F/3656, 509, .58, .644, 359, F/3090/2 – F/3090/4

Metatarsale III, dext: Inventory No: 1989, 2806, F/3649, F/3650, F/3130/4, F/3130/5, F/3090/1

Metatarsale IV, sin: Inventory No: F/3130/2, 503

Metatarsal IV, dext: Inventory No: 1709, 2192, 2788, F/3651

Metatarsale V, sin: Inventory No: 5, 409, 1438, 2250, 2249, 2008, F/3652 – F/3655

Metatarsale V, dext: Inventory No: 126, 341, 541

Höbarth Museum in Horn

Material from the Teufelslucken cave, which was excavated by Josef Höbarth in 1926.

Inventory No from Ho 21527 to 21530, Ho 21532, Ho 21534 to 21537, 8885: *Crocuta crocuta spelaea*, adult, left maxilla

Inventory No Ho 21531, Ho 21533, Ho 21539: *Crocuta crocuta spelaea*, adult, right maxilla

Inventory No Ho 21554, Ho 21557 - 21558, Ho 21561 - 21562: *Crocuta crocuta spelaea*, adult, left upper P_4

Inventory No Ho 21555 - 21556, Ho 21559, Ho 21560 and 21563: *Crocuta crocuta spelaea*, adult, right upper P_4

Inventory No Ho 21564, 21568 and 21571: *Crocuta crocuta spelaea*, adult, left upper P_3

Inventory No Ho 21565 – 21567, Ho 21569 – 215670: *Crocuta crocuta spelaea*, adult, right upper P_3

Inventory No Ho 21672 – 21573, Ho 21575 – 21576 and Ho 21652: *Crocuta crocuta spelaea*, adult, left upper P_2

Inventory No Ho 21574 and Ho 21648: *Crocuta crocuta spelaea*, adult, right upper P_2

Inventory No Ho 21577 – 21580, Ho 21650 – Ho 21651: *Crocuta crocuta spelaea*, adult, left and right upper P_1

Inventory No Ho 21654 – 21660: *Crocuta crocuta spelaea*, adult, left Caninus superior

Inventory No Ho 21661 – 21665: *Crocuta crocuta spelaea*, adult, right Caninus superior

Inventory No Ho 21538, 8885, Ho 21540 – 21544, Ho 21548 – 21549, Ho 21552 – 21553: *Crocuta crocuta spelaea*, adult, left Mandible

Inventory No Ho 21545 – 21546, Ho 21550 – 21551: *Crocuta crocuta spelaea*, adult, right Mandible

Inventory No Ho 21581, Ho 21583 – 21584, Ho 21587 – 21588, Ho 21590, Ho 21592, Ho 21594, Ho 21596: *Crocuta crocuta spelaea*, adult, left lower m_1

Inventory No Ho 21582, Ho 21585 – 21586, Ho 21589, Ho 21591, Ho 21593, Ho 21595: *Crocuta crocuta spelaea*, adult, right lower m_1

Inventory No Ho 21597 – 21606: *Crocuta crocuta spelaea*, adult, left lower p_4

Inventory No Ho 21607 – 21613: *Crocuta crocuta spelaea*, adult, right lower p_4

Inventory No Ho 21614 – 21618, Ho 21640 – 21641, Ho 21643 – 21646: *Crocuta crocuta spelaea*, adult, left lower p_3

Inventory No Ho 21619 – 21623, Ho 21643, Ho 21647: *Crocuta crocuta spelaea*, adult, right lower p_3

Inventory No Ho 21624 – 21629: *Crocuta crocuta spelaea*, adult, right lower p_2

Inventory No Ho 21666 – 21667: *Crocuta crocuta spelaea*, adult, left Caninus inferior

Inventory No Ho 21668 – 21678: *Crocuta crocuta spelaea*, adult, right Caninus inferior

Inventory No Ho 21630 – 21631: *Crocuta crocuta spelaea*, juvenil, left mandible

Inventory No Ho 21632 – 21634: *Crocuta crocuta spelaea*, juvenil, right lower dp_4

Inventory No Ho 21653: *Crocuta crocuta spelaea*, juvenil, right lower dp_3

Inventroy No Ho 21638 – 21639: *Crocuta crocuta spelaea*, juvenil, upper dp_4

Inventory No Ho 21635: *Crocuta crocuta spelaea*, juvenil, left upper dp_3

Inventory No Ho 21636 – 21637: *Crocuta crocuta spelaea*, juvenil, right upper

4.2 Aufhausener Höhle

The rescue excavation for the material in the Aufhausener cave began in 1964 and last until 1965. But soon the excavation stopped due to quarrels within the members of the excavation team. Because of this the valuable fossil material was for long years not worked with. During this time the entrance of the cave was broken open and some of the fossils in the first layer were stolen.
The members of the Naturkunde Museum in Stuttgart collected all the remaining fossils in the Aufhausener cave. Numerous site inspections took place between 1977 and 1978 and several times in 1981.
The located fossil material, not only from the cave hyena, was prepared in the Naturkunde Museum in Stuttgart and stored there (after Thomas Rathgeber (1982)).

Material

Inventory No AH 251 – AH 253: *Crocuta crocuta spelaea*, adult, left mandible

Inventory No AH 251: *Crocuta crocuta spelaea*, adult, right mandible

Inventory No AH 248: *Crocuta crocuta spelaea*, adult, Skull
(left and right Maxilla

Inventory No AH 256: *Crocuta crocuta spelaea*, adult, upper P_4

Inventory No AH 180: *Crocuta crocuta spelaea*, adult, right Humerus

Inventory No AH 188: *Crocuta crocuta spelaea*, adult, right Uln

Inventory No AH 184 and AH 185 *Crocuta crocuta spelaea*, adult, left Radius

Inventory No AH 182: *Crocuta crocuta spelaea*, adult, right Radius

Inventory No AH 200: *Crocuta crocuta spelaea*, adult, left Tibia

Inventory No AH 189 and AH 20: *Crocuta crocuta spelaea*, adult, right Tibia

Inventory No AH 193: *Crocuta crocuta spelaea*, adult, right Femur

Inventory No AH 155, AH 154: *Crocuta crocuta spelaea*, adult,
left Metacarpale V

Inventory No AH 153 and AH 157: *Crocuta crocuta spelaea*, adult, left and right Metacarpale IV

Inventory No AH 152: *Crocuta crocuta spelaea*, adult, left Metacarpale III

Inventory No AH 150 – AH 151, 162 and AH 156: *Crocuta crocuta spelaea*, adult, left and right Metacarpale II

Inventory No AH 166: *Crocuta crocuta spelaea*, adult, right Metatarsale II

Inventory No AH 163 and AH 167: *Crocuta crocuta spelaea*, adult, left and right Metatarsale III

Inventory No AH 164 – AH 165 and AH 168: *Crocuta crocuta spelaea*, adult, left and right Metatarsale IV

4.3 Irpfelhöhle

Figure 4.3: Picture of the Irpfel cave (www.lochstein.de, 2012).

Approximately 1700 m WNW from Giengen at the Brenz in Württemberg, (Germany) opens the Irpfelhöhle to the South. The trademark of this cave is the isolated gateway made of stone. The Irpfelhöhle extended up to 56 m in length and is situated in the Oberen Massenkalk (late Jurassic). Furthermore, numerous bones from glacial animals were found and some artefacts from the Moustérien (European Middle palaolithic) after Andree (1939), Cramer (1941) and Lehmann (1960). This cave is a typical hyena den. About 25% of the fossil findings belong to the cave hyena and 50% of the fossil bones are from horses.Furthermore, some Mousterien artefacts were found (www.lochstein.de (2012), www.geoparkalb.de (2012)).

Material

Inventory No 7907.2-E, 32599, 32600.5, 32600.6 and 32600.7:
Crocuta crocuta spelaea, adult, left mandible

Inventory No 7907.2-E, 7907.5, 7907.2-E, 7911.7, 7911.8, 32600.3, 32600.4:
Crocuta crocuta spelaea, adult, right mandible

Inventory No 7911.1, 7911.2, 7801 (skull): Crocuta crocuta spelaea,
left maxilla

Inventory No 7801(skull): Crocuta crocuta spelaea, adult, right maxilla

Inventroy No 7912: *Crocuta crocuta spelaea*, adult, left Tibia

Inventory No (no No) *Crocuta crocuta spelaea*, adult, Metatarsale IV

Inventory No (no No) *Crocuta crocuta spelaea*, adult, Metacarpale II, III and IV

4.4 Oberrhein/Ketsch

This material was found by workers in gravel pits along the Rhine river in Germany mainly troughout trenching. In this gravel pits, the bones were collected, before they get destroyed (Cajus G. Diedrich, 2008).

Material

Inventroy No 6617: *Crocuta crocuta spelaea*, adult, Skull

4.5 Villa Seckendorff

The "cave" lies in Stuttgart-Bad Cannstadt in Germany. At the beginning of February in 1957 excavation operations started, because the Residential Home for the elderly in Villa Seckendorff needed to be expanded. During this excavation operation a swallow hole (Karstschlot) with numerous bones was found. A rescue excavation lasting only a few weeks under the administration of K.D. Adam took place. Based on the gnawing marks of several bones, Adam thought that this place was a den of the cave hyena. Also some scattered, smashed and destroyed bones were found, which were thought to be the work of early human beings. (von Koenigswald (1985), Forsten and Ziegler (1995), Ziegler (1996)).

Material

Inventory No 31370 – 31374, 31365 and 31369: *Crocuta crocuta spelaea*, adult, left mandible

Inventory No 31375 – 31378 and 31380: *Crocuta crocuta spelaea*, adult, right mandible

Inventory No 31340 – 31341: *Crocuta crocuta spelaea*, adult, left maxilla

Inventory No 31335 – 31338: *Crocuta crocuta spelaea*, adult, right maxilla

Inventory No 31343, 31351 and 31354: *Crocuta crocuta spelaea*, adult, right upper P_4 and Caninus superior

Inventory No 31349 and 31408: *Crocuta crocuta spelaea*, adult, left Caninus superior

Inventory No 31404: *Crocuta crocuta spelaea*, juvenil, right Mandible

4.6 Čertova pec Cave

The Čertova pec cave is located at the foot of Nad Lipovcom Hill, near the village Radošina in the western part of Slovakia. The cave is a karstic feature in dolomite limestone and looks like a tunnel. It is 27 kilometres long and accessible from both directions. The first archeological research was in 1958 – 1961 by Juraj Bârta. (Hokr, 1951) was the first, who described the older fossils record from Čertova pec. Later (Musil, 1996) discovered the fossil material from Bârta, and described it. Now the fossil material on which Musil worked is stored in the Slovak Museum of Natural Protection and speleology in Liptošky (pers. comm. Martin Sabol).

Figure 4.4: Picutre of the Čertova pec cave in Slovakiahttp://commons.wikimedia.org (2012),www.regionitra.sk (2012),www.penzionzachej.sk (2012)

Material

The material from the Čertova pec has no inventory numbers only excavation numbers. The material belongs to a private collector.

Excavation No 84?: *Crocuta crocuta spelaea*, right Mandible, adult

Excavation No CP 9/220-230: *Crocuta crocuta spelaea*, right Mandible, juvenil

Excavation No CP 7/210-220: *Crocuta crocuta spelaea*, right lower m_1, adult

Excavation No CP 7/210-220: *Crocuta crocuta spelaea*, right lower m_1, adult

Excavation No CP 7/210-220: *Crocuta crocuta spelaea*, right lower m_1, adult

Excavation No CP 7/200-210: *Crocuta crocuta spelaea*, right lower m_1, adult

Excavation No CP 9/310-320: *Crocuta crocuta spelaea*, left lower p_4, adult

Excavation No ?7/210-220: *Crocuta crocuta spelaea*, right lower p_4, adult, dated by ^{14}C

Excavation No no Number: *Crocuta crocuta spelaea*, lower p_3, adult, dated by ^{14}C

Excavation No ?9/220-230: *Crocuta crocuta spelaea*, upper P_4, adult, dated by ^{14}C

4.7 Slouper Cave

The cave is situated in the Northeastern part of Brünn and is the biggest complex of caves in Mähren. It is a labyrinth of caves and ranges about 500 km in length and 200m in width. The cave can be divided in three parts.
First of all there is the so called Kuhstall or Schopfen (Kulna), which extends to the south. It is a very flat tunnel and ranges 80 km in length and 20m in width.
Second part is the actual Slouper cave or Bärenhöhle (= bear cave). This cave starts behind an isolated pillar made of stone, the sloup, which gave the cave its name. The way leads to a low entrance, which is filled with water in spring.

This part of the cave has lots of branches and big halls, which are often filled with water. The top of the sediments was already raked up from collectors searching for fossil bones and teeth. But on the basement the scientists found many remains of *Ursus spelaeus* (cave bear). Based on these remains the cave got its name.
And last but not least the third part is the Nichtsgrotte. The entrance from the Nichtsgrotte is also behind the sloup. This cave is elongated and ends in the north with an alluvial fan. Near to the end of the Nichtsgrotte there is an impressive stalactite cave, which was discovered in 1879 (Suombathy (1883), Wankel (1867)).

Material

Inventory No: 2008z0087/009 dext, 2008z0087/0015 dext, 2008z0087/0013 dext, 2008z0087/0014 dext, 2008z0087/0012 sin, 2008z0087/0011 dext juv., 2008z0087/0005 dext, 2008z0087/0007 dext, 2008z0087/0010 dext, 2008z0087/0006 dext, 2008z0087/0006 sin:
Crocuta crocuta spelaea Mandible, sin and dext

Inventory No: 2008z0087/0040 sin, 2008z0087/0039 sin, 2008z0087/0037 sin, 2008z0087/0036 dext, 2008z0087/0035 dext, 2008z0087/0038 sin:
Crocuta crocuta spelaea lower m_1, sin and dext

Inventory No: 2008z0087/0034 sin: *Crocuta crocuta spelaea* lower p_4

Inventory No: 2008z0087/0030 dext, 2008z0087/0031 dext:
Crocuta crocuta spelaea lower p_3:

Inventory No: 2008z0087/003 sin, 2008z0087/002 dext, 2008z0087/002 sin:
Crocuta crocuta spelaea Maxilla, sin and dext

Inventory No: 2008z0087/0033 dext, 2008z0087/0032 sin, 2008z0087/0029 sin: *Crocuta crocuta spelaea* Upper P_4, sin and dext

Inventory No: 2008z0087/0026 dext, 2008z0087/0028 sin:
Crocuta crocuta spelaea Upper P_3, sin and dext

Inventory No: 2008z0087/0025 sin: *Crocuta crocuta spelaea* Upper P_2

4.8 Recent Material: from the Natural History Museum in Vienna

Inventory No. 397: *Crocuta crocuta*, adult, sex unidentified, eastern South Africa (Orange Free State – Zambia), (1883 – 1887), Dr. Emil Holub leg et don. (AV 1894/II/2), Publication Dockner M. 2006, diploma theses

Inventory No. 1150: *Crocuta crocuta*, adult, sex unidentified, Masai-Hochland, Prov. Arusha, Tansania, 1899/1900, Prof. C. G. Schillings leg et don., (AV 1900/II/15a), diploma theses M. Dockner

Inventory No. 1244: *Crocuta crocuta*, adult, sex unidentified, eastern South Africa (Orange Free State – Zambia), (1883 – 1887), Dr. Emil Holub; brought from his estate 1903 (AV 1903/II/22), DNA sample rigtht I_1, Dr. Doris Nagel 22.5.2002. Publication Rohland et al 2005, diploma theses M. Dockner

Inventory No. 1275: *Crocuta crocuta*, juvenil, sex unidentified, eastern South Africa (Orange Free State – Zambia), (1883 – 1887), Dr. Emil Holub leg, brought from his estate 1903 (AV 1903/II/..), DNA sample from right P_1, Dr. Doris Nagel 22.5.2002, Publication Rohland et al 2005, diploma theses M. Dockner

Inventory No. 1744/B: *Crocuta crocuta*, adult, sex unidentified,on the Setit-river near the border of the Sudan (=Homera), Prov. Begendir or Sernyen, Athiopia, 14"15'N, 36"40'E, 1907, Nemev/Beneschau leg et vend (AV 1907/XIII/(1)) Diploma theses M. Dockner

Inventory No. 1755: *Crocuta crocuta*, adult, female, Somaliland (=Brit. S.; now North Somalia, perhaps at the Berbera – Hargeisa route, 1898, Nemec leg.; bougth 1907, (AV 1907/XIII/(1)), DNA sample left I_1, Dr. Doris Nagel, 22.5.2002, Pulication Rohland et al 2005, diploma theses M. Dockner 2006

Inventory No. 3919: *Crocuta crocuta*, adult, sex unidentified, Stony Athi, 1°36' S/ 37°01' E, Kenya, 2. October 1908, Dr. Horaz Sonnenthal leg. (came probably in 1920 in the Museum of Natural History with his estate, although listed in AV1929/XII only antilopes and native Ungulates),DNA

sample right I_1, Dr. Doris Nagel, 22.5.2002, Publication Rohland et al 2005, Diploma theses M. Dockner 2006

Inventory No. 5584: *Crocuta crocuta, adult*, male?, Ngalhni/Sigare (n.lok.), Prov. Nord, Cameroun, 9. Mai 1933, E.A. Zwilling leg. et don, DNA sample left I_3, Dr. Doris Nagel 22.5.2002, Diploma theses M. Dockner 2006

Invenory No. 6061: *Crocuta crocuta*, adult, sex unidentified, upper reaches of river Dinder between Abu Hashim and Hegeirat, Blue Nile Provence, Sudan, 1925, Prof. Dr. H. A. Bernatzik leg. et don., DNA sample right m_1 (distal root), Dr. Doris Nagel 22.5.2002, Publication Rohland et al 2005, Diploma theses Martin Dockner 2006

Inventory No. 6062: *Crocuta crocuta*, addult, sex unidentified, upper reaches of river Dinder between Abu Hashim and Hegeirat, Blue Nile Province, Sudan, 1925, Prof. Dr. H. A.Bernatzik leg. et don., DNA sample left I_1, Dr. Doris Nagel, 22.5.2002, Diploma theses M. Dockner 2006

Inventory No. 6063: *Crocuta crocuta*, adult, sex unidentified, upper reaches of river Dinder between Abu Hashim and Hegeirat, Blue Nile Province, Sudan, Prof. Dr. H. A. Bernatzik leg. et don., DNA sample left I_3, Dr. Doris Nagel, 22.5.2002, Diploma theses M. Dockner 2006

Inventory No. 6064: *Crocuta crocuta*, adult, sex unindentified, upper reaches of river Dinder between Abu Hashim and Hegeirat, Blue Nile Province, Sudan, Prof. Dr. H. A. Bernatzik leg. et don., Diploma theses M. Dockner 2006

Inventory No 7392: *Crocuta crocuta*, adult sex unidentified, Wadelai (now Mutir), 2°45' N/ 31°26' E, Uganda (labelled with "Upper Egypt"), (1882), Dr. Emin Bey leg. et don., 1913, assumed from the geological - palaeontological department, DNA sample m_1, Dr. Doris Nagel, 22.5.2002, Publication Rohland et al. 2005

Inventory No 7393: *Crocuta crocuta*, adult, male, Beni, 0°26' N/ 29°35' E, Prov. Kivu, Kongo/Zaire, July 1910, Rudolf Grauer leg. Ph. v. Oberländer don., Diploma theses Mag. M. Dockner 2006

Inventory No 21495: *Crocuta crocuta*, adult, sex unidentified, Wadelai (now Mutir), 2°45' N/ 31°26' E, Uganda (labelled "upper Agypt"), Dr. Emin Bey leg. Et don.; 1913 assumed from the geological - palaeontological department, (right site of the cranium sliced), DNA sample left P_2 (proximal part), Dr. Doris Nagel, 22.5.2002, Publication Rohland et al. 2005, Diploma theses Mag. M. Dockner 2006

4.9 Recent material form the Natural History Museum in Berlin

Inventory No. ZMB 16575 sin : (all elements belong to one individual) *Crocuta crocuta*, subadult, female, Ruwana-Steppe, Bez. Muansa East-Afrika, Kittenberger, Rolle, 6. 191, Humerus, Radius, Ulna, Femur, Tibia, Fibula, Calcaneus, Astragalus. Mc II, Mc III, Mc IV, Mc V, Mt II, Mt III, Mt IV, Mt V

Inventor No. ZMB 82413 dext: (all elements belong to one individual) *Crocuta crocuta*, subadult, sex unidentified, Tibati in Kamerun, Riggenbach, 11. 8.1909, Humerus, Radius, Ulna, Femur, Tibia, Fibula, Calcaneus, Astragalus. Mc II, Mc III, Mc IV, Mc V, Mt II, Mt III, Mt IV, Mt V

Inventory No. ZMB 82471 sin: (all elements belong to one individual) *Crocuta crocuta*, subadult, male, Senafè in Eritrea, Berger, 13. 3. 1913, Humerus, Radius, Ulna, Femur, Tibia, Fibula, Calcaneus, Astragalus. Mc II, Mc III, Mc IV, Mc V, Mt II, Mt III, Mt IV, Mt V

Inventory No. 82516 sin: (all elements belong to one individual) *Crocuta, crocuta*, subadult, male, Msamwia in eastern Africa, Fromm, Humerus, Radius, Ulna, Femur, Tibia, Fibula, Calcaneus, Astragalus. Mc II, Mc III, Mc IV, Mc V, Mt II, Mt III, Mt IV, Mt V

Inventory No. A168.10: Skull, juvenile

Inventory No. 73149: Skull, juvenile

5 Methods

All measurements were taken with a digital or a manual calliper to the nearest of 0.1 mm. The material was cleaned, labeled with ink and catalogued. Moreover, the material was photographed with a Nikon 5000 and arranged. I used Photoshop 7, Illustrator 10 and SPSS 15 for visual arrangements and for the statitic evaluations.

5.1 Measurements

Measurements were taken on the teeth; cranial and post-cranial elements of the cave hyena and measurements from teeth, cranial and post-cranial elements of the recent spotted hyena. The post-cranial measurements include the maximum length (GL), the maximum width proximal (Bp), the minimum width of the diaphysis (KD) and the maximum width distal (Bd).

Table 5.1: Abbreviations for the taken measurements on the post-cranial skeleton (based on von den Driesch (1976))

GL	maximum length
GLC	maximum length from the caput
Bp	maximum width proximal
KD	minimum/smallest width of the diaphysis
Bd	maximum width distal
Tpa	depth over Processus ancaeus
KTO	minimum depth of the olecranon
Bpc	maximum width over Processus coronerii = maximum width of the prox. articular surface
TC	Tiefe des Caput Femuri
Lp	maximum length proximal
BT	maximum width of the Trochlea

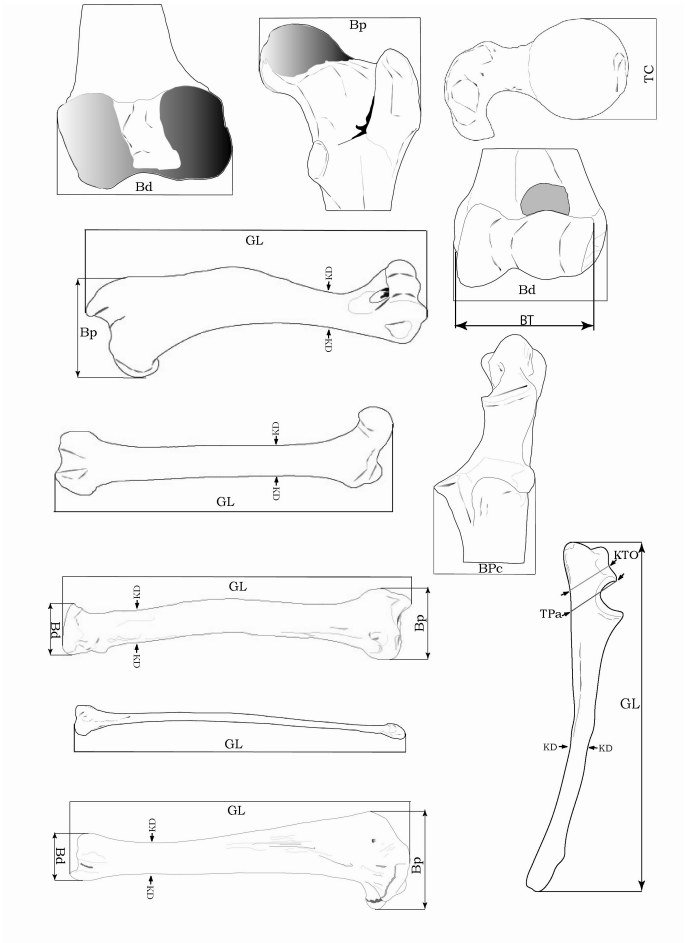

Figure 5.1: Measurements on the post-cranial skeleton.

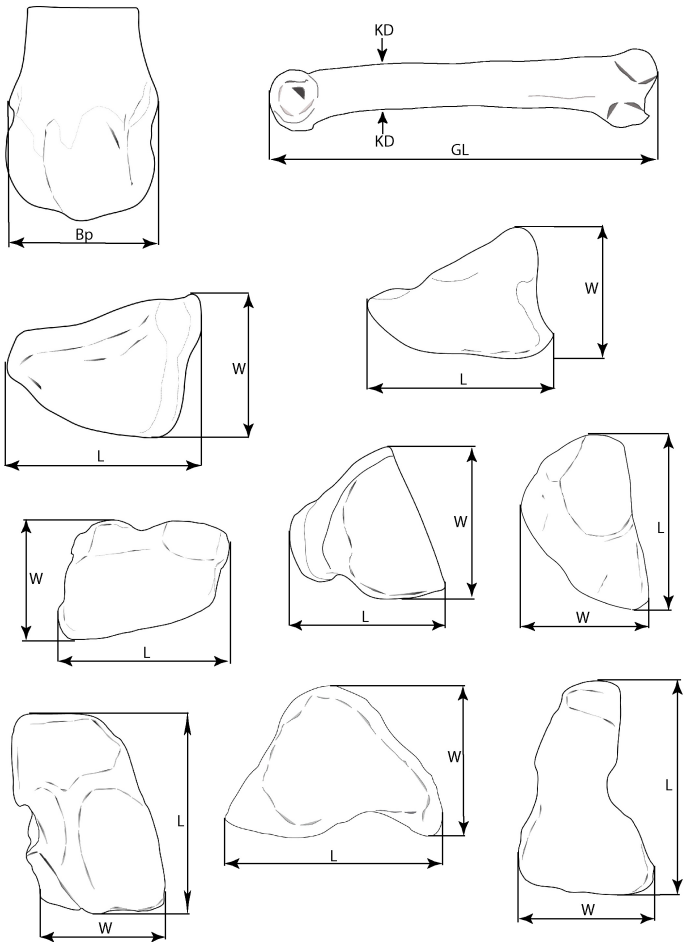

Figure 5.2: Measurements on the Metacarpale and Metatarsale.

On the skull, eight measurements were taken, which are shown in the picture below. On the juvenile skull only the measurements 1, 2 and 3 were taken.

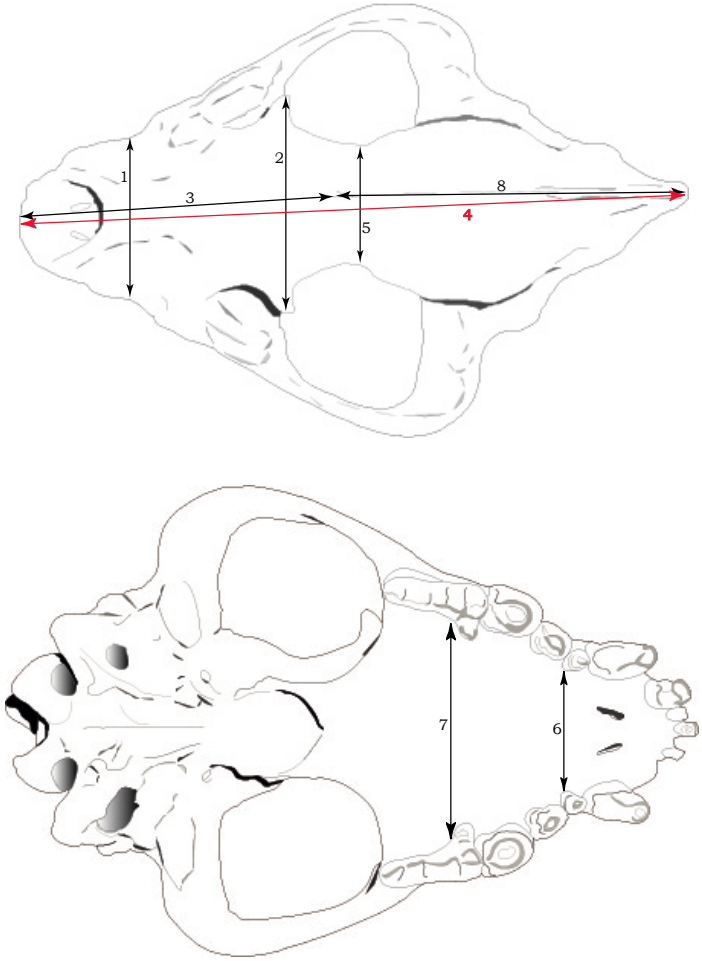

Figure 5.3: Measurements on the palatine and on the Skull.

For the upper P_3, P_2, P_1, the caninus and the lower p_4, p_3, p_2 and the caninus the total length, the width and the height were taken. Furthermore, for the lower m_1 additional measurements were taken, height of the protocon (Hpr), height paraconid (Hpa), length of the talonid (lengthTa) and the width of the talonid (widthTa). Also for the upper P_4 additional measurments were taken, width of the protocon (Wpr) and the length of the metacon blade (Lme).

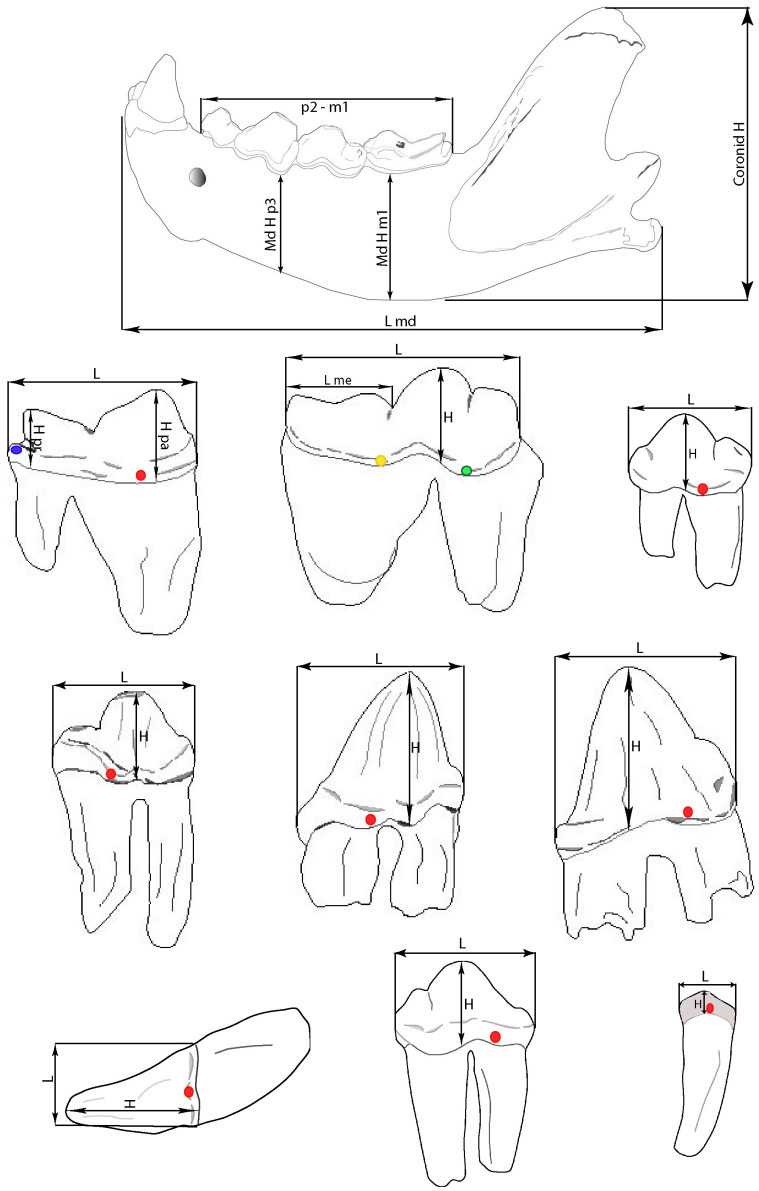

Figure 5.4: Measurements on the teeth.

The red dots on the teeth show the point at which the measurements for the width were taken. The green dot demonstrate the measurements for the width with the protocon and the yellow dot for the width. The blue dot show additional measurements like the the width of the Talonid and the length of the talonid.

6 Statistics

Specimens from the Teufelslucken cave, from four caves in Germany, from the Slouper cave in the Czech Republic, the Čertova pec cave in Slovakia, four recent individuals from the Museum für Naturkunde in Berlin and 15 recent individuals from Africa (NHMW) were measured. In particular, the focus was layed on the measurement of the teeth from the upper and lower jaw. Furthermore, the available post-cranial skeleton was measured.
For the calculations the raw measurements were taken and no standardized form was used.

At first a discriminatory analysis in SPSS was made of the recent specimens to look if it is possible, like in the mtDNA analysis, to separate populations. For this reason, the recent specimens were split accroding to their origin in a Northern, Eastern and Southern populations. Unfortunately, it was not possible to get material of South Africa and therefore the specimens of the "Southern Population" are not really in the effective South of Africa. More precisely, the Southern Population consists of specimens from Zambia and Kongo, which is more in the central region of Africa.

The result of this analysis of the lower jaw, show that it is possible to split the recent population of the spotted hyena.

The results of the upper jaw from the fossil hyena display that the specimens of the various locations separate. Only the specimens of the Teufelslucken cave and the Slouper were grouped. The German locations separate from each other and from the Teufelslucken-Slouper Complex.

The groups were correctly assigned by a 100% to the given groups.

In contrast to the results of the upper jaw, the diagram of the lower jaw shows that all locations except for the Čertova pec cave are very close together whereas the Čertova pec cave lies completely outside of the range of the others.

Only sites 7 to 10 (= group seven and ten, Fig. 6.1) were correctly assigned by the given groups. Group 8, 88.5% were correctly assigned and only 55.6% in group 9.

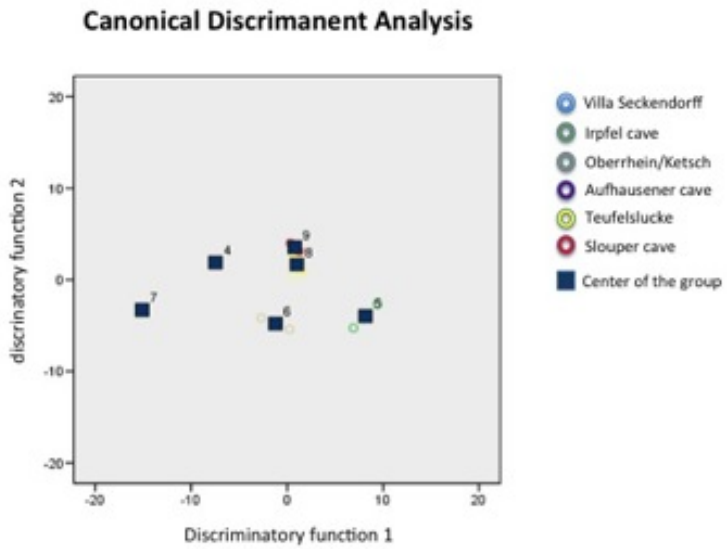

Figure 6.1: Canonical discriminatory function of the fossil groups (upper jaw) . Explanation for the used numbers in the diagram 22 Fossil specimens: 4 = Villa Seckendorff (Germany), 5 = Irpfel cave (Germany),6 = Oberrhein/Ketsch (Germany), 7 = Aufhauser cave (Germany), 8 = Teufleslucken cave (Austria) and 9 = Slouper cave (Czech)

After the evaluation of the extant samples a discriminant analysis of the recent and fossil lower jaws of the spotted hyena was made. Only the specimens were it was possible to take all measurements were considered. Only two gaps in the measurements were filled with a multiple linear regression. Moreover, the calculated results from the multiple linear regressions fit perfectly.

The results show that in the second function, length and width of the p_3, the width of the p_4 are significant. Also the talonid width of the m_1, the length of the p_4 and the width of the p_2 are very meaningful.

Furthermore, it was not possible to assign all specimens of the various localities with a 100% likelyhood. The groups 3, 7 and 10 were correctly assigned by a 100%. Furthermore, group 8 had the widest dispersial.

The graph below illustrates the split of the extant and fossil specimens, with one exception. One recent specimen of *Crocuta crocuta* is closely situated to the Slouper cave results (Fig.6.2). The other specimens, regardless of which location, except for the Čertova pec cave are placed closely together.

Surprisingly, the few specimens of the Čertova pec cave are far outside the range of the other locations.

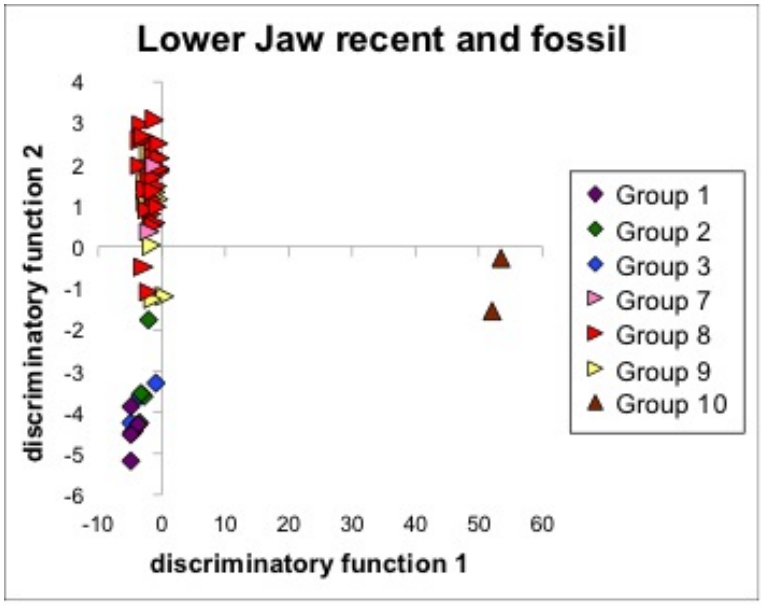

Figure 6.2: Discriminant analysis of the lower jaw. Explanation for the used numbers in the diagram; Recent specimens: 1 = Eastern Population (Africa), 2 = southern Population (Africa), 3 = Northern Population. Fossil specimens: 7= Aufhauser cave (Germany), 8 = Teufleslucken cave (Austria), 9 = Slouper cave (Czech), 10 = Čertova pec cave (Slovakia)

The Discriminant analysis of the upper jaw did not show any significant separation, which is why the results are not presented here.

7 Results

There is no evidence, that there is a sexual dimorphism present in the fossil material, neither, in the skulls, nor dentition or post-cranial of the extinct cave hyena. Also the bones of the modern spotted hyena show no sexual dimorphism. Cajus G. Diedrich (2008) suggested that it is possible to separate the female from the male individuals along with the measurements of the occipital condylus. But the size differences between female and male individuals of the modern spotted hyena are in the average only ten percent, which may vary with population, and geographical distribution as suggested by Kurtèn (1957).

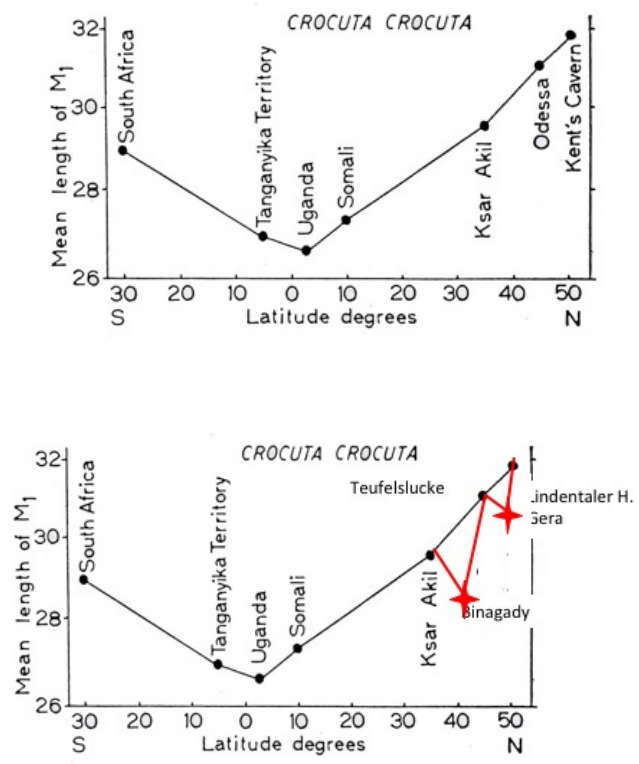

Figure 7.1: Distribution of *Crocuta crocuta* and the cave hyena in order to the mean length of the m_1 and the latitude (Kurtèn, 1957).

Kurtèn (1957) desdcribed a correlation between the size of the spotted hyena and its geographical range. In Figure 7 from Kurtèn (1957) the small-sized hyenas all come from around the Equator. The hyenas increase their size to the North and South with increasing Latitudes.

In Figure 7.1, some of the evaluated fossil caves were incorporated to show that they fit more or less perfectly in the modern distribution, others like the Lindentaler cave and specimens from Binagady not at all.

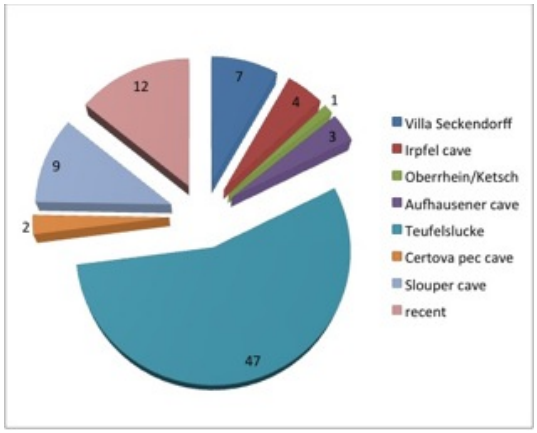

Figure 7.2: The minimum individual numbers from Crocuta c. spelaea of the investigated caves.

Furthermore, the caves were compared by their density of specimens. The distribution of the specimens in the various caves is not equal. The Teufelslucken cave has the most specimens. The specimens of the German caves yielded only a limited number of specimens and the lowest number of specimens were found in Ketsch and Čertova pec. Therefore a size distribution might be biased due to a lack of specimens.

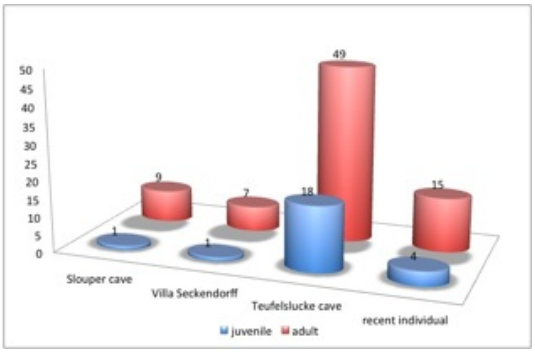

Figure 7.3: The blue bar shows the adult specimens and the red bar shows the juvenile specimens of Crocuta c. spelaea of the different location

In the Teufelslucken cave a large amount of juvenile fossils were found. Compared with the other caves the remains of young ones are very rare (as shown in Fig. 7.3). Juvenile specimens are very common in the Teufelslucken cave (36,7%) and very rare in the others (Slouper cave, Villa Seckendorff and the recent specimens) and in some locations non-existent (Čertova pec cave, Oberrhein/Ketsch, Aufhausener cave and Irpfel cave)

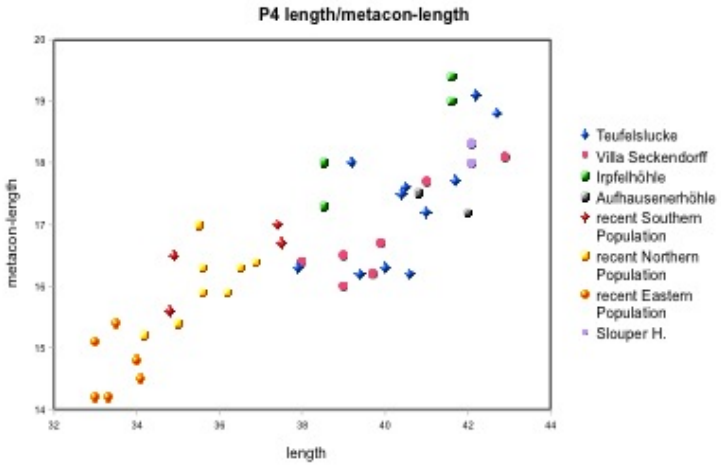

Figure 7.4: Comparison between the length of the upper P_4 and the length of the metacon also of the upper P_4 from Crocuta c. spelaea from the Teufelslucke (Austria) compared.

Furthermore, the comparison of the length of the upper P_4 and the length of the metacon length also of the upper P_4 show that the modern spotted hyena can be clearly separated from the fossil cave hyena.

Even more, there can be some separation seen in the recent population. The recent Eastern population, close to the Equator, has the smallest and the recent Southern population has the biggest representatives.

In the fossil samples from specimens of the Slouper cave and Aufhausener cave are very close in size. The Teufelslucken cave has the biggest variation, with the smallest and biggest representatives probably because of the larger sample size. Similar are the results in the lower jaw. As mention above, the recent specimens are the smallest and the extinct spotted hyenas are the biggest one. But in this case, the constraints between the extinct and extant hyenas are indistinct. The modern spotted hyena is not so clearly separated from the fossil spotted hyena.

Moreover, it can be seen that most of the specimens of the Eastern population are usually the smallest but with some exceptions. The extant Southern population ranges in the middle of the modern distribution.

As seen above there is no separation within the fossil populations (Fig. 7.4). The specimens of Teufelslucken cave enclose more or less in the range of all the other fossil specimens.

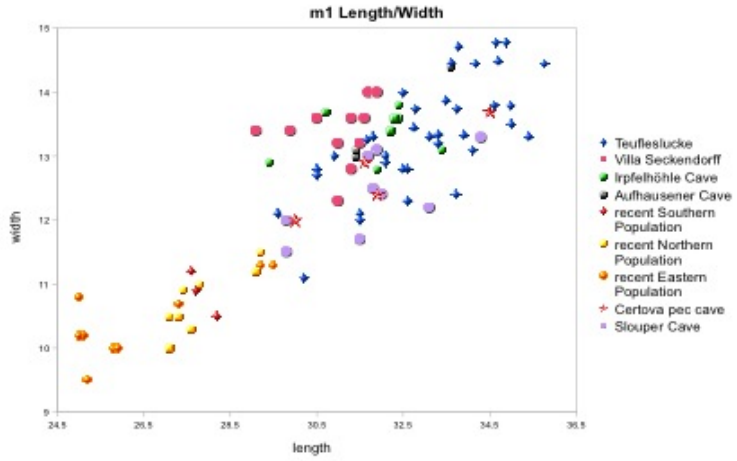

Figure 7.5: Comparison between the length and the width of the lower $m_1$from Crocuta c. spelaea from the Teufelslucke (Austria) compared.

8 Discussion

As suspected, there is no sexual dimorphism in the recent and fossil remains of the spotted hyena. The size differences between males and females is very little. More detailed, in the average the female is about 10% bigger than the male, unlike most of the other mammals, were the males are bigger than the females, like lions (Turner, 1984).
This probably is true also for the fossil cave hyena. As mentioned above there is no sexual dimorphism recognizable. There are only size differences between the various age stages. There are maybe minor chances in the skeleton, but they are negligible. For example, the sagittal crest of a female spotted hyena is said to be a little bigger and higher than that of a male (Cajus G. Diedrich, 2008). It should be possible to discriminate the female from the male, if there is a good data set of the two sexes from a site to compare the length and width of several linear measurements.

The modern spotted hyena has a very strict and unique hierarchical system. In this system a female stays on top of the clan. The so called alpha female has the biggest chance of mating. But all females in a clan have the possibility to mate with a male. One, two or sometimes three cubs are possible in one litter. The cubs were raised in dens that can be private or communal (www.hyaenidae.org, 2012)

Numerous hypotheses are common related to the "masculinization" of the female spotted hyena. But only two are more or less accepted. The first hypotheses suggested that, the penis of the female spotted hyena have an adaptive function. Which means that the females mate with several males and only the fittest and strongest sperm get their way trough that female genital (Cunha et al. (2003), Cunha et al. (2005), www.hyaenidae.org (2012)).

The second hypotheses suppose a side effect of selection. The females are bigger in size and more aggressive than the males. This hypothesis seems to be correct, because when female spotted hyenas get drugs that block androgenic hormones trough pregnancy. The female cups get the pseudo penis in full-size (Drea et al., 1998).

The female spotted hyena invests a lot of energy in raising their cups. Furthermore, siblings consume more investment than singletons, on account of this singletons grow faster. Also the sex of cups can affect their survival. More detailed, the growing rates of females are higher in the first year than for males. New studies show that maternal rank is not compulsory responsible for cup survival or dead (www.hyaenidae.org, 2012) .

The Teufelslucken cave, with the most specimens and the widest variability, enclose nearly all variations in size and form of the other locations. Unfortunately, the other locations from Germany and Slovakia have only very few specimens. Furthermore, it was very difficult to find enough material for comparison because not many museums store material from the modern spotted hyena. Often only some skulls were present which maybe had been collected as a trophy. Material of the post cranium is also very rare. This group of extraordinary carnivores is not really well known in detail. This fact makes it very difficult to compare behaviours of the cave hyena with its extant relatives.

The rare material from the other caves can be explained as follows. The location Villa Seckendorff was a construction pit with only limited time to collect as many bones as possible. The Aufhausener cave seems to be a place of hibernation and a shelter of several animals, like the lion, bear and wolf. Most of the caves were cave bear dens and the cave hyena occupied it only occasionally. In contrast, the Teufelslucken cave was a hyena den for many generations.

What was very interesting and very special was the huge amount of juvenile fossil material in the Teufelslucken cave (see Fig.7.3). Approximately half of the material is from juveniles. This material has to be attended in future works. Many jaws have almost all deciduous teeth with some permanent dentition breaking through. A better knowledge about the tooth replacement mode would give

in sight at which age the young one died and if that was a crucial time for a juvenile cave hyena. Maybe the mother stopped lactating them, or providing food. More research has to be done on modern hyenas to answer this question.

Not in all caves juvenile material was found, it is assumed that this missing can be explained that this cave might not had been used as a raising place for the young. Maybe some caves were used over many generations to live and raise the young there or are only for a stay over a short period of time (Cajus G. Diedrich, 2008).

It could be possible that the fossil spotted hyena uses the cave only for raising their young and as shelter for the winter. The modern spotted hyena only uses burrows and caves to raise their young. Sometimes the young enlarge the caves to hide there until their mother comes back to feed them. No hibernation mode is known today.

It is not certain if the clans of the extinct cave hyena were as big as they are today but the cave hyena used the cave as a den for all clan members probably all year round. The remains of their bones of different age stages indicate this. A clan size cannot be judged because there is no way to know how many material has been lost over time and trough the scavenging activities of hyenas. But there are also some more differences between the extinct and extant spotted hyena. These disparities are not only the size because the fossil hyena is 30% bigger than the recent one. In cave hyena dens there are also findings of their prey, with the typical gnawing marks. This is a special behaviour of the extinct hyena because their modern relative never carries their prey to the young because the smell of the dead animal might attract lions. When the cub is old enough to eat meat, their mother leads them to the carcass of the hunt.
It is very unlikely to assume large packs (up to 80 individuals known from Negronogro, Kruuk (1975)) in the European Pleistocene. Fossil record and available prey contradicts this.

As mentioned in the results above, Kurtèn (1957) suggested, that the Pleistocene mammals, like the cave hyena, could be correlated with the latitude, which means that the smallest mammals are common in the equator region.

The biggest ones are up to 50 degrees North and South. The fossil specimens in general fit into these assumptions (see Fig. 7 and 7.1). This ascertainment explains or confirms the "Bergmann'sche Regel" which signifies that mammals in colder regions tend to grow bigger to minimize their loss of warmth by reducing their surface and simultaneous increasing their volume.

Furthermore the attempt was made, if it is possible to confirm the result of Kurtén's research by comparing the total length and the metacon length of the upper P_4 and by comparing the length and width of the lower m_1.

On both diagrams (see Fig. 7.4 and 7.5) can be seen that the recent population separates from the fossil ones. The first diagram depicts a more distinct differentation between the extinct and extant populations. Moreover, the recent eastern population has the smallest representatives whereas the recent southern population seems to be more variable. It was not possible to get hold of enough specimens from South Africa for a reliable statistical analysis. The specimens from the so called Southern Population came from the central part of Africa (Ethiopia, Kenya) but not from South Africa.

Due to the fact that the diagrams in excel did not provide a meaningful result a discriminatory analysis in SPSS was made. At first the fossil and recent specimens were treated separately. Only these specimens with a full set of all measurements were retained. A discriminatory analysis was made with the upper jaw and with the lower jaw.

The results of the upper jaw were not as significant as the ones of the lower jaw. It is estimated, that most of the variations takes place in the lower jaw.

The diagram of the results in SPSS of the lower jaw shows a perfect separation of the recent and the fossil spotted hyena with one exception (Fig.6.2). As mentioned above, no specimens from South Africa could be obtained. More measurements might show a stronger overlap between extant and fossil populations. Right now this is pure speculation. What is very remarkable is the position of the Čertova pec cave in the graph. It lies neither in the range of the fossil specimens nor in the range of the recent specimens. Additionally, the

specimens from this cave are the oldest ones (about 50.000 BP) in the present material.
Furthermore, Rohland et al. (2005) presented in the course of the research that the specimens of the Čertova pec cave originated from the modern southern population. Whereas the other migrations waves form Africa originated from the modern northern population.

Unfortunately, there are no recent specimens from South Africa, so this assumption can be confirmed morphologically. This will be a subject for future work to check if the specimens of the Čertova pec cave will stay outside the range even when compared with more specimens from South Africa.

It is possible that the time range was enough to allow this group to evolve in different direction. Small difference can be seen on the posterior part of the lower p_3, which is variable. Regrettably, no upper jaws are preserved to compare if the upper p_4 and p_3 show similar changes.

Moreover, also the morphology of the lower p_4 is different from the p_4 of the fossil locations. More precisely, the talonid of the lower p_4 of the Čertova pec cave is a little bit broader towards the lingual side of the tooth. Also the cingulum seems to be a slightly thicker.

With metrical measurements it is possible to separate the fossil from the recent spotted hyena *(Crocuta crocuta crocuta)*. The results of the statistical analysis show that the fossil cave hyena is clearly separated from the recent spotted hyena. Unfortunately, it is not possible to isolate the single fossil and extant populations.

The hyenas from the Teufelslucke have the widest morphological range in comparison to the other caves and the recent population as shown in the statistic. However, two specimens of the Slouper cave are very close to one specimen of the recent southern population. The other recent specimens are more or less very close together and clearly separated from the fossil ones.

9 Conclusion and Perspective

Although the material of Crocuta c. spelaea from the Teufelslucke (Upper Pleistocene, Lower Austria) is one of the richest material of the cave hyena on Europe. No proof for a sexual dimorphism can be found.
The large amount of juvenile specimens in the material indicates a breeding den of the cave hyena. The juveniles material consist mainly of subadults in the state of tooth replacement and this was maybe a crucial time when the mother stopped lactating them.

Them main question however was the intraspezific variation in the cave hyena as seen in previously genetic investigations. Since the sample size of the populations in question was not high enough to perform a detailed morphological investigation, some of the genetically evaluated site had to be excluded from this study.

However, the results from the discriminatory analyses of measurements on the lower jaw of the extant Crocuta crocuta yield significant results with a clear separation into a Southern and a Northern population.
From the few fossil sites that gave enough metric data to allow to perform the above mentioned analyses, the Čertova pec cave hyenas did not fit into the general distribution of the cave hyena. This gives an indication that with enough fossil material a separation in populations could be possible in the fossil European cave hyena as well.

It would be very useful for a better understanding of the cave hyena and its behaviour to investigate a recent den of the spotted hyena in order to understand better the findings in fossil caves of the extinct spotted hyena. For example, to try to excavate a recent where cubs were raised to get an idea what was dragged into the site and what can be find outside the dens.

The juvenile upper and lower jaws with the deciduous teeth are of big interest. In further publication this material will be X-rayed to get a tooth replacement mode.

10 How to present this fossil Material to the Public?

In the course of my diploma thesis, I got the possibility to present the fossil hyena material from the Teufelslucke in the Höbarth Museum in Horn in line with a large exhibition of the Teufelslucken cave together with the big display of the Ice Age Mammoth. It was very interesting to get this unique chance, to represent fossil material to the public.

At first I visited the Teufelslucken cave to get an idea how it looks like today, because I just know it from pictures of the excavation in the 1940s. I took some photos there.

The next step was to create some information with interesting facts about the cave hyena at its living relatives.

Figure 10.1: The first picture shows me and Doris Nagel in the Höbarth-Museum (Horn, Lower Austria) cutting-out the silhouette of the cave hyena

To show the size differences between the modern and fossil spotted hyena, I made a silhouette model of the cave hyena and project it on a wooden plate to enlarge it to the correct size. The next step was to redraw the silhouette of the cave hyena and cut it out. For a better understanding of the size differences

the museum staff borrowed a stuffed recent spotted hyena from the Museum in St. Pölten and we placed it in the foreground of the cut-out silhouette of the cave hyena. It would also be possible to make another cut-out silhouette of the modern spotted hyena in a different colour and place it in front of the other silhouette of the extinct cave hyena but it was better this way.

Furthermore, the different age stages, which are represented in the Teufelslucken cave were arranged in a display cabinet. As an eye-catcher a complete skull was placed in the upper part of this cabinet. On the left side of the picture the fossil jaws and teeth of the young were represented. From left to right, the specimens were of older age, up to senile one.

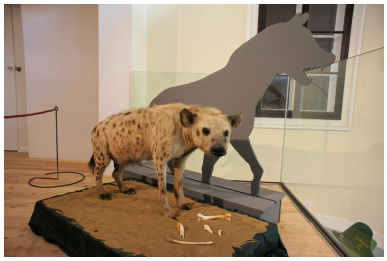

Figure 10.2: The second picture is of the display in the exhibition to demonstrate the size differences.

Figure 10.3: This picture shows the different ages of the fossil cave hyena with a complete skull installed in the centre of the vitrine in the Höbarth-Museum (Horn, Lower Austria).

The characteristic gnawing marks on the bones of the cave hyena's prey are clearly to be seen on some long bones. The cave hyena like the modern spotted hyena is specialized on bone cracking. These marks occur when the hyena tries to get the substantial marrow out of the bone. Already some the recent cubs of todays spotted hyena have their nibbling bones, when they get their permanent dentition.

Furthermore, the hyena coprolites were often found in caves. They were sometimes used for pollen analyses to reconstruct the environmental conditions during the Pleistocene. These coprolites fossilized due to the fact that they hold a lot of calcium carbonate, which come from the eaten bones.

Figure 10.4: This picture shows the display of the coprolites and the bones with the gnawing marks in the Höbarth-Museum (Horn, Lower Austria).

The cave hyena had a wide spectrum of its prey. These animals hunted horses, reindeer and really large animals like the bison and mammoth. This broad hunted spectrum was tried to be shown in an own display of its own. It is possible very likely that the cave hyena had similar hunting strategies like the modern spotted hyena and hunted alone as well as in pack.

Figure 10.5: Picture with the display of the hunting spectrum of the cave hyena in the Höbarth-Museum (Horn, Lower Austria).

11 Thanks

First of all, I would like to thank my advisor Dr. Doris Nagel. She always helped me with my diploma theses and had always a sympatic ear for my problems and me. She also helped me to design the display in the Höbarth-Museum in Horn.

Furthermore, I would like to thank these persons, which had helped me with my material from miscellaneous Museums: Reinhard Ziegler and Thomas Rathgeber (Löwentormuseum Stuttgart); Johannes M. Tuzar and Franz Pieler (Krahuletz-Museum Eggenburg); Toni Kurz, Wolfgang Andraschek and Hermann Maurer (Höbarth-Museum Horn); Anita Gamauf, Wolfgang Bibl (1st Zoological Department, Mammals); Ursula Göhlich (Department of Geology and Paleaontology), all Natural History Museum Vienna.

And my most sincere thanks go to my parents, which supported me trough my academic studies and this diploma thesis. Without them it would not have been possible to get that far.

12 Appendix

12.1 Abstract

Genetic studies allocate, that it is possibility to separate the recent spotted hyena *(Crocuta crocuta)* in a northern and southern population. Examination of the mitochondrial DNA gave no indication how to separate the extant spotted hyena from the fossil ones but two variations were found in Europe and so there probably was a split on the population level during the ice age.
The question was, if it is possible to confirm the split of fossil spotted hyena by applying new measurements and statistical analysis on morphological features.

For this purpose the substantial material from the Teufelslucken cave in Roggendorf by Eggenburg was measured. Not only the material from the Krahuletz Museum in Eggenburg was considered, also material from private collections like the one from the Höbarth Museum in Horn was included. Furthermore, teeth- and bone-material from the Irpfel cave, the Aufhausener cave, Villa Seckendorff, Oberrhein/Ketsch (Germany), as well as fossil remains from the Slouper cave and from the Čertva pec Cave in Slovakia was measured. For comparison the extant material of the spotted hyena from the Natural History Museum in Vienna and the Museum of Nature Study in Berlin was used.

12.2 Zusammenfassung

Genetische Studien belegen, dass es möglich ist die rezente Tüpfelhyäne *(Crocuta crocuta)* in eine Nord- und Südpopulation zu trennen. Mit Hilfe der Untersuchung der mitochondrial DNA ist es nicht möglich rezente und fossile Tüpfelhyänen zu trennen, allerdings gibt es zwei Variationen in Europa, die auf eine Trennung der Population während der Eiszeit hinweisen. Die Frage war nun, ob es mittels neuer Vermessungen und statistischer Auswärtungen möglich ist,

das Material der fossilen Tüpfelhyäne auch nach morphologischen Merkmalen zu trennen.

Zu diesem Zweck wurde das umfangreiche Material der Teufelslucken Höhle in Roggendorf bei Eggenburg neu vermessen und dabei nicht nur das Material aus dem Krahuletzmuseum berücksichtigt, sondern erstmals auch Funde aus Privatsammlungen die unter anderem im Höbarth-Museum in Horn aufbewahrt werden. Weiters wurde Zahn- wie auch Knochenmaterial aus der Irpfelhöhle, Aufhausener Höhle, Villa Seckendorff, Oberrhein/Ketsch (Deutschland), sowie fossile Reste aus der Slouper Höhle aus dem Naturhistorischen Museum in Wien und das Material aus der Čertova pec Höhle in Slowenien vermessen. Zum Vergleich diente das rezente Material der Tüpfelhyäne ebenfalls aus dem Naturhistorischen Museum in Wien und dem Museum für Naturkunde in Berlin.

Figure 12.1: In this table one adult and one juvenile skull were depicted. **A** Skull Teufelslucke 1218, **B** Skull ZMB 73149, **C** Skull ZMB 73149

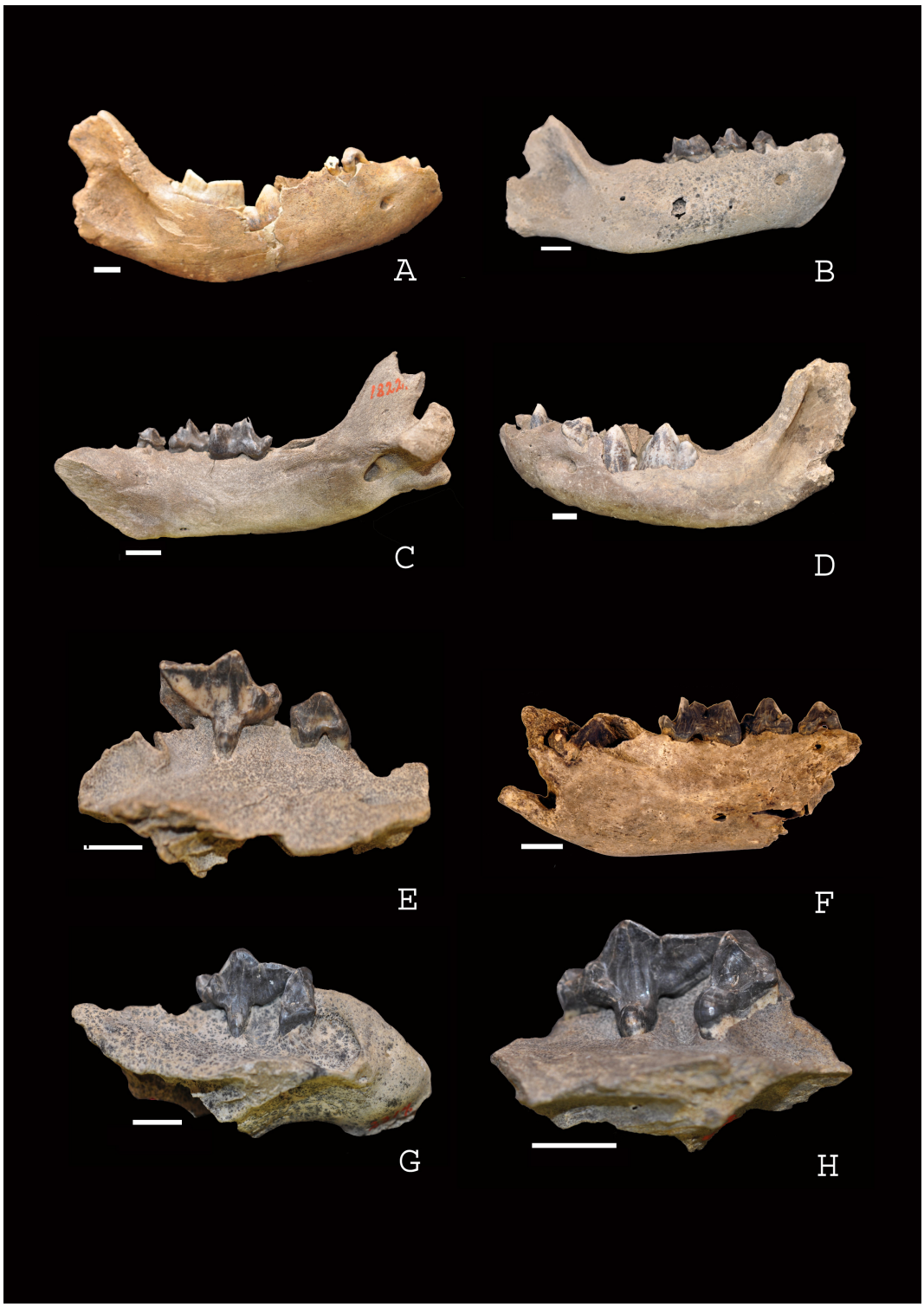

Figure 12.2: The table shows some juvnile lower and upper jaws of various caves. **A** Slouper 2008z0087/0011, **B** TL F/3498, **C** TL 1822, **D** TL 2042, **E** TL 2144, **F** Ho 21630, **G** TL 2314, **H** TL1742

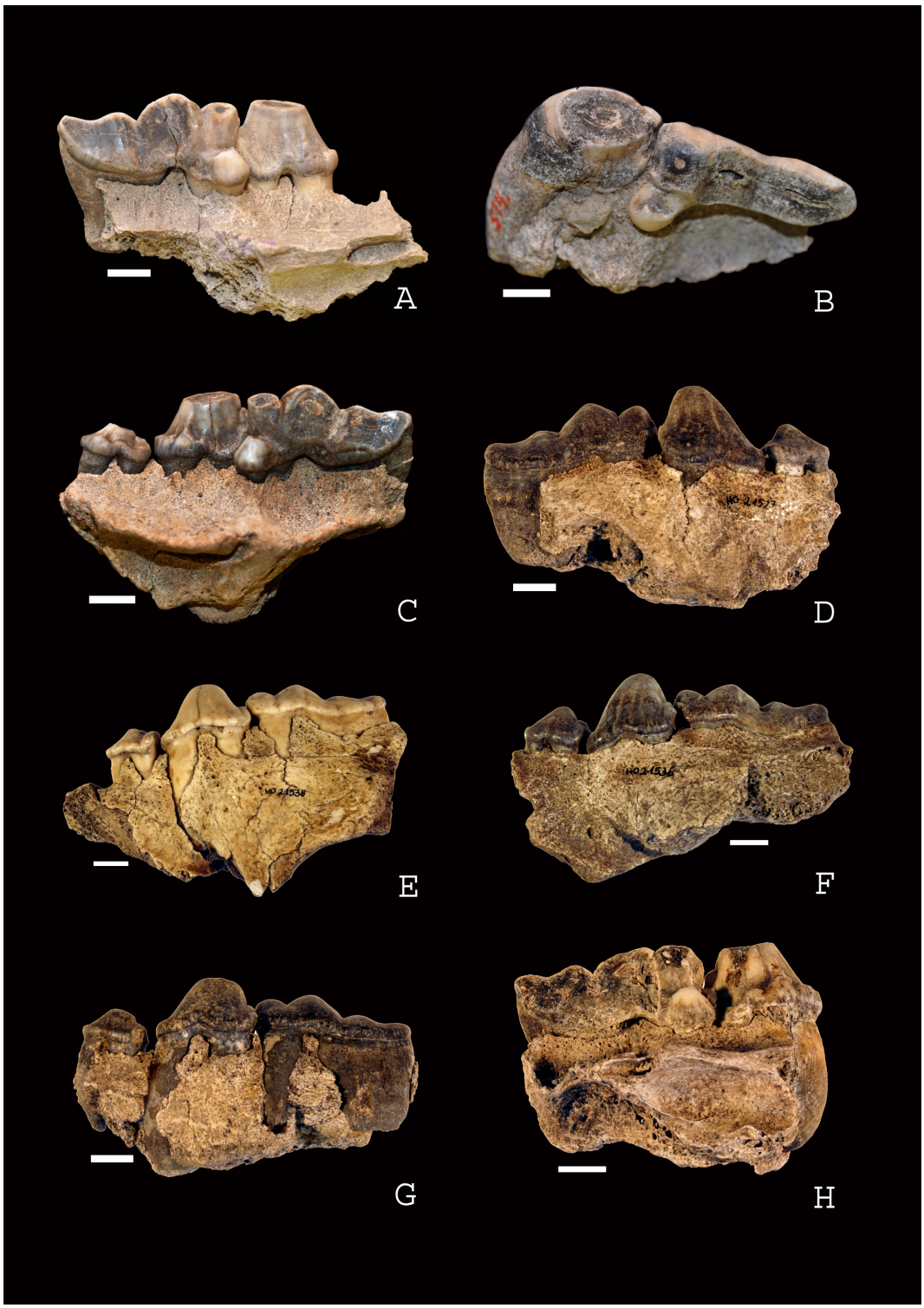

Figure 12.3: In this table adult upper jaws were depicted. **A** TL without number, **B** TL 514, **C** TL 1318, **D** Ho 21527, **E** Ho 21538, **F** Ho 21536, **G** Ho 21533, **H** Ho 21531

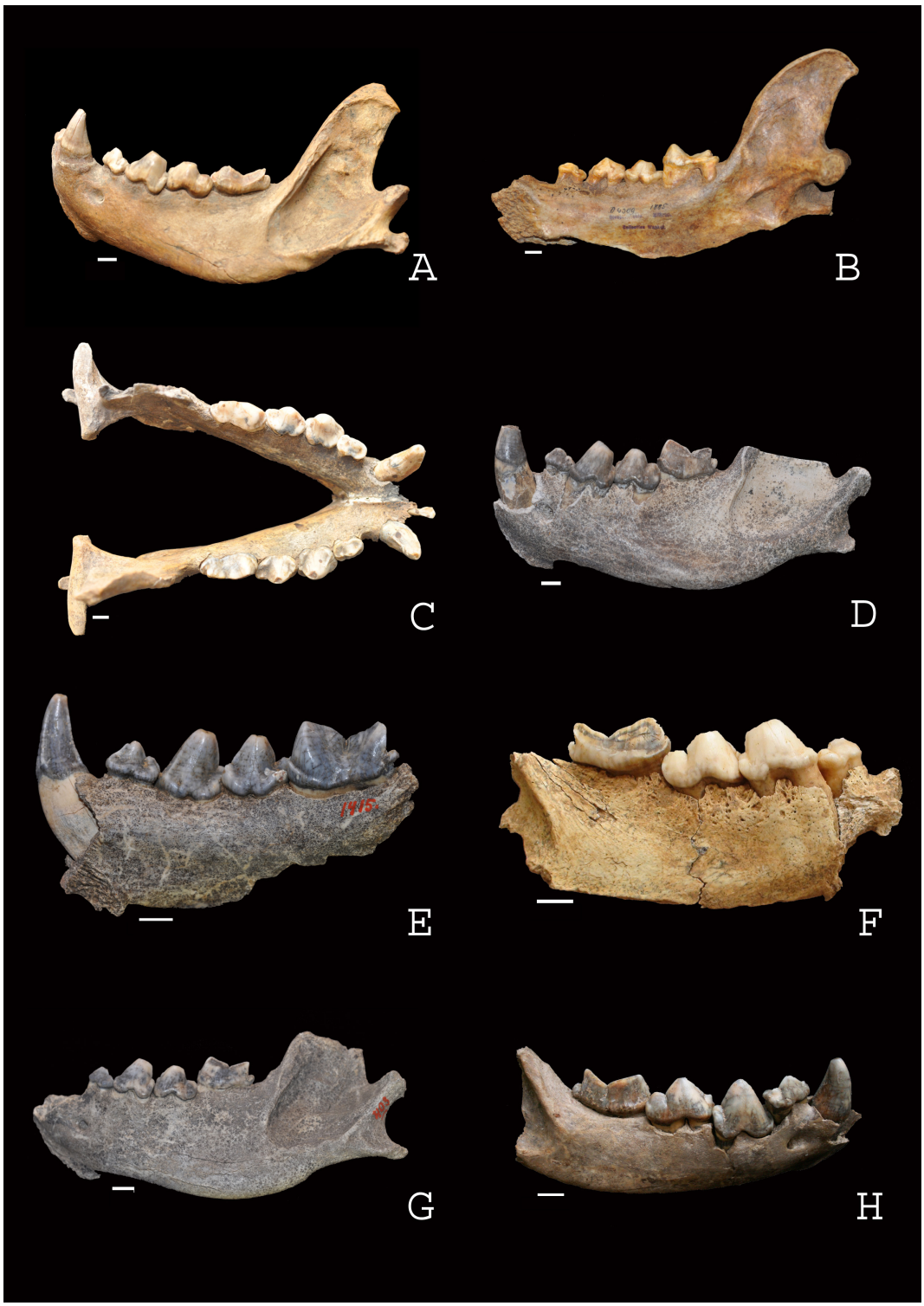

Figure 12.4: This table shows adult lower jaws. **A** Souper 2008z0087/0002, **B** Slouper 2008z0087/0005, **C** Slouper 2008z0087/0006, **D** TL F/3558, **E** TL 1415, **F** VS 31377, **G** TL 403, **H** Certova LM9_220-23001 (picture from Martin Sabol)

Figure 12.5: In this table tibia, fibula, calcaneus and Astragalus were depicted. **A** TL 2219, **B** Slouper 2008z0087/0057, **C** Slouper 2008z0087/0058, **D** ZMB 16575, **E** TL 122, **F** ZMB 16575, **G** ZMB 16575, **H** ZMB 16575

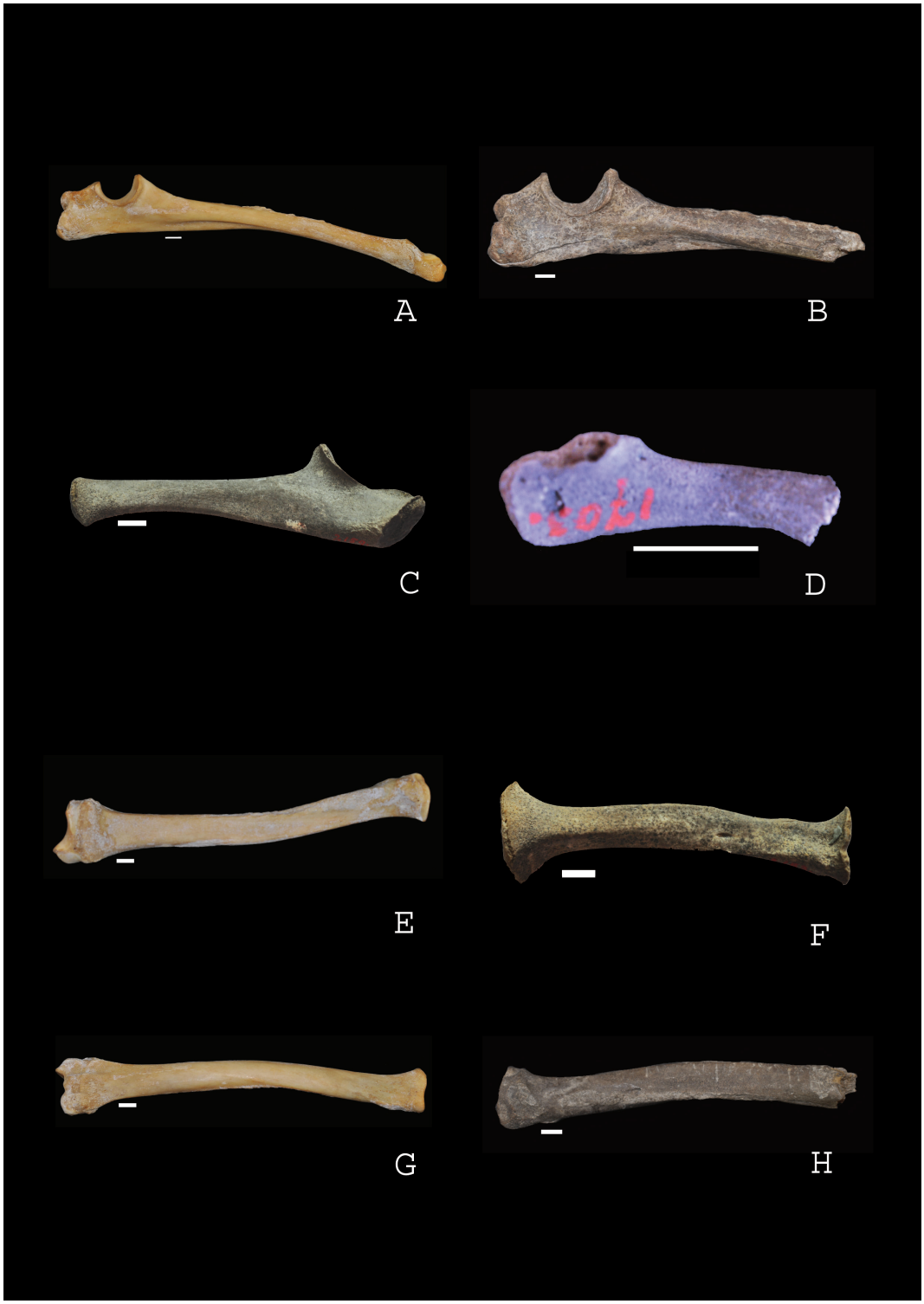

Figure 12.6: This table show radius and ulna of various caves. **A** ZMB 16575, **B** TL 115 , **C** TL 2150, **D** TL 1703 , **E** TL 2218 , **F** TL 2163 , **G** ZMB 16575 , **H** TL 2173

Figure 12.7: In this table humeri and femura were depicted. **A** Slouper 2008z0087/0055, **B** Slouper 2008z0087/0056, **C** ZMB 16575, **D** TL 10.. , textbfE ZMB 16575, **F** TL 1788, **G** TL 226, **H** Slouper 2008z0087/0041

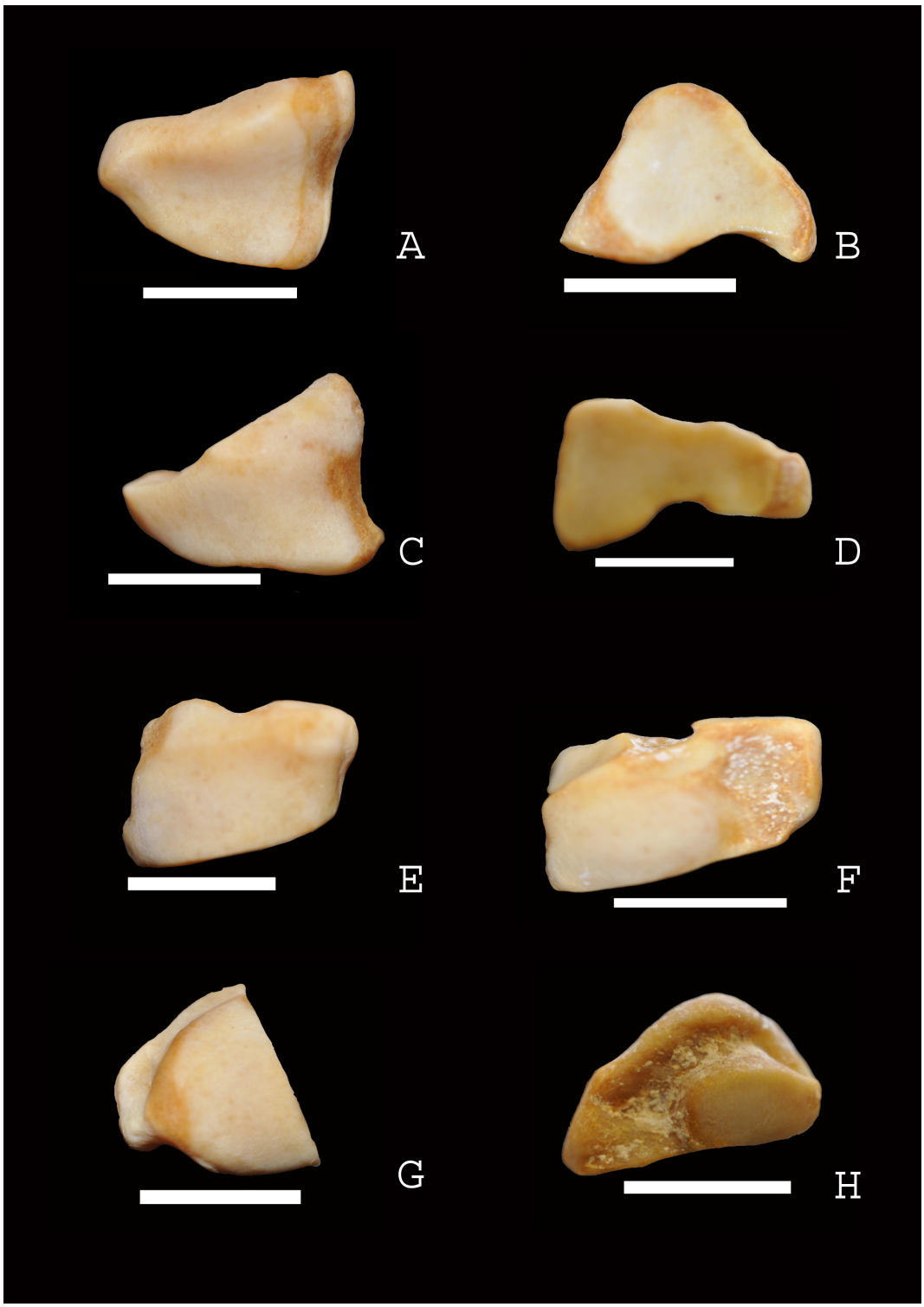

Figure 12.8: This table shows the proximal sides of the metapods. **A** ZMB 16575, **B** ZMB 16575,**C** ZMB 16575, **D** ZMB 16575, **E** ZMB 16575, **F** ZMB 16575, **G** ZMB 16575, **H** ZMB 16575

12.3 Measurements of the specimens of the various caves

Čertoca pec cave

Number	Place	m1	m1	m1	m1	m1	m1	m1
No	Place	Length	Width	2.width	Hpr	Hpa	LengthTa	WidthTa
84? Dext (w)	Čertova	34,5	13,7	0	13	17,7	4,4	8,2
CP 9/220-230 dext (juv)	Čertova	31,9	12,4	13,7	13,6	16,2	3,5	7,3

Number	Place	p4	p4	p4	p4	p3	p3	p3
No	Place	Length	Width	2. width	Height	Length	Width	Height
84? Dext (w)	Čertova	26,6	13,6	15,2	15,8	22,9	15,5	18,7
CP 9/220-230 dext (juv)	Čertova	24,8	13,6	14,3	17,1	23,1	14,6	21,3

Number	Place	p2	p2	p2	p2	cinf	cinf	cinf
No	Place	Length	2.width	Width	Height	Length	Width	Height
84? Dext (w)	Čertova	17,2	13,9	10,5	10,6	16	13,4	26,7
CP 9/220-230 dext (juv)	Čertova	17	12,1	10,1	10,6	in erup.	12,2	0

No	Placep	2-m1	Md H m1	Md H p3
84? Dext (w)	Čertova	96,3	0	38,2
CP 9/220-230 dext (juv)	Čertova	88,5	33,7	28

Slouper cave

Number	Place	m1	m1	m1	m1	m1	m1
No	Place	Length	Width	Hpr	Hpa	Length Ta	Width Ta
2008z0087/0009 dext senil	Slouper	31,9	13,1	0	0	3,4	7,7
2008z0087/0015 dext	Slouper	0	0	0	0	0	0
2008z0087/0013 dext vw	Slouper	29,8	12	broken	15,8	4,5	6,9
2008z0087/0014 dext	Slouper	29,8	11,5	10	14,2	3,8	7,3
2008z0087/0012 sin senil	Slouper	33,1	12,2	0	0	5	8
2008z0087/0005 dext vw	Slouper	31,7	13	0	0	4,1	7,4
2008z0087/0007 dext vw	Slouper	34,3	13,3	13,2	16,1	3,7	8,6
2008z0087/0010 sext vw	Slouper	0	0	0	0	0	0
2008z0087/0006 dext w	Slouper/Vypustek	31,5	11,7	0	0	3,5	8,1
2008z0087/0006 sin w	Slouper/Vypustek	31,8	12,5	11,1	15,6	3,9	8,3
ohne Nummer sin senil	Slouper	32	12,4	0	0	3,6	8,5

Lower Jaw

Number	Place	p4	p4	p4	p3	p3	p3
No	Place	Length	Width	Height	Length	Width	Height
2008z0087/0009 dext senil	Slouper	23,9	13,5	0	23,1	15,1	0
2008z0087/0015 dext	Slouper	24,9	15,1	18,3	23,2	16,2	23,8
2008z0087/0013 dext vw	Slouper	22,3	13,4	16,1	21	14,2	19,1
2008z0087/0014 dext	Slouper	22,1	13,4	0	20,3	14,6	0
2008z0087/0012 sin senil	Slouper	24,1	14,5	0	22,5	15,1	0
2008z0087/0005 dext vw	Slouper	23,8	13,5	10,9	22,3	14,3	9,3
2008z0087/0007 dext vw	Slouper	24,6	15,1	15,7	22,3	15,7	17
2008z0087/0010 sext vw	Slouper	23	13,3	0	22	14,5	0
2008z0087/0006 dext w	Slouper/Vypustek	23,7	14,2	15	22,9	15,7	17,8
2008z0087/0006 sin w	Slouper/Vypustek	23	14,4	15	22,3	15,9	18,1
ohne Nummer sin senil	Slouper	24,6	13,3	0	22,8	14,5	0

Number	Place	p2	p2	p2	cinf	cinf	cinf
No	Place	Length	Width	Height	Length	Width	Height
2008z0087/0009 dext senil	Slouper	17,5	11,1	0	0	0	0
2008z0087/0015 dext	Slouper	0	0	0	0	0	0
2008z0087/0013 dext vw	Slouper	16,6	10,6	10,3	0	0	0
2008z0087/0014 dext	Slouper	15	9,5	0	0	0	0
2008z0087/0012 sin senil	Slouper	17	10,1	0	0	0	0
2008z0087/0005 dext vw	Slouper	16,4	10,3	7,3	0	0	0
2008z0087/0007 dext vw	Slouper	17,2	10,2	8,9	0	0	0
2008z0087/0010 sext vw	Slouper	14,9	9,8	0	0	0	0
2008z0087/0006 dext w	Slouper/Vypustek	17,6	10,5	9,2	17,3	13	29,7
2008z0087/0006 sin w	Slouper/Vypustek	16,9	10,5	9,4	17,3	13,7	29,5
ohne Nummer sin senil	Slouper	16,9	11,3	0	16,2	12,2	0

Number	Place	p2-m1	Md H m1	Md H p3	L md	Coronoid H	Md H p2
2008z0087/0009 dext senil	Slouper	92,6	0	0	0	0	0
2008z0087/0015 dext	Slouper	0	33,9	0	0	0	0
2008z0087/0013 dext vw	Slouper	84,5	44,8	33,5	0	0	38,8
2008z0087/0014 dext	Slouper	79,1	0	0	0	0	0
2008z0087/0012 sin senil	Slouper	93,5	0	44,1	0	0	48,2
2008z0087/0005 dext vw	Slouper	91,4	0	0	199,95	0	0
2008z0087/0007 dext vw	Slouper	91,7	51,7	42,2	0	0	44,9
2008z0087/0010 sext vw	Slouper	0	0	0	0	0	0
2008z0087/0006 dext w	Slouper/vypustek	92,1	52,9	41	204,68	0	0
2008z0087/0006 sin w	Slouper/vypustek	90,7	51,3	40	203,54	0	0
ohne Nummer sin senil	Slouper	91,5	46	38,8	192,74	132,9	40

Upper Jaw

Number	Place	m1	m1	m1	m1	m1	m1
No	Place	Length	Width	Hpr	Hpa	Length Ta	Width Ta
2008z0087/0040 sin	Slouper	32,9	12,5	13,6	17	3,5	9,1
2008z0087/0039 sin	Slouper	33,1	13,6	13	15,5	3,8	8,5
2008z0087/0037 sin	Slouper	31,9	13,4	15	17,8	4,5	8
2008z0087/0036 dext	Slouper	30,2	12,2	13,5	16,3	3,9	8,9
2008z0087/0035 dext	Slouper	32,9	14	14,4	17,5	4,2	9
2008z0087/0038 sin	Slouper	32,4	12,4	12	16,5	4	7,8

Number	Place	p4	p4	p4	p3	p3	p3
No	Place	Length	Width	Height	Length	Width	Height
2008z0087/0030 dext	Slouper	0	0	0	21,8	15	17,3
2008z0087/0031 dext senil	Slouper	0	0	0	22,8	14,7	0
2008z0087/0034 sin vw	Slouper	23,4	14,1	12,4	0	0	0

Number	Place	P4	P4	P4	P4	P4
No	Place	Length	L me	Width	W pr	Hpa
2008z0087/003 sin	Slouper	0	0	0	0	0
2008z0087/002 dext	Slouper	42,1	18,3	13,3	24,7	20,5
2008z0087/002 sin	Slouper	42,1	18	13,4	23,4	21

Number	Place	P3	P3	P3	P2	P2	P2
Number	Place	Length	Width	Height	Length	Width	Height
2008z0087/003 sin	Slouper	24,9	17,8	19,8	18,6	11,8	10,4
2008z0087/002 dext	Slouper	24,8	18,3	21,7	19,1	12,9	11,7
2008z0087/002 sin	Slouper	25,9	18,4	22,1	18	12,7	11,8

Number	Place	P1	P1	P1	Csup	Csup	Csup
Number	Place	Length	Width	Height	Length	Width	Height
2008z0087/003 sin	Slouper	0	0	0	0	0	0
2008z0087/002 dext	Slouper	7,3	7,2	6,7	17,5	15,6	28,8
2008z0087/002 sin	Slouper	0	0	0	17,7	13,8	34,1

Number	Place	P4	P4	P4	P4	P4
No	Place	Length	L me	Width	W pr	Hpa
2008z0087/0033 dext	Slouper	39,6	17,8	12	20,4	19,5
2008z0087/0032 sin w	Slouper	40,3	17,7	12,2	0	17,7

Number	Place	P3	P3	P3	P2	P2	P2
Number	Place	Length	Width	Height	Length	Width	Height
2008z0087/0026 dext senil	Slouper	24,7	16,7	0	-	-	-
2008z0087/0025 sin vw	Slouper	-	-	-	18,4	11,90	9,9

No	Place	1	2	3	4	5	6	7	8
2008z0087/0002	Slouper	71,8	94,8	211,36	0	54,2	76,7	55,4	0
2007z0087/0001	Slouper	0	0	0	44,7	0	0	133.5	0

Post-cranial bones

Radius

Number	Place	GL	Bp	Bd	KD
2008z0087/0047 sin	Slouper	0	31,4	0	22,1
2008z0087/0045 sin	Slouper	236,38	35,5	47,7	23,2
2008z0087/0046 dext	Slouper	236,12	33,9	47,2	21,8
2008z0087/0044 sin	Slouper	234,73	34,8	47,7	22,5

Tibia

Number	Place	GL	Bp	Bd	KD	Lp
2008z0087/0058	Slouper	200,54	53,7	39,8	19,3	57,5
2008z0087/0057	Slouper	208,95	53,2	43,2	21,5	62,2

Femur

No	Place	GL	Bp	Bd	/KD	Tc
2008z0087/0056 dext	Slouper	280,52	64,8 (70,5)	53,5	24,8	31,6
2008z0087/0055 sin	Slouper	282,64	64 (71)	54,2	25,9	32,2

Humerus

Number	Place	BT	Bd	Bp	GL	KD
2008z0087/0042 sin	Slouper	48,6	60,2	66,8	255,07	26,8
2008z0087/0043 dext	Slouper	45,7	52,9	0	0	24,6
2008z0087/0041 dext	Slouper	50,9	61,2	67,5	254,95	24,7

Metacarpale II

Number	Place	GL	Bd	Lp	Bp	KD
2008z0087/0050 dext	Slouper	77,5	16,1	19,6	13,3	12,2

Metacarpale III

Number	Place	GL	Bd	Lp	Bp	KD
2008z0087/0049 sin	Slouper	95,3	14,8	21,5	13,3	12,2

Metacarpale IV

Number	Place	GL	Bd	Lp	Bp	KD
2008z0087/0048 dext	Slouper	87,4	14,9	20,8	14,3	11,1

Villa Seckendorff

Lower Jaw

Number	Place	m1	m1	m1	m1	m1	m1
No	Place	Length	Width	Hpr	Hpa	Length Ta	Width Ta
31375 right	Villa Seckendorff	31,3	13,6	16,7	16	3,9	8,6
31371 left	Villa Seckendorff	29,9	13,4	19,5	15,3	2,7	7,5
31372 left	Villa Seckendorff	29,1	13,4	16,5	14,7	-	-
31365 left	Villa Seckendorff	31,3	12,8	14,9	12,2	3,1	7,7
31376 right	Villa Seckendorff	31,7	14 16,1	11,5	2,6	8,8	-
31369 left	Villa Seckendorff	(33,2)	-	-	-	-	-
31378 right	Villa Seckendorff	31,5	13,2	17,2	14,4	3,4	7,9
31377 right	Villa Seckendorff	31	12,3	15,6	12,1	3,7	7,1
31380 right	Villa Seckendorff	31,6	13,6	18,4	14,1	3,8	8,2
31374 left	Villa Seckendorff	31,9	14	18,5	15,5	3,6	8,5
31373 left	Villa Seckendorff	30,5	13,6	16	10,8	2,8	10,3
31370 left	Villa Seckendorff	31	13,2	18,9	15,6	4,2	7,5

Number	Place	P4	P4	P4	P3	P3	P3
No	Place	Length	Width	Height	Length	Width	Height
31375 right	Villa Seckendorff	23,5	14,2	16	22,5	15,1	19,4
31371 left	Villa Seckendorff	-	-	-21,6	15	22,1	-
31372 left	Villa Seckendorff	23,3	13,4	14	20,6	14,5	15,6
31371 left	Villa Seckendorff	23,3	13,5	14,6	21,6	14,6	13,7
31376 right	Villa Seckendorff	24,6	14,4	13,2	23,4	16,1	16,5
31369 left	Villa Seckendorff	25,5	14,5	18,2	23,4	17,5	21,6
31378 right	Villa Seckendorff	-	-	-	20,8	15	20,6
31377 right	Villa Seckendorff	23,5	14,2	13,2	22	16,4	14,6
31380 right	Villa Seckendorff	22,7	13,9	18	-	-	-
31374 left	Villa Seckendorff	23,6	14,2	16	21,9	15,6	19,2
31373 left	Villa Seckendorff	23,4	14,9	12,1	22,6	15	13
31370 left	Villa Seckendorff	24,8	13,7	18,5	21,6	14,7	20,9

Number	Place	p2	p2	p2	cinf	cinf	cinf
No	Place	Length	Width	Height	Length	Width	Height
31375 right	Villa Seckendorff	16,6	11,6	11,3	15,4	13,5	28,3
31371 left	Villa Seckendorff	-	-	-	15	12,8	29,7
31376 right	Villa Seckendorff	17,8	13,1	10,5	-	-	-
31369 left	Villa Seckendorff	17	12,9	9	16,3	15,5	30,5
31378 right	Villa Seckendorff	-	-	-	16,4	13,5	31,1
31377 right	Villa Seckendorff	15,7	10,6	8,3	-	-	-
31373 left	Villa Seckendorff	17	12,6	8,4	-	-	-
31370 left	Villa Seckendorff	15,8	10,3	9,8	16	12,7	21,3

Number	Place	p2-m1	Md H m1	Md p3
31375 right	Villa Seckendorff	88	39,9	40,4
31371 left	Villa Seckendorff	83,4	36,5	28,2
31372 left	Villa Seckendorff	70,7	42,1	-
31376 right	Villa Seckendorff	90,2	-	41,4
31369 left	Villa Seckendorff	-	44,4	-
31378 right	Villa Seckendorff	84,7	30,5	23,2
31377 right	Villa Seckendorff	84	-	-
31380 right	Villa Seckendorff	-	30,2	-
31370 left	Villa Seckendorff	80,5	25,7	-

Upper Jaw

Number	Place	P4	P4	P4	P4	P4
No	Place	Length	L me	Width	W pr	Hpa
31340 left	Villa Seckendorff	39	16	14,2	23,1	19,4
31336 right	Villa Seckendorff	41	17,7	12,9	22,2	19,9
31335 right	Villa Seckendorff	42,9	18,1	12,3	22,7	10,1
31337 right	Villa Seckendorff	39,7	16,2	13,5	22,5	18
31351 right	Villa Seckendorff	39	16,5	12,5	21,4	19
31343 right	Villa Seckendorff	39,9	16,7	13	22,9	18,3
31354 right	Villa Seckendorff	38	16,4	13,6	19,2	17,9

Number	Place	P3	P3	P3	P2	P2	P2
No	Place	Length	Width	Height	Length	Width	Height
31338 right	Villa Seckendorff	24	17,9	21,1	-	-	-
31340 left	Villa Seckendorff	25,2	19,6	19,4	18,5	14,9	10,4
31336 right	Villa Seckendorff	23,4	15,7	23,2	-	-	-
31335 right	Villa Seckendorff	25,9	18	15,1	-	-	-
31341 left	Villa Seckendorff	24,3	17,8	21,6	17,5	13,2	12
31337 right	Villa Seckendorff	25,1	17,7	18,7	-	-	-

Number	Place	Csup	Csup	Csup
31351 right	Villa Seckendorff	14,9	11,3	28,4
31349 left	Villa Seckendorff	17,5	14,5	31,4
31408 left	Villa Seckendorff	16,6	12,3	29,3

Juvenile Material

Number	Place	dp4	dp4	dp4	dp4	dp4	dp4
No	Place	Length	Width	Hpr	Hpa	Length Ta	Width Ta
31404 right	Villa Seckendorff	18,3	6,7	9,2	8,5	4,6	5,9

Number	Place	dp3	dp3	dp3	dp2	dp2	dp2
No	Place	Length	Width	Height	Length	Width	Height
31404 right	Villa Seckendorff	13,1	6,4	8	8,8	4,6	4,6

Number	Place	dcinf	dcinf	dcinf	-	-	-
Number	Place	Length	Width	Height	p2-m1	Md H m1	Md H p3
31404 right	Villa Seckendorff	6,6	4,6 9,8	-	-	25,9	

Irpfel cave

Lower Jaw

Number	Place	m1	m1	m1	m1	m1	m1
No	Place	Length	Width	Hpr	Hpa	Length Ta	Width Ta
7907.5, dext	Irpfelhöhle	32,4	13,8	19,5	15,7	3,4	7,9
7911.7 dext worn	Irpfelhöhle	30,7	13,7	12,2	9,6	3,1	7,9
7911.8 dext not worn	Irpfelhöhle	29,4	12,9	17	13,3	broken	broken
32600.3 dext worn	Irpfelhöhle	32,2	13,4	16	12,9	3,1	8
32600.4 dext not worn	Irpfelhöhle	33,4	13,1	19,6	16,5	4,2	8,8
32600.5 sin worn	Irpfelhöhle	32,4	13,6	16,4	11,6	3,7	8,5
32600.6 sin	Irpfelhöhle	32,3	13,6	20,1	15,7	broken	9
32600.7 sin	Irpfelhöhle	31,9	12,8	17,6	14,1	4,5	8,2

Number	Place	p4	p4	p4	p3	p3	p3
No	Place	Length	Width	Height	Length	Width	Height
7907.2-E dext	Irpfelhöhle	-	-	-	21,4	15,2	14,2
7907.2-E sin, n.No.	Irpfelhöhle	23,4	14,3	17,5	22,4	15,2	20,9
7907.5, dext	Irpfelhöhle	23,6	14,7	19,3	-	-	-
7907.2-E dext, n.No.	Irpfelhöhle	-	-	-	22	16,7	21,2
32599 sin	Irpfelhöhle	24,6	15,1	17,7	20,2	16	21,7

Number	Place	p2	p2	p2	cinf	cinf	cinf
No	Place	Length	Width	Height	Length	Width	Height
7907.2-E dext	Irpfelhöhle	15,9	11	7,6	14,2	14,7	21,4
7907.2-E sin, n.No.	Irpfelhöhle	17,2	13	11,1	-	-	-
7907.2-E dext, n.No.	Irpfelhöhle	-	-	-	17,7	14,5	32
32599 sin	Irpfelhöhle	15,5	12,7	10	15,2	12,6	30,4

No	Place	p2-m1	Md H m1	Md H p3
7907.2-E dext	Irpfelhöhle	-	-	42,5
7907.5, dext	Irpfelhöhle	-	33	-

Upper Jaw

Number	Place	P4	P4	P4	P4	P4
No	Place	Length	L me	Width	W pr	Hpa
7911.1 sin worn	Irpfelhöhle	41,6	19	12,2	23,6	16,4
7911.2 sin worn	Irpfelhöhle	41,6	9,4	13,5	20	20,7
7801 sin skull	Irpfelhöhle	38,5	18	11,8	21,1	16,4
7801 dext skull	Irpfelhöhle	38,5	17,3	11,8	21,2	15,5

Number	Place	P3	P3	P3	P2	P2	P2
No	Place	Length	Width	Height	Length	Width	Height
7801 sin skull	Irpfelhöhle	24,4	16,7	17,5	16,8	10,8	8,8
7801 dext skull	Irpfelhöhle	25	16,7	16,2	17,6	12,2	8,7

Number	Place	P1	P1	P1	Csup	Csup	Csup
No	Place	Length	Width	Height	Length	Width	Height
7801 sin skull	Irpfelhöhle	8,2	7	5,5	18	11,7	21
7801 dext skull	Irpfelhöhle	7,5	7	5,5	17,8	12	20,4

Skull

No	Place	1	2	3	4	5	6	7
7801	Irpfelhöhle	71,5	84,9	161,5	284,3	40,8	91,1	52,7

Post-cranial elements

Number and Element	Place	L	KD
7912 Tibia sin	Irfpelhöhle	195	17,9
Mt4	Irfpelhöhle	87,4	12,1
Mc3	Irfpelhöhle	90,1	12,5
Mc2	Irfpelhöhle	69,8	12
Mc5	Irfpelhöhle	64,8	10,8

Oberrhein/Ketsch
Skull

No	Place	1	2	3	4	5	6	7
6617	Ketsch	73,9	87,6	171,3	289,8	47,8	99	45,1

Upper Jaw

Number	Place	P4	P4	P4	P4	P4
No	Place	Length	L me	Width	W pr	Hpa
SMNS 6617 sin skull	Ketsch	38,8	16,7	12,7	21,3	14
SMNS 6617 dext skull	Ketsch	37,8	17,1	11,9	21,2	13,5

Number	Place	P3	P3	P3	P2	P2	P2
No	Place	Length	Width	Height	Length	Width	Height
SMNS 6617 sin skull	Ketsch	23,3	16,5	14	15,3	10,6	7,6
SMNS 6617 dext skull	Ketsch	23,3	16,3	13,7	15,7	10,6	7,5

Number	Place	P1	P1	P1	Csup	Csup	Csup
No	Place	Length	Width	Height	Length	Width	Height
SMNS 6617 sin skull	Ketsch	7,4	7,4	4,7	15	12,9	21,5
SMNS 6617 dext skull	Ketsch	7,5	7,5	5,3	16,1	12,6	21,8

Aufhausener cave

Upper Jaw

Number	Place	P4	P4	P4	P4	P4
No	Place	Length	L me	Width	W pr	Hpa
AH 248 sin	Aufhausenerhöhle	40,8	17,5	14,2	23,7	14,7
AH 256 sin	Aufhausenerhöhle	42	17,2	12,5	13,4	20,6

Number	Place	P3	P3	P3	P2	P2	P2
No	Place	Length	Width	Height	Length	Width	Height
AH 248 sin	Aufhausenerhöhle	23,6	19	18,1	17,2	12,3	9,7
AH 248 dext	Aufhausenerhöhle	-	-	-	17,7	11,6	8

Number	Place	P1	P1	P1
No	Place	Length	Width	Height
AH 248 sin	Aufhausenerhöhle	7,2	7,3	4,9

Lower Jaw

Number	Place	m1	m1	m1	m1	m1	m1
No	Place	Length	Width	Hpr	Hpa	Length Ta	Width Ta
AH 251 dext	Aufhausenerhöhle	31,4	13	14,4	12,7	3,4	8,5
AH 253 sin	Aufhausenerhöhle	31,4	13,1	12,9	10,8	3,4	8
AH 252 sin	Aufhausenerhöhle	33,6	14,4	19,7	16,2	3,9	8,5

Number	Place	p4	p4	p4	p3	p3	p3
No	Place	Length	Width	Height	Length	Width	Height
AH 251 dext	Aufhausenerhöhle	22,5	13,8	10	broken	broken	broken
AH 251 sin	Aufhausenerhöhle	22,5	13,7	10,4	21,5	15,5	10,3
AH 252 sin	Aufhausenerhöhle	24,8	14,5	16	23	15,6	19,5

Number	Place	p2	p2	p2	Cinf	Cinf	Cinf
No	Place	Length	Width	Height	Length	Width	Height
AH 251 dext	Aufhausenerhöhle	14,7	9,4	7	14,2	13,5	24,5
AH 251 sin	Aufhausenerhöhle	15,1	10,3	6,9	17,7	12,6	27,5
AH 252 sin	Aufhausenerhöhle	17	11,6	9,4	16,5	15	28,5

No	Place	p2-m1	Md H m1	Md H p3	L md	Coronoid H
AH 251 dext	Aufhausenerhöhle	86,8	49,4	38,3	200,1	
AH 251 sin	Aufhausenerhöhle	86,2		41,8		92,3
AH 252 sin	Aufhausenerhöhle	89,5	41,2	34,5		

Skull

No	Place	1	2	3	4	5	6	7	8
AH248	Aufhausenerhöhle	81,5				53	95,6	59	127,6

Post-cranial Elements

No	Element	L	KD
AH 180	Humerus dext	106,2	19,9
AH 188	Ulna dext	100,5	13,4
AH 182	Radius dext	86	21,7
AH 184	Radius sin	69	21,3
AH 1856	Radius sin	68,5	19,6
AH 189	Tibia dext	195,2	17,8
AH 200	Tibia sin	197,8	19,6
AH 20	Tibia dext	198,7	19,6
AH 193	Femur dext	253	23,3
AH 155	Mc 5 sin	69,2	11,9
AH 153	Mc 4 sin689	2	10,9
AH 152	Mc 3 sin	89,4	11,5
AH 151	Mc 2 sin	77,5	11,1
AH 150	Mc 2 sin	79,2	12,4
AH 154	Mc 5 sin	71	11,9
AH 156	Mc 2 dext	76,5	12,5
AH 157	Mc 4 dext	87,3	10,5
AH 162	Mc 2 sin	68,1	11,1
AH 163	Mt 3 sin	77,7	10,2
AH 164	Mt 4 sin	79,8	9,1
AH 165	Mt 4 sin	74,5	9,2
AH 166	Mt 2 dext	66,5	11,2
AH 167	Mt 3 dext	77,4	10,5
AH 168	Mt 4 dext	78,5	10,1

Höbarthmuseum Horn

Upper Jaw

Number	Place	P4	P4	P4	P4	P4
No	Place	Length	L me	Width	W pr	Hpa
HO 21527 (lw)sin	Horn TL	40,47	17,07	12,72	23,95	21,69
HO 21528(w)sin	Horn TL				21,13	20,41
HO21531 (vw) dext	Horn TL	40,61	17,28	11,9	21,85	
HO 21533 (vw) dext	Horn TL	37,34	16,49	11,49	21,04	
HO 21534 (exw) sin	Horn TL	38,93	15,4	12,01	21,93	
HO 21535 (vw) sin	Horn TL	42,75	broken 1	2,88	23,27	18,34
HO 21536 (lw) sin	Horn TL	40,71	16,8	12,4	20,61	20,43
8885 (w) sin	Horn TL	42,9	18,45	13,63	21,72	21,19

Number	Place	P3	P3	P3	P2	P2	P2	P2
No	Place	Length	Width	Height	Length	Width	2.Height	Heigth
HO 21527 (lw)sin	Horn TL	24,76	18,9	23,9	17,5	13,5	11,90	12,06
HO 21529 (w) sin	Horn TL	P26,45	19,03	23,12	17,95	13,2	12,00	11,2
HO 21530 (w) sin	Horn TL	26,46	19,24	20,35				
HO21531 (vw) dext	Horn TL	25,25	18,25					
HO 21532 (vw)sin	Horn TL	24,3	19,5					
HO 21533 (vw) dext	Horn TL	23,46	15,99		15,48	11,38	10,26	
HO 21534 (exw) sin	Horn TL	24,9	17,6					
HO 21535 (vw) sin	Horn TL	26,95	17,94	18,6	18,33	broken	12,60	9,45
HO 21536 (lw) sin	Horn TL	22,2	17,15	22,31	17,4	13,44	11,82	12,76
HO 21537 (vw) sin	Horn TL	24,12	16,9	17,07				
HO 21539 dext	Horn TL	21,6	16,72	22,87	15,94	12,38	10,57	11,35
8885 (w) sin	Horn TL	25,64	18,72	23,82	19,85	14,29	12,80	12,48

Number	Place	P1	P1	P1	Csup	Csup	Csup
No	Place	Length	Width	Height	Length	Width	Height
HO 21529 (w) sin	Horn TL	18,73	13,73	28,05			
8885 (w) sin	Horn TL	7,72	7,17	6,67	18,32	13,03	29,81

Single Upper Teeth

Number	Place	P4	P4	P4	P4	P4
No	Place	Length	L me	Width	W pr	Hpa
HO 21554 sin	Horn TL	brokem	18,85			
HO 21555 dext (exw)	Horn TL	39,18	17,05	12,06		
HO 21556 dext (vw)	Horn TL	41,78	17,69	12,54	broken	18,37
HO 21557 sin (vw)	Horn TL	42,55	19,34	12,44		
HO 21558 sin (w)	Horn TL	38,87	16,61	11,16	20,18	17,97
HO 21560 dext	Horn TL	41,42	18,36	13,05	23,31	22,06
Ho 21561 sin (w)	Horn TL	39,45	16,69	13,28	broken	19,65
HO 21562 sin(exw)	Horn TL	41,52	18,9	12,58	22,06	
HO 21563 dext (vw)	Horn TL	41,56	18,64	13,19	22,93	18,55

Number	Place	p3	p3	p3
No	Place	Length	Width	Height
HO 21564 sin (w)	Horn TL	25,9	18,39	21,08
HO 21565 dext (w)	Horn TL	25,27	18,02	19,03
HO 21566 dext	Horn TL	26,06	18,16	27,07
HO 21567 dext	Horn TL	25,8	18,85	23,42
HO 21568 sin (vw)	Horn TL	25,25	18,41	
HO 21569 dext	Horn TL	24,55	18,1	27
HO 21570 dext (lw)	Horn TL	24,11	17,51	
HO 21571 sin	Horn TL	23,97	17,82	27,55

Number No	Place Place	P2 Length	P2 Width	P2 2.Height	P2 Heigth
HO 21572 sin (lw)	Horn TL	17,41	13,41	12,29	10,33
Ho 21573 sin	Horn TL	18,32	14,22	12,27	12,74
HO 21574 dext	Horn TL	19,25	13,35	12,04	12,55
HO 21575 sin	Horn TL	18,64	14,33	11,69	12,24
HO 21576 sin	Horn TL	16,49	12,87	10,99	12,12
HO 21652 sin (zkrone)	Horn TL	18,51	14,42	12,66	12,36
HO 21648 dext (zKr)	Horn TL	16,88	12,94	11,40	12,86

Number	Place	P1	P1	P1
No	Place	Length	Width	Height
HO 21577	Horn TL	8,05	7,47	6,52
HO 21578	Horn TL	8,52	8,46	7,3
HO 21579	Horn TL	7,2	6,64	6,58
HO 21580 (lw)	Horn TL	7	7,36	5,92
HO 21650	Horn TL	7,42	6,77	6,26
HO 21651 (lw)	Horn TL	7,15	7,51	6,06

Number	Place	Csup	Csup	Csup
No	Place	Length	Width	Height
HO 21654 sin (vw)	Horn TL	17,2	13,5	
HO 21655 sin (lw)	Horn TL	16	13,1	27,8
HO 21656 sin (lw)	Horn TL	16,1	13,8	27,8
HO 21657 sin (vw)	Horn TL	18,4	13,8	28,6
HO 21658 sin (lw)	Horn TL	16,4	14,3	28,5
HO 21659 sin (vw)	Horn TL	16,7	13,2	
HO 21660 sin	Horn TL	15,2	11,5	28,2

Lower Jaw

Number	Place	m1	m1	m1	m1	m1	m1
No	Place	length	width	hpr	hpa	length ta	width ta
HO 21543 sin (w)	Horn TL	32,68	13,31(14,63)	13,28	18	3,74	8,67
HO 21550 dext (exw)	Horn TL	33,93	13,49			3,07	8,1
HO 21551 dext (w)	Horn TL	33,74	13,36	12,49	17,95	2,91	8,82
HO 21552 sin (w)	Horn TL	32,36	13,79	13,88	17,52	3,65	7,92
8885 sin (lw)	Horn TL	30,18	13,31	13,66	18,58	3,7	7,77
HO 21538 Sin (exw)	Horn TL	30,72	12,7			3,8	6,8

Number	Place	p4	p4	p4	p3	p3	p3
No	Place	length	width	hight	length	width	hight
HO 21540 sin (lw)	Horn TL	24,53	15,51	17,47	23,26	15,99	21,94
HO 21541 sin (exw)	Horn TL				23,28	17,27	
HO 21542 sin (lw)	Horn TL				22,82	14,95	18,28
HO 21543 sin (w)	Horn TL	24,38	15,63	16,45	22,52	16,17	19,15
HO 21544 sin (w)	Horn TL				20,74	15,91	16,13
HO 21545 dext (w)	Horn TL				22,7	16,59	18,72
HO 21546 dext (lw)	Horn TL	24,61	14,92	15,97	23,79	15,68	18,97
HO 21547 sin (vw)	Horn TL	25,35	16,10		24,36	16,37	
HO 21548 sin (w)	Horn TL				23,7	16,23	18,62
HO 21549 sin	Horn TL	24,26	15,08	18,21	23,13	15,62	22,03
HO 21550 dext (exw)	Horn TL	24,3	15,23		23,86	15,54	
HO 21551 dext (w)	Horn TL	24,84	15,55	14,66	22,82	16,32	17,08
HO 21552 sin (w)	Horn TL	24,08	15,05	15,91	22,69	15,28	18,37
HO 21553 sin (lw)	Horn TL	25,2	14,54	16,27	23,83	15,62	19,45
8885 sin (lw)	Horn TL	24,91	13,83	18,6	21,73	15,21	21,43
HO 21538 Sin (exw)	Horn TL	24,13	14,13		22,37	14,91	

Number	Place	p2	p2	p2	p2	Cinf	Cinf	Cinf
No	Place	length	2. breite	width	height	length	width	height
HO 21540 sin (lw)	Horn TL	16,6	12,93	10,89	11,07			
HO 21542 sin (lw)	Horn TL	17,54	11,96	9,51	10,04	16,37	14,54	28,14
HO 21543 sin (w)	Horn TL	17,96	13,43	11,27	10,51			
HO 21544 sin (w)	Horn TL	16,21	12,7	11,28				
HO 21545 dext (w)	Horn TL	17,47	13,62	11,62	10,53			
HO 21546 dext (lw)	Horn TL	18,28	13,07	11,09	10,73			
HO 21547 sin (vw)	Horn TL	17,67	13,51	11,4		17,58	15,9	
HO 21548 sin (w)	Horn TL	17,16	12,01	10,7	11,33	broken		
HO 21549 sin	Horn TL	16,83	12,89	10,34	10,99	17,21	13,94	29,08
HO 21550 dext (exw)	Horn TL	17,46	broken	10,17		17,85	12,76	
HO 21551 dext (w)	Horn TL	16,56	12,86	11,03	9,2	broken		
HO 21552 sin (w)	Horn TL	17,45	13,17	11,04	9,91			
HO 21553 sin (lw)	Horn TL	17,69	12,62	10,85	11,31			
8885 sin (lw)	Horn TL	16,98	12,78	10,83	11,76	16,47	14,13	29,49

Number	Place	Hm1	Hp3	H coronoid	Md length
HO 21541 sin (exw)	Horn TL		49,52		
HO 21543 sin (w)	Horn TL	54,51	44,8		
HO 21546 dext (lw)	Horn TL		39,27		
HO 21549 sin	Horn TL		33,27		
HO 21550 dext (exw)	Horn TL	59,81	52,01		
HO 21551 dext (w)	Horn TL	51,53	40,42	128,58	204,86
HO 21552 sin (w)	Horn TL		48,04		
HO 21553 sin (lw)	Horn TL		39,61		
8885 sin (lw)	Horn TL	41,71	34,61	179,91	
HO 21538 Sin (exw)	Horn TL	57,05	47,76	124,25	183,88

Single Lower Teeth

Number	Place	m1	m1	m1	m1	m1	m1
No	Place	length	width	hpr	hpa	length ta	width ta
HO 21581 sin (vw)	Horn TL	32,75	13,44	13,59	16,98	3,43	8,79
HO 21582 dext (vw)	Horn TL	34,88	14,78	14,1	17,75	3,56	8,88
HO 21583 sin (vw)	Horn TL	33,61	14,46	15,06	17,75	3,62	9,23
HO 21584 sin (exw)	Horn TL	34,98	13,79			3,6	8,19
HO 21585 dext (vw)	Horn TL	33,31	13,34	14,16	17,77	4,07	8,35
HO 21586 dext (Zkeim)	Horn TL	31,67	13,26	14,64	17,01	3,25	7,95
HO 21587 sin (w)	Horn TL	34,69	14,49	14,35	19,39	3,85	9,84
HO 21588 sin (vw)	Horn TL	33,78	14,72	12,15	16,73	3,7	9,68
HO 21589 dext (w)	Horn TL	33,49	13,87	14,8	17,39	3,97	9,37
HO 21590 sin (zkeim)	Horn TL	33,72	12,4	15,24	16,89	3,51	8,58
HO 21591 dext (vw)	Horn TL	33,9	13,33	12,55	broken	3,47	broken
HO 21592 sin (lw)	Horn TL	32,78	13,75	15,39	19,07	3,62	broken
HO 21593 dext (lw)	Horn TL	34,18	14,45	14,98	18,55	3,57	9,14
HO 21594 sin	Horn TL	33,73	13,75	13,76	17,52	3,58	8,48
HO 21595 dext (zkeim)	Horn TL	35,77	14,45			4,87	8,79
HO 21596 sin	Horn TL	34,65	14,79	14,54	18,14	4,33	9,46

Number	Place	p4	p4	p4
No	Place	length	width	heigth
HO 21597 sin (vw)	Horn TL	24,95	15,94	13,83
HO 21598 sin (lw)	Horn TL	23,17	14,37	16,28
HO 21599 sin (w)	Horn TL	24,17	15,24	16,78
HO 21600 sin (w)	Horn TL	23,86	15,05	15,33
HO 21601 sin (vw)	Horn TL	23,66	14,03	15,17
Ho 21602 sin	Horn TL	23,51	14,73	16,73
HO 21603 sin (w)	Horn TL	24,16	15,57	17,13
HO 21604 sin	Horn TL	22,46	13,93	19,15
HO 21605 sin (exw)	Horn TL	24,02	15,24	
HO 21606 sin (zkeim)	Horn TL	22,11		
HO 21607 dext (lw)	Horn TL	25,3	15,65	
HO 21608 dext (w)	Horn TL	25,56	15,20	16,06
HO 21609 dext (w)	Horn TL	26,33	14,66	16,63
HO 21610 dext (lw)	Horn TL	23,89	14,97	17,61
HO 21611 dext (vw)	Horn TL	25,4	14,61	15,21
HO 21612 dext	Horn TL	23,63	13,52	17,93
HO 21613 dext Zahnkrone	Horn TL	24,63	13,81	19,37

Number	Place	p3	p3	p3
No	Place	length	width	heigth
HO 21614 sin (w)	Horn TL	22,1	15,62	broken
Ho 21615 sin (exw)	Horn TL	22,69	15,66	
HO 21616 sin	Horn TL	23,21	15,67	21,87
HO 21617 si	Horn TL	22,73	16,41	23,56
HO 21618 sin	Horn TL	22,1	16,03	22,22
HO 21619 dext	Horn TL	22,92	15,64	21,5
HO 21620 dext	Horn TL	22,74	16,33	24,2
HO 21621 dext	Horn TL	24	17,12	23,99
HO 21622 dext (lw)	Horn TL	24,1	16,68	21,41
HO 21640 sin (Zkeim)	Horn TL	broken	13,99	broken
HO 21642 dext (Zkrone)	Horn TL	22,79	16,47	22,47
HO 21643 sin (vw)	Horn TL	22,6	15,6	16,66
HO 21644 sin (Zkrone)	Horn TL	23,23	16,27	23,13
HO 21645 sin (Zkrone)	Horn TL	22,21	14,66	20,1
HO 21646 sin (Zkrone)	Horn TL	23,55	17,41	22,32
HO 21647 dext (w)	Horn TL	22,1	16,53	broken

Number	Place	p2	p2	p2	p2
No	Place	length	2.width	width	heigth
HO 21624 dext (lw)	Horn TL	18,04	12,94	11,09	9,99
HO 21625 dext	Horn TL	15,77	11,3	10,01	10,32
HO 21626 dext (w)	Horn TL	17,05	broken	broken	8,67
HO 21627 dext (w)	Horn TL	15,71	12,18	10,95	9,29
HO 21628 dext	Horn TL	16,08	12,44	10,5	11,21
HO 21629 dext	Horn TL	17,25	12,4	10,33	10,5

Number	Place	Cinf	Cinf	Cinf
No	Place	length	width	heigth
HO 21668 dext	Horn TL	17,2	12,6	29,8
HO 21669 dext (w)	Horn TL	15,1	12,3	23,8
HO 21670 dext (w)	Horn TL	17	13,6	27,3
HO 21671 dext (lw)	Horn TL	18,1	12,9	29
HO 21672 dext	Horn TL	16,4	13,9	30,2
HO 21673 dext	Horn TL	17,4	13,4	32,2
HO 21674 dext	Horn TL	17	12,3	30,7
HO 21675 dext	Horn TL	17,8	13,9	33
HO 21676 dext (lw)	Horn TL	16,9	13,2	28,6
HO 21677 dext	Horn TL	16,4	12,8	
HO 21678 dext (w)	Horn TL	17,6	12,8	28,7
HO 21666 sin (lw)	Horn TL	16,5	12,8	27,5
HO 21667 sin (w)	Horn TL	18	13,6	

Juvenile Lower Jaw

Number	Place	dp4	dp4	dp4	dp4	dp4	dp4
No	Place	Length	Width	Hpa	Hpr	Length Ta	Width Ta
HO 21630 sin	Horn TL	20,19	7,61	9,56	10,13	4,84	5,69
HO21632 dext (lw)	Horn TL	20,56	7,37	9,48	9,79	4,66	6,05
HO 21633 dext (lw)	Horn TL	20,28	6,89	9,01	9,12	5,14	5,94
HO 21534 dext (lw)	Horn TL	20,43	6,58	9,4	9,02	5,78	4,97

Number	Place	dp3	dp3	dp3	dp2	dp2	dp2
No	Place	length	width	heigth	length	width	heigth
HO 21630 sin	Horn TL	14,33	6,84	8,66	10,42	5,18	5,9
HO 21631 sin	Horn TL	13,48	6,79	7,51	9,2	4,42	5,27
HO 21653 dext (w)	Horn TL	14,61	6,90	7,19			

Juvenile single Upper Teeth

Number	Place	dp4	dp4	dp3	dp3	dp3	dp3	dp3
No	Place	width	length	length	Lme	width	Wpr	Hpa
HO 21638	Horn TL	14,13	11					
HO21639	Horn TL	12,71	8,45					
HO 21635 sin? (w)	Horn TL			22,4	8,29	6,32	14,44	9,93
HO 21636 dext?	Horn TL	broken						11,07
HO 21637 dext? (w)	Horn TL			22,03	8,7	6,08	12,2	10,15

Number	Place	dp2	dp2	dp2	dcinf	dcinf	dcinf
No	Place	length	width	heigth	length	width	heigth
73149 dext	Horn	7,8	4	4,8	6,3	4,2	11
73149 sin	Horn	8,2	4,5	4,9	6,6	4,3	11,6
A168.10 Hyena dext	Horn	10,4	4,8	5,2	7,3	4,2	10,7
A168.10 Hyena sin	Horn	10,6	5,5	5,2	6,9	4,5	11

No	Place	dp4-dp2	Md H m1	Md H p3
73149 dext	Horn	40,2	27	26,7
73149 sin	Horn	40,4	26,7	27,2
A168.10 Hyena dext	Horn	38,2	21,4	21,8
A168.10 Hyena sin	Horn	38,4	22,8	21,2

Teufelslucke

Upper Jaw

Number	Place	P4	P4	P4	P4	P4
No	Place	Length	L me	Width	W pr	Hpa
514 sin (ex w)	Teufelslucke	42,2		11,2	22,9	9,3
724 dext	Teufelslucke	40,4	17,5	12,7	22	21,8
1318 sin (vw)	Teufelslucke	37,9	16,3	12,2	21,5	14,9
723 sin	Teufelslucke	40,6	16,2	13	22,5	23
1081 sin	Teufelslucke	41,7	17,7	12,7	23,5	19
847 dext (w)	Teufelslucke	40,5	17,6	12	22,9	20,3
F/3580 (w) dext	Teufelslucke	42,2	19,1	12,3	22	19,8
F/3581 (vw) sin	Teufelslucke	41	17,2	12,7	21,4	20,5
F/3582 (ex w) dext	Teufelslucke	39,2	18	11,5	23,5	13,3
F/3583 dext	Teufelslucke	40	16,3	12,4	20,4	21,8
F/3584 sin	Teufelslucke	39,4	16,2	12,7	20,8	21,2
F/3597 sin (vw)	Teufelslucke	42,7	18,8	13,7	23,6	20,3

Number	Place	P3	P3	P3	P2	P2	P2
No	Place	Length	Width	Height	Length	Width	Height
514 sin (ex w)	Teufelslucke	22,5	17,7	7,2			
724 dext	Teufelslucke	24,5	18,1	25			
1318 sin (vw)	Teufelslucke	24,5	17,1	13	17,8	11,6	7,7
723 sin	Teufelslucke	broken	17,4	25,8			
1045 dext	Teufelslucke				15,6	10,5	10,8
1081 sin	Teufelslucke	26	17,8	21,1			
847 dext (w)	Teufelslucke	26,4	17,8	22,5			
F/3580 (w) dext	Teufelslucke	26	19	21,1			
F/3582 (ex w) dext	Teufelslucke	25,7	17,1	13,1	18,4	11,5	8,4
F/3583 dext	Teufelslucke	24,8	18,2	24,4			
F/3584 sin	Teufelslucke	24	18,5	26,4			
F/3585 sin	Teufelslucke	24,5	17,1	23,2	18,5	11,4	11,5
F/3586 dext	Teufelslucke	23	16,9	23	17	10,3	10,8
F/3587 dext	Teufelslucke	22,4	16,8	24,3	16,4	10,5	12
F/3588 dext (w)	Teufelslucke	23,2	17,4	22,6	17,9	12,2	11,8
F/3589 sin (w)	Teufelslucke	26,2	17,7	19,5	17,5	12,1	9,5
F/3590 sin (vw)	Teufelslucke	25,6	18,9	16,8	18,8	11,4	8,8
F/3591 dext	Teufelslucke	25,5	18,3	24,6			
F/3592 sin (w)	Teufelslucke	26,1	18,9	22			
F/3593 sin (vw)	Teufelslucke	22,4	15	12,2			
F/3594 dext (w)	Teufelslucke				18	11,8	9,5
F/3595 sin (w)	Teufelslucke			1	8,3	11,4	10,2
F/3597 sin (vw)	Teufelslucke	26,1	18,5	22,6	18,3	11,7	10,7

Number	Place	P1	P1	P1	Csup	Csup	Csup
No	Place	Length	Width	Height	Length	Width	Height
F/3595 sin (w)	Teufelslucke	9	7,8	6,6			
F/3596 (nur 1 I)	Teufelslucke	7,4	6,5	4,2			
F/3597 sin (vw)	Teufelslucke				18,9	13,3	16,1

Single Teeth of the Upper Jaw

Number	Place	P4	P4	P4	P4	P4
No	Place	Length	L me	Width	W pr	Hpa
1416 sin	Teufleslucke	37,3	24	13	18,9	19,2
877 sin	Teufleslucke	41,8	18,1	12,2	broken	
F/3314 sin nur krone	Teufleslucke	43	19,5	13,8	23,5	21,2
F/3315 sin nur Krone	Teufleslucke	40	18	12,1	broken	21,4
F/3316 sin	Teufleslucke	42	18,7	13,5	22,4	21,8
F/3317 sin	Teufleslucke	42,8	18,9	11,9	22,8	22,6
F/3318 sin broken	Teufleslucke			12	23,1	22
F/3320 sin	Teufleslucke	40,6	16,5	12,4	23,3	23
F/3321 sin	Teufleslucke	43,7	19,4	12,8	25,5	21,7
F/3614 sin (vw)	Teufleslucke	broken	16,9	13,2		18
F/3615 sin (w)	Teufleslucke	42,1	17,7	12,2	23,1	20
F/3616 sin	Teufleslucke	42,5	17,6	13,2	23,6	24
F/3617 sin (w)	Teufleslucke	40,3	18,1	12,8	21,4	17,8
F/3618 sin	Teufleslucke	38,9	18	12,5	19,5	21,2
F/3619 sin	Teufleslucke	42,4	19,1	13,1	broken	23,4
946 sin (lw)	Teufleslucke	39,7	17,2	13	23,3	20,4
F/3104/1 sin (Zahnkeim)	Teufleslucke	41,9	19,1	12,3	20,6	23
F/3104/2 sin	Teufleslucke	38,8	17,2	11,4	21	21,1
F/3104/3 sin (Zkeim)	Teufleslucke	42,8	18,1	13,3	20,8	22,7
F/3204/4 sin (exw)	Teufleslucke	42,1	19	12,9	22,3	
F/3104/5 sin (exw)	Teufleslucke	42,7	18,9	13,1	21,1	
516 dext (vw)	Teufleslucke	40,6	17,3	11,7	24,1	17,2
916 dext	Teufleslucke	37,7	17	12	20	20,6
2577 dext	Teufleslucke			11,7	19,8	18,6

Number	Place	P4	P4	P4	P4	P4
No	Place	Length	L me	Width	W pr	Hpa
F/3300 dext	Teuflesluckе	39,8	16,8	12,3	21	21
F/3301 dext broken	Teuflesluckе			12,8	23	21,4
F/3302 dext	Teuflesluckе	39,4	17,1	11,7	19,2	20
F/3303 dext (w)	Teuflesluckе	41,1	17,7	13,4	22,7	21,5
F/3304 dext broken	Teuflesluckе	41	17,2		11,8	23,2
F/3305 dext (exw)	Teuflesluckе	41,9		13,7	24	
F/3306 dext (vw)	Teuflesluckе	40,8	17,8	11,7	20,9	16,3
F/3307 dext	Teuflesluckе	38,5	17,2	12,3	19,6	21,2
F/3308 dext (vvw)	Teuflesluckе	40,2	18,1	12,5	22,2	18,7
F/3309 dext bro. (w)	Teuflesluckе	42,4	19,7	12,2		19
F/3310 dext broken	Teuflesluckе	37,9	14,6	11,1	20,4	
F/3311 dext broken	Teuflesluckе	38,6	17,1	11,7		21
F/3312 dext Krone	Teuflesluckе	40	17,7	11	20,7	20,5
F/3313 dext Krone	Teuflesluckе	43,3	19,2	12,1	20,50	21,4
F/3319 dext broken	Teuflesluckе	41,3	19,2	12,4	22,7	20,1
1621 dext (exw)	Teuflesluckе	37,6	16,9	11,9	21,9	(11,9)
1323 dext (w)	Teuflesluckе	39,9	17,8	12,7	22,6	23,1
496 dext (Zkeim)	Teufelslucke	41,6	17,7	12,6	23,6	22,5
2079 dext (w)	Teufelslucke	38,1	16,2	13	22,4	20,3
F/3104/6 dext (lw)	Teufelslucke	42,5	16,7	14,1	22	23,3
F/3104/7 dext (w)	Teufelslucke	43,9	20,6	12,5	21,5	18,7
F/3104/8 dext (zkeim)	Teufelslucke	39,7	18	12,7	21,9	22,3
1744 dext (w)	Teufelslucke	40,2	16,2	12,9	23	19,8

Number	Place	P3	P3	P3
No	Place	Length	Width	Height
892 dext	Teufleslucke	23,5	16,8	24,4
98 dext	Teufleslucke	25,4	17,2	25,1
893 dext juv broken	Teufleslucke		16,2	12,4
1322 dext (exv)	Teufleslucke	23,6	16,4	
F/3330 dext br (vw)	Teufleslucke	26	17,8	
F/3331 dext	Teufleslucke	25,1	17,4	24,5
F/3332 dext	Teufleslucke	24,4	17,2	23,8
F/3333 dext	Teufleslucke	25	19,2	27,2
F/3334 det (w)	Teufleslucke	23,2	16,7	15,6
F/3335 dext	Teufleslucke	26,9	17,8	23,9
F/3336 dext	Teufleslucke	23,4	15,8	27,5
F/3337 dext	Teufleslucke	25	17,8	24,9
F/3338 dext (exw)	Teufleslucke	22,2	16,5	
F/3339 dext	Teufleslucke	24,1	16,9	24,5
F/3340 dext	Teufleslucke	25,4	16,1	23,6
F/3341 dext Krone	Teufleslucke	23,3	15,9	21,9
F/3342 dext	Teufleslucke	24,7	18	25,1
F/3343 dext (w)	Teufleslucke	24,9	16,9	20,5
908 dext (tafel)	Teufleslucke	25,3	18,9	27,2
F/3496 dext	Teufleslucke	25,6	18,7	28,2
F/3497 dext	Teufleslucke	23,7	16,1	23,3

Number	Place	P3	P3	P3
No	Place	Length	Width	Height
728 dext (w)	Teufelslucke	25,3	18,1	23,6
949 dext (exw)	Teufelslucke	23,5	15,7	
1622 dext (exw)	Teufelslucke	23,6	15,5	
F/3103/4 dext (w)	Teufelslucke	26,6	20	26,2
F/3103/5 dext (w)	Teufelslucke	24,7	17,5	23
F/3103/6 dext (exw)	Teufelslucke	25,4	18,5	21,4
F/3103/7 dext (exw)	Teufelslucke	26,3	18,5	
?F/3103/8 dext (exw)	Teufelslucke	24,7	15,7	
?F/3103/9 dext (exw)	Teufelslucke	23,5		
550 sin (exw)	Teufelslucke	25,7	18	
2445 sin (exw)	Teufelslucke	26,9	18,5	
1529 sin (exw)	Teufelslucke	23,8	16,2	
334 sin (W)	Teufelslucke	25,8	18,5	22,5
F/3103/1 sin (exw)	Teufelslucke	25,7	18	18,3
F/3103/2 sin (exw)	Teufelslucke	27	19,1	
F/3103/3 sin (exw)	Teufelslucke	24,7	17	
270 sin	Teufleslucke	24,5	16,5	23,6
302 sin (exw)	Teufleslucke	25,3	16.6	
659 sin	Teufleslucke	21,9	16,2	20,8
926 sin Krone	Teufleslucke		16,9	24,4
2870 sin (w)	Teufleslucke	24,5	17,2	22,3
2024 sin Krone	Teufleslucke	24	15,6	26,9

Number	Place	P3	P3	P3
No	Place	Length	Width	Height
1360 sin Krone	Teufleslucke	23,7	16,2	23,5
F/3322 sin (lw)	Teufleslucke	24,8	17,6	23,4
F/3323 sin (w)	Teufleslucke	24,6	16,6	21,6
F/3324 sin	Teufleslucke	25,7	17,6	26,5
F/3325 sin	Teufleslucke	27,1	17,8	24,2
F/3326 sin (vw)	Teufleslucke	24,2	17,5	20,2
F/3328 sin	Teufleslucke	26,7	17,3	25,5
F/3329 sin Krone	Teufleslucke	26,2	16,6	25,6
F/3350 sin Krone	Teufleslucke	24,8	17,1	26,4
F/3495 sin	Teufleslucke	24,3	17,3	24,9
745 sin broken (w)	Teufelslucke	broken	15,4	20,6

Number	Place	P2	P2	P2
No	Place	Length	Width	Height
147 dext (w)	Teufelslucke	18	12,1	10,2
528 dext	Teufelslucke	16,2	11,2	10,8
1062 dext	Teufelslucke	16,8	10,8	12
1450 dext	Teufelslucke	17,8	11,3	12,4
2875 dext (w)	Teufelslucke	17,6	11	9,1
F/3484 dext Krone	Teufelslucke	18,2	11,7	12
F/3485 dext (w)	Teufelslucke	17,1	12,2	10,4
F/3486 dext (exw)	Teufelslucke	18,7	12,5	8,3
F/3096/2 dext (zkeim)	Teufelslucke	17	11,8	10,8
F/3096/3 dext	Teufelslucke	17,9	11,6	12,1
F/3096/4 dext (w)	Teufelslucke	17	11,8	10,3

Number	Place	P2	P2	P2
No	Place	Length	Width	Height
F/3096/5 dext (w)	Teufelslucke	18,6	12,1	10,1
F/3096/6 dext (W)	Teufelslucke	17,9	11	8,4
1626 dext (w)	Teufelslucke		10,8	8,6
1634 sin (vw)	Teufelslucke	16,5	11	7,7
1632 sin	Teufelslucke	18,5	12,1	12,8
F/3487 sin Krone	Teufelslucke	17,8	11,9	11,8
F/3488 sin Kr. (vw)	Teufelslucke	15,8	10,7	9,1
F/3489 sin (w)	Teufelslucke	18,1	12,8	11,2
F/3490 sin (vw)	Teufelslucke	17,3	11,1	9
F/3491 sin	Teufelslucke	17,2	11,5	13,9
F/3492 sin	Teufelslucke	20,5	12,6	13,9
921 sin (w)	Teufelslucke	18,1	11,9	11,2
301 sin	Teufelslucke	17,7	11,2	12
148 sin(vw)	Teufelslucke	17	11,6	9,2
2339 sin	Teufelslucke	17,8	11,3	12,3
F/3096/1 (vw)	Teufelslucke	broken	10,2	8,4

Number	Place	Csup	Csup	Csup
No	Place	Length	Width	Height
616 sin (vw)	Teufelslucke	18,1	14,3	24,9
732 sin broken	Teufelslucke		14,5	26,2
F/3402 sin (vw)	Teufelslucke	16	14,7	23,3
F/3403 sin (exw)	Teufelslucke	15,1	13,3	20,4
32 sin (w)	Teufelslucke	16,3	11,7	28,3

Number	Place	Csup	Csup	Csup
No	Place	Length	Width	Height
2442 sin (exw)	Teufelslucke	17,8	13	
F/3108/1 sin	Teufelslucke	17,4	12,6	29,7
F/3108/2 sin	Teufelslucke	17	12,1	28,4
F/3108/3 sin (exw)	Teufelslucke		13,2	
F/3108/4sin (exw)	Teufelslucke	18,5	13,6	
F/3208/5 sin (exw)	Teufelslucke		14,4	
490 dext (w)	Teufelslucke	18,7	13,5	24,8
398 dext	Teufelslucke	17,6	11,8	31,3
896 dext (w)	Teufelslucke	17,5	12,8	26,3
F/3399 dext	Teufelslucke	17	12,5	32
F/3400 dext (w)	Teufelslucke	17,3	12,7	28
F/3401 dext (w)	Teufelslucke	17,2	12,7	26,2
542 dext (w)	Teufelslucke	16,7	12,6	24,7
518 dext (exw)	Teufelslucke		13	
1196 dext (exw)	Teufelslucke	17	12,5	
2545 dext (exw)	Teufelslucke		13,1	
F/3108/6 dext (exw)	Teufelslucke		12,3	
F/3108/7 dext (w)	Teufelslucke	17,3	13,2	27,6
F/3108/8 dext (exw)	Teufelslucke	17,4	12,2	
F/3108/10 dext (w)	Teufelslucke	17,9	13,7	24
F/3108/11 dext (w)	Teufelslucke	18	13,4	26,5
F/3108/12 dext (exw)	Teufelslucke		14,5	
F/3108/13dext (exw)	Teufelslucke	15,7	12,8	

Lower Jaw

Number	Place	m1	m1	m1	m1	m1	m1
No	Place	Length	Width	Hpr	Hpa	Length Ta	Width Ta
2520 sin	Teufleslucke	32,5	14	18,5	18,2	3,4	9,2
540 sin	Teufleslucke	30,2	11,1	15	11,6	3,4	7,7
1415 dext	Teufleslucke	32,6	12,8	18,5	15,0	4	7,1
684 sin	Teufleslucke	broken	12,8		13,2	broken	broken
2041 dext	Teufleslucke	32,1	12,9	17,7	13,1	3,7	7,6
475 sin w	Teufleslucke	33,1	13,3	15,9	12	4,1	8,3
403 sin w	Teufleslucke	29,6	12,1	17	12,3	3,7	8,2
488/2 dext vw	Teufleslucke	31,5	12,1	12,5	10,9	4	7,3
942 dext vw	Teufleslucke	30,9	13	16,6	11,7	2,7	7,5
943 sin (w)	Teufleslucke	32,1	13	15,7	12	3,9	7,4
786 dext (w)	Teufleslucke	31,8	13,3	17	12,2	3,2	8,2
1219 sin (w)	Teufleslucke	32,6	13	13,2	17,0	3,2	7,6
1895 sin (w)	Teufleslucke	31,5	12,6	14,8	16,6	4	8,5
F/3556 (4) w sin	Teufleslucke	30,5	12,8	17,4	14,2	3,1	7,5
F/3557 (1) w dext	Teufleslucke	30,5	12,7	16,2	11,0	2,9	8,1
F/3558 w sin	Teufleslucke	33,3	13,2	17,4	12,7	4,1	8
F/3560 dext	Teufleslucke	32,5	12,8	17,3	14,7	4,1	8,3
F/3561 (5) sin	Teufleslucke	32,6	12,3	18,6	13,9	4,9	8,6
F/3562 sin	Teufleslucke	34,1	13,1	broken	15,5	4,1	7,7
F/3565 sin (w)	Teufleslucke	35	13,5	18,5	14,8	3,9	8,6
F/3566 dext	Teufleslucke	34,6	13,8	17,9	14,0	4,5	8
F/3572 dext (vw)	Teufleslucke	35,4	13,3	17	12,0	4	9,2
F/3575 (2) sin (vw)	Teufleslucke	31,5	12			3,1	7,8

Number	Place	p4	p4	p4	p3	p3	p3
No	Place	Length	Width	Height	Length	Width	Height
2520 sin	Teufleslucke	26,1	15	17,3	23,9	16,3	22
540 sin	Teufleslucke	22,9	13,2	12,5 (w)	21,2	14,3	12,3
1415 dext	Teufleslucke	23,4	14	17,1	22,3	16,3	21,4
488/1 dext	Teufleslucke	25,5	15,7	14,7 (w)	24	17,2	16,7 (w)
684 sin	Teufleslucke	25	14,9	14,6 (w)	23,9	15,9	16,9 (w)
941 sin	Teufleslucke	25,8	14,9	14,5	22,9	15,9	14,9
2041 dext	Teufleslucke				22,9	15	19,3
812 sin	Teufleslucke	25,4	14,3	16	24,2	16,1	16,1
2038 dext VW	Teufleslucke	26	15	14,1	23,3	14,6	13,6
475 sin w	Teufleslucke	24	13,7	15,4	23,6	14,9	15,5
403 sin w	Teufleslucke	22,5	12,9	14,6	20,9	13,5	16,2
488/2 dext vw	Teufleslucke	24,3	14	13,3	22,9	14,9	12,8
1220 dext	Teufleslucke	24,7	14,2	16,2	21,8	15,8	19,2
942 dext vw	Teufleslucke	24,8	14,2	14,4			
722 dext (vw)	Teufleslucke	25,7	15	14,5	23	16	15,6
467 dext (vw)	Teufleslucke	23,2	14,4	10,6	21,5	16	11,8
785 sin	Teufleslucke	25,9	14,8	17,7	23	15,6	16,1
513 dext (vw)	Teufleslucke	24,8	14,3	12,3	23,3	16,2	14,2
726 dext (vvw)	Teufleslucke	23,3	14,9		23,3	16,1	
943 sin (w)	Teufleslucke	23,8	15,1	15,8	23	16,5	18,2
786 dext (w)	Teufleslucke	24,8	14,4	18,4	23,2	15,9	19,4
1219 sin (w)	Teufleslucke	missing			22,8	15,9	19,9
1895 sin (w)	Teufleslucke	23,6	13,7	17,9	22,7	15,3	21,2
F/3556 (4) w sin	Teufleslucke	23,2	15,1	17,4	23	15,8	20,70
F/3557 (1) w dext	Teufleslucke	21,7	14,3	13,3	22	15,7	15,1

Number	Place	p4	p4	p4	p3	p3	p3
No	Place	Length	Width	Height	Length	Width	Height
F/3558 w sin	Teufleslucke	24,6	15,1	16,4	23	16,5	17,7
F/3559 dext (w)	Teufleslucke	25,5	15	13,9	23,5	15,7	18,6
F/3560 dext	Teufleslucke	24,4	13,5	18,5			
F/3561 (5) sin	Teufleslucke	25	14,3	17,9	24,3	16,4	21,9
F/3562 sin	Teufleslucke	23,4	14,7	16,9	23	15,2	19,1
F/3564 dext (w)	Teufleslucke	24,6	14,5	14	23,2	15,9	16,5
F/3565 sin (w)	Teufleslucke	24,3	14,7	17,1	22,9	16	20,5
F/3567 (3) sin	Teufleslucke	24,5	13,7	16,8	22,4	15,7	19,8
F/3568 dext (w)	Teufleslucke	26,3	14,5	17,5	23,8	15,9	20,4
F/3569 dext (w)	Teufleslucke	23,2	14,5	17,6	22	15,7	20,5
F/3570 dext	Teufleslucke	25,7	14,7	18,2	24	16,4	22,9
F/3571 sin	Teufleslucke	24	14,5	18			
F/3573 dext (w)	Teufleslucke				23,3	16,5	20,3
F/3574 (3) sin (vw)	Teufleslucke	23,4	12,8	12,8	22,9	14,8	15,2
F/3575 (2) sin (vw)	Teufleslucke	22	14,2	10,5	21,2	15,5	8,9
F/3576 sin (lw)	Teufleslucke	22,7	13,9	17	22,1	15	20
F/3577 dext	Teufleslucke	24,3	13,8	16,7	23,4	14,4	20,5
F/3578 sin (vw)	Teufleslucke	24,3	15	13,2	23,4	16,3	16,5
F/3579 dext (w)	Teufleslucke	25,5	14,7	15,2			

Number	Place	p2	p2	p2	Cinf	Cinf	Cinf
No	Place	Length	Width	Height	Length	Width	Height
2520 sin	Teufleslucke	18,2	11,3	11	17,5	15,8	31,5
540 sin	Teufleslucke	16,2	9,5	7,5			
1415 dext	Teufleslucke	16,20	10,7	11,5	16,7	15	32,2
488/1 dext	Teufleslucke	18,9	12,3	8(w)	15	16,2	25,4 (w)
684 sin	Teufleslucke	broken	10,5	8,8 (w)			
941 sin	Teufleslucke	16,9	10,2	8,4	15,1	16	22,2
2041 dext	Teufleslucke	16,7	10,5	11,2			
812 sin	Teufleslucke	17,5	11,5	9,2	15,4	15,4	19,1
2038 dext VW	Teufleslucke	18,1	11,2	10,3	20,9 (alveole)	24 (alv)	
475 sin w	Teufleslucke	18	10,5	9,5			
403 sin w	Teufleslucke	16	9,3	8,5			
488/2 dext vw	Teufleslucke	18,1	11,5	8,5			
1220 dext	Teufleslucke	17,2	10,6	9,5	14,3	14,2	28
722 dext (vw)	Teufleslucke	17	10,1	8	16,3	14,6	23,8
467 dext (vw)	Teufleslucke	16,4	10,8	8,2			
867 sin	Teufleslucke	15,3	9,7	8,3			
785 sin	Teufleslucke	11	10,3				
513 dext (vw)	Teufleslucke	17,1	10,3	9			
726 dext (vvw)	Teufleslucke	broken	11,8		16,9	12,7	22,1
943 sin (w)	Teufleslucke	17	11,5	10,8	15,6	16,5	27,6
786 dext (w)	Teufleslucke	18,7	10,9	10,8			

Number	Place	p2	p2	p2	Cinf	Cinf	Cinf
No	Place	Length	Width	Height	Length	Width	Height
1219 sin (w)	Teufleslucke	15,9	10,4	9,5			
1895 sin (w)	Teufleslucke	16,4	10	10,3			
F/3556 (4) w sin	Teufleslucke	16,1	10,8	10,3			
F/3557 (1) w dext	Teufleslucke	16,2	10,8	8,4			
F/3558 w sin	Teufleslucke	16,2	10,7	9,4	16	15,3	14,9 broken
F/3559 dext (w)	Teufleslucke	15,8	11,1	9,5			
F/3561 (5) sin	Teufleslucke	16,8	11	11,10	16,9	16,1	30,1
F/3562 sin	Teufleslucke	16,9	10,5	10	15,7	15,2	28,3
F/3563 dext (w)	Teufleslucke	17,5	10,9	10,4	18,2	15,9	30,7
F/3565 sin (w)	Teufleslucke	16,7	11	10,5	90,8		
F/3567 (3) sin	Teufleslucke	16	10,3	10,6			
F/3568 dext (w)	Teufleslucke	16,9	11	8,9			
F/3569 dext (w)	Teufleslucke	15,1	10,5	9,2			
F/3570 dext	Teufleslucke	17,6	10,7	11			
F/3573 dext (w)	Teufleslucke	17,2	11,3	10,4	15,5	15,3	28,1
F/3574 (3) sin (vw)	Teufleslucke	15,3	10,1	8,5			
F/3575 (2) sin (vw)	Teufleslucke	15,3	10,3	6,3			
F/3576 sin (lw)	Teufleslucke	16,1	11,4	10,8	15,3	13,9	28,8
F/3577 dext	Teufleslucke	18,4	10,8	11,2			

No	Place	p2-m1	Md H m1	Md H p3	L md	Coronoid H
2520 sin	Teufleslucke	93,	41,1			
540 sin	Teufleslucke	88	53,5	44		
1415 dext	Teufleslucke	86,2				
488/1 dext	Teufleslucke			48,6		
684 sin	Teufleslucke	90				
2041 dext	Teufleslucke	90,5				
2038 dext VW	Teufleslucke	98,8	58,1	46		broken
475 sin w	Teufleslucke	99,8				
403 sin w	Teufleslucke	86,3	54,3	43,2	198,4	
488/2 dext vw	Teufleslucke	92,2				
1220 dext	Teufleslucke			36,8		
942 dext vw	Teufleslucke		50			
943 sin (w)	Teufleslucke	91,2				
F/3556 (4) w sin	Teufleslucke	87,5	50	40,7		
F/3557 (1) w dext	Teufleslucke	87,4	54,8	46,5		
F/3558 w sin	Teufleslucke	91,8	52,2	40,2	200,8	
F/3559 dext (w)	Teufleslucke			43,3		
F/3561 (5) sin	Teufleslucke	90,2		38		
F/3562 sin	Teufleslucke	90,5		35,8		
F/3567 (3) sin	Teufleslucke			35,9		
F/3574 (3) sin (vw)	Teufleslucke			44,7		
F/3575 (2) sin (vw)	Teufleslucke	87	50,8	44,5		
F/3576 sin (lw)	Teufleslucke			36,2		

Single Teeth of the Lower Jaw

Number	Place	m1	m1	m1	m1	m1	m1
No	Place	Length	Width	Hpr	Hpa	Length Ta	Width Ta
901 sin	Teufelslucke	30,8	12,3	15	17,9	3,9	8
585 sin	Teufelslucke	34,5	12,7	15,1	20,0	3,9	8,4
988 sin	Teufelslucke	32,3	12,9	14,7	18,0	3,2	7,9
2088 sin Krone	Teufelslucke	31,7	12,3	14	18,5	4,8	8,5
2083 sin	Teufelslucke	31,7	12,9	15,1	18,5	4,8	7,6
511 sin Krone	Teufelslucke	31,1	10,6	14,7	broken	4,9	8,3
784 sin Krone	Teufelslucke	30,3	10,8	12,5	15,7	5,3	8
1748 sin	Teufelslucke	32	12,8	14	17,0	4,1	8,6
639 sin (w)	Teufelslucke	32,2	13	12,6	15,2	4,1	8
510 sin (w)	Teufelslucke	32,2	13,1	13,1	16,9	3,7	7,7
2754 sin (w)	Teufelslucke	33,7	13,7	13	16,1	4,3	8,9
F/3378 sin Krone	Teufelslucke	28,8	10,6	14	15,6	4,2	8
F/3379 sin Krone	Teufelslucke	33	12,8	14,2	17,4	5,1	8,5
F/3381 sin Krone (w)	Teufelslucke	30,1	11,8		14,2	4,1	8,7
2832 sin Krone	Teufelslucke	31,2	12	13,6	16,3	4,2	8,1
F/3382 sin (w)	Teufelslucke	31,3	13,6	14,1	17,4	2,9	8,3
F/3383 sin (vw)	Teufelslucke	32,4	13,5	12,5	18,3	broken	broken
F/3384 sin	Teufelslucke	33,7	13,1	14,1	18,0	4,2	8,3
F/3385 sin (vw)	Teufelslucke	32,1	13,1	12,5	16	3,7	7,9
F/3386 sin (exw)	Teufelslucke	33,4	13,6	13	15,3	3	7,9
F/3387 sin	Teufelslucke	31,1	13	14,2	17,5	3,4	7,4
F/3388 sin	Teufelslucke	32,8	12,5	14,5	19,0	4,9	8,5
F/3389 sin	Teufelslucke	34,5	13,3	14	17,0	4,5	9,4

Number	Place	m1	m1	m1	m1	m1	m1
No	Place	Length	Width	Hpr	Hpa	Length Ta	Width Ta
F/3390 sin	Teufelslucke	32,7	13	14,8	17,9	4,4	8,5
F/3391 sin	Teufelslucke	35,7	14,4	15	18,2	5	9,1
F/3392 sin	Teufelslucke	33,4	13,8	15,5	19,3	4,7	7,1
F/3393 sin Krone	Teufelslucke	32,6	12,8	15,2	broken	4,4	8
F/3394 sin (w)	Teufelslucke	33,3	13,7	broken	17,7	3,8	9
F/3395 sin Krone broken	Teufelslucke		12			5,6	7,6
F/3396 sin	Teufelslucke	32,5	13,3	14,3	19,1	4	8,8
F/3397 sin Krone	Teufelslucke	30,8	12,1	12,7		4,1	7,3
F/3398 sin	Teufelslucke	33,2	12,7	14,1	18,8	4,1	8,3
F/3620 sin (lw)	Teufelslucke	32,3	13,7	broken	17,7	4,6	9,7
1924 sin (lw)	Teufelslucke	32,3	12,9	13,8	17,0	3,4	8,5
960 sin (vw)	Teufelslucke	33,5	13,7	14,2	17,6	3,6	8,5
F/3095/1 (vw)	Teufelslucke	33	13,3	12,8	16,8	3,3	8,9
F/3095/2 (lw)	Teufelslucke	34	15,2	13,9	18,3	4,8	9,4
F/3095/3 (w)	Teufelslucke	33,3	12,3	13,8	17,3	4,5	8,5
966 dext broken	Teufelslucke	broken	11,6	15,6	18,1	4,5	8,3
564 dext (w)	Teufelslucke	30	12	12,9	16,8	3,4	7,6
873 dext broken (lw)	Teufelslucke	broken	12,1	13,5	17,1	broken	broken
934 dext (exw)	Teufelslucke	33,4	13,1	(12,3)	(15,4)	3,2	8,8
878 dext	Teufelslucke	33,5	14,1	14,9	18,1	4,6	8,2
1425 dext (w)	Teufelslucke	32,3	14	14,6	17,4	3,7	9,1
1530 dext Krone	Teufelslucke	28,8	12,6	13,9	broken	3,6	8,7

Number	Place	m1	m1	m1	m1	m1	m1
No	Place	Length	Width	Hpr	Hpa	Length Ta	Width Ta
509 dext	Teufelslucke					2,4	7,3
57 dext (vw)	Teufelslucke	32,9	13,5	13,3	16,7	3,3	8,3
F/3361 dext Krone	Teufelslucke	broken	10,9	broken	15,7	4	broken
F/3362 dext Krone	Teufelslucke	32,9	12,2	12,9	16,8	3,7	8,1
F/3363 dext	Teufelslucke	31,5	13	14	18,6	3,7	8,7
F/3364 dext Krone	Teufelslucke	31,6	12,4			4,2	8
F/3365 dext (w)	Teufelslucke	32,6	12,5	12,2	15,9	3,8	7,8
F/3366 dext (w)	Teufelslucke	(31,2)	13	13,2	17,3	4,4	8,7
F/3367 dext (w)	Teufelslucke	31,7	13,2	14	17,1	3,3	8,8
F/3368 dext (vw)	Teufelslucke	31	13,4	12,6	14,7	3,2	8,3
F/3369 dext	Teufelslucke	32,8	15,1	14,2	18,0	3,3	8,9
F/3370 dext (w)	Teufelslucke	31,6	12,8	13,8	16,5	4,1	7,8
F/3371 dext (w)	Teufelslucke	32	12,8	14,4	16,3	3,5	7,5
F/3372 dext	Teufelslucke	29,3	12,6	13,5	16,6	4,2	7,1
F/3373 dext (vw)	Teufelslucke	30,3	12,6	12,3	14	3,7	7,1
F/3374 dext (w)	Teufelslucke	broken	13,5	12,8	17,1	broken	broken
F/3375 dext Krone	Teufelslucke	31,7	10	(16,5)	(16,3)	4,3	8,2
F/3376 dext	Teufelslucke	31,3	12,7	13,5	16,5	3,8	8,7
F/3377 dext Krone	Teufelslucke	33	11,8	15,4	17,2	4,3	8,5
F/3380 dext (w)	Teufelslucke	35,3	14,3	14	19	3,9	9,7
F/3619 dext (w)	Teufelslucke	31,2	12,9	13,2	16,0	4,3	7,9
947 dext (lw)	Teufelslucke	30,5	12,5	12,6	16,1	4,5	7,9
F/3095/4 dext	Teufelslucke	32,3	12,8	broken	17,4	3,6	8,1
F/3095/5 dext (lw)	Teufelslucke	31,2	12,7	14,2	17,4	3,6	9
F/3095/6 dext (w)	Teufelslucke	34,6	13,5	14,9	18,8	4	8,6

Number	Place	p4	p4	p4
No	Place	Length	Width	Height
66 (oder 99) sin	Teufelslucke	23,3	14,4	16,5
743 sin	Teufelslucke	24,9	15,2	18
2675 sin (w)	Teufelslucke	25,7	14,6	16,9
1431 sin	Teufelslucke	24,4	15,2	18,1
2409 sin (vw)	Teufelslucke	26	14,4	13,8
951 sin	Teufelslucke	25	15	18
2889 sin (w) Krone	Teufelslucke	23,2	13,6	17,3
F/3356 sin	Teufelslucke	22,4	13,4	16,3
F/3357 sin (exw)	Teufelslucke	broken	14,5	10,6
F/3358 sin (w)	Teufelslucke	24,6	13,8	15
F/3359 sin Krone	Teufelslucke	24	12,7	(19,4)
F/3360 sin Krone	Teufelslucke	23,5	broken	broken
F/3457 sin	Teufelslucke	24,1	13,7	17,5
F/3458 sin (lw)	Teufelslucke	24,2	14,2	18,6
F/3459 sin Krone	Teufelslucke	23,8	13,8	
F/3460 sin	Teufelslucke	24,2	13,9	16,2
F/3461 sin	Teufelslucke	25	13,7	17,5
F/3462 sin	Teufelslucke	25,2	14,5	18,5
F/3463 sin (exw)	Teufelslucke	23,5	14,5	12,5
F/3464 sin	Teufelslucke	24,6	15	18,4
F/3465 sin	Teufelslucke	21,2	13	16,4
F/3466 sin (w)	Teufelslucke	23,4	14	15,4
F/3467 sin Krone	Teufelslucke	23	13	17,8
F/3468 sin Krone	Teufelslucke	24,4	13,1	
1526 sin (lw)	Teufelslucke	22,7	13,8	17

Number	Place	p4	p4	p4
No	Place	Length	Width	Height
930 sin (exw)	Teufelslucke	23,2	13,4	(9,7)
600 sin (lw)	Teufelslucke	25	14,2	15,2
89.. Sin	Teufelslucke	23,9	14,2	18,8
96 dext (w)	Teufelslucke	23,6	14,7	15,2
683 dext (lw)	Teufelslucke	24,1	14,6	17,3
643 dext	Teufelslucke	25,4	14,9	19,7
1047 dext	Teufelslucke	23,1	14,5	17,7
1925 dext	Teufelslucke	24,5	14,2	19
876 dext Krone	Teufelslucke	24,1	broken	broken
2876 dext Krone	Teufelslucke	22	13,7	(14,8)
64 dext (vw)	Teufelslucke	23,7	13,9	11,2
2097 dext (vw)	Teufelslucke	25	15,7	14,8
3040 dext (vw)	Teufelslucke	24,4	13,6	15,1
3043 dext	Teufelslucke	23	13,7	16,9
F/3351 dext (w)	Teufelslucke	25,3	14,8	16
F/3352 dext	Teufelslucke	24	13,5	18,5
F/3353 dext	Teufelslucke	23	14,5	19,5
F/3354 dext	Teufelslucke	24,2	14	18,6
F/3355 dext (w)	Teufelslucke	broken	14,7	14,6
F/3440 dext (w)	Teufelslucke	24,4	14,2	16,2

Number	Place	p4	p4	p4
No	Place	Length	Width	Height
F/3441 dext Krone	Teufelslucke	26,7	14,4	18,9
F/3442 dext (vw)	Teufelslucke	23,9	13,8	13,2
F/3443 dext (vw)	Teufelslucke	23,3	13	12,2
F/3444 dext	Teufelslucke	23,4	13,2	17,9
F/3445 dext	Teufelslucke	26	16	20,9
F/3446 dext	Teufelslucke	24,8	13,7	19,5
F/3447 dext	Teufelslucke	25,3	14,4	17,7
F/3448 dext (w)	Teufelslucke	25	14,4	15,5
F/3449 dext (vw)	Teufelslucke	23,6	14,9	13,2
F/3450 dext	Teufelslucke	24,6	14,5	19,3
F/3451 dext	Teufelslucke	24,1	14,1	18,3
F/3452 dext Krone	Teufelslucke	23,7	13,7	18,5
F/3453 dext Krone	Teufelslucke	22,7	13	(17,4)
F/3454 dext Krone	Teufelslucke	25	14,2	19,7
F/3455 dext Krone	Teufelslucke	23,5	13,4	17,7
F/3456 dext (lw)	Teufelslucke	24,1	13,8	16
1743 dext (exw)	Teufelslucke	22,7	13,6	(9,5)
27 dext	Teufelslucke	23,8	13,9	18,4
865 dext	Teufelslucke	26,7	15,1	19,5
1008 dext broken	Teufelslucke		13,2	17,7
734 dext (lw)	Teufelslucke	23,4	13,9	17

Number	Place	p3	p3	p3
No	Place	Length	Width	Height
985 sin	Teufelslucke	22,4	16,2	22
875 sin (w)	Teufelslucke	21,6	15,5	17,3
508 sin (w)	Teufelslucke	22,3	15,8	16
1429 sin	Teufelslucke	23,9	16,4	22,5
736 sin	Teufelslucke	23,8	15,4	23
F/3434 (vw)	Teufelslucke	22,4	15	15,8
F/3435 (vw)	Teufelslucke	22,5	16	16,1
F/3436 (vw)	Teufelslucke	24,4	16	18,1
F/3437 (lw)	Teufelslucke	22	15	20,3
F/3438 (lw)	Teufelslucke	24,4	16,5	21,3
F/3439	Teufelslucke	21,7	15,7	21,8
929 sin (tafel)	Teufelslucke	22,9	16,2	23
526 sin (tafel)	Teufelslucke	23,2	17,6	23,1

Number	Place	p3	p3	p3
No	Place	Length	Width	Height
744 dext	Teufelslucke	20,5	15	21,6
1623 dext	Teufelslucke	22,6	15,6	22,7
F/3425 dext	Teufelslucke	23,2	15,7	22,8
F/3426 dext krone	Teufelslucke	23	16,2	21,9
F/3427 dext Krone	Teufelslucke	22,1	14,8	21,4
F/3428 dext	Teufelslucke	21	16,1	22
F/3429 dext (exw)	Teufelslucke	22,1	16,5	11,3
F/3430 dext	Teufelslucke	22	15,5	21,8
F/3431 dext	Teufelslucke	21,2	15,3	21,9
F/3432 dext (lw)	Teufelslucke	23	15,2	19,8
F/3433 dext	Teufelslucke	20,9	15,5	21,3
F/3493 dext	Teufelslucke	22,8	16,5	24,6
F/3494 dext	Teufelslucke	20,4	13,8	21,2

Number	Place	p2	p2	p2
No	Place	Length	Width	Height
2885 sin	Teuflslucke	15,4	10,2	10
807 sin (lw)	Teuflslucke	16,3	10	9,5
1754 sin	Teuflslucke	17,6	10,7	11,4
F/3344	Teuflslucke	17,3	11,5	10,4
F/3345 sin	Teuflslucke	18,3	10,6	10,7
F/3346 sin	Teuflslucke	17,5	10,8	10,8
F/3347 sin	Teuflslucke	17	11	11,7
F/3476 sin (vw)	Teuflslucke	16	10,8	8
F/3477 sin	Teuflslucke	16,9	10,7	10,7
F/3478 sin	Teuflslucke	17,3	10,3	12,1
F/3479 sin	Teuflslucke	16,5	10,6	10,4
F/3480 sin (vw)	Teuflslucke	17,1	11,4	
F/3481 sin (vw)	Teuflslucke	16,9	10,4	7,4
F/3482 sin (vw)	Teuflslucke	15,8	10,3	8,5
F/3483 sin	Teuflslucke	16,7	10,7	11,2
550 dext (w)	Teuflslucke	15	10,2	9,1
417 dext	Teuflslucke	18,5	11,9	12,1
740 dext (vw)	Teuflslucke	16	10,9	7,3
2869 dext (w)	Teuflslucke	16,5	11	8,3
2912 dext	Teuflslucke	16,2	10,1	10,6
996 dext (vw)	Teuflslucke	17,5	10,4	8,3
F/3348 dext	Teuflslucke	19	11,5	10,5

Number	Place	p2	p2	p2
No	Place	Length	Width	Height
F/3349 dext	Teuflslucke	16,7	11,4	12
F/3469 dext (vw)	Teuflslucke	17,9	11,3	8,2
F/3470 dext (w)	Teuflslucke	16,9	11,6	10,2
F/3471 dext	Teuflslucke	17,2	10,4	10,4
F/3472 dext (vw)	Teuflslucke	15,8	10,3	7,8
F/3473 dext	Teuflslucke	16,2	10,9	11,6
F/3474 dext (lw)	Teuflslucke	18,1	11,3	9,4
F/3475 dext Krone	Teuflslucke	17,8	broken	broken

Number	Place	Cinf	Cinf	Cinf
No	Place	Length	Width	Height
355 sin	Teufelslucke	15,5	14,2	28,8
F/3416 sin (lw)	Teufelslucke	18,2	13,2	27,6
F/3417 sin (lw)	Teufelslucke	27,3	13,5	27,8
F/3418 sin (w)	Teufelslucke	27,9	13	27,2
F/3419 sin (w)	Teufelslucke	27,6	13,4	25,1
F/3420 sin (lw)	Teufelslucke	14,4	13,2	28,8
F/3421 sin (w)	Teufelslucke	17,2	14,8	24,1
F/3422 sin (w)	Teufelslucke	15,8	14	27,5
F/3423 sin (lw)	Teufelslucke	16,3	14,3	27,2
F/3424 sin (lw)	Teufelslucke	16,7	14,2	28,3
1320 sin (lw)	Teufelslucke	16,8	13,3	27,8
206 indet? Sin (exw)	Teufelslucke	16,1	13,6	22,6
1998 sin (w)	Teufelslucke	14,5	11,5	23,3
2586 sin	Teufelslucke	16,8	14,2	28,2
730 sin	Teufelslucke	16,7	13,4	30
1117 sin (w)	Teufelslucke	16,2	12,8	25,1
F/3107/1 sin	Teufelslucke	16,5	13,8	27,6
F/3107/2 sin	Teufelslucke	16	12,8	28,7
F/3107/3 sin (w)	Teufelslucke	16,4	13	15
F/3107/4 sin (exw)	Teufelslucke		13,3	
F/3107/5 sin (exw)	Teufelslucke		12,8	
F/3107/6 sin (exw)	Teufelslucke		14,6	
F/3107/7 sin (w)	Teufelslucke	17,5	14	28,7
F(3107/8 sin (exw)	Teufelslucke	16,5	13,5	
F/3107/9 sin (w)	Teufelslucke	16,6	12,1	26,3

Number	Place	Cinf	Cinf	Cinf
No	Place	Length	Width	Height
F/3107/11 sin (w)	Teufelslucke	19,3	14,6	30,3
503 sin (w)	Teufelslucke	16	12,4	27,5
2866 dext (vw)	Teufelslucke	14,3	13	19,4
944 dext (vw)	Teufelslucke	13,5	11,7	18,2
2438 dext (lw)	Teufelslucke	17,1	14,2	28,7
1922 dext (w)	Teufelslucke	15,3	11,3	29
2491 dext (lw)	Teufelslucke	15	12	27,5
28.. Dext (vw)	Teufelslucke	16	12,4	21,9
F/3404 dext	Teufelslucke	16,8	13,5	28,7
F/3405 dext (exw)	Teufelslucke	17,1	13	(15,6)
F/3406 dext (lw)	Teufelslucke	15,3	11,5	26,8
F/3407 dext	Teufelslucke	18,8	12,2	30,4
F/3408 dext (lw)	Teufelslucke	17,5	13,3	29
F/3409 dext (w)	Teufelslucke	18,6	13,7	27,1
F/3410 dext (w)	Teufelslucke	17,4	14,1	27,9
F/3411 dext (w)	Teufelslucke	17,1	13,2	26,7
F/3412 dext (vw)	Teufelslucke	19,2	12,5	21,5
F/3413 dext (lw)	Teufelslucke	17	13,5	26,8
F/3414 dext (lw)	Teufelslucke	17,8	13,2	28,3
F/3415 dext (exw)	Teufelslucke	15,8	11,7	(17,5)
2549 dext (evw)	Teufelslucke	16,2	11	25,6
1851 dext (w)	Teufelslucke	17,1	13,3	29,5
628 dext (w)	Teufelslucke	18,3	12,5	31,6
F/3102/1 dext (w)	Teufelslucke	16,1	13,2	28,7
F/3102/2 dext (w)	Teufelslucke	18,7	12,7	26,9

Juvenile Lower Jaw

Number	Place	dp4	dp4	dp4	dp4	dp4	dp4
No	Place	Length	Width	Hpa	Hpr	Length Ta	Width Ta
1822 dext	Teufelslucke	18,9	6,4	8,2	8,9	4,6	5
3033 dext	Teufelslucke	20	6,6	8,9	9	4,8	5,2
2627 dext (lw)	Teufelslucke	20,2	7	9,3	9,9	4,2	6,1
F/3498 dext (w)	Teufelslucke	18	6,2	8,4	8	4,3	4,9
F/3499 dext broken	Teufelslucke	19,5	6,7	9	9,1	4,5	4,6
F/3501 dext	Teufelslucke	20,5	6,8	8,1	9,1	5,1	5,9
F/3502 dext broken (w)	Teufelslucke	broken	6	9,1	8,5	broken	broken
348 sin (m1 im drbruch)	Teufelslucke	19,9	7,2	8,7	8,9	5,1	5,2
783 sin (w)	Teufelslucke	18,8	6	8,4	8,3	5	5,2
672 sin	Teufelslucke	20,5	6,7	9,2	9,8	5,5	5,1
218. sin (lw)	Teufelslucke	20,1	6,1	7,5	8,9	4,8	5,2
3016 sin	Teufelslucke	18,3	6,3	8	8,7	4,7	5,4
825 sin (vw)	Teufelslucke	18,4	6,5	8,4	9	4,9	5,3
F/3500 sin (vw)	Teufelslucke	20,1	6,7	8,8	9,2	5,9	6,1
F/3505 sin (w)	Teufelslucke	19,1	6,4	8,6	8,5	4,9	5

No	Place	dp4-dp2	Md H m1	Md H p3
1822 dext	Teufelslucke	39,4	26,6	26,5
3033 dext	Teufelslucke		20,3	
F/3498 dext (w)	Teufelslucke	42,4	32,6	31,7
F/3499 dext broken	Teufelslucke	41,9	24,9	28,1
F/3501 dext	Teufelslucke		28,4	
672 sin	Teufelslucke		26,5	
2392 sin (w)	Teufelslucke		28,9	28,9
218. sin (lw)	Teufelslucke		28,2	
2050 sin (vw)	Teufelslucke			35,5
825 sin (vw)	Teufelslucke	46,1	33,6	33,1
2492 sin (w)	Teufelslucke			30,5
2042 sin (alle im drbru)	Teufelslucke	85,9		
F/3500 sin (vw)	Teufelslucke	42,7	34,3	33
F/3503 sin	Teufelslucke			25,2
F/3505 sin (w)	Teufelslucke		25	

Single Juvenile Lower Teeth

Number	Place	dp4	dp4	dp4	dp4	dp4	dp4
No	Place	Length	Width	Hpa	Hpr	Length Ta	Width Ta
262 sin	Teufelslucke	18	6,2	8,3	8,5	4,2	4,9
2679 sin	Teufelslucke	18,1	6,1	8,7	9	3,9	4,7
1111 sin (krone) (lw)	Teufelslucke	19,5	7,3	8,3	9,4	4,7	6
1756 sin	Teufelslucke	20,8	6,4	9,9	9,2	5	5,4
F/3511 sin	Teufelslucke	broken				5,3	5,6
F/3512 sin (w)	Teufelslucke	18,9	6,2	10	10,2	5,2	5,2
F/3513 sin	Teufelslucke	19,2	6	9,2	8,7	5,5	5,3
F/3514 sin	Teufelslucke	18,2	6,7	8,5	8,7	4,5	5,2
F/3515 sin (w)	Teufelslucke		7,4	9,5	8,8		
F/3516 dext (w)	Teufelslucke					5,5	5,2
F/3517 sin	Teufelslucke	19,3	6,8		9,1	5,5	5,4
739 dext (w)	Teufelslucke	19,5	6,8	8,4	8,5	5,8	5,5
1330 dext	Teufelslucke	20,5	6,6	9,3	9	5,3	5,5
2105 dext	Teufelslucke	18,1	5,3	7,9	8	4,3	4,9
F/3518 dext (vw)	Teufelslucke	19,7	6,8		8,2	5	5,3
F/3519 dext	Teufelslucke	20,5	6,9	9,1	9,5	4,9	6
F/3520 dext (lw)	Teufelslucke	20,3	6,7	9,4	9,8	5,5	6,1
F/3521 dext (w)	Teufelslucke	20,4	6,3	9	8,9	5,8	6
F/3522 dext	Teufelslucke	19,8	6,4	8,9	9	5,3	5,2
F/3523 dext	Teufelslucke	21,2	6,6	9,2	9,6	5,1	5,3
F/3524 dext (vw)	Teufelslucke	20,3	6,5	8	8,4	5,5	5,3
F/3525 dext Krone (vw)	Teufelslucke	19,6	6,4			4,4	

Number	Place	dp3	dp3	dp3
No	Place	Lenght	Width	Height
2731 sin (w)	Teufelslucke	13,8	6	7,8
2852 sin	Teufelslucke	13,2	5,8	9,1
3074 sin (lw)	Teufelslucke	14	6,1	8,7
3119 sin	Teufelslucke	13,4	5,6	
F/3546 sin (exw)	Teufelslucke	13,9	6,2	
F/3545 sin	Teufelslucke		6	8,5
F/3544 sin (exw)	Teufelslucke	13,7	5,8	6,7
F/3543 sin	Teufelslucke	14,5		9
F/3542 sin (lw)	Teufelslucke	13,9	6	8,6
F/3541 sin (lw)	Teufelslucke	14,3	6,2	9,4
F/3540 sin (w)	Teufelslucke	13,8	5,4	7,3
F/3539 sin (exw)	Teufelslucke	14	5,9	5,7
F/3538 sin	Teufelslucke 14			
F/3537 sin (lw)	Teufelslucke	12,3	5,5	6,9
41 dext (exw)	Teufelslucke	13,6	5,8	5,2
1333 dext (exw)	Teufelslucke	14,1	5,9	6,8
1346 dext	Teufelslucke	13,4	4,8	8,1
F/3536 dext (w)	Teufelslucke	14,1	5,9	8,4
F/3535 dext (exw)	Teufelslucke	13,6	5,9	6,9
F/3534 dext (w)	Teufelslucke	14,1	5,7	7,6
F/3533 dext (lw)	Teufelslucke	13,7	5,6	7,4
F/3532 dext	Teufelslucke	13,8	5,6	8,9
F/3531 dext (exw)	Teufelslucke	13,3	5,7	6,3
F/3530 dext (w)	Teufelslucke	14	5,7	7,8
F/3529 dext	Teufelslucke	14	5,7	8,4
F/3528 dext (exw)	Teufelslucke	14,3	6,1	

Juvenile Upper Jaw

Number	Place	dp4	dp4	dp3	dp3	dp3	dp3	dp3
No	Place	Length	Width	length	Lme	width	Wpr	Hpa
2069 dext (lw)	Teufelslucke			22	8,9	6	12,3	9
1817 dext	Teufelslucke	6,9	12,7	21,6	7,7	6,6	11,8	11,2
2144dext	Teufelslucke			22,5	8,8	6,1	11,8	10,7
F/3507 dext	Teufelslucke						12,2	
F/3656 dext (lw)	Teufelslucke				22,5 8	5,8	12,2	broken
1639 sin	Teufelslucke	6,8	13,2	22	8,9	5,7	13,1	10,3
1453 sin	Teufelslucke			22,2	8,6	5,8	12,5	10,4
1742 sin	Teufelslucke	8,2	15,5	21,4	7,8	5,5	13	10
F/3509 dext	Teufelslucke			22,8	9,2	5,9	13,3	10,1
F/3510 sin	Teufelslucke			21,9 9	5,7			9,9
F/3605 sin	Teufelslucke			21,1	9,2	5,8	13,3	11,1
F/3606 sin	Teufelslucke	7,6	13,3	20,9	9,1	5,6	13,2	9,6
2314 sin (w)	Teufelslucke	7,6	13,2	21,9	8,8	5,8	12,4	9,4

Number	Place	dp2	dp2
No	Place	length	width
2144dext	Teufelslucke	11,2	5,9
F/3506 dext	Teufelslucke	11,5	6
F/3507 dext	Teufelslucke	10,4	6,3
1453 sin	Teufelslucke	10,8	5,9
F/3509 dext	Teufelslucke	11,2	7
F/3510 sin	Teufelslucke	10,6	5,9

Juvenile Single Teeth of the Upper Jaw

Number	Place	dp4	dp4
No	PLace	Length	Width
F/3598 sin	Teufelslucke	7,8	14
F/3599 sin	Teufelslucke	8,8	14,8
F/3600 sin	Teufelslucke	8,2	14,7
F/3601 sin	Teufelslucke	7,7	13,8
F/3602	Teufelslucke	7	11,9

Number	Place	dp3	dp3	dp3	dp3	dp3
No	Place	Length	Lme	width	Wpr	Hpa
1326 sin	Teufelslucke	21,7	8,6	5,7	13	9,4
F/3354 dext	Teufelslucke					11,5
F/3555 dext	Teufelslucke	22,7	8,8	6,3	13,2	10,4
454 dext	Teufelslucke	21,8	9	6,3	12,9	11,8
323 dext	Teufelslucke	21,6	8,4	5,7	12,9	9,3
F/3553 sin	Teufelslucke	22,4	8,3	6		11,1
F/3552 sin	Teufelslucke	22,8	8,6	5,6		9,3
F/3551 sin	Teufelslucke	20,6	8,2	5,2	10,5	8,7
F/3550 sin	Teufelslucke	22,8	8,6	5,4		10,2
F/3549 sin	Teufelslucke	22,3	9,2	5,8	13,4	11
1325 dext	Teufelslucke	22,8	9	5,7	13,3	10,7
454 dext	Teufelslucke	21,9	8,7	6,2	12,8	11,2
1325 dext	Teufelslucke	22,7	9,4	5,7	13,3	broken
F/3548 sin	Teufelslucke	broken				11,6
F/3549 sin	Teufelslucke	22,3	9	5,5	13,4	10,9

Skull

No	Place	1	2	3	4	5	6	7	8
1218	Teufelslucke	76,27	0	0	0	0	86,98	52,49	
1478	Teufelslucke	70,2	86,1	211,78	352,08	49,9	76,5	54	140,3

Humerus

No	Place	Bt	Bd
255 dext	Teufelslucke	47,3	60,8
F/3125/1	Teufelslucke	49,1	62,8

Tibia

No	Place	Bd
F/3621 dext	Teufleslucke	40,1
2219 sin	Teufleslucke	41,5
122 sin	Teufleslucke	42,1
164 de/sin	Teufleslucke	43,6

Radius

No	PLace	GL	Bp	Bd	KD
F/3622 dext	Teufelslucke		47,4		
2173 sin	Teufelslucke		32,3	19,4	
169 sin	Teufelslucke			20,7	
F/3628 sin	Teufelslucke				22,3
F/3629 sin	Teufelslucke				(23,1)
F/3630 sin	Teufelslucke				
F/3631 sin	Teufelslucke	distales Stk	46,1		
2218 sin	Teufelslucke	226,39	46,6		33,7 22,8

Ulna

No	Place	KTO	Tpa	BPc
814 dext	Teufelslucke			34,4
1892 dext	Teufelslucke	36,3	43,6	35,2
F/3624 dext	Teufelslucke	0	0	0
F/3625 dext	Teufelslucke	0	0	0
1?893 sin	Teufelslucke	34,8	42,4	36,9
1670 sin	Teufelslucke	0	0	35,7
115 sin	Teufelslucke	41,3	49,5	39,5

Metacarpale II

No	Place	GL	Bd	Lp	Bp	KD
419 dext	Teufelslucke		12,2			
2145 dext	Teufelslucke	juvenil		13,2	11,7	7,4
1280 dext	Teufelslucke			19,3	14,1	
2807 dext	Teufelslucke	juvenil		17	12,7	9,6
2393 dext	Teufelslucke	juvenil		20,6	15,2	9,4
2789 dext	Teufelslucke	juvenil		18,6	14	9,4
F/3632 dext	Teufelslucke	76,6	14,4	21,6	15,6	10,1
F/3633 dext	Teufelslucke	juvenil				9,5
F/3634 dext	Teufelslucke			17,1	12	10,5
F/3635 dext	Teufelslucke					
F/3636 dext	Teufelslucke	juvenil		13,9		8,4
F/3637 dext	Teufelslucke	juvenil		17,7	12,1	9
F/3638 dext	Teufelslucke	juvenil		16,2		8,9
F/3083/1 dext	Teufelslucke	76,6	16,1	18,4	13,7	12,2
F/3130sin	Teufelslucke	77,3	16,5	19,2	14,7	8,7
1986 sin	Teufelslucke	78,1	16,8	19,4	15,5	12,8
2248 sin	Teufelslucke	79,6	16,7	18,4	14,3	12,7
F/3083/2 sin	Teufelslucke	74,6	15,9	19,5	14,9	12
F/3083/3 sin	Teufelslucke	78,8	15,8	20,2	15	12,1

Metacarpale III

No	Place	GL	Bd	Lp	Bp	KD
F/3130/6 sin	Teufelslucke	90,5	15,6	20,4	16,7	9,2
F/3130/7 sin	Teufelslucke	91,4	15,1	18,4	13,2	9,5
F/3130/8 sin	Teufelslucke	juvenil		16,7	10,2	8,3
F/3091/2 sin	Teufelslucke	92,8	16,6	21	16,5	12,6
F/3091/3 sin	Teufelslucke	broken		19,2	15,1	
F/3091/4 sin	Teufelslucke	broken		21,5	16	
F/3091/5 sin	Teufelslucke	broken		20,9	14,5	
F/3130/9 dext	Teufelslucke	95,8	16,3	21,3	15,4	9,4
F/3130/10 dext	Teufelslucke	95,4	16,3	22	18,1	11,9
2064 dext	Teufelslucke	89,8	15,4	19,7	15	11,8
F/3091/1 dext	Teufelslucke	92	17,2	20,5	15,3	12,1
F/3091/6 dext	Teufelslucke	broken		18,2	14	

Metacarpale IV

No	Place	GL	Bd	Lp	Bp	KD
34 dext	Teufelslucke	juvenil	0	17,6	12,6	8,5
F/3641 dext	Teufelslucke	juvenil	0	18,3	0	9
F/3642 dext	Teufelslucke	0	0	22,2	15,5	11,3
F/3130 sext	Teufelslucke	juvenil		19	11,1	10
189 dext	Teufelslucke	80,7	15,4	21,6	9,7	11,4
208 dext	Teufelslucke	82,6	14,2	21,6	10,7	11,2
1900 dext	Teufelslucke	broken			21,4	11,2
F/3093/4 dext	Teufelslucke	77,7	14,6	20	9,7	11,6
F/3093/5 dext	Teufelslucke	broken		20	10,4	
192 sin	Teufelslucke	broken				14,5
F/3092/4 dext	Teufelslucke	92	14,7	19,1	13,6	11,5
F/3092/5 dext	Teufelslucke	broken		22,1	15,1	
F/3092/6 dext	Teufelslucke	broken		21,6	12,7	
F/3092/7 dext	Teufelslucke	broken		20		
F/3639 sin	Teufelslucke	juvenil	0	20,5	0	10,3
F/3640 sin	Teufelslucke	juvenil	0	17	0	9,4
756 dext?	Teufelslucke	juvenil	0	16,8	13,3	0
1721 sin?	Teufelslucke	juvenil	0	13	12,7	0
F/3093/1 sin	Teufelslucke	84,2	14,6	18,2	10,2	11,8
F/3093/2 sin	Teufelslucke	80,9	14	19,1	19,2	11,4
F/3093/3 sin	Teufelslucke	80,5	13,5		11	10,9
F/3092/1 sin	Teufelslucke	95,1	17,2	23,3	15,2	13,2
F/3092/2 sin	Teufelslucke	broken		20,9	13,7	
F/3092/3 sin	Teufelslucke	broken		24,8	16	

Metacarpale V

No	Place	GL	Bd	Lp	Bp	KD
37 dext	Teufelslucke	73,2	17,2	19	19,6	10,3
F/3643 dext	Teufelslucke	juvenil	0	17	17,9	9,6
F/3644 dext	Teufelslucke	juvenil	0	17,8	20,5	10,9
F/3132 dext	Teufelslucke	71,6	17,2	19,5	19,9	12,5
F/3084/1 dext	Teufelslucke	74		17,9	19,8	12,3
F/3084/2 dext	Teufelslucke	74,5	16	17,7	18,9	12,2
F/3084/3 dext	Teufelslucke	78,9	15,9	18,4	19	11,8
F/3084/4 dext	Teufelslucke	broken		17,5	19,2	
F/3645 sin	Teufelsucke	76,1	17,3	16,2	18	8,9
F/3646 sin	Teufelsucke	juvenil	0	16	16,9	9,3
F/3647 sin	Teufelsucke	76	16	0	0	10,2
F/3132 sin	Teufelsucke	71,4	16,1	17,7	19,3	10,5
F/3130/1 sin	Teufelsucke	76,4	17,6	19	20,1	10
317 sin	Teufelsucke	70,8	17,5	18,7	19	12,5
1835 sin	Teufelsucke	77,3	15,4	18	19,4	11,9
F/3084/5 sin	Teufelsucke	72,8	16,2	16,5	18,6	13,7
F/3084/6 sin	Teufelsucke	71,6	16,6	17,6	19,8	12,8
F/3084/7 sin	Teufelsucke	71,5	13,5	16,3	16,7	11,7
F/3084/8 sin	Teufelsucke	broken		18,8	18,3	
F/3084/9 sin	Teufelsucke	broken		17,5	19,2	

Metatarsale II

No	Place	GL	Bd	Lp	Bp	KD
F/3081/1 dext	Teufelslucke	71	14,1	17,1	13,9	10,4
F/3081/2 dext	Teufelslucke	72	15,4	15,7	10,4	10,1
F/3081/3 dext	Teufelslucke	72,1	15	16,1	12,9	11,2
F/3081/4 dext	Teufelslucke	72,4	15,5	18	13,9	11,7
F/3081/5 dext	Teufelslucke	69	14,6	16	14,4	9,8
F/3081/6 dext	Teufelslucke	broken		16,1		
1830 sin	Teufelslucke	75,2	15,9	19,5	14,5	10,5
678 sin	Teufelslucke	71	14,8	17,1	14,5	10,6
F/3081/7 sin	Teufelslucke	71,5	15,3	14,7	12,5	10,4
F/3081/8 sin	Teufelslucke	70,4	15,8	17,7	14,9	11,7
F/3081/9 sin	Teufelslucke	71	16,9	17,5	13,7	11,8

Metatarsale III

No	Place	GL	Bd	Lp	Bp	KD
1989 dext	Teufelslucke	juvenil		0	14	9,6
2806 dext	Teufelslucke	juvenil		20,3	13,8	9,4
F/3649 dext	Teufelslucke	juvenil		20,6	15	9,9
F/3650 dext	Teufelslucke	juvenil	0	15,1	12,9	8,8
F/3130/4 dext	Teufelslucke	85	15	17,8	14,6	10,3
F/3130/5 dext	Teufelslucke	81,7	15,6	21,1	15,1	11,3
F/3090/1 dext	Teufelslucke	broken		21,2	15,1	
1508 sin	Teufelslucke	juvenil		18,5	11,7	9,6
2628 sin	Teufelslucke	juvenil		19,5	14	9,5
F/3648 sin	Teufelslucke	juvenil		16,3	0	7,1
F/3656 sin	Teufelslucke	juvenil		15,9	11,5	
509 sin	Teufelslucke	85,6	17,6	20,9	15,5	13
?58 sin	Teufelslucke	79,9	16		13	9,8
359 sin	Teufelslucke	broken		18,9	12,9	
F/3090/2 sin	Teufelslucke	76	14,8	19,3	14	11,3
F/3090/3 sin	Teufelslucke	79	16,2		15,4	12,2
F/3090/4 sin	Teufelslucke	81	14,8	23,3	17	12,4

Metatarsale IV

No	Place	GL	Bd	Lp	Bp	KD
1709 dext	Teufelslucke	juvenil		13,7	7,6	7,2
2192 dext	Teufelslucke	juvenil		13,8	7,5	6,6
2788 dext	Teufelslucke	juvenil		18,3	9,9	8,1
F/3651 dext	Teufelslucke	juvenil		18,7	10,4	9
F/3130/2 sin	Teufelslucke	84,4	14	19,3	12,3	9,9
503 sin	Teufelslucke	77,8	12,8	19,5	9,6	9,5

Metatarsale V

No	Place	GL	Bd	Lp	Bp	KD
126 dext	Teufelslucke			18,2	9,9	9
341 dext	Teufelslucke	65,8	11,3	16,9	10,8	9
541 dext	Teufelslucke	juvenil		16,8	10	8,1
5 sin	Teufelslucke	67,5		19,3	12,7	8,9
409 sin	Teufelslucke				11,6	9,5
1438 sin	Teufelslucke	juvenil		17,7	11	8,6
2250 sin	Teufelslucke	71,2	12,9	19,7	11,5	8,8
2249 sin	Teufelslucke	75,1	13,6	19,7	12,9	9
F/3652 sin	Teufelslucke	juvenil		16,8	10,6	7,4
F/3653 sin	Teufelslucke			21,8	11,5	9,5
F/3654 sin	Teufelslucke	69	15,1	21,1	12,9	10,2
F/3655 sin	Teufelslucke	67,6	14,5	18,5	12,1	9,4
2008 sin	Teufelslucke	juvenil/neonat?		12,4	7,8	7,5

Crocuta recent: Natural History Museum in Vienna

Upper Jaw

Nmber	Place	P4	P4	P4	P4	P4
No	Place	Length	L me	Width	W pr	Hpa
1150 dext	Tansania	34,5	10	19,6		
1150 sin	Tansania	34,7	9,7	19,1		
7393 dext	Kongo/Zaire	34,8	15,6	9,5	20,3	15
7393 sin	Kongo/Zaire	34,9	16,5	9,7	19,3	14,6
7392 sin	Uganda	34,2	15,2	10	18,8	16,3
7392 dext	Uganda	34,1	0 9,8	19	16,1	
1755 sin	N-Somalia	33	15,1	9,4	16,5	16,2
1755 dext	N-Somalia	33,5	15,4	9,7	17,6	16,1
21495 sin	Uganda	33	14,2	10,5	16,7	15,5
21495 dext	Uganda	33,3	14,2	10,1	17,4	15,7
1744 b dext	Ethiopia	36,5	15,8	9,8	19,6	17,2
1744 b sin	Ethiopia	36,8	16	9,8	18,6	16,8
6061 dext	Sudan	36,5	16,3	11	20,6	
6061 sin	Sudan	36,9	16,4	10,	19,1	
6062 dext	Sudan	36,2	15,9	11,4	19,8	17,3
6062 sin	Sudan	35,6	15,9	11	19,7	17,5
6063 dext	Sudan	35,6	16,3	10,4	18,1	
6063 sin	Sudan	35,5	17	10,2	18,2	
3919 sin	Kenya	34	14,8	9,8	19,4	
3919 dext	Kenya	34,1	14,5	10,3	20,7	
1275 dext	Zambia	37,4	17	11,6	20,7	
1275 sin	Zambia	31,5	16,7	10,5	20,5	
6064 dext	Sudan	35	15,4	10	19,2	
6064 sin	Sudan	34,2	15,2	11	20	

Number	Place	P3	P3	P3	P2	P2	P2
No	Place	Length	Width	Height	Length	Width	Height
1150 dext	Tansania	21,6	14,2	13,7	9,3		
1150 sin	Tansania	21,5	14	13,9	9		
7393 dext	Kongo/Zaire	20,2	15,3	17,1	15	10	7
7393 sin	Kongo/Zaire	20	15,1		15,3	9,1	
7392 sin	Uganda	21,1	14,1	17,4	14,3	8,7	7,5
7392 dext	Uganda	19,1	14	17,2	14,3	8,6	8,1
1755 sin	N-Somalia	19,3	14,2	14,1	14,2	9,2	7,3
1755 dext	N-Somalia	19,9	14,2	14,5	14,8	9	7,3
21495 sin	Uganda	20,6	15	17,1	Nur Alveolen		
21495 dext	Uganda	19,9	15,4	17,5	13,3	9,4	8,8
1744 b dext	Ethiopia	21,2	16	18,4	missing		
1744 b sin	Ethiopia	21,4	15,2	18,5	14,5	10,4	9,2
6061 dext	Sudan	22,2	16				
6062 dext	Sudan	21	15,8		15,7	10,1	
6062 sin	Sudan	21,1	15,5		15,4	10,3	
6063 dext	Sudan	19	15		13,7	8,7	
6063 sin	Sudan	19,7	14,5		14,6	9,7	
3919 sin	Kenya	21,9	15,1		13,4	9,4	
3919 dext	Kenya	21,6	15,2		14,2	9,2	
1275 dext	Zambia	20,9		15,6	9,5		
1275 sin	Zambia	22,5		14,6	9,1		
6064 dext	Sudan	20,4	15		totally worn		
6064 sin	Sudan	21,2		broken	totally worn		

Number	Place	P3	P3	P3	P2	P2	P2
No	Place	Length	Width	Height	Length	Width	Height
7393 dext	Kongo/Zaire				16,2	11,3	30
7393 sin	Kongo/Zaire				16,9	11,1	27,7
7392 sin	Uganda	7,2	5,5	5,1	15	10,2	26,3
7392 dext	Uganda	7,5	5,7	5,4	broken		
1755 sin	N-Somalia	7,4	6,7	5,8	15	10,3	24,1
1755 dext	N-Somalia	6,8	7,1	5,4	14,8	11,4	23
21495 sin	Uganda	7,7	5,7	5,6	nur Alveolen		
21495 dext	Uganda	7,8	5,9	4,5	14,5	11,2	broken
1744 b dext	Ethiopia	missing			17,3	12,2	30,5
1744 b sin	Ethiopia	missing		missing	17,5	11,8	33,3
6061 dext	Sudan				15,1	11,8	26,8
6062 dext	Sudan	7,2	6,3		15,6	11,7	23,5
6062 sin	Sudan	7,2	6,4		15,2	11,6	23,7
6063 dext	Sudan	7,2	5,9		14,4	11,1	27,3
6063 sin	Sudan	8,1	6,5		14,1	10,6	
3919 sin	Kenya	6,3	5,9		15,2	10,1	
3919 dext	Kenya	6,7	6,1		15,3	10,5	
1275 dext	Zambia	7,4	6,4		(20,5 Alveole)	14,6(Alveole)	
1275 sin	Zambia	7,3	6,1		19(Alveole)	13,5(alveole)	

Number	Place	P1	P1	P1	Csup	Csup	Csup
No	Place	Length	Width	Height	Length	Width	Height
7393 dext	Kongo/Zaire	0	0	0	16,2	11,3	30
7393 sin	Kongo/Zaire	0	0	0	16,9	11,1	27,7
7392 sin	Uganda	7,2	5,5	5,1	15	10,2	26,3
7392 dext	Uganda	7,5	5,7	5,4	broken		
1755 sin	N-Somalia	7,4	6,7	5,8	15	10,3	24,1
1755 dext	N-Somalia	6,8	7,1	5,4	14,8	11,4	23
21495 sin	Uganda	7,7	5,7	5,6	nur Alveolen		
21495 dext	Uganda	7,8	5,9	4,5	14,5	11,2	broken
1744 b dext	Ethiopia	missing			17,3	12,2	30,5
1744 b sin	Ethiopia	missing		missing	17,5	11,8	33,3
6061 dext	Sudan				15,1	11,8	26,8
6062 dext	Sudan	7,2	6,3		15,6	11,7	23,5
6062 sin	Sudan	7,2	6,4		15,2	11,6	23,7
6063 dext	Sudan	7,2	5,9		14,4	11,1	27,3
6063 sin	Sudan	8,1	6,5		14,1	10,6	
3919 sin	Kenya	6,3	5,9		15,2	10,1	
3919 dext	Kenya	6,7	6,1		15,3	10,5	
1275 dext	Zambia	7,4	6,4		(20,5 Alveole)	14,6(Alveole)	
1275 sin	Zambia	7,3	6,1		19(Alveole)	13,5(alveole)	

Lower Jaw

Number	Place	m1	m1	m1	m1	m1	m1
No	Place	Length	Width	Hpr	Hpa	Length Ta	Width Ta
7393 sin	Kongo/Zaire	27,6	11,2	11,5	13,6	3,4	6,5
7393 dext	Kongo/Zaire	28,2	10,5	10,7	12,8	4,5	5,9
7392 sin	Uganda	25,1	10,2	broken	12,6	3,2	4,9
7392 dext	Uganda	25,2	9,5	9,7	broken	3,3	5,1
1755 dext	N-Somalia	25	10,2	11,9	12,9	2,1	6,4
1755 sin	N-Somalia	25	10,8	11,8	12,3	2,2	6
21495 sin	Uganda	25,8	10	11,5	13,8	2,8	6,1
21495 dext	Uganda	25,9	10	11,2	13,4	2,8	6,5
1744 b dext	Ethiopia	29,2	11,3	12,5	14,1	3,1	7
1744 b sin	Ethiopia	29,5	11,3	12,4	14,2	3,1	7,4
6061 dext	Sudan	29,1	11,2	11	13,9	3,4	6,4
6061 sin	Sudan	29,2	11,5		3,4	7,4	
6062 dext	Sudan	27,4	10,9		14,9	3,2	7,8
6062 sin	Sudan	27,8	22	11,3	13,6	2,8	7,3
6063 dext	Sudan	27,1	10	11,7	15,2	3,8	5,4
6063 sin	Sudan	27,6	10,3	12,5	15,3	3	6,5
3919 dext	Kenya	27,3	10,7			2,5	6,7
3919 sin	Kenya		10,5				
1275 dext	Zambia	25,3	10,5	12,2	14,5	3,4	5,4
1275 sin	Zambia	27,7	10,9	12,2	15,5	2,5	5,7
6064 dext	Sudan	27,1	10,5		3,4	6,7	
6064 sin	Sudan	27,3	10,5	broken	13,6	2,8	6,5

Number	Place	p4	p4	p4	p3	p3	p3
No	Place	Length	Width	Height	Length	Width	Height
7393 sin	Kongo/Zaire	22	10,9	11,3	20,2	12,9	15
7393 dext	Kongo/Zaire	21,7	12		20,1	12,8	15,2
7392 sin	Uganda	21,7	10,4	13,2	19,8	12,2	15,6
7392 dext	Uganda	21,4	10,5	12,8	19,7	12,2	16,5
1755 dext	N-Somalia	20,2	10,7	11,4	19,1	12,5	13,6
1755 sin	N-Somalia	19,7	11,1	11,5	19,3	12,7	13,2
21495 sin	Uganda	20,9	11	12,7	19,4	12,7	14,9
21495 dext	Uganda	21,2	11,6	13,2	19,3	13,2	15,4
1744 b dext	Ethiopia	22,4	11,2	16	20,7	12,9	16,8
1744 b sin	Ethiopia	22,8	11,9	15,8	20,6	13,3	16,9
6061 dext	Sudan	22,7	broken		20,7	14,1	
6062 dext	Sudan	22,2	12,7		20,3	13,9	
6062 sin	Sudan	22,8	12,3		20	13,7	
6063 dext	Sudan	22	11,5		19,6	12,3	
6063 sin	Sudan	20,1	11,1		19,7	12,4	
3919 dext	Kenya	21,3	11,8		19,9	13,5	
3919 sin	Kenya	21,4	11,9		19,9	11,9	
1275 dext	Zambia	21,5	10,9	15,8	20,6	13	20,2
1275 sin	Zambia	21,7	12,1	16,7	in eruption		
6064 sin	Sudan	22,3	12,3		19,8	13	

Number	Place	p2	p2	p2	cinf	cinf	cinf
No	Place	Length	Width	Height	Length	Width	Height
7393 sin	Kongo/Zaire	14	9,4		14,9	10,6	27,1
7393 dext	Kongo/Zaire	15,5	9,4		15	12	27,6
7392 sin	Uganda	14,8	8,5	8,3	13,2	10,6	26,8
7392 dext	Uganda	14,2	8,3	8,4	12,6	10	27,7
1755 dext	N-Somalia	13,7	8,4	7,1	12,6	12,7	23,3
1755 sin	N-Somaliav	14,6	8,5	7	13	13,2	23,7
21495 sin	Uganda	12,2	7,3	7,5	14,8	11,5	26,4
21495 dext	Uganda	13,7	7,5	7,9	15,1	11	27,5
1744 b dext	Ethiopia	broken			13,7	13,5	31,3
6061 dext	Sudan				14,9	11,4	27,6
6062 dext	Sudan	15,5	10,1		14	11,8	27,5
6062 sin	Sudan 15,5	10,2			13,8	10,5	24,3
6063 dext	Sudan	14,4	8		12,8	10,6	26
6063 sin	Sudan	14,5	8,1		13,4	11,4	24,6
3919 dext	Kenya	13,5	8,7				
3919 sin	Kenya	14	8,8				
1275 dext	Zambia	15,4	8,2	9,3	13,6	10,3	in eruption
1275 sin	Zambia	missing			13,4	10,1	in eruption

Numer	Place	p2-m1	Md H m1	Md H p3	L md	Coronoid H
7393 sin	Kongo/Zaire	82	38,8	30,9	183,1	109,3
7393 dext	Kongo/Zaire	82,4	39,7	30,6	183,37	104,8
7392 sin	Uganda	78	39,2	31,9	179,35	
7392 dext	Uganda	77,7	39,3	32,9	177	96,6
1755 dext	N-Somalia	75,6	41,6	33,3	175,85	107,5
1755 sin	N-Somalia	75,4	41	35,6	175,19	102,5
21495 sin	Uganda	79,1	45,5	31	184,53	113,3
21495 dext	Uganda	77,8	42,7	31,6	181,49	105,9
1744 b dext	Ethiopia	85,9	43,4	35,4	194,06	105
1744 b sin	Ethiopia	85,8	43,8	39,5		108,5
6061 dext	Sudan				179,4	104,3
6061 sin	Sudan				183,37	102
6062 dext	Sudan	80,5	39,8	31,2	172,23	93,2
6062 sin	Sudan	80,7	39,5	30,8	172,33	95,3
6063 dext	Sudan	79,9	39,9	33,9	178,08	108,2
6063 sin	Sudan	103,4	39,3	33,5	181,29	106
3919 dext	Kenya	78,7	38,8	30,4	176,76	104,9
3919 sin	Kenya	79	39,3	31	178,72	103
1275 dext	Zambia	77,3	33,7	28,3	152,41	83,1
1275 sin	Zambia	77,4	39,5	26,8	broken	broken
6064 dext	Sudan	78,5	41,8	35,5	173,41	98,8
6064 sin	Sudan	79,6	42,6	34,8	175,11	98,6

Skull

No	Place	1	2	3	4	5	6	7	8
1150	Tansania	57	0	167,61	254,5	50,6	58,7	42,4	103,2
7393	Kongo/Zaire	55,8	67,1	160,36	268,25	41,5	55,2	40,8	130,6
7392	Ugandea	59,8	0	168,65	256,02	47,7	53	41,2	119,6
397	Östl. s-Afrika	66,9	86,1	186,54	296,53	45,2	65,2	46,4	131,3
1244	S -afrika	67	83,1	167,06	271,96	42,3	Prot. gebr	44,8	125,8
1755	N-somalia	56,4	76,5	153,57	257,33	44,6	57,5	41,3	128,8
21495	Uganda	55,4	78,1	178,85	266,79	49,3	59,5	41,9	108,8
5584	Cameroun	67,5	96,7	200,53	294,92	51,5	65,1	49	119,6
1744 b	Ethiopia	61,1	86	193,91	289,97	48,8	62,4	45,2	123,9
6061	Sudan	57,7	72	167,6	277,99	36,8	58,5	42,7	131,5
6062	Sudan	68,7	69,7	179,04	250,31	46,7	56,3	39	89,8
6063	Sudan	57,2	85,1	193,55	271,76	47,2	58,8	41	105,2
3919	Kenya	54,7	89,9	165,22	251,19	47	59,1	49	107,1
1275	Zambia	55	58,8	158,04	231,53	58,4	52,1	38,7	92,5
6064	Sudan	60,1	74,6	179,34	265,5	47,3	59,6	42,2	110,9

Material Naturkunde Museum Berlin

Juvenile Upper Jaw

Number	dp4	dp4	dp3	dp3	dp3	dp3	dp3	dp2	dp2
No	length	Width	length	Lme	width	Wpr	Hpa	length	width
73149 dext	10,9	14,9	19,6	7	4,9	12,1	9,5	9,7	5,7
73419 sin	10,7	14,7	19,7	7,3	5	12,1	9,4	9,5	5,2
A168.10 Hyena dext	8,3	12,9	21,5	7,7	5,3	12,2	9,4	13	6
A168.10 Hyena sin	8,4	13,2	21,3	8	5,8	12,2	9,1	in eruption	

Juvenile Lower Jaw

Number	dp4	dp4	dp4	dp4	dp4	dp4	dp3	dp3	dp3
No	Length	Width	Hpa	Hpr	Length Ta	Width Ta	Length	Width	Height
73149 dext	17,5	5,6	8,1	8,5	5,3	4,7	12,9	5,3	7,9
73149 sin	17,6	5,3	8,4	9,2	5	5	13	5,7	7,8
A168.10 Hyena dext	16,9	6	8,2	7,5	6,1	5,6	14,4	6,4	6,1
A168.10 Hyena sin	16,6	6	8,3	7,9	5,5	5,5	14,3	5,3	7

Number	dp2	dp2	dp2	dcinf	dcinf	dcinf			
No	Length	Width	Height	Length	Width	Height	dp4-dp2	Md H m1	Md H p3
73149 dext	7,8	4	4,8	6,3	4,2	11	40,2	27	26,7
73149 sin	8,2	4,5	4,9	6,6	4,3	11,6	40,4	26,7	27,2
A168.10 Hyena dext	10,4	4,8	5,2	7,3	4,2	10,7	38,2	21,4	21,8
A168.10 Hyena sin	10,6	5,5	5,2	6,9	4,5	11	38,4	22,8	21,2

Measurements on the Skull

Number	A	B	C	D
73149	44,1	50,4	63,2	
A168.10 Hyena	34,5	46,8	58,3	141,8

Metatarsale II

No	Place	GL	Bd	Lp	Bp	KD
16575 sin	Ruwana-Steppe, Bez. Muansa	88,5	12,8	13,6	12,1	8,7
82413 dext	Kamerun	91,5	13,2	17,6	12,6	11,5
82741 sin	Eritrea	72,1	11,7	12,9	12,4	9
82516 dext	Ostafrika	80,9	12,1	17,7	12,5	8,8

Metatarsale III

No	Place	GL	Bd	Lp	Bp	KD
16575 sin	Ruwana-Steppe, Bez. Muansa	91,5	13,3	18,8	11,7	9,5
82413 dext	Kamerun	99,8	15,3	19,7	14,4	10,5
82741 sin	Eritrea	88,1	11,5	17 1	1,2	8,9
82516 dext	Ostafrika	91,2	13,2	20	14,4	10

Metatarsale IV

No	Place	GL	Bd	Lp	Bp	KD
16575 sin	Ruwana-Steppe, Bez. Muansa	84,8	11,2	16,9	9,7	8,5
82413 dext	Kamerun	97,7	12,7	18	18,9	10
82741 sin	Eritrea	71,4	12,2	13,5	16,5	9,2
82516 dext	Ostafrika	89,2	11,1	17,9	8,2	8

Metatarsale V

No	Place	GL	Bd	Lp	Bp	KD
16575 sin	Ruwana-Steppe, Bez. Muansa	72,2	10,4	15,4	10,1	7,9
82413 dext	Kamerun	80,4	11,4	15,9	10,2	9,2
82741 sin	Eritrea	66,8	8,8	14,2	9,4	7
82516 dext	Ostafrika	73,8	9,5	16,3	9,2	6,5

Metacarpale II

No	Place	GL	Bd	Lp	Bp	KD
16575 sin	Ruwana-Steppe, Bez. Muansa	84	13,9	17,4	12,4	10,8
82413 dext	Kamerun			18,2	15,1	
82741 sin	Eritrea 77,2	12,9	14,7	12,2	9,6	
82516 dext	Ostafrika	88,1	14	18	13,9	10,7

Metacarpale III

No	Place	GL	Bd	Lp	Bp	KD
16575 sin	Ruwana-Steppe, Bez. Muansa	96,2	13,8	18	12,1	10,7
82413 dext	Kamerun	108,3	17,2	19,3	15,2	12
82741 sin	Eritrea	90,1	12,4	18,3	12,9	9,2
82516 dext	Ostafrika	103	10,9	19,7	15	9,7

Metacarpale IV

No	Place	GL	Bd	Lp	Bp	KD
16575 sin	Ruwana-Steppe, Bez. Muansa	92,9	12,9	17,9	12,2	9,7
82413 dext	Kamerun			20,1	13,3	
82741 sin	Eritrea	86,8	11,9	17,2	10,4	9,2
82516 dext	Ostafrika	98,3	13,1	19	12,7	9,8

Metacarpale V

No	Place	GL	Bd	Lp	Bp	KD
16575 sin	Ruwana-Steppe, Bez. Muansa	77,1	13,3	14,6	17	9,4
82413 dext	Kamerun			17	19,3	
82741 sin	Eritrea	80,2	10,7	14,8	8,8	8,7
82516 sin	Ostafrika	80,5	13,2	16,3	10	10,3

Radius

NO	Place	GL	Bp	Bd	KD
16575	Ruwana-Steppe, Bez. Muansa	197,86	29	38,2	28,2
82413	Kamerun	230,17	30,5	43,8	21,2
82741	Eritrea	215,18	25,2	35,1	17,8
82516	Ostafrika	231,47	28,6	39,4	18,7

Tibia

NO	Place	GL	Bp	Bd	KD	Lp
82413	Kamerun	212,36	52,3	36,8	19,1	52,2
82741	Eritrea	187,75	44,2	32,6	15,5	46,4
82741/1 sin?	Eritrea	187,33	44	33,3	15,6	45,8
82516	Ostafrika	203,1	49	37,2	17,5	50,8

Femur

NO	Place	GL	Bp	Bd	KD	Tc
16575	Ruwana-Steppe, Bez. Muansa	219,07	58,6	46	21,2	27,8
82413	Kamerun	245,09	57	48,1	23 2	8,8
82741	Eritrea	226,97	54	45,4	16,5	26
82516	Ostafrika	243,67		47,5	18,9	28,7

Humerus

No	Place	GL	Bp	Bd	KD
16575	Ruwana-Steppe, Bez. Muansa	198,74	49,8	50	17,8
82413	Kamerun	227,11	44,2	53,6	20,2
82741	Eritrea	203,14	49,1	47,5	16,3
82516	Ostafrika	216,04	51,6	51,5	17,8

Ulna

No	Place	GL	Tpa	Bpc	KTO
16575	Ruwana-Steppe, Bez. Muansa	232,53	46	33,3	34,5
82413	Kamerun	263,69	53,6	36,1	42,2
82741	Eritrea	247,22	39	29,9	31,2
82516	Ostafrika	262,74	43,7	33,8	38,7

Fibula

No	Place	GL
16575	Ruwana-Steppe, Bez. Muansa	157,86
82413	Kamerun	191,51
82741	Eritrea	176,72
82741/2	Eritrea	176,58
82516	Ostafrika	187,33

Calcaneus

No	Place	GL	GB
16575	Ruwana-Steppe, Bez. Muansa	60,9	21
82413	Kamerun	68,7	24,5
82471	Eritrea	57,2	21,1
82516	Ostafrika	65,5	24,4

Astragalus

No	Place	GL
16575	Ruwana-Steppe, Bez. Muansa	41,6
82413	Kamerun	44,5
82741	Eritrea	38,9
82516	Ostafrika	42,7

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