REEXAMINATION AND MEANING OF THE PACITANIAN ASSEMBLAGES IN THE CONTEXT OF THE SOUTH-EAST ASIAN PREHISTORY

Martha Rosintauli Bakara

Orientadores:
1. Claire Gaillard
2. François Sémah

Ano académico 2006/2007
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I. INTRODUCTION

“Chopper Chopping Tool Complex”: I heard this terminology so many times in my first and second year in the department of archaeology in Gadjah Mada University, Yogyakarta, Indonesia. Each time one of my professors talked about this, she also mentioned about a region called Pacitan, on the south coast of Central Java, not far from the city I studied.

In connection with this topic, Pacitan, or Pacitanian, I also heard very often some European names like Von Koenigswald, Movius or Van Heekeren. And I kept in mind that they took a very important role for Pacitanian, and also opened a completely new chapter in the history of prehistoric research in Indonesia. I never thought that I would remember those names easily and never had the intuition that I would be more familiar with their opinion about Pacitanian, and moreover involved in the study of Pacitanian lithic assemblages. Since Pacitanian has been found in the Baksoka valley, continuously questions are raised but not solved yet, especially connected with the dating and the signification of those archaeological remains. In the term of lithic assemblages, some previous researchers described the typology of the Palaeolithic implements, and the interpretation was essentially focused on the meaning of the Pacitanian artifacts as a cultural complex connected with the earliest human occupation of South-East Asia.

From the historical reports about Pacitanian, it is clear that a high quantity of artefacts were collected at different moments by numerous researchers from many countries and with a different selection of the material collected. In consequence these artefacts are distributed in various institutions and private collections spread in the whole world. Nowadays, this condition has drained most of the resources of the site and is the major difficulty for the researchers who would have a global overview of all the Pacitanian artifacts and would give a new and modern interpretation about the meaning of all these findings.

All this light memory inspired me to deal with Pacitanian, which is famous among numerous Palaeolithic assemblages. The topic of this study deals with the lithic technotypology of Pacitanian artifacts which are conserved in some institutions in Europe and some in Indonesia. Almost 40 years after the last important study about Pacitanian, we would offer a modern interpretation of these lithic artifacts, correlated with the historical background, the actual management of this cultural heritage and the main problematic that lead modern prehistoric research about the earliest human occupation in Indonesia and, moreover, in South-East Asia.
II. GENERAL INTRODUCTION TO PACITANIAN

A. Localization of Pacitan Area

Pacitan is regency located in southwestern East Java Province, in Indonesia (fig.1), with central Java Province on its West border (between 7.55° - 8.17° S and 110.55° - 111.25° E). The Pacitan Regency is about 1,342.42 km² and most of it is mountainous and rocky. That kind of landscape covers about 88% of the regency and this is why Pacitan is located in the Gunung Sewu “Thousand Mountains” that stretches along Java (fig.2).

The Baksoka River crosses this area and lies near Punung, a village some 10 miles north of Pacitan on the south coast, East Java (fig. 3). The measure of the river is about 23 kilometers long and 50 meters wide which flows from east to west, then turns southwards. It bears four names: Baksoka River for the upper and middle part, and Kladen, Maron, and Sambi River for downstream (Simanjuntak, 2002).

Baksoka River has attached the attention of scholars due to the dense Palaeolithic remains found in the riverbed and on its terraces since 19th century, particularly since the earlier researchers quickly noticed its richness in prehistoric artifacts, from the numerous Neolithic adzes until “archaic-looking” implements lying in the riverbeds (Semah et al, 2004).
Figure 2. Location of the Gunung Sewu (after Bartstra. 1976).

Figure 3. Situation Sketch-map of Baksoka River (after Van heekeren 1955).
B. History of Researches

1. Geological Researches

Since 19th century, a lot of work has been done by European researchers in Gunung Sewu region, especially about the landscape and the geology of the region.

The first research was conducted in 1836 by Junghuhn. He made an extensive study of the land and its people, crossed the Gunung Sewu and he noticed that the region was characterized by numerous isolated hemi-spherical hills, some of which being conical in form: like a giant field of hills with in between narrow, labyrinthian valleys. He believed that the Southern Mountains were uplifted during the formation of Gunung Merapi, a volcano to the north, and conclude that the Gunung Sewu is the largest, thickest and most remarkable limestone formation on the whole Java (Junghuhn, 1850).

Van Dijk (1872a) made a fieldwork in Gunung Sewu as well, and his opinion is that a fault has taken place in the Gunung Sewu, observable in the landscape as a line along which the Southern Mountains were raised. Van Dijk suspects the composition of Java’s south coast to be very monotonous: always trachyte covered with limestone.

According to Verbeek and Fennema (1896) the limestone of Gunung Sewu lies almost horizontal, though there is a slight, but visible dip towards the south. They believed that the typical conical hills were formed after the limestone had risen above the sea; basically as a result of erosion and possibly also wave. They also said that the limestone of the Gunung Sewu and the exposed rocks of surrounding mountains are Upper Tertiary in age: all are the result of a Neogene sedimentation cycle on Java (Verbeek & Fennema, 1896 in Bartstra, 1976).

In twentieth century, the geology of Gunung Sewu is studied more and more by Niermeyer, Danes, Van Valkenburg and White, and Escher. Danes, a Czech geographer, made the first extensive study of the karst phenomena (Danes, 1910). According to Danes, the limestone in the Gunung Sewu is fairly hard, mechanic and chemical erosion must consequently play an important part. Van Valkenburg and White (1924) put emphasis on chemical weathering may explain the bowl shaped valleys and the formation of the depressions in Gunung Sewu, but not the origin of the conical hills. Afterward, Escher supposes that the sharp ridges of the hills have been rounded by weathering. And he states
that the limestone of the Gunung Sewu is of Miocene age (Van Valkenburg and White, 1924 in Bartstra 1976).

In nineteen-thirties, Van Heek (1932) is the first person to draw a detailed geological map of the eastern Gunung Sewu and the adjoining Eastern Plateau. He observes the different morphologies around the village of Punung. To the west there is the karst with its numerous conical hills, its subterranean rivers and dripstone caves. To the east there are quietly sloping hills, built up of detrital volcanic deposits, which can be divided into a dacitic and an andesitic part. He also observes them in the landscape above the much softer breccias of the andesitic formation. He considers the limestone as well as the clastic sediments to be Miocene (Van Heek, 1932 in Bartstra 1976).

After Van Heek, Lehmann (1936) explained that the present karst is the result of the combination of like epeirogenesis (tilting ad warping of the limestone massif) and tropical climate (such as the action of rainwater under hot conditions). According to him, the hills of the Gunung Sewu are rather steep, regularly rounded and also fairly close together. Another about the limestone in Gunung Sewu, Lehmann said that it was formed during the Upper Miocene and lies on underlying volcanic sediments; later it was elevated above the sea, resulting in a vast Post Upper Miocene plain of degradation. This plain was formed by subaerial erosion, and perhaps not by marine denudation. This drainage was directed southward and Lehmann points to the course of some old rivers, such as Oyo and Baksoka (Lehmann, 1936).

In general, all the investigations which started in nineteen-thirties, especially in geological researches in the Eastern Gunung Sewu and the Eastern Plateau were influenced by the discovery of a new site with big stone artifacts of various types including hand-axes. This discovery threw new light on the problem of the evolution of Palaeolithic man in this part of Asia, and was also important from the geological point of view.

In 1938, in the spring time, after this first discovery of "Chellean" lithic artefacts, the members of the Joint American Southeast Asiatic Expedition for Early Man made a short visit to Punung. Since this visit, Teilhard de Chardin, De Terra, and Movius firmly mention the occurrence of younger tuff deposits around Punung, which can be distinguished from the Tertiary volcanic deposits beneath the limestone. At the time of their time to visit to the Gunung Sewu, they also made a short visit to the Baksoka valley.
In the nineteen-fifties, the investigation was still continuing, especially by Marks and Sartono. In 1953 it was Marks who first showed the simple superposition of limestone and volcanic sediments in the Gunung Sewu. According to him, the Eastern Plateau is made up of sands and gravels, often with a large amount of silicified wood fragments (Marks, 1953 in Bartstra, 1976).

Sartono published an important study in 1964, concentrated in geological and geomorphic development of the area, especially around Punung. In his opinion the area is more of less a plateau, composed in the west of the limestone zone with a subterranean drainage pattern (Gunung Sewu), and in the east of volcanic clastic sediments with a dendritic drainage pattern. Giving a contribution to the Baksoka region, Sartono made the cross-sections of the Baksoka area and showed that it is the youngest and the last-deposited clastic formation which interfingers with the limestone (Sartono, 1964).

Flathe and Pfeiffer (1965) published an article about the morphology, geology, and hydrogeology of the Gunung Sewu. Bartstra (1976) summarized about chronological study that has been made by several researchers since 19th century in Gunung Sewu and Eastern Plateau. From this summary, scholars believe that volcanic activity and epirogenic movements have played a major role in the formation of Gunung Sewu.

Simanjuntak and Intan (Simanjuntak, 2002) explain about the history of formation of rock components of Gunung Sewu. According to them, the Gunung Sewu region was originally a plain with deposits of various sediments of marine environment. Depressions occurred since the Oligocene and during Middle Miocene tectonic movements occurred in the Gunung Sewu, and then during the Holocene erosion formed the alluvial unit that was deposited above the limestone of Gunung Sewu.
2. Archaeological Field Researches

The archaeological history about Gunung Sewu, and especially Pacitan, is connected with the discovery of lithic assemblage in this area since the beginning of the 20th Century.

Von Koenigswald and Tweedie discovered an archaeological site on the 4th of October 1935. This site, near Pacitan, yields of big stones implements of various types, including hand-axes. These artifacts were found in a dry watercourse, most of them lying spread out in the river bed, but some in situ in a boulder conglomerate in the river bank, from which all were probably derived. This new find was directly published in May 1936 by Von Koenigswald. In his article, von Koenigswald describes more the lithic assemblage. All the implements are made of silicified volcanic rocks (tuffs), different kinds of silicified limestone and fossilized wood. The state of preservation of the implements is quite variable. Some specimens are hardly rolled, and in other cases the specimens have sharp cutting edges but are heavily patinated. The rest of his work in this report is to describe the typology of the assemblages and by reviewing the various types of implements he suggests that Java has a “complete Chellean” component (Von Koenigswald, 1936).

The papers that Movius published in 1944 and 1948 mentions and describes more about what he calls “The Patjitanan Culture”. Guided by the deposits and the lithic implements, he supposes that Pacitanian should be placed in the late Middle Pleistocene or at the latest in the early Upper Pleistocene Period. He also says that mostly the implements have been manufactured of silicified tuff, although some are of silicified limestone, and in a few cases of fossil wood. After, he divides the lithic implement into several main typological categories. He concludes at the end that the Lower Palaeolithic of Java clearly does not belong to the true hand-axe culture-complex of Europe, Africa, the Near East and India (Movius, 1944 & 1948).

By passing through the time, investigations more focus on the lithic assemblages. Van Heekeren and A. Christie made a brief trip to the Baksoka Valley and collected some stone tools. Besides studying the lithic assemblages from Baksoka area, Van Heekeren also reveals some new localities notably in Tabuhan area, North of Punung and describes the lithic assemblage by categories. Briefly, Van Heekeren said that Pacitanian shows an extreme slowness in the tempo of technical change and in creating new forms (Van Heekeren, 1955).
3. Overview on the Previous Studies of the Pacitanian Collections

a) The Opinion of Von Koenigswald

Von Koenigswald comments the state of preservation of the artefacts which are collected from Baksoka River as variable (1936). The degree of patination depends on the material, but in most cases with strong patination. When Von Koenigswald and Tweedie collected artefacts from Baksoka River, they also found some Neolithic implements from Punung and Pacitan. They observed that these implements were made of the same materials, but practically did not have patination. For the Palaeolithic implements, some of specimens are hardly rolled, as most of the tools found in the river-bed have only recently been derived from the original layer. But in other cases the undulating or the rolling is more marked and the artefacts seem to be older. Other specimens again have sharp cutting edges but they are heavily patinated. Possibly the boulder conglomerate is not the true parent layer of all the material, some of which maybe of secondary origin, derived from other layers, nowadays possibly destroyed by erosion. Anyhow, though the implements may originate from several horizons, the typology suggests that they do not differ to any great extent. Besides relating to the preservation of the artefacts, he also classified them into categories such as: hand-axes, points, scrapers, awls, blades, cores, and flakes (Von Koenigswald, 1936).

Hand-axes, also called coups-de poings are the most typical implements and the most important for sake of correlations. From the collection he studied, all the hand-axes were worked bilaterally, and the points formed by flaking. If the hand-axes were shaped on flake, in most of the cases, only the bulb of percussion and the zone of striking platform that can be seen on the ventral side. The edges are usually retouched on one face only.

From the drawings (fig.4), Von Koenigswald tried to distinguish several sections of hand-axes. The option “a” is made from a round, elongated pebble, with pointed cutting edge at the anterior end. The option “b” is a short and pointed hand-axe, the last one is the option “c” also considered as a pointed specimen. In general, there is a specific sequence from poorly to well worked tools, but in most of the cases cortex of the pebble is preserved.

1 In Koenigswald's article he writes down: pl. XLIV, fig. 1 to show the option "a" in sections of Hand-axes, but in fact it seems there is a mistake in writing, it should be pi. XLVI.
He also describes the typology of other hand-axes and he arrives into the conclusion that hand-axes are only known elsewhere from a few cultures and that in none of the material is strictly comparable with that from the new Javanese site. Those hand-axes from Pacitan are not comparable to the Acheulian hand-axes which are more finished, thin, symmetrical, and worked all around the edge. The Javanese hand-axes look very primitive: in most cases the base is not worked and consists of the original surface of the stone (cortex). Implements comparable with this type, are found in the beginning of human industry, in the early Palaeolithic “Chellean” culture which is known from Europe, Africa and India, and without a doubt in the most primitive phase of this culture. Yet the late Chellean hand-axe in some cases is better worked with a cutting edge all around. Moreover, the hand-axes from Java are broader and shorter (Von Koenigswald, 1936).

b) The Opinion of Movius

Concerning the Pacitan culture, Movius studies Von Koenigswald’s collection (2419 items, table 1) in Bandung in 1938 (Movius, 1944 and 1948). He said that some of the artefacts are rounded, but others are not. Normally, the artefacts which are found in the river
bed are more rolled compared with those which are found on the valley slopes. The location of the find-spot is indeed important, not only with regard to the degree of rounding, but also in relation to patination and weathering. The typical patination is brown, and a few specimens are dark grey, but this is very rare in the case of the silicified tuff implements. However, the silicified limestone shows all shades of grey.

He also makes some remarks about the technique to obtain the raw material, and he finds it very interesting. In the Baksoka valley, occur huge boulders of silicified material. It seems that prehistoric man broke these into fitting sizes for implements by dropping other stone on them. Flakes which are obtained by this crushing process could rarely show either a bulb of percussion or a striking platform. It is very usual that large flakes have been used as cores. In Movius’ opinion, only a very small proportion of the Pacitanian implements are true core, because majority of them are made on flakes (Movius, 1944).

<table>
<thead>
<tr>
<th>Type of implement</th>
<th>Total (n)</th>
<th>Total (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Choppers</td>
<td>431</td>
<td>17.82</td>
</tr>
<tr>
<td>Chopping-tools</td>
<td>89</td>
<td>3.68</td>
</tr>
<tr>
<td>Hand-adzes</td>
<td>87</td>
<td>3.59</td>
</tr>
<tr>
<td>Proto-hand-axes</td>
<td>195</td>
<td>8.06</td>
</tr>
<tr>
<td>Hand-axes</td>
<td>153</td>
<td>6.32</td>
</tr>
<tr>
<td>Flake implements</td>
<td>596</td>
<td>24.64</td>
</tr>
<tr>
<td>Trimmed flakes showing signs of use</td>
<td>807</td>
<td>33.36</td>
</tr>
<tr>
<td>Cores</td>
<td>31</td>
<td>1.28</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>30</td>
<td>1.24</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>2419</strong></td>
<td><strong>99.99</strong></td>
</tr>
</tbody>
</table>

Table 1. Distribution of Pacitanian artefacts in the Bandung series, collected by Von Koenigswald, according to Movius (1949).

Movius divided the 2419 artifacts into nine categories; choppers, chopping-tools, hand-adzes, proto-hand-axes, hand-axes, flake implements, trimmed flakes showing signs of use, cores, and miscellaneous, even though he admits that it is difficult to describe sharp dividing-lines between the various categories. His classification is based on his study of the stone tools from Irrawaddy Valley (Burma/Myanmar).

**Chopper** (fig.5): large, crude scrapers and massive scrapers mostly unifacial, and very often plano-convex implements, with “round, semi oval or almost straight cutting edges which have been formed by the removal of flakes on the upper surface”. It is significant that bifacial choppers also occur. Choppers can be considered as core tools, although they can
also be made out of thick flakes. Finally, the category of choppers can be further divided into certain sub-categories such as: double-ended choppers (bifacial double-ended choppers are also possible), and pointed double-sided choppers.

**Chopping-tools** (fig.6): these are core implements usually made on pebbles, or rough, more or less tabular, chunks, of silicified or similar types of rock. They are worked in both sides. In most of the cases, the edge thus produced is markedly sinuous, since it is normally worked by alternate flaking, or rather by the intersection of alternating flake scars (Movius, 1948).

Shape of tip in some cases is concave or square-ended, but commonly they are slightly convex edges and usually on the upper surface only. Even for the choppers, Movius makes another terminology as bifacial chopper that means a chopper with only limited flaking on their lower surface, in most cases the result of use.

Movius also sees that Chopping-tools are identical from Anyathian forms, and in almost cases, the edge is battered and chipped as a result of use. He also says that the chopping-tools are core implements with an alternately flaked cutting edge (Movius, 1944).

**Hand-adzes** (fig.6): preparation of this type produces the characteristic single beveled, always unifacial, and plano-convex implements with a straight, slightly rounded or even a pointed cutting edge, which forms a right angle with the long axis of the implement.
Thus these hand-adzes are to be regarded as a special class of chopper, but of square or rectangular, rather than of round or oval form. Hand-adzes may have been manufactured from cores or thick flakes as well. They could be divided into many subcategories such as pointed, side, concave, or double-ended specimens (Movius, 1943; Movius, 1948). According to Movius, around 8% of the entire series from the Baksoka Valley is made up of a crude and roughly pointed type of hand-adze with a plano convex section (Movius, 1944).

**Hand-axes:** true bifacial tools, extensively flaked on both upper and lower surfaces (Movius, 1944). By comparing with the opinion of Von Koenigswald in his article in 1936, Movius believes that it is originally claimed that the Lower Palaeolithic material from the Baksoka Valley is characterized by hand-axes. Because from 2419 artefacts he has studied, only 153 were classified as hand-axes (more or less 6.32%), and some are very crude examples made on natural nodules of silicified limestone sharpened at one end. Most of the forms are roughly oval, triangular types, *limandes* and elongated pick-like implements. The fundamental importance regarding the Pacitanian hand-axes is the character of the chipping: from the oval or roughly pointed end this has been made longitudinally, parallel to the main axis of the implement. At the end, he believes that there is nothing characteristically Acheulean about the Javanese specimens. Somehow, he prefers to consider them as series of Abbevillian types, even though the longitudinal flaking is a special feature. So, it means...
that in his opinion the hand-axe (or at least hand-axe-like) implement has evolved in Java from tools of the chopper or chopping-tool variety (Movius, 1944, 1948).

Two possibilities of typological development are considered by Movius (fig.7):

![Hand-axes development diagram](image-url)

**Proto hand-axes** (fig.8): They are considered by Movius as transitional between hand-adzes and true bifacial hand-axes, in a sense that they are crude and roughly oval or pointed. Proto-hand-axes are crude and roughly pointed or oval types of hand-adze with a plano-convex section. Normally these are worked on the upper surface only, and in many cases they are made on flakes. Normally, at the butt-end there is cortex. In his opinion, these implements represent a special peculiar development to Pacitanian, because they are unknown anywhere else (Movius, 1948).

![Proto-hand-axe](image-url)
True flake implements include scrapers\(^2\), points, and perforators (fig. 9). In addition to side scrapers, concave scrapers and a few end scrapers are present, as well as large disc-shaped types made on carefully trimmed flakes (Movius, 1944). Besides, unretouched flakes of all types, as well as a few true blades also play an important role. Most of these are well struck, and the scars on the upper surface reveal careful preparation on the core prior to detachment. Plain striking platform at a high angle to the long axis of the implement which calls “Clactonian” technique is very characteristic. Movius also finds that there are fifty eight specimens which have faceted butt (fig.9). But nevertheless, the classic Levalloisian technique itself is absent, but maybe Levallois-like flakes are present at Pacitan.

Many of the flakes that have not been retouched, exhibit edge-chipping as result of utilization. Few specimens classified as “gigantoliths” have been worked along the edges, but in fact the majority of them are sharp, unretouched, primary flakes which are produced by the shattering technique. So, Movius supposes that they should be considered as representing the first stage of manufacture of choppers, proto-hand-axes, etc. He also pays considerable attention to divide the flakes in two main subcategories: first are the trimmed flakes and the crudely worked flake implements, and the second are the flake implements (Movius, 1948).

![Figure 9. Lower Palaeolithic implements from South Central Java, Pacitanian.](image)

\(^2\) The essential difference between choppers and scrapers can be recognized only by size (Movius, 1943, 1948).
As mentioned above, **cores** are extraordinarily rare in Pacitan, even though the proportion of flakes and blades are overwhelming. From 2419 artefacts, the amount of cores is only thirty-one, not really comparable with the abundance of flake implements. So, Movius says that it is very possible that most of the material used in the process of implement manufacture was obtained directly from the large natural boulders since they are plentiful in the bed of the Baksoka River. And in other part, these latter cores (thirty-one pieces) should produce flakes which have facetted butts (Movius, 1948).

At the end of his conclusion, the Pacitanian fits closely into the Lower Palaeolithic chopper/chopping-tool complex of Southeastern Asia, Northern India, and China. And the Lower-Palaeolithic hand-axes of Java are to be regarded as the result of independent development and not due to influence from outside (Movius, 1948).

c) **The Opinion of Van Heekeren**

The other researcher who made the typology of Pacitanian is Van Heekeren. In general, he classified the Pacitanian assemblage into three groups. The first group is constituted by the flakes (the tools, as well as the utilized material and the debitage). The second group includes the massive monofacial pseudo-core implements with a plano-convex cross-section. This group is divided into the so-called flat-iron form (oblong and high curved) and the tortoise form (short and round). And the third group is composed by the bifacial implements. This group is divided into chopping tools, hand-axes, and hand-adzes. He describes these hand-adzes as crude, flat, which have been worked only at the edge by alternate flaking on the upper and lower surface.

From the second and the third groups, there are some differences with what Movius has mentioned in his study. For the second group for instance, Movius calls them as choppers and proto-hand-axes. And for the third group, Movius mentions that hand-adzes are not bifacial tools. Nevertheless, in general Van Heekeren accepts the terminology of Movius, even though there are some distinctions in the meaning of their terminology like mentioned above. Furthermore, Van Heekeren has redefined the choppers into three distinct types:

1. ‘Flat-iron’ choppers: Long, high-backed; plano-convex section; flat-iron shape; resolved longitudinal trimming; some examples are “keeled”;
2. ‘Tortoise’ choppers or turtle-backed choppers: Short, high-backed and flat-bottomed: tortoise shape. Van Heekeren also says that there is not much difference between tortoise choppers or turtle-backed choppers with what Movius calls as hand-adzes;


After subdividing the category of choppers, Van Heekeren agrees to say that flat-iron choppers and tortoise choppers are very characteristic for the Pacitanian, and that these categories could be used as type-specimens or as landmark for this industry (Van Heekeren, 1955).

In 1972, Van Heekeren further explains the division of choppers (fig. 10). In his publication in 1955, there are only three distinct types of choppers.

![Figure 10. Van Heekeren's typology. Hand-adze (upper part) and keeled flat-iron chopper (lower part). 15-20 meters terrace, Baksoka Valley, Java.](image)

But then he re-divided the choppers into four type: flat-iron types (long, high-backed, plano-convex in section, flat-iron shaped, with resolved longitudinal trimming; some examples are keeled3), side-choppers (massive side-scrappers irregular in outline), end-

---

3 After Van Heekeren and Knuth’s study in Northwestern Thailand in 1960-1962, they also defined the “flat-iron type” as a heavy pickk ending in a point and a flat bottom giving the finished tool the appearance of a flat-iron (Van Heekeren & Knuth, 1967).
choppers (longitudinally flaked at the end, parallel to the main axis of the tool), horse-hoof choppers (high-backed, with steep and stepped retouch around all edges of the upper face producing a massive pebble-tool in the shape of a horse-hoof). In his study in 1955 he says that flat-iron choppers and tortoise choppers are very characteristic for the Pacitanian. But in 1972 he mentions that flat-iron choppers and horse-hoof choppers are the Pacitanian’s characteristic (Van Heekeren, 1972).

In 1953, when Van Heekeren and team made a visit for ten days in the Gunung Sewu, and they collected some Palaeolithic implements including two beautiful hand-axes, with round outline and almond shape. The axes are made out of glossy fossilized limestone; both are chipped on both faces very carefully as well as on the butt-end.

Of course, besides these two hand-axes, he also notices there are some amounts of hand-axes from this region (fig. 11 & fig. 12). And finally, Van Heekeren arrives into statement which is contrary with Movius’ concept of Pacitanian. As Movius believes that the hand-axes in Pacitan culture are different from the western Acheulean hand-axe in the term of manufacture technique since they show a characteristic longitudinal flaking, parallel to the main axis. Beside that, Movius also agrees to say that the Pacitanian bifaces are locally
developed, notably the pointed specimens evolved from the choppers and the ovates developed from the chopping tools\(^4\). But according to Van Heekeren, even though many hand-axes do indeed show this end-long trimming, there are still some specimens with the true criss-cross chipping and regular outlines, flaked in the best tradition of the Early Acheulean technique. And this fact should support the opinion that Javanese hand-axes could be considered as Acheulean; but nevertheless the Levallois tools are completely absent (Van Heekeren, 1955; 1972).

From the collection and study that Van Heekeren published in 1955 and revised in 1972, he and his team have revealed new localities in the Tabuhan area, north of Punung. The total finds in the Tabuhan area are 202 pieces (table 2), and choppers dominate the category of stone implements. Mostly, the tools are made from deeply patinated silicified limestone, ochreous, dark-brown or even black. Others are made of dull-grey silicified tuff; only a few are made on fossil wood.

\(^4\) See the scheme of hand-axe development made by Movius (fig. 7).
<table>
<thead>
<tr>
<th>Type of Implement</th>
<th>Total</th>
<th>Percentage of total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Choppers</td>
<td>23</td>
<td>11.40%</td>
</tr>
<tr>
<td>Chopping-tools</td>
<td>16</td>
<td>7.90%</td>
</tr>
<tr>
<td>Hand-adzes</td>
<td>1</td>
<td>0.50%</td>
</tr>
<tr>
<td>Proto Hand-Axes</td>
<td>8</td>
<td>4.00%</td>
</tr>
<tr>
<td>Hand-Axes</td>
<td>6</td>
<td>3.00%</td>
</tr>
<tr>
<td>Flake-tools</td>
<td>148</td>
<td>73.20%</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>202</strong></td>
<td><strong>100.00%</strong></td>
</tr>
</tbody>
</table>

Table 2. Distribution of the stone implements from Tabuhan area.

d) The Opinion of Bartstra

In 1976, Bartstra published his doctoral dissertation “Contribution to the Study of the Palaeolithic Patjitan Culture Java, Indonesia”. He published only the first volume with three main parts of his study. The first one deals with chronological study that has been made by several researchers since 19th century in Gunung Sewu and Eastern Plateau. The second part is a field study and contains some results of investigations on the terraces of the Baksoka River, in which the stone tools occur in situ. The last one is considered as an introductory commentary on the existing typology of the Pacitanian artefacts (Bartstra, 1976).

Like some Indian scholars such as Khrisnawami, Sankalia, Khatri, and Ghosh, he expresses doubts regarding Movius typology, especially the concept of a separate chopper/chopping-tool complex (Bartstra, 1972). Das considers the Pacitanian assemblage more as pseudo-artefacts, and he also mentions that these stones are all naturally made (Das, 1968). But Bartstra himself says that it should be remembered that some Pacitanian artefacts are not easy to recognize because of weathering and rounding (Bartstra, 1973).

As mentioned above, Khatri is one of Indian scholars who do not really support the idea of Movius to make a separation between chopper/chopping tool complex tradition and hand-axe tradition. In his opinion, the Pacitanian hand-axes are true hand-axes (Khatri, 1973). Ghosh also supports the idea of Khatri and he also considers that the term of Movius “proto-hand-axe” is incorrect, saying that hand-axes on flakes are not always bifacially worked, because sometimes it is not necessary. So, one will definitely find in a collection of proto-hand-axes some specimens which can be regarded as true hand-axes and could be
some which should be categorized as choppers or a specific type of choppers\textsuperscript{5}. Besides, Ghosh (1973b) also assumes that Levallois technique occurs both in Anyathian and Pacitanian, he uses the concept of \textit{Levallois technique sensu lato} (according to the definition of Bordes: cores with radial flake scars around, the so-called tortoise cores, and those with parallel flake scars all around, the so-called prismatic cores) (Bordes, 1961 in Bartstra, 1976). According to Bartstra, the definitive criteria for a Levallois or Levallois-like flake are that the striking platform and primary flake surface should be approximately at a right angle, while the striking platform should be prepared (Bartstra, 1976).

Bartstra also states that the final shape of an artifact is influenced by numerous factors, which he believes many of them be psychological, the skill of the tool maker being the most important. What he calls as “law of least effort” comes into force when an instrument is needed for urgent purpose for which it is adequate even though with the crudest form.

\textbf{C. Conclusion and Objective of this Study}

As described before, the “Pacitanian problematic” results a long history of researches by scientists interested in various way. If the first consideration was essentially about the geology of the Pacitan area and especially about Gunung Sewu, the first discoveries of artefacts by Von Koeningswald started a specific interest about the human occupation in this area. Since that time, it has taken so much attention from European and Indonesian researchers. This interest should be understood in the global context of the Prehistoric research at this time: the prehistoric research has been undertaken in Asia only since the famous discovery of \textit{Pithecanthropus erectus} by Eugène Dubois in 1891. The discoveries of Dubois raised a huge interest about Asian prehistory and especially Java. As the researchers of that time considered that Asia is probably the birthplace of Humanities, it’s easy to understand the intense researches in different area (like in Chou-Kou-Tien, China).

In term of chronology, of culture, or of goal of Pacitanian lithic assemblage, the idea is not clear. More than this, the Pacitanian artifacts are now spread in different collections in the world. Also, these collections have been made at different times and by researchers who had different points of view, priorities, interests, and methodologies. These preliminary

\textsuperscript{5} Ghosh also says that if the specimens have a flat ventral surface, or the primary flake surface without flaking at all or only a minimum (compared with the amount of flaking on the lower surface of a “bifacial chopper” in Movius sense), so they could be called as unifacial hand-axe.
considerations help in understanding the difficulty of researcher to study old collections. It is not so easy, in fact, to deal with old data (often not enough precise) under modern considerations.

In this condition, the main goal of this thesis is to collect as much data as possible about Pacitanian (in term of bibliography and collection) in order to obtain at a general overview of the present day knowledge about Pacitanian within the prehistory of Java and of the world.

One of considerations of this work is about the cultural heritage management. The Pacitanian collections are spread in different countries, some have disappeared, and these collections do not contain especially the same kind of artifacts. This study bears on samples of Pacitanian collections which are conserved in Indonesia, France, Germany, and Belgium. This work will also compare between the different collections which are studied.

For each collection, a general techno-typological study will be undertaken and the result of this study will be compared briefly with the previous interpretation by former researchers. In this way, we want to understand the collections with the actual methodology and to check the validity of the previous interpretation.

We also want to relate these collections to the geological conditions of the sites. Patination and abrasion clearly show that a part of the material has been rolled and another not. And for the rolled material, there are different degrees; this may indicate a mix of artefacts from different periods. A confrontation between patination, abrasion and typology will be carried out and it may lead to separate distinct group of artefacts.

The integration of considerations about heritage management, history of research, geological conditions of the site, taphonomy of the artefacts and techno-typological analysis of this material should allow us to propose some way of reflection or recommendation about these collections and their interpretation.

Chronologically, there are five points which will be discussed in this paper:

1. To describe what contribution has been done before in the term of archaeology and geology.
2. To study the techno-typological Palaeolithic assemblages of Pacitanian which are conserved in Europe and Indonesia by using the parameter nowadays.
3. To find out if this industry is comparable with other industry or it is very specific and characteristic industry by comparing in general the Pacitanian with collection from South China, India, Philippine, etc.

4. To give some recommendation for research about Pacitanian in the future.
III. THE CONTEXT OF PACITANIAN ASSEMBLAGES

A. Geological Context

In general, many geological studies bear on the Gunung Sewu region which belongs to the southern zone of plateaus (fig. 13), of which the greater part consists in limestone hills with an undulating topography. According to Intan, the tectonic movements active in the Gunung Sewu region effect in faults, folds, and joints. The faults are usually normal and strike slip faults, whereas the folds form anticlines and synclines (Billing, 1972 in Simanjuntak, 2002).

![Geomorphological map of Gunung Sewu](After Simanjuntak, 2002).

The rocks that show disconformities on the normal faults are the tuffaceous rock unit and igneous rock unit. Based on this tectonic structure, the Gunung Sewu region can be divided into two areas, East Gunung Sewu and West Gunung Sewu. East Gunung Sewu forms the region with the most active tectonic movements, evidenced by the presence of faults, folds, and other geological structures, as well as by the volcanic activity. West Gunung Sewu undergoes active erosion process only, and it is more stable, in the sense that its topography has not changed much due to endogenous forces (Simanjuntak, 2002).
Some rivers flow through the Gunung Sewu such as Baksoka, Girintonro, Oyo, and smaller rivers. These rivers belong to the mature and old river stadium that has undergone transformation. The path of these rivers is interesting, with their dendritic pattern, typical of homogenous areas and rectangular pattern with perpendicular branches, typical of structured areas. Additionally based on geological structure and relief, the rivers can be grouped into consequent rivers with the track following the elevation of the rock layering, and subsequent rivers, which have courses parallel with the hard and steep cliffs.

Now the Gunung Sewu is composed of a series of typical karstified hills formed by an uplifted and tilted block of Upper Miocene limestone which dips northward. The limestone rests on a volcanic formation made of shales and tuffaceous beds, containing layers of silicified tuff with some fossil wood. In the base of the valley, where the volcanic series is exposed, large pebbles and boulders of silicified material are washed out by the stream (Movius, 1944).

Considering the quantity of water, some of these rivers are periodical rivers, with a large volume of water in the rainy season, and a small one in the dry season. In another part, some of them are episodic rivers, only flowing in the rainy season. Baksoka River, the main site of this study, is of episodic type, as in the rainy season (November-April) this river has a great volume of water, but it is very dry during the dry season (May-October). After the rainy season, when the amount of water in the Baksoka River is reduced, it point bars can be seen at the inner sides of the river bends. These have the classic shape with pebbles and cobbles in a sandy matrix. When the volume of water is more and more reduced, the Baksoka River takes on the character of a braided stream, and forms central bars (channel bars). Normally, in this condition, it would be easier to study miniature features of stream deposition in the river bed. In a contrary, during the wet season, after heavy rains, as mentioned before, the Baksoka River is a wild river (fig. 14).

Sometimes one can hear cobbles and boulders being pulled downstream. After one day or even some hours, the amount of water decreases rapidly and it becomes a quieter stream, even though at first still with rapidly-flowing, brown and muddy water (Bartstra, 1976).
B. Stratigraphy

It is clear from observation that in the Baksoka valley the structure of alluvium outside the river-bed is primarily the result of lateral accretion in the crests of the meander bends and at the connection of branches (Bartstra, 1976).

At the first time, in 1937, Teilhard de Chardin mentioned terraces explicitly along the upper reaches of the Baksoka River. He distinguished three terraces: a high terrace (T1, ± 25 m above the river bed), a middle terrace (T2, ± 10 m), and a low terrace (T3, ± 2 m). T1 consists of dissected remnants of boulder gravel overlain by red loam; T2 is composed of red gravel and loam with a basal layer of coarse gravel and in this basal layer several rolled and obviously derived Lower Palaeolithic implements, in addition to a premolar of Bos sp., have been found; the T3 is composed mainly of silt. Teilhard de Chardin said that implements are found on all three of them, particularly hand-axes, heavily rounded and patinated. Only on the low terrace he found non-rounded artifacts, among which smaller flakes (Teilhard de Chardin, 1937 in Bartstra, 1976).
After his first visit in 1936, he came back once again in 1938 and made his second publication in the same year. This time Teilhard de Chardin gives an improved diagram on his study (fig. 15). He differentiates andesitic, Miocene volcanic sediments below the limestone and younger, Pleistocene ashes filling the karst depressions. He also believes that the slopes of the Baksoka valley are covered with lateritic earth. In the second publication, he also mentions that there are three terraces and each of them contains artifacts (Teilhard de Chardin, 1938 in Bartstra, 1976).

Following the first statement of Teilhard de Chardin, De Terra determines in 1943 that there are only two terraces (fig. 16), one at a height 15 to 20 m (50-60 feet) above the Baksoka bed (T1), and one at height of 10 m (T2). The second terrace corresponds to the artifact-bearing conglomerate boulder mentioned by Von Koenigswald. But Von Koenigswald says that the conglomerate occurs up to 3 to 4 m above the bed, while De Terra definitely places T2 at 10 m height (De Terra, 1943).
Then in 1944 and 1948 Movius explained once again the subsection of these terraces. He also worked in the framework of the "Joint American Southeast Asiatic Expedition for Early Man", after Teilhard de Chardin and De Terra. In term of number of terraces, he agrees with Teilhard de Chardin: a high terrace (T1) at least 15 m (15 to 60 feet) above the present river-bed; a middle terrace (T2) at a height of about 9 m (30 feet); and a low terrace (T3) at 1, 5 m (5 to 6 feet). Movius agrees with De Terra about the correlation between Von Koenigswald's boulder conglomerate and the T2 (fig. 17). He also mentioned that he didn't find any artifacts in T1, but without intensive research maybe due to the rain at the time of this fieldwork (Movius, 1944, 1948).

After the independence of Indonesia in 1945, the next researcher who undertook investigation in Baksoka was Van Heekeren. At the beginning he distinguished three terraces. But then in his publication in 1955 and 1972, and after observing the Baksoka valley for several times since 1952 to 1954, he mentioned that four terraces occur in Baksoka. T1 was the highest terrace, laying 15 to 20 m above the present river-bed, T2 at about 10 m, T3 at 5 to 6 m, and T4 at 0.5 to 2 m. He observed that the most artifacts were found in the lowest terrace (T4), often an accumulation of pebbles, cobbles, and boulders. And in this terrace also he found that the stone tools were rounded and occurred only in the upper part of the gravel. While in his visit in July 1954, for the first time he found the artifacts
at 20 m above the river-bed, which was matching with the T1 of de Terra (fig. 18). Van Heekeren said that this terrace contains lateritic gravel with top layers consisting of several meters of red clay. He called the place where he found at the first time artifacts on the T1, site 11B (Van Heekeren, 1955, 1972). After Van Heekeren, Soejono, a student of Van Heekeren continued the research in Baksoka in 1961, 1962, 1963. Generally, his idea about the division of the terraces is the same as Van Heekeren (Bartstra, 1976).

Then, Sartono, in his publication in 1964 mentions that there is only one terrace: a coarse gravel deposit at 0.5 to 1.5 m above the present river-bed which consists of large and small boulders cimented together by a tuffaceous sand and limonite. These boulders are of silicified tuff, andesite, limestone, and fossil wood, which all derived from the Tertiary formations in the area. This coarse gravel also contains Palaeolithic stone tools (Sartono, 1964 in Bartstra 1976). So, the low-level coarse gravel bed described by Sartono is equal to the T3 of Teilhard de Chardin and Movius, the T4 of Van Heekeren, and almost certainly comparable to “boulder conglomerate” from Von Koenigwald (Bartstra, 1976).

Bartstra also presents in his publication in 1976 the terraces of the Baksoka Valley. His opinions in general are influenced by J. van Heek (1932), H. Lehman (1936, 1955), A.J. Pannekoek (1948, 1949), Teilhard de Chardin (1937, 1938), and Bammelen (1949). According to him, at about 14 m above the river-bed occurs an exposure of a thin coarse gravel layer, covered by several meters of red clay. From this gravel deposit two artifacts were found from the site 10B (see black arrow in fig. 19), a chopper and a retouched flake. At the beginning he observed only one true high-level terrace deposit in Baksoka Valley. During his subsequent investigations it became evident that the higher terraces reported by Teilhard de Chardin, De Terra, Movius, and Van Heekeren really exist. But to define bi, tri, or quadripartite grouping of the river terraces on the Eastern Plateau is not at all easy, and for
that Bartstra thinks that the sections of the Baksoka valley described by Teilhard de Chardin, De Terra, and Movius are incorrect (Bartstra, 1976).

![Figure 19. Map of part of the upper course of the Baksoka River by Bartstra. The encircled numbers indicate sites. The dotted lines represent cross-valley sections (after Bartstra, 1976).]

The last description was held by The Gunung Sewu Team from the Prehistory Department, National Research Centre of Archaeology between 1996 and 1999. One of their focuses was the geology of the Baksoka River, and they reached the conclusion that in fact there are five terraces:

- **Terrace 1 (T1/U1)** is located at an elevation of 125 m above the river course. The rock components consist of sandstone with conglomerate intrusions (lenses), and the thickness of this layer is about 15 m. In the sandstone layer some flake tools were found. The T1/U1 is considered to match to Sartono’s T1.

- **Terrace 2 (T2/U2)** lays at an elevation of 100 m above the river course. The thickness is around 15-20 m with rock components of sandstone with conglomerate lenses, and in this sandstone layer yielded flake tools too. T2/U2 is considered to match with Sartono’s T2.

- **Terrace 3 (T3/U3)** is located at an elevation of 25 m above the river course with a thickness of approximately 15 m. It is composed of tuffaceous sandstone with conglomerate lenses. In this layer also flake tools were found. T3/U3 is considered to match with Bartstra’s B1, and Heekeren’s H3-H4.

- **Terrace 4 (T4/U4)** is located at an elevation of 10 m above the river course. The thickness of this layer is about 10 meters and components are clayey sandstone and
conglomerate lenses. Again, in this layer flake tools occur. T4/U4 is considered as corresponding to Sartono’s T4, Bartstra’s B2 and Heekeren H5-H6.

- The last terrace is terrace 5 (T5/U5), located at an elevation of 0-10 m above the river course with a thickness of 5 meters more or less. Riverine deposits are conglomerate gravel, sand, silt, and clay. This deposit yielded Palaeolithic tools. This last terrace is supposed to match with Sartono’s T5-T6, Bartstra’s B3-B4 and Van Heekeren’s H7.

In term of grouping the terraces according to their elevation, there are three groups. The first group includes terraces with an elevation of 0-40 meters above river course level, the second terraces with an elevation of 100-200 meters. The last group terraces with an elevation of 125-140 meters. On the basis of this grouping, it is assumed that there have been three episodes of uplift. The first uplift resulted in the T1/U1; the second uplift in the T2/U2; and the uplift III in T3/U3-T5/U5 (Simanjuntak, 2002).

**C. Dating**

To determine the age of Pacitan assemblages is not an easy work but it needs to be solved in the future. Theoretically and practically, there are some obstacles which are undergone by researchers to establish the age of the discoveries found in the different terraces. Faunal and floral remains and also fossil hominids are lacking but in fact lithic artifacts are abundant on the river bank or riverbed. Until now, no artifacts have been found which can be correlated with geological horizons with known dates (Simanjuntak, 2002). Nevertheless, there are some opinions about the dating of Pacitanian from some previous researchers.

As Von Koenigswald had mentioned that the “Chellean” implements were found lying scattered in the river bed and some being contained in a boulder conglomerate in the river bank. This conglomerate rested in some places on a volcanic conglomerate and elsewhere on the limestone; it was found up to 3 or 4 meter above the river-bed in one situation, and in another it was dipping under the level of the floor of the valley. And Koenigswald believed that it was a point of great importance because no strata younger than those of Trinil (middle Pleistocene) age were known to be folded in Java. The only fossil found was a premolar of *Bos* sp., which was insufficient to afford any clue as to the age of the conglomerate. As mentioned above the tectonics of the implementiferous conglomerate point to an age not younger than middle Pleistocene (Von Koenigswald, 1936). This relative date was supported by various finds of faunal remains correlated with this conglomerate in Tabuhan, from a
depression and fissures of the karst hills in Punung area. The faunal remains which have been found by Von Koenigswald contained of: Stegodon sp. Elephas namadicus, bear, tapir, and teeth of Simia, Symphalangus, Echinosorx, and Hylobates (Van Heekeren, 1972). De Terra was inclined to date the Pacitan tools in the late Middle Pleistocene or the early Late Pleistocene (De Terra, 1943), Van Stein Callenfels assumed that they may date from Notopoero beds or Ngandong period and represent the culture of Homo soloensis (Callenfels, 1940a).

Movius suggests that the cultural material probably dates from late Middle Pleistocene or at the latest early Upper Pleistocene. There are some points that he keeps to propose this date:

1. The raw material of implements is obtained from the older volcanic series. This could only have been available after the stream had cut down into these series, and following De Terra, this happened during the period when Trinil fauna occupied the region. And according to Movius’ opinion, it seems very doubtful that the Lower Miocene volcanic was exposed before the later part of the Middle Pleistocene, which fixes a maximum age for the archaeological material.

2. In term of the conservation of all Palaeolithic implements, typologically there is no visible difference between the rolled and the unrolled specimens, and both are heavily patinated. This fact suggests that the region was occupied prior to the last tectonic movement in the Gunung Sewu. Van. Bemmelen (1949) believes that this occurred at the end of Trinil times, which indicates an Upper Pleistocene dating for the Baksoka terraces. But then some implements have been found in T2, so probably they belong to late Middle Pleistocene or early Upper Pleistocene.

3. The Pacitanian implements are not comparable to those from "Ngandong culture" which are associated to Notopoero deposits yielding an Upper Pleistocene fauna. Van Stein Callenfels (1940a) says that the difference between implements from Pacitan and the artifacts of the Solo River terraces is so big that it seems like these two cultures were made by two very different types of primitive Homo (Movius, 1944).

So, at the end Movius believes that the Pacitanian should be placed in the late Middle Pleistocene, or at the latest in the early Upper Pleistocene (fig. 20). And he adds a comment that as long as the Pacitanian has not been found either in a definitely dated deposit or in a fossiliferous fissure, it is almost impossible to make statement regarding its age (Movius, 1944).
Van Heekeren supports Movius’ idea to give the dating of Pacitanian maybe around Late Middle Pleistocene, and continued into Upper Pleistocene and even beyond without any significant modification into the Upper Pleistocene and even the later period. It seems that Pacitanian shows evidence of a very slow tempo of change, in tool technique and in the creation of new forms (Movius, 1948; Van Heekeren 1972). Apparently the tools were fashioned during a period when the karst was nascent (appeared), and before the river wore down its bed into the volcanic breccias, when the silicified tuff became available to the tool markers. During this stage the Trinil fauna may have populated the region as their fossil remains have been found by Von Koenigswald in fissures and sinkholes near Tabuhan (Van Heekeren, 1972).

Other statement connected with the age of Pacitanian was stated by Bartstra (1982). He also recorded findings of Paleolithc type on the surface, far away from the river. In some cases, he preferred to say that this industry was from Holocene or latest Upper Pleistocene, but not older than that. And in his other article (Bartstra, 1989; see also Bellwood 1997), once again he tried to stress that the large core industries near Pacitan should be assigned to the later phases of the Upper Pleistocene and associated with the appearance of Homo.

![Figure 20. Pleistocene stratigraphy in Java (Movius, 1944).](image-url)
sapiens on Java (fig. 21). Bartstra also added that the Pacitanian core tools were not comparable at all with lithic industries from the Solo High terrace and the Old River Gravel. They were made by two different hominid species that occupied Java during the Pleistocene: *Homo erectus* can be connected with Solo High terrace/ Old River Gravel, and *Homo sapiens* can be connected with a Late Pacitanian chopper-chopping-tool complex.

Figure 21. Simplified stratigraphic framework of the Pleistocene and the Palaeolith of Central Java – time in thousands of years B.P (after Bartstra 1989).

Widianto (in Simanjuntak, 2002) also gives his comment about this industry. He does not comment directly to which age it should be fixed, but he prefers to connect the industry to the owner. He believes that *Homo erectus* is the creator of the Pacitanian culture, no matter its evolutionary stage. Widianto rejects Bartstra’s opinion saying that the Pacitanian belongs to *Homo sapiens* (the Wajak man), which is dated relatively around 11,000 years.

---

6 Human physical evolution on Java, from the beginning to the end of the Pleistocene, can be described as (Widianto in Simanjuntak 2002):
- Mid Middle Pleistocene – late Pleistocene: progressive *Homo erectus*
- Early Middle Pleistocene – Mid Middle Pleistocene: typical *Homo erectus*
- Late Lower Pleistocene – Early Middle Pleistocene: archaic *Homo erectus*.
Normally, Wajak Man should have developed the flake-blade-bone tool culture and occupied caves (e.g: in caves near Campurdarat, Tulungagung), not the “Chopper- Chopping Tool Complex” like the Pacitanian culture (Simanjuntak, 2002).
IV. RESULT OF LITHIC STUDIES

A. Methodology

In the beginning of this work, we have collected and studied as many as possible publications which are connected with Baksoka River and Pacitanian typology by previous researchers such as Von Koenigswald, Movius, Van Heekeren and Bartstra. To understand their categorization and their point of view gave us a general overview of the present day knowledge about Pacitanian (cf. chap. I). This step allows us to decide which orientation we will give to this work, according to both the actual knowledge about Pacitanian and the modern problematic in prehistoric research.

The next step was to decide which collections will be integrated to this study. According to Bartstra (1976), the most important collections of Pacitanian assemblages are conserved in many institutions around the world such as: the National Archaeological Institute at Jakarta, Indonesia (collected by Van Heekeren and Soejono); the local department of this same Institute at Jogjakarta, Indonesia; the National Museum at Jakarta, Indonesia (collected by Von Koenigswald, Van Heekeren, and Soejono); the Peabody Museum at Cambridge, U.S.A (collected by Von Koenigswald and Movius); the Senckenberg Museum at Frankfurt, Germany (collected by Von Koenigswald); the Anthropos Institut at Sankt Augustin, Germany (collected by Maringer and Verhoeven); the Instituut voor Zuid-Aziatische Arheologie in Amsterdam, Netherlands (collected by Houbolt; described by C.R. Hooijer in 1969); the Rijksmuseum voor Volkenkunde in Leiden, Netherlands (collected by Van Heekeren and Soejono); and the Biologisch-Archaeologisch Instituut in Groningen, Netherlands (collected by Houbolt and Van Heekeren).

Finally, we chose 5 collections conserved in different Indonesian and European institutions: the National Research Centre of Archaeology (NRCA, Jakarta, Indonesia), the Laboratory of Gunung Sewu Prehistory (LGSP, Punung, Indonesia), the Senckenberg Museum (SMF, Frankfurt, Germany), the Musee de l’Homme (Paris, France), and the Royal Belgian Institute of Natural Sciences (RBINS, Brussels, Belgium). The last institution was not recorded by Bartstra (1976) or in any publication but we discovered this collection during a visit to this institution.
The first step in all these institutions was to determine whether the artifacts were Paleolithic implements or not, because some Neolithic artifacts are sometimes integrated in the collections.

The second step was to split these artifacts in different main typological categories. According to the main determination introduced by the previous researchers, we decided to make 7 main typological categories: flakes, cores, choppers, chopping-tools, hand-axes, picks and miscellaneous. This last category grouped all the artifacts which mostly are undetermined or even can be considered as natural.

For each category, some criteria have been examined. Some of them are specific to each main typological group, but some are common to all the artifacts. To all the categories, the 5 following criteria have been taken in account:

- **Blank**: the support of the artifact. It can be the raw material collected by the man (nodule, cobble, pebble, and boulders), or it can be the result of a previous activity of debitage (flake or core). Pebbles, cobbles and boulders are distinguished from the nodules and the blocks by the texture of the cortex that, in this case, shows clearly the action of the river (neo-cortex). The maximum breadth of the block distinguishes pebbles ($\leq$ 64 mm) from cobbles ($\geq$ 65 mm to $\leq$ 255 mm) and boulders ($\geq$ 256 mm) (Stow, 2005)

- **Artifact category**: the main techno-typological category for each artifact (flakes, cores, choppers, chopping-tools, hand-axes, picks and miscellaneous)

- **Raw material**: macroscopick determination based on the color of the implements and according to the main distinction introduced by Von Koenigswald: the volcanic rocks don't show any patination and the silicified limestone is always patinated. Our own observations of the artifacts lead us not to agree with Von Koenigswald when he says about the silicified limestone that "the worked parts have a beautiful dark patination" (1936: 53). In fact, the patination is very variable and can be in some tones of white, grey, yellow, brown and red. A precise determination of the nature, the stratigraphical and the geographical origin of the raw material would need more precise analysis of rocks available in the local environment of the Baksoka and also to make destructive analysis on, at least, some archaeological implements (Frölich, 2007, personal communication). These analyses are out of the topic of this work.

- **Level of abrasion**: some pieces are very abraded on their edges and eroded on their surfaces, but some are not. Between these two extremities, we observed a
gradation in the degree of conservation. These observations lead us to determine the level of abrasion by using a scale going from 0 to 5 (0 = very fresh; 1= fresh; 2= low abrasion; 3 = medium; 4 = abraded; 5 = very abraded);

- **Measurement**: maximal length, maximal width and maximal thickness in mm according to the orthogonal axis (Inizan *et al.*, 1992).

**For the debitage process** (flakes and cores categories), the following specific criteria have been taken in account:

- **Retouch**: The presence of retouch has been noticed;
- **Proportion of cortex**: The quantity of cortex present on the dorsal surface of the flakes or of the cores, with a scale from level 0 to level 5 (table 3).

<table>
<thead>
<tr>
<th>Level</th>
<th>Quantity of cortex</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Absent</td>
</tr>
<tr>
<td>1</td>
<td>&lt;25 %</td>
</tr>
<tr>
<td>2</td>
<td>&gt;25 to &lt;50 %</td>
</tr>
<tr>
<td>3</td>
<td>&gt;50 to &lt;75 %</td>
</tr>
<tr>
<td>4</td>
<td>&gt;75 to&lt;100 %</td>
</tr>
<tr>
<td>5</td>
<td>100 %</td>
</tr>
</tbody>
</table>

Table 3. Scale used to determine the proportion of cortex on the artifacts.

- **Localization of cortex**: the subdivisions below are for the flakes only, the cores are not concerned (table 4).

<table>
<thead>
<tr>
<th>Localization</th>
<th>Quantity of cortex</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>whole part of the dorsal face</td>
</tr>
<tr>
<td>Proximal</td>
<td>1/3 of the flake where we can find the butt</td>
</tr>
<tr>
<td>Distal</td>
<td>1/3 of the flake near the distal edge</td>
</tr>
<tr>
<td>Mesial</td>
<td>1/3 of the flake between proximal and distal sides</td>
</tr>
</tbody>
</table>

Table 4. Terminology used to determine the position of the cortex on the artifacts.

- **Number of flake negatives**: On the flakes, this criterion shows us how many removals were done before the removal of the studied flake. It provides an evaluation of the degree of preparation for each flake. On the cores, all the removals present on the core are taken in account. It gives an idea of the productivity of the nucleus.

- **Striking platform morphology** (table 5):
In the debitage process, 2 criteria are specific for the cores:

- **Type of core**: this criterion refers to the reduction method that was applied for production of flakes;
- **Morphology of the core**: the general shape of the core;
- **Utilized or not utilized**: the presence of an irregular and small retouch may be the sign of utilization. However, according to the geological context of the artifacts (collected directly in the river bed of the Baksoka or in different old terraces of the river), the presence of the retouch is not simply automatically a human activity (utilization or retouch) but can also reflect the action of the river and, in this case, have a natural origin.

The **shaped tools** are divided into chopper, chopping, hand-axe, and pick. Inside these types, we made some sub-categorization according to the general shape of the artifacts.

The criteria for the **choppers and chopping-tools** are:

- **Shape of the edge**: shape of the cutting edge which is formed by removals;
- **Number of negatives**: the removals that exist on the artifact;
- **Percentage of cortex**: level 0 to level 5 (see tab. 3);
- **Location of cortex**: see tab. 4;
- **Butt morphology**: see tab. 5.

<table>
<thead>
<tr>
<th>Morphology</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cortical</td>
<td>cortex on the entire butt</td>
</tr>
<tr>
<td>Plain</td>
<td>Plane butt shaped by only 1 removal</td>
</tr>
<tr>
<td>faceted</td>
<td>Butt prepared by some previous removals</td>
</tr>
</tbody>
</table>

Table 5. Striking platform morphology used in this study.
The criteria for the *hand-axes* and the *picks* are:

- **shape of the tip**: the morphology of the distal part;
- **Shaping**: to describe if the artifact is shaped by removals on 1 surface (unifacial), 2 surfaces (partially bifacial or bifacial) or 3 surfaces (trifacial);
- **Retouch**: a specification if the artifact is retouched or not, and if this retouch is unifacial or bifacial.

For the *miscellaneous* category, no specific criteria have been taken in account.

These data included in database will be the ground of our study. The different criteria will be exploited in the different following sub-chapter.

In the next sub-chapter, we will present the material collection by collection, trying to put on light the specificity of each collection and some differences between the different assemblages notably in terms of typology, raw material or abrasion.

After this presentation, we will study all the artifacts, main category by main category. The goal is to put on light the specificity of each type in term of raw material management, technology and typology. A general conclusion for each type will browse the main characteristics of the production and give a general comment on these artifacts and a first interpretation.

In the last part of this study, some comparisons with other sites in Asia will be helpful for the general conclusions. In this part, we want to give a new interpretation of the Pacitanian assemblage. This conclusion will take in account the context of the discoveries, all the parameters put on light by our study, the comparisons, and the modern problematic related to Indonesian, and more largely South-East Asia, prehistory. In this way, we will notably discuss the validity of the Movius Line.
B. General Overview of the Collections Studied

We have studied 434 pieces spited in the 4 institutions mentioned above (table 6 and fig. 22).

<table>
<thead>
<tr>
<th></th>
<th>Indonesia</th>
<th>France</th>
<th>Germany</th>
<th>Belgium</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NRCA</td>
<td>LGSP</td>
<td>Musée de l'Homme</td>
<td>SMF</td>
<td>RBNSI</td>
</tr>
<tr>
<td>Quantity</td>
<td>57</td>
<td>35</td>
<td>5</td>
<td>307</td>
<td>30</td>
</tr>
<tr>
<td>%</td>
<td>13.1</td>
<td>8.1</td>
<td>1.2</td>
<td>70.7</td>
<td>6.9</td>
</tr>
</tbody>
</table>

Table 6. Quantity of material studied by institution

Figure 22. Distribution of Pacitanian lithic assemblages

1. Pacitanian Kept in Indonesia

In Indonesia, the study was made in National Research Centre for Archaeology (NRCA), Jakarta and in Laboratory of Gunung Sewu Prehistory (LGSP), Punung.

In NRCA, lithic assemblages consist in Paleolithic and Epi-Paleolithic implements which have been collected by R.P. Soejono, Van Heekeren since 1968 until recent time. At the beginning the Paleolithic implements and Epi-Paleolithic implements was mixed in some boxes in this institution.
The collection from LGSP has been collected since 1994 until very recent time\(^7\) by several collectors.

a) Composition of the Assemblage

The composition of the assemblages for each category in NRCA and LGSP is quite similar, flakes take an important place both in LGSP and NRCA, but in LGSP the hand-axes are more represented compared with NRCA (see table 7 and fig.23).

<table>
<thead>
<tr>
<th>Flakes</th>
<th>Cores</th>
<th>Choppers</th>
<th>Chopping-tools</th>
<th>Hand-axes</th>
<th>Picks</th>
<th>Miscellaneous</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>NRCA (n)</td>
<td>35</td>
<td>6</td>
<td>3</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>%</td>
<td>61.4 %</td>
<td>10.5 %</td>
<td>5.3 %</td>
<td>7.0 %</td>
<td>1.8 %</td>
<td>1.8 %</td>
<td>12.3 %</td>
</tr>
<tr>
<td>LGSP (n)</td>
<td>12</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>9</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>%</td>
<td>34.3 %</td>
<td>11.4 %</td>
<td>5.7 %</td>
<td>5.7 %</td>
<td>25.7 %</td>
<td>0 %</td>
<td>17.1 %</td>
</tr>
</tbody>
</table>

Table 7. Typological composition for NRCA and LGSP collections.

Figure 23. Typological composition (in percentage) of NRCA and LGSP collections.

\(^7\) This information is gotten from the catalog of lithic assemblages in NRCA and LGSP.
b) Raw Material

The raw material consists of silicified rocks (silicified limestone and silicified tuff) and fossil wood. The collection from NRCA shows a slight majority of silicified limestone while in LGSP artifacts made on silicified tuff are dominating. Only a few are made on fossil wood (fig. 24).

![Figure 24. Distribution of raw material in NRCA and LGSP collections.](image)

c) Abrasion

The state of preservation for the collections in Indonesia is quite variable, but in general the degree of abrasion of the artifacts is high. Some are fresh but most of them are abraded. By using the scale from 0 (fresh) to 5 (very abraded), both from NRCA and LGSP collections mostly situate in scale 3 and 4, and some are even scale 5. Fresh artifacts are very rare. In NRCA and LGSP collections, we can sometimes find different levels of abrasion coexisting on the same artifact, for instance level 2 and 5, or level 2 and 3 (fig. 25).
d) Dimensions

In general, the Pacitanian industry is composed of artifacts with big dimensions, but nevertheless in some collections it is possible to find small size of artifacts.

In NRCA the smallest size of artifact is with 32 mm length, 21 mm width, and 13 mm thickness. The biggest size of artifact which can be found in NRCA is with 154 mm length, 75 mm width, and 49 mm thickness.

The collection from the LGSP in Punung shows more regular “gigantolith” size. Compare with the collection from NRCA, Paleolithic assemblages in this institution are really big. The smallest and the unique size which is found in this institute is the artifact with 50 mm length, 45 mm width, and 37 mm thickness. The rest of collection is with big size, and the biggest dimension that can be found is with ± 260 mm length, ± 280 mm width, and 174 mm thickness.

Figure 25. Degree of abrasion of Pacitanian collections in Indonesia. Upper part : NRCA, Lower part, LGSP.
2. Pacitanian Kept in the Musée de l’homme in Paris, France

a) Composition of the Assemblage

Only 5 Paleolithic implements are conserved in this institution; a hand-axe and four flakes (table 8). The 4 flakes are categorized as 1 big flake, 2 double scraper and 1 composite tool (denticulate and scraper). These artifacts were discovered in the area of Pacitan without any precise localization but probably close or in the Baksoka River. Their presence in this institution might be due to a gift of Von Koenigswald (Simanjuntak, 1997).

b) Raw Material

All the artifacts are made on silicified limestone. Only the hand-axe has been identified more precisely as made in silicified reef limestone (Fr. Frölich, personal communication, 2007).

c) Abrasion

The abrasion of these five implements is from level 2 to level 4. There is a flake with level 2, and one other flake with level 3, two flakes with level 4, and the hand-axe with level 4. It means that, almost all implements are abraded.

d) Dimensions

The smallest artifact is made on flake with 103 mm length, 117 mm width, and 36 mm thickness, while the biggest one is also made on flake with 180 mm length, 160 mm width, and 27 mm thickness.
3. Pacitanian Kept in Senckenberg Museum in Frankfurt, Germany

The collection of Pacitanian in the Senckenberg Museum Frankfurt (SMF) was collected by Von Koenigswald in 1930th.

a) Composition of the Assemblage

The collection in the Senckenberg Museum includes 307 pieces. Most of them are flakes (n=161), but not all of those flakes were categorized as Paleolithic implements. Some of the flakes collected in the Baksoka river area and conserved in the Pacitanian collection were accompanied, in their box, by an anonymous and undated note giving a Mesolithic attribution. For us, the lack of obvious techno-typological characteristics allowing us to separate them from the rest of the Pacitanian collection, their conservation with the Pacitanian collection, and the anonymous character of the note leads us to consider these flakes as a true part of the Pacitanian collection and to integrate them in our study. The hand-axes take also an important place (n= 41). The less represented artifacts in this collection are the cores (n=18; see table 9 and fig.26).

<table>
<thead>
<tr>
<th>Flakes</th>
<th>Cores</th>
<th>Choppers</th>
<th>Choppings</th>
<th>Hand-axes</th>
<th>Picks</th>
<th>Miscellaneous</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>(n)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>307</td>
</tr>
<tr>
<td>%</td>
<td>51.5</td>
<td>6.5</td>
<td>9.1</td>
<td>10.4</td>
<td>13.4</td>
<td>2.6</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Table 9. Typological classification for the collection in SMF
b) Raw Material

Except silicified limestone, silicified tuff, and fossil wood, one single flake is made on quartz or silica (fig. 27). But in general, most of the artifacts are made on silicified limestone (63.8%), silicified tuff (33.2%).

Figure 26. Typological composition of the SMF collection (in percentage).

Figure 27. Distribution of raw material in SMF collection.
c) Abrasion

The state of preservation for the collection in Senckenberg Museum is quite regular, between level 1, level 2, and level 3 (fig. 28). This phenomenon shows that the Pacitanian conserved in SMF is not very abraded, probably because of a selection during the fieldwork.

![Figure 28. Degree of abrasion of Pacitanian collection in SMF](chart)


d) Dimensions

The size of Pacitanian collection in SMF is quite various. For instance, the flakes can be found with a very big size and also with the smallest one. The smaller flake is 30 mm length, 24 mm width, and 5 mm thickness. The biggest piece is a pick with 303 mm length, 144 mm width, and 89 mm thickness.

4. Pacitanian Kept in the Royal Belgian Institute of Natural Sciences at Brussels, Belgium

The collection of Pacitanian in the Royal Belgian Institute of Natural Sciences at Brussels Belgium (RBINS) was sent by J. H. Houbolt from Bandung to Prof. V. van Straelen, the director of RBINS on 1st of December 1938. The artifacts are conserved and registered in the good condition, including all letters that have been sent by J. H. Houbolt.
a) Composition of the Assemblage

The collection in RBINS includes 30 pieces. On the catalog series of RBINS, it is written: “collection d’éolithes\(^8\) et Paléolithique du Pléistocène de Java”. It seems that the Pacitanian collection in this institute is less selected because, from 30 artifacts, 10 can be considered as miscellaneous. Nevertheless, most of the artifacts are flakes (n = 10), cores (n = 6), picks (n = 2), chopping (n = 1), hand-axe (n = 1), and there is no choppers (fig. 29).

![Pie chart showing typological classification for the collection in RBINS.](image)

Figure 29. Typological classification for the collection in RBINS.

b) Raw Material

There are 2 kinds of raw materials in the Pacitanian collection of this institute: silicified limestone and silicified tuff. However, the raw material determination was impossible for a lot of pieces. There is no much difference of quantity between each raw material (fig. 30).

---

\(^8\) Eolith was once thought to have been artifacts, the earliest stone tools, but now is believed to be naturally produced by geological process (Harrison, 2006).
c) Abrasion

The abrasion that occurred in the Pacitanian collection in RBINS is very irregular because we can observe the same quantity of artifacts between the level 1 to the level 4 (fig. 31).
d) Dimensions

The dimensions of Pacitanian artifacts in RBINS are quite regular. The smallest piece is a core with 84 mm length, 73 mm width, and 38 mm thickness. The biggest piece is a pick with 216 mm length, 99 mm width, and 104 mm thickness. But in general, the concentration of artifacts is between 90 mm length to 140 mm width (fig. 32).

![Figure 32. General dimensions of artifacts in RBNIS.](image)

5. General Consideration about all the Collections

In general, the collections which are conserved in each institution have different condition and composition. Most of the Pacitanian artifacts that have been studied are conserved in Senckenberg Museum (SMF, Frankfurt, Germany). In the term of the condition of the artifacts, those from SMF (Frankfurt, Germany), Musée de l’Homme (Paris, France), the Laboratory of Gunung Sewu Prehistory (LGSP, Punung, Indonesia), are selected artifacts, easily to identify, and represent some specific categories. In the collections from the National Research Centre of Archaeology (NRCA, Jakarta, Indonesia) and the Royal Belgian Institute of Natural Sciences (RBINS, Brussels, Belgium), artifacts are quite difficult to identify, sometimes even difficult to determine an anthropic origin. This is also the reason why the Pacitanian artifacts in RBINS Brussels were called as eolith when they have integrated the institution.
In SMF and in RBNIS, the Pacitanian collections are conserved in very good conditions and have been inventoried in general organized catalog of the collections. Also, from all the collections conserved in these 5 institutions, the less abraded artifacts can be found in SMF.

In each institution, the flake category is always more represented. It was a big surprise that in the Laboratory of Gunung Sewu Prehistory (LGSP, Punung, Indonesia) there are 2 very big cores 260 which do not exist in other Institutions.
**C. Flake Production**

1. Flakes

Flake implements play a big role in Pacitanian assemblage, as we have observe that they are very abundant in each institution (n = 219) and especially in Senckenberg Museum (SMF, Frankfurt, Germany) where we studied 158 flakes that represent more than 50% of the whole collection. At the National Research Centre for Archaeology (NRCA, Jakarta, Indonesia) we studied 35 flakes (61.4 % from the total collection) and at the Laboratory of Gunung Sewu Prehistory (LGSP, Punung, Indonesia), we recorded 12 flakes from 35 artifacts. In the Musee de l’Homme (MDH, Paris, France) there are 4 flakes for 5 artifacts, and at the Royal Belgian Institute of Natural Sciences in Brussels (RBINS, Brussels, Belgium), we registered 10 flakes.

For this category, we applied both a techno-morphological and a metrical approach separately to two groups of flakes (big and small) that were clearly distinguished by techno-morphological and metrical parameters during a first overview of the collections. The Techno-morphological analysis allows us to describe the chaînes opératoires by a categorization of the flakes, the examination of the dorsal surface of the flakes in terms of presence and localization of cortex and negatives of previous removals, and the observation of the butt. The metrical analysis, by the examination of the dimensions of the flakes (length, width, and proportion of length/width), gave some confirmations to the techno-morphological approach. In fact, the combination of these two ways allows us to clearly distinguish the big and the small flakes. The separate techno-morphological analysis of these two groups of flakes is supposed to put on light some technological and morphological differences while the metrical approach will clearly confirm in a second time that these two groups are also clearly distinct in term of dimensions.

a) Morphological Analysis

(1) Raw Material and Chaînes Opératoires

4 raw materials have been used to produce the flakes: silicified limestone, silicified tuff, fossil wood, and quartz. In all these raw materials, the silicified limestone is clearly the most dominant. The important selection of this raw material is very obvious if we compare its representation with the one of the silicified tuff: the silicified limestone is two times more used than the silicified tuff. In the SMF, we found also 1 flake in a different raw material that
is probably quartz, and in LGSP and SMF we found some flakes made on fossil wood (fig.33).

![Flakes: raw material](image)

**Figure 33.** Raw material used for the flakes, by institution.

(a) Big Flakes

From 219 flakes, 165 can be considered in the group of the big flakes. Less than 50% of the artifacts we have studied don’t have any traces of cortex (level 0, fig. 35). The rest of the production present some traces and are distributed between the level 1 until level 5.

From the graph below (fig. 34) we can see that the presence of cortex for the big flakes is quite variety but, nevertheless, the artifacts with a high level of cortex are the less represented in the collection compared with the level 0, level 1, level 2, level 3, and level 4. This observation leads us to a main interrogation concerning their absence in the collection. If the production is local, these artifacts should be represented. In fact, the general context of the collection of these artifacts is probably the main cause of their absence in the actual series. We suspect these artifacts have not been collected, especially because their identification is less easy during a surface collection, and also because, at the time of their collection, these artifacts without any obvious typo-technological value were most of the time not collected.
Connected with the presence of the cortex, we have also examined the number of negatives presents on the dorsal surface of the flakes. The number of negatives is most of the time include between 1 to 5 negatives. Besides, only 8 flakes have 6 to 10 negatives (fig. 35).
The study of the butt morphology allows us to identify 3 main morphologies on the artifacts we have studied: cortical, plain, and facetted. Plain butt is largely dominant (n = 99), far away from the cortical butt (n = 36). On the total of the flakes, only 17 show a more important preparation of the butt by the removal of more than one flake (fig. 36).

These big flakes, sometimes, don't have any clear trace of secondary removals. In these cases, these artifacts have been recorded as simple flakes.

Anyway, in most of the cases these flakes have on the ventral or on the dorsal surface (or sometimes on both) some negatives of small secondary removals. Most of the time, these secondary removals give an irregular delineation to the edge, have an irregular disposition along the edges of the flakes and are present without any apparent organization on the two faces of the flakes. In these cases, we applied the term “irregular retouch” and consider these scars as the fruit of a natural activity and not as the result of an anthropic activity. In fact, these stigmata are very frequent in this kind of context and are, most of the times, due to the choc received during the transportation of the Paleolithic implements by the river.

In the material we have studied, these two categories (simple flakes and irregular retouch) are the most represented. In few cases, we can suspect these scars to be the result of an anthropic activity but, anyway, without any certitude according to the context of the deposits. In these cases, we gave a typological attribution to these pieces (side scraper, end scraper, double scraper, discoidal scraper, denticulate) but the reader should absolutely
keep in mind the previous comment about the natural causes of most of the artifacts and the
difficulty, in this case, to distinguish the human part of all the secondary removals we have
observed (Fig. 37; 38; 39).

Figure 37. Categorisation of the big flakes by type of retouch.
Figure 38: Big flakes
a. simple flake; b. side scraper; c. end scraper; d. double scraper.
Figure 39. Big flakes.
e. denticulate; f. discoidal scraper; g. irregular retouch
(b) Small Flakes

54 of the artifacts have been considered as small flakes. Concerning the quantity of cortex on these artifacts, the graph below clearly shows the largely domination of the flakes without any cortical traces. Their amount is more important than for the big flakes and only few present some traces of cortex. We consider it as the result of the selection during the collect, but also as the proof of a more important preparation of the dorsal surface, reflecting a real prepared core technology (fig. 40).

![Percentage of cortex](image)

**Figure 40. Proportion of cortex for the small flakes, by institution.**

The number of flake negatives present on the dorsal surface mostly ranges from 1 to 5 (n = 29) but also from 6 to 10 negatives (n = 21), and even from 11 to 15 negatives allows us to say that in general, the small flakes present more removal negatives on their dorsal surface than the big flakes (fig. 41). This observation match perfectly with the comment made just before about the higher degree of preparation for these small flakes and, for us, confirm that the big and the small flakes result from two distinguished technologies and can absolutely not be considered as two successive steps of the same chaîne opératoire.
For the small flakes we also have identified the 3 same kind of butt morphology: cortical, plain, and facetted. The graphic below shows clearly that, even if the plain but is the most represented one as for the big flakes, the preparation of the butt is more important for the small than for the big flakes. The prepared butt is represented on nearly 50 % of the small flakes. This amount, for the small flakes, is almost equal to the percentage of the plain butt (fig. 42). According to the observation about the cortex and the negatives presents of the dorsal surface, the observation of the butt gives a third proof to the distinction we make between the chaîne opératoires of the big and the small flakes, more sophisticated in the second case than in the first one.
b) Metrical Analysis

The dimensions of the big flakes are quite various, included between 66 mm length, 60 mm width, and 30 mm thickness to 189 mm length, 90 mm width, and 29 mm thickness. Overall, the dimensions of the big flakes are concentrated between 75 mm to 140 mm length to 50 to 120 mm width (fig. 43).

In other part, the dimensions of the small flakes are more regular and clearly distinguished on the graphic below, as the length of the flakes is mostly concentrated between 40 mm to 60 mm, and between 30 to 55 mm width (fig. 43).

The two last graphic take in account the proportion length/thickness of the artifacts that is supposed to give us an idea of the absolute thickness or flatness degree for the artifacts. The general observation of these two graphics doesn’t show easily a clear difference between the two productions. Nevertheless, it appears that the small flakes seem to be a little bit flatter than the big one (fig. 44 and 45).
Figure 43. Distribution length/thickness for the small and the big flakes.

Figure 44. Proportion length/thickness for the big flakes.
The observation of the secondary removals should take into account the comments made for the big flakes and, in this way, we can observe as for the big flakes that the flakes with an irregular and natural origin retouch are the most represented in the collection.
For the flakes on which the secondary removals could have an anthropic origin, we distinguished some side scraper, convex side scraper, end scraper, double scraper, pointed double scraper and denticulate (fig. 47 & fig. 48). From the graph above (fig. 46), we can see the obvious presence of the pointed double scraper and of the double scrapers.
Figure 47. Small flakes.
a. simple flake; b. side scraper. C. double scraper; d. pointed double scraper.
Figure 48. Small flakes.
e. irregular retouch
c) Interpretation

At the end, we can observe a clear difference in term of techno-typological parameters between the two main flakes productions put on light by our study. For instance, most of the big flakes are inclined to be simpler, without any specific transformation by an anthropic retouch. However, we also can see that on one big flake the retouch and the advanced flaking technique are present (fig. 38d). But nevertheless, it is important to divide these flakes as the context of these discoveries is totally imprecise and that the actual collection mix more than probably different productions from different epochs (as it’s testified also by the discovery of some Neolithic implements mixed with the Paleolithic artifacts in the same context).

By dividing the big and the small flakes, at the end we can see that finally there are some differences between the two. It is not only the question of size, but also the dissimilarity result after applying the same parameters. The quantity of removals gives us result that the big flakes have less number of flake negatives, while the small flakes have more negatives before the removal of the studied flake. So, the quantity of negatives allows us to say that the small flakes are more prepared. This idea is also connected with the proportion of cortex on the flakes. In general, the non cortical flakes are dominated both in the big and small flakes. The difference is that on some big flakes the presence of level 1 to level 5 is spread obviously, while on the small flakes there are only few flakes with level 1, level 2, only 1 flake with level 4, and the rest are without cortex. So, the presence of the cortex is also connected with the preparation that has been made before removing the actual flake. In this case we can say that the time to manufacture the small flakes is longer because of the preparation.

The striking platforms of the big and small flakes are cortical, plain, and faceted. The plain striking platform dominates for both the small and big flakes. The difference between the two groups is that on small flakes the proportion of faceted butt is higher compared to the cortical one, while the big flakes are more often cortical and rarely faceted. All this combination gives by the presence of the cortex or not, the proportion of flake negatives and the morphology of the striking platform allow us to determine a more important preparation for the small flakes group than for the big flakes group.

In our observations about the retouch on the flakes, the big ones are mainly simple flakes or with an irregular and natural retouch. In the case of the small flakes, except the
domination of the natural retouch like for the big flakes, we also can see obviously the presence of double scraper and pointed double scraper.

So, by comparing the small and the big flakes with the same parameters, we can see two different technologies, with a more important sophistication for the small flakes.

2. Cores

From all the collections that have been studied, 36 artifacts have been considered as cores. Most of them are coming from Senckenberg Museum (n=20), but some are coming from NRCA (n = 6), LGSP (n = 4), and RBINS (n = 6). We studied these artifacts both with morphological analysis and metrical analysis. The first approach includes the general shape of the cores, their type, raw material, support, and retouch and utilization. The second one allows us to know more about the dimension of the artifacts.

a) Raw material

The composition of both silicified limestone and silicified tuff for the core category is not much difference. For each institution, the rank is fairly similar. But nevertheless the silicified tuff takes the biggest number of the comparison (n=19) compared to silicified limestone (n = 16). There is one artifact that we conclude as core and made on fossil wood (fig. 49).

From the graphic below (fig. 50), we can see the diversity of the core supports including flake, pebble, cobble, boulder, nodule, and some are undetermined. Cores made on nodule (n = 17) represent a larger quantity compared to cores made on cobble (n = 12) or made on pebble (n = 1), boulder (n = 2), flake (n = 3), and there is 1 piece included as undetermined blank. This observation allows us to describe 2 kinds of chaînes opératoires: direct knapping from the blanks and production from some big flakes that come from a debitage process. But the production of flakes from natural blanks seems to represent the most common chaîne opératoire, as we found most of the cores are made on nodule and cobble.
Figure 49. Raw material used for the cores, by institution.

Figure 50. Blank of the cores, by institution.
b) Core morphology and flaking method

The study of general shape of the cores allows us to distinguish 4 divisions (quadrangular, circular, triangular, and elongated). The circular shape and elongated shape are the dominating ones. Then, from technical point of view, the types of the core are divided into 9 groups: simple core, semi prismatic, rectangular bifacial, discoidal, discoidal bifacial, irregular bifacial, triangular bifacial, prismatic, and polyhedral. But most of the cores normally are discoidal bifacial, semi prismatic, and the rectangular bifacial. If we connect between the general shape and the type of the core, we can see that most of elongated shapes are associated with the semi prismatic cores and most of circular shapes are linked with discoidal bifacial types and the quadrangular shapes are connected with rectangular bifacial and polyhedral cores.

![Figure 51. Type of cores, by institution.](image)
**Quadrangular:** this general shape is rectangular, and for this shape we have 3 artifacts and we conclude their type as simple core, rectangular bifacial, and polyhedral. The sample below is the polyhedral type, as the edges of removal are more than 3 faces (fig. 52)

![Figure 52. Core, quadrangular morphology.](image)

**Triangular:** the general shape of the core is triangle, and for this shape we have triangular bifacial and prismatic core. The sample figured below is made on flake, it has the triangle shape and we conclude as prismatic because it results more than 2 faces (fig. 53).

![Figure 53. Core, triangular morphology.](image)
**Circular:** the general shape is normally more or less rounded. We have 14 pieces of artifacts for this shape, and the type of the core is variable. We divide this shape into 4 types of core: rectangular bifacial, discoidal bifacial, irregular bifacial and partial prismatic. The one which is presented below is the rectangular bifacial type made on cobble (fig. 54).

![Figure 54. Core, circular morphology.](image)

**Elongated:** the important shape of this category is the elongation of the core (fig. 55). We define 3 type of core for the elongated shape: discoidal bifacial, semi prismatic, and prismatic. The sample below is the semi prismatic core which is conserved in Senckenberg Museum Frankfurt (see also Bartstra, 1976).

![Figure 55. Core, elongated morphology.](image)
**Prepared core:** we see this part from the technological context. And from the type of core we conclude them as discoidal bifacial. The sample below is a core we found in NRCA collection (fig. 56).

![Core, prepared type.](image)

**c) Metrical analysis**

The dimension of the cores is quite variable. In the same time we can find the very small core with 45 mm length, 37 mm width, and 30 mm thickness. However, it seems this dimension is not very usual for Pacitanian core as we can also see that the biggest dimension of the core is 260 mm length, 280 mm width, and 174 mm thickness. In general, the concentration of the dimension is between 100 mm to 130 mm for the length and 80 mm to 120 mm for the width (fig. 57).
d) Interpretation

From 36 cores we have studied, we can see that the cores are mostly made on silicified tuff and silicified limestone. The supports of the cores mostly are nodule and cobble, and only a few cores are made on flakes. The debitage process normally made on two faces, or in other part the removals are only on one face. From this step, we can describe the type of the core: simple core, semi prismatic, rectangular bifacial, discoidal, discoidal bifacial, irregular bifacial, triangular bifacial, prismatic, and poliedral. In one case, we can see that there are so many flake negatives on the core, and normally with prepared striking platform. This latter type of core may correspond to the group of small flakes. In other case, we also can see that there are only few or some removals. From the dimension point of view, we can see the variation of the cores size, but from all collections (especially in Europe) the cores normally are not so big. However in LGSP collection (Punung, Indonesia) we saw the very big cores with 300 mm length and 300 mm width.

In the term of conservation and collection of the Pacitanian artifacts, it seems that the previous researchers selected the size of artifacts (including the categories and dimension) to be conserved in Europe. Because in general the size of the core collections in Europe is concentrated between 100 mm to 130 mm length and between 80 mm to 120 mm width, while in LGSP (Punung, Indonesia) we can see the very gigantic cores, which obviously correspond to the group of big flakes.
It is also important to notice that horsehoof chopper of Van Heekeren typology corresponds to the semi prismatic core in our study (see fig. 55).

3. Core Reduction Sequence

The presence of abundant flakes (n = 216) is not so comparable to the 36 cores in the collections we have studied. However, we should bear in mind that the division of flakes dimension is important to have the logical connection to the cores. From our observation, the small flakes that normally have so many flake negatives and plain/facetted butt are matched to some of the small or medium size cores. In another hand, we also can connect the big flakes which are normally not prepared with the big boulder cores (these gigantic cores are conserved in LGSP, Punung, Indonesia).
**D. Shaped Tools**

1. Chopper

From all the collections that have been studied, 34 artifacts are classified as choppers. Most of them are coming from Senckenberg Museum (n=28). The first approach is included the general shape of the artifacts and also the general shape of the edge. The second one allows us to know more about the dimension of the artifacts.

a) **Raw Material and Shaping of the Tools**

The composition of both silicified limestone and silicified tuff for the chopper category does not differ (fig. 58). It seems that these 2 raw materials are appropriated to shape the choppers. But nevertheless the silicified tuff is slightly more frequent (n=18).

![Figure 58. Composition of the raw material on choppers.](image)

From the graphic below (fig. 59), we can see a large variety of the support of the choppers between cobble, flake, nodule and some being undetermined. Choppers made on flake (n = 18) represent the majority compared with choppers made on nodule (n = 6) or on cobble (n = 6), and there are 4 pieces whose support are undetermined. This remark allows us to distinguish 2 stages of chaîne opératoires where chopper are manufactured: direct shaping from the blank directly collected in the environment and production from some big
flakes resulting from a debitage process. But it seems that the selection of big flakes is more frequent for shaping the choppers. Possibly because the ventral face of the flake provide an excellent striking platform to make removals on the dorsal face and produce an efficient sharp edge.

b) Morphological Classification

The study of general shape of the choppers allows us to describe 5 main groups (type 1, type 2, type 3, type 4, and type 5). Those which are not possible to include in the 5 groups are called chopper *sensu lato*. The type 1 dominates the composition, followed by the type 2 and type 5 (fig. 60).

![Blank of Choppers](image)

*Figure 59. Composition of the blank on choppers.*
Figure 60. Morphological categories for the choppers.

**Type 1:** this type contains 19 pieces. The general shape is relatively circular. The shape of the edge is convex, convergent, or polygonal. Some artifacts in this type have a globally circular shape. The sample figured below (fig. 61) is quite circular with a convergent edge produced by two main negatives.

![Figure 61. Choppers, sample of the type 1.](image)

**Type 2:** this type contains 6 pieces. The general shape is elongated this type is represented by very big tools. The one which is presented below is the most typical of this series (fig.62).

![Figure 61. Choppers, sample of the type 1.](image)
This chopper is shaped from a massive flake and has a convex edge produced by some big and abrupt removals on the distal part.

Figure 62. Choppers, sample of the type 2.

Figure 63. Choppers, sample of the type 3.
**Type 3**: the morphology of this type is “double-triangular”. Only one artifact belong to this category but we decided to distinguish it form the other chopping-tools for this specific and unique morphology. The artifact, presented below, is shaped from a flake. The shaping is important and the morphology of the artifact seems to correspond really to a specific will (fig. 63).

**Type 4**: the shape of this type is relatively cordiform or triangular. Only 1 piece has this specific morphology, it is shaped by removals on both surfaces and the shape of the edge is convergent (fig. 64).

![Figure 64. Choppers, sample of the type 4.](figure64)  

**Type 5**: this last type group all the chopping-tools made on cobbles and on which the morphology of the cobbles is still very obvious. In this category, the cutting edge is produced by 3 or 4 unipolar or convergent removals only. The artifact figured below (fig. 65) is a representative sample of this category. On this artifact, 3 convergent removals on one extremity of the cobbles produce a convergent cutting edge.
c) **Shape of the Edge**

In all the collections, we observed that the convex shape edge \( n = 17 \) is dominating (fig. 66) compared with convergent \( n = 12 \), polygonal \( n = 4 \), and irregular \( n = 1 \).

![Figure 65. Choppers, sample of the type 5.](image)

![Figure 66. Shape of the edge for the choppers.](image)
d) Metrical Analysis

The dimensions of the choppers are between 71 mm to 248 mm for the length, and from 78 mm to 144 mm for the width. From the graphic below we can see that in fact there is no specific regular size for the choppers. But nevertheless the concentration of the length is more or less between 100 mm to 140 mm and the width between 90 to 130 mm (fig. 67).

![Graph showing the distribution of chopper dimensions](image)

Figure 67. Repartition length/width for the choppers.

e) Interpretation

In the term of raw material, it seems that there is no specific choice for the raw material and the use of silicified limestone and silicified tuff is almost similar (graphic below). The very great distinction found for the choppers is related to the support/blank. Most of them are made on flakes and after nodules and cobbles. So, probably the Prehistoric Man wanted to take benefit of the ventral face of the flakes as striking platform to make some removals on the dorsal face and to sharp the edge. By grouping the choppers into general morphological categories (type 1, type 2, type 3, type 4, and type 5) shows us the variation of the choppers shape. Type 1 with the circular shape is the most dominant. The shape of the edge is mostly with convex shaping on the distal part with 3 or 4 removals. The morphological analysis shows us the result that the dimensions of the choppers concentrated between 100 mm to 140 mm for the length and 90 to 130 mm for the width.
Movius (1944, 1948) mentioned that the Pacitanian choppers are identical with those of the Early Anyathian of Burma, Myanmar. According to him, some of the choppers have a concave or square end edge, but most of them have convex edges which are produced by resolved flaking, in most cases on the upper surface only. It is interesting to notice that the hand-adze of Movius and the tortoise chopper of Van Heekeren typology correspond to the type 1 (circular) in this study (see fig. 61).

2. Chopping-Tools

38 chopping-tools have been studied, and most of them are from Senckenberg Museum. Generally, the parameter of the study is the same with choppers: morphological analysis and metrical analysis.

a) Raw Material and Shaping of the Tools

There are 3 kinds of raw material for chopping-tools: silicified limestone ($n = 23$), silicified tuff ($n = 14$), and fossil wood ($n = 1$). The silicified limestone is the dominant rock compared to the silicified tuff, and even though there is only 1 artifact made on fossil wood, it shows that this kind of raw material is used to make the shaped tools (fig. 68).

![Figure 68. Raw material used for the choppers, by institution.](image-url)
The dominating frequency of silicified limestone while among chopper the silicified tuff is more frequent, suggests that Prehistoric Man preferred to make the chopping-tools on silicified limestone because the shaping needs a more important investment\(^9\).

There are 4 kinds of support or blank for the chopping-tools: cobble, flake, nodule, and block (fig. 69). Most of the chopping-tools are made on nodule \((n = 15)\) or block \((n = 12)\). However, there are 7 artifacts made on cobble, 3 artifacts made on flake, and 1 undetermined. This occurrence shows that chopping-tools are made at two different stages of the \textit{chaîne opératoire}: either at the beginning by direct shaping from the blank or later by shaping some big flakes that come from a debitage process. But the direct shaping from the blank is largely dominant, on the contrary with choppers, where the blanks are mostly flakes.

![Blank of chopping-tools](image)

*Figure 69. Distribution of blanks among chopping-tools, by institution.*

**b) Morphological Classification**

The study of general shape of the chopping-tools shows us 4 main types: \textit{ebauches} or roughout, circular, elongated, and triangular shape. However, those which can not be fitted to the 4 types are included in \textit{sensu lato}. The circular shape is the dominant one (fig. 70).

\(^9\) This opinion is also supported by personal communication with Truman Simanjuntak, 2007.
Figure 70. Morphological categories for the chopping-tools, by institution.

**Type 1:** this type is connected to the artifacts with some removals only (roughout). There are only 2 artifacts as the representative of this type in the collections (fig. 71).

![Figure 71. Chopping-tools, type 1 (roughout).](image)

**Type 2:** include 14 pieces. The general shape is relatively circular, like those ones from choppers. The shape of the edge from the artifacts of type 1 is convex and polygonal. The sample figured below (fig. 72) is quite circular with the convergent shape of the edge.
Type 3: The most important shape of this type is elongated, and it does not matter whether if it is thick or not. In general, the dimension of the artifacts is big (fig. 73).

Type 4: The general morphology of this type is triangular. This type includes convergent, convex, and irregular shape of the edge. The sample below shows the convergent shape of tip (fig. 74).
c) Shape of the Edge

In general, there are 4 kinds of shape of edge for the chopping-tools: convex, convergent, polygonal, and irregular (fig. 75). The convex shape takes an important place (n=22), compared to the convergent (n = 12), polygonal (n = 1), and irregular (n = 3). This frequency is almost the same as for the choppers where the convex shape is also dominant.
d) Metrical Analysis

The dimensions of the chopping-tools are between 74 mm to 200 mm for the length, and between 65 mm to 165 mm for the width. They are relatively irregular and make a small concentration of the length between 100 mm to 120 mm, and the width between 90 mm to 110 mm (fig. 76).

![Figure 76. Repartition length/width for the chopping-tools.](image)

e) Interpretation

The study of raw material shows that silicified limestone was preferred to silicified tuff for making the chopping-tools while the inverse is observed for the choppers. The study of the support or blank helps us to understand that the direct shaping from the blank is more dominant.

The study of general shape shows that the circular shape occurs more often, and the shape of the edge is mostly convex. The morphological analysis shows us the result that the dimensions of the choppers concentrated between 100 mm to 120 mm, and the width between 90 mm to 110 mm.

According to Movius (1944, 1948) the Pacitanian chopping-tools are core implements with alternately flaked cutting edge, and similar from Early Anyathian forms.
3. Hand-Axes

51 hand-axes have been identified in the different collections, but mostly in the SMF. We have studied these artifacts by both a morphological and a metrical analysis. In the first approach, the hand-axes have been classified in different categories according to their general shape. In the second approach, the metrical analysis provides us some information about the size and the proportion of these artifacts.

a) Raw Material and Shaping of the Tools

Most of the hand-axes have been made from silicified tuff and silicified limestone of different quality. The graphic below (fig. 77) shows that for all the collections, the varieties of silicified limestone have been chosen preferentially to the silicified tuff. It seems that the quality of the raw material was an important criterion and that the raw materials of lower quality for knapping in general (silicified wood, tuff, limestone, and some bad varieties of tuff) were absolutely not represented among the hand-axes.

![Figure 77. Raw material for the hand-axes, by institution.](image)

The supports of the hand-axes are essentially cobbles and nodules collected directly in the local environment of the sites, probably directly in the river bed or in the old terraces of the Baksoka. However, 4 of the artifacts are clearly shaped from a flake (fig. 78). This observation shows that the hand-axes belong to 2 different phases of the chaînes opératoires: direct shaping of a natural blank or shaping of a big flake coming from a specific
work of *debitage*. Implicitly, it includes the collect of big blocs of raw material and the production of flakes with important dimensions. In this case, the support of the hand-axes is related with the big cores conserved in the Punung collection and with the long and massive flakes observed in all the collections.

![Blank of Hand-axes](image)

**Figure 78. Blank of hand-axes**

b) Typology

The observation of the general shape of the hand-axes clearly shows some morphological recurrences and it allows us to subdivide the series in 9 main categories. For those not possible to include in these categories, we just conserved them as hand-axes *sensu lato* (fig. 79).

Some of these categories remind us the classical typology of the Acheulean defined by F. Bordes (Bordes, 2000; see also Debenath & Dibble, 1994) and some seems to have no specific correlation with another typology, so we simply considered it as 4 different local types.
(1) Acheulean Typology

These 5 categories of hand-axes can be grouped in 2 major subdivisions: the pointed and the rounded. The pointed hand-axes include amygdaloid, elongated amygdaloid and lanceolate. The rounded hand-axes include *limande* and ovates.

![Hand-axes typology](image)

**Figure 79.** Morphological classification for the hand-axes, by institution.

**Amygdaloid:** this category is the most important with 11 artifacts showing the specific shape describe by F. Bordes (2000): almost similar to cordiform for the shape, but most of the time thicker (proportion Breadth/Thickness < 2, 35), less standardized and with some traces of cortex conserved on the artifact (fig. 80).
Elongated amygdaloid: we consider two pieces in this category that is very similar to the previous one. We simply distinguish these artifacts by a more important elongation (fig. 81).

Lanceolate: this category includes 3 hand-axes that are characterized by 2 straight and convergent edges, with the distal part most of the time more regular than the proximal one. The basis of the hand-axe is massive and very often conserves some traces of the original cortex. The artifact figured below is a representative sample of this category (fig. 82)
Proto-limande: this type belongs to the rounded hand-axes and includes 8 artifacts. Their characteristic oval shape is related to the position of the maximal width, close to the middle of the length. They should be distinguished to the ovate type by a more important elongation. The ratio Breadth/Thickness between 2.35 and 3.88 allows us to consider them as proto-limandes. However, most of the time their shape is not so regular and the sample below can be considered as the most typical proto-limande in the studied collections (fig. 83).
**Ovate**: This category includes 7 artifacts that are the most rounded of the collections. The maximal width is almost at the middle of the artifact, and therefore the proximal and the distal parts of the hand-axes have more or less the same shape. They can be elongated or not (in this case, the shape is more circular) and very often present some traces of the original cortex. The sample presented below is typical and with a medium elongation (fig. 84).

![Figure 84. Hand-axes, oval type.](image)

**(2) Local Typology**

4 specific shapes of hand-axes are recurrent in the collections but do not seem to have any correlation with any typology defined previously. 3 types can be considered as rounded (type 1 to 3) and 1 is pointed with a triangular shape (type 4).

**Type 1**: this type includes 5 pieces. The shape is more or less triangular or cordiform due to 2 straight or convex and convergent edges. The butt also can be more or less straight or convex. The half-circular shape of the distal part is the most important characteristic of this type and is present on all the artifacts belonging to this category. The sample figured below is elongated, with a convex butt and two straight edges (fig. 85). The specific half-circular shape of the distal part is present and very characteristic on this artifact.
Type 2: as for the type 1, the main characteristic is less the general shape of the hand-axe (approximately triangular) than the half-circular morphology of the distal part. In the type 2, each edge has a waisted, a more or less important concavity in the mesio-distal part giving a nose-shape to the distal part. This type includes 3 artifacts. The one presented bellows is the more typical of the series (fig. 86).
**Type 3:** this last variation of the hand-axes with the rounded tip can be distinguished from the two previous ones because only one edge presents a waisted, the other one is still straight or convex. It results from this characteristic that the nosed tip of the tool is not in the longitudinal axis but a bit projected on one side of the artifact. This category includes 9 artifacts. The general shape is not regular: it can be more or less triangular, squared, or sometimes reminding the cordiform shapes (fig. 87). In fact, the shape of these hand-axes can sometimes really remind the Acheulean typology.

![Figure 87. Hand-axes, local type 3.](image)

The specimen presented above is characteristic of this category, with the rounded tip, the saddle and the general shape that remind us the *limande* type if we except the proximal part on the side of the shoulder.

**c) Metrical Analysis**

The dimensions of the hand-axes are important, ranging from 109 to 215 mm for the length, and from 74 to 154 mm for the width. The graphic below doesn't show any specific concentration that could reflect standardization (fig. 88). Except the important size and a concentration of most of the artifacts between 130 mm to 190 mm for the length, and between 80 to 130 mm for the width, it seems the production obey more to some morphological rules (with all the types put on light by this study) than to metrical parameters.
For the hand-axes, the proportion between the breadth and the thickness is an indicator often found in the literature to appreciate if the hand-axes are thick or flat. Fr. Bordes (2000) separates arbitrary the flat and the thick hand-axes. If the proportion is lower than 2.35, the hand-axes are considered as thick. If the proportion is higher than this, they are considered as thin. Even if the validity of such a strict distinction can be discussed, this calculation is still a good indicator if we consider the general repartition of a series of hand-axes.

For our case, the graphic below shows that most of the production is on the lower part of the 2.35 line (fig. 89). In this case, just a small part of the production can be considered as thin.
d) Interpretation

The morphological analysis clearly shows some affinities between a part of the Pacitanian hand-axes and the classical Acheulean production. For the rest of the hand-axes, we didn't succeed in establishing any correlation between this production and any classical typology. It seems so that these four specific shapes of hand-axes are typically an original production.

The presence of hand-axes in Pacitanian collections has been put on light long ago by Movius, but for him, they were essentially proto-hand-axes and he considered them as a local evolution from the chopper - chopping-tool complex and not as an occurrence of the Acheulean. This way he places the Pacitanian assemblage outside the distribution's area of the Acheulean.

Our analysis shows the morphological similitude between the classical Acheulean typology and the Pacitanian hand-axes, notably by the occurrence of some typical Acheulean shapes of hand-axes and the notion of symmetry clearly present in the Pacitanian series. The metrical parameters of these hand-axes, match well with the classical Acheulean even though the proportion B/T of our hand-axes shows that just a small part of the production can be considered as thin.
If this kind of hand-axes was found in Africa, Europe, or even in India, there will not be any discussion about their belonging to the Acheulean culture. Therefore, the position of Movius line is difficult to understand and probably he was only referring to the most typical hand-axes.

It is interesting to note that a large group of Pacitanian hand-axe has a well rounded tip and not a distal point as expected on this type of tool.

4. Pick

From all the institutions, we found pick implements only in the National Research Centre of Archaeology (NRCA, Jakarta, Indonesia), the Senckenberg Museum (SMF, Frankfurt, Germany), and the Royal Belgian Institute of Natural Sciences at Brussels Belgium (RBINS). 23 picks composed the category: 1 comes from NRCA, 20 pieces come from SMF, and 2 come from RBINS. We studied these artifacts both with morphological analysis and metrical analysis.

a) Morphological Raw Material and Blank

3 different raw materials are used for pick implements: silicified limestone, silicified tuff, and fossil wood. From NRCA the pick is made on fossil wood, in SMF the picks are made on silicified limestone and silicified tuff, and in RBINS it is made on silicified limestone and on some undetermined raw materials (fig. 90). In term of proportion, silicified limestone and silicified tuff are the most utilized, and the silicified limestone ($n = 13$) is more represented than the silicified tuff ($n = 8$).

3 main supports have been utilized for the shaping of the picks: block, nodule, and flake. Most of them are made on nodule ($n = 11$), few on flakes ($n = 5$) and blocks ($n = 3$). The support is undetermined for 4 picks, including the one which is made on fossil wood (fig. 91). Once again, like the case for the choppers, chopping-tools, and hand-axes, we define 2 kinds of chaînes opératoires: direct shaping from the blank and shaping from some big flakes that come from a debitage process. But for the case of picks, the direct shaping from the blank is more common, only few of them are made on flakes.
Figure 90. Raw material used for the picks, by institution.

Figure 91. Support used for the shaping of the picks, by institution.
b) Morphology

The study of the general shape of the pics allows us to describe 7 main morphological groups: amygdaloid, elongated amygdaloid, elongated asymmetric, elongated oval, elongated triangular, lanceolate, and naviform. Those which are not possible to include in the 7 groups are called as *sensu lato* or roughout. From all the types, the elongated asymmetric and the elongated amygdaloid are the dominant. But in general the composition of all the types is almost similar. So in this case, it seems there is no specific domination of a specific morphology, except that several of these picks have a well rounded tip that led the previous scholars to give them the name of “iron chopper” or “flat iron chopper”. Since they are usually elongated, they rather deserve the name of “pick”.

![Typology of picks](image.jpg)

**Figure 92. Typology of the picks, by institution.**

*Amygdaloid*: this category is the less important with only 1 artifact. This small amount is radically different with the hand-axes group, largely dominated by this shape. On the figure below, we can see that the cortex is still present on 2 faces. This sample has been made on block and the shaping is not so important and the general morphology of the original support is still very obvious and very similar to the morphology of the shaped pic (fig. 93).
Elongated amygdaloid: we consider 4 pieces in this category that is very similar to the amygdaloid one. We simply distinguish these artifacts by a more important elongation. For this category as for the hand-axe category, we see that the general shape is symmetric but that the cross section shows an important asymmetry between the two surfaces (fig. 94).
Elongated asymmetric: this type is almost similar with the previous one (elongated amygdaloid), and the main difference is the asymmetry between the two side of the artifact, given by both a convex and a straight side. 4 pieces have this typical double asymmetry (bilateral and bifacial), and the sample figured below is very characteristic of this category (fig. 95).

Figure 95. Pick, elongated type.

Elongated oval: the general shape of this type is oval and the elongation is also important. 4 pieces have this morphology and as for the two previous types, the main characteristic of these artifacts is the bifacial asymmetry. The sample below is representative of this category, and we can observe also that the distal part of this pic seems more worked than the rest of the artifact and present a more abrupt angle with the flat surface than the other areas (fig. 96).
Figure 96. Pick, elongated oval type.

Elongated triangular: the general shape of this category is triangular, the cross section is asymmetric, and the elongation is important. The lateral edges are either straight or lightly convex. In fact, the shape is not perfectly triangular, because sometimes the shape is slightly asymmetric (fig. 97).

Figure 97. Pick, elongated triangular type.
**Lanceolate:** this morphology is produced by 2 straight or very slightly convex sides and the distal part is pointed or slightly rounded (fig. 98). 2 artifacts belong to this category.

![Figure 98. Pick, lanceolate type.](image1)

**Naviform:** this type is elongated and pointed at both extremity and have the specific bifacial asymmetry like the other picks (fig. 99). 2 artifacts have this morphology and are very thick (one has thickness 73 mm and other pick has 88 mm).

![Figure 99. Pick, naviform type.](image2)
Some names given to the picks are adopted from the description of hand-axes by Bordes. In fact, these names, here, are valid for the general outline of the artifacts, however the bifacial asymmetry observed on each morphological group is the main characteristic of this kind of tool.

(1) Shape of the Tip, Removal, and Retouch

After the general morphology of the picks, we will focus on the specific shape of the tip. We define 5 different shapes: rounded, pointed, double pointed, straight, and polygonal. Most of them are pointed and rounded. On the graphic below, we can see obviously that most of the picks have a pointed tip (n=13) and some are rounded (n=7). The other types are anecdotic (fig. 100).

![Shape of tip](image)

**Figure 100. shape of the tip for the picks, by institution.**

The shaping is mostly partially bifacial (fig. 101). This characteristic is linked with the general bifacial asymmetric morphology that seems to be specifically researched for this kind of tool. The inferior surface, plane, doesn’t need any specific shaping. The retouch on the picks is not so common, because from 23 artifacts, only 10 artifacts present a retouch on one side and 13 artifacts are without any retouch (they are only shaped by flaking).
c) Metrical analysis

The dimensions of the picks show a large range of values, especially for the width. In general we have between 101 mm to 303 mm for the length, and 63 mm to 144 mm for the width. The main concentration shows something more regular about the dimensions, with a length between 155 mm to 210 mm and a width between 80 mm to 100 mm. The thickness is very regular, always include between 70 mm to 89 mm. In conclusion, we can say that this kind of pieces is very thick but also very elongated (fig. 102).
d) Interpretation

The study of raw material allows us to say that there is no special selection of raw material to manufacture picks because the composition both from silicified limestone and silicified tuff is almost the same. Fossil wood is also used as raw material for the picks, even though there is only one artifact, but it shows that the raw material selection doesn’t play an important role, but that probably the state of original morphology influences the production (as it is shown by the few or absolutely not shaping of the plane surface, it seems the support is selected for an advantageous triangular section that allow the knapper to decrease the shaping for obtaining the tool). The general morphology of the picks is quite various (we conclude 7 main morphological groups of picks), but the very specific elongation, the bifacial asymmetry and the thickness are very important. The shape of the tip is frequently pointed or some are rounded, and mostly not retouched. Picks with rounded tip mostly correspond to what the previous scholars had called “flat iron chopper”, despite the conspicuous elongation of these artifacts. The dimension of them is fairly regular, especially for the thickness and the width. So, except influenced by the original morphology, the other important things is the general morphology of the tool because almost all the picks are very thick and elongated. This characteristic is very regular and common for all the Pacitanian collections.
By comparing with the previous typologies, we conclude that this type is equal to the “flat-iron chopper” from Van Heekeren and that some of the artifacts considered by us as picks were considered as hand-axes by Von Koenigswald. Van Heekeren considers that this category (“flat-iron chopper” for him, picks for us) is one of the main characteristics of Pacitanian assemblages.
E. Miscellaneous

Like it was mentioned at the methodology, this last category grouped all the artifacts which mostly are undetermined or even can be considered as natural. 31 pieces from all the institutions are included in this category. Most of them come from the Royal Belgian Institute of Natural Sciences (RBINS, Brussels, Belgium).
V. COMPARISON, CONCLUSION, AND RECOMMENDATION

A. General and Brief Comparison between Pacitanian and other Industries

1. Sangiran

The material used in Sangiran consists of all kinds of siliceous material like chalcedony, agate, silicified wood and limestone probably coming from the Gunung Sewu, behind the Lawu Volcano (Von Koenigswald, 1939; 1973).

The Sangiran assemblages (Von Koenigswald called it as “stone implements from the Trinil beds of Sangiran, Central Java) include scrapers, end-scrapers, ogival points, some borers, core-scrapers, and crude blades. Most of the artifacts are made on short, broad, and thick flakes. The striking platform is mostly unfacetted, completely unworked and covered by cortical surface. Von Koenigswald also divided the flakes into big flakes and small flakes. Most of the big flakes are unretouched or transformed into side scraper. On the small flakes, the controlled flaking was improved and some are pointed with untrimmed sides, thick, with a prominent medial edge on the dorsal surface that give a triangular cross section to the artifacts. On some other flakes, the pointed shape is obtained by a convergent retouch. In general, the technology in Sangiran is divided into two phases (Von Koenigswald, 1973):

- Technology employed for detaching the flake or blade from the core.
- Subsequent workings on flake or blade, to give a form with some functional implications.

Connected with the description of Von Koenigswald, Bartstra stated that some of the chalcedony flakes are only pseudo-artifacts (Bartstra, 1974).

The Ngéngung site in Sangiran is more interesting than all these artifacts collected in surface because the collection result from a modern excavation. The Kabuh layer containing the discoveries is dated to 0.8 M.a (Semah, 2001). The assemblage includes pebbles, polyhedral tools, bolas, choppers, chopping tools, cleavers and flakes. These artifacts were found associated with animal fossils. The flakes are normally of small size, the striking platforms are flat and narrow (some of them are faceted with large bulbs of percussion. They are rather abraded and heavily patinated, but some have fresh edges. The intensive abrasion is connected to the transportation process (Simanjuntak, 2001).
From the view point of techno-morphology, the Sangiran assemblage coming from the surface collections is not so comparable with Pacitanian. The absence of cobble tools and large cutting tools such as hand-axes, picks, chopper and chopping-tools is one of the main distinctions. Moreover, the chaînes opératoires are not really the same (In Pacitan we can see both the direct shaping from the blanks and the production of retouched tools from some flakes that come from a debitage process).

We can state that in one part there is similarity between the small flakes from Pacitan to the small flakes from Sangiran by the presence of the bulb and some retouch at the pointed flakes is very obvious. But in another case, the preparation on the small flakes from Pacitan is more noticeable than those ones from Sangiran. The core preparation is almost absent in Sangiran, while in Pacitanian some prepared cores have produced the small flakes with plain or faceted butt. This short comparison allow us to say that in general the “flake and blade industry” from so-called Trinil beds of Sangiran is not so compatible with Pacitanian.

In another part, the find of Ngebung site shows the presence of cobble tools (chopper-chopping tools) and large cutting tool (cleaver), but there is no presence of hand-axes. This doesn't mach with Pacitanian where hand-axes are present but cleavers are absent. However it is interesting to note that both hand-axes and cleavers are typical tools of the Acheulean technical tradition.

2. Song Terus

The Song Terus cave is located in Punung area. The dating of Song Terus section was achieved by a combination of carbon-14 and U/Th methods. The lower part of the section indicated an age of 200,000 years (consistent ratios in enamel and dentine of Rhinoceros tooth). Moreover, other analyses were applied on bone which resulted in ages ranging between 80,000 years and 160,000 years (Semah et al., 2004).

More than 800 lithic artifacts with various sizes where collected to a depth more than 12 meters. Even though the access to the raw material resources was available in the nearby river deposits, the pebble tools are lacking (only 4 pebble tools have been discovered). This occurrence makes the Terus industry different from Pacitanian assemblages. The Song Terus industry is interpreted as flake industry which is dominated
by scrapers and denticulates (Semah et al., 2004). Considered from the point of view of patination, the Song Terus artifacts look like the Pacitan ones (Semah et al., 2004; Lumley et al., 2001). Semah et al., proposed two possibilities of this phenomenon:

- The Song Terus industry is not compatible with Pacitanian assemblages, it gives a light to assume an older age for Pacitanian, which might represent a true “Pithecanthropus” industry
- These two artefactual groups might characterize very local facies of one contemporaneous industry.

3. India

The brief comparison between Pacitanian assemblages with lithic assemblages from India shows some clear difference between the two areas. In India, the Lower Paleolithic is represented by two different cultural traditions: Soanian which is specific to Sub-Himalayan India and Acheulean is connected with Peninsular India (Gaillard, 1995, 1996).

In Sub-Himalayan India (especially in the Siwaliks), the large majority of Palaeolithic assemblages belong to the Soanian which is mostly composed on cobble tools without any hand-axes or cleavers. The Soanian assemblage from the Beas valley shows that the majority of this collection is composed of choppers, mostly unifacial (which is characteristic of the Early Soanian), either trimmed on the upper, rounded face or on the lower, flattest face. In other part, the proportion of chopping is much lower. Nevertheless, there is also a discovery of Acheulean assemblage from Siwaliks: Atbarapur, in the Hoshiarpur Siwalik Range, Punjab, India (Gaillard et al., in press). The find of Acheulean at Atbarapur shows that the cleavers represent the most component of the assemblage, and the number is largely double than hand-axes. Gaillard assumes that the Acheulean industries in South Asia were not preceded by chopper industries, as in Europe and Africa (Gaillard & Mishra, 2001, Gaillard, 2006).

In peninsular India, the Acheulean industry of Singi Talav (Didwana, Rajasthan) for example was found in a stratigraphical context. The low energy environment preserved these artifacts and it is easy to distinguish 2 main archaeological levels at about 40 and 80 cm below the surface, dated to 800,000 years (Kailath et al. 2000). The lower level is typically Acheulean with the big amount of coarse hand-axes. In general the assemblage is based on five categories: flakes, debris, small tools on flake or debris, large cutting tools...
(hand-axes and similar), and large core tools (including cores) which have no morphological or technologically specific characters (choppers, polyhedrons, spheroids).

Compare with Pacitanian, the attributes from the sites mentioned above exist also in Pacitanian, except cleaver. The occurrence from Atbarapur is quite different with Pacitanian which has so many hand-axes, but no cleaver. In fact, to shape a cleaver should be very possible as there are so many large flakes found in Pacitan. If it is not the question of the possibility of the resources, so probably it could be the question of choice.

The general techno-morphological comparison of the Indian hand-axes with Pacitanian hand-axes shows some similarities and some distinctions. In some case, the general morphology of the hand-axes is almost similar, where in both Indian and Pacitanian hand-axes sometimes one can see the presence of cortex. Besides, the form of some hand-axes such amygdaloid, elongated, lanceolate, and ovate shapes are quite comparable between both. There are many Acheulean sites in peninsular India, and a large diversity of hand-axe types, made on various rocks, either flakes or slabs or cobbles. If some of the India hand-axes may easily be compared to those from Pacitan, the absence of cleaver in this latter region is a conspicuous difference between the assemblages.

Some points can be comparable between the Soanian cobble tools and some Pacitanian chopper-chopping-tools which are made on cobble. Both are trimmed on the upper and rounded face or on the lower. Nevertheless, majority of choppers’ blank from Pacitan are nodule and big flake which are not only trimmed on the upper part. The Soanian cobble tools are more regular in shape. This can be connected to the characteristics of the blank resources because in the Soanian the rounded cobbles are more prominent.

4. China

Since the first discovery in 1973, 4,000 stone artifacts have been collected on the high terraces of the Youjiang River in Bose basin northwestern Guangxi of South China. Only about twenty sites have been excavated (Xie & Bodin, 2007). Stone artifacts are associated with tektites dated to 803, 000 ± 3000 years ago. Raw materials of stone artifacts from these sites are mostly quartzite, quartz and sandstone. Tools types are chopper, chopping-tool, pickk, scraper, and hand-axe. Between them, the picks and hand-axes are the most characteristic. One can say that Bose represents the oldest known large cutting tools in East Asia (Hou Yamei et al., 2000). Nevertheless, there are still some debates on
the hand-axes from Bose, as some archaeologists consider the hand-axes as core-axes, picks even chopping-tools.

In general, the large cutting tools morphologies of Mode 2 are typically ovate with distinctive tip ends (thin and convergent) and butt ends (thicker, sometimes unmodified). Normally it was made on large flakes, flat cobbles, or nodules which are appropriated to be thinned by percussion (Hou Yame, 2000). According to Xie (1999) and Hou Yamei et al (2000), Bose hand-axes technology exhibits the characteristics of Mode 2. Although unifacial flaking dominates, a strong degree of bifacial flaking is present on 35% of large cutting tools in Bose sample, nearly a quarter of which are made on large flakes and quite comparable within the morphological range of Acheulean hand-axes, picks, or knives. Moreover they concluded that Bose archaeological assemblages show evidence of flaking capabilities, strategies of lithic reduction, and spatial distributional patterns that are similar to those of the Acheulean.

The first impression when we saw the illustrations (Huang et al., 2001) of hand-axes collection from Bose was that they really look like the Acheulean. But further, we can observe some typo-technological differences with Acheulean. Probably, this also makes some archaeologists consider the hand-axes from Bose as core-axes, picks or chopping-tools. Nevertheless, there are some hand-axes that are similar to the Acheulean, from the shape or the techno-morphology like it was mentioned above. But in fact, most of them can be considered as local typology. The unifacial removal or retouch\(^\text{10}\) also can lead us a question about the compatible with Acheulean, as only 35% of the hand-axes conclude as bifacial hand-axes. Besides, on both bifacial and unifacial hand-axes, some of them are with a limited investment for the shaping and seem rough. Moreover, the ovoid and the biconvex cross section are very lack in Bose hand-axes, probably because most of them are unifacial hand-axes (Hou Yamei et al., 2000). It is also possible that Bose hand-axes or in general Chinese hand-axes result from a morpho-technological convergence in the local development of the lithic production, without connection to the Indian or African Acheulean (M. Otte, personal communication, 2007).

Anyhow, the occurrence of hand-axes in Bose takes our attention to compare it to our Pacitanian hand-axes. Whether it is Acheulean or not, what is interesting and is that we observed some similarities between the Bose and the Pacitanian hand-axes. Even though in

\(^{10}\) This unifacial removal is mostly not made on flakes (Hou Yamei et al., 2000).
general the Pacitanian hand-axes are normally with bifacial removal (besides picks which are often unifacial), the general shapes from some of Pacitanian local type with the rounded tip hand-axes are really similar to those from Bose. This likeness is connected with our “type 2” (where each edge has a sort of shoulder and an important concavity in the mesio-distal part that gives a nose-shape to the distal part) and the “type 3” (only one edge presents a shoulder, the other one is still straight or convex) categories of the local typology. Nevertheless, if we compare to the Pacitanian hand-axes that we consider as Acheulean, some of Bose hand-axes are similar to our lanceolate and amygdaloid category. The Pacitanian lanceolate category normally has the massive basis and very often conserves some traces of original cortex, and we also see this occurrence in some Bose hand-axes (cf. chapter 3).

So, one can say that the some of Bose hand-axes are comparable to the Pacitanian ones, nonetheless the latter have more removal on both faces; the unifacial “hand-axes” from Bose may find their equivalents among the picks of the Pacitanian assemblages. Techno-typologically, Acheulean can be present in Bose, but perhaps the quantity of Acheulean shapes is too low and these shapes result from a convergence. A precise technological study of the hand-axes from Bose should be made to see whether they are compatible with the Acheulean technical tradition.

In the personal communication with Claire Gaillard (2007), the definition of Acheulean also requires more accuracy. If it is considered in a large sense, then any assemblage which includes a few hand-axes (bifacial, more or less symmetrical, elongated tool) disserves the attribution to Acheulean tradition. If Acheulean has to be considered in a more selective meaning, then its definition is still to be worked out, by all the scholars concerned with this technical tradition.

**B. General Conclusion and Some Recommendations**

Concerning the heritage management, we tried to record the data of Pacitanian which is conserved in Europe and Indonesia. In this part, we update some information and made new discoveries, like in Groningen Institute for Archaeology\(^{11}\) the Pacitanian collection is not conserved in this institution anymore, but has been sent both to

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\(^{11}\) Biologisch-Archaeologisch Instituut is the old name of this institution.
Indonesia and England\textsuperscript{12} (but it was impossible to find out to which institution exactly the collection has been sent). In other part, we also found that there is a Pacitanian collection in the Royal Belgian Institute of Natural Sciences (RBINS, Brussels, Belgium), collection that was not mentioned in the publications before. In the term of heritage management, to record the spread of Pacitanian collection was a big work but it provides useful information about the Indonesian patrimony. This work could be continued by a research and a recording of other Pacitanian collection in other European institutions.

Like it was mentioned in chapter 1 and chapter 2 about the context of the industry, the Palaeolithic and Neolithic artifacts were mixed in the river bed and river bank. In this case, it is impossible to consider Pacitanian as a contemporaneous assemblage, but most of them are palimpsest (in this case it can be from Middle Pleistocene to Holocene).

The typological study shows the important variability of the tools. For some categories, the border made between the different types is not so clear. For instance, chopper, chopping-tool and core are not clearly distinguished from one to another (as the chopper and chopping-tool can be considered as core also). In another hand, we can obviously create a distinction between a chopper chopping tools complex and the pick and hand-axes assemblages.

In this case, we can not agree with Movius, who mentioned that Pacitan belongs to the “chopper chopping-tool complex”. The choppers and chopping tools are present but beside them, the strong occurrence of hand-axes and picks shows affinities with the artifacts typical of the Acheulean technical tradition. Some specific shapes of the hand-axes are, however, not typical of the Acheulean, and considered in this study as an original and local production; it is interesting to note that they present some affinities with the Bose assemblages in South China.

Another kind of assemblage can be distinguished also with the small and very elaborated flakes connected to some small and better controlled cores. These flakes have been collected by Von Koenigswald and conserved in Senckenberg Museum (SMF, Frankfurt, Germany).

So, at the end we can see that the Pacitanian collection is clearly composed by four different groups of artifacts: core tools like choppers and chopping-tools, symmetrical tools

\textsuperscript{12} Personal communication with Daphne Maring-Van der Pers (Secretariat GIA/Archeologie) and Gert-Jan Bartstra.
like hand-axes and picks, big flakes and more elaborated, smaller flakes. Sometimes, Neolithic implements are mixed with the Paleolithic ones.

Movius places the Pacitanian assemblage outside the distribution area of the Acheulean, beyond the famous “Movius line” he defined. But our analysis shows the morphological similarity between the classical Acheulean and some of the Pacitanian hand-axes, notably by the occurrence of some typical shapes of Acheulean hand-axes. The fact that the hand-axes are bifacial, some are elongated, symmetric, some of the tip ends are pointed, the presence of biconvex cross section, support our idea that Pacitanian belongs to the Acheulean. Moreover, the presence of big flakes production and also the presence of picks also support this opinion. Nevertheless, it is interesting also to note that cleaver is absent in Pacitanian assemblage.

The four local types of hand-axes show also clearly some morphological recurrences but that doesn't match with the classical Acheulean typology. Like it is impossible for the moment to link this specific production to any culture or other typology defined previously, we can consider these four types as a typical local production that is, eventually, a local adaptation of the Acheulean production. So this occurrence also support the idea that bifacial technology is the product of the both cultural influences and convergence due to technological and environment constraint (Otte, 2003).

The result of our comparison shows that so far, except Bose in South China, we still cannot find absolute similarity between the Pacitanian assemblage (especially the hand-axe) and other industry.

As a final conclusion of our study, we can say that it is not enough to take a general overview about Pacitanian by only studying one collection because each collection we have studied in this work shows specificities connected with the resolution (and sometimes the obvious selection) applied to the collection of the artifact on the field. For instance, the huge cores are absent in all the collections except in the Laboratory of Gunung Sewu Prehistory (LGSP, Punung, Indonesia), whose location is very close to the site itself.

In the future, it would be interesting to confirm the validity and the geographical and chronological extension Pacitanian assemblages (especially the hand-axes) by some new discoveries. In the Pacitanian area, a complete study could be done about the different river bank. New excavations in the different river banks could allow a comparative study between the techno-typological characteristics of the assemblages coming from each bank. Some
researches and discoveries in other sites that have a good chrono-stratigraphical context could also help us to define more precisely the meaning of the discoveries made in the Pacitanian area. Our study put on light the main techno-typological characteristics of the Pacitanian assemblages and the specific interest of the Javanese Lower Paleolithic for the debate about the Acheulean diffusion and the first human migration waves in Asia. Unfortunately, the context of the discoveries in the Pacitan area was not well defined. This potential and all the questions put on light in this work should motivate new fieldwork oriented to the precise chrono-stratigraphical context of the industries. And maybe these fieldworks will confirm the intuitions of this study and oriented in another way our comprehension of the human settlement in South-East Asia.
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REEXAMINATION AND MEANING OF THE PACITANIAN ASSEMBLAGES IN THE CONTEXT OF THE SOUTH-EAST ASIAN PREHISTORY

The discovery of some artifacts along the Baksoka River, near Pacitan, in the South of Java, has been made by Von Koenigswald in 1935. Based on these findings, he decided to determine the Pacitanian Culture and to attribute it to the Lower Palaeolithic.

The researchers who studied the assemblages of the Baksoka after him, especially Movius, interpreted it in relation with the first human migrations and the diffusion of the main cultures during the Lower Paleolithic, and especially with the geographical limit of the Acheulean in Asia.

After 70 years of field investigations, the Pacitanian assemblages are now conserved in different countries and have been the subject of various interpretations. It results that on the present day, it is very difficult to have a precise idea about Pacitanian materials and the context of these findings.

This historical background and the passionate debates about the first human migration in Asia are the background of this study. We have analyzed some collections conserved in different institutions and applied a uniform and modern approach. Our goal was to obtain an up-to-date state of the art of the assemblages and to propose new interpretations connected with their cultural and chrono-stratigraphical problematic.

Our main results concern the validity of Pacitanian as a specific culture and the occurrence of some types of artifacts. The well-known chopper - chopping tool complex coexist with hand-axes and picks, and also with two distinct flake technologies. The characteristics of these groups and the problematic stratigraphical context lead us to consider Pacitanian as a palimpsest that group different chronological and cultural stages and not as a culture.

At the end, this approach deals with the difficulties to study the old collections and the limits of their interpretation. But it shows also their interest when they are correlated to specific questions. In this way, the true Hand-axes and Picks complex and it's relation to the Acheulean production shows the necessity to goes further and to lead new and multidisciplinary field researches. It's when they generate questions and new researches that the old collections reveal their full potential and shows all their interest.

Key Words: Java, Pacitan, Baksoka River, Pacitanian assemblages, Movius line, Acheulean.