

**A Pleistocene Mammalian Locality  
in the Lijiang Basin, Yunnan Province**

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## Introduction

In the Spring of 1960, the Yunnan expeditionary force from the Institute of Vertebrate Paleontology and Paleoanthropology, Academia Sinica, visited the Yunnan Provincial Museum in Kunming, where they studied numerous fossil vertebrates collected from a single locality in Lijiang County including three hominid limb bones in various stages of fossilization. The fossil site is located approximately 50 meters south of the village of Mujianqiao in the Yangxi administrative district of Jinshan People's Commune, on the bank of the Yanggongjiang River in Lijiang County (Figure 1, IVPP Locality 6003). The locality constitutes the first discovery of a paleoanthropological and paleomammalian site in the expansive innermontane basins of western Yunnan. This report is the result of a preliminary investigation made there in order to further comprehend the conditions of the fossil locality.

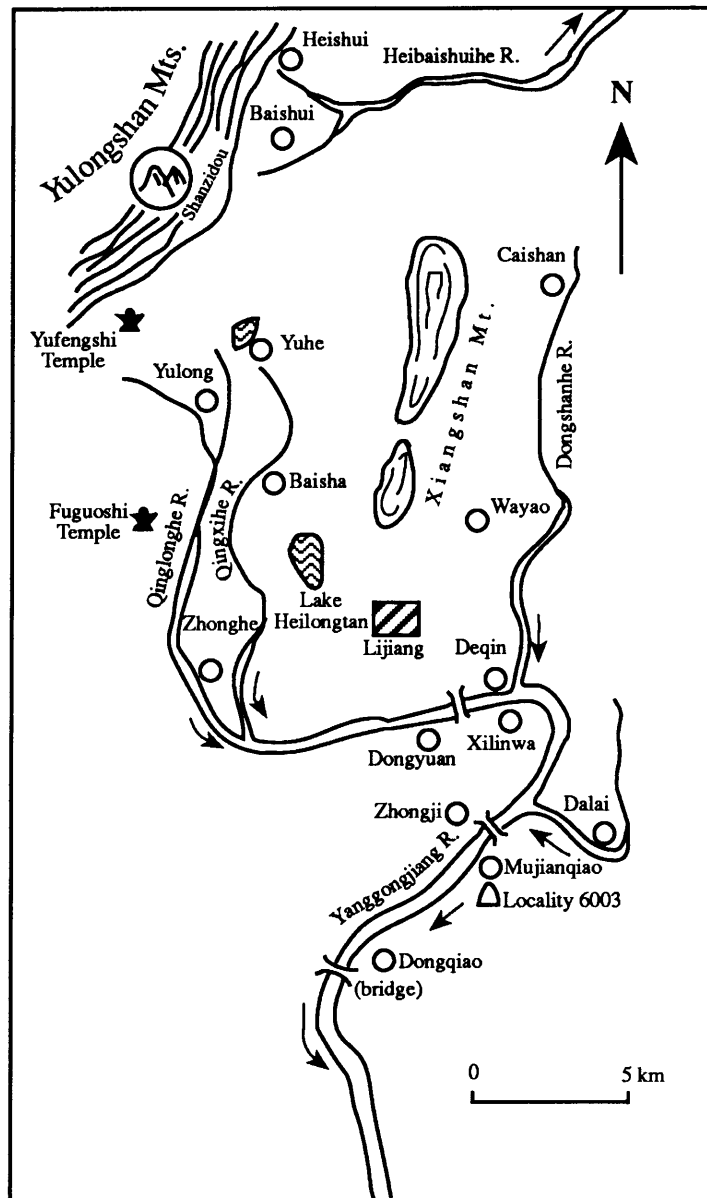
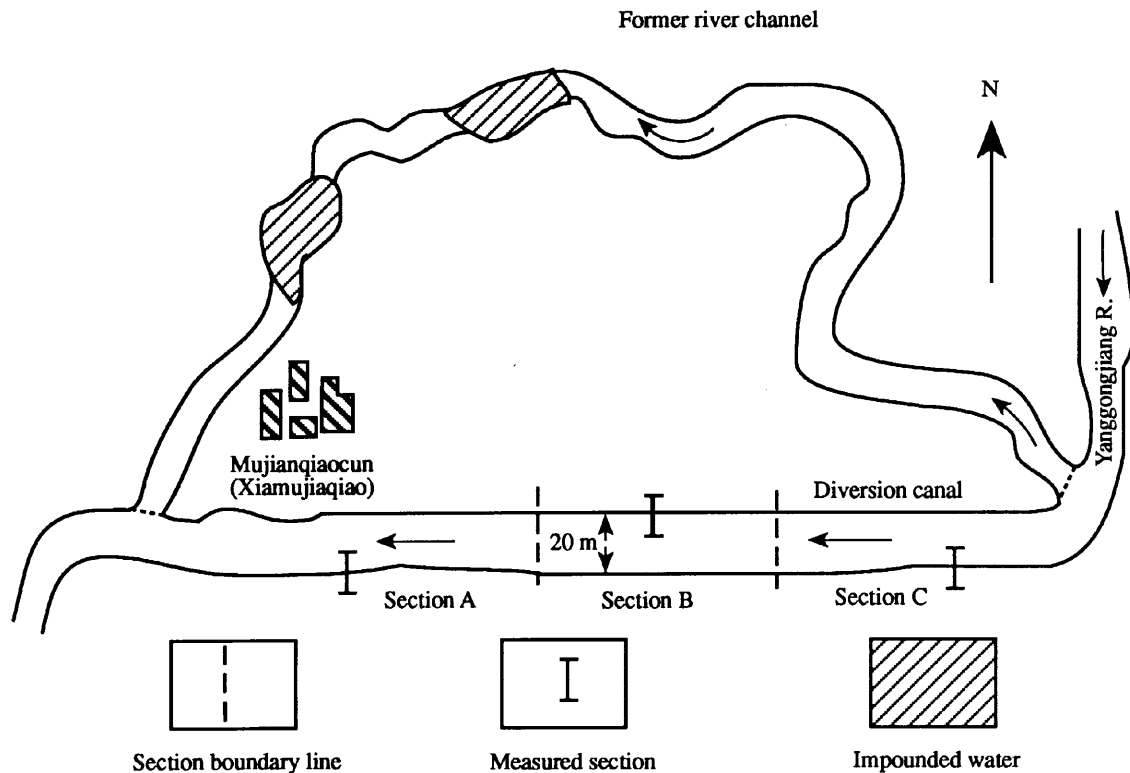


Figure 1. Map of the Lijiang vicinity.

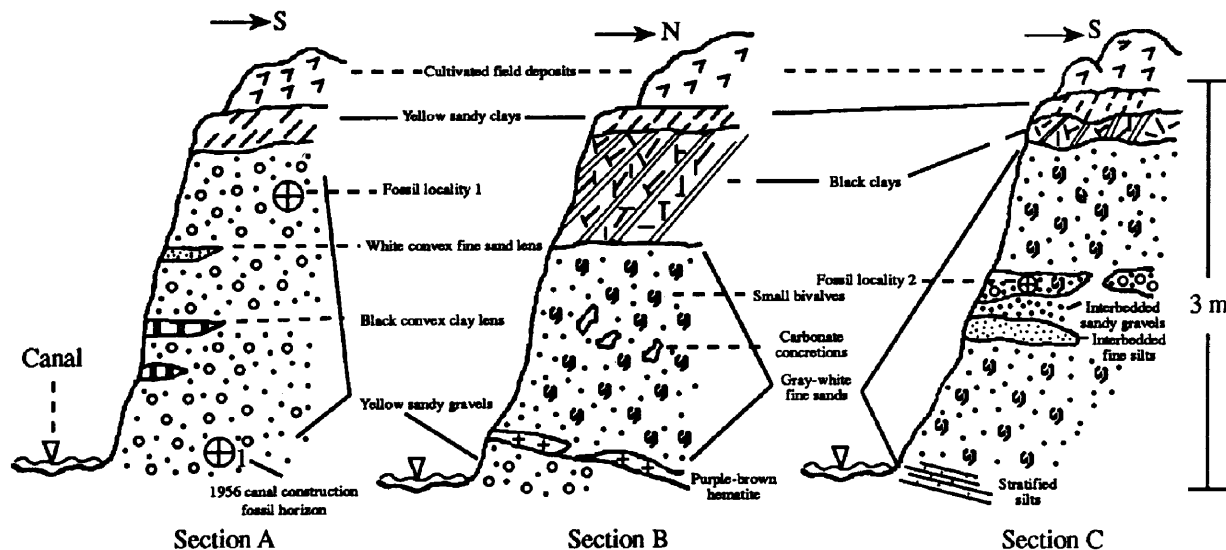


**Figure 2.** Map of fossil locality 6003.

### Stratigraphy

Deposits of the fossil locality are composed of fluviolacustrine sediments within the Lijiang Basin. These sediments are extensively distributed as open fields that overlie the foundation of the basin as overburden. The evolution and fluctuation of the Yanggongjiang River system was the predominant origin of these deposits, which are most completely developed and exposed in the vicinity of Locality 6003. The locality description, based on three stratigraphic sections along a diversion canal, is provided below (Figure 3).

**Cross-section A:** The predominant vertebrate-bearing sediments consist of approximately 3 m of fine yellow gravels and coarse sands composed of approximately 1 cm diameter loosely consolidated predominantly limestone clasts. Overlying this unit are variable thicknesses of Holocene sandy clays and cultivated soils. Recently, excavations in the sandy gravels produced a bovid horncore and limb bones. Earlier, during the excavation of the diversion canal, fragmentary remains of cervid antlers were recovered within the sandy gravelly clays, which are the source for all the fossil mammals from Lijiang that are housed in the Yunnan Provincial Museum. The precise stratigraphic level producing the earlier fossils was probably lower, or approaching the base of the canal, although it is still recognized as the same stratigraphic unit as the higher site. The fossil hominid remains were, however, probably not derived from levels contemporaneous with the other mammals (as discussed below). The 3 m thick sandy gravels also contain gradational unfossiliferous convex lenses of white fine sands and double or triple laminated black clays, but these do not change the total nature of the sedimentary package.



**Figure 3.** Geologic cross-sections along the irrigation canal at Locality 6003.

Cross-section B: Three recognizable, relatively well-developed sedimentary units are present from top to bottom as:

(1) Upper unit - Approximately 1 m of black clays with abundant desiccation cracks overlain by an extremely thin unit of yellow cultivated soils.

(2) Middle unit - Approximately 1.5 m of fine gray-white sands with numerous carbonate concretions, and associated with some slightly consolidated silts. Contains abundant freshwater bivalves, particularly noticeable in the north wall of the canal where some locations display concentrated life assemblages. In general bivalves are white, brittle, broken, and approximately 1.5 cm long. A few gastropods are also present, but vertebrate fossils are absent. Preliminary analysis assigns them to extant taxa of freshwater invertebrates. Bivalves are identified as *Corbicula fluviatile*, commonly found in South China. Gastropods are identified to the genus *Melania*.

(3) Lower unit - Composed of yellow coarse sands and fine gravels equivalent to the lithologies in Section A, but reduced to a thickness of 0.5 m and with fewer fine gravels.

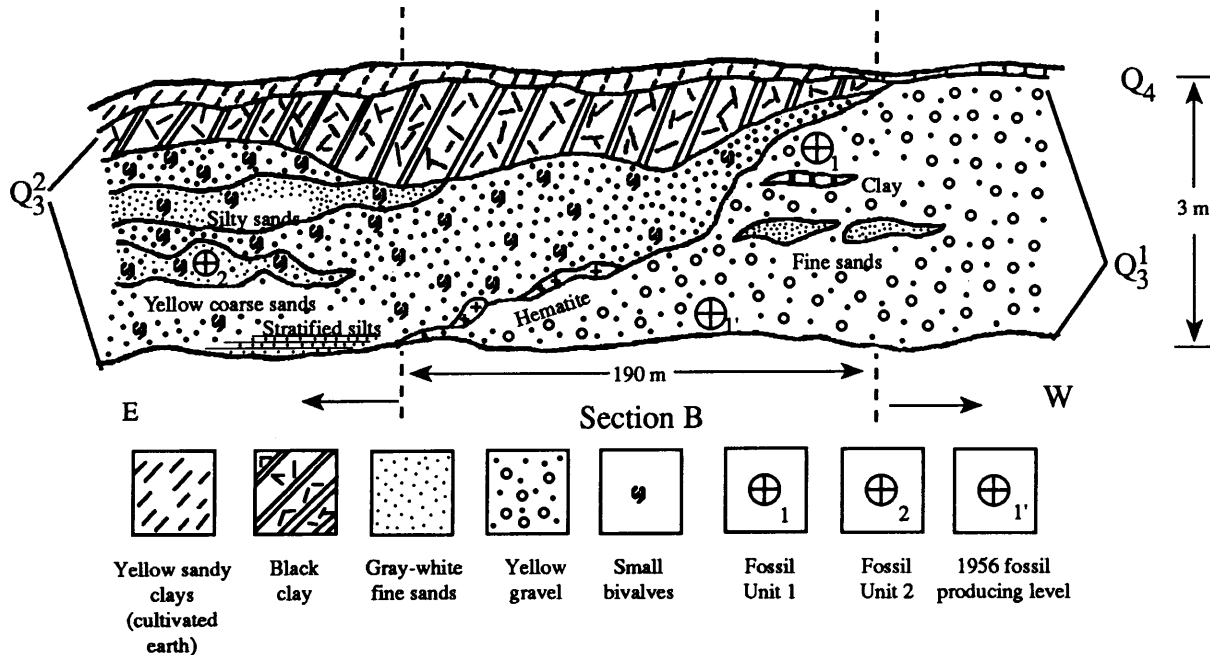
Purple-brown, well-consolidated bog iron ore lenses are present between the middle and lower units, occurring irregularly and intermittently. In general, these ferruginous units are not numerous and their upper and lower surfaces are cemented with fine sands and gravels. The presence of hematite reflects depositional environment or climatic fluctuation, and may indicate the inception of paludification.

Cross-section C: The entire unit consists of fine-grained clastics, equivalent to the middle member of section B with interbedded silts and coarse sands that increase in thickness. Portions of the lithology differ by the absence of the yellow gravels noted in cross-sections A and B. The stratigraphy of the entire section suggests that the gravels should lie at the base of this section, or underlying the diversion canal. Worth noting at this section is the continued presence of a small amount of gray-white irregular coarse sands with limited fine gravels contained within them. It was in these interbedded coarse sands that the fragmentary limb bones and cervid antler were recovered. Interbedded units are sparse and thin, and fossils are rare. But this unit is sufficient to confirm the presence of a secondary fossil horizon. Small bivalves are also noted in the fine sands

of this section. The fine sand unit becomes relatively better consolidated approaching the base of the canal, and thin layers of clay and loess continue to overlie the unit.

The geologic conditions exposed along both walls of the diversion canal are illustrated by the linking of cross-sections A, B, and C. Section B represents the complete depositional sequence with relatively complete secondary exposures of upper and lower stratigraphic units. East and westward of section B the stratigraphy becomes more homogeneous.

Figure 4 illustrates the gradual fining of sediments eastward. The sandy gravels of cross-section A wedge toward the east and gradually pinch out to be replaced entirely by the fine sands at cross-section C. The undulating contact surface of the sandy gravels with the fine sands is extremely distinct. At several localities, above the base of the sandy gravels, ferruginous deposits lie on an oblique plane, representing an erosional surface, or indicating a depositional hiatus. Numerous remains of small pelecypods are contained within the fine sands, but in the sandy gravels they are totally absent. It is believed here that the lithologic distinction between the yellow sandy gravels and the gray-white fine sands indicates diachronous deposition.



**Figure 4.** Diagrammatic cross-section of the east wall at Locality 6003.

The depositional sequence and the relatively coarse lithologies at section A, compared to the relatively fine nature of section C, indicate an older and comparatively stronger hydraulic velocity at section A. Later, the hydraulic force weakened and the water level lowered, and an undulating obliquely inclined erosional surface was created. In superposition are lacustrine deposits, as suggested by the large number of small bivalves. Above these appear black clays that extend from section B to section C, but are absent within section A. The appearance of these clays indicates the relative paludification of water, and may illustrate the termination of the lacustrine phase and the inception of a marsh phase. In general, organically rich peat is found in marsh facies, but here the clays are merely black, which may be related to the short duration of lithologic genesis. It is believed here that the section begins with fluvial sediments which later become lacustrine and finally result in the muddy sands of a marsh region.

### Concise Description of Fossil Mammals

The vast majority of fossil mammals recovered from the Yanggongjiang River, although fragmentary and not numerous, are housed in the Yunnan Provincial Museum. Preliminary observations of this set of data suggest the following:

(1) Cervid antlers are predominantly represented although dentition for the family is totally absent. Bovid horn cores are second in representation. Lastly are pieces of proboscidean tusks and numerous undiagnostic fragmentary limb bones.

(2) Matrix still adhering to the fossils comprises yellow fine and coarse sands representing the lithologies at Locality 6003. In general the specimens are well fossilized, relatively large in size, and red-yellow in coloration, with black mottling. These characters clearly distinguish the specimens from Holocene material. Because some of the specimens display gray-white sand adhering to them, this may be an indication that they were derived from the higher second locality discussed in this text.

Four taxa are represented among the collections made here and in the Yunnan Provincial Museum:

#### *Pseudaxis* sp.

Basal antler stems are mostly represented (Fig. 5). The position of the initial brow tine bifurcation is relatively low with an angle of  $90^\circ$ . Cross-section of the stem is round to subround. From the perspective of biogeography these specimens approach *Pseudaxis* cf. *kopschi*

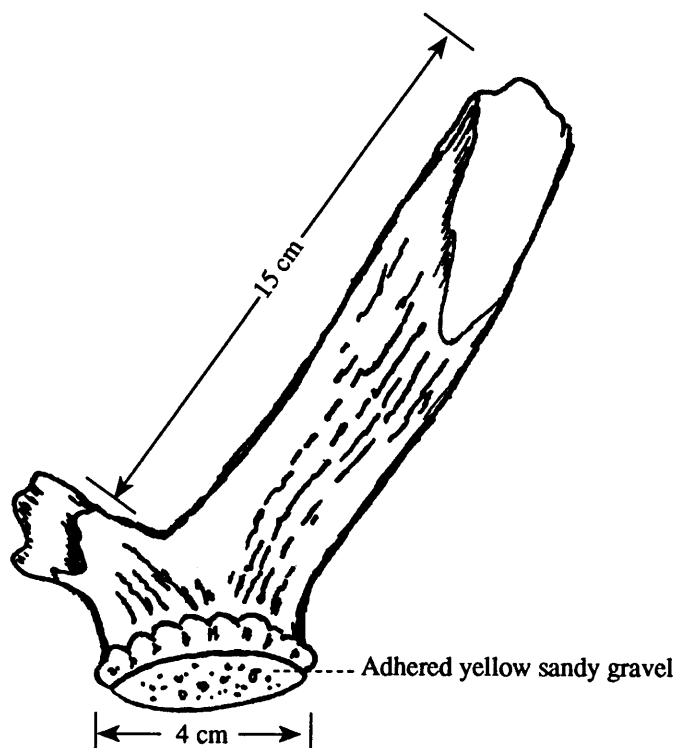


Figure 5. *Pseudaxis* antler.

### ***Bubalus* sp.**

In cross-section the horn core is triangular and posterior curvature is not great (moderately crescentic). Also represented is the posterior section of a right mandible containing M<sub>2</sub> and M<sub>3</sub>. Dental morphology approaches *Bubalus bubalus*.

### ***Rhinoceros***

Material consists of a single upper deciduous premolar excavated from the first fossil horizon at Locality 6003. The specimen differs in morphology from both *R. sinensis* and *Coelodonta antiquitatis*, and is closer to *R. unicornis* from India. Because the genus *Rhinoceros* is currently extinct in this geographic region, its occurrence here is further evidence that the age of the locality predates the Holocene. Additionally, two right molars from Guole, Liuou, Lijiang were studied in Kunming—an M<sub>3</sub> and another lower molar similar to the specimen mentioned above. Both had not undergone dental wear. This is further indication that rhinoceros were still extensively distributed throughout the Lijiang basin in the Late Quaternary (see below for a discussion of sedimentary age).

## **Short Discussion of Lijiang Hominid Material**

### ***Homo sapiens***

Three femora derived from the Lijiang sediments are housed in the Yunnan Provincial Museum but have yet to be studied in detail by specialists. Hence only a preliminary report can be provided here.

(1) Left femur (Yunnan Provincial Museum #5083, Gushi 23, App 1): The specimen is well preserved but mostly incomplete on the medial and lateral sides of the proximal and distal ends. The greater trochanter is not preserved but a small portion of the lesser trochanter is present. A portion of the curved femoral neck is also present, but the head is completely missing. At the distal end, both condyles are broken. The length of the element is 32.5 cm and there is nothing characteristic about its morphology. Its coloration is gray-yellow, it is lightly fossilized, and a small amount of gray-yellow clay still adheres to the surface.

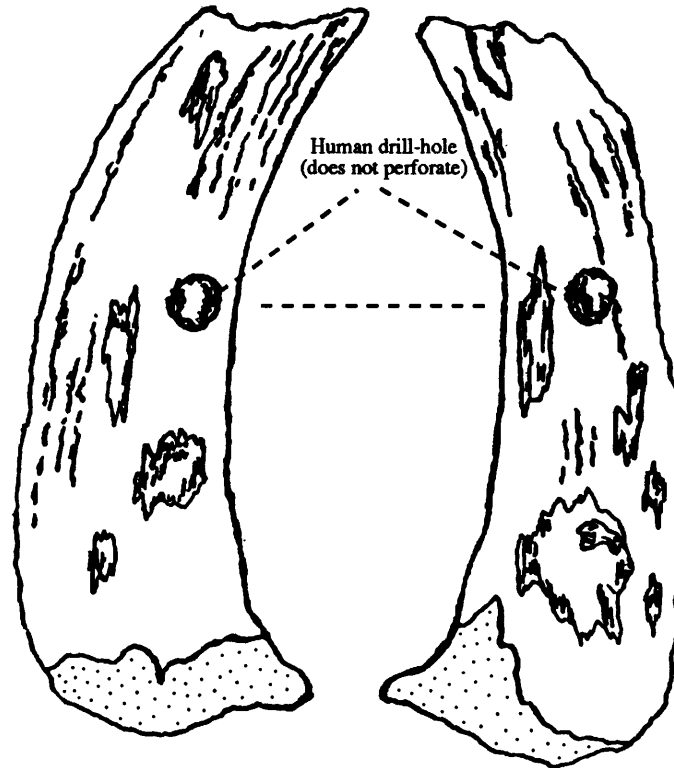
(2) Right femur (Yunnan Provincial Museum # 5083, Gushi 23, App. 2) This specimen occurs precisely like the previous femur and only differs by representing the opposite side of the body. Particularly coincidental is the preserved length of 32.5 cm. Consequently, it appears that these femora may represent a single individual.

Because of the light degree of fossilization, matrix still adhering to the specimen, and other aspects, it appears that these two specimens were not derived from the mammal-producing unit at Locality 6003 but were recovered from an ancient regional grave site.

(3) Left femur (Yunnan Provincial Museum # 5083, Gushi 23, App. 3). This element is relatively completely preserved, but the distal end is more damaged than the previous two. At the proximal end the femoral head and neck are moderately preserved. The ventral surface of the greater trochanter and a small section of bone distal to this has been broken such that the lesser trochanter is unobservable. The linea aspera is distinct, and femoral walls are equivalent to the two described previously. The length of the element is 33 cm. A comparison of equivalently preserved sections to the previous two femora suggests that this is a larger individual, possibly a male.

This specimen is relatively well fossilized and coarse gray sand infills cavities on the bone surface. The grain size of this matrix is equivalent to the coarse sands interbedded with the fine sands at Locality 6003, such that it is very possible that this specimen was derived from the second stratigraphic position at the locality.

Worthy of note is a piece of antler shaft with crude holes bored into both sides that do not appear to have been drilled by metal and that do not penetrate the antler completely (Fig. 6). It is very possible that this specimen was derived from the second fossil horizon, which might indicate that the hominids at that time resembled other contemporaneous hominids in the manufacture of antler tools.



**Figure 6.** Human drill-hole on a *Pseudaxis* antler.

### Summary

The fossils described above are not archaic taxa and are all recent species. Because the geographic position of Lijiang approaches the subtropical regions, the presence of rhinoceros does not indicate a large climatic fluctuation or more archaic time period.

The fossil-producing horizon is uncemented and lightly consolidated, substantiating its age to be younger than Middle Quaternary. But because of the degree of fossilization, the sediments cannot be Holocene in age. Moreover, as indicated above, the fluviolacustrine deposits that have been truncated by the Yanggongjiang River illustrate orogenic activity, and consequently the sediments constituting both banks of the Yanggongjiang River and the fossils recovered from the vicinity of Mujiangqiao Village were initially regarded as Late Quaternary ( $Q_3$ ). Sedimentary perspectives from other workers suggest that the western sandy gravels are comparatively older, while the eastern fine sands are younger or may be  $Q_3^2$ . Further advanced determinations of geologic age must await larger-scaled excavations and more fossil discoveries.



Glacial effects also bear upon the age of the fossil deposits in the Lijiang region. In the summer of 1956 the University of Yunnan organized a field expedition to conduct observations in the glacial regions of the Yulongshan Mountains, on the northwest border of the Lijiang Basin. According to the data of Ren et al. (1957)\* these mountains have undergone three successive glacial stages, including one in the Holocene. From oldest to youngest these stages are recognized as Lijiang Glacial, Dali Glacial, and Holocene Glacial. The lowest descent of ice flow was to the 2,800 m level during the Lijiang Glacial Stage, which Ren et al. believed to probably be Middle Pleistocene (Q<sub>2</sub>). This text concurs with Ren et al. After the Lijiang Stage the ice gradually retreated to higher levels and became restricted to mountain peaks with the result of an absence of interglacial sedimentation. This represented a third glacial retreat and is completely consistent with the results of research conducted within the basin. From the Middle Pleistocene onward a gradual warming occurred within the Lijiang Basin which signified the initiation of the Late Pleistocene (Q<sub>3</sub>). The climate was tropical, resulting in the success of subtropical large mammals including rhinoceros and water buffalo. It was at this time that hominids entered the Lijiang Basin for habitation.

### **Acknowledgement**

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\* Ren, E.M. et al., 1957; Preliminary observations on the geomorphology of the Yulongshan Mountains and Lijiang. *Reports from the University of Yunnan (Natural Sciences)*. April, 1957, 16 p.