THE LITHIC INDUSTRY OF THE *SINANTHROPUS* DEPOSITS IN CHOUKOUTIEN

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1 The present paper on the Choukoutien industry is a common development made by the authors, using the last available data, of a manuscript prepared by Mr. W.C. Pei in the course of the winter 1932.

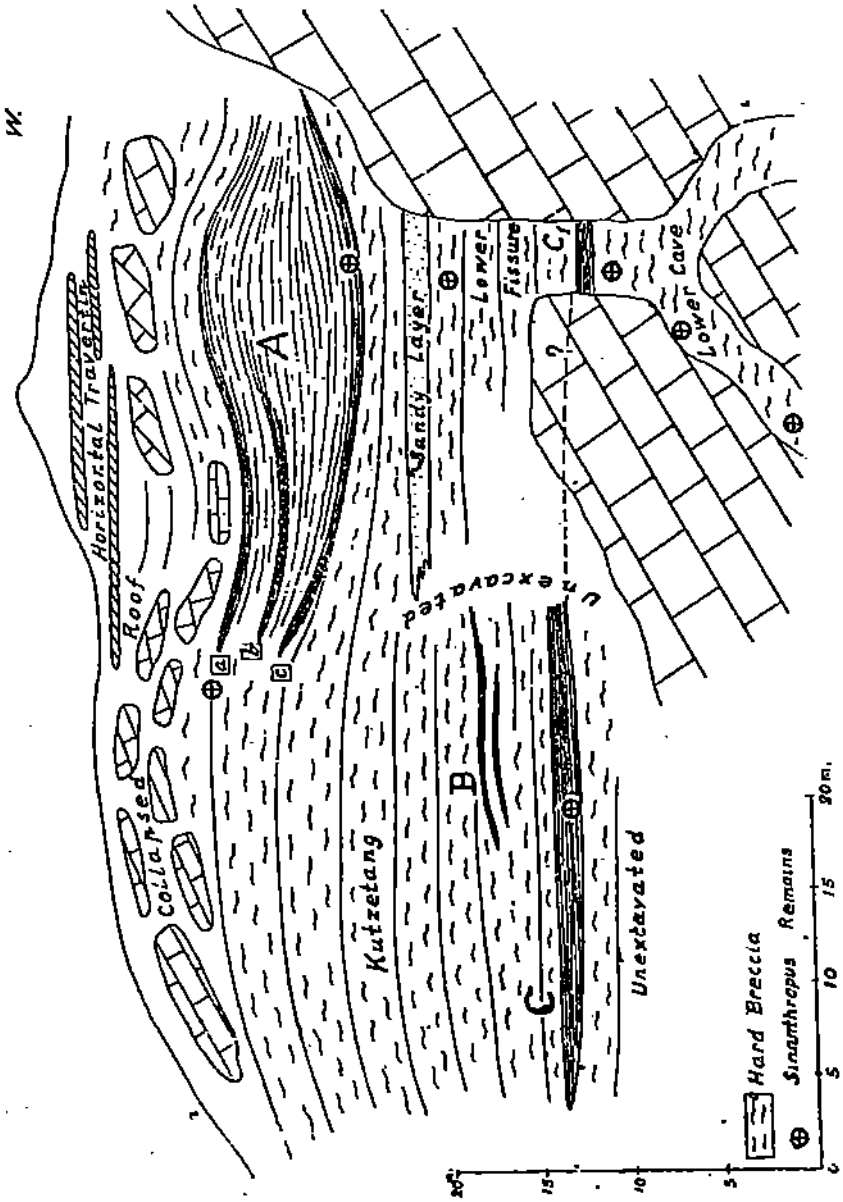

Fig. 1, a.—Archæological section of the Choukoutien Locality 1. *A* (*a,b,c,*) *B,C*, cultural zones (cf. the text).

Introduction.

A preliminary description of the first stone implements found in direct association with *Sinanthropus* remains in Choukoutien has already been published in the preceeding number of this Bulletin.[1] But since that time, the study of a much more abundant archæological material, further observations in the field, and also a gradual shifting in the Choukoutien prehistorical problems, make it advisable to give a new and supplementary exposition of the facts.

A short review of the chief cultural levels so far recognized in Choukoutien, then a detailed study of the lithic industry so far collected *in situ* in the deposits, and finally a statement of the actually solved or non-solved parts of the Choukoutien riddle: such will be the division of the present paper.

The Cultural Layers in Choukoutien (Figure 1)

In the present state of the excavations (spring 1932) the sediments of the Choukoutien Locality 1 (*Sinanthropus* cave) can be described as a massive accumulation of hard coarse breccia, in which three cultural zones at least, can be distinctly recognized (Figure 1, A, B, and C).

In the uppermost cultural *Zone A* we include the whole (7 meters thick) accumulation of banded yellow, red and black sandy clay indicated as "Layer 4" in the preliminary report of 1930.[2] This entire deposit (as observed by Prof. Breuil in 1931) is an ashy deposit, in which three layers at least containing artificially broken quartz (Quartz Layers) have been observed: an upper one *a* (Quartz Layer 3 of Pei); a middle one *b*; and lower one *c* (Quartz Layer 1 of Pei). The Quartz Layer *Aa*, especially rich in the eastern part of the deposits (near the Kutzetang), is strongly consolidated into a breccia, which by a dense accumulation of quartz chips and burnt bones, is strikingly similar to the classical culture layers met with in the caves of Western Europe;

1 See W. C. Pei, Notice of the discovery of quartz and other stone artifacts in the Lower Pleistocene hominid-bearing sediments of the Choukoutien cave deposit. Bull. Geol. Soc. China, Vol. XI, No. 2, 1931, pp. 110-141.
cf. Davidson Black, Evidences of the use of fire by *Sinanthropus*, ibid., pp. 107-108.
cf. H. Breuil, Le feu et l'industrie lithique et osseuse à Choukoutien, ibid., pp. 148-154.

2 Teilhard de Chardin, P. and C. C. Young, Preliminary report on the Choukoutien fossiliferous deposits, Bull. Geol. Soc. China, Vol. VIII, No. 3, 1930, pp. 173-202.

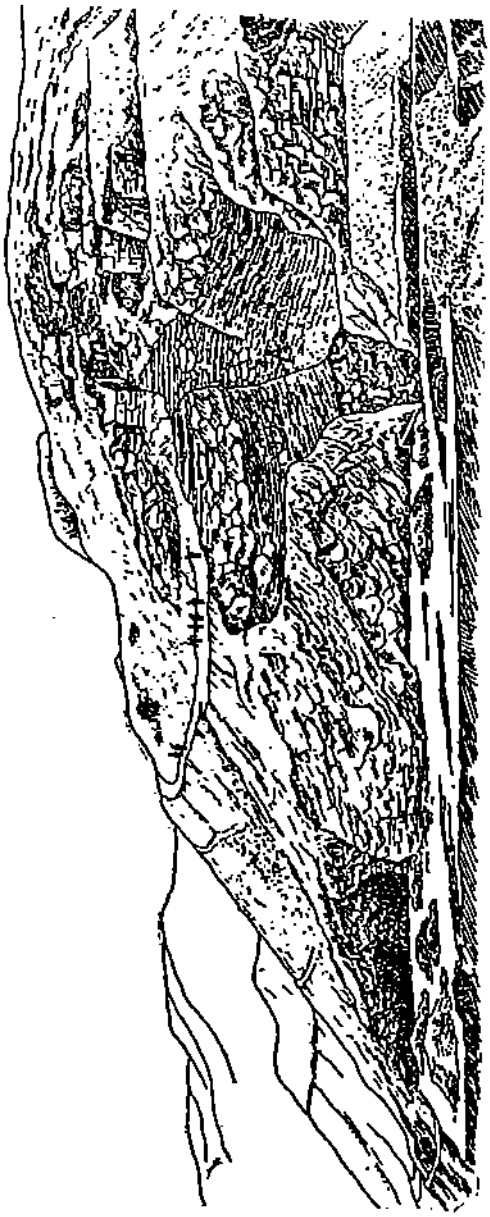

Fig. 1, b.—A general view of the Choukoutien Locality 1. At the left corner, the entrance of the Kotzetung. *A* and *a*, cultural layers (cf. fig. 1, a).

the *Sinanthropus* Locus B belonged probably to this level. The Quartz Layer *Ab* is at present scarcely known. The Quartz Layer *Ac*, first recognized in April 1931 by Pei, Teilhard and Young, (Quartz Layer 1 of Pei), seems to correspond stratigraphically with the *Sinanthropus* Locus A.

The Middle Cultural *Zone B* is only represented by two thin (50 cm thick) ayers of red and black sandy clay (ashy layers) crushed and laminated in the mass of the stratified hard coarse breccia in the eastern part of the deposits (Kutzetang). It lies 8 meters under the Quartz Layer 1 (*Aa*) and 4 meters above the Lower *Zone C*.

The Lower Cultural *Zone C* (Quartz Layer 2 of Pei) has exactly the same lithological characters as the Upper *Zone A* (gray, yellow, red and black banded sandy clay), but where exposed is only 2 meters thick on the average. It corresponds possibly with a rather thin ashy layer (yellow, red and black sandy clay) *C1*, containing foreign rock pebbles, clearly observed in the "Lower fissure", in the vicinity of Layer 10 of the Preliminary Report of 1930 (loc. cit.) The fauna collected in *Zone C*, in association with the ashes and stone artifacts, is abundant and characteristic. In addition to *Sinanthropus* (two lower jaws, several pieces of skull, a clavicle) it includes the following types: *Equus sanmeniensis*, *Rhinoceros "sinensis"*, *Rh.* cf. *tichorhinus*[1](?), *Elephas namadicus*, *Cervus* (*Euryceros*) *pachyosteus* (a fine antler, etc.), *Spirocerus peii* (a frontal with two horn cores), *Ovis ammon* (burnt horn cores), *Hyaena sinensis* (bones and coprolithes), *Struthiolithus*. The several sub-layers (*a*, *c*, *e*) of the *Zone C* as recognized by Pei (loc. cit., 1931, p. 118), namely the descending succession of grey, yellow, red and black sandy clays, are very constant; but their faunistical and archæological content seems to be very variable. For instance, in the course of a limited excavation made recently in the eastern part of the deposit, the richest quartz level was found above, not under, the black layer *c*.

Outside of the three *Zones A*, *B*, *C*, artifacts occur probably from place to place, scattered in the mass of the brecciated sediments. For instance, a clearly chipped fragment of quartz has been given to Mr. Pei by the workmen

1 Just as in Nihowan (see Teilhard de Chardin, P. and Piveteau, J., Les Mammifères fossiles de Nihowan. Annales de Paléontologie, T. XIX, 1930), a *Rh.* cf. *tichorhinus* occurs in Choukoutien, in habitual association with the typical Lower Pleistocene fauna, and especially with *Rh. "sinensis"*. The species here designated "*sinensis*" is almost certainly a new one, closely allied to *Rh. merckl*.

Fig. 1, c.—An interior view of the Kotzetang. *B* and *C*, cultural layers (cf. fig. 1, a). The wall is entirely made of solid brecia.

as found in the Lower Cave; and we can mention also several artificially (?) scored bones found in the vicinity of the so-called "sandy layer" of the western deposits[1]. Therefore, further observations will possibly prove that traces of industry are to be found in the entire series of the Locality 1 deposits. It would seem, nevertheless, that the number of individuals engaged in the lithic industry represented by these artifacts, had probably been increasing gradually in the course of the time. A characteristic abundance of *Hyaena* and *Ursus* remains, pointing to a reduced occupation of the cave by the Man, is observed in the lowest parts of the formation; and on the other hand, the big cultural *Zone A* extends not far from the presumably terminal layers of the cave.

The archaeological material coming from *Zone A* is extremely rich. But since it has been collected chiefly in the "déblais" of the 1928 excavations (the artificial nature of the quartz chips not being realized at that time), its detailed description will be only given when further researches (actually started) will enable us to study a series of such specimens found actually *in situ*.

The *Zone B*, highly interesting stratigraphically, has so far yielded but a small series of clearly flaked boulders (choppers, see below, Figures 33 and 34).

The present paper therefore will deal chiefly with the artifacts collected, surely *in situ* and in immediate association with *Sinanthropus* remains (see Pei, loc. cit., 1931, p. 118), in the *Zone C*. In a last paragraph only, a few specimens of *Zones A* and *B* are described, the first ones chiefly in order to make clearer the definite nature and the remarkable constancy of some types of implements across the whole Choukoutien deposit.

We have thought better not to deal at present with the non-lithic industry of Choukoutien (recently emphasized by Prof. Breuil, loc. cit., 1931) because the question, not sufficiently clear so far, is still under study and discussion. A brief mention will only be made (p. 354) of some surely artificially broken, or incised or burnt bones collected in the deposit.

1 This "sandy layer" (see Figure 1, *a*), especially rich in well preserved fossils (entire skulls of *Sus* and *Bubalus*, complete antler of Sika deer, etc.) has yielded so numerous deeply incised bones, that it might prove, by further excavations, to represent a fourth and important cultural layer.

A DESCRIPTION OF THE LITHIC INDUSTRY FROM *ZONE C*.

So far, the cultural layers of the *Zone C* have been excavated over about 16 x 10 square meters, a work resulting in the discovery of several thousands of minor fragments of stone, and more than a hundred of chipped or intact boulders of foreign rocks.

The boulders consist mostly of a moderately hard, easily weathered, green sandstone (metamorphosed Jurassic sediment), but also of vein quartz[1], and exceptionally of quartzite or quartz-porphyric rocks.

The minor fragments are practically only vein quartz, with the exception of a few pieces made of a beautiful transparent quartz crystal. Chert is only represented by two or three flakes. Three good artifacts in limestone are described below, p. 348.

The quartz and greenstone boulders would be easily found by the Choukoutien cave dwellers in the adjacent river-bed. But the quartz crystals, with their perfectly preserved facets, were more probably searched for *in situ*, in the granitic massif found some seven kilometers north of the cave.

In comparison with the enormous quantity of broken stones collected in the Zone C, the number of specimens sufficiently flaked or chipped to be designated as "implements" is rather small: no more than 150.

On the other hand, the generally ill-definite characters of these pieces, together with the irregularly breakable nature of their substance, make their study and their illustration especially difficult.[2]

We shall try however to present their description in the most clear and rational way we can, perfectly aware that our classification is still largely artificial, provisional and subjective.

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1 In some cases, this quartz is derived from pegmatitic veins in the granite; in some others from intrusive seams in the adjacent Carboniferous series.

2 A serious difficulty was experienced in rendering the illustrations of the present paper adequate for expressing in a distinct, and nevertheless in a true way, the chipping of the quartz implements. In fact, our sketches give too much the impression of flint artifacts; but taken as a partly diagrammatic expression of the Choukoutien industry, they are correct: each represented trace of flaking or chipping has been carefully checked on the specimen, any trace of breaking referable to some recent cause being omitted in the sketches.

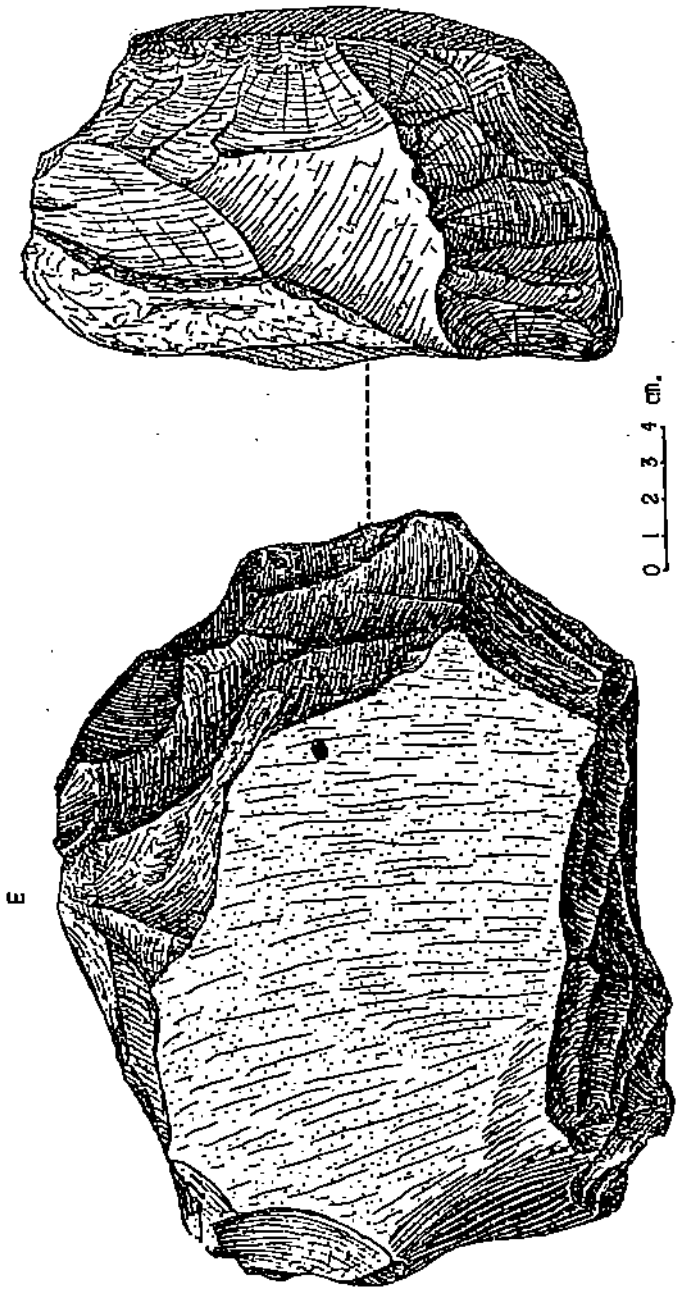


Fig. 2.—Squared block in greenstone (chopper). (Zone C).

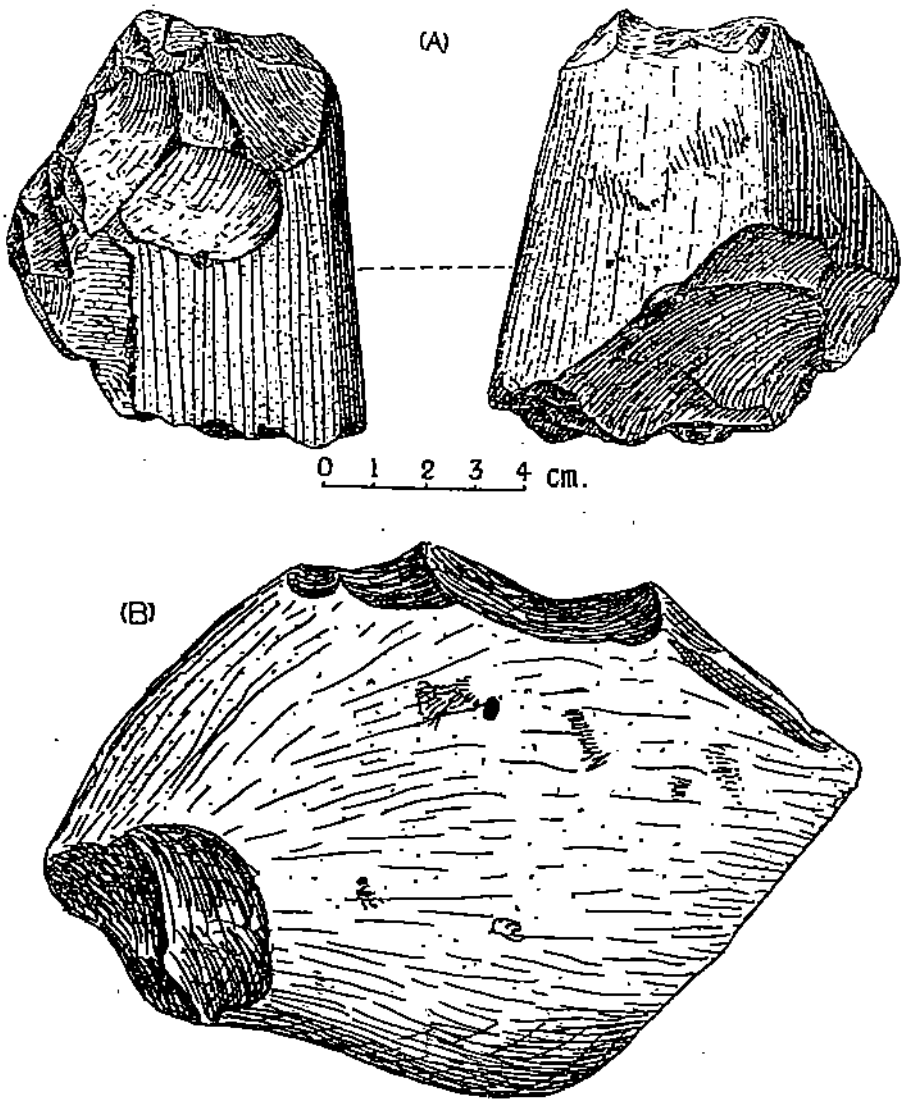


Fig. 3.—*A*, Flaked boulder (chopper?) in greenstone. *B*, Crude chopper in greenstone. (Zone *C*).

I. *Flaked boulders*

As a first category of implements, we may consider those artifacts which are made of entire boulders of large fragments of boulders. In this group, the following types are recognisable:

A. *Squared blocks* (one specimen, *Figure 2*). A large boulder of greenstone (210 × 170 × 90 mm) distinctly squared on three sides by a vertical

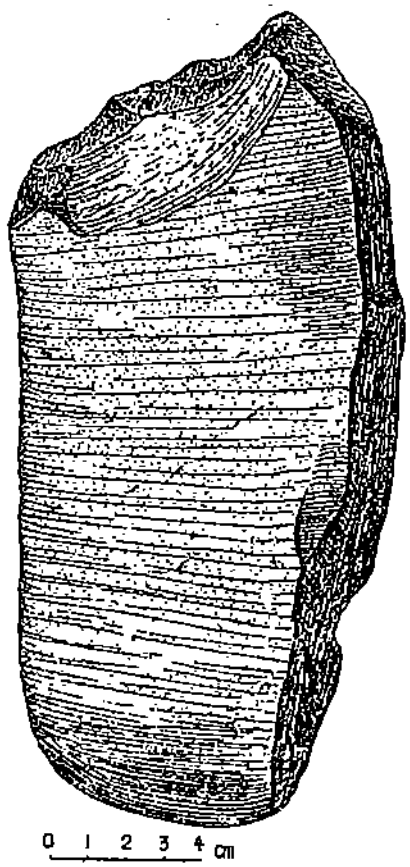


Fig. 4.—Elongated chopper in greenstone (Zone C).

flaking. Traces of blows (produced by use) are recognizable along the fourth side *E*, so that the interpretation of this block as a large chopper is possible. In any way, the occurrence in the *Zone C* of several large flakes made of the

same rock proves that the squaring of the boulders was a common practice among the dwellers of the cave.

B. *Truncated boulders* (four specimens). A series of smaller boulders seem to have been systematically truncated by transversal flaking, in order to separate the rounded tip or "head" of the pebble. Such as they are, these truncated boulders might have been used as crushing tools, the convex part working as a rounded hammer. But, with the possible exception of one case, no traces of blows are observable on this part of the stone.

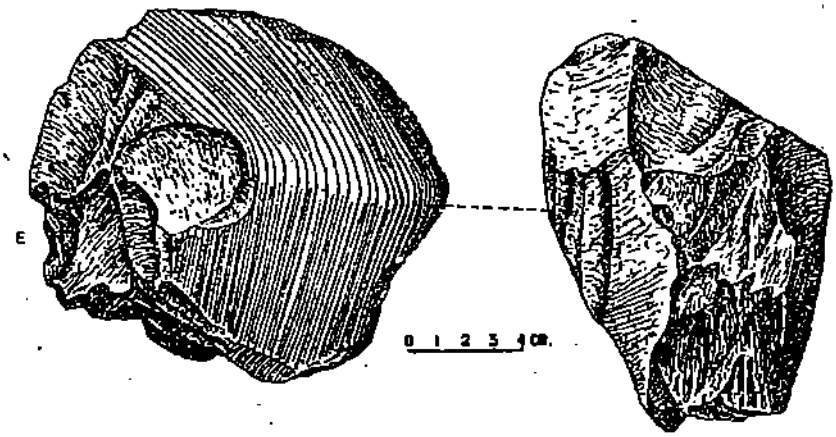


Fig. 5.—Crude chopper in greenstone (Zone *C*). *E*, the edge flaked by use.

C. *Choppers*. The majority of the chipped or flaked boulders collected in the *Zone C* seem to represent more or less trenchant choppers, in which three categories can be distinguished: the crude choppers (no preparatien of the boulder); the choppers with a prepared heel; the choppers with a possibly prepared edge.[1]

(a) *Crude choppers*. The simplest type of this category (*Figure 5 B*) (four specimens) consists in flat and large pebbles of greenstone hammered in one or several places along their natural edge, the edge splitting, and becoming sharpe by simple use.

In the somewhat more specialized choppers such as the one illustrated in *Fipure 4* (three specimens in greenstone), the boulder or fragment of boulder is elongated, and a definite end has been split or flaked *by use*.

1 No clear specimens of the "pitted boulders", so common in the *Zone A* have been reported so far from the lower *Zones*.

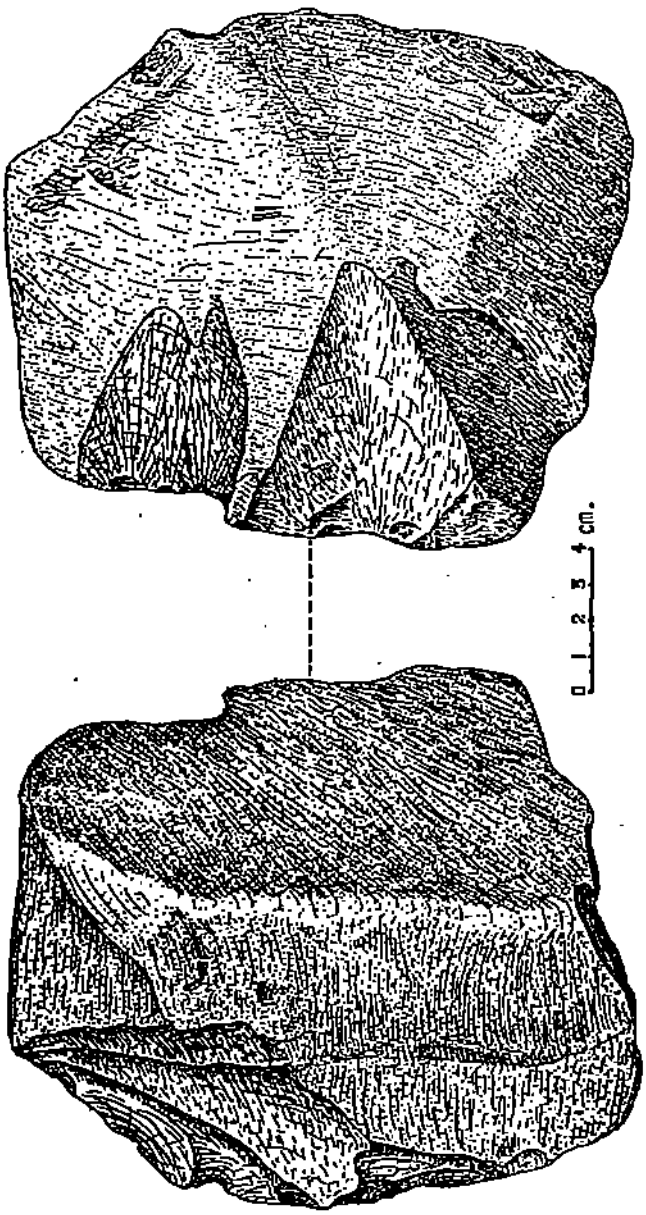


Fig. 6.—Crude chopper in greenstone (Zone *C*). Two edges of the boulder are flaked by use.

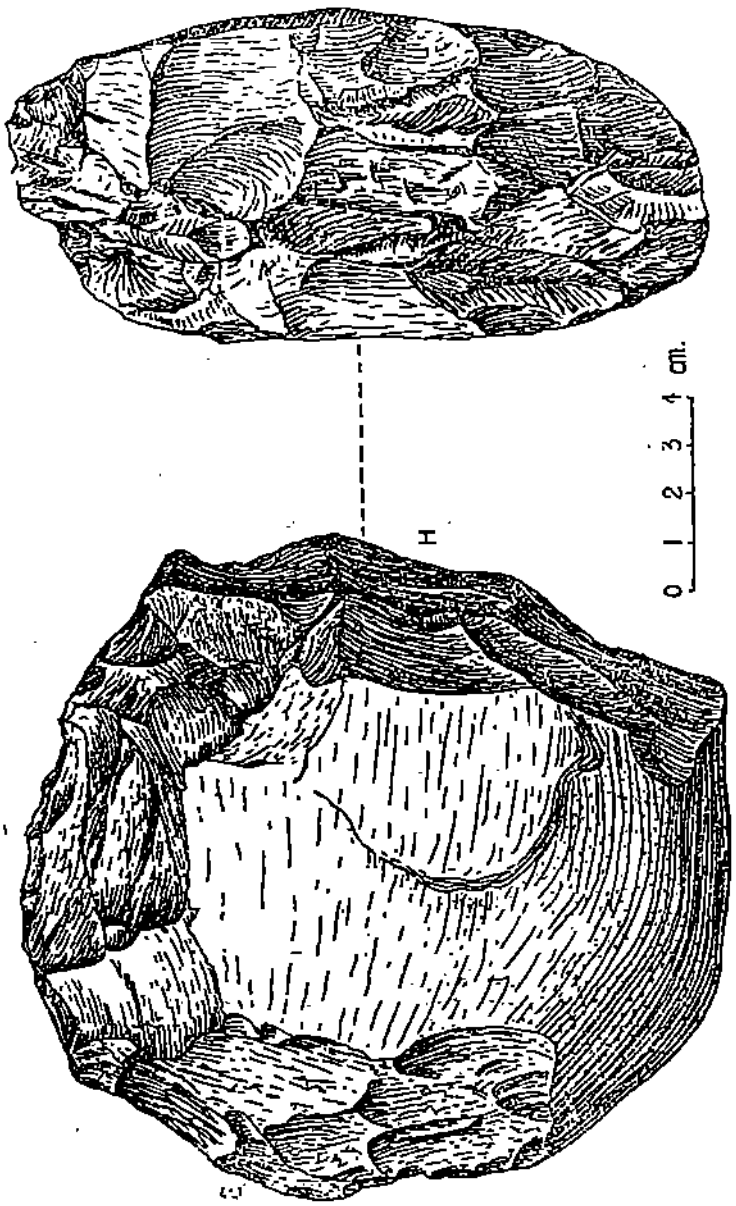


Fig. 7.—Chopper in greenstone, with a prepared heel *H*, (Zone C). *E*. edge flaked by use.

Another case is represented by the specimen illustrated in *Figure 5* (one specimen in greenstone, one in quartz, two in quartzite), in which a boulder has been so much used in hammering along a natural edge that a sharp trenchant has been developed at this place, limited on both sides by an irregular zone of coarse splitting.

The specimen shown in *Figure 6* is rather exceptional, because two successive edges of the block (a trihedral boulder of greenstone) have been used

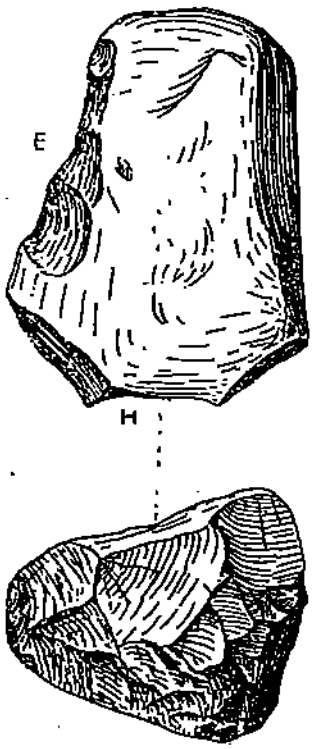


Fig. 8.—Small chopper in greenstone, with a prepared heel *H* (Zone C). *E*, edge flaked by use. Reduced one half.

for striking, this use resulting in the ablation along both edges of a few large flakes, simulating an alternate "retouche" of the boulder.

(b) *Choppers with a prepared heel.*

In this second category of choppers, we place the boulders in which, opposite to the part split and crushed by use, is observed a face squared by

several flakes. The meaning of these flakes, too vertical for a scraper, and too small and irregular to indicate a core (nucleus), becomes perfectly clear if we suppose that the boulder has been truncated in order to be more "handy".[1]

In the specimen illustrated in *Figure 7* (greenstone), the edge *E* opposite to the prepared heel *H* shows perfectly distinct traces of strong blows which have caused the formation of a clear zigzag edge (due to the alternating ablation of tangential flakes).

In the specimen illustrated in *Figure 8* (greenstone), the pebble after being truncated in *H*, has been chipped by hammering on the lateral edge *E*: this specimen is especially typical. Cf. *Figure 8A*.

The specimens illustrated in *Figure 9 B* and *9 C* (greenstone) do not show distinct traces of blows along the edge opposite to the squared face. On the other hand, this face *E* is flaked rather obliquely, better suggesting perhaps a trenchant than a place for handling. They might therefore belong to the next following category.

(c) *Choppers with a possibly prepared edge.*

The boulders here described are characterized by a cutting edge produced by a distinctly oblique flaking on one side only of the edge. Therefore, they could be named "large scrapers": and in fact, all the transition are observed between them and real scrapers. But, on account of their large size, and also of traces left by hard secondary blows (responsible for the ablation of large flakes), they are more likely interpreted as choppers. It is very hard, of course, and rather arbitrary, to trace in such occurrences a clear line between "flaking by use" and "flaking by preparation"; and it is possible that the latter one was, in several cases, very elementary, if not absent.

The specimen illustrated in *Figure 9 A* (greenstone) was evidently obtained by using a square piece of rock derived from a large boulder. In another specimen (not figured), also in greenstone, an entire rounded, handy boulder has been employed: and the resulting tool is identical with the chert specimen, from the *Zone B*, represented in *Figure 5A*.

1 The hypothesis of a core is also excluded by the generally soft nature of the boulder: the flakes would have been of no possible use; and in fact, such flakes are found *not used* in the layer.

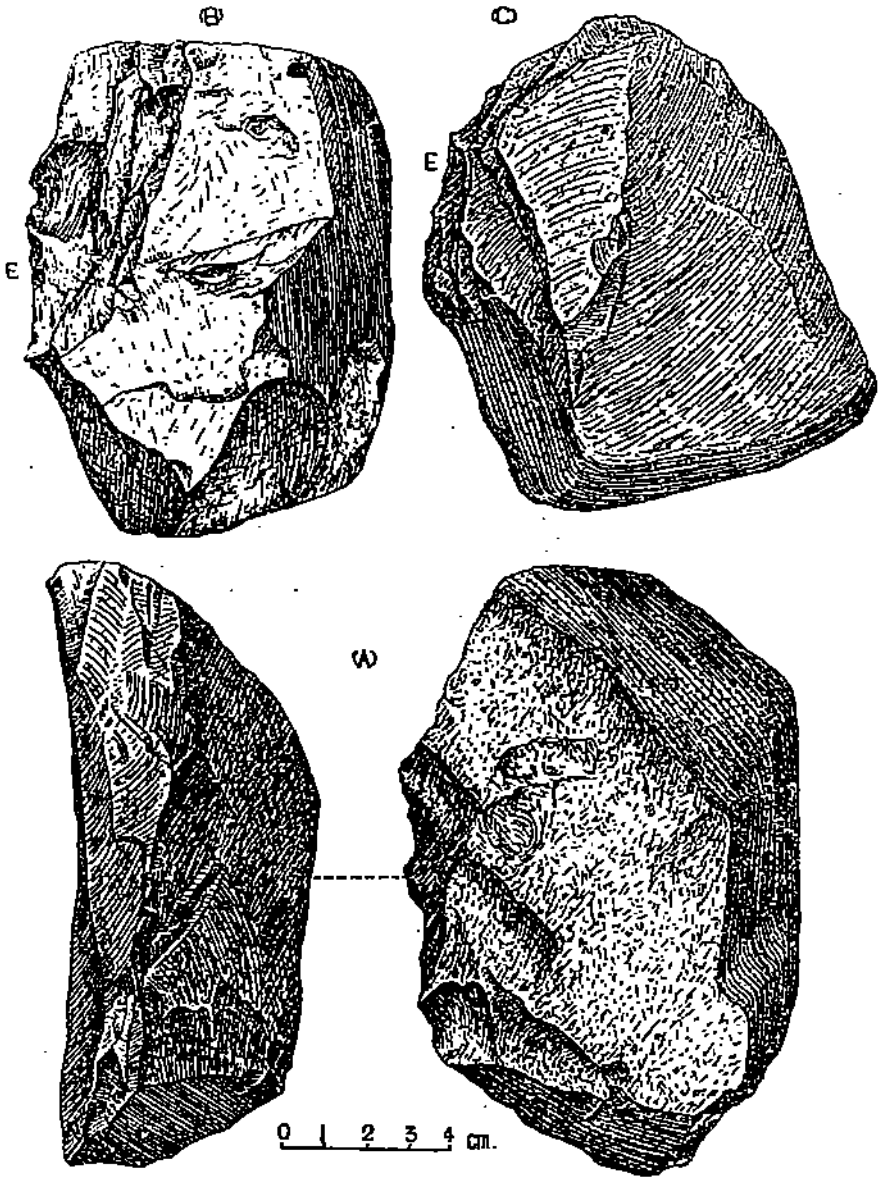


Fig. 9.—Three choppers in greenstone, with more or less prepared edges (Zone *C*).

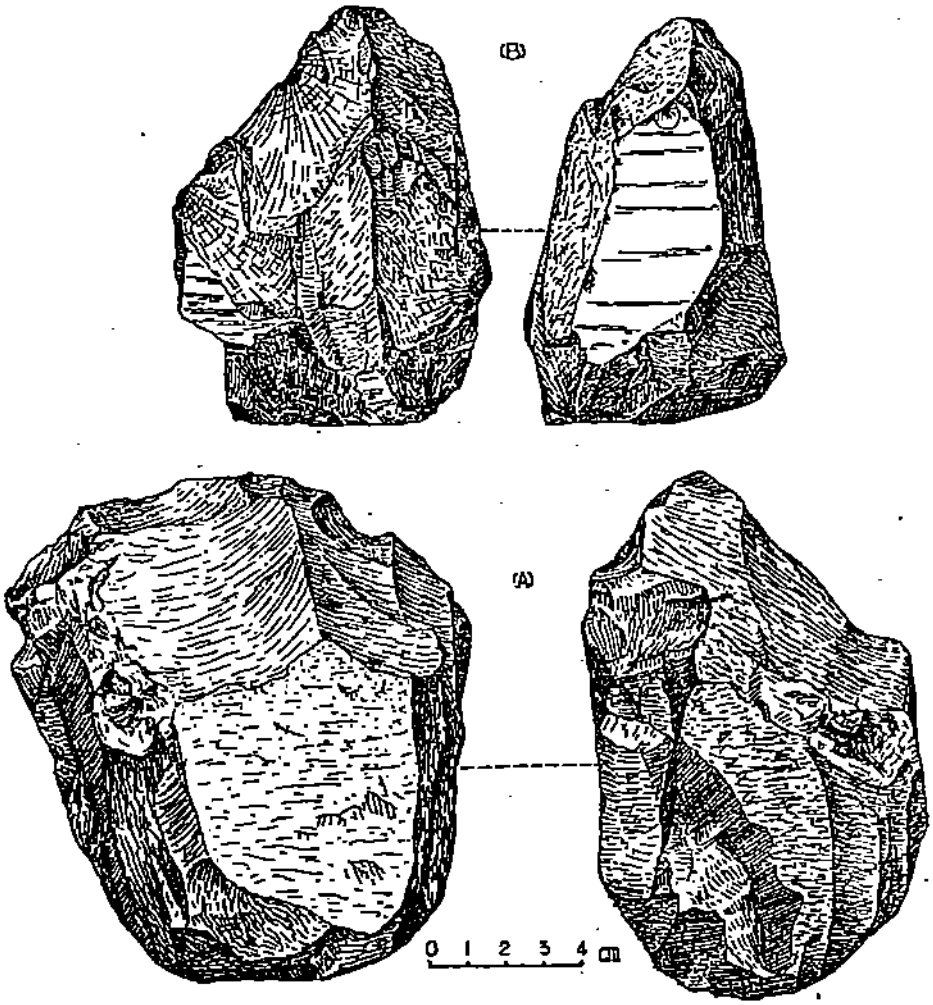


Fig. 10.—Choppers with a possibly prepared edge (Zone *C*). *A*, in vein quartz. *B*, in a quartz crystal.

These two specimens first described are exceptional since they are made from a soft rock. More generally quartz boulders or pebbles (because harder?) have been chosen for the trenchant choppers belonging to the present category. Such is the specimen shown in *Figure 10 A*, a type represented in our actual

series by at least ten clear specimens, the biggest being of considerable size (170 × 150 × 110 mm.). The specimen illustrated in *Figure 10 B*, made of a large quartz crystal, is especially clear and attractive.

II. *Quartz cores.*

By this name of "core", we shall designate here middle sized, rather small, or decidedly small pieces of quartz irregularly flaked into a discoidal or a conical shape. In the discoidal type, a trenchant zigzag edge, due to the intersection of two rows of "retouches", runs along the whole, or only a part, of the equatorial zone of the core. In the conical type, the "retouches", extending on the lateral sides of the core, start from the roughly circular base of the stone. Sometimes, such cores are probably true "nuclei" resulting from the breaking or the flaking of a boulder. But, in several cases, they have been directly used (or re-utilized) as choppers or as small hammer-stones.

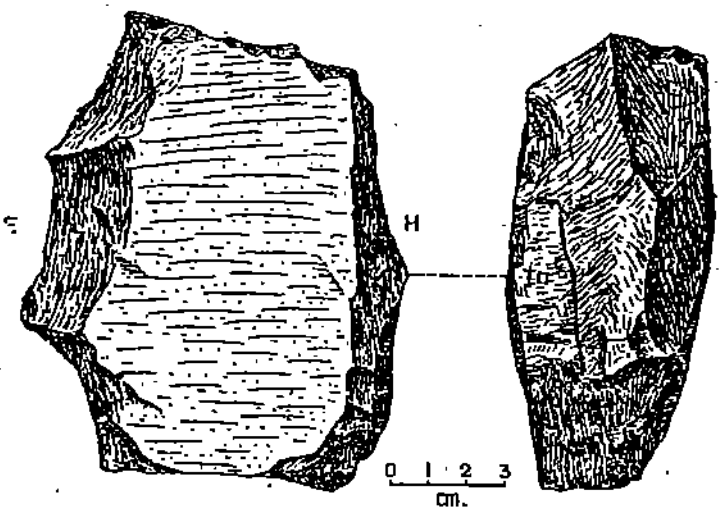


Fig. 11.—Large discoidal core in vein quartz (Zone *C*). *E* and *H*, cf. the text. Reduced one half.

A. *Discoidal cores.* In this first category, we include a series of artifacts of rather heterogeneous form.

For instance the specimen illustrated in *Figure 11* represents an isolated type (one specimen) made of a sub-rectangular flat piece of strongly quartzified

quartzite. The equatorial edge (produced by the intersection of two rows of convergent "retouches") is developed along the two longer sides *E* and *H* of the rectangle only (sharper in *E*. weaker in *H*) so that the piece could be put almost as well into the category of choppers as amongst the discoidal tools.

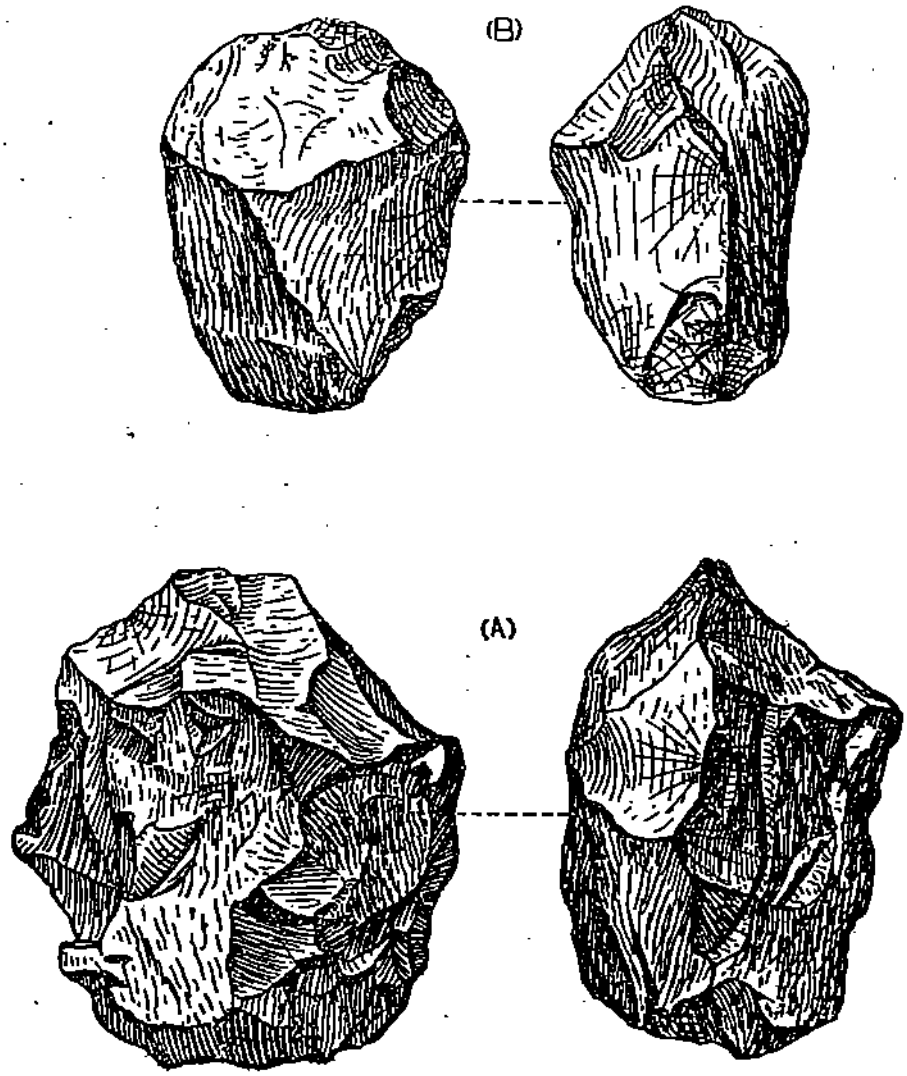


Fig. 12.—Discoidal cores in vein quartz (Zone *C*). Reduced to 3/4.

As a much more typical example of disc can be proposed the specimens illustrated in *Figure 13*, in which the flaking observed on both sides of the equatorial edge is probably largely due to use (rather than to preparation).

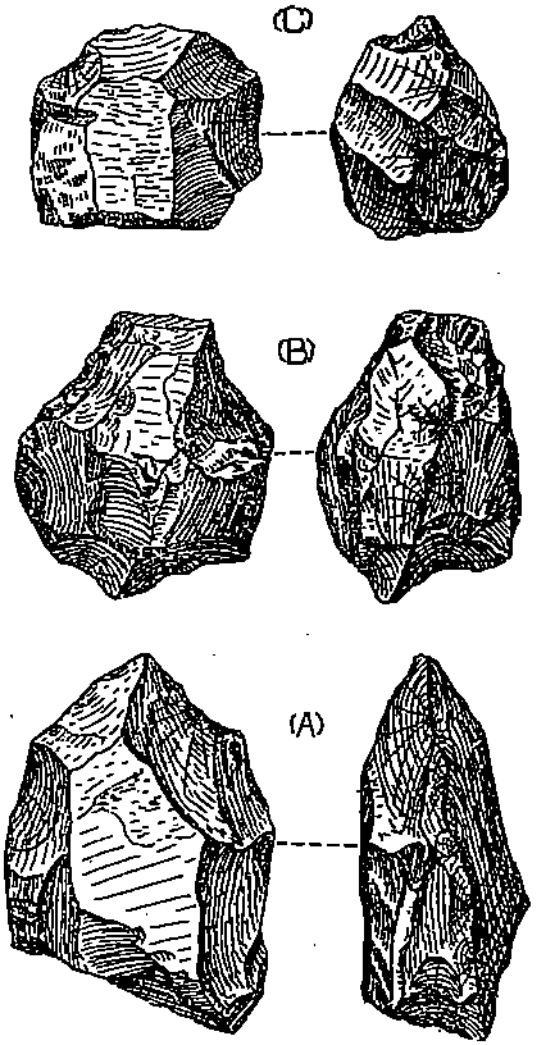


Fig. 13.—Discoidal cores in vein quartz (Zone C). Reduced to 4/5.

We have some ten specimens of this type, passing gradually, by flattening, to pieces which can not be separated from large, irregularly polygonal flakes (average length, 80 mm).

Starting in an opposite direction another series can be constructed (thirteen specimens) in which the discoidal cores, becoming gradually rounder,

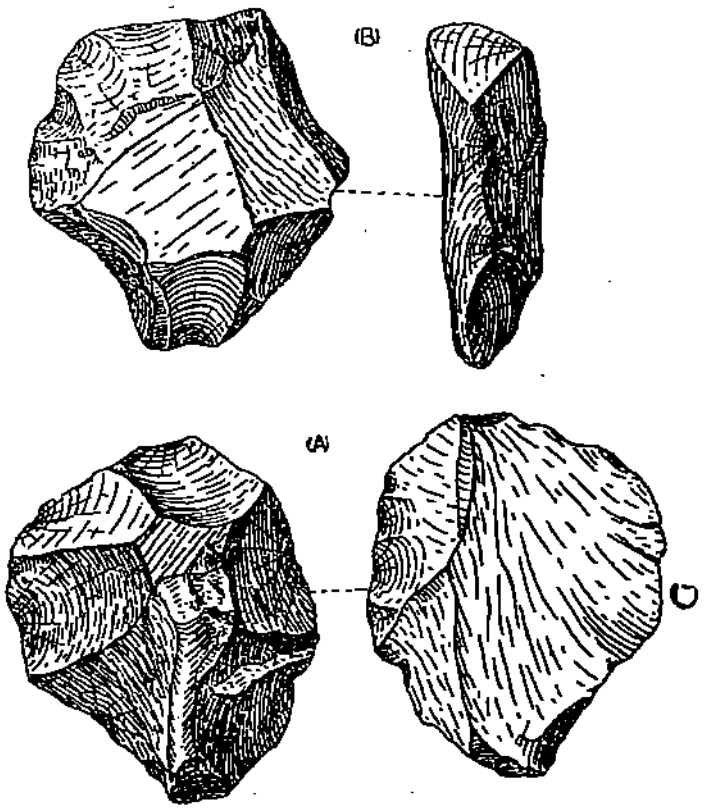


Fig. 14.—Discoidal cores in vein quartz (Zone C). Natural size.

pass into roughly spheroidal stones, which by reduction or disappearance of the equatorial edge, can not be distinguished from rounded hammer-stones. *Figure 13* illustrates three specimens of this type, clearly shaped but of small size. The average maximum diameter of the other specimens is 65 mm.

In another group (v. *Figure 14*) the discoidal artifacts, generally small (maximum diameter, 50 mm in average) have been obtained by separating, as

a single flake, a convex "cap" from a rounded pebble (or core), this cap being afterward retouched circularly along its base (eight specimens).

B. *Conical cores.* In the conical cores (*Figure 15*, three specimens only) numerous and minute retouches are observed all around the flat base of the core, extending along the convex or roughly conical part of the stone. The

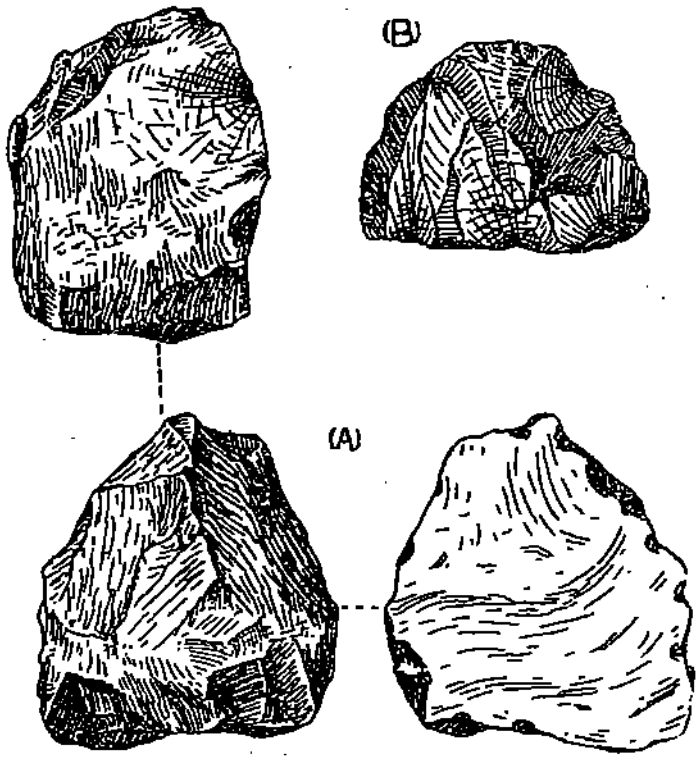


Fig. 15.—Conical cores in vein quartz (Zone *C*). The black spots on the flat lower surface of *A* mark the places of chipping. Reduced to 4/5.

flakes removed by this chipping were evidently too small and irregular for being possibly transformed into implements; so that such cores can not be interpreted as true nuclei. We think that they were rather used as small hammers, the blows being struck with the sharp basal edge of the core.

III. *Scrapers.*

Together with the choppers and the discs, scrapers are the common type of artifacts met with in the *Zone C*. The biggest scraper-like forms have been described already (v. above, p. 330) as trenchant choppers. The forms left to be studied can be distinguished as of three types: linear, concave and convex scrapers.

Fig. 16.—Scrapers in vein quartz (Zone C). Reduced one half.

A. *Linear scrapers.* Some of the "linear scrapers" collected in *Zone C* are of a rather large size, e.g. the quartz specimen shown in *Figure 16 A* (120 mm.); or that in *Figure 17* (a truncated greenstone pebble, retouched along an edge); or the quartzite specimen already figured by Pei, loc. cit., 1931, Fig. 13 and Pl. III, Fig. 1.

But some others made of small chips of quartz (*Figure 18, A* and *B*) are almost microlithic, the retouches being still perfectly distinct. Specially attractive on account of their substance (perfectly translucid quartz crystals)

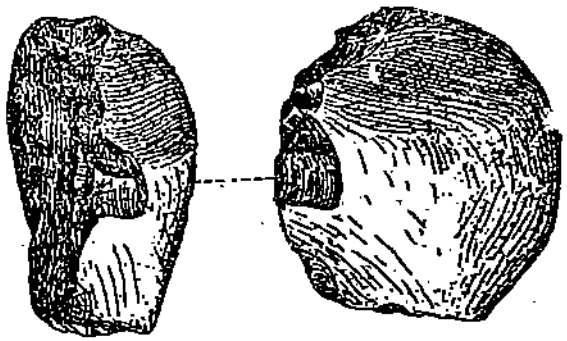


Fig. 17.—Scraper made of a pebble of greenstone (Zone *C*). Reduced one half.

are the specimens shown in *Figure 19, A* and *B*. In the specimen illustrated in *Figure 19, A*, not only the sides of the flake are retouched but also the tip of the crystal has been used for scratching.

The small quartz scraper (or rather scratcher) represented in *Figure 20 A* (two specimens) is interesting because it is made of one of those "bipolar"

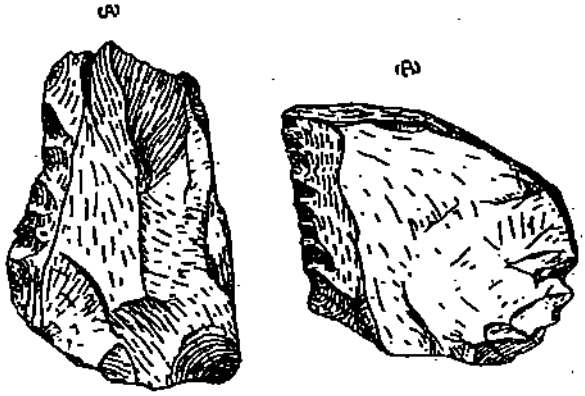


Fig. 18.—Linear scrapers in vein quartz (Zone *C*). Natural size.

flakes which we are going to describe below (p. 351). The chipping due to use is superposed upon the splitting due to the original crushing (between two boulders) of the pebble from which the flake has been derived.

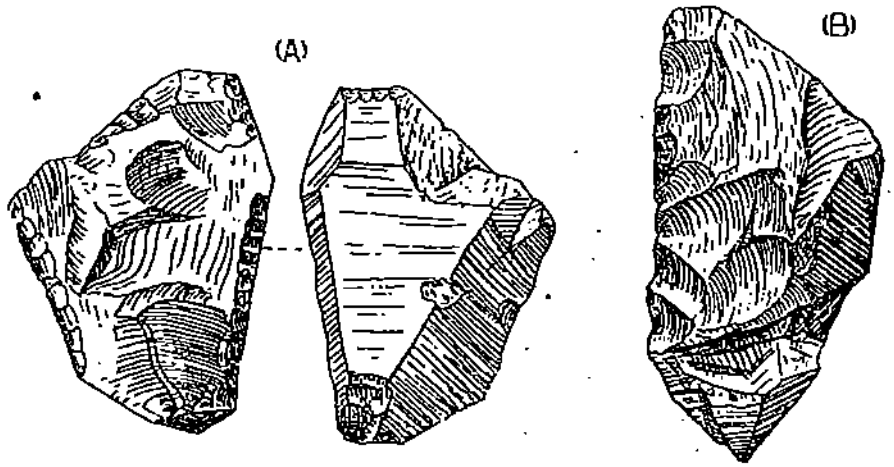


Fig. 19.—Linear scrapers in quartz crystal (Zone *C*). *A*, slightly reduced. *B*, slightly enlarged.

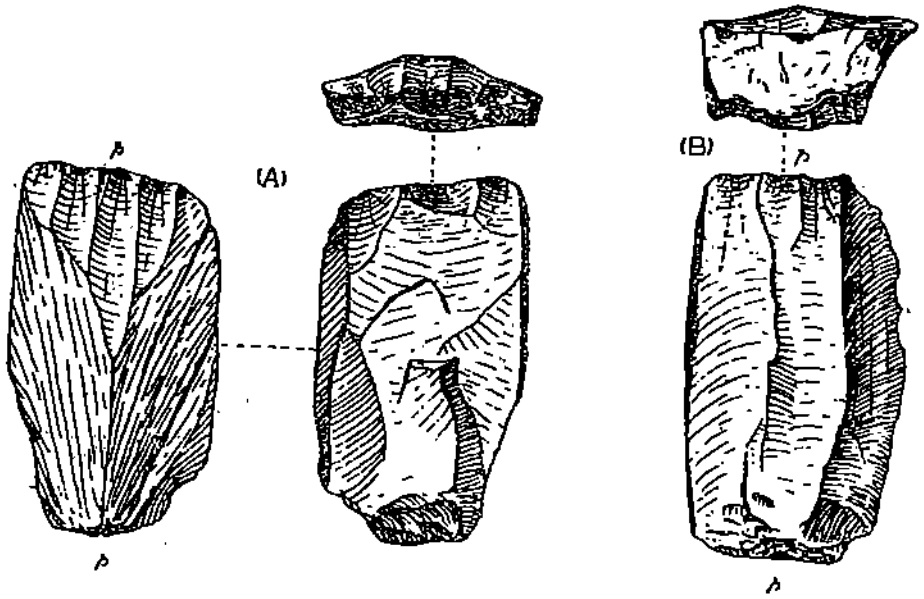


Fig. 20.—*A*, scratcher in vein quartz, made of a bipolar flake (Zone *C*). *B*, a crude bipolar flake, for comparison (Zone *C*). *p*, the opposite points of crushing. Enlarged one third.

B. *Concave scrapers.* Very few specimens reducible to this type have been found so far. The larger specimen shown in *Figure 21* is in quartzite; the two specimens illustrated in *Figure 22* are in ordinary quartz.

Fig. 21 —Concave scraper in quartzite (Zone *C*). Reduced to 3/4.

C. *Convex scrapers.* This is a rare type also, and possibly accidental. Two good pieces are illustrated in *Figure 23*, and possibly two or three other

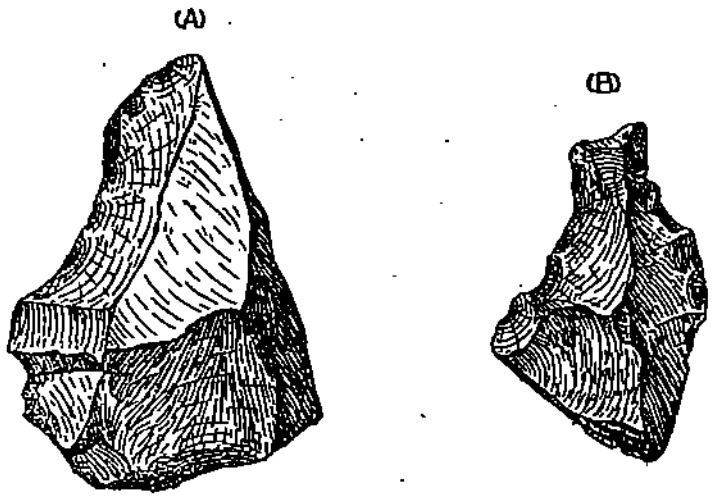


Fig. 22.—Concave scrapers in vein quartz (Zone *C*). Enlarged one third.

less clear specimens occur in the collection. The larger specimen shown in *Figure 24*, shaped into a very obtuse point, might be referred to the category of "pointed implements" described below.

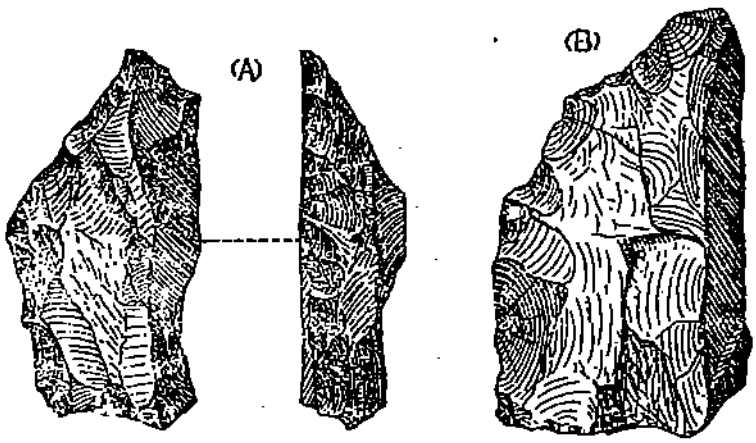


Fig. 23.—Convex scrapers in vein quartz (Zone *C*). Enlarged one third.

N.B. In all the cases mentioned above, and more especially in the case of the concave scrapers, we think that the chipping is largely (if not entirely) due to the use of the artifacts. No clear traces of any preparatory work can be detected, apart from the irregular breaking of the original boulder or pebble into sharp "utilisables" fragments.

Fig. 24.—Convex scraper in vein quartz (Zone *C*). Slightly enlarged.

D. *Complex scrapers.* In addition to the minute quartz scrapers or scratchers described above, a small number of more complex artifacts occur in *Zone C*, concerning which it is not yet easy to decide whether they represent accidentally shaped or definitely planned artifacts. Essentially, those tools consist of small quartz flakes in which not only one, but several contiguous sides are retouched.

In a first case (*Figure 25*; specimen already described by Pei, loc. cit., 1931, Figure 12, and Pl. III, Fig. 2), the flake is rectangular and the four

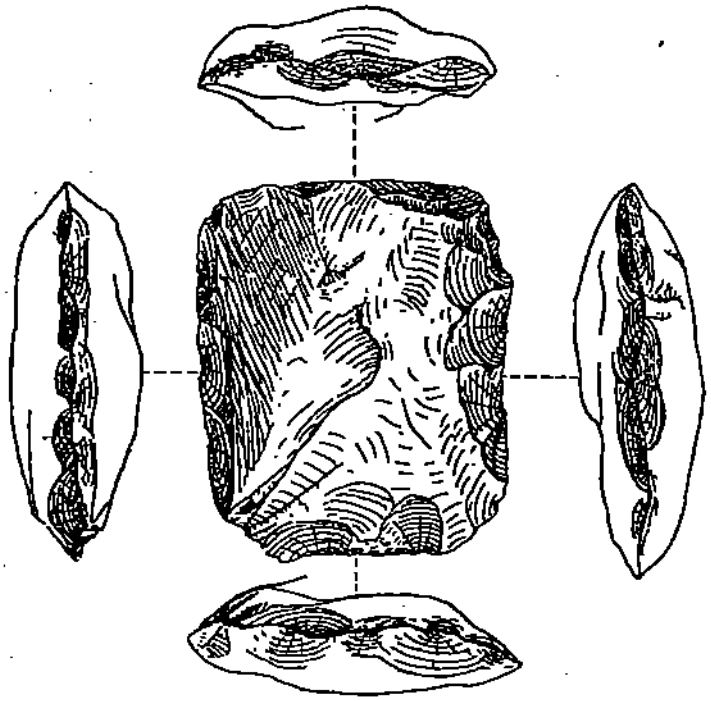


Fig. 25.—Complex scraper in vein quartz (Zone C). Enlarged one third.

straight edges are chipped on both upper and lower sides. It must be observed that this implement, very refined in appearance, might possibly represent only the residual core of a pebble crushed between two other stones in two orthogonal directions (parallel to the two sides of the rectangle); the edges are bruised and split, rather than retouched or chipped. One specimen only.

In a second case (*Figure 26*) two adjacent sides of an angle of the flake have been retouched in a more or less concave way, the result being the production of a distinct *beak b* at the intermediate angle. Has such an artifact to be interpreted as a kind of burin, or simply (as suggested by the specimen illustrated in *Figure 27*) as two accidentally adjacent crescentic scrapers? We cannot decide. In favour of the first interpretation are the facts: (1), that

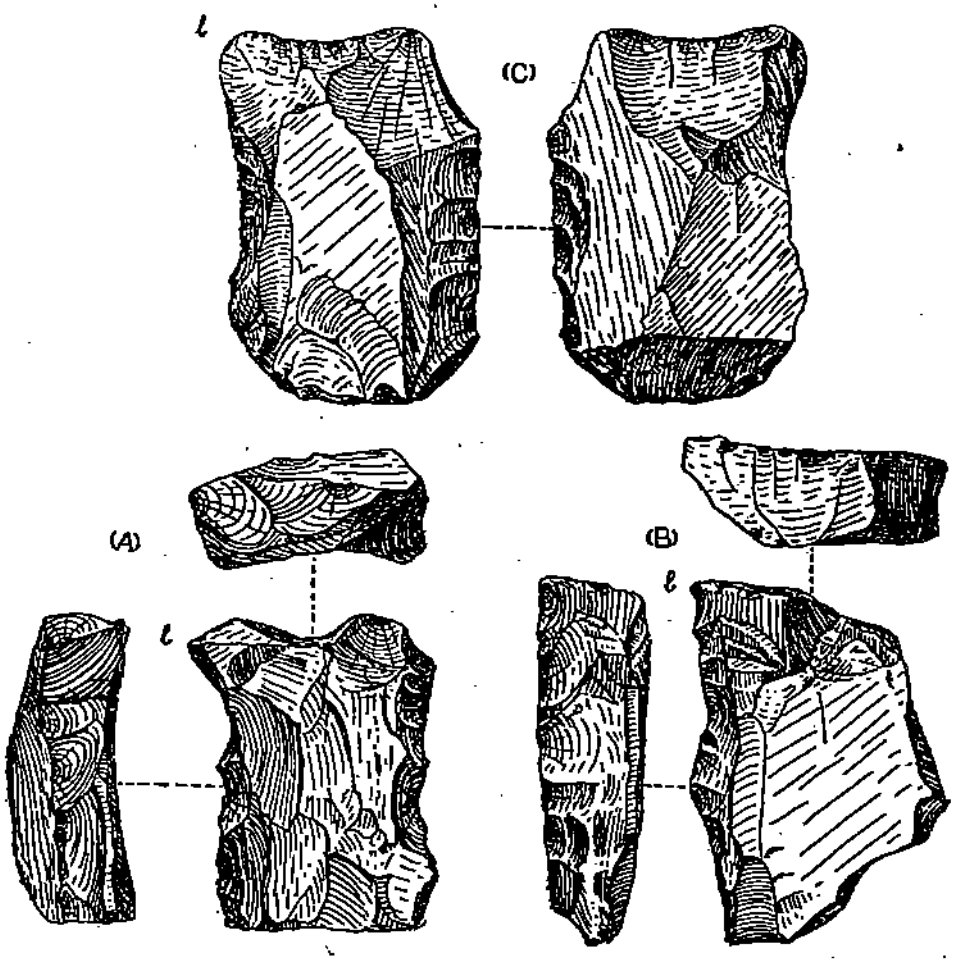


Fig. 26.—Complex scrapers in quartz crystal (*A*) and in vein quartz (*B* and *C*) (Zone *C*). *b*, the "beak". Slightly enlarged.

we have no less than four specimens of the same fundamental type, found in *Zone C*; and (2), that, coming from *Zone A*, we have collected a small implement in chert in which the same features are perfectly distinct (v. below, *Figure 35, C*).

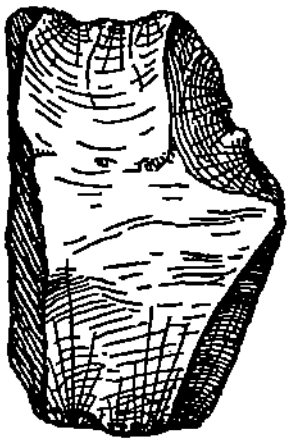


Fig. 27.—Double scratcher (or beak?) in vein quartz (Zone C). The specimen was made using a bipolar flake. Enlarged one third.

E. *Pointed implements.* Further suggestions of the presence in *Zone C* of some quartz artifacts more advanced than simple scratchers or scrapers, are afforded by four pointed pieces which have been possibly worked out with the definite plan of getting a "point", the basal part (or heel) of the pieces being generally left un-retouched and completely irregular.

In the specimen illustrated in *Figure 28, A*, the "alternes" retouches forming, or rather sharpening, on both right and left sides, the pointed end of the flake, are not very distinct, but sure. The heel is sharply flaked.

In the specimen illustrated in *Figure 28, B*, the pointed end is strongly carinated, the heel being formed by an irregular piece of quartz.

In the specimen illustrated in *Figure 29*, the point has been obtained in breaking, or rather in crushing coarsely the sides of a piece of quartz crystal: the piece is bruised, rather than chipped, the resulting artifact being widely different from the fine Mousterian points of quartz crystal found in Western Europe.

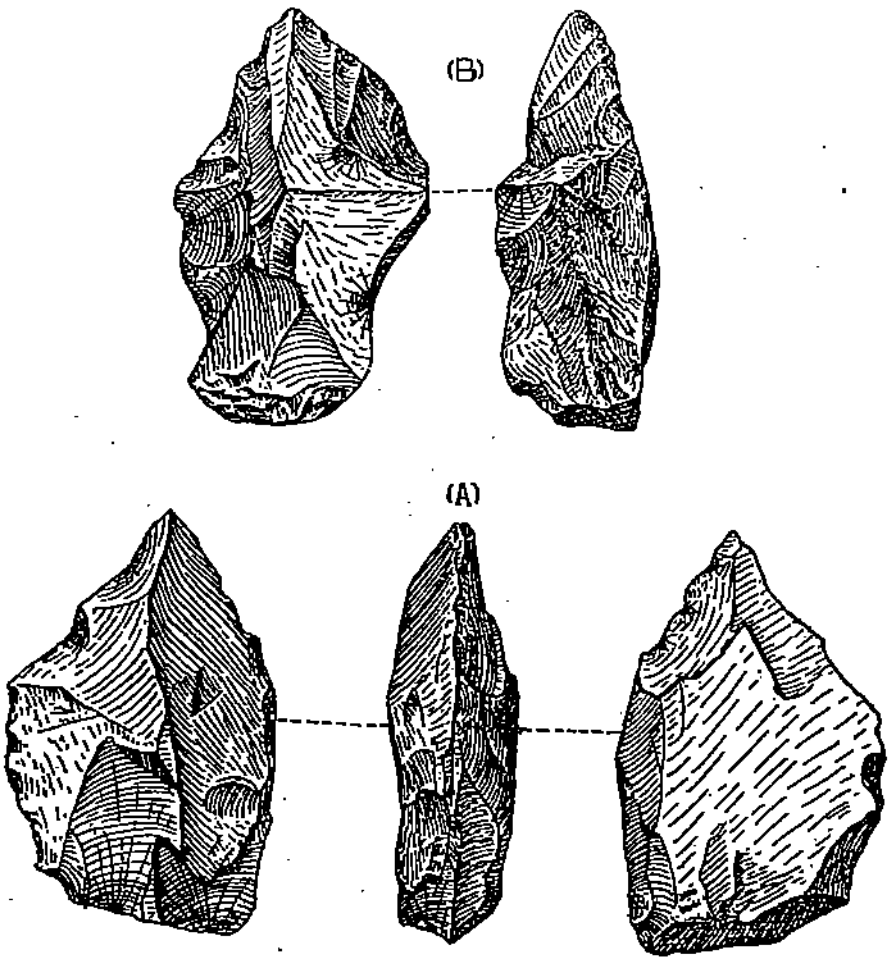


Fig. 28.—Two pointed implements in vein quartz (Zone C). Natural size.

Finally, in the specimen illustrated in *Figure 30*, a small projecting angular corner of a rather long and irregular "bipolar" flake (see below) has been modified into a point, by use probably, more than by any preparation. On account of the asymmetrical position of the pointed angle, the piece is somewhat taking to the "beak" implements described above.

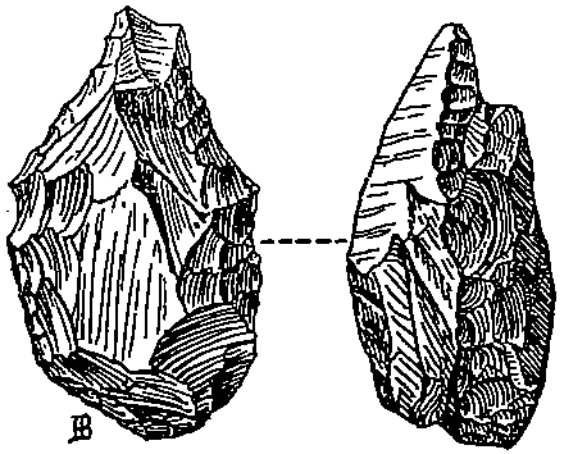


Fig. 29.—Pointed implement in quartz crystal (Zone *C*). Natural size.

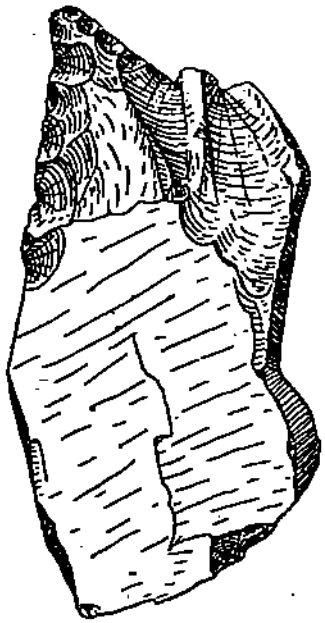


Fig. 30.—Pointed implement in vein quartz (Zone *C*). Enlarged one third.

F. *Chipped or flaked limestone pieces.* In *Figures 31 and 32* are represented two nicely chipped pieces of fine-grained, partly metamorphosed limestone, collected by ourselves a few centimeters one from the other in the red ash-layer of *Zone C.*[1] At first glance the specimen illustrated in *Figure 31* seems to represent a convex scraper and the specimen in *Figure 32* a very fine pointed implement. But a more careful analysis suggests that such an interpretation would be deceptive: first, because the edges of the stone along the retouched border are so fragile and sharp that they were evidently never used

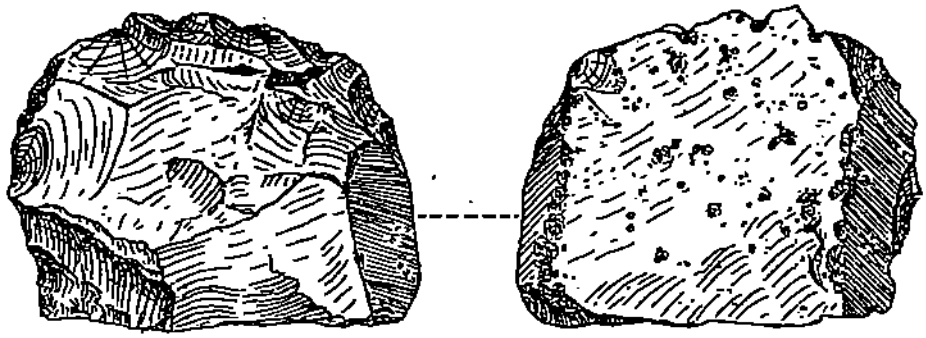


Fig. 31.—Artifact in limestone (Zone C). Observe the several blows on the flat surface. Reduced to 2/3.

(nor of any possible use); and further because, on the flat un-retouched side of the pieces (formed by the original surface of the boulder) numerous traces of irregular blows[2] are perfectly distinct, identical with the blows responsible for the marginal flaking of the pieces.

We suspect therefore that (just as in the case of the conical quartz cores above described) the two limestone pieces here discussed do not represent true tools, but rather some cores, or small anvils, or hammer-stones, the peculiar shape of which has possibly to be correlated in some way with the breaking of the quartz. The traces of blows impressed in the limestone suggest that they were struck with some sharp and hard object (see just below).

1 Associated with those two pieces was a small disc in the same rock, exactly like the quartz discs represented above in *Figure 15*.

2 In a limestone each blow is immediately recognizable, being indicated by a white spot, due to the internal crushing of the rock.

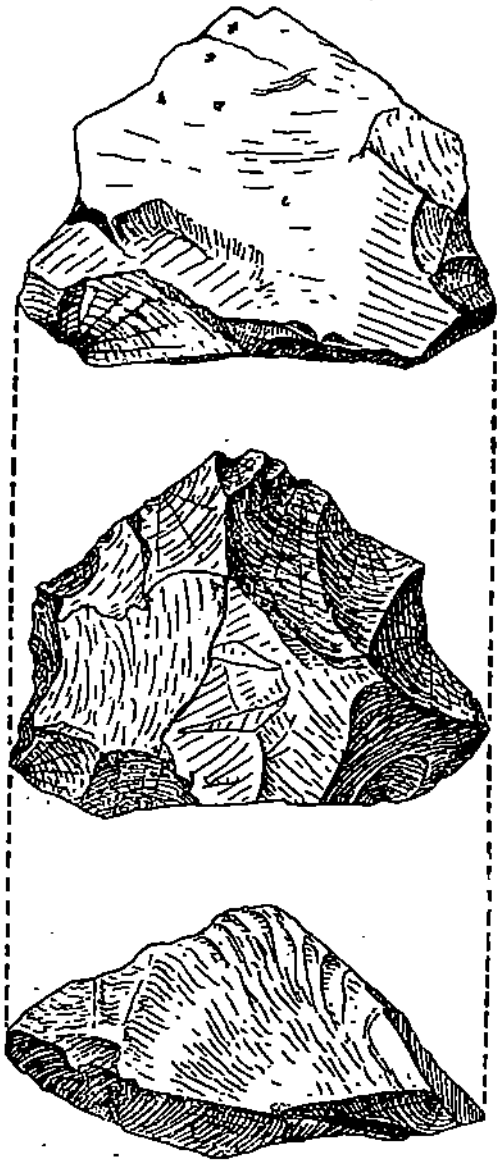


Fig. 32.—Artifact in limestone (Zone *G*). Reduced to 2/3.

IV. *Some observations concerning the making of the artifacts in the cultural Zone C.*

If we try now (using not only the artifacts above described but also a large number of rough flakes collected in the same *Zone C*) to analyse the way in which the rocks have been worked out into artifacts, the following remarks have to be made:

a). Neither in the cores, nor in the flakes can any systematic "préparation du plan de frappe" be recognised. Whenever the original smooth surface of the boulder is not preserved on the heel of the flakes, the facets

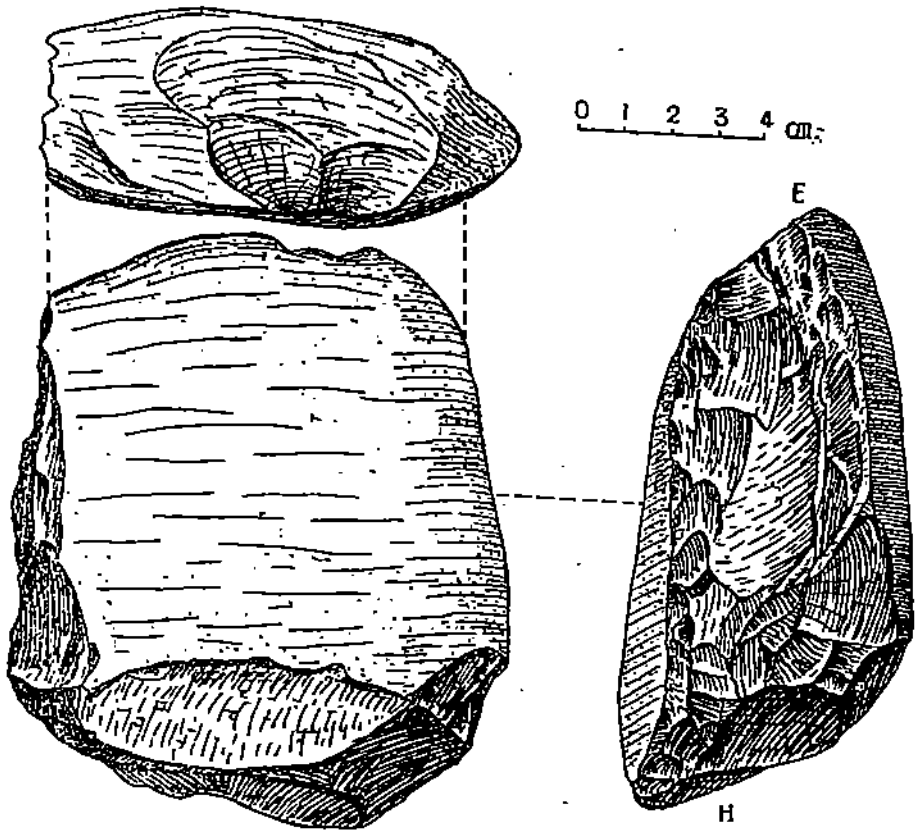


Fig. 33.—Chopper with prepared heel, in greenstone (Zone *B*). *H*, the prepared heel. *E* the edge flaked by use.

observed are easily explainable by accidental irregularities occurring in a bruised core.

b). The blows by which the flakes have been produced, were generally struck using a sharp-edged tool: deep indentations are observable at the points of percussion, especially distinct in the soft greenstone and limestone, but even in the quartz cores.

c). Many times the flakes were obtained by an ordinary side-flaking of the core: a single bulb or star marks the point of percussion. But very often also (chiefly in the case of the smaller quartz fragments) the original stone has been *crushed between two boulders*, the result being the production of elongated laminæ or cores, split and cracked at two diametrally opposite points. We shall call such specimens "bipolar flakes" or "bipolar fragments" ("outils écaillés doubles" of Prof. Breuil ?). See above *Figures 20 A* and *27*.

d). It is interesting to note that most of the Choukoutien artifacts seem to have been handled with the right hand[1]: e.g. the linear scrapers illustrated in *Figure 18*; the "beaks" in *Figure 26*; the chopper in *Figure 8*. But there are some exceptions: e.g. the beak in *Figure 35, C*.

V. *Some observations concerning the lithic industry from Zones A and B.*

As noted above (p. 321), the middle *Zone B* has yielded in 1931 a small series of chipped boulders perfectly comparable to those found in the *Zone C*. Two of them are represented hereby, in *Figures 33* and *34*. The specimen illustrated in *Figure 33* (greenstone) is a typical chopper with a prepared heel (see above p. 329) and the specimen in Figure 34 (coarse chert) a typical trenchant chopper of scraper appearance (v. p. 330), in which the very irregular flaking of the edge seems to be decidely due to use, not to preparation.

Now, concerning the industry of the *Zone A*, it is worth observing (while awaiting further excavations) that judging by the numerous artifacts collected in the rubbish of the 1928 excavations[2], this level contains essentially the same types of quartz implements as *Zone C*, but possibly they may be of more refined workmanship (see *Figure 35*). In addition to this possible advance

1 This observation was first made by Prof. R.D. Jameson in conversation with us.

2 The original site from which these pieces were derived (namely *Zone A*) is practically unquestionable, many of them being still partly embedded in a characteristic matrix.

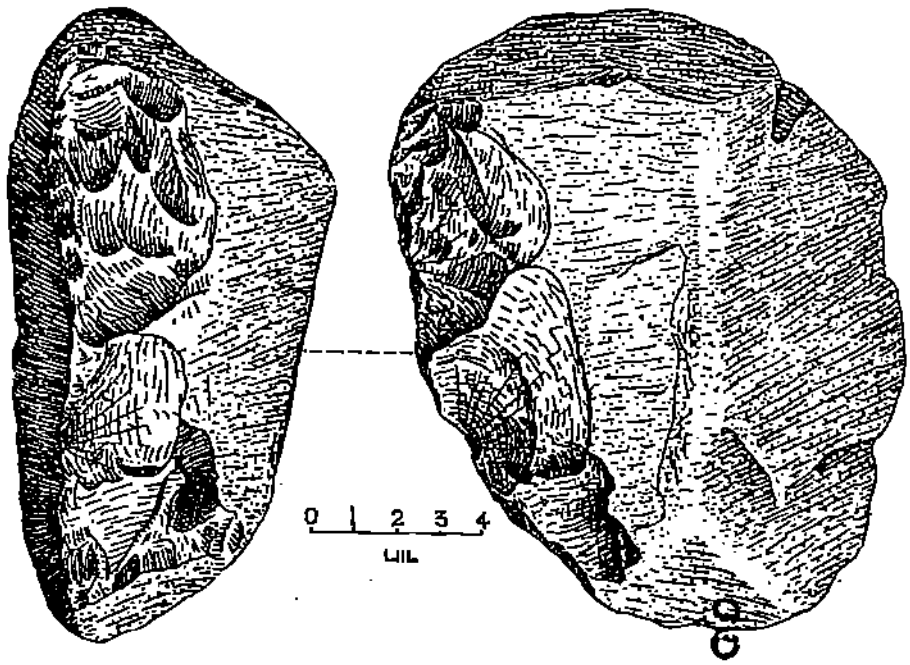


Fig. 34.—Chopper in coarse chert (Zone *B*)

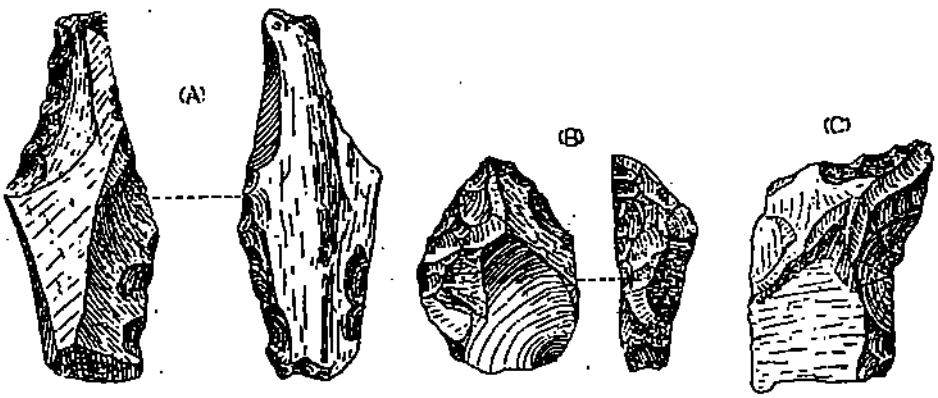


Fig. 35.—Some artifacts of the Zone *A*. *A*, complex scraper in vein quartz. *B*, point in vein quartz. *C*, beak in chert (cf. fig. 26). Slightly enlarged.

in the shape of the artifacts, there can be added, as differential features characterizing the industry of the *Zone A:* (a) the predominance of small elongated flakes of the "bipolar" type; (b) a more common use of flint-like material (allowing a better shape of the small tools); and (c) a curiously large number

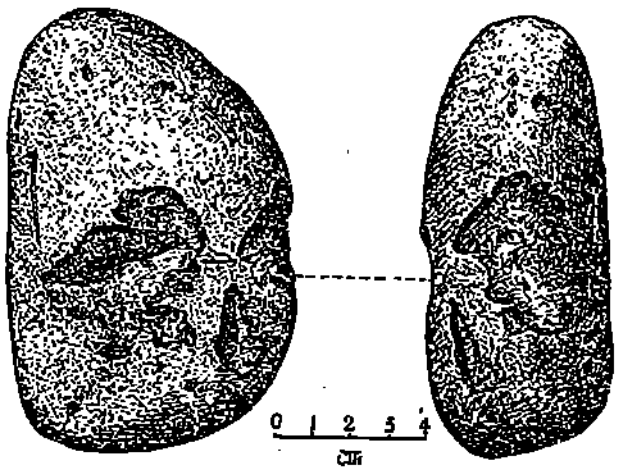


Fig. 36.—Pitted and bruised boulder (Zone *A*).

of pitted or bruised boulders (*Figure 36*), possibly used for crushing the quartz pebbles.

VI. *General characters of the Choukoutien industry (chiefly Zone B and C).*

After describing the implements collected in Choukoutien, we are probably expected to express our opinion concerning the stage of culture reached by the workers of these artifacts, and also concerning the possible analogies to be observed between the Choukoutien industry and some other lithic cultures elsewhere in the world.

Such estimations are made doubly difficult: first by the geographical isolation of the Choukoutien finds; and, further by the fact that most of the Choukoutien implements are made of ordinary quartz, a most difficult substance to be chipped in an artistic and analysable way. What could the Choukoutien cave-dweller have been able to make if, instead of brittle quartz, he had been using quartzite or chert?

A few points may however be fixed, helping to circumscribe the solution of the problem:

a). In Choukoutien *Zone C*, not a single highly refined implement has been found so far, which could for instance be compared with the best pieces found in the Mousterian quartz-layers of France.

b). The "preparation" of the implements is generally absent or rudimentary, the retouches resulting apparently in most cases from a use-chipping, rather than from a preparatory chipping. As due to a preparatory chipping the truncated heel of some choppers has however to be understood (see above p. 329), and less surely, the two notches observed on both sides of the "beaks" or burins (?) described on p. 344. Most of the "points" (at least in the Lower *Zone C*) can be explained as resulting from the simple use of pointed flakes.

c). The presence of a true bone industry seems so far not to be clearly established. Of course, artificially broken, scratched and burnt bones are abundantly found in the Choukoutien cultural deposits. But further evidences of a systematic utilisation of Deer antlers, jaws, etc. seem to be based so far on *equivocal* traces of wear or breaking, such as may occur in any fossil Mammals deposit.[1]

Our present and provisional (and, we confess, highly subjective) opinion is rather therefore that the Choukoutien *Zone C* industry exceeds distinctly, but moderately, what we could expect to be, *a priori*, the most primitive recognizable human industry. The workers of these artifacts had already some definite methods of choosing, breaking and adapting the stone to several uses. But in doing these things, they were still largely dependent upon the material used, obeying, rather than mastering it. It is difficult to conceive of more primitive methods in the hands of individuals, who have already been shown to be familiar with the use of fire.

In any case, the Choukoutien industry, by its association of choppers and an almost microlithic industry, represents a very characteristic cultural type, so far unique in China. Several analogies, of course, are easily traceable between these implements and the choppers, scratchers, etc. found in other

1 We do not positively deny that the bones have been systematically used in the way suggested by Prof. Breuil (loc. cit., 1931). But we think that this use can not be proved positively and objectively by un-equivocal criteria.

countries: but such similarities concern exclusively primitive types of artifacts, recurring unavoidably in any lithic industry.

The Archaeological Problem of Choukoutien.

For two years (1929-1930), because the excavations were driven in an area especially poor in cultural remains (the so-called Lower Fissure and Lower Cave), the presence of artifacts was not clearly recognized in Choukoutien, and the occurrence of any industry associated with *Sinanthropus* was held as improbable. Consequently, on the occasion of the first archæological discoveries (spring 1931), the first important question seemed (and was, in fact) to establish that the quartz fragments collected in the strata were really broken and chipped in an artificial way.

Now that this artificial origin of the broken stones of Locality 1 is proved in an overwhelming way, a different problem has come to the foreground, raised we must say, rather a *priori*, by scientists abroad who find it difficult to admit that *Sinanthropus*, as at present known by cranial characters, could be able to make fire and turn stones into definite implements. "Is *Sinanthropus* the real worker of the Choukoutien implements? or are not the latter traces of culture referable rather to another, more advanced human type who might have occupied the Choukoutien site *posteriorly to the Sinanthropus times*?" This is the question that has been put to us.

By a very rare stroke of luck, a direct answer to this objection has been provided when, in the summer of 1931, remains of *Sinanthropus* (two jaws, several pieces of skull, and a clavicle) were found actually associated *in situ* within the *Zone C* (v. Pei, loc. cit., p. 118). This coincidence is strengthened by the fact that the *Sinanthropus* Locus A seems to correspond with the Layer *Ac*, the Locus B with the Layer *Aa*, and possibly the other "Loci" of the Lower Fissure and the Lower Cave with other less definitely recognised cultural layers (see above, p. 321).

But stratigraphically, lithologically and palæontologically, we can go still further in the demonstration that no difference can be detected between the cultural layers and the *Sinanthropus* layers.

Stratigraphically and lithologically, a suggestion that *two* periods of occupation might eventually be distinguished in the cave (a first one by *Sinanthropus*, and a later one by some more recent Hominid) could have been made a year ago from the fact that the cultural *Zone A* (Layer 4 of the Preliminary Report of 1930) seemed to represent, in the Locality 1 sediments, a special upper "sandy phase" (v. Teilhard and Young, 1930, p. 182) sharply distinct from the lower "brecciated zone". But now that the characteristic facies of the *Zone A* (red, yellow and black sandy clays) has been found, exactly the same, in the cultural *Zones B* and *C*, deeply and intimately connected, several times, with the lower brecciated strata, such a suggestior can not longer be entertained. No secondary intrusion of the cultural, unconsolidated sediments is conceivable. We have personally broken and investigated the laver of hard breccia capping immediately the Layer *Zone C* (May 1932): it was found containing exactly the same, perfectly clear, flakes of quartz and greenstone as the loose ash-beds underneath. The breccia therefore in this horizon, was merely the consolidated upper part of the loose clayish sediments. Breccia and ashy deposits can not be separated one from the other in the Locality 1: but both are tightly bound in the same process of sedimentation. The cultural layers are a primitive and structural feature in the general filling of the Choukoutien cave.[1]

Palæontologically the evidence is just the same. We have already given above (v. p. 319) a list of the fossils collected in *Zone C*. They represent in the most characteristic way the typical and common stock of the *Sinanthropus* fauna. Just as two years ago (Teilhard and Young, loc. cit., p. 184) no traces of any faunistic change have been detected so far throughout the whole thickness of the Locality 1 deposits.

For the scientist trying to avoid the fact that *Sinanthropus* is the real maker of the Choukoutien implements, a single line of escape is left (and has been tried already): namely to suppose that, *contemporary* with *Sinanthropus*, another dweller has been living in the cave, that is a more modern type of

1 It is a possible significant fact that all the three *Zones A*, *B* and *C* occur in a crushed and laminated state *under the collapsed roof* of the cave. Above this roof (v. Figure 1) a horizontal series of hard travertine layers is observed, still containg (it would appear so far) the same fauna as beneath in the main deposit itself: *Rhinoceros*, Chiroptera and a large-beaver-like Rodent.

man, not yet known of course by any fossil remains. This hypothetical Man would then be responsible for the industry; and this Man also, would have killed and brought to the cave *Sinanthropus*, exactly as he did with the *Rhinoceros*, the Deer and other wild animals.[1]

Nothing can be directly answered to this hypothesis, but that it is entirely gratuitous and highly improbable. Not only should we have, in this case, to account for the presence of an entirely unknown Early Pleistocene Man in Choukoutien, but we would have also to regard as fortuitous the extraordinary association, in the same place, of a wholly new industry with remains of an equally new, highly advanced, Hominid: a rather difficult series of assumptions of course, for which is no positive evidence whatever.

On the other hand, no recent facts, gathered in Choukoutien or elsewhere in China, alter so far the general stratigraphical views presented in the Preliminary Report of 1930 (Teilhard and Young, loc. cit., p. 199, Table I. A careful study of the Locality 1 fossils, especially Artiodactyles[2], has on the contrary reinforced the conclusion that the Choukoutien cave-deposits (faunistically homogeneous in their whole thickness) are: (1) distinctly older than the Loessic formation of China, and (2) younger than the Nihowan Uppermost Pliocene beds, more closely connected, however, with the latter than with the former.

In accordance with these biological data, further geological observations made along the border of the Chihli plain seem to establish that two very different types of deposits are extensively recognisable in the fissures occurring in the Ordovician limestone: a very ancient one (Pontian?) represented by barren gravels or coarse sands, corresponds to alluvial fans or terraces[3]; and a later rather complex one (Upper Pliocene to Lower Pleistocene), represented by fossiliferous brecciated clays and travertines, means a long phase of subaerial sedimentation. In this latter group of pocket-deposits, an earlier series

1 As observed by Prof. Breuil (personal communication) the same idea exactly was put forward when the first remains of *Homo neanderthalensis* were found associated with implements in W. Europe. *H. neanderthalensis* was supposed to have been killed by another more advanced Man, the real worker of the artifacts!

2 A full memoir on the Artiodactyles of Locality 1 by Dr. C. C. Young is now in press.

3 To this group belong the Upper fissure gravels of Choukoutien, v. Teilhard and Young, loc. cit., 1930, p. 186.

(Tangshan,[1] Nanyeli?[2]) seems to be contemporary with the Nihowan (Middle Sanmenian = Uppermost Pliocene) beds. To a more recent, but still early Pleistocene, phase, belong the Choukoutien cave fossiliferous deposits. Pending the difficulties still encountered by Geology in correlating the western glacial periods with the physiographic stages of E. Asia, any closer assimilation of the Choukoutien formation with the Old Palæolithic levels of Europe would be premature.

Finally, as a short conclusion of this paper, and using the actually available facts, we can give the following objective statement:

(1) The cave deposits of Choukoutien, older than the Loessic formations of China, and later than the Sanmenian Nihowan beds, are of an early Pleistocene age.

(2) The culture layers of Choukoutien Locality 1 make a single stratigraphical and palæontological whole with the *Sinanthropus* breccia.

(3) *Sinanthropus* has to be held, culturally speaking, as an early representative of the Old Palæolithic cycle.

1. W. C. Pei, On a collection of mammalian fossils from Chiachiashan near Tangshan. Bull. Geol. Soc. China, Vol. IX, No. 4, 1930 pp. 371-377. The Tangshan fossiliferous cleft contains the Middle Sanmenian *Siphneus litngi* fauna, and possibly also some Lower Sanmenian deposits (with *Prosiphneus intermedius*).

2 Licent, E. The Nanyeli Sanmenian fossiliferous deposit. Bull. Geol. Soc. China, Vol. IX, No. 2, 1930, p. 101-104.

Explanation of

Plate I

PLATE I

Fig. 1 Chopper, in greenstone, from the *Zone C* (cf. text-fig. 9, A). Reduced.

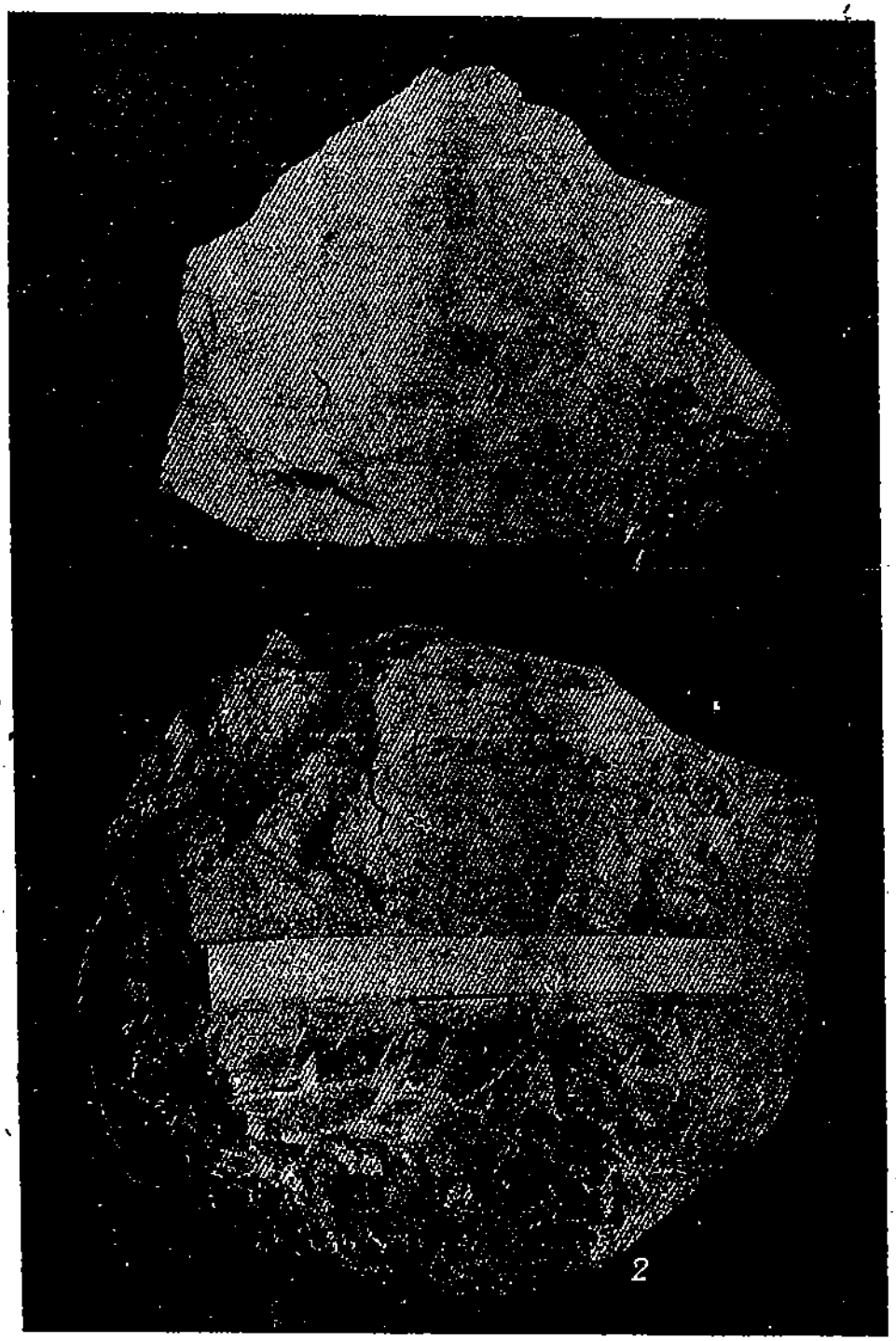
Fig. 2 Chopper, in greenstone, from the *Zone B* (cf. text-fig. 33). Reduced.

Explanation of Plate II

PLATE II

Fig. 1 Triangular artifact, in limestone, from the *Zone C* (cf. text-fig. 32). Natural size.

Fig. 2 Chopper, in greenstone, from the *Zone C* (cf. text-fig. 7). Reduced.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Explanation of Plate III

PLATE III

Fig. 1 Beak-shaped artifact, in vein quartz, from the *Zone C* (cf. text-fig. 26, C).

Fig. 2 Beak-shaped artifact, in quartz crystal, from the *Zone C* (cf. text-fig. 26, A).

Fig. 3 Pointed artifact, in vein quartz, from the *Zone C* (cf. text-fig. 28, B).

Fig. 4 Pointed artifact, in vein quartz, from the *Zone C* (cf. text-fig. 28, A).

Fig. 5 Pointed artifact, in vein quartz, from the *Zone C* (cf. text-fig. 30).

Fig. 6 Linear scratcher, in quartz crystal, from the *Zone C* (cf. text-fig. 19, B).

All these specimens are represented in natural size.