The Nyu industry and Other Palaeolithic remains in Japan

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I. Introduction

At present, very little is known concerning the palaeolithic cultures in Japan. As materials are few, it can not be said that the substance of the Nyu Industry has been sufficiently clarified but it furnishes more materials than any of the other industries which have been discovered up to this date. It can be considered that this industry has a close relation to the Lower Palaeolithic cultures in Southern and Eastern Asia. Besides this, several choppers were found at the Fujiyama site in the northern Kanto Region. A few hand-axe-like implements were also found at the Gongenyama site in the same area. These are considered later than the Nyu Industry.*

II. The Nyu Industry

1. Geomorphology and Geology of the neighborhood of the Nyu site

Takashi Tomiku of Oita University and Shun-ichi Nakamura found a group of stone implements including pebble tools at the Nyu site in February 1962. According to Tomiku's information, Naoichi Kokubu of Shimonoseki college of Fisheries inspected the site on March 4. Then, Takeo Kanazeki of Tottori Medical College (at present Yamaguchi Medical College) made an investigation on March 7 and 8, and pointed out that the specimens from Nyu are similar to those of the Soan culture. Kanazeki reported this important result to Sugao Yamanouchi of Tokyo University (at present Seijo University). According to Yamanouchi's request, the writers engaged in research for nine days in March (Kanazeki, Yamanouchi and Sato, 1962; Sato Kobayashi and Sakaguchi, 1962; Sakaguchi and Sato, 1962).

The Nyu site is located in one of the uplands facing the northeastern coast of Kyushu. One of the largest caldera, the Aso Volcano, is located approximately 70 km southwest from these uplands. The uplands spread out in deltaic form at the mouth of the Ono River which flows from the Aso Volcano. The upland on the right bank is called the Nyu Upland and that on the left bank is called the Tsurusaki Upland. Both uplands are formed by the Oita Formation of tuff, mud, sand, gravel and pumice which is considered as lower Pleistocene. The seven terraces are formed by cutting these strata (Fig. 2).

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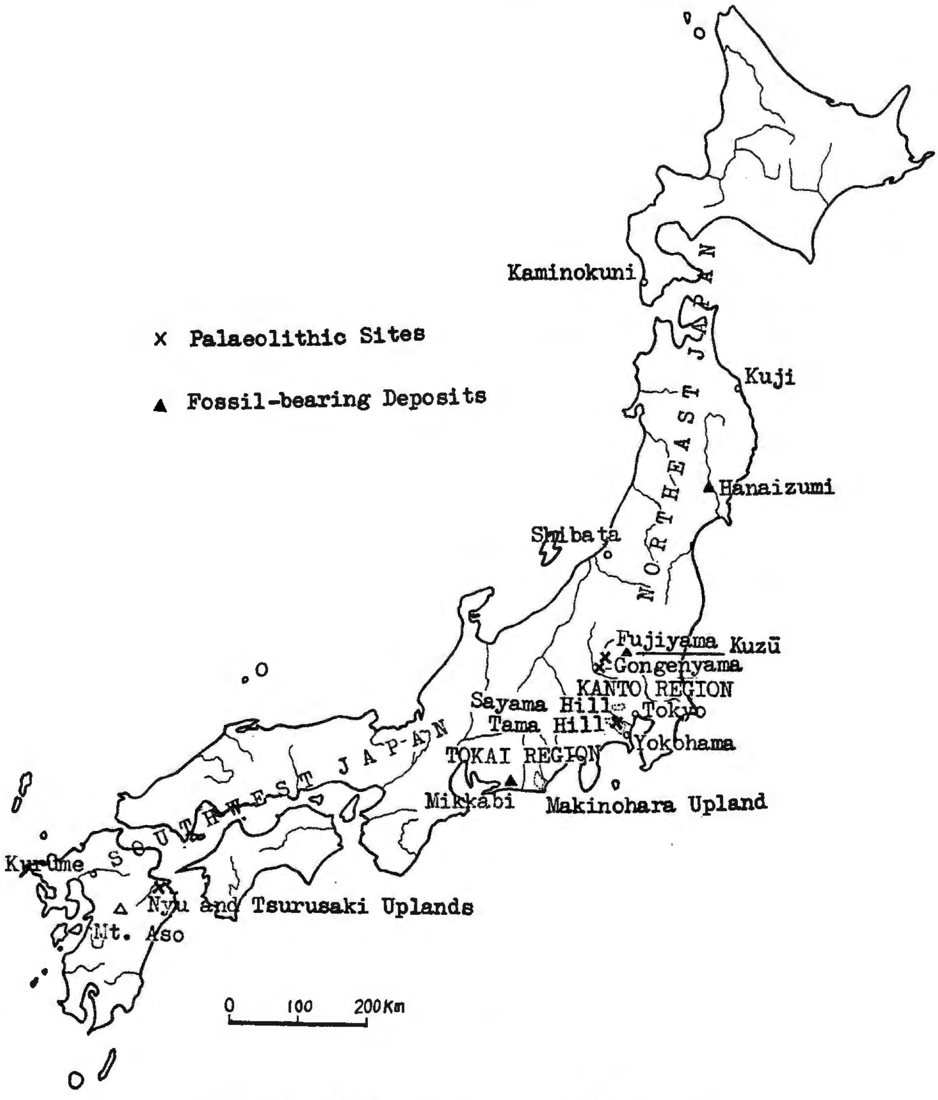

Fig. 1. The localities mentioned in the text.

I. The First Terrace is 80–100 m above sea level and dips in reverse way and lowers from north to south. Existence of deposits is unknown.

II. The Second Terrace is 60–90 m above sea level and also dips from north to south like the First Terrace. It dissects a little and is undulated. The majority of the remains are found on this terrace.

The terrace deposits are gravels which chiefly consist of slate, chert and igneous rocks and are poor-sorted, and contain plenty of matrix. The largest diameter of these gravels is 40 cm. These deposits are called the Nyu gravel bed. Some gravels are weathered to the extent of being able to cut by a shovel but as a whole they are fresh. The upper part of this bed is a pumiceous sand and gravel bed with a clay layer. The size of gravel is very small in comparison with that of the lower part. The largest diameter is 20 cm. The majority of these are around 5 cm. The gravels consist of slate, chert and igneous rocks. The thickness of the Nyu gravel bed is about 15 m.

The Nyu breccia-clay bed covers the Nyu gravel bed. The lower part is a breccia layer and the upper part is a light yellowish brown tuffaceous clay layer. The breccia

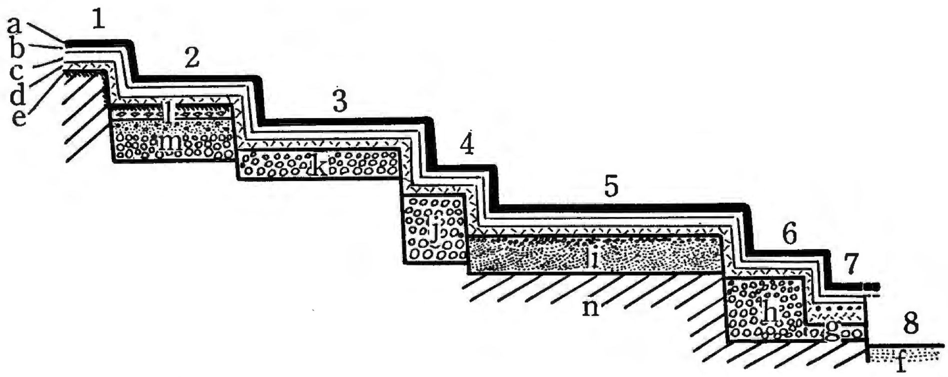

Fig. 2. Compiled schematic profile of the Nyu and Tsurusaki Uplands. 1–7: terraces, 8: alluvial plain, a: black volcanic ash, b: yellowish brown volcanic ash, c: brown volcanic ash, d: pumice flow deposit and volcanic ash (ejecta of Aso Volcano), e: Red Soil, f: alluvial deposits, g–k: terrace deposits, l: Nyu breccia-clay bed (implement-bearing bed), m: Nyu gravel bed, n: base (Oita Formation).

layer alternates with the tuffaceous clay layer and gradually changes to the upper tuffaceous clay layer. The breccia clay layer is approximately 3 m in thickness. The clay becomes hard and develops into a nutty structure when dried. The clay contains angular and large rounded gravels, and may be considered as aqueous volcanic ash.

A flake was found about 35 cm below the ground surface at the outcrop made by cutting the clay layer on the roadside. The other stone implements were gathered from a surface which had been dug out as deep as the breccia layer by the bulldozer during the making of a tea plantation. But it is undoubted that the implement-bearing bed is the lower part of the tuffaceous clay layer.

The upper part of the clay layer at the site has a tinge of chocolate and the surface of the nutty aggregate is reddish brown in color. On the Second Terrace of the Tsurusaki Upland, the Red Soil (10 R) is formed in the upper 1 m of the terrace deposits. The Red Soil is covered with the volcanic ashes. The upper part of the clay layer at the site is considered the B-horizon of the Red Soils.

III. The Third Terrace is 75–85 m above sea level and also descends from north to south. Although the investigation of deposits in the Nyu Upland is not sufficient, in the Tsurusaki Upland there is a gravel bed chiefly consisting of gravels of andesite with

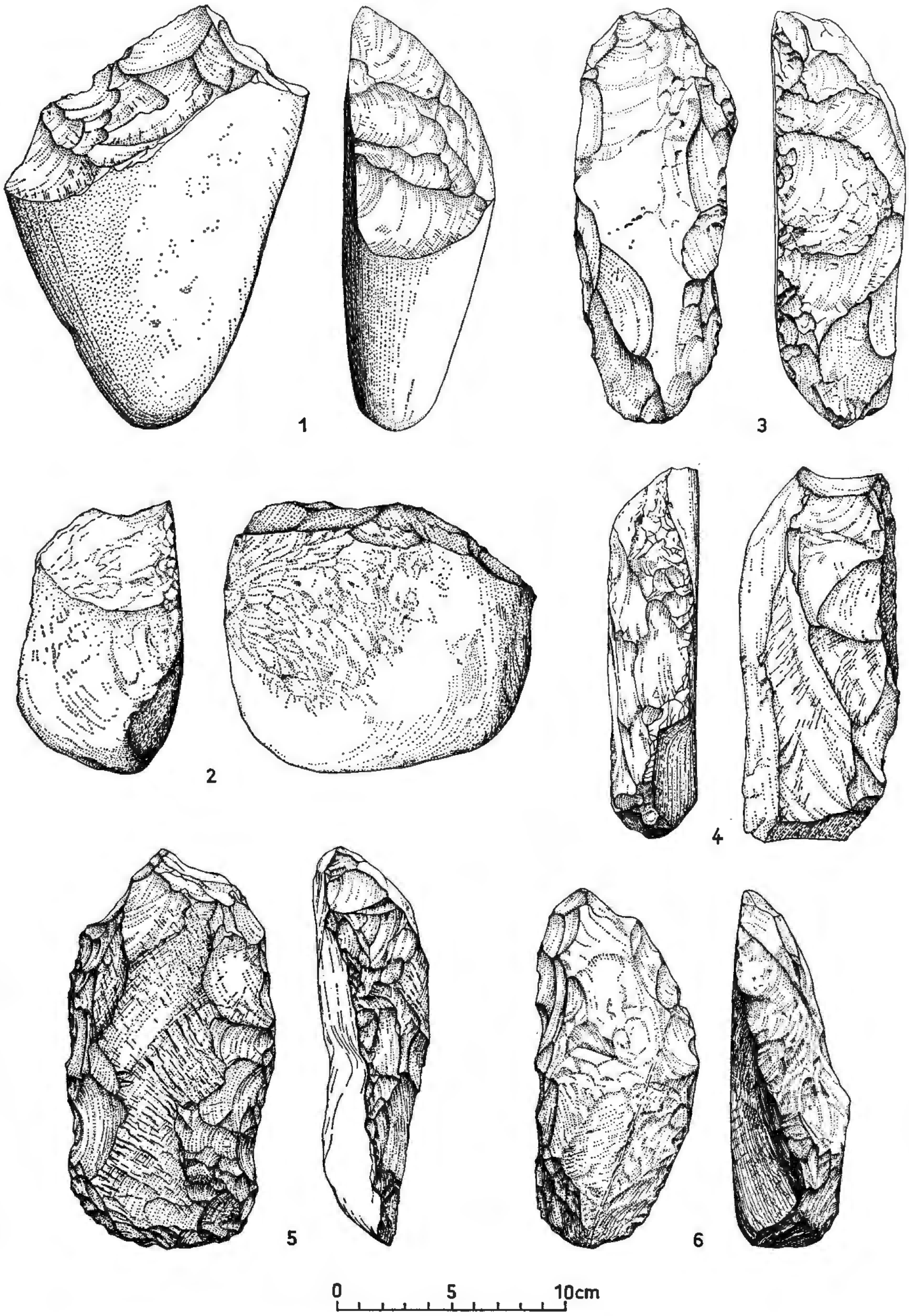

Fig. 3. Unifacially flaked tools from Nyu.

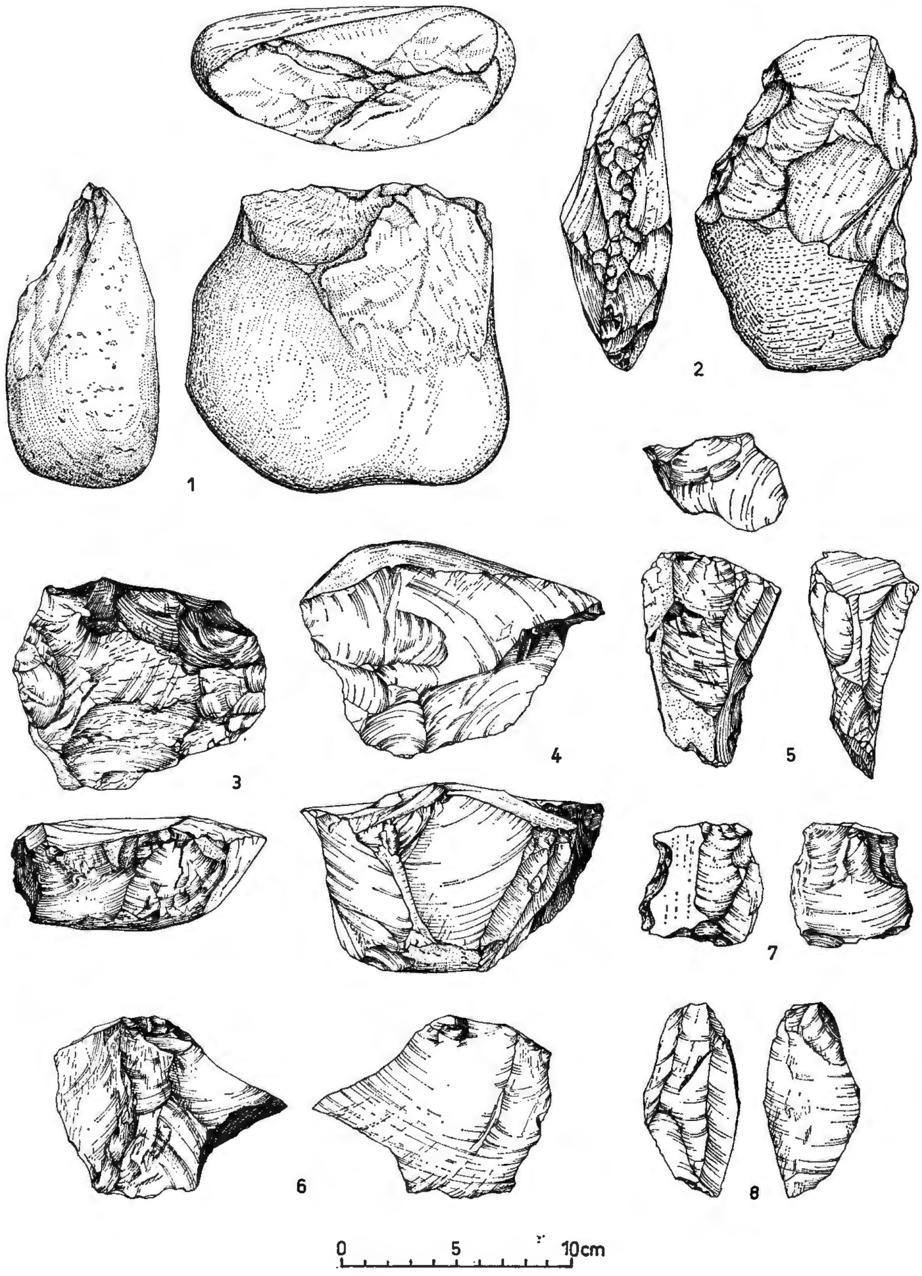

Fig. 4. Bifacially flaked tools, cores and flakes from Nyu.

maximum 40 cm in diameter. The gravels are well rounded. The thickness of the bed is considered 10–15 m.

IV. The Fourth Terrace is 60–70 m above sea level. The deposits in the Tsurusaki Upland are gravel beds chiefly consisting of gravels of andesite. The thickness of the bed is more than 10 m.

V. The Fifth Terrace is 40–50 m above sea level and is quite flat. The deposits are clay, pumiceous sand, sand and gravel. The cross-bedding develops in some places and sand pipe can be observed. The thickness of the bed is more than 5 m.

VI. The Sixth Terrace is 35 m above sea level. The deposits in the Tsurusaki Upland are of well rounded gravels consisting of clay slate and igneous rocks. The gravel becomes larger in the lower part. The horizontal bedding can be observed. The thickness of the bed is more than 10 m.

VII. The Seventh Terrace is 15 m above sea level. In the Nyu Upland, volcanic ejecta (pumice flow desposits) 4 m in thickness are observed between the lower gravel layer of 2 m in thickness and the upper gravel layer of 1.5 m in thickness. In the upper 1 m of these ejecta ash predominates. These are the ejecta from the Aso Volcano. The Aso Volcano has erupted three times while forming the caldera. The ejecta of the last activity reached a distance of 80 km from the somma and covered the vast area in Central Kyushu. These ejecta are partly welded tuff, and partly pumice and volcanic ash (tuffaceous clay). The volcanic ash layer which is a different facies of the Aso welded tuff is well preserved on the Fifth Terrace of the Nyu Upland. The thickness of this layer is almost 3 m. This volcanic ash layer is successively covered with the brown claylike volcanic ash layer, the yellowish-brown volcanic ash layer and the black humic volcanic ash layer. Since these are easily eroded, it is rare that the perfect sequence is observed as in this case. Several flakes were found in the brown volcanic-ash-like deposits. These flakes belong to a non-ceramic culture.

2. Classification of stone implements

The stone implements referred to are 50 specimens in all including 26 tools made on pebbles and flakes (8 cores and 16 flakes). These implements are deeply patinated, but are not heavily worn.

The tools made on pebbles and flakes are generally large and massive. These tools are roughly classified as follows:

I. Unifacially flaked tools

A. Tools of simpler forms

Many specimens are made on pebbles with flat under-surfaces, and few are on flakes. Flaking is limited to the edge part which is either on the end or on the side of the specimen.

1. Tool with a pointed edge; 4 examples (Fig. 3, No. 1).
   One is flaked on two adjacent sides of a quadrangular flake.
2. Tool with a convex edge; 4 examples (Fig. 3, No. 2).
3. Tool with a straight edge; 2 examples.

B. Tools of more specialized forms

Flaking is more advanced. The under-surface is entirely covered with cortex, and the upper-surface is almost completely flaked.

1. Straight parallel-sided tool worked by steep flaking; 5 examples.
   3 examples; with a rounded or pointed end (Fig. 3, No. 3).
   2 examples; with a square end (Fig. 3, No. 4).
   One of the latter is flaked on both sides and one end, and is covered with cortex on both surfaces and the other end.
2. Tool which is comparatively wide and thin; 2 examples. One has a pointed edge worked by steep flaking on one end (Fig. 3, No. 5). There ist not such a feature on the other.
3. Tool with a pointed end and a massive base; 3 examples (Fig. 3, No. 6).

Besides there is one fragmental specimen made on a rather thin flake.

II. Bifacially flaked tools

A. Tools of simpler forms

3 examples. These are made on pebbles, and are similar to the unifacially flaked tools of group A. Flaking is limited to the edge part. One example is flaked alternately on one side of a quadrangular pebble (Fig. 4, No. 1). The others are made on oval pebbles. One is flaked on one end, and the other is flaked on one end and one side.

B. Tools of more specialized forms

2 examples. One is made on a large oblong flake, and is flaked unifacially on one side and alternately on the other side. One surface of this specimen is almost covered with cortex. The other specimen resembles a hand-axe in shape. About half of one surface is covered with cortex, and the other part of this surface is flaked. On the other surface, the opposite portion of the part covered with cortex is chiefly flaked. As the result of a kind of alternate flaking, wavy edges are formed on both sides. The edge on one side is like a twisted-edge (Fig. 4, No. 2).

As the flakes and cores are few, it is difficult to make a clear classification based on flake-producing technique. The flakes may be classified into three types as follows:

A. Flakes of irregular forms

7 examples. Scars on the upper-surface of the flake show different directions of striking. 2 examples; with a plain striking platform. 3 examples; each one has a striking platform with a ridge which joins to the main flake surface in a T-shape at the striking point (Fig. 4, No. 6). One example has a striking platform with an irregular facet. The other lacks the striking platform.

B. Flakes of rather regular forms

2 examples. The ridge on the striking platform and scars on the upper-surface show careful preparation on the core. The ridge is similar to that of the flake of group A. One has a concave scraping-edge on one side (Fig. 4, No. 7).

C. Blade-like flakes

3 examples. Two are not definite. The other has signs of use (Fig. 4, No. 8). Each has a small plain striking platform.

The striking angle varying between about 100°–120°. Specimens with comparatively narrow striking platforms are more abundant than those with wide striking platforms. Besides these, there are four flakes including a crude massive one, two very small ones and a medium-sized crude one. The fourth flake might have been removed from some kind of tool. There has not been found any flake tool of regulated form.

The cores may be also classified into three types as follows:

A. Comparatively thin cores with flat upper-surfaces

2 examples. The under-surface of the core is covered with cortex. Flakes are struck off alternately from the upper-surface and side (Fig. 4, No. 3). These specimens show that ridges on upper-surfaces and sides were chosen for striking points. It seems that many flakes of group A were detached from this type of core.

B. Cores with prepared striking platforms

3 examples. One resembles the core of group A (Fig. 4, No. 4). Another is similar to a blade core. The third has two striking platforms on opposite ends. Flakes are removed from cores by striking done against the ridge on the prepared striking platform. It appears that the flakes of group B were produced from this type of core.

C. Blade core

1 example (Fig. 4, No. 5). This specimen is worked on a flake with cortex on one surface, and has a roughly prepared striking platform.

There are two other cores. One is scarcely worked on a pebble. The other is quite diminutive, and looks like a flake.

Although the stone implements from Nyu are not sufficient for making a definite classification, it is noticed that there is some degree of specialization both in types of tools and in flake-producing technique.

3. Comparisons of stone implements

As far as specimens found heretofore are concerned, unifacially flaked tools are more numerous than bifacially flaked tools. A Similar tendency is observable in the Choukoutienian, Patjitanian and Anyathian cultures. The tools of simpler forms and those of more specialized forms are about the same in amount. The latter shows characteristics of the Nyu Industry.

The unifacially flaked tools of sub-group B–1 closely resemble the keeled "Flat-iron" chopper (van Heerkeren, 1957, Pl. 13a) and proto-hand-axes of steep-ended forms (Movius, 1949, Fig. 14, Nos. 1 and 2) in the Patjitanian. According to Hallam L. Movius, Jr. and van Heerkeren, these types of tools are characteristic of the Patjitanian. These specific tools in the Nyu Industry may be important in consideration of the descent and the age of this Industry. Moreover, some kinds of proto-hands-axes of the Patjitanian resemble the unifacially flaked tools of subgroups B–2 and B–3 (Movius, 1949, Fig. 14, Nos. 3 and 4). A chopper from Locality 1 of Choukoutien is similar to the tools of subgroup B–1 in steep-sided form (Teilhard de Chardin and Pei, 1932, Fig. 33). Pointed tools called the "Tingtsun Point", from early Palaeolithic sites of Kēhé, Tingtsun and Feng Cheng Shan in Shansi Province, China are different from the tools of sub-group B–1, but have a similar feature as a kind of pick like tool (Chia, Wang and Wang, 1962; Pei, Woo, Chia, Chow, Lin and Wang, 1958; Chia, Wang and Chiu, 1961).

An Artifact which resembles the bifacially flaked tools of group B has not been found in any other area. But two implements from Locality 15 of Choukoutien show some resemblances. These are made on large flakes and they are flaked from two directions on one side so as to be easier to hold (Pei, 1955. Fig. 8).

A core of the early Soan resembles that of group A from Nyu (de Terra and Paterson, 1939, Pl. 36, No. 2). Flakes removed from this core must have possessed ridges on striking platforms.

The cores and flakes of group B show a remarkable flake-producing technique. It seems that the method of flake manufacture observed on the flakes and cores of group A developed into the technique of group B. For the first time, Chia Lan-po noticed this technique in his reexamination of implements of Sinanthropus (Chia, 1956). He pointed-that out flakes with ridges on the striking platforms exist in common at the Sinanthropus site and Locality 15 of Choukoutien (Chia, 1957). The same kind of flakes were found also at Litsun Hsi Kou (Chia, 1959, Pl. 2, No. 2) in Shansi. Cores from Tingtsun and Kēhé are similar to those of group B from Nyu. The existence of this technique in China and Japan may suggest a close relation between the two areas.

The blade core from Nyu is worked on a thick flake. The utilization of flakes as cores is known in the Patjitanian (Movius, 1949).

On the other hand, it should be noticed that there are many differences between the Nyu Industry and the early Palaeolithic cultures in China and other areas. For example, hand-axes are not only found in the Patjitanian; a hand-axelike implement was also obtained from Tingtsun. At Nyu, however, no real hand-axe has been discovered. Core tools with alternately flaked edges are characteristic of industries at Tingtsun, Kěhé, Litsun Hei Kou and Chiao Ch'eng (Chia and Wang 1957) in Shansi. According to reports, these sites have been dated in the later stage of the early Palaeolithic age, except Kēhé. On the age of Kēhé, different opinions have been manifested. This type of core tools has not been found at Nyu.

From the above comparisons of stone implements, it may be recognized that there are some important affinities between the Nyu Industry and the Lower Palaeolithic cultures in China and Southern Asia. But there are some weighty differences.

III. The Sites of Fujiyama and Gongenyama, Northern Kanto Region

The Fujiyama site was discovered in 1949 and the Gongenyama site in 1948 by Tadahiro Aizawa. Several choppers and flakes were found at the Fujiyama site. The Gongenyama site was reported by Johannes Maringer in detail (Maringer, 1956a; 1956b; 1957a; 1957b). This site comprises three localities, where three different assemblages were found. Gongenyama I from the lower horizon includes three bifacially flaked tools made on flakes (a pear-shaped hand-axe-like specimen, a heart-shaped hand-axe-like specimen and a pick-like specimen), side scrapers and flakes with faceted striking platforms. Gongenyama II from the middle horizon includes a massive chopper, a pointed chopping-tool, side scrapers, flakes with faceted striking platforms, blades and a blade core. Gongenyama III from the upper horizon includes unifacially flaked pebble tools and flakes. Maringer concluded that Gongenyama I and II belong to the Patjitanian tradition and are datable in the early Late Pleistocene. He also recognized that Gongenyama III has the early Hoabinhian features.

Fusao Arai of Gumma University has done research on the volcanic ash beds in the northern Kanto and divided them into three beds, namely the Lower, Middle and Upper Loam. According to Arai, the implement-bearing bed of Gongenyama I exists in the Middle Loam and Gongenyama II exists at least below the Upper Loam. He also made it clear that the implement-bearing bed at Fujiyama exists below the pumiceous bed which is the lowest part of the Middle Loam (Arai, 1962). The Lower, Middle and Upper Loam are correlated respectively with the Shimosueyoshi, Musashino and Tachikawa Loam of the southern Kanto Region by Arai.

These two sites were found ten years or more prior to the discovery of the Nyu site. But there was a large gap between the discoveries of the sites and the establishment of geological sequences of the Pleistocene in this district. Unless more artifacts are found in the future, it is impossible to make a correct description on the stratigraphical position of the implement-bearing beds at the sites.

IV. Geomorphological Considerations on the Age of the Palaeolithic Implements in Japan

Since no human or mammalian fossil remains have been found, it is impossible to consider the age of the Nyu site by a palaeontological method. At the present status, the chronology must be established by a geomorphological method. The age of the Nyu Industry has to be determined from evidence based upon the age of the Red Soil which was formed on the upper part of the implement-bearing bed at Nyu. The following are concerned with the correlations between the ages of Red Soils and those of palaeolithic implements. The Red Soils are considered as a key bed in the correlations.

In the southern part of Tokai Region and Southwest Japan, Red Soils have tinges of reddish brown, reddish orange, pink-red, etc. which have been developed from various parent materials and are widely distributed. These soils have been considered as the zonal soils formed under the present bio-climatic conditions. Recently some pedologists have studied the Red Soils in Northeast Japan, and have considered those Red Soils as the lateritic weathered products in the warmer periods of the Pleistocene.

Since the Red Soils in Northeast Japan have been regarded as relict soils, it has been expected that a wide-ranged formation of the Red Soils in Southwest Japan consists also of relict soils. Takeshi Matsui found such a relict Red Soil near Kurume. Sakaguchi also made a study in the same district. Matsui and Yoshiro Kato recently have compiled their data after the discussions of the characteristics of the Relict Red Soils in Japan. They have established the three stages of the Red Soils, the pre-Shimosueyoshi, Shimosueyoshi and post-Shimosueyoshi stages. But this correlation is tentative. The Shimosueyoshi stage is an accumulation period of marine deposits (Shimosueyoshi Formation) forming, a 45 m – terrace in the Tokyo and Yokohama districts. It has been proved from the mollusca fauna that the climate of this period was warmer than at present. The marine deposits correlated to the Shimosueyoshi Formation are widely distributed in Japan. The transgression in this period is called the Shimosueyoshi transgression. This stage, lacking any conclusive evidence, is correlated to the Riss-Würm Interglacial age. On the basis of his knowledge of the red soils on the Chinese Continent (Mainland), Matsui has inferred that the true zonal red soils formed under the present bio-climatic conditions may be distributed as far south as the Amami Islands.

According to the writers' observations, there are two kinds of terraces in Japan, the laterized and the non-laterized terraces on which the Red Soils are not developed, and there are at least two periods of formation of the Red Soils.

1. Kaminokuni, Southwestern Hokkaido

Along the whole coast of Hokkaido, two marine terraces of 40 m and 80 m in height of type localities are formed. In the neighborhood of Kaminokuni the Red Soil (10 R) is formed on the upper terrace and other higher geomorphic surfaces, but it can not be observed on the lower terrace. It has been proved by the results of the pollen analysis that the deposits of the 40 m – terrace of Hokkaido, in general, accumulated under a colder climate than at present. According to the writers' pollen analytical investigation of the humus layer under the Red Soil of the upper terrace at Kaminokuni, *Tsuga* predominates among the tree pollen, but it also contains a small amount of *Quercus*. This fact is very interesting. In Japan there are two kinds of *Tsuga*, namely *Tsuga Sieboldii* and *Tsuga diversifolia*. The former is found in the southern part of 37°30'N and the latter in the southern part of Honshu, chiefly in the Central Japan, and neither of them are distributed in Hokkaido. It has not yet been proved whether or not the Tsuga of the fossil pollen at Kaminokuni belongs to Sieboldii. If it belongs to Sieboldii, it is inferable that the climate was warmer.

2. Kuji, Pacific Coast of Northern Honshu

In this area, there are four marine terraces which Hisao Nakagawa has named the Kunohe terrace (200–300 m), the Shiromae terrace (100–110 m), the Taneichi terrace

(60 m), and the Tamanowaki terrace (40 m) respectively from the top (Nakagawa, 1961). In the Kunohe terrace, the Red Soil is formed on the top of the volcanic-ash-like deposit covering a sand-gravel bed. Where the Red Soil is not found, the top of the sand-gravel bed is remarkably weathered. Moreover, the Red Soil is covered with a gravel bed. The Red Soil (10 R) is also found along the steep slope of a cliff of the Shiromae terrace. This Red Soil is different from that of the Kunohe terrace, and is covered with three volcanic ash layers.

3. Shibata, Central Honshu

In the upland, at the base of the mountain in the southeastern part of Shibata City, there are three terraces, namely, the Funayama terrace (higher than 110 m), the Nagaminehara terrace (60–110 m) and the Tao terrace (45–70 m). The Red Soil is well developed on the Nagaminehara terrace and the higher geomorphic surfaces. In the Nagaminehara terrace, the Red Soil is formed in the upper part of the terrace gravel bed, and is covered with the chocolate colored volcanic ash layer. In the lower part of the volcanic ash layer, a cracky zone is remarkably developed. The writers assumed that at least in the first part of volcanic ash falling period the climate was still adequate for the formation of the Red Soils, and strong weathering took place.

4. Tokyo and Yokohama Districts

In these districts; there are four terraces, namely the Tama terrace (T. 1 terrace 100–200 m, T. 2 terrace 60–90 m), the Shimosueyoshi terrace (45 m), the Musashino terrace (10–100 m) and the Tachikawa terrace (– 30–100 m). The T. 1 terrace deposits are called the Gotentōge gravel bed, and are covered with the volcanic ash layer (20 m in thickness) which is named the Tama Loam. The T. 2 terrace deposits are called the Byobugaura Formation. Its marginal deposits are the Oshinuma sand-gravel bed and are conformable to the Tama Loan. As already mentioned, the Shimosueyoshi terrace deposits (or the Shimosueyoshi Formation), gradually change to the volcanic ash layer (7 m in thickness) called the Shimosueyoshi Loam. The Musashino and Tachikawa terrace deposits are called the Musashino and Tachikawa sand-gravel beds (both are 5 m in thickness) respectively. The former is covered with the volcanic ash layer (5 m in thickness) called the Musashino Loam, and the latter with the Tachikawa Loam (3.5 m in thickness) (Hatori and Juen, 1958a; Kantō Loam Research Group, 1961). The gravels of the Gotentōge sand-gravel bed are conspicuously weathered. The writers found the Red Soil (2.5 YR) near the type locality of this bed.

Also in the Sayama Hill which is located in the northeastern part of the Tama Hill, the Red Soil 2.5 YR) was found in the upper part of the weathered sand-gravel bed called the Imokubo gravel bed. The Sayama Hill has been correlated to T. 2 terrace (Hatori and Juen, 1958b), but on the basis of the existence of the Red Soil the writers correlate the Sayama Hill to the T. 1-terrace of the Tama Hill.

The Tama Loam is compact volcanic ash which is remarkably chocolate colored (5 YR) and cracky. It seems that this volcanic ash was affected by weathering. Accordingly, it can be concluded that after the laterization of the Gotentōge gravel bed the Tama Loam was accumulated and again the laterization took place. This laterization period is correlated to the Shimosueyoshi stage.

5. Makinohara, Pacific Coast of Central Honshu

In the Makinohara Upland, there are three terraces, namely the Takaneyama terrace (60–200 m), the Makinohara terrace (35–200 m) and the Iroo terrace group (80 m) (Tsuchi, 1960). The Red Soil (10 R) is observed in the upper part of the Takaneyama gravel bed (Ogasa gravel bed). The lower part of the Makinohara gravel bed is correlated to the Furuya mud bed. The mollusca fauna contained in this mud bed are the species of southern habitat which do not live in the sea of this district. Also a *Palaeoloxodon Naumanni* fossil was found in this bed. From these facts the Furuya mud bed is correlated to the Shimosueyoshi Formation.

In Makinohara terrace a Red Soil as brilliant as that of the Takaneyama terrace is not observed, but a reddish-brown soil (5 YR) is developed.

6. Kurume District

Five terraces the Kōradai terrace I and II (50–100 m) the Imabuku terrace (30–45 m), the Kakezuka terrace (25–35 m) and the Hainuzuka terrace (25 m), are observed in this district. The parent materials of the Red Soil consist of schist, Tertiary lacustrine deposits and Pleistocene gravels. This Red Soil is remarkable in the Kōradai terrace. But in the Kuroki Basin of the east, the terrace sand-gravel bed in the terrace which is correlated to the Imabuku terrace is covered with the Inuyama bed, tuffaceous clay, and the top of the Inuyama bed is laterized. Consequently, it is considered that the Red Soil was formed after the formation of the Imabuku terrace in this district. The Red Soil in the Kōradai terrace has not yet been clarified as to whether it is monogenetic or polygenetic. The surface of the terrace is covered with one to four layers of volcanic ashes. The volcanic ash, called the Yame clay, is of a different facies of the Aso welded tuff, and stretches over up to Kakezuka terrace.

As mentioned above, it has been clarified that there were at least two periods of laterization before the formation of the Shimosueyoshi terrace in the Pleistocene epoch. They are the pre-Shimosueyoshi and Shimosueyoshi stages.

In the Nyu Upland the brilliant colored Red Soil is observed only in the Second Terrace. But it is difficult to determine, owing to the insufficient invesitigation of the Third Terrace and the lower ones, whether this Red Soil is a monogenetic one formed in the Shimosueyoshi stage or a polygenetic one formed during both laterization periods in the Shimosueyoshi and pre-Shimosueyoshi stages. The Fifth Terrace, however, is characteristic of the elevated coastal plain, and is possibly correlated to the Shimosueyoshi terrace in the Tokyo-Yokohama districts. If the Red Soils should not be found in the Third an Fourth Terraces in the future, it may be concluded that the Red Soil in the Second Terrace was formed in the pre-Shimosueyoshi stage. The age of the Nyu Industry is before the Red Soil formation and decidedly not after the Shimosueyoshi stage.

According to Sun Dyan-chin and Yan Khuei-dzen (Sun and Yan, 1962), three types of boulder clay have been recently discovered in the neighborhood of Choukoutien. The first type of boulder clay lies immediately under the *Sinanthropus pekinensis* fossil-bearing bed. As the results of spore-pollen analysis, it has been known that it contains a large quantity of spores of *Botrychium lunaria, Bryophyta* and *Selaginella,* and was accumulated under comparatively cold climate. On the other hand, the Sinanthropus-bearing bed contains *Ulmus, Salix, Betula, Celtis, Pinus, Fraxinus, Picea, Carpinus, Alnus, Tilia,* etc. It suggests that the accumulation of the bed took place under a mild climate in an interglacial age. The second type of boulder clay has the tinge of brick, and is distributed outside of the Sinanthropus cave. It was formerly called "Lower gravels". The results of spore-pollen analysis show that it contains *Saxifraga, Selaginella, Compositae* (containing Artemisia), *Bryophyta, Ranunculaceae,* etc., and was accumulated under a severe climate during a glacial age different from the age when the first boulder clay was accumulated. The third type of boulder clay is distributed over the basin near Choukoutien. The deposits on the upper part of the Sinanthropus cave were formerly called "Upper gravels". According to the results of spore-pollen analysis, it contains a great quantity of spores of *Botrychium* and *Selaginella* and a small quantity of pollen of GIMNOSPERMAE. They indicate that the deposits were accumulated under a cold climate. As explained above, the three types of boulder clay in Choukoutien and its environs were formed during the glacial ages. But a correlation between the periods of these three types of boulder clay and the glacial ages in Europe and America has not yet been clarified.

The schematic profile of the Sinanthropus cave and its neighborhood presented by Sun and Yan indicates the formation of laterite on the upper part of the second type of boulder clay (Lower gravels). This laterite, though Sun and Yan have not mentioned anything about it, is interesting in consideration of the ages of the Red Soils in Japan.

V. Remarks

Stone implements obtained from the Kanto Loam are known as remains of non-ceramic cultures[1] which are earlier than the Jōmon Culture. These specimens were found at various sites without the association of pottery. Many archaeologists and geologists considered that the non-ceramic cultures belong to the Palaeolithic-Mesolithic age. Recently it has been considered that the greater part of the non-ceramic culture belongs to the earlier part of the Neolithic age (Yamanouchi and Sato, 1962). Consequently real Palaeolithic remains have come to be more limited as described above. The present article owes a great deal directly to this result.

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[1] Sugihara, Sosuke, The Stone Age Remains found at Iwajuku, Gumma Pref., Japan. Reports on the Research by the Faculty of Literature, Meiji University, Archaeology No. 1, 1956.
Serizawa, Chosuke and Fumiko Ikawa, The Oldest Archaeological Materials from Japan. Asian Perspectives, Vol. 2, No. 2, pp. 1–39, 3 pls., 1960.

The geomorphological and paleopedological evidences show that there were at least two Red Soil formation periods or warmer periods in the Quaternary of Japan. One is correlated to the Shimosueyoshi stage, and the other to the pre-Shimosueyoshi stage. Since the implement-bearing bed at the Nyu site has passed at least one Red Soil formation period, it is definite that the age of the Nyu Industry is older than the Shimosueyoshi stage (Riss-Würm Interglacial age). According to the considerations on the relationship between the Red Soils and the Kanto Loam, it is clear that the Nyu site is much older than the Fujiyama site.

From a typological point of view, it can be considered that the Nyu industry was closely related to the Lower Palaeolithic cultures in Southern Asia and China, and localy developed to some extent. No fossil remains have been found at Nyu. Though only an imagination, the Nyu Industry may possibly have been left by men who had some connection with Pithecanthropus erectus and Sinanthropus pekinensis and who reached Japan through means of the land-bridges which existed at that time.

At present, materials concerning the Pleistocene Man in Japan are only fragmentary. Nobuo Naora found fossil human bones in caves around Kuzū in the northern Kanto Region[2]. Hisashi Suzuki and Fuyuji Takai discovered several fossil human bones including a worked parietal bone in association with mammalian fossils from the limestone fissure site at Mikkabi in Tokai Region[3]. Until now, no stone implements have been found associated with human fossils. Several worked horns and bones and a few stone flakes were found in the fossil-bearing bed at Hanaizumi in Northeast Japan by Hiroshi Sone, Hikoshichiro Matsumoto, Hiroshi Ozaki and Nobuo Naora[4]. These were associated with abundant mammalian fossils, but human bone was absent.

Kanazeki and Kokubu are conducting a study of the Palaeolithic sites in Southwest Japan. Shinnosuke Ishii is continuing his search for Palaeolithic implements in the Tama Hill. Recently several choppers have been found at a locality in this Hill. It is expected that the sequences of Palaeolithic cultures and the Pleistocene Man in Japan will be clarified in the near future.

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[2] Naora Nobuo, Old Stone Age in Japan. Report of the Archaeological Institute, Waseda University, No. 2, 1954.

[3] Mikkabi, Man and Fossil bearing Deposits from Tadaki Limestone Quarry at Mikkabi, Central Japan. Jour. Anth. Soc. Nippon (Zinruigaku Zassi), Vol. 70, No. 1, 1962.

[4] Naora Nobuo, On the Fossils found in Hanaizumi, Iwate Prefecture. The Quaternary Research, Vol. 1, No. 4, pp. 118–124, 1959.

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