SEASONAL ACTIVITIES OF HUMAN AND NON-HUMAN INHABITANTS OF THE GEIßENKLÖSTERLE-CAVE, NEAR BLAUBEUREN, ALB-DANUBE DISTRICT

Susanne C. MÜNZEL*

Summary

The Geißenklösterle-cave in the Achtal-valley near Blaubeuren on the Swabian Alb delivered a stratigraphical sequence between 50,000 and 10,000 bp. This paper concentrates on the faunal remains of the Gravettian horizons. The seasonality of cave bear and human hunting activities was investigated. Both species used the cave site probably during winter and spring, the summer season could be excluded.

Résumé

Activités saisonnières des habitants humains et non humains de la grotte de Geissenklösterle, près de Blaubeuren, Alb-Danube District.

La grotte de Geissenklösterle dans la Vallée de l'Achtal, près de Blaubeuren, sur l'Alb souabe, a livré une séquence stratigraphique datée entre 50 000 et 10 000 bp. Cet article présente les restes de faune des horizons gravettiens. La saisonnalité des activités de l'ours des cavernes et celle de la chasse par l'homme est étudiée. Les deux espèces ont probablement utilisé la grotte pendant l'hiver et le printemps, l'été pouvant être exclu.

Zusammenfassung

Saisonale Aktivitäten der menschlichen und nichtmenschlichen Bewohner der Geißenklösterle-Höhle bei Blaubeuren.

Die Geißenklösterle-Höhle bei Blaubeuren im Achtal/Schwäbische Alb birgt eine Schichtensequenz, die zwischen 50 000 und 10 000 bp datiert.

Dieser Beitrag befaßt sich mit den Überresten der Fauna des Gravettiens. Untersucht wurde die jahreszeitliche Abhängigkeit der Aktivitäten von Mensch und Höhlenbär. Beide nutzten die Höhle wahrscheinlich im Winter und Frühjahr, während sie im Sommer unbewohnt blieb.

Key Words

South-West Germany, Gravettian, Cave Site, Season, Cave Bear, Prey Animals.

Mots clés

Sud-ouest de l'Allemagne, Gravettien, Grotte, Saison, Ours des cavernes, Animaux de proie.

Schlüsselworte

SW-Deutschland, Gravettien, Höhlenstation, Jahreszeit, Höhlenbär, Jagdwild.

The Geißenklösterle-cave is situated in the Achtal-valley near Blaubeuren-Weiler on the Swabian Alb. The cave is part of the Bruckfelsen massive, a rock formation, which rises 60 m above the valley bottom. In Pleistocene times, the valley was more than 10 m deeper than today (Hahn, 1988: 15) and the path to the Geißenklösterle must have been steeper. The southeastern part of the Bruckfelsen massive, including the Geißenklösterle, probably formed a big hall in former times, like the Brillenhöhle (Riek, 1973) or Hohler Fels near Schelklingen (Fraas, 1872; Scheer, 1994: 24), two other caves in the Achtal-area. The roof of the big hall broke down probably during the last glaciation (Hahn, 1988: 17f).

Excavations at Geißenklösterle started in 1974 by the "Institut für Urgeschichte" at the University of Tübingen, directed by Joachim Hahn, and have continued since then with almost no interruption.

Geißenklösterle contains a stratigraphical sequence from 50,000 to 10,000 bp and revealed archaeological remains from the Magdalénian, the Gravettian, the Aurignacian and the Middle Palaeolithic. Beside many stone artefacts and worked antler pieces, several art objects, like carved ivory beads and figurines of mammoth, bear, bison and a human being, probably an "adorant" and, very recently, a bird bone flute made out of a swan's radius (Hahn and Münzel, 1995) were also found.

This paper concentrates on the faunal remains of the Gravettian horizons (geological horizons: 6-10).

The most abundant animal in the faunal assemblage is cave bear: about 40% of all bone fragments and 41% of the total bone weight could be assigned to *Ursus spelaeus*. The usual main prey animals, like mammoth, horse, reindeer and ibex, account altogether for only

* *Institut für Ur- und Frühgeschichte, Archäobiologie, Eugenstr. 40, 72072 Tübingen, Germany.*

25.1% of the bone fragments and 32.1% of the total bone weight (tab.1).

Bone accumulations of cave bear represent individuals, which died during hibernation and like in typical bear caves the percentage of young bears is very high in the Geißenklösterle. Therefore this paper likes to address the question: did cave bear hibernate in the Geißenklösterle, even if the present shape of the cave shows no comfortable places for hibernation, or do we have to consider human hunting on cave bear?

These questions will be discussed with seasonal dating of the teeth and/or postcranial elements of cave bear, mammoth, horse and reindeer, to decide on the basis of the faunal material whether human activities overlap or complement cave bear activities in the Geißenklösterle.

The seasonal classification adopted here is that of the modern Arctic: spring is from May to June; summer runs from the last week of June to the end of September; autumn goes from October to mid-November; and winter is from mid-November to the end of April (Sturdy, 1975: 59).

The age composition of the cave bear population was first investigated, to see if it corresponds to a typical age profile of a fossil bear cave, which was not "disturbed" by human activities in Pleistocene times.

Typical cave bear populations should have a typical age profile with distinctive peaks, which are one year apart from each other, and the time of death of the youngest cave bears should coincide with the end of the hibernation in spring (Kurtén, 1958). The exact age of the cubs is crucial for the analysis of the season of death.

In the Geißenklösterle almost all deciduous and permanent teeth of all age-classes were found as loose teeth, therefore their age determination is difficult.

The absolute age determination of cave bear was based on data for brown bear, but it is restricted to the very young bears. The ontogenetic developement of infant cave bear and brown bear is very much the same (Ehrenberg, 1931; 1935), but it begins to diverge at about the age of six months (Dittrich, 1959: 116f). Therefore a fossil comparative material was needed for the age analysis.

Table 1: Number of identified bone fragments (NISP) and bone weight in the Gravettian (GH6-10) of the Geißenklösterle.

SPECIES	NISP		Bone weight (g)	
	n	%	g	%
Brown/Mountain Hare *(Lepus europ./timidus)*	178	5.5	175.1	1.9
Wolf *(Canis lupus)*	17	0.5	29.5	0.3
Red Fox *(Vulpes vulpes)*	5	0.2	13.1	0.1
Arctic Fox *(Alopex lagopus)*	3	0.1	4.9	0.1
Red/Arctic Fox *(Vulpes/Alopex)*	89	2.7	51.1	0.5
Cave Bear *(Ursus spelaeus)*	1,296	39.7	3821.6	41.0
Brown Bear *(Ursus arctos)*	2	0.1	57.2	0.6
Stoat or Weasel *(Mustela erminea/nivalis)*	1	0.0	0.0	0.0
Wolverine *(Gulo gulo)*	3	0.1	3.3	0.0
unident. small Carnivores (Marten-/Fox-size)	4	0.1	0.0	0.0
unident. large Carnivores (Wolf-/Bear-size)	7	0.2	4.0	0.0
Mammoth *(Mammuthus primigenius)*	58	1.8	1308.2	14.0
Horse *(Equus* sp.*)*	107	3.3	979.8	10.5
Reindeer *(Rangifer tarandus)*	92	2.8	506.4	5.4
Ibex *(Capra ibex)*	34	1.0	204.9	2.2
Chamois *(Rupicapra rupicapra)*	6	0.2	40.1	0.4
unident. small Ruminants (Ibex/Chamois)	98	3.0	176.2	1.9
unident. large Ruminants (Deer-size)	4	0.1	0.0	0.0
unident. large Ungulates (Horse/Rhino)	6	0.2	7.0	0.1
unident. no size determinable	634	19.4	48.4	0.5
unident. < than Hare-/Fox-size	8	0.2	0.0	0.0
unident. in Hare-/Fox-size	63	1.9	23.2	0.2
unident. small Rumin./mid-sized Carniv.	35	1.1	35.9	0.4
unident. Reindeer-/Ibex-size	128	3.9	165.7	1.8
unident. Horse-/Bear-size	301	9.2	819.6	8.8
unident. Rhino-/Mammoth-size	86	2.6	855.0	9.2
Sum	3265	100.0	9330.5	100.0

For comparison, the lower jaws of cave bear of the Erpfinger Höhle near Urach on the Swabian Alb (Binder, 1977: 114) were used. This cave was discovered in 1834 and is known by many tourists as the "Bärenhöhle".

The young cave bear population in the Erpfinger cave shows two distinctive age groups. In the first of these "the first molars are almost in place, but the milk teeth are still retained in the jaws, and the second lower molar has only emerged with the tips of the anterior cusps" (Kurtén, 1958: 7). This age-group consists the 3-4 month old cubs, it indicates the first mortality peak. Explanation: this first mortality peak of the cave bear death assemblage coincides with the end of the hibernation in Spring.

In the second age group "all permanent teeth are already formed, but only a few of them are in place. In the lower cheek dentition, M_1 is in its permanent position or almost so, P_4 and M_2 have ermerged and are nearly but not quite in position, whereas M_3 is still turned sideways and partly concealed in the ascending ramus, only part of the crown is visible through an opening in the wall of the jaw. The tip of the permanent canine may just protrude out of its alveolus. The last milk teeth have just been shed" (Kurtén, 1958: 7). This is the stage of the yearlings. The age group of the yearlings is the second mortality peak and it coincides again with the end of the hibernation. In Geissenklösterle, we found the same mortality peaks like in the Erpfinger Höhle which was not visited by humans and that proofs that cave bear hibernated in Geißenklösterle.

The loose teeth in the Geißenklösterle can be aged to the same distinctive groups, one group of 3-4 month old cubs and one group of yearlings.

The age analysis of cave bear teeth in the Geißenklösterle therefore showed that the cave was obviously used in the wintertime by hibernating bears, even if there might have been better places in the Achtal-valley.

The season of death for the hunted prey was difficult to evaluate, because the prey animals are not only scarce but seem to be selected as well. Only certain parts of the prey were carried up the steep slope. The hunted animals were probably butchered at the kill-site which is nowadays covered by some dozen meters of sand and gravel on the Pleistocene valley bottom.

Mammoth *(Mammuthus primigenius)*

The best example for selective procurement are the mammoth remains. Only certain skeletal elements are present in the cave, like ribs, which, after defleshing (defleshing is recognizable by intensive cut and scrape marks) have been used for tool manufacture. Other remains derive from young mammoth calves, these include skull fragments, the upper jaw and a milk tusk, as well as foot bones and phalanges. Even if most of the mammoth calf remains discussed here are from the old excavation and were recently placed into the upper Aurignacian layer, there still remain young mammoth bones in the Gravettian. The left side of the upper jaw contains the first and the second "milk" molars. The first molar is in place but shows no wear and the second is coming into position, the lamellae are still loose and not connected to each other with cementum. The root of the milk tusk is still open and not completely formed. One first phalanx of the foreleg, which is bigger than the other foot bones, must have been from a slightly older mammoth calf.

Following Gary Haynes (1991), it can be assumed that the age developement of mammoth and modern elephants are quite comparable. If this is indeed true, then the mammoth calf's upper jaw belongs to Laws' (1966:12) age group I, the newborns, in which no teeth are worn, M1 is protruding above the alveolar border, M2 lamellae are fused, M3 is forming. In Laws' second age group, which represents the six-month old elephants, M1 and M2 show slight wear, M3 is still forming.

In other words, the age of the mammoth calf in the Geißenklösterle is closer to the newborns than to six-month old elephants, it must have been hunted shortly after birth. If we consider the vegetational foraging conditions during the late Pleistocene, then mammoth most probably had a calving season in spring like other grazing and browsing animals in subarctic climates. We can therefore suggest that the mammoth calf was hunted in spring (June, after Sturdy, 1975: 59), whereas the slightly bigger phalanx might have been of an older calf hunted somewhat later. The other possibility is that calves of different ages are represented in a mammoth herd like in modern elephant herds (Haynes, 1991: 77f).

There is no doubt that the mammoth calves of the Geißenklösterle were hunted by man, because two of the skull fragments show clear cut marks. Mammoth calves of this size, smaller than Dima, the half year old frozen mammoth baby discovered in 1977 in Sibiria, which is 115 cm long and 104 cm high (Sutcliffe, 1985: 111f), are portable and could be easily transported to the cave site.

There seem to be a seasonal pattern in mammoth hunting at Geißenklösterle: milk tusks, as well as upper jaws of the age described above and other mammoth calf remains, were found in three independent archaeological layers: in the Gravettian, and in the upper Aurignacien as well as in the lower Aurignacian layer. In other words, mammoth was hunted repeatedly in this season of the year close to the Geißenklösterle.

Horse *(Equus* sp.*)*

The most frequent prey animal in the Geißenklösterle is horse; however, there are very few remains that could be used for seasonality.

The postcranial remains include a scapula (G131) and a proximal humerus (G136) as well as a first phalanx (89/395) of juvenile horses. The scapula (G131) and the humerus (G136) are from the old excavation and were recently placed into the upper Aurignacian layer, but additional we found a pelvis of a fetal horse from the Gravettian, which indicates the same season. Cut marks along the articular edge of the scapula show that this foal was hunted and butchered by Palaeolithic hunters.

The coracoid process of the scapula and the proximal epiphysis of the humerus are unfused, as well as the epiphyseal fusion between the trochanter and the caput humeri, therefore it can be suggested that the humerus belongs to the same young individual as the scapula. The epiphyseal fusion line at the coracoid process of the scapula disappears around 10 to 12 months (Habermehl, 1975: 48), so the foal must have been younger than 10 months.

The horse remains in the Geißenklösterle seem to be slightly larger than the reference skeleton of an Islandic pony (EQ42) and both elements, the scapula and the humerus, have almost reached the size of an adult horse, so the foal should have been older than half a year.

The social organization of Type I equid bands probably is the appropriate model for interpreting most of the extinct grazing equids throughout Holarctica (Mac Fadden, 1992). The Type I equid bands characteristically live in dry regions with high seasonality, resulting in significant changes in temperature and rainfall over the year. Comparing them with feral bands of *Equus caballus* in the Western United States, births usually occur within a two-to-three-month period and are concentrated within a six-week period during late spring and early summer (Mac Fadden, 1992: 265), which corresponds to June/July.

In the case of this foal, the bones come from an animal at least six months old, and not older than ten months.

The seasonal implication for the hunt would be sometime between December/January, and April/May.

Reindeer *(Rangifer tarandus)*

The representation of young reindeer is very low in the faunal remains. There is only one lower jaw with an almost complete dentition. The third molar in this jaw is just erupting and the P4 is already present as a enamel bud. The age at the death of this subadult reindeer is between 17 and 22 months (Miller, 1974: 39f). If we assume that the fawns are born in the first half of June (Parker, 1972: 28f), then this reindeer was hunted sometime between November and March.

Many reindeer antler pieces were found in the Gravettian layers, but only one was still attached to the skull. It is a small and unworked piece, which obviously wasn't very interesting for tool manufacture.

The diameter of the socket between corona and skull of the Geißenklösterle antler beam is comparable in size to a young male caribou reference skeleton (RA4) in its second year (Miller, 1974: 39f), but the pattern of the suture on the skull near the base of the antler, which is highly characteristic of young and old animals of both sexes (Sturdy, 1975: 55f), shows a more complicated pattern, which is more similar to a much older reference skeleton (RA1).

Another characteristic to distinguish between male and female is the suture around the socket of the antler (Gripp, 1937). In females it is closer to the socket or even on the slope of the socket and this is true for the Geißenklösterle antler as well, whereas the suture in males is situated on the skull. Therefore the antler beam of the Geißenklösterle must have belonged to an older reindeer cow.

Unfortunatly this piece of antler is not very conclusive for seasonal aspects, because females bear antler from autumn to spring (resp. October to May/June) (Spiess, 1979: 99, fig. 3-7).

The postcranial remains revealed one distal humerus (99/191), with its epiphysis almost closed, but a gap was still visible. This humerus is probably from a subadult reindeer in its second year (Bratlund, 1991: 59). The final closure of this epiphysis is, however, not precisely known and no seasonal information can be gained from it.

Ibex *(Capra ibex)* and chamois *(Rupicapra rupicapra)*

There are several milk teeth of small bovids, which could be either ibex or chamois, but for the age analysis they can not be analysed together, because ibex and chamois are not comparable in tooth age developement (Habermehl, 1985: 77ff). Saiga antelope could be also represented in the milk teeth material, for it's presence in the Achtal is prooved by a horn core in a Gravettian layer (Schicht V) of the Brillenhöhle (Boessneck and Driesch, 1973: 34), and by two teeth in one of the Aurignacien layers of the Geißenklösterle (Münzel *et al.*, 1994).

In the postcranial remains a radius (76/373) of a very young ibex with an open proximal epiphysis was found. This skeletal element shows heavy carnivore gnawing, but no human alterations, like cut marks. So it is very likely that this young ibex was hunted by a middle-sized carnivore, e.g. wolf.

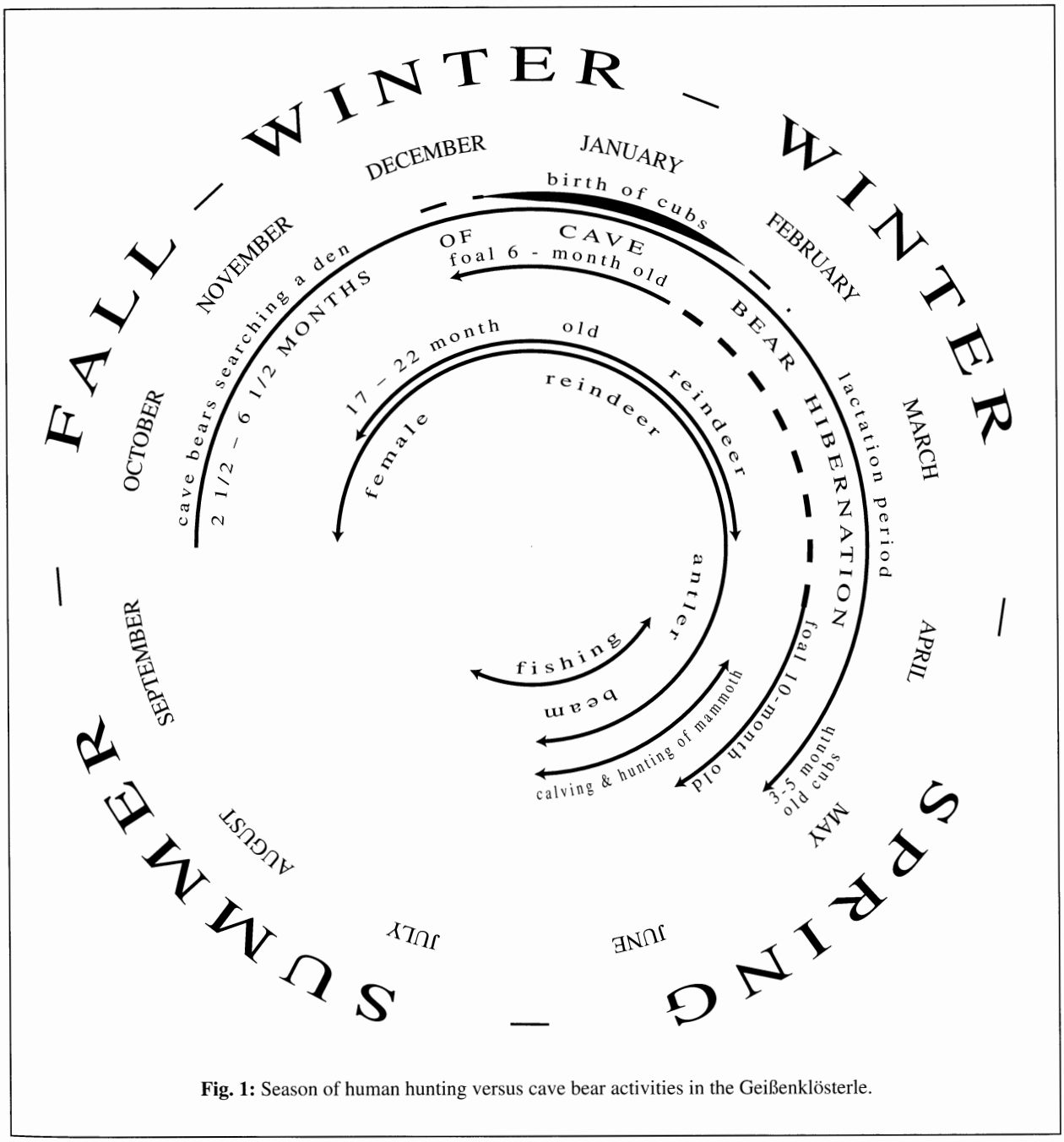

Fig. 1: Season of human hunting versus cave bear activities in the Geißenklösterle.

Seasonal interpretation

In this analysis, I originally wanted to show that Pleistocene hunters avoided places like caves, when they knew that these places were used as cave bear dens. But obviously they did not avoid the Geißenklösterle in this time!

On the contrary, it seems that we can exclude the summer season for hunting (fig. 1). The hunters were probably present in the cave during the critical time when the cave bears woke up from hibernation. This is shown by the hunted mammoth calves and finally also by a parietale of a young cave bear with a clear cut mark, which seem to exactly fit the youngest age group of the 3-4 month old bear cubs.

So we can speculate about hunting, or let's better say harvesting, of cave bear cubs, which might have been caught while the mother was still too dazed from sleeping to defend them.

The fish remains, in the Gravettian layers, of mainly *Thymallus thymallus*, *Lota lota*, *Cottus gobio* and *Phoxinus phoxinus* are the only exception, as they indicate fishing activities in spring or early summer (Torke, 1981: 108f).

In conclusion, the faunal remains in the Gravettian layers of the Geißenklösterle represent selected bone remains of a few scattered hunting events. The skeletal elements were selected partly for consumption, partly for tool manufacture. The bigger part of the hunted prey was undergoing an on-the-spot processing at the kill site.

The seasonality of the human activities is difficult to determine since there are so few complete dentitions or skeletal elements of infants, which are seasonally characteristic. But at least the young mammoth remains demonstrate a seasonal pattern of repeated hunting in the spring, suggesting there may have been a breeding ground nearby.

It cannot be shown from the faunal remains whether or not the Achtal people migrated seasonally. However some clues can be provided by chipped stone refitting. Anne Scheer (1986) was able to refit stone artefacts from the Gravettian layers of Geißenklösterle and Brillenhöhle. If these obvious movements are seasonal or just a back and forth movement has still to be clarified; but a plausible model would be that the Achtal people hunted horse in winter/early spring at the Brillenhöhle, which yielded fetal horse bones in all Gravettian layers (Boessneck and Driesch, 1973: 25f), and mammoth in spring at the Geißenklösterle.

Bibliography

BINDER H., 1977.– *Höhlenführer Schwäbische Alb.* Stuttgart : Konrad Theiss Verlag.

BOESSNECK J. and DRIESCH A. von den, 1973.– Die jungpleistozänen Tierknochenfunde aus der Brillenhöhle. *In* : G. Riek ed., *Das Paläolithikum der Brillenhöhle bei Blaubeuren (Schwäbische Alb)*, Teil II. *Forschungen und Berichte zur Vor- und Frühgeschichte in Baden-Württemberg*, 4/II. Stuttgart : Verlag Müller & Gräff.

BRATLUND B., 1991.– Die spätglazialen "Opfertiere" von Meiendorf und Stellmoor, Kreis Stormarn. *Offa*, 48 : 41-73.

DITTRICH L., 1959 (1961).– Milchgebißentwicklung und Zahnwechsel beim Braunbären (*Ursus arctos L.*) und anderen Ursiden. *Morphologisches Jahrbuch*, 101 : 1-141.

EHRENBERG K., 1931.– Über die ontogenetische Entwicklung des Höhlenbären. *In* : O. Abel and G. Kyrle eds., *Die Drachenhöhle bei Mixnitz.* Wien : *Speläologische Monographien 7-9,* p. 624-710.

EHRENBERG K., 1935.– Neue Untersuchungen über das Skelett von neugeborenen Braun- und Höhlenbären. *Verhandlungen der Zoologisch-Botanischen Gesellschaft in Wien*, 85 : 5-13.

FRAAS O., 1872.– Resultate der Ausgrabung im Hohlefels bei Schelklingen. *Württembergische naturwissenschaftliche Jahreshefte des Vereins für vaterländische Naturkunde in Württemberg*, 28 : 21-36.

GRIPP K., 1937.– Die Rengeweihstangen von Meiendorf. *In* : A. Rust ed., *Das altsteinzeitliche Rentierjägerlager Meiendorf.* Neumünster : Wachholtz Verlag, pp. 62-72.

HABERMEHL K.-H., 1975.– *Altersbestimmung bei Haus- und Labortieren.* Stuttgart : Paul Parey Verlag.

HABERMEHL K.-H., 1985.– *Altersbestimmung bei Wild- und Pelztieren.* Stuttgart : Paul Parey Verlag.

HAHN J., 1988.– Die Geißenklösterle-Höhle im Achtal bei Blaubeuren I. *Forschungen und Berichte zur Vor- und Frühgeschichte in Baden-Württemberg*, 26. Landesdenkmalamt Baden-Württemberg. Stuttgart : Konrad Theiss Verlag.

HAHN J. and MÜNZEL S., 1995.– Knochenflöten aus dem Aurignacien des Geißenklösterle. *Fundberichte aus Baden-Württemberg*, 20 : 1-12.

HAYNES G., 1991 (1993).– *Mammoths, mastodonts, and elephants. Biology, behavior, and the fossil record.* Cambridge : University Press.

KURTÉN B., 1958.– Life and death of the Pleistocene cave bear. A study in Paleoecology. *Acta Zoologica Fennica*, 95 : 2-59.

LAWS R. M., 1966.– Age criteria for the African elephant, *Loxodonta a. africana. East African Wildlife Journal*, 4 : 1-37.

MacFADDEN B., 1992.– *Fossil horses : systematics, paleobiology, and evolution of the family Equidae.* Cambridge : University Press.

MILLER F. L., 1974.– Dentition as an indicator of age and sex composition and socialisation of the population. Biology of the Kaminuriak Population of Barren-Ground-Caribou, Part 2. *Canadian Wildlife Service, Report Series*, No. 31. Ottawa : Queen's Printer.

MÜNZEL S., MOREL Ph. and HAHN J., 1994.– Jungpleistozäne Tierreste aus der Geißenklösterle-Höhle bei Blaubeuren. *Fundberichte aus Baden-Württemberg*, 19 (1) : 63-93.

PARKER G. R., 1972.– Total numbers, mortality, recruitment, and seasonal distribution. Biology of the Kaminuriak Population of Barren-Ground-Caribou, Part 1. *Canadian Wildlife Service, Report Series*, No. 20. Ottawa : Queen's Printer.

RIEK G., 1973.– Das Paläolithikum der Brillenhöhle bei Blaubeuren (Schwäbische Alb), Teil I. *Forschungen und Berichte zur Vor- und Frühgeschichte in Baden-Württemberg*, 4/I. Stuttgart : Verlag Müller & Gräff.

SCHEER A., 1986.– Ein Nachweis absoluter Gleichzeitigkeit von paläolithischen Stationen? *Archäologisches Korrespondenzblatt*, 16 (4) : 383-391.

SCHEER A., 1994.– Neue jungpaläolithische Funde aus dem Hohle Fels bei Schelklingen, Alb-Donau-Kreis. *Archäologische Ausgrabungen in Baden-Württemberg* 1994 : 24-27.

SPIESS A. E., 1979.– *Reindeer and caribou hunters. Studies in Archaeology*. New York, San Francisco, London : Academic Press.

STURDY D. A., 1975.– Some reindeer economies in Prehistoric Europe. *In* : E. S. Higgs ed., *Palaeoeconomy*. Cambridge : University Press, p. 55-95.

SUTCLIFFE A. J., 1985.– *On the track of Ice Age mammals*. London : British Museum (Natural History).

TORKE W., 1981.– Fischreste als Quellen der Ökologie und Ökonomie in der Steinzeit Südwest-Deutschlands. *Urgeschichtliche Materialhefte*, 4. Tübingen : Archaeologica Venatoria.