

## **A Preliminary Report on New and Previously Known Vertebrate Paleontological Sites in Baoshan Prefecture, Yunnan Province, China**

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**Exploration and test excavation of new and previously known vertebrate paleontological sites in Baoshan Prefecture in southwestern Yunnan Province in October and November 2002 led to the recovery of several important Middle Pleistocene, Late Pleistocene and early Holocene mammalian faunas. The new site of Nanfeng, which appears to span the Middle to Late Pleistocene, is of particular interest because of its rich assemblage of micromammals, including numerous and diverse rodents as well as insectivores and bats. The previously known site of Wanrengang, is also of importance because its deposits appear to include the transition from the Late Pleistocene to the early Holocene; the stone tool assemblages at the site alone suggest Late Paleolithic occupation. Mammalian fossils from these sites as well as from the previously known sites of Tangzigou and Laohudong promise to shed significant light on the environmental evolution of the area, and the influence of humans on local biodiversity. Future detailed studies of the geology, geochronology, taphonomy and vertebrate paleontology of the four aforementioned sites are planned.**

Yunnan Province in southwestern China is renowned for its biodiversity, and ecological and anthropological diversity. This diversity has evolved because of the great range of physical landforms and environmental conditions that exist in the province. In western Yunnan, the Hengduan Mountains, which border Myanmar, provide some of the most interesting and least well-known environments in East Asia. The Hengduan Mountains comprise three north-south trending, parallel chains of high mountain peaks separated from west to east by the Salween (locally, the Nujiang), Mekong (Lancang) and Yangtze (Jinsha) Rivers. The Hengduan orogeny preceded that of Himalayas and created some of the oldest and most isolated peaks and deeply dissected valleys in all of Asia. As the rivers cut their way through the upland, many rock types were exposed and a diversity of niches created (Ferguson 1993). Depending on the orientation and depth of the valleys, small-scale rain-shadows developed, creating a wide range of biotopes (Ferguson 1993). The Hengduan Range has been referred to by Ferguson (1993:174) as “a last resting place of a number of paleoendemics and the cradle for diverse neoendemics”. The Hengduan Range and especially its westernmost chain, the Gaoligongshan or Gaoligong Mountains, are considered one of the major biodiversity “hotspots” of the world. Because of the large range of temperatures, altitudes, and lat-

itudes represented within the Gaoligongshan, the mountains harbor many endemic species, especially at their northern extremity. The largely undocumented ecological diversity and the imminent threat of rapid human incursion due to new road-building activity in western China has prompted urgent surveys of the flora and fauna of the Gaoligongshan to be undertaken by the scientists of the California Academy of Sciences, in collaboration with their colleagues at the Kunming Institutes of Botany and Zoology.

A survey of late Tertiary and Quaternary vertebrate paleontological sites in Baoshan Prefecture of Yunnan Province was undertaken in October and November 2002 as part of the Gaoligongshan Biodiversity Survey Project of the California Academy of Sciences. A survey of the vertebrate paleofauna of the Gaoligongshan and adjacent regions was considered important to the goals of the project because it provided an opportunity to understand how the fauna of the region had evolved in relation to natural and human-induced environmental change in the latest Tertiary and Quaternary. Knowledge of the evolutionary trajectories of different vertebrate lineages under different environmental regimes provides important background for understanding how different animals may react to future environmental change. Our goal in this survey was to identify a range of paleontological sites from latest Tertiary through Neolithic age, which could shed light on faunal evolution in the region in the absence and presence of modern humans.

In this paper, we present the preliminary results of excavations at the new paleontological site of Nanfeng in addition to information on new collections made at the previously known sites of Wanrengang, Huoxinshan, Tangzigou, and Laohudong. We also briefly discuss four further sites –Yangyi, Dianjiangtai, Jiangdongshan, and Longwangtang – which were visited in November 2002, but from which no collections were made. A map of these sites is presented in Figure 1.

## NEW SITE

### **Nanfeng (N 24° 49' 05.4"; E 099° 06' 09.4"; altitude 1710 m)**

In 1991, the villagers of Nanfeng discovered abundant mammalian fossils during the course of road construction. Some of the fossilized long bones recovered were scraped by villagers in order to make medicinal poultices for the skin, but most had been collected and handed over intact to the Cultural Bureau of the city of Shidian, where they were safely stored until our study.

In October 2002, a test excavation at the Nanfeng site was carried out by a team led by one of us (Ji X.-P.), leading to the recovery of a small number of large mammal fossils. During the course of our November 2002 expedition, this excavation was significantly enlarged (Fig. 2). This report represents a preliminary review of what is a richly fossiliferous and taphonomically complex site. Future papers dealing with the geology, geochronology, and taphonomy of the site, along with details of the vertebrate fossil assemblage will be prepared following the completion of further investigations.

The site of Nanfeng represents a collapsed limestone cave or very deep rock shelter. Excavation carried out over the course of one week in November 2002 at Nanfeng resulted in the deepening of the test pit to a total depth of ~1.3 m, revealing four weakly defined layers of silty clay, all of which were fossiliferous. The original assemblage of mammalian fossils collected from Nanfeng in 1991 appears to have been recovered from the most superficial 0.5 m of the southern end of the site, which forms part of Layer 1 (Fig. 3). Layer 1 varies in its composition from south to north. At the southern end of the excavation – closer to the rock face – this layer includes many angular pieces of limestone from gravel through cobble size up to half-meter size (Figs. 2 and 3). These inclusions probably represent the roof of the collapsed cave. In the central and northern portions of the excavation, Layer 1 is composed mostly of brown silty clay. Layer 2 is a layer of black-

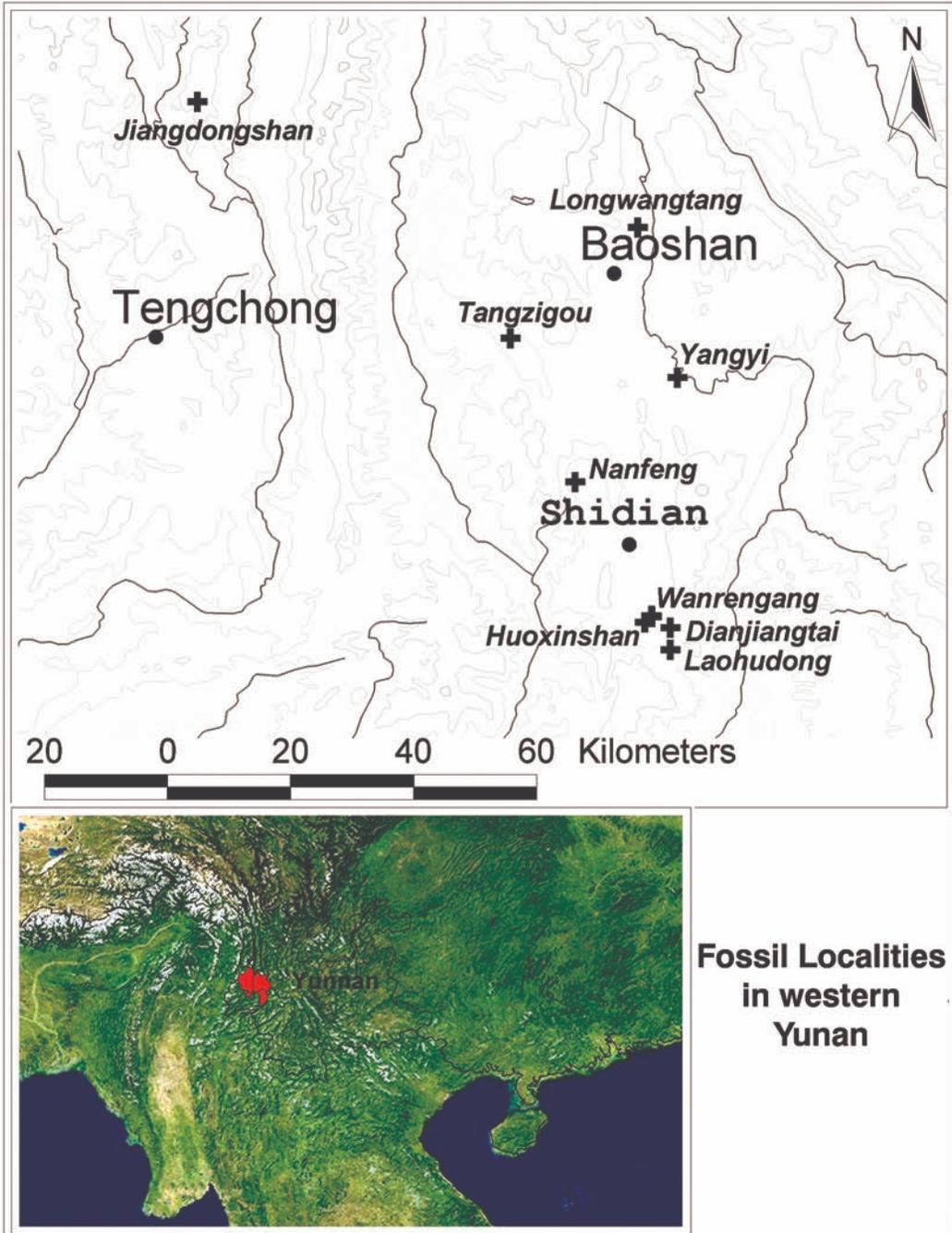


FIGURE 1. Map of Yunnan Province showing the cities of Baoshan and Shidian, with inset map showing the vertebrate paleontological sites discussed in text.

ish brown silty clay, which varies in thickness about 0.2–0.5 m; the layer is absent from the southern extremity of the excavation. Layer 3 is a 0.2–0.4 m thick layer of reddish brown silty, and Layer 4 comprises a layer of brown and black silty clay, with the black displacing the brown near the base of the excavation. The depth of Layer 4 is unclear because the excavation had not yet reached its base, but is almost certainly less than 0.5 m. Large stalagmites were found at the base of Layer 4 and throughout Layer 4 (Fig. 4). Samples of stalagmites from Layer 4 were taken for  $^{230}\text{Th}/^{234}\text{U}$  dating. The black layer at the base of Layer 4 may represent a paleosol at or near the original floor of the cave. This attribution is suggested because the black layer is variable in thickness and slopes at an angle of about  $20^\circ$  toward the rock face.

Larger mammalian fossils were recovered at the site as the excavation proceeded. These bones and teeth were moderately well mineralized and required little preparation. The discovery of a murid rodent tooth adhering to one of the specimens in the original collection led us to collect clay matrix from all four layers of the site in order to recover further remains of small mammals by wet-sieving. During our work in November 2002, matrix from Layers 1 and 4 only was washed and picked. This operation led to the retrieval of many dental and bony remains of rodents, insectivores and bats. The mammal fossils recovered from Layer 1 are fewer in number and represent fewer taxa than those of Layer 4. A detailed study of these materials is planned.

Fossils of large mammals, typical of the *Ailuropoda-Stegodon* fauna, dominate Layers 1 and 3 of the site. These fossils are most strongly concentrated at the base of Layer 1, which is interpreted as highest in the succession of the floor deposits of the former cave or rock shelter. In addition to the nominate taxa, this assemblage includes the genera *Hystrix*, *Rattus*, *Ursus*, *Rhinoceros*, *Cervus*, *Muntiacus*, and *Bos* (Table 1; Fig. 5). The apparent recovery of



FIGURE 2. Nanfeng. The south face of the excavation; tape measure held by Yang Shengyi, Director of the Shidian Cultural Relics Bureau. Note the disturbed surface layer with large inclusions (Layer 1); these may represent the roof of the original cave or rock shelter. The rock face in the background is thought to have formed the original rear wall of the cave or rock shelter.

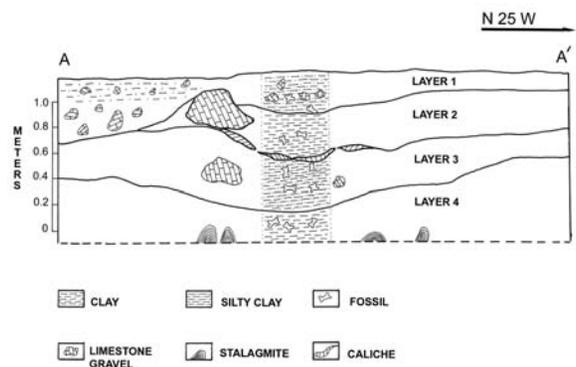


FIGURE 3. Nanfeng. Stratigraphic plan of the site. Drawing by Dr. Jean DeMouthe.

tooth plates of *Elephas* at the site by villagers in 1991 is significant, as there are no other known fossil sources in the area and the matrix adhering to the specimen and its preservation indicates that it came from the site, although this cannot be conclusively confirmed. If the co-occurrence of *Stegodon* and *Elephas* were confirmed by subsequent finds, this would support a Middle Pleistocene age for the fauna of Layer 1. Layers 2 and 3 produced relatively few large mammal fossils, mostly cervids. As of this writing, wet sieving of Layers 2 and 3 had not yet been conducted, so the nature of the small mammal assemblages in these layers is not yet known.

The fossil assemblage of Layer 4 is significantly different from that of Layer 1, being dominated by small nocturnal mammals such as mice, rats, hamsters, and bats (Table 1). At least one set of associated remains (two incisors, a molar and



FIGURE 4. Nanfeng. Cross section of a stalagmite recovered from Layer 4, thought to be at or near the floor of the original cave or rock shelter.

TABLE 1. Preliminary list of mammalian genera from Nanfeng.

<b>Layer 1</b>	<b>Layer 3</b>
<i>Ailuropoda</i> sp.	Viverridae gen. indet.
<i>Ursus</i> sp.	<i>Cervus</i> sp.
Viverridae gen. indet.	<i>Muntiacus</i> sp.
? <i>Hyaena</i> sp.	Cervidae gen. indet.
<i>Panthera</i> sp.	<b>Layer 4</b>
<i>Stegodon</i> sp.	Erinaceidae gen. indet.
<i>Elephas</i> sp.	?Soricidae gen. indet.
? <i>Megatapirus</i> sp.	?Talpidae gen. indet.
Rhinocerotidae gen. indet.	Vespertilionidae gen. indet.
<i>Sus</i> sp.	<i>Myotis</i> sp.
<i>Cervus</i> sp.	<i>Cervus</i> sp.
<i>Elaphurus</i> sp.	Cervidae gen. indet.
<i>Muntiacus</i> sp.	<i>Sus</i> sp.
<i>Hydropotes</i> sp.	<i>Bubalus</i> sp.
Cervidae gen. indet.	<i>Sciurotamias</i> sp.
Antelopinae gen. indet.	Sciuridae gen. indet.
<i>Ovis</i> sp.	<i>Rhizomys</i> sp.
Caprinae gen. indet.	<i>Apodemus</i> sp.
<i>Bos</i> sp.	<i>Micromys</i> sp.
<i>Rhizomys</i> sp.	<i>Rattus</i> sp.
<i>Apodemus</i> sp.	<i>Myospalax</i> sp.
<i>Micromys</i> sp.	<i>Hystrix</i> sp.
<i>Rattus</i> sp.	<i>Ochotona</i> sp.
<i>Hystrix</i> sp.	<i>Cricetulus</i> sp.
<b>Layer 2</b>	<i>Microtus</i> sp.
Cervidae gen. indet.	? <i>Lepus</i> sp.

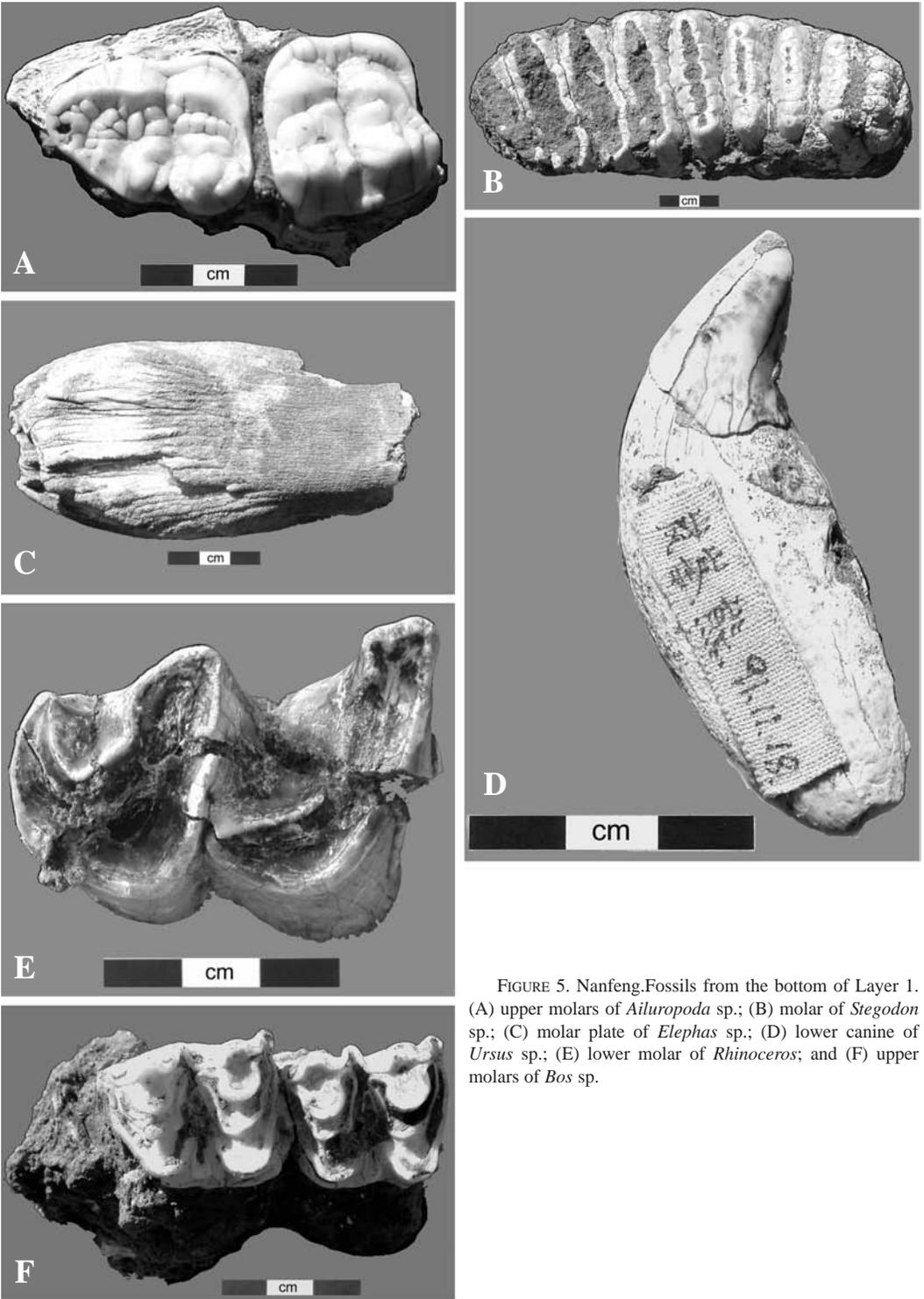


FIGURE 5. Nanfeng. Fossils from the bottom of Layer 1. (A) upper molars of *Ailuropoda* sp.; (B) molar of *Stegodon* sp.; (C) molar plate of *Elephas* sp.; (D) lower canine of *Ursus* sp.; (E) lower molar of *Rhinoceros*; and (F) upper molars of *Bos* sp.

three limb bones) of a rodent was found in one small piece of about 3 cm<sup>3</sup> of clay matrix. This evidence, combined with the fact that most of the mammalian taxa recovered are nocturnal or crepuscular, is consistent with the suggestion that many of the bones and teeth in Layer 4 represent the remnants of owl pellets. A complete study of the small mammal remains from Nanfeng will be undertaken in late 2003 and 2004.

A preliminary interpretation of the taphonomy of the Nanfeng site can be ventured on the basis of faunal assemblages so far recovered. Based on the preponderance of small nocturnal mammals in the oldest layer of the site, the Nanfeng cave or rock shelter is reconstructed to have had a small opening, which would have provided easy access for owls and bats, but otherwise only occasional and fatal access by larger mammals. Through time, the opening of the cave or rock shelter appears to have become larger, permitting the ingress of more and larger mammals, as witnessed by the accumulation at the base of Layer 1. Finally, the roof of the cave collapsed, possibly as a result of tectonic activity – common in the area – sealing the faunal assemblage until its accidental discovery in 1991.

The Nanfeng assemblage appears to be late Middle Pleistocene in age, based on the results of <sup>230</sup>Th/<sup>234</sup>U dating conducted by Dr. Shen Guan jun of Nanjing University (Table 2).

TABLE 2. Results of <sup>230</sup>Th/<sup>234</sup>U dating of stalagmites from Layer 4, Nanfeng.

Lab Number	U Volume(ppm)	<sup>230</sup> Th/ <sup>232</sup> Th	<sup>234</sup> U/ <sup>238</sup> U	<sup>230</sup> Th/ <sup>234</sup> U	<sup>230</sup> Th age (ka)
0267	0.061	21.5	1.154±0.053	0.847±0.040	188
0269	0.16	30.6	1.074±0.019	0.891±0.030	227

NEW COLLECTIONS FROM PREVIOUSLY KNOWN SITES

**Wanrengang (N 24°37'24.2"; E 099°12'52.9"; altitude 1843 m)**

In the Summer of 1987, poorly mineralized bones and teeth, as well as stone tools, and bone and antler tools of apparent Paleolithic age, were recovered by Mr. Yue Qi, the former director of the Shidian Cultural Relics Administration Office during his investigation at Wanrenggang rock shelter. Soon after (24–25 September 1987), experts from the Yunnan Provincial Museum and Baoshan Cultural Relics Administration Office joined them to do a test excavation. This resulted in the discovery of an almost complete hominin skull, mammalian fossils and more tools. A brief report, which described the 1987 excavation at the site and the human skull unearthed at that time, was published in 1992 (Zhang et al. 1992). This report provided a preliminary faunal list that included birds and nine species of mammals, which were referred to only by their common names in Chinese: porcupine, pig, rhesus macaque, bear, tiger, two species of deer, muntjac, and bovid.

Wanrengang is a large open rock shelter site near Xiaohanzhang village, Yaoguan country, about 23 kilometers from Shidian city (Fig. 1). Fossils and stone tools have been found over a large area, from the back wall of the current rock face (rock shelter) through an area ~30 m to the south and ~20 m below the level of the rock shelter floor (Fig. 6). The stratigraphy and geochronology of the site have not yet been studied in detail, but initial study of the archaeological remains so far recovered indicates that the site spans late Pleistocene to early Holocene, or roughly 15–7000 yr BP. A preliminary visit to the site was made by a team led by one of us (Ji X.-P.) in 2001 and a new test excavation was dug approximately 20 m south and 10 m below the level of the rock shelter floor in October 2002. Much of the site is currently under cultivation. During our visit, we did not make a formal excavation, but simply reviewed the 1987 and October 2002 excavations, combed



FIGURE 6. Wanrengang. General aspect of site. The large arrows indicate the area immediately in front (south) of the rock face (the back of the rock shelter) in which the densest accumulations of fossils and artifacts were found. The smaller arrows in the foreground indicate the cultivated field from which bones and artifacts were found at lower density.

the cultivated area for fossils and dug small exploratory pits near the rock face to ascertain the extent of the site.

Wanrengang is a richly fossiliferous site, which is dominated by the remains of large deer and muntjacs, including *Cervus* sp., *Hydropotes* sp. and *Muntiacus* sp. Most of the fossils recovered are fragmentary and may have been crushed while *in situ* on a living floor (Fig. 7). This floor surface extends ~10 m from the current rock wall and appears to have been inhabited by a succession of humans from late Paleolithic times, based on the stone tools and fauna so far recovered. A preliminary faunal list for Wanrengang is provided in Table 3, and photographs of some of the specimens recovered from the site are presented in Figure 8. The limited variety of range of mammalian species recovered, the presence of only two carni-



FIGURE 7. Wanrengang. A typical accumulation of broken bone fragments from the floor of the rock shelter.

vores (*Ursus* sp., *Panthera* sp.), and the large number of remains of old and immature deer and muntjacs present suggest that at least part of the site reflects a human accumulation.

While our project was not concerned with the recovery or identification of archaeological materials, one of us (G.C.) recovered an interesting tool in the course of combing the cultivated field approximately 15 m down slope in front of the Wanrengang rock shelter face. This tool represents an internal quartzite cast of a large gastropod shell, which was subsequently used by humans as a grinding tool, as judged by its highly worn convex surfaces (Fig. 9). To our knowledge, this provides one of the first examples of a fossil being fashioned and used by ancient humans as a tool.

During the course of our survey at Wanrengang, a new rock shelter site was discovered about 100 m to the west of the original site. This site, tentatively referred to as Wanrengang II (N 24°37'31.1"; E 99°12'50.1"; altitude 1807 m), is broadly part of the same rock face and is also a rock shelter with an overhang. The deposits extend downslope about 15 meters to the south and less than 10 meters along the rock wall. This rock shelter yielded a small number of mammalian bone fragments, teeth of *Cervus* sp., and a piece of red ochre during a very short reconnaissance; further exploration will be conducted.

Further survey and excavation at both Wanrengang I and Wanrengang II are planned, as is study of the stratigraphy and age of both sites.

**Huoxinshan (N 24°36.594'; E 099° 12.260'; altitude 1777 m)**

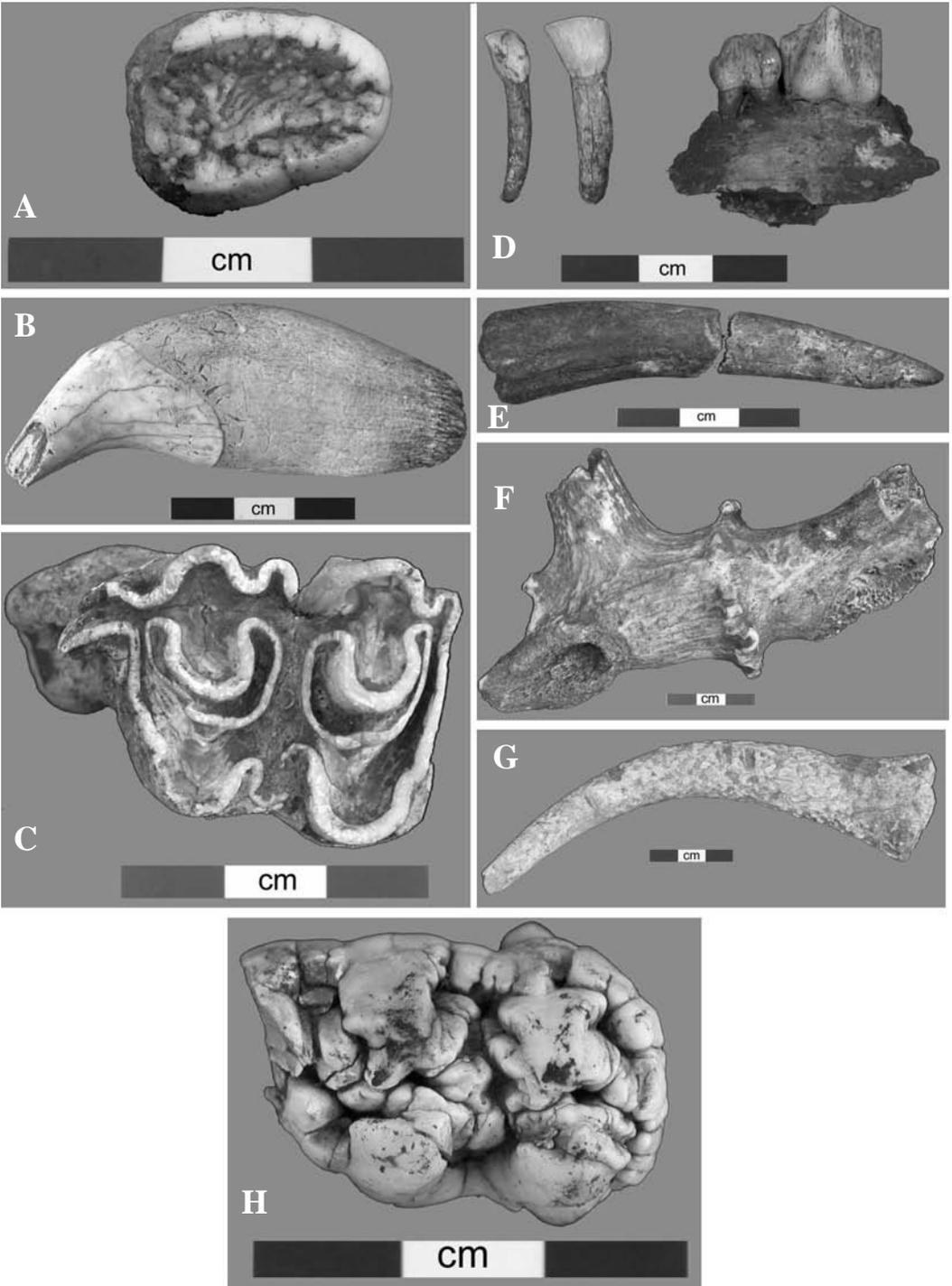
A team from the Baoshan Cultural Bureau investigated the rock shelter site of Huoxinshan in 1987 and a brief report on the archaeological and paleontological discoveries at the site was published in 1992 (Li et al. 1992). The site yielded a large number and a wide variety of stone tools, as well as some bone tools, representing a time period spanning the late Paleolithic through the Neolithic. The fauna recovered from the site was not described in detail, but comprised *Cervus* sp., *Muntiacus* sp., *Bos* sp., *Panthera* sp., and Aves. During our short visit to the site, we slightly enlarged the previous excavation (Fig. 10), and recovered a small number of subfossil mammalian bones, bone fragments, and teeth, as well as three probable quartzite flake tools. Only one complete bone was discovered during the course of our work — a scapula of a large artiodactyl (probably *Cervus* sp.). This bone was eventually recovered in pieces and will be reconstructed. Teeth and dental fragments of *Cervus* sp., as well as isolated teeth of *Ovis* sp., *Bos* sp. and *Canis* sp. were also recovered. The estimated age of the site is 8–7000 yr BP, on the basis of a putative correlation to upper levels of the site of Tangzigou – dated by radiocarbon at 8–7000 yr BP (Li et al. 1992).

**Tangzigou (N 25°01'31.0"; E 099°00'27.9"; altitude 1394 m)**

The site of Tangzigou is well known for the partial skull of a Late Pleistocene hominin it has produced, sometimes referred to as “Pupiao Man” (Yunnan Provincial Museum Team, 1992; Gen and Zhang, 1992). The site has produced rich Late Pleistocene and Holocene mammalian faunas, which were described respectively by a joint team from the Yunnan Provincial Museum and Baoshan Prefecture Museum (1992) and by Zhang et al. (1992). About 29 species of mammals were reported as present at the site. In October 2002, a small test excavation at Tangzigou was

TABLE 3. Preliminary list of mammalian genera from Wanrengang

<i>Macaca</i> sp.
<i>Homo sapiens</i>
<i>Panthera</i> sp.
<i>Ursus</i> sp.
<i>Rhinoceros</i> cf. <i>sinensis</i>
<i>Equus</i> sp.
<i>Sus</i> cf. <i>scrofa</i>
<i>Muntiacus</i> sp.
<i>Cervus</i> cf. <i>unicolor</i>
<i>Cervus</i> sp.
<i>Moschus</i> sp.
<i>Elaphurus</i> sp.
<i>Hydropotes</i> sp.
<i>Bubalus</i> sp.
<i>Naemorhedus</i> sp. or <i>Ovis</i> sp.
<i>Rhizomys</i> sp.
<i>Hystrix</i> sp.



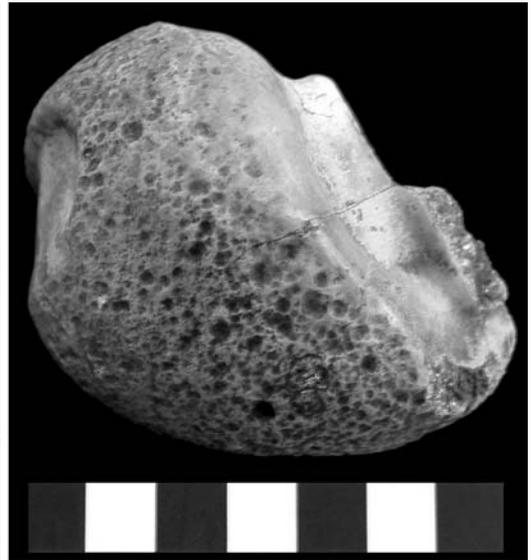
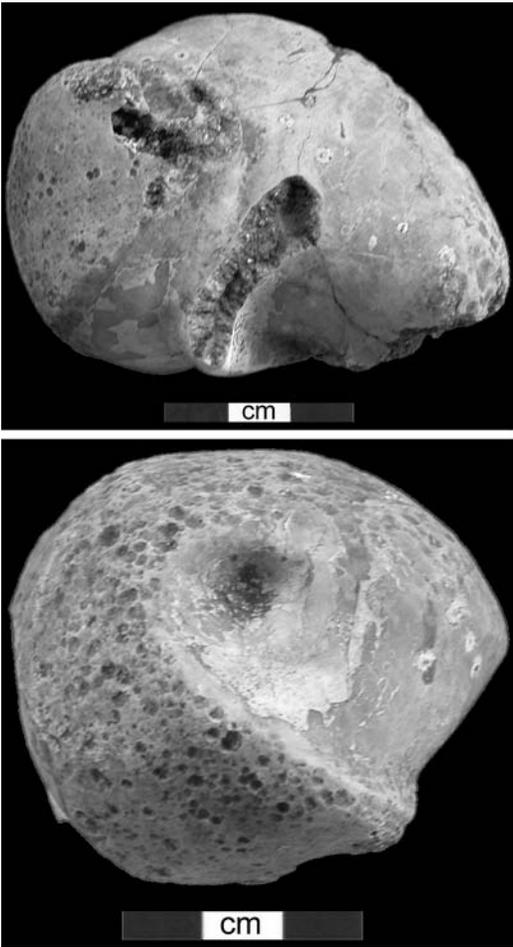


FIGURE 9. Wanrengang. Three views of the internal quartzite cast of a large gastropod shell that has been used as a grinding tool. Note the pock-marked, convex grinding surfaces.

supervised by one of us (Ji X.-P.). During our November 2002 visit to the site, a small number of vertebrate specimens, including a fragment of a molar of *Homo* sp. and remains of several cervids and a large bird were gathered from the test pit and from other areas of exposed sediment nearby. A formal excavation of the site is planned for late 2003.

**Laohudong (N 24°34.551'; E 099°14.506'; altitude 1839 m)**

Laohudong, “the Tiger’s Cave”, is a limestone cave, from which fossilized mammalian bones have been unearthed over the course of many years by local inhabitants. A brief report on the stratigraphy and archaeology of the site was published by Yue (1992). That account included a brief listing (in Chinese only) of vertebrate remains recovered from the cave: Aves (Family unknown), *Macaca mulatta*, *Rhizomys* sp., *Ursus* sp., *Mustela* sp., *Canis* sp., *Rhinoceros* sp., Cervidae (genus not specified), *Sus* sp. and Bovidae (genus not specified). The report also provided a radiocarbon

FIGURE 8. Wanrengang. Some of the mammalian genera represented at the site. (A) *Ursus* sp. molar; (B) *Ursus* sp. canine, with rodent gnaw marks evident on surface of root; (C) *Equus* sp. molar; (D) *Muntiacus* sp. incisors and partial mandible with premolar and molar; (E) *Muntiacus* sp. horn core; (F) *Hydropotes* sp. partial antler; (G) horn core of *Ovis* sp. or *Naemorhedus* sp.; (H) *Sus* sp. partial molar. All specimens pictured except for the molar of *Ursus* sp. were recovered during the course of the October and November 2002 expeditions. The ursid molar was recovered in 1987.

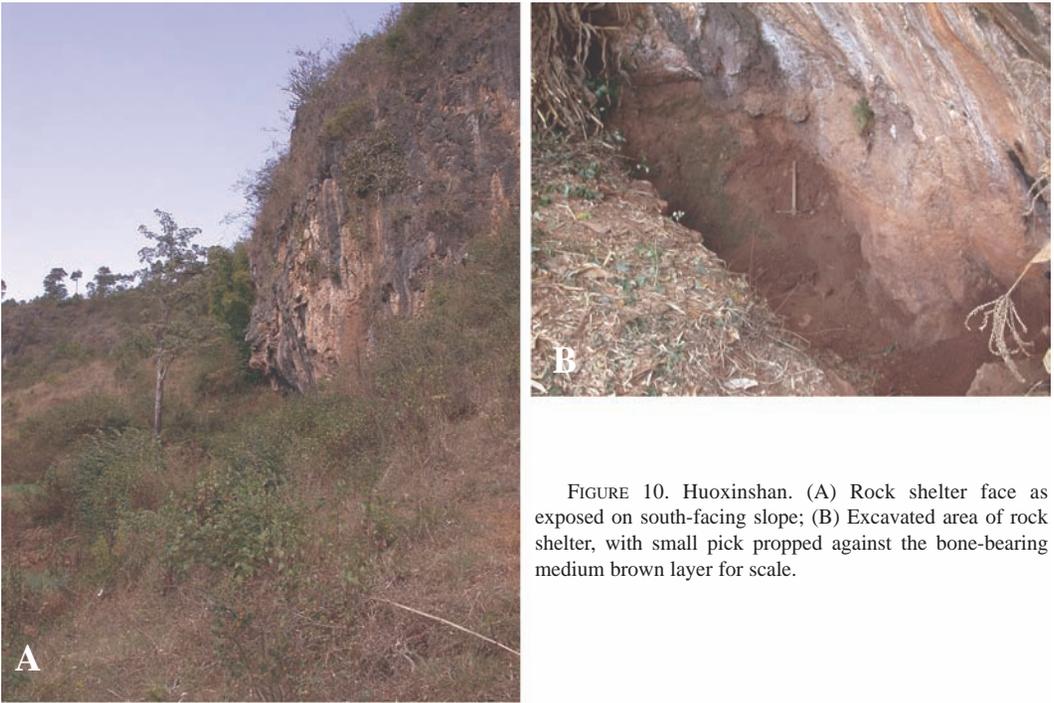


FIGURE 10. Huoxinshan. (A) Rock shelter face as exposed on south-facing slope; (B) Excavated area of rock shelter, with small pick propped against the bone-bearing medium brown layer for scale.

age on charcoal of  $18,403 \pm 1181$  yr BP from the cave. A collection of fossils from Laohudong was deposited at the Shidian Cultural Bureau in 1989.

During our short visit to Laohudong in November 2002, we entered the cave and assessed the desirability and feasibility of conducting an excavation therein. The cave has two narrow entrances, which merge into a common aditus of about 10 m length, through which it is possible to crawl. This passageway leads to a chamber of about  $3 \times 4 \times 2$  m in which excavations had been carried out by villagers over the years. From the chamber, a tunnel of about 15 m extends until a drop off to a lower level; this was not followed because of a lack of appropriate equipment. Layers of densely fossiliferous, heavily cemented flowstone are exposed in the cave entrances and along the aditus and the walls of the chamber. The well-mineralized but generally fragmentary remains of many, mostly small to medium-sized mammals are preserved in these layers (Table 4; Fig. 11).

The Laohudong accumulation almost certainly represents one that was washed into the cave by flowing water. *Hystrix* and *Muntiacus* fossils, with considerably smaller numbers of other rodent, carnivore, monkey, and large cervid remains, dominate the site. It is unclear whether the dominance of small- to medium-sized mammals at Laohudong is a taphonomic bias (due to the preferential transport and deposit of smaller elements by flowing water in the cave), or whether this represents a modern or latest Pleistocene fauna bereft of megafauna. Further explorations and excavations of the cave

TABLE 4. Preliminary list of mammalian genera from Laohudong

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<i>Trachypithecus</i> sp.
<i>Macaca</i> sp.
<i>Ailuropoda</i> sp.
<i>Canis</i> sp.
<i>Ursus</i> sp.
<i>Cervus</i> sp.
<i>Muntiacus</i> sp.
Cervidae gen. indet.
<i>Bubalus</i> sp.
<i>Sus</i> cf. <i>scrofa</i>
<i>Rhizomys</i> sp.
<i>Equus</i> sp.
<i>Rhinoceros</i> cf. <i>sinensis</i>
<i>Hystrix</i> sp.
<i>Lepus</i> sp.

complex are planned, as well as new determinations of the age of the site. (The published radiocarbon date for the site based on archaeological charcoal appears much too young for what otherwise appears to be the cave's Late Pleistocene fauna.)

OTHER SITES

**Yangyi (N 25°01.426', E 099°00.514', Altitude 1375m) and Dianjiangtai (N 24°36.487', E 099°14.506', Altitude 1831m)**

The sites of Yangyi and Dianjiangtai represent two latest Miocene or early Pliocene sites, from which fossils have been retrieved from clay strata immediately overlying lignite deposits. Both sites are active mines: Yangyi is a lignite mine, and Dianjiangtai is a lignite mine and brickworks. Yangyi has yielded a relatively diverse fauna, including two primates (Table 5), while Dianjiangtai has only produced fossils of *Stegodon* cf. *yangyiensis* and *Axis* sp. Most of these fossils were discovered by miners and workers at the site, and subsequently turned in to paleontologists. Yangyi is highly significant for having yielded a primate fossil (Gen 1995), which is thought to be the youngest Eurasian fossil hominoid so far recovered (Harrison et al. 2002). The possibility of retrieving further fossils from either of these important late Tertiary sites will depend upon the activities of the mines' employees, because active searching or deliberate excavation for fossils is precluded. At Yangyi, the mine manager informed us that the skeleton of an entire *Stegodon* had been recently unearthed and then discarded because he erroneously did not think anyone would be interested in it.

TABLE 5. Preliminary list of mammalian genera from Yangyi

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<i>Lufengpithecus</i> sp.
<i>Sinoadapis</i> sp.
<i>Zygodon</i> sp.
<i>Chilotherium yunnanensis</i>
<i>Stegodon yangyiensis</i>
<i>Stegodon elephantoides</i>
<i>Axis</i> sp.

**Natural Well on Jiangdongshan, Tengchong (N 25°22', E 098°33' altitude 1900–2000m)**

A natural well on Jiangdongshan (Jiangdong Mountain) near the village of Gudong, west of Tengchong, was found to contain mammalian fossils by nearby villagers. A small team from the Tengchong Cultural Bureau, led by the Bureau's director, Mr. Li Zheng, undertook a preliminary exploration of this well in the mid-1990s. The natural well is estimated to be 46 m deep, with a surface opening of about 2 × 4 m. The internal shape of the well (to the extent to which it is now known) is described as pear-shaped, with diameter of about 10 m at an intermediate platform. This platform does not represent the bottom of the well, however; the bottom slopes from this base at an angle of 30–45° downward, but was not explored by Li's team because of a lack of necessary equipment. The platform is reported to be covered with a clay-like infilling of approximately 0.5 m thickness, which contained abundant mammalian fossils. During our visit to Tengchong, we interviewed Li Zheng, viewed some of the fossils unearthed, and inspected photographs of the site and of other fossils. A visit to the natural well itself was not possible because of bad weather and the remoteness of the site. The mammalian fossils retrieved from the site include a modern Asian elephant (*Elephas* sp.), three individuals of giant panda (*Ailuropoda* sp.), a large gazelle, a large deer (*Cervus* sp.), a hypsodont muntjac (probably *Muntiacus* sp.), and a very large rhizomyid rodent. We also learned that another fossil-bearing site (probably a rock shelter) exists near the well, on the same mountain. Based on the composition of the mammalian assemblage, a Late Pleistocene age for the fauna is hypothesized.

The sites at Jiangdongshan are of special importance because they are some of the few documented vertebrate paleontological sites that are west of the Nujiang River, and therefore within the

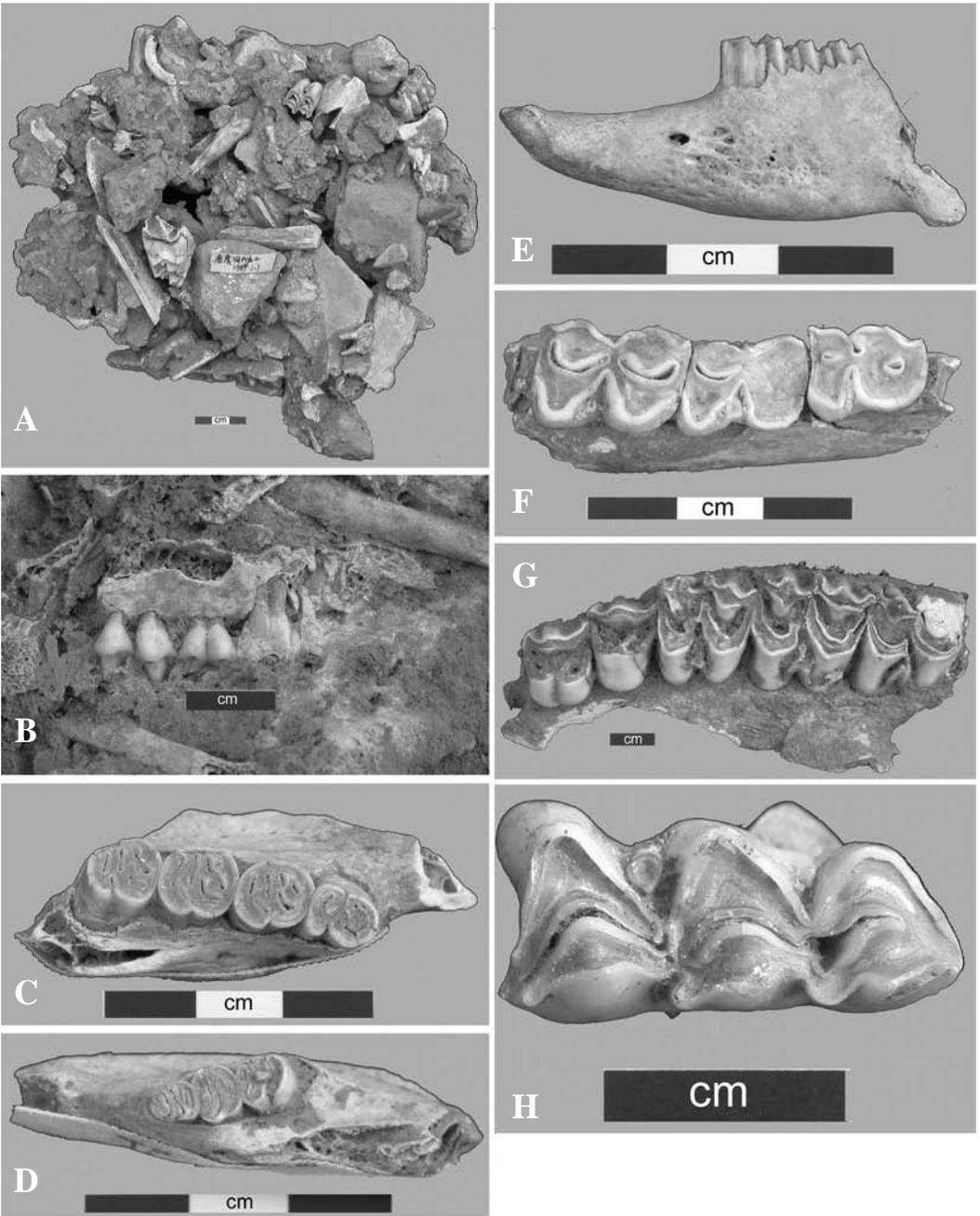


FIGURE 11a-h. Laohudong. Some of the mammalian remains recovered from the site. (A) Mammalian fossils *in situ* in calcareous flowstone recovered from the cave; (B) upper premolars and molars of *Trachypithecus* sp.; (C) molars in lower jaw of a porcupine, *Hystrix* sp.; (D) lower jaw of the bamboo rat, *Rhizomys* sp.; (E) lower jaw and molars of a rabbit, *Lepus* sp.; (F) lower molars of the water deer, *Hydropotes*; (G) upper molars of a large deer (cervid); (H) lower molar of a large deer (cervid).

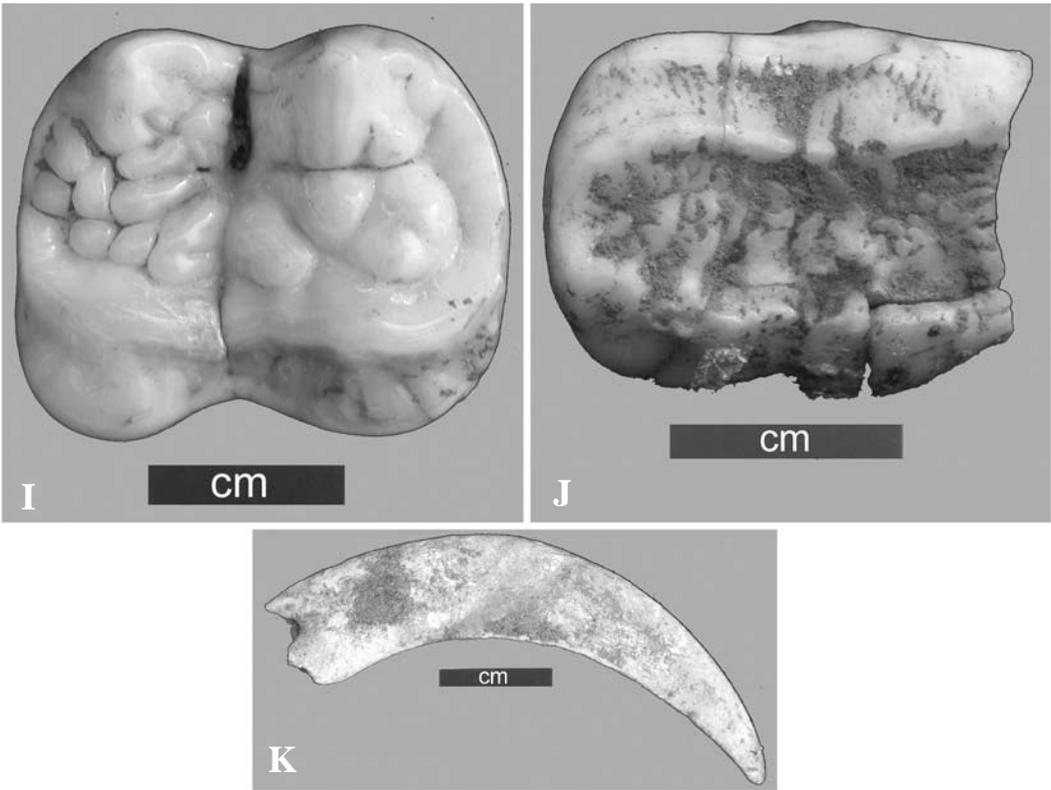


FIGURE 11 (continued). (I) lower molar of the panda, *Ailurapoda*; (J) partial lower molar of a bear, *Ursus* sp.; (K) distal phalanx ('claw') of a probable bear, *Ursus* sp.

strict confines of the Gaoligongshan Range itself. To our knowledge, the retrieval of a giant panda fossil from this site marks the westernmost extent of the animal's known range in the past. Exploration of these sites and retrieval of fossils from them is planned for the coming years.

**Longwangtang (N 25°11.106'; E 099°11.650'; altitude 1659m)**

The site of Longwangtang was discovered by a farmer in 1984, when he unearthed some bones and teeth while getting construction materials from a cave area; these were reported to Baoshan City Museum (Gen et al. 1992). A subsequent visit to the site by representatives of the Museum confirmed the presence of fossils, including teeth of *Megatapirus* sp., and charcoal at the site. An excavation carried out at the site in 1987 led by the late Zhang Xingyong of Yunnan Provincial Museum revealed further evidence of a Late Pleistocene fauna comprising *Panthera* sp., *Canis* sp., *Ursus* sp., *Cuon* sp., *Megatapirus* sp., *Bibac* sp., *Sus* cf. *scrofa*, *Muntiacus* sp., *Cervus* sp., and *Ovis* sp. or *Naemorhedus* sp., *Rhizomys* sp., *Hystrix* sp., Sciuridae gen. indet. and *Lepus* sp., in addition to Late Paleolithic stone tools (Gen et al. 1992).

The site of Longwangtang abuts a gently sloping field system, which in turn abuts a modern limestone rock face. The site represents a collapsed cave (Gen et al. 1992), and warrants further exploration and excavation because of the abundant Late Pleistocene fauna it produced.

## DISCUSSION AND CONCLUSIONS

Baoshan Prefecture is rich in vertebrate paleontological and archaeological sites (Zhang, 1992), especially Late Pleistocene and Holocene sites. Our preliminary survey of one new paleontological site (Nanfeng) and review of several previously known sites indicates that the prospects of future significant discoveries Quaternary faunas in the Prefecture are great. This is particularly so of the probable Middle to Late Pleistocene site of Nanfeng, the Late Pleistocene sites of Laohudong and Longwangtang, the Late Pleistocene to Holocene sites of Wanrengang and Tangzigou, the Late Paleolithic and Neolithic site of Huoxinshan, and a few other Neolithic sites, which straddle the Pleistocene/Holocene boundary.

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