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A Canal in Kiangsu Province

Dragon-hunting in China

By J. G. ANDERSSON, Mining Adviser to the Chinese Government

In the December issue, 1915, of the FAR EASTERN REVIEW there appeared an article by J. O'MALLEY IRVIN on "Fossils of the Chinese Dragon" depicting the supposed discovery of fossil remains of a saurian in a cave near Ichang in the middle Yangtze



Fig. 1.—SKULL OF RHINOCEROS
E. MONGOLIA

valley. These objects were found forming part of the floor of the cave and were described as six or eight stone dragons lying coiled together. The length of the largest specimen was something like 65 feet, and legs as well as the head were distinguished by the observers.

The find was interpreted as probably being the fossil remains of an extinct marine reptile, and special stress was laid upon the assumption that these fossils "may clearly indicate the origin of the Imperial Chinese Dragon" and that the discovery at that moment might be considered as "Good Joss" for the then imminent restoration of the monarchy.

For a trained collector of fossils there appeared in this article many statements which made the fossil nature of the objects in question very doubtful, and the illustrations showing parts of the "dragons" exhibited most striking resemblance to stalagmite formations which are very common in limestone caves.

In order to form a definite opinion in the matter I wrote to Mr. M. HEWLETT, British Consul at Ichang, and asked him kindly to get for me a piece of the supposed fossils. Before I had received the specimen for which I have to thank the obliging courtesy of Mr. HEWLETT, I got another piece of the "dragon" collected by a Chinese officer who had been sent by the Government to Ichang in order to inquire into the matter. Both the specimens thus procured show the characteristic composition and structure of lime stalagmites, and I understand that now probably all interested parties discard the fossil nature of these objects.

This case is of considerable interest as showing in a new and striking instance what is well known to the palaeontologist, namely that often inorganic bodies of fanciful shape strongly attract the layman's mind, where again the genuine fossils are mostly inconspicuous objects. It is for instance extremely seldom that the fossil collector discovers a saurian specimen showing the external shape of the reptile's body. Mostly he has to be satisfied with more or less incomplete parts of the skeleton, often only a fragment of the skull or a detached legbone, which require an expert examination before the true nature can be ascertained.

Caves are favourite localities for the fossil hunter, but they do not as a rule contain extinct marine reptiles, but rather a collection of the mammals and birds which lived in the surroundings of the cave at the time when the deposit was formed. In

most cases the cave deposits are refuse heaps collected by carnivorous animals, or a still more interesting case by prehistoric man, who inhabited the cave and left the relics of the meals to form a bone deposit covering the floor of the cave. This type of fossil bone occurrence has already yielded valuable contributions to the prehistoric fauna of China, and there are no doubt still hundreds of interesting caves waiting for the spade and knife of the collector, but the prospective explorer ought to keep in mind, that caves where the bed-rock everywhere forms the bottom, are probably barren, and that only those which contain a loam deposit covering the rock floor offer a favorable chance. Moreover, as far as my limited experience goes, it is little use to go to the big famous caves where, often, entire subterranean temples are constructed, and the virgin state of the cave practically obliterated. The collector will in this case receive little or no guidance from the local population but will have to depend largely upon his own reconnaissance survey of the hill slopes where small and apparently insignificant grottos and rock-shelters may offer excellent opportunities.

An easy chance of obtaining material of fossil mammals is offered by the druggist shops where "dragon bones" and "dragon teeth" are offered for sale as a staple product of the medicine market. It may be said at once that these fossils have nothing whatsoever to do with extinct reptiles. As far as all my experience goes they belong to mammals, partly of tertiary age, partly pleistocene and in some few cases rather recent.

Most likely these fossils are named by the Chinese "dragon bones" and "dragon teeth" simply because they are found buried in the earth layers, and, in many instances, such as the *elephas* and *rhinoceros* teeth, which are of striking size and shape, because they are apparently quite different from the animals now living in these tracts.

There is little probability that these fossils have had anything to do with the rise and development of the dragon myth of Chinese folklore and the dragon design in Chinese art. The Chinese dragon is apparently an allegoric creature of polygenetic nature with the body and limbs of a crocodile, the head of a lion and the horns of a deer. An investigation carried out along the lines followed in the systematic study of vertebrates would probably reveal that there are of the Chinese dragon not only several species but different genera and families as well. In certain aberrant types of this composite monster I have thought it possible to distinguish features probably obtained from the long filamentous appendages at the mouth of the common freshwater fish silurus, from the strange body of the small marine fish hippocampus and from the arms of cephalopoda.

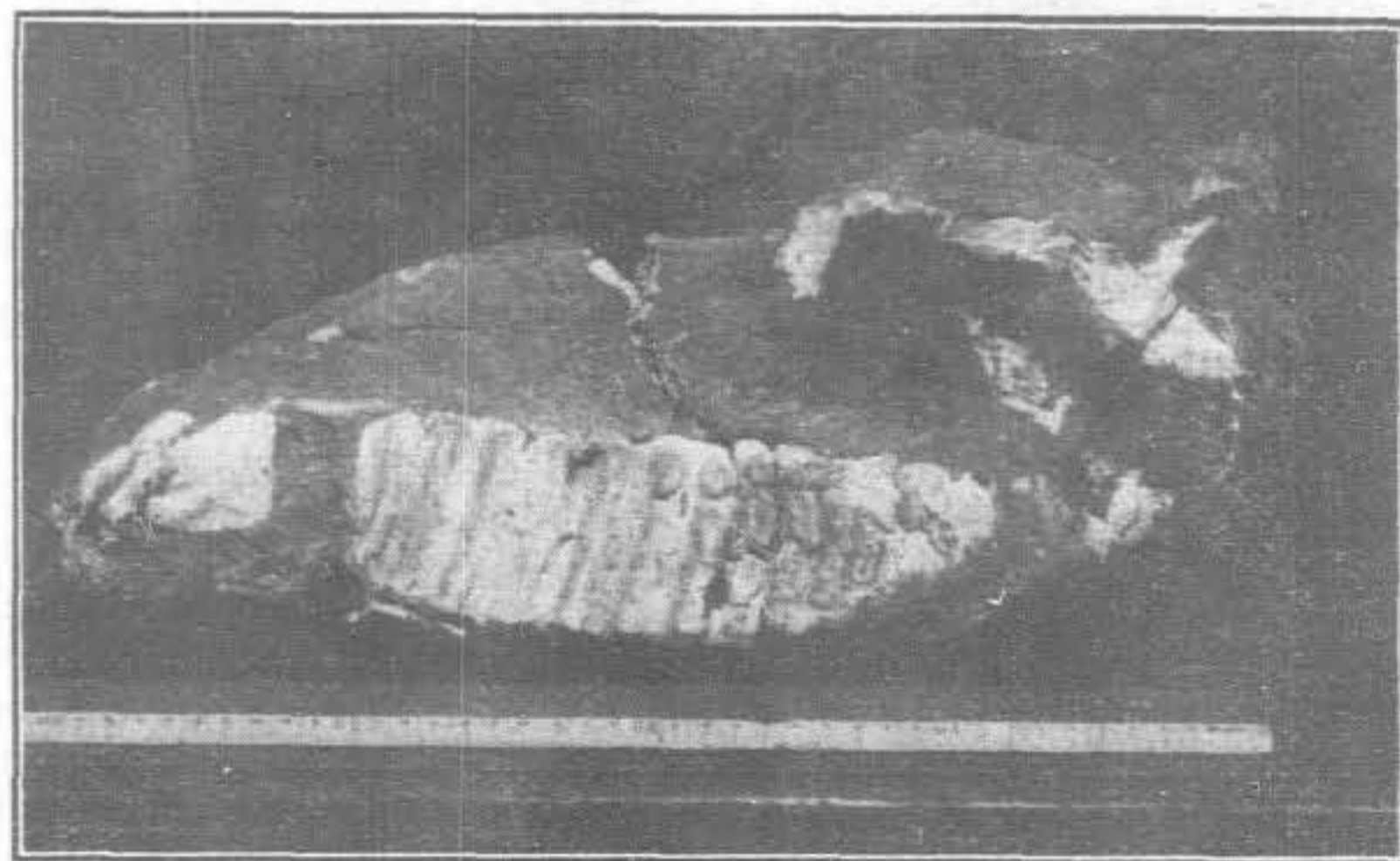


Fig. 2.—MOLAR TOOTH OF ELEPHAS
FOUND IN LOESS, HONAN

The dragon teeth and dragon bones which are sold in the Chinese medicine shops are held in high repute as substances of considerable therapeutic value. The teeth are considered to have a much higher healing power than the bones and are correspondingly higher in price. They are administered, after being

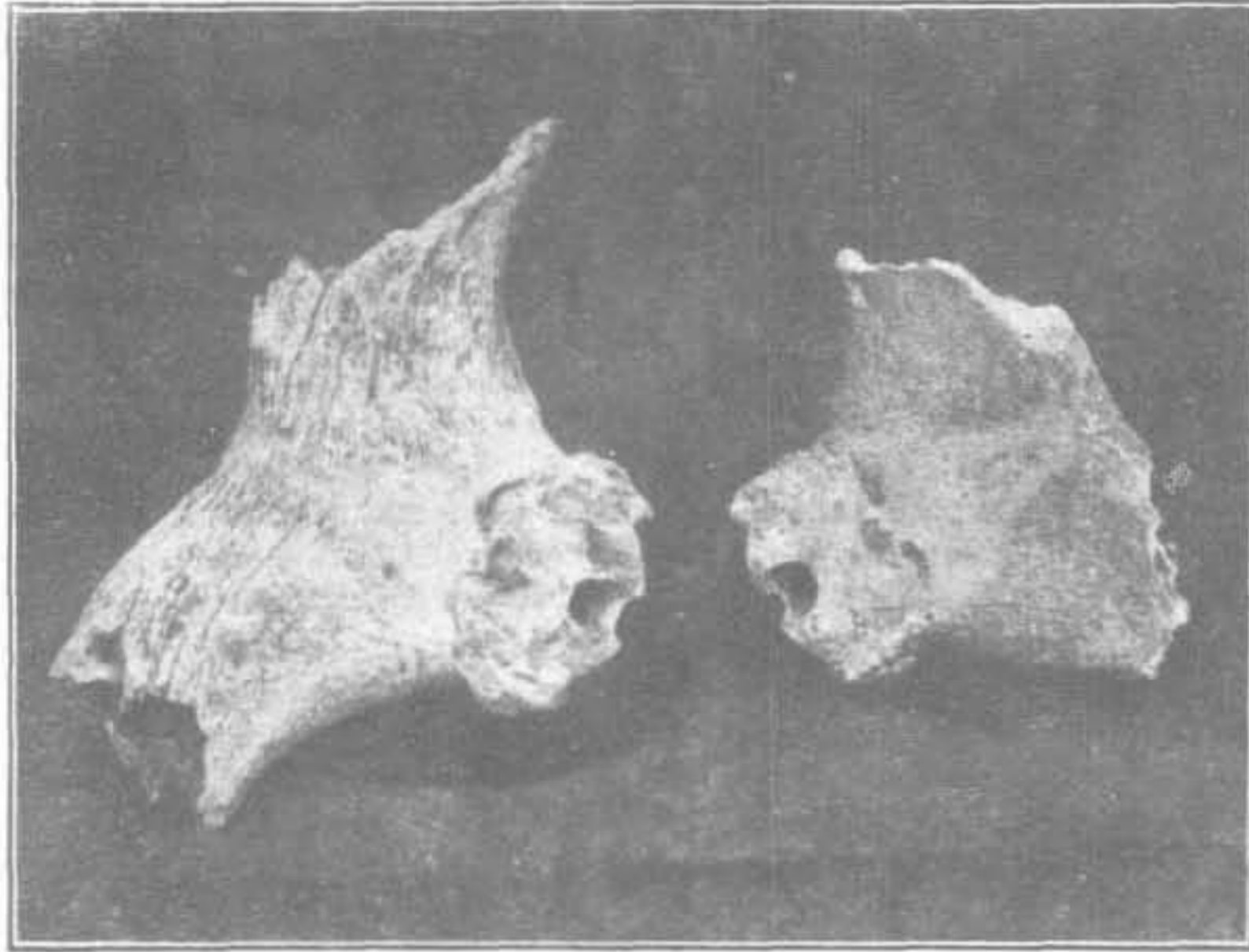


Fig. 3.—SKULLS OF WILD SHEEP
N.W. CHIHLEI PROVINCE

crushed to fine powder, in a suitable dose mixed in a cup of tea. I must confess much ignorance as to the nature of the diseases to be cured by this remarkable drug, but I have been told by a local pharmacist here in Peking that it is good for curing troubles in the liver, for absorbing excessive fluids in the body and for medicating insanity.

During the years 1899-1901 extensive collections of these dragon teeth and dragon bones were collected in druggist's shops in Shanghai, Ichang, Tientsin and Peking by a German naturalist Dr. HABERER, and this material was described by the distinguished German vertebrate palaeontologist, MAX SCHLOSSER, who was able to identify not less than 85 species of fossil mammals, the majority of which lived under the tertiary period, a smaller number belonging to the more recent pleistocene time.

SCHLOSSER's monograph is certainly a product of profound and careful scientific research, but the material at his disposal suffered from serious imperfections which radically reduce the usefulness of his work.

As already mentioned, the fossils had been obtained in Chinese druggist's shops, and, in order to prepare them for medical use, the skulls which were certainly in many cases nearly perfect when they were dug out of the ground, had been crushed to small pieces in order to extract the teeth which as mentioned above are considered to have a specially strong healing effect and consequently command a higher price. Thus our knowledge of these fossil mammals, as far as SCHLOSSER's work goes, is based almost exclusively upon isolated teeth which in the hands of the expert are illustrative to identify the species but cannot of course furnish sufficient evidence to reconstruct the exact dimensions of the whole animal.

Moreover, we know very little about the conditions under which the fossils are found, and in the vast majority of cases even the locality or province from where these fossils originate are only very vaguely known, as the dealers in this kind of merchandise are rather anxious to keep secret the location of the places from where they obtain their goods.

When in 1917 it was decided within the then recently established Geological Survey of China to begin systematic researches on the extinct faunas of China, we first tried to trace the material backwards from the retail medicine dealers to the localities where they had been excavated. But it soon became evident that they only could be followed to some big medicine markets which they had reached after having passed through so many hands that their origin was very much obscured.

We then started a new campaign by sending out to the mission stations all over China, Protestant as well as Catholic, and also

to other foreign residents, a circular letter asking for volunteer aid in the extensive research work just started. The missionary has, the whole world over, proved a most devoted and effective collaborator in scientific work, whenever his assistance has been asked for, and the response accorded to the Geological Survey of China was up to the highest standard of this distinguished body of foreigners. This is not the proper place to acknowledge in detail the important and varied services rendered to us by missionaries, but in order to indicate the cordial relations between the Government organs and the missionaries in this scientific enterprise it may be proper to mention that the Minister of Agriculture and Commerce has, in recognition of valuable contributions to the Museum of the Geological Survey, granted special honours to two of our most active co-workers, Père FL. DE PRETER, of the Belgian Mission, Sungshutsweize, Eastern Mongolia, and the Rev. A. BERTRAM LEWIS of the China Inland Mission, Hotsin, South Shansi.

From the mission stations as distributing centres a small circular in Chinese has been spread over considerable areas of Northern China, and it is safe to say that many thousand villagers have read and meditated over our appeal for contributions of dragon bones and our promise to pay suitable reward to the discoverer of such material.

The harvest of specimens and observations at present in our hands is already considerable.

We know in broad lines the composition and distribution of the pliocene fauna contained in the red clays which form one of the most common soils in the northern provinces. This fauna has been named the *hipparion* fauna after one of its most common species, the three-toed horse *hipparion*, a distant ancestral precursor of the *equus* of to-day. Next in importance in this extinct fauna are the *rhinoceroses*, represented by the genera *aceratherium* and *rhinoceros*. The slender and elegant jaws of *antelopes* are also very common, and in the second line follow some species of the genus *sus*, carnivorous mammals such as *hyenas*, *rodents*, etc. These ancient animals evidently enjoyed a genial climate, strolling in herds over the even grass lands or swarming to their hearts' delight in the ponds and streams of the sheltered fertile valleys.

A somewhat younger fauna, probably late pliocene or early pleistocene, has been discovered in certain river deposits. Besides numerous freshwater molluscs these beds have yielded remains of an *elephas*, not yet specifically identified.

A sediment, widely distributed all over northern China and most conspicuous because of its tendency to form deep gullies and precipitous cliffs is the loess, the yellow earth or *huang t'o* of the Chinese. Everything points to the conclusion that this soil, which locally attains a thickness of more than a hundred feet, was formed during an arid and cold climate, largely by means of aeolian deposition. Probably the loess of Northern

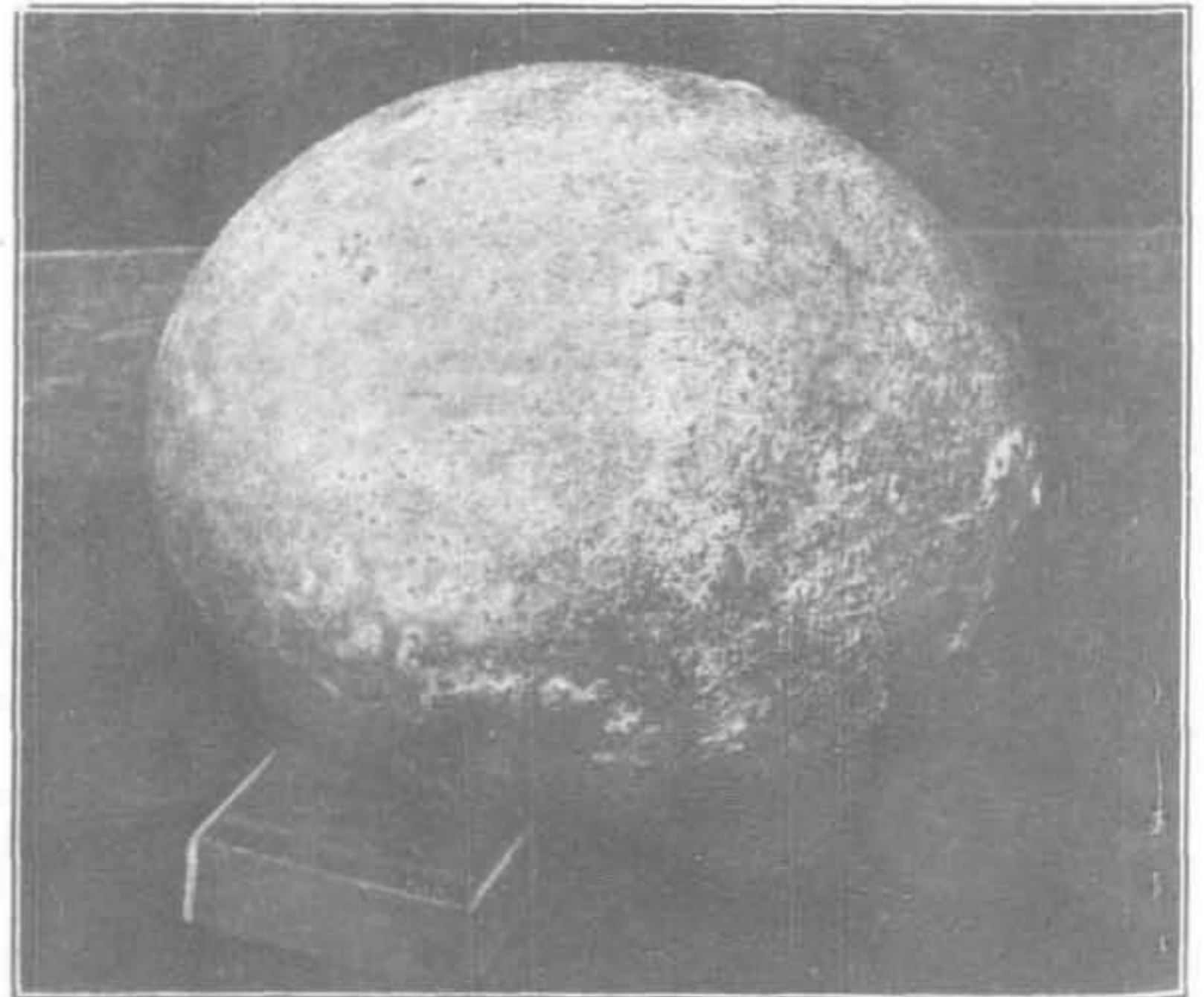


Fig. 4.—EGG OF EXTINCT OSTRICH (STRUTIOLITHUS)
SHANSI

China is a steppe facies of the great ice age of Europe and North America. Fossil mammals are rare in the loess and the specimens are isolated and fragmentary. Pieces of tusks and molar teeth of an *elephant*, nearly related to the mammoth have been unearthed in several localities, and some beautiful skulls of rhinoceros may also belong to the genuine loess.

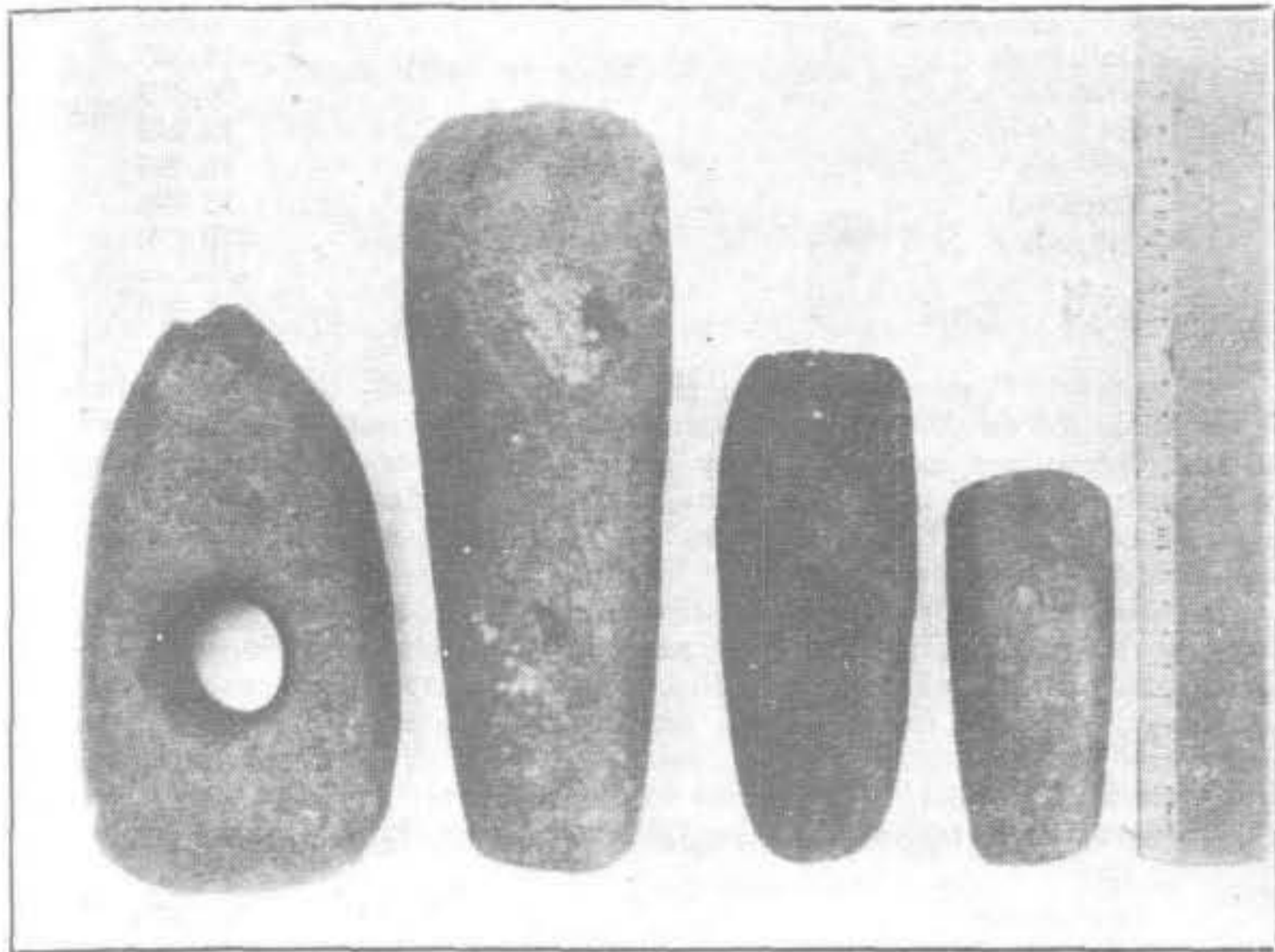


Fig. 5.—STONE HAMMER AND STONE CHISEL
E. MONGOLIA

In redeposited fluviatile loess and gravels we find a fauna nearly resembling that of to-day and containing amongst other forms the big deer, the *wapiti*, and the *wild sheep*. Numerous skulls of the latter have been collected in the plains of Hsuan-huhsien and Lungkuanhsien of north-western Chihli from where the wild sheep have now entirely disappeared.

A most remarkable fossil, in fact one of the most fascinating objects to be collected in these tracts, are the gigantic eggs of an extinct *bird*. Such eggs have certainly been unearthed in hundreds in Northern China, something like 15 specimens being at present well-known to the writer. An egg of this kind was brought to the United States in 1896 by the Rev JAMES H. ROBERTS and was described by C. R. EASTMAN under the name *struthiolithus chersonensis*. The bird probably belonged to the ostrich group, and its size can be approximately estimated from the fact that the fossil eggs measure 173-186 millimeters in length, when compared with 140-160 millimeters for recent ostrich eggs. We do not know with full certainty the age of this extinct ostrich, but it seems most probable that the eggs come from the loess. This question is one of the many inviting problems waiting for continued research, and still more imperative is it to get some parts of the now unknown skeleton, as only then can the systematic position of this big bird be definitely settled.

* * *

I have often been asked by interested friends and layman co-workers about the age of the fossils found in the different earth-layers of Northern China. The question is a rather unwelcome one as the method of the geologist is to record, not in absolute figures but in relations of one group of fossils or one group of sediments to others. From China we have no data allowing even a rough calculation of absolute figures, but it can be mentioned that an American author has estimated the time elapsed since the beginning of the pliocene, the age of the hipparion fauna to one million and a half of years, and that the duration of the ice age has been put to half a million years.

In France, the classical ground of palæolithic research, the history of mankind has been traced backwards with admirable fulness through a number of succeeding progressive cultures for a period of somewhat more than 100,000 years. If the still more primitive *homo heidelbergensis* and the *pithecanthropus* of Java are taken into consideration, it may be possible to trace the early history of man backwards something like half a million years.*

The history of the Chinese race dates back some 5,000 to 6,000 years. Previous to that time the history of man in these tracts is practically unknown.

In SCHLOSSER's collection there was a tooth of an *anthropoid mammal*, and a Japanese scientist MATSUMOTO has recently described from Honan a fossil *human sacrum* which offers striking affinity to the sacrum of the palæolithic *homo neanderthalensis* of Western Europe. But these data are at present too isolated and uncertain to afford any reliable basis for a record of the early history of man in North China.

A small number of stone implements of neolithic type found in widely different parts of China, Chihli, Shensi, Szechuan, Yunnan, Chinese Turkestan and Mongolia have been described by various authors. Recently much new material has been forwarded in LAUFER's admirable treatise on Chinese Jade and in two important papers by the Japanese archæologist TORII on Neolithic implements from South Manchuria and Eastern Mongolia. Now we have taken up this line of research, and a beautiful collection of stone implements from Manchuria, Eastern Mongolia and North-western Chihli is at present in my hands.

It seems to be a current opinion that the Chinese are originally immigrants in their present home-country, that they migrated from an earlier home in the interior of the continent and that they carried with them at the time of their arrival to the present China a considerably developed civilization. LAUFER seems to be of opinion that they had left behind them the stone stage, and he expressly points out that they were in the possession of metals and bronze implements when they settled in Shantung, where, however, a number of stone implements have been collected by Mr. S. COULING. Consequently it is reasonable to assume that these implements did not originate from the Chinese invaders but have emanated from the hands of earlier aboriginal tribes.

In the same way the stone implements collected by JOHN ANDERSON and J. COGGIN BROWN in Yunnan are, by LAUFER, ascribed to the non-Chinese culture-group, possibly the Shan tribe, and according to the detailed investigations carried out by TORII the numerous stone implements found in Eastern Mongolia were manufactured by the Tung-Hu, the ancestors of the present Mongols.

The majority of the polished stone implements found in China are evidently of no high antiquity and can in the terms of Chinese records not be called pre-historic. The flint arrow-

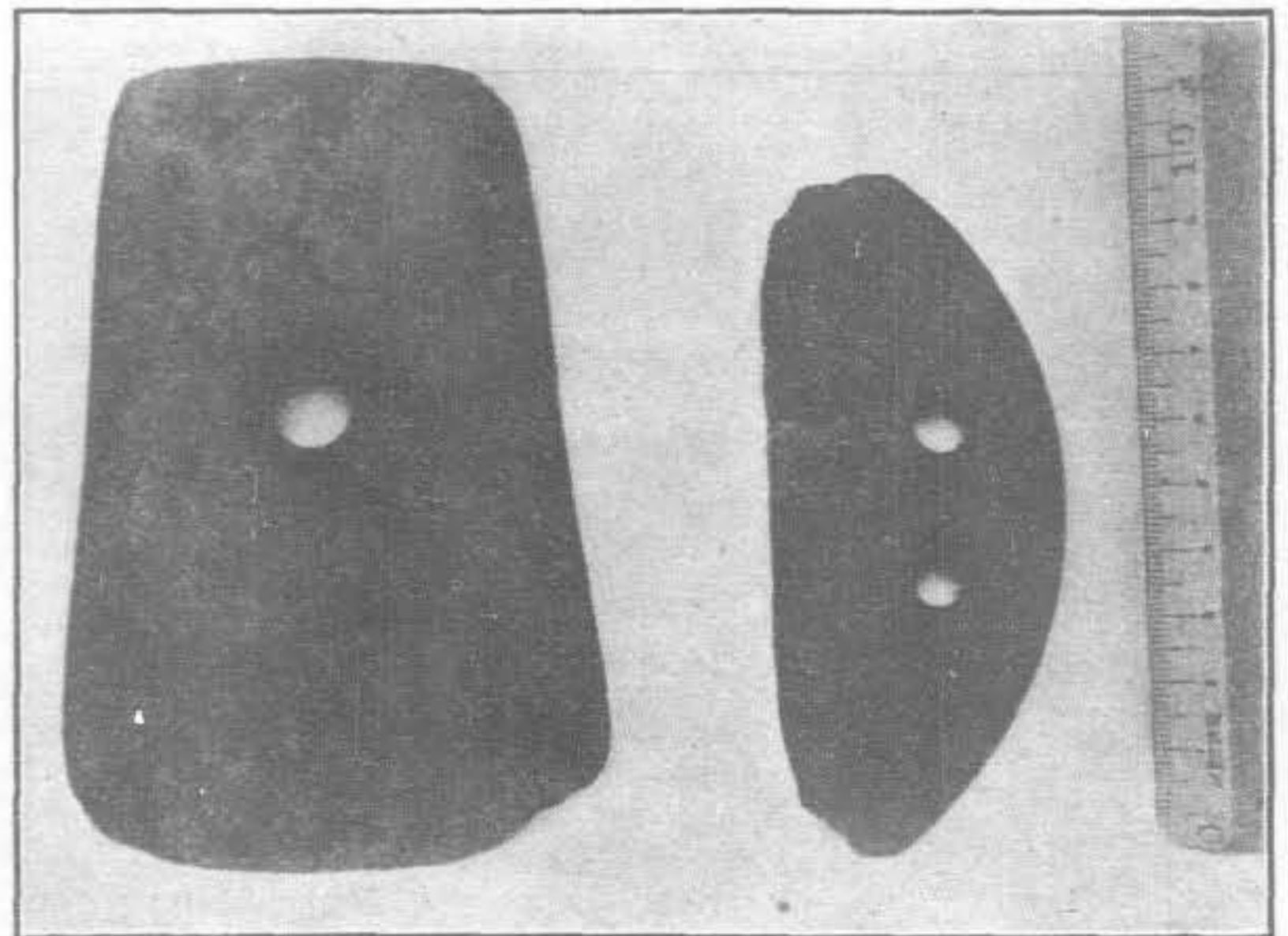


Fig. 6.—STONE CHISEL AND STONE KNIFE
E. MONGOLIA

heads collected by ARMAND DAVID in Mongolia were found together with metal instruments. In Eastern Mongolia coins from the second Han Dynasty have, by TORII, been found together with stone implements and ancient pottery. Consequently the stone implements at present known ought to be assigned, not so much to Pre-Chinese peoples as rather to frontier tribes of lower civilization living at the outskirts of the growing empire where metals were already in extensive use.

* H. F. Osborn: Men of the old Stone Age. Third Edition. New York, 1918, pp. 40-41.

The above rapid sketch may suffice to show that at present very little is actually known about the late geological history and the early archaeology of China. We are just able to catch a glimpse of the magnificent dynasties of *rhinoceroses* and *elephants* who reigned here in late pliocene and early peistocene times, but so far we have not even found the slightest trace of the early primitive human tribes who fought the huge beasts, made chase upon the herds of the gigantic ostrich and finally settled down to till the vast plains and the fertile valleys.

This article is written as an appeal to the scientifically interested public to assist the Geological Survey of China in its researches along the lines here indicated.

The objects we are hunting are mostly inconspicuous and fragmentary and afford nothing of the attraction attached to the curios, such as porcelain, bronze and jade objects. Even to the biologist the fossils found in this country offer little of novelty. Nothing like the startling discoveries of past decades in North and South America can be expected here, where the fossil mammals all belong to well-known types and even the species are in many cases already described. But to the student of old continents and past climates these broken bones often reveal stories of noticeable interest.

It is not the discovery of a mammoth-tooth itself that offers the opportunity to the scientist, but rather the circumstances under which the find was made, the kind of soil in which the tooth was imbedded, the details of the whole section exposed and the topographical features of the surroundings. Therefore it is imperative that finds of this kind be reported to an organized and resourceful body of experts who can undertake a detailed examination of the locality where a fossil skull or a human artifact has been unearthed.

Any communication on these matters addressed to *The Geological Survey of China, Ministry of Agriculture and Commerce, Peking*, will be highly appreciated and meet a prompt reply from the Directors of the Survey or from the writer of this article. To every prospective volunteer co-worker we will be glad to send our circulars in Chinese to be distributed amongst the local population. It goes without saying that we are prepared to pay all the expenses incurred and to give suitable monetary reward to the natives who have found the objects forwarded to our institute.

Formosa Coal Industry

The output of coal by the principal mines in Formosa in 1918 was, according to the "Japan Chronicle," as follows:—

	Tons.
Shikyakutei	125,913
Keelung Coal Mine	68,619
Kyunem No. 1	18,445
Kyunem No. 2	24,369
Daikanrin	14,040
Shimno	26,019
Sekikoko	13,949
Daisoko	18,493
Roku-sai	12,495
All other	479,178
Total	801,520

"All other" represent more than half the total, but they include no fewer than 268 small mines and in no case was the output in 1918 as much as 10,000 tons per annum. They are mostly mines that have sprung up in the course of the past 18 months, and owe their existence to the present high price of coal. Some may turn out to be good mines, but the majority will probably be short-lived.

Of the mines mentioned, nearly all are near Keelung. Good quality coal at present costs about Y.19 per ton at Keelung. So far only one British ship has bunkered there this year. Hitherto, Formosan mines have in general suffered from lack of capital, but Mitsui's are now interested in several of the larger and a considerable number of small ones, so that this drawback should be remedied to some extent.

Exports of Formosan coal in 1918 were as follows:—

	Tons.
Hongkong	186,473
China	88,682
Philippines Is.	6,801
Other countries	130
Total	282,086

These were valued at Y.2,893,754—an increase of 29,000 tons and Y.1,102,895 as compared with 1917. The increase in value is striking and shows how the price has risen in the past year. This rise in price has been even more pronounced in 1919, as the exports for the first five months of this year amounted to 170,390 tons, valued at Y.2,543,856.

Mining methods at most of the coal mines in Formosa are very primitive and little machinery is used. The system is generally to dig the coal out along the outcrop as far as possible. Now, however, some of the large mines are getting deeper, and with the entry of Mitsui's more progressive measures may be adopted.



CHUNGKING, THE GREAT TRADING

Chungking is the great river port of Szechuan. Here the produce of a large hinterland is accumulated for export, trade now being conducted with the outer world through junks and a few light draft steamers which brave