

## TRACE FOSSILS FROM BEARS IN CAVES OF GERMANY AND AUSTRIA

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**Abstract:** The article gives an overview of trace fossils from bears in caves of Germany and Austria. Recorded trace fossils are Bärenschliffe, bear dens, scratch marks and kidney stones. The trace fossils were found in 22 different cave sites of Germany and in only five cave sites of Austria. All traces cannot be attributed to either the cave or the brown bear, they can neither be dated.

**Key words:** Bärenschliff, trace fossils, bears, caves, Germany, Austria, Quaternary.

### INTRODUCTION

Fossil bones of bears, particularly those of the cave bear, are commonly found in caves of Germany and Austria. Traces of bears and their usage of caves are, however, rare. The following traces of bears have been recorded in caves: (i) polished rock surfaces (so-called “Bärenschliffe”), (ii) bear dens, (iii) scratch marks of claws and (iv) bear kidney stones. The first three traces arise from the activity of the bears in the cave, while (iv) are remains of the metabolism of bears.

Outside of the two countries, footprints of bears have also been reported, for example from the Grotte de Bruniquel in France (ROUZAUD *et al.*, 1995). Late glacial brown bear footprints have, however, been discovered at the open-air site Mertloch, Eifel, preserved in volcanic ashes (BAALES & BERG, 1997).

(i) The “Bärenschliffe” are smooth, polished and often shining surfaces, thought to be caused by passing bears, rubbing their fur along the walls. These surfaces do not only occur in narrow passages, where the bear would come into contact with the walls, but also at corners or rocks in wider passages.

The oldest known mention of animal polished rock surfaces are given in a report from the Austrian Erzherzog Rainer, in which he describes his visit to the Mixnitzer Drachenhöhle at the 13<sup>th</sup> of October 1806 (ABEL, 1931). In the report is written: “...in the deeper and narrower part of the cave the rocks are partly polished like marble, probably done by rubbing of large animals, unthinkable times ago”.

The scientific introduction of the matter of fact and

the term “Bärenschliff” was given in 1826 by Johann Jacob Nöggerath (NÖGGERATH, 1826), geologist at the Bonn University, according to his observations in the “Alte-Höhle” near the village of Sundwig in the Sauerland/Northrhine-Westfalia (NÖGGERATH, 1823).

(ii) The bear dens are elliptical, shallow pits, on average between one and three meters in diameter and a couple of decimetres deep. These are interpreted as formed by the bears as resting dens for hibernation.

(iii) The scratch marks attest to the habit of bears - as is typical for clawed carnivores - to wear down their claws by dragging them across rough surfaces.

(iv) Bear kidney stones were first described without recognizing what they were by RATH (1834): He referred to them as unusually shaped, globulous mineral deposits. However the concentric structure and the chemical composition revealed that these objects were biologic in origin (EDINGER, 1933; BAUSCH *et al.*, 1997).

All traces cannot be attributed to either the cave or the brown bear, nor can they be dated.

### SITES AND GROUPS OF LIFE TRACES

#### 1. Germany

##### 1.1. Bärenschliffe

##### 1.1.1. Vogelherd/Swabian Alb, Baden-Wuerttemberg

The Vogelherd, near the village of Stetten in the Lone Valley, 25 km northeast from Ulm, is one of the most important Upper Palaeolithic cave sites in Central Europe. The site was discovered in 1930 and excavated in 1931 (RIEK, 1932). Because of several animal ivory figures from the

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Aurignacian layers (FLOSS, 2000) the 41 m long cave is known worldwide. A perfect, preserved Bärenschliff is located on the left cave wall of the southwestern entrance (pl. 1.1), around 2 m above the ground (i.e. RATHGEBER, 1993).

#### 1.1.2. Bärenhöhle in the Höhlenstein/Swabian Alb, Baden-Wuerttemberg

The Bärenhöhle is situated in the rocks of the so-called Höhlenstein, near the village of Öllingen in the Lone Valley, 24 km northeast of Ulm. The cave is 72 m long and 14 m wide. Oscar Fraas undertook first excavations in 1861 (FRAAS, 1862). During the excavations Fraas recognized smooth, polished rock surfaces, which he interpreted as Bärenschliffe (FRAAS, 1862: 187, RATHGEBER, 1993). One Bärenschliff from this site is exhibited in the Höhlenkundemuseum at the Laichinger Tiefenhöhle (pl. 1.2).

#### 1.1.3. Charlottenhöhle/Swabian Alb, Baden-Wuerttemberg

The Charlottenhöhle was discovered in 1893 and is situated near the village of Giengen, 30 km northeast of Ulm. With a total length of 587 m the cave is the longest tourist cave of the Swabian Alb. Bärenschliffe are located on a part of the cave wall near the entrance (BLEICH, 1968; RATHGEBER, 1993; pl. 1.3).

#### 1.1.4. Hohle Fels/Swabian Alb, Baden-Wuerttemberg

One of the most important cave sites in the Aach Valley is the Hohle Fels near the village of Schelklingen, 20 km west of Ulm. The cave is 120 m long and has in its back part a hall to the size of 6000 m<sup>3</sup>, one of the biggest cave halls of the Swabian Alb. The first bones were discovered in 1830 and O. Fraas undertook the first excavations in 1870/71. Till today archaeological excavation is taking place in the cave. In total a 5 m thick sediment section displays a stratigraphic sequence with layers from the Middle Palaeolithic to the Magdalenian. The cave is one of the most important archaeological cave sites in Central Europe, not only because of several animal ivory figures from the Aurignacian layer (i.e. BLUMENTRITT & HAHN, 1991; CONARD, 2003).

During the excavations in all Upper Palaeolithic layers from the cave wall splintered Bärenschliffe (pl. 1.4) were discovered (HAHN, 1993). Most important of these finds are Bärenschliffe from the Gravettian layers. They show difference by palaeolithic human produced engravings (HAHN, 1993, pl. 1.5).

#### 1.1.5. Kleine Scheuer in the Rosenstein/Swabian Alb, Baden-Wuerttemberg

The Kleine Scheuer is a cave situated in the Rosenstein, a rock massif near the village of Heubach, 40 km northwest from Ulm. The first excavations in the 26 m long cave were undertaken in 1906 (KELLER, 1933; MAIER, 1936). Bärenschliffe are located on the left wall near the entrance, on a boulder in the back part of the cave and on the back wall (KELLER, 1933).

#### 1.1.6. Bären- und Karlshöhle/Swabian Alb, Baden-Wuerttemberg

The Bären- und Karlshöhle (Bear's and Charles' Cave) is situated 2,5 km northeast of the village of Erpfingen, 20 km southeast of Tübingen. The total length of the tourist cave is 292 m. While the Karlshöhle (Charles' Cave), the first part of the cave system, was discovered in 1834, the Bear's Cave, the second cave part, was discovered only in 1949, at the end of the last hall of the Karlshöhle. Both caves have an importance in quaternary palaeontology (RATHGEBER, 2003). A Bärenschliff is located direct behind the small connection passage between the two cave parts (RATHGEBER, 2003).

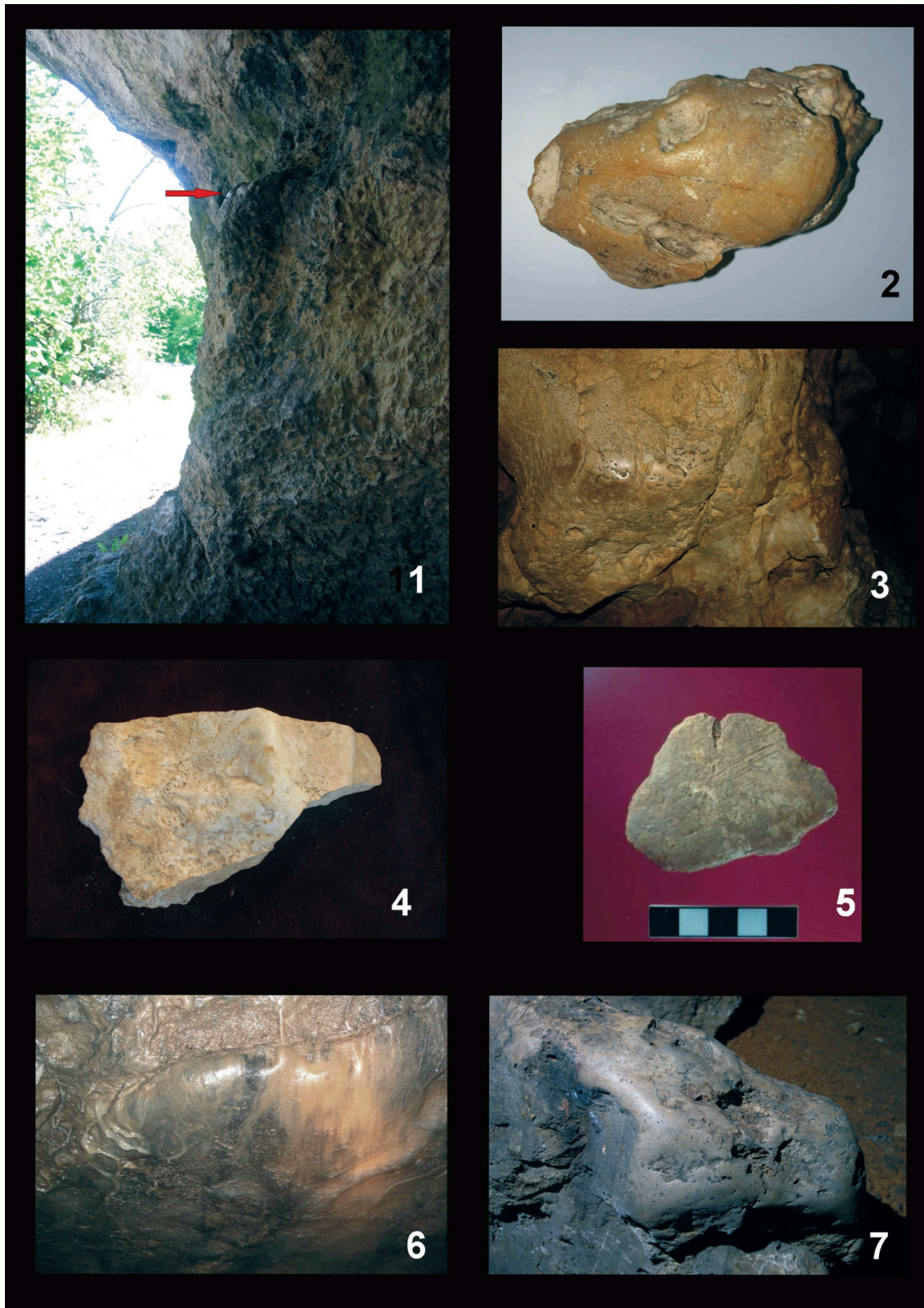
#### 1.1.7. Sundwiger Höhle/Sauerland, Northrhine-Westfalia

The Sundwiger Höhle is situated in the village of Hemer-Sundwig, 30 km northwest of Dortmund. Together with the Heinrichshöhle (today a tourist cave) the Sundwiger Höhle is part of a huge cave system called Perick-Höhle, which is altogether over 3 kilometres long. The Sundwiger Höhle is an important site in science history and very well known since the 19<sup>th</sup> century (e. g. CUVIER, 1806; NÖGGERATH, 1823). J. J. NÖGGERATH did the first scientific description of Bärenschliffe after observations in this cave (NÖGGERATH, 1826). Several Bärenschliffe are located on the wall of a 50 long cave channel part, 150 m far from the entrance (pl. 1.6).

#### 1.1.8. Großes Schulerloch/Franconian Alb, Bavaria

The cave Großes Schulerloch is situated in the Altmühl Valley between the villages of Kehlheim and Essing, 22 km southwest Regensburg. In 1824 the 420 m long cave was opened as a tourist cave (ILLMANN, 1984). During excavations near the entrance of the cave, F. Birkner discovered pleistocene faunal remains and Mousterian artifacts (KAULICH, 1984). Several Bärenschliffe are located on the eastern wall of a lateral channel in northwestern direction, 200 m far from the entrance (ILLMANN, 1984).

Plate 1



Bärenschliffe from different localities: 1. Vogelherd, 2. Bärenhöhle in the Höhlenstein, 3. Charlottenhöhle, 4. Hohle Fels (from the Aurignacian layer), 5. Hohle Fels (from the Gravettian layer, with human produced engravings), 6. Sundwiger Höhle, 7. Großes Rohrloch. (Photos: W. Rosendahl, 1, 2, 3, 4, 7; H.W. Weber, 6; Universität Tübingen, 5).

## 1.1.9. Zahnloch near Steifling/Franconian Alb, Bavaria

The Zahnloch cave is situated 500 m southeast of the village of Steifling, 36 km northeast of Erlangen. First palaeontological excavations in the 80 m long cave were undertaken in the second half of the 18th century. In some publications Bärenschliffe are reported on the surface of a larger rock (called Magnetblock) in the central part of the cave (i.e. HERRMANN, 1991). Recent observations in the cave couldn't confirm this.

## 1.1.10. Großes Rohrloch near Viehofen/Franconian Alb, Bavaria

The cave Großes Rohrloch is situated in the Kupfer Valley, 1 km northeast of the village of Viehofen, 40 km east of Erlangen. The cave is 67 m long (LANG, 2002) and several Bärenschliffe are located in different levels along the walls (CRAMER, 1931), mainly in the first half of the cave (pl. 1.7).

## 1.1.11. Großes Teufelsloch near Krögelstein/Franconian Alb, Bavaria

The cave Großes Teufelsloch is situated 1.5 km west of the village Krögelstein, 20 km east of Bamberg. The cave has been known for a long time, is only 26 m long and built by a small channel. Several Bärenschliffe are located in the first half of the cave, on the left and right cave wall (pl. 2.1), at a level of around 20 cm over the floor.

## 1.1.12. Kleines Höhlloch near St. Wolfgang/Franconian Alb, Bavaria

The cave is situated 110 m north of the village St. Wolfgang, 50 km southeast of Nuremberg. The cave is characterised by a 34 m long main channel and three lateral channels. All together the cave has a length of 113.50 m. Palaeontological and archaeological excavations were started at the end of the 19<sup>th</sup> century and ended in 1935. Several Bärenschliffe are located on the walls in the first half of the main channel and on the walls at the beginning of first left lateral channel (pl. 2.2). The polished rock parts are always found on the upper part of the walls, between 30 and 50 cm over the floor.

## 1.1.13. Große Kuhsteinhöhle near Gößmannsberg/Franconian Alb, Bavaria

The Große Kuhsteinhöhle is situated on a slope of the Aufseß Valley, 1350 m east of the village Gößmannsberg, 20 km east of Bamberg. The cave opens with a huge entrance (12 m broad and 3.50 m high) and has a total length of 35 m. From a wide-open main part two smaller cave channels (a left and a right one) goes in a westerly direction. Bärenschliffe are located mainly on the left and

right wall of the junction from the main cave part to the left lateral cave passage (pl. 2.3).

## 1.1.14. Geisloch near Oberfellendorf/Franconian Alb, Bavaria

The Geisloch is situated 500 m east of the village Oberfellendorf, 30 km northeast of Erlangen. The cave was discovered in 1972 and has a total length of 700 m (TE-SCHNER & GEYER, 1981). The essential part of the cave is a large, speleothem rich hall, from which eight lateral channels (between 20 and 50 m length) branch off in different directions. A Bärenschliff without any specific localisation in the cave (pl. 2.4) is shown in ROSENDAHL *et al.* (2000).

## 1.1.15. Breitenwinner Höhle/Franconian Alb, Bavaria

The cave is situated today in the central part of the military area "Hohenfels", 15 km northwest of the village Hohenfels and 45 km northwest of Regensburg. A visit to the cave is only possible with a special permit. Before closing the area for military use, the cave was in parts opened for the public. The oldest description of the cave is known from the 16<sup>th</sup> century (HAGEN, 1892).

Bärenschliffe are mentioned by HAGEN (1892) and CRAMER (1931), without any specific localisation in the cave. One Bärenschliff is located in the first part of the main cave channel (pl. 2.5), on the right wall of a more narrow part (LORENZ, pers. comment).

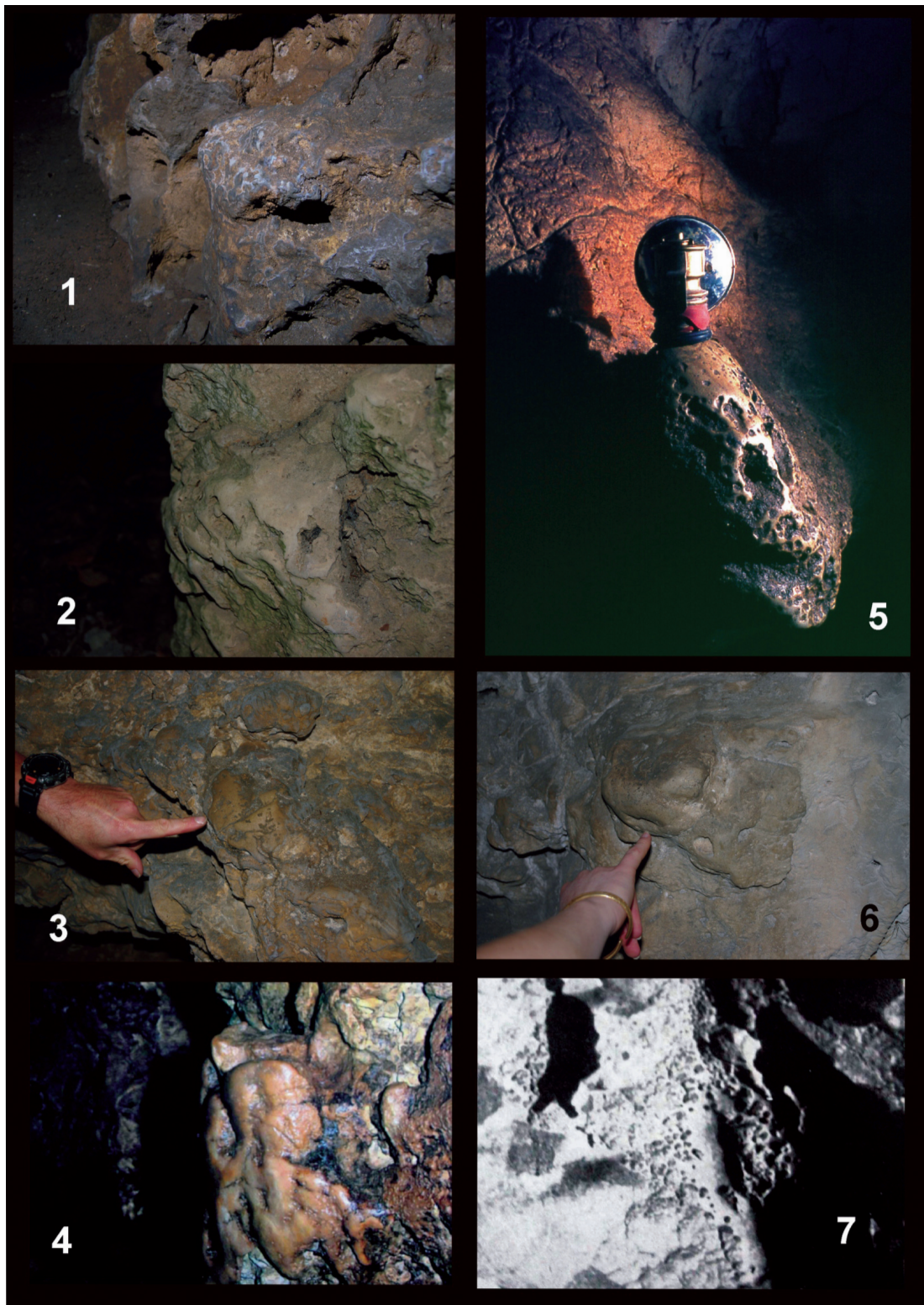
## 1.1.16. Obere Höhle in the Höhlenknock near Draisendorf/Franconian Alb, Bavaria

The Obere Höhle in the Höhlenknock (Höhlenknock in the local franconian dialect means irregular rock massif with caves) is situated 1225 m northeast of the village Draisendorf, 36 km northeast of Erlangen. The 67 m long tunnel like cave is built by a main channel with two lateral passages at the western side. The cave opens with three entrances. Several Bärenschliffe are situated on left and right wall of the lateral passage (pl. 2.6), which opens with the third entrance (the second smaller and higher entrance from the northern part of the Höhlenknock rock massif). The presence of Bärenschliffe in the cave is also mentioned by KAULICH & HILPERT (2005).

## 1.1.17. Petershöhle near Hartenstein, Bavaria

The Petershöhle is situated on the northeastern slope of a hill called Kreitsberg, 1 km northeast of the village Hartenstein and 40 km east of Erlagen. The total length of the cave is 110 m. Bärenschliffe are mentioned by CRAMER (1931) and HUBER (1967), without any specific localisation in the cave.

## Plate 2



Bärenschliffe from different localities: 1. Großes Teufelsloch near Krögelstein, 2. Kleines Höhlloch near St. Wolfgang, 3. Große Kuhsteinhöhle near Gößmannsberg, 4. Geisloch near Oberfellendorf, 5. Breitenwinner Höhle, 6. Obere Höhle in the Höhlenknock near Draisendorf, 7. Mixnitzer Drachenhöhle. (Photos: W. Rosendahl, 1, 2, 3, 6. H. Schabdach, 4. G. Lorenz, 5. after ABEL & KYRLE 1931, 7).

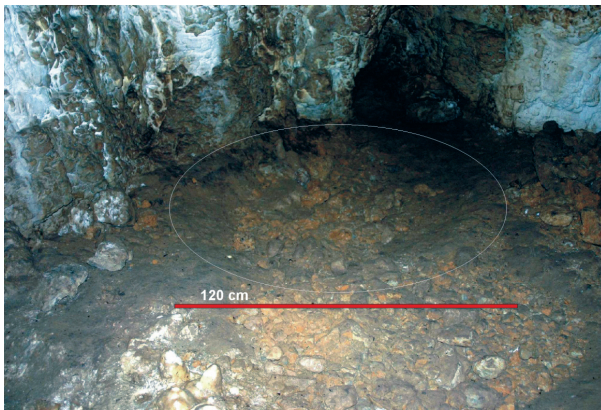


Figure 1. Bear den in the Jubiläumshöhle (Photo: W. Rosendahl).

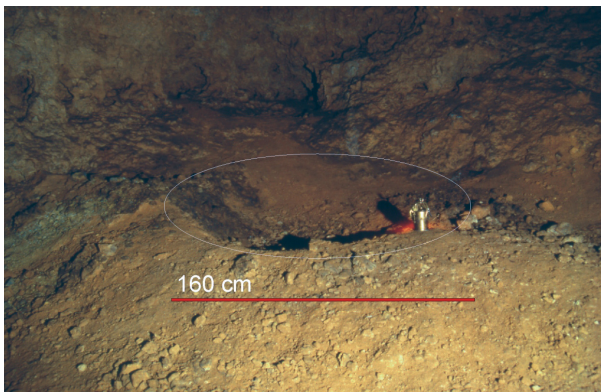


Figure 2. Bear den in the Große Klingerberghöhle (Photo: B. Kaulich).

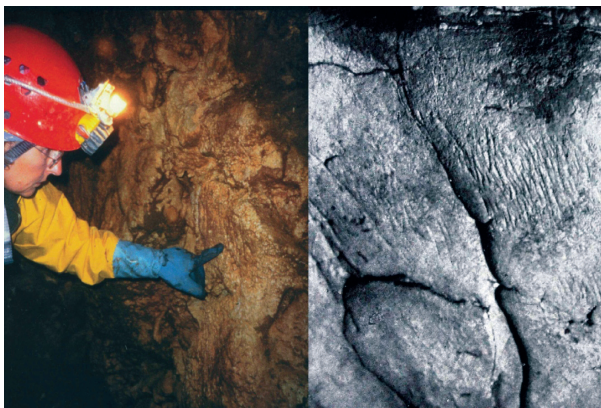


Figure 3. Scratch marks in the Neue-Laubenstein-Bärenhöhle (left: Photo W. ROSENDAHL) and in the Mixnitzer Drachenhöhle (right: after ABEL & KYRLE, 1931).

#### 1.1.18. Osterloch near Hegendorf, Bavaria

The Osterloch, a 66 m long cave, is situated 150 m north of the village Hegendorf, 40 km east of Nuremberg. Bärenschliffe are mentioned by CRAMER (1931) and in the documents of the franconian cave register. After the documents Bärenschliffe are located in a narrow passage leading into the “speleothem chamber”.

#### 1.1.19. Bodenberghöhle near Neutras, Bavaria

The Bodenberghöhle is situated in the northeastern slope of a hill called Bodenbergl, 850 m northeast of the village Neutras and 45 km east of Nuremberg. Bärenschliffe are mentioned in the 23.50 m long cave by CRAMER (1931) and in the documents of the franconian cave register, without any specific localisation in the cave.

### 1.2. Bear dens

#### 1.2.1. Neu-Laubenstein-Bärenhöhle, Chiemgau Alps, Bavaria

The Neue-Laubenstein-Bärenhöhle (NLB) is situated in the Laubenstein region in the Chiemgau Alps (Bavarian Alps), 100 km south of Munich (ROSENDAHL *et al.*, 2000). The cave was discovered in 1996 and has a total length of 120 m and maximum depth of 58 m. It is the first alpine cave bear bearing cave in Germany (ROSENDAHL & DARGA, 2003). In the back part of the first hall are two oval depressions on the floor that are possibly bear dens. The cave floor is built by loam and limestone debris.

#### 1.2.2. Jubiläumshöhle/Franconian Alb, Bavaria

The Jubiläumshöhle is situated on the left upper part of the Püttlach Valley, 1500 m northeast of the village Elbersberg, 36 km northeast of Erlangen. The cave was discovered in 1974 and is built mainly by one big hall with 40 m length, 11 m width and 9 m height. On several places of the cave, mostly close to the walls, round-oval hollows were observed (AUER, 1974). Some of them are today destroyed, but some can be still interpreted as bear dens (fig. 1).

#### 1.2.3. Große Klingerberg Höhle/Franconian Alb, Bavaria

The Große Klingerberg Höhle is situated 1 km southeast of the village Berghausen, 30 km south of Amberg. The 230 m long cave was discovered in 1953 and consist of a lower and upper level (LEJA, 1994). Baer dens are located only in the 55 m long horizontal lower level. Altogether eight bear dens with a round-oval form were observed in the loamy cave floor (fig. 2; LEJA, 1999). The depth is

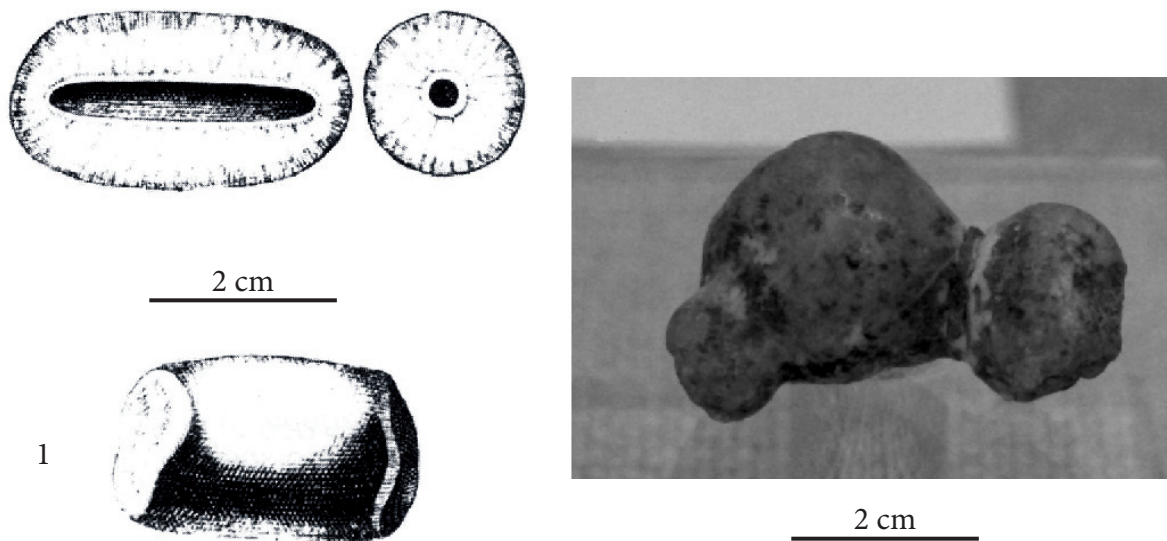


Figure 4. Kidney stones from the Bären- und Karlshöhle (left: after RATH, 1834) and from the Zahnloch (right: Photo W. ROSENDAHL).

between 20 and 25 cm, the diameters of the hollows are between 1.2 m and 2.5 m.

### 1.3. Scratch marks

#### 1.3.1. Bären- und Karlshöhle/Swabian Alb, Baden-Wuerttemberg

For general cave informations see 1.1.6.

Scratch marks are located close to the Bärenschliff, direct behind the small connection passage between the Karls- and Bärenhöhle (RATHGEBER, 2003).

#### 1.3.2. Neu-Laubenstein-Bärenhöhle/Chiemgau Alps, Bavaria

For general cave informations see 1.2.1.

The scratch marks are in the first hall, close to the descent in the deeper part of the cave (fig. 3), around 1.5 m over the cave floor (ROSENDAHL *et al.*, 2000).

### 1.4. Kidney stones

#### 1.4.1. Bären- und Karlshöhle, Swabian Alb, Baden-Wuerttemberg

For general cave informations see 1.1.6.

Already in the first description of the cave part of the Karlshöhle, written by C. RATH (1834), beside cave bears bones and teeth also rollers-shaped stones were described (fig. 4). In 1933 T. EDINGER could prove, that the stones were biological in origin, which means kidney stones (EDINGER, 1933). Today the whereabouts of the findings is unknown (RATHGEBER, 2003).

#### 1.4.2. Zahnloch near Steifling/Franconian Alb, Bavaria

For general cave informations see 1.1.9.

During the historical excavations in the cave also an unusually formed concretion was found. In 1997, BAUSCH *et al.* could prove by XRD-analyses, that the concretion is a kidney stone, probably from *Ursus spelaeus* (BAUSCH *et al.*, 1997). Today the find is displayed in the Fränkische Schweiz Museum in Tüchersfeld (fig. 4).

## 2. Austria

### 2.1. Bärenschliffe

#### 2.1.1. Drachenhöhle near Mixnitz, Styria

The Drachenhöhle is situated in the Mur Valley near the village Mixnitz, 40 km north of Graz. The entrance is 20 m broad and 20 m high. The horizontal cave has a total length of 710 m and three huge rock falls divide it in four parts. The Drachenhöhle has been visited at least since the Middle Ages. The cave was excavated between 1919 and 1923 (ABEL & KYRLE, 1931). The cave is well known because of the discovery of several thousands cave bear individuals during the excavations of the 10 m thick sediments.

Several Bärenschliffe are present in six different parts of the cave. They are located on cave walls and on several big blocks (pl. 2.7). After the first rock fall ("1. Versturz"), approximately 115 m from the entrance, the first Bärenschliff occurs. Bärenschliffe can be found even in the very back of the cave ("Ostergang") (ABEL & KYRLE, 1931).

### 2.1.2. Bockhöhle, Styria

The Bockhöhle is situated in the Mur Valley near the village Peggau, 24 km north of Graz. The cave has two entrances, is 101 m long and was rediscovered in 1967. Excavations took place in 1997 in the eastern part of the cave (KUSCH, 1998). Five polished rock surfaces (maybe Bärenschliffe, see KUSCH, 1998:29) are located in the main corridor, 35 m far from the entrance (KUSCH, 1998; fig. 2).

### 2.1.3. Schottloch, Styria

The Schottloch is situated on the Plateau of the Dachstein Massif, near the village Haus im Ennstal, 70 km southwest of Salzburg. The narrow but 5 m broad entrance leads into two small rooms.

During the first scientific excavations in 1881 a Bärenschliff from the entrance wall was removed to widen the entrance. After KRAUS (1881), it should be stored in the collections of the Geological Survey of Austria.

### 2.1.4. Bärenhöhle im Hartelsgraben, Styria

The Bärenhöhle im Hartelsgraben is situated in the western slope of the Schalenkogel, a part of the Gesäuse Mountains, southwest of Hieflau and 100 km northwest of Graz. The cave consists of three chambers whose first two are divided by a big rock fall ("Trümmerberg"). First scientific excavations took place in 1982 (RABEDER, 1997). Several Bärenschliffe are located on the right wall in the second chamber, directly after the big rock fall (G. STUMMER, pers. comment).

### 2.1.5. Arztberghöhle, Styria

The Arztberghöhle is situated in the Salza Valley between the villages Wildalpen and Fachwerk, around 75 km northwest of Graz.

Several holes in the ceiling of the entrance chamber lead on one hand to the next higher cave system and on the other hand to the outside.

MOTTL (1947) described Bärenschliffe from the centre of a narrow passage, which was blocked by rock fall. Several Bärenschliffe are also located in the back of the 278 m long cave system (G. STUMMER, pers. comment).

## 2.2. Scratch marks

### 2.2.1. Drachenhöhle near Mixnitz, Styria

For general cave information see 2.1.1.

Scratch marks are located at the so-called "Färtenwand", a part of the cave wall at the eastern side of the last big cave chamber ("Großer Dom", ABEL & KYRLE, 1931; fig. 3).

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