A Metrical Analysis of Palaeolithic Handaxes in Korea:
Identification for Shape Consistency

Lee Hyeong Woo

Abstract

In Korea, the number of Palaeolithic handaxes that have been recovered has increased as the results of many carefully conducted excavations. Of them, the most prolific handaxe sites are highly concentrated in the Imjin-Hantan Valley. A comparative study is required in order to verify the artefacts' variation. Because the characteristic features of the handaxes from Korea are still being questioned, the determination of a useful definition for understanding the Palaeolithic culture in Korea is highly required. For the comparative study, the artefacts from the Upper Thames Valley in Britain are applied. The author tried to extract the attributes that are morphologically significant. The attribute for overall outline of shape is determined with extracted metrical data. To consider this matter, so-called tripartite shape diagrams that were generated by Derek Roe have been used. This series of methods allows the most objective verification procedure and enables a reconstruction of past human behaviour in Korea.

Keywords: handaxes, metrical analysis, the Imjin-Hantan Valley, the Upper Thames Valley

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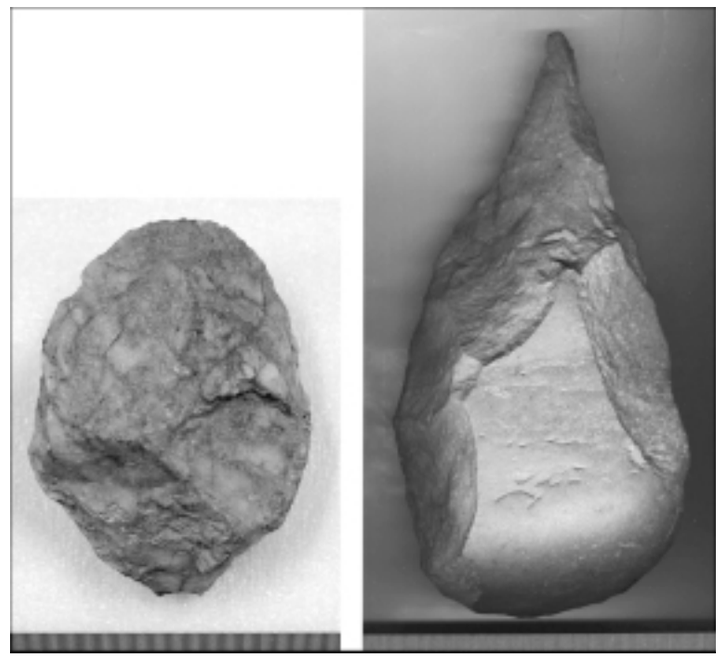
Understanding Handaxes with Metrical Analysis

The debate over the definition of the Palaeolithic handaxe in Korea began with the tools found in the Imjin-Hantan Valley. Since a large numbers of handaxes were discovered (see figure 1), numerous relevant articles have been published (Kim and Jung 1979; Bae 1980; Choi 1983; Chung 1984; Yi J. 1991; Lee Heon-jong 1997; Bak 2000; Yi S. 2000). At first, these handaxes were named "Acheulian handaxes" because of the typological similarity with those from Europe (Kim and Chung 1979). Soon after, in one of the early official reports, Hwang (1983) argued the artefacts to be not Acheulian handaxes, but



Note: Source from Kyung Hee University Museum (left) and Seoul National University Museum (right). The ruler is graduated in millimeter.

Fig. 1. Handaxes from Imjin-Hantan Valley

"Acheulian-like" handaxes. He did not regard them as being typically old enough, and their morphology not shared with that of the typical ones. After the 1990s, Yoo (1997a, 1997b) argued that the handaxes from the Imjin-Hantan Valley were different from the Western ones, since the Korean handaxes are morphologically cruder and technologically inferior. Bae (2000) scrutinized them on the basis of comparative works that were done in other areas, such as East Africa. This meant that more work led to more unique cultural identities being found.

It is highly likely that handaxes in Korea are rather unique and possess their own culturally distinct features. Not only in terms of culture and region, but there is also an obvious chronological difference. Yi (1996, 2000) claimed that the cultural layer could not be older than roughly 100,000 years BP ("before the present") on the basis of geological work done. The most highly debated site for dating in Korea is Jeongok-ri (Chonkokri). Various dating methods have been applied, but conclusive answers are not fully ready yet. However, recent analyses suggest that human occupancy would be between 500,000 and 350,000 years BP (Bae 2003).

On the other hand, the artefacts from the European handaxes are generally older than those from the Imjin-Hantan Valley. In a large sense, the British handaxes dealt in the paper also fall into the general European category. Handaxes from the area have been found in the river terrace deposits. Since many of them are derived from the original contexts it is difficult to evaluate a precise chronological data. However, many artefacts could have been from the deposits formed between O. I. S. (Oxygen Isotope Stage) 5 and 7 (Lee Hyeong-woo 2001b). They might have been made during the earlier periods than the expected chronological period for they could have been derived from their original contexts. It should be born in mind that the earliest handaxes culture in Britain is much older than that found in Korea. For example, Boxgrove and High Lodge were formed during the pre-Anglian Period, which means that these sites are more than 500,000 years old (Roberts et al. 1997; Ashton 1988). Therefore, regionally and chronologically, these two sets of handaxe groups are different.

In spite of this fact, Korean handaxes still share many features with the European ones, including the British ones. Simply put, typological similarity cannot be neglected. For this reason, establishing what is similar and dissimilar is also important for understanding handaxes in Korea. This article will extract similarities and differences between handaxes from Korea and those from Britain, and verify the Korean handaxes' own characteristic features. The main reason why the European handaxe group is referenced here is that it has been repeatedly compared to the Korean one and has been treated as a typical handaxe group. Moreover, a large number of handaxes have been found and well analysed, so it is ready to have a comparative study that considers a Korean handaxe group within it.

The handaxes that are analyzed are from Jeongok-ri (Bae 1989, 2002) and Juwol-ri (Yi and Lee 1993). Sadly, many of them are from derived conditions and were collected from surface sites, but their relative chronology has been revealed by an *in-situ* component of the given geological conditions. For the sake of our comparative work, mainly the handaxes from the Thames Valley, Britain will be examined.

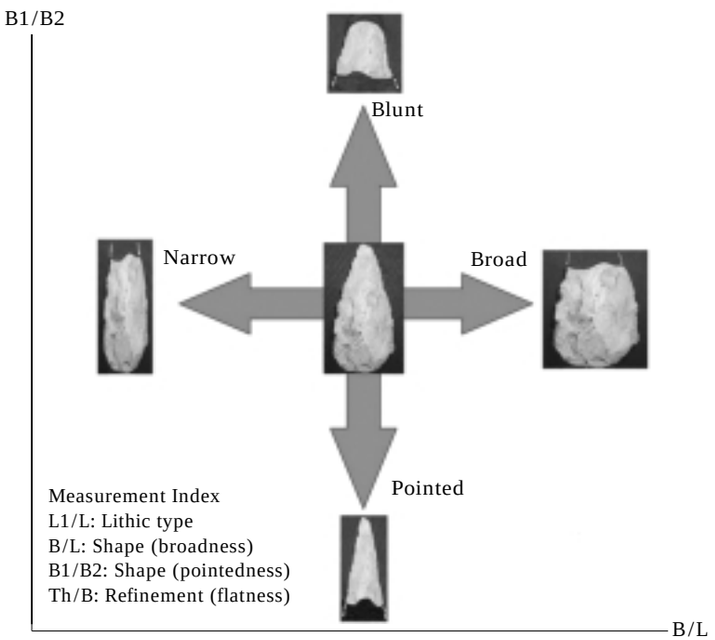
The forthcoming problem is one of classification. Typological sorting is highly dependent on each researcher's own arbitrary visual classifications. To avoid such arbitrariness, a metrically devised categorical criterion is required. Such an approach provides an objective view of handaxe variation (Lee Hyeong-woo 2001b).

Roe (1968, 1981, 1994) introduced a method of metrical analysis. The core of his method is the examination of various ratios of the measurements; these are L (length), B (breath), T (thickness), B1 (breadth at 4/5 of the distance from the handaxe butt), B2 (breadth at 1/5 of the distance from the handaxe butt), T1 (thickness at the distance from the tip equal to 1/5 of the length for the pointed types only) and L1 (the distance from the butt end to the point along the implement's long axis, at which the position of the maximum breadth occurs).

He wrote about two important main issues: the refinement and the shape of handaxes. In the case of the artefacts' refinement (flat-

ness), he used Th/B and T1/L (for the pointed types) and Th/B by itself (for the ovate types). To illustrate aspects of its shape, he used the ratios B/L and B1/B2. B/L shows the range of broadness or narrowness of the general outline shape in the handaxe group. B1/B2 shows the range of pointedness or bluntness of the tip (see figure 2). The horizontal scale is the artefact broadness, while the vertical scale is the artefacts pointedness; a rightward distribution indicates a broader handaxe, leftward a narrower one, while an upward one indicates a blunter tip and a downward distribution a more pointed tip.

Finally, he generated the ratio L1/L as the range of general shapes in the handaxe group, with lower values indicating generally triangular shapes, central values ovate shapes, and higher values



Note: modified from Roe (1968, 1981).

Fig. 2. Exploiting the Measurement of Handaxes

cleaver ones.

These measurements have been applied to handaxes from Korea and Britain. However, before measurement, a pre-conceived categorical idea that provides an answer for the question is required. Actually, the biggest question is that of understanding whether handaxes in Korea are of a typical Acheulian type, but the sub-question revolves around the extent to which artefact shape and refinement are different. This approach, while it is supported by the archaeological data, must also consider the chronology and the condition of the raw material.

Metrical Study of Handaxes on a Small Scale

As was explained earlier, the handaxes for the quantitative analysis are from sites at Imjin-Hantan (Jeongok-ri and Juwol-ri) and also from the Upper Thames (Berinsfield, Stanton Harcourt, Iffley, and Wolvercote). Within the Imjin-Hantan Valley, Jeongok-ri supplied twenty-eight handaxes and Juwol-ri supplied twenty-one. In the Upper Thames, a total ninety-four flint handaxes was found, and twenty quartzite handaxes were also test material. Of them, the most prolific site is Stanton Harcourt, which had fifty handaxes.

Since the quality of rock can easily affect the general conditions of the artefacts, this information should be carefully scrutinized. All the handaxes from the Imjin-Hantan Valley were made of poor quality rock such as quartzite, while only some of those from the Upper Thames Valley were made of quartzite. But most of them were made of fine quality flint. For instance, mostly well-known Wolvercote handaxes are made of flint, but some of them are knapped with quartzite (Tyldesley 1986, 1988).

By adopting Roe's tripartite shape diagram, each site's artefact shape can be envisaged. If the rock quality is a key factor in determining morphology, a significant difference between the flint and quartzite handaxes should be observed. In order to verify this, the site of the Upper Thames was considered as supplying two separate sets of handaxes; the flint and quartzite handaxes. However the handaxes from

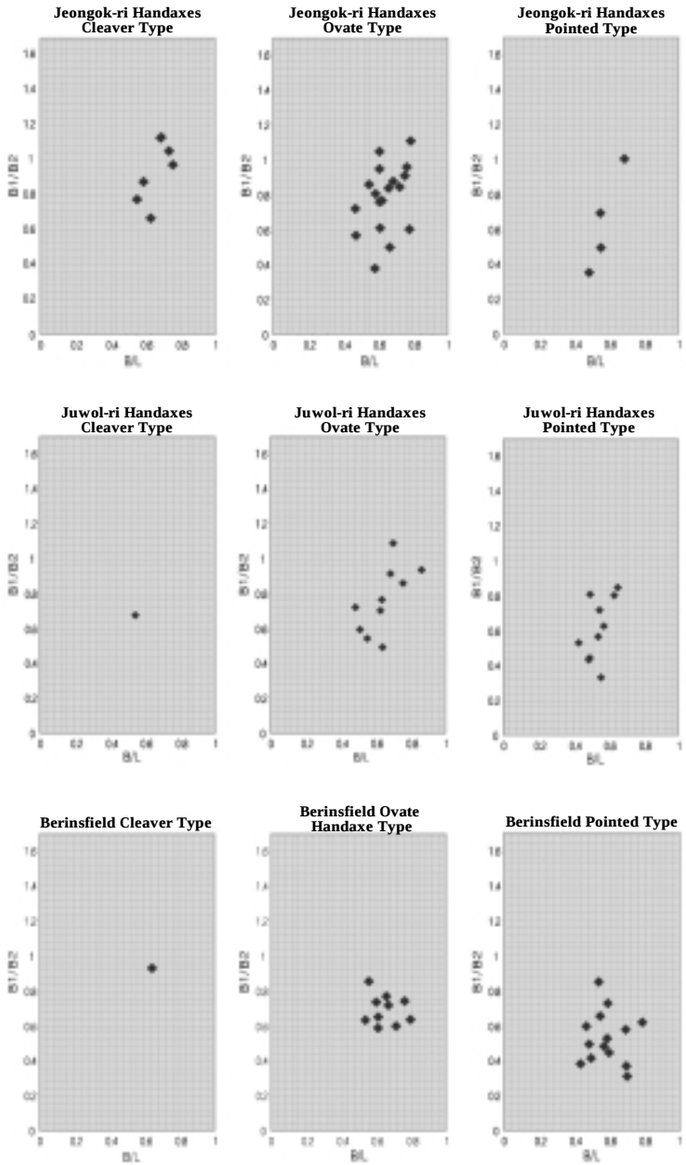
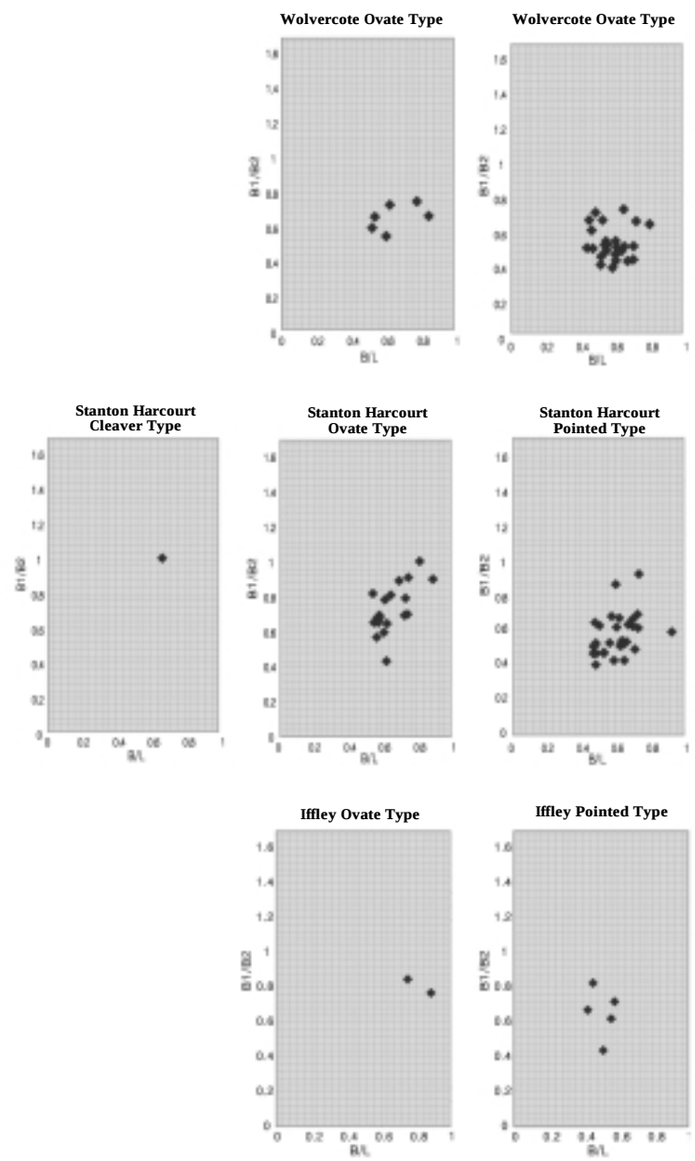


Fig. 3. Handaxe Distribution Diagrams of Each Site



Note: From top left to bottom right, Jeongok-ri, Juwol-ri, Berinsfield, Wolvercote, Stanton Harcourt, and Iffley.

the Imjin-Hantan Valley are largely regarded to be a set of quartzite handaxes, even though they are not completely homogeneous.

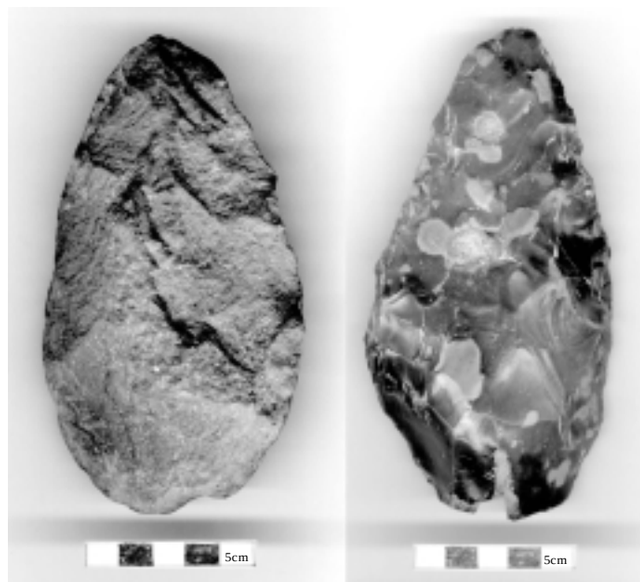
Following the Roe's criteria, if the L1/L value is equal to or smaller than 0.350, the handaxe will be classified as a pointed handaxe. The values lying from 0.35 to 0.55 indicate an ovate handaxe and ones more than 0.55 point to a cleaver (Roe 1968). The two dimensional figures are composed with the values of B1/B2 and B/L. One of the good merits is to reclassify the handaxes in an objective way. Even if a handaxe is categorized as an ovate handaxe upon arbitrary visual inspection, it can be resorted into the cleaver or pointed handaxe category.

Figure 3 shows each site's tripartite shape diagram. There are many interesting distributions that can be observed. First, the most distinctive pattern is the presence and absence of the cleaver types. In the case of the Upper Thames, the cleaver type is hardly found. The Wolvercote and Iffley sites have not yielded a single cleaver type. Although Berinsfield and Stanton Harcourt have shown this type of tools, it is significant that only a small number have been found (each site has only one each). In the case of the Imjin-Hantan Valley, the Juwol-ri handaxes share a very similar pattern with those of the Upper Thames Valley. However, the Jeongok-ri site has a significantly large numbers of cleavers. Still, cleavers do not dominate in Jeongok-ri, but are a bit more numerous than pointed handaxes. In general, for the six archaeological sites, there are none dominated by cleavers. Therefore, the Imjin-Hantan handaxes have a consistent pattern with those from the Upper Thames Valley. That is to say, all the sites are dominated by ovate or pointed handaxes.

Second, it is necessary to determine whether the sites are ovate or point-dominated. In the case of Jeongok-ri, pointed handaxes have usually been introduced in various publications. So, the pointed ones are easily regarded as the major type of handaxes. However, an actual test revealed that the ovate handaxes (64.3%) are significantly large in number. Since Juwol-ri shows equal numbers between the two types—ovate and pointed—this also illustrates that the ovate handaxes are an important characteristic feature for understanding

Table 1. The Percentages of the Handaxe Typological Distribution Made by L1/L

Site/Type	Cleaver (%)	Ovate (%)	Pointed (%)
Berinsfield	3.8	38.5	57.7
Iffley	–	25	75
Stanton Harcourt	2	38	60
Wolvercote	–	19.4	80.6
Jeongok-ri	21.4	64.3	14.3
Juwol-ri	4.8	47.6	47.6



Note: Source from Lee (2001b). The ruler is graduated in centimeter.

Fig. 4. Two Handaxes from Berinsfield:
a quartzite tool (left) and a flint tool (right)

the lithic tradition at the given site. However, the sites from the Upper Thames show a far different distribution. All of them are highly concentrated around the pointed type and not the ovate (see table 1). All the sites are more than 60% dominated by the pointed type.

Third, the morphological differences should be examined. With regards to the two points mentioned above, the handaxes from the Imjin-Hantan Valley display a few distinctive patterns shared with those from the Thames Valley. The next step is to determine how similar the Imjin-Hantan handaxe shapes themselves are to those from the Upper Thames. The outline of the shape can be explained by the ratios of B/L and B1/B2. Since the distribution of the ratios is plotted in figure 3, the artefacts' broadness (B/L) and pointedness (B1/B2) are instantly visualized.

As seen in figure 3, it is not still easy to reveal any striking differences between the sites. In other words, it is hard to conclude that these two sets of handaxe groups are significantly different. An overall impression is that the B/L and B1/B2 values between the two of them are plotted at similar ranges and places. It is unlikely that these two sets are completely different tool kits. It should be remembered that the handaxes from the Upper Thames were made of flint and quartzite together (figure 4), while Imjin-Hantan handaxes are made mainly from quartzite and equivalent rocks. For this reason, the fourth consideration became that of the artefact shape with the raw material that was used.

As seen from the figure 5, the distribution patterns of the Upper Thames flint handaxes are not all too different from quartzite handaxes observed in the Upper Thames. The values of the Upper Thames quartzite handaxes are placed within the range of the Upper Thames flint ones. Horizontally and vertically, the most values are concentrated within certain individual categories. Although the raw material varies, the overall distributions are quite similar to each other in the case of the ovate and pointed sections.

Turning to a comparison of the Imjin-Hantan tools with the Upper Thames quartzite ones, differences are seen in the presence of cleaver handaxes and a wider distribution of three types of handaxes.

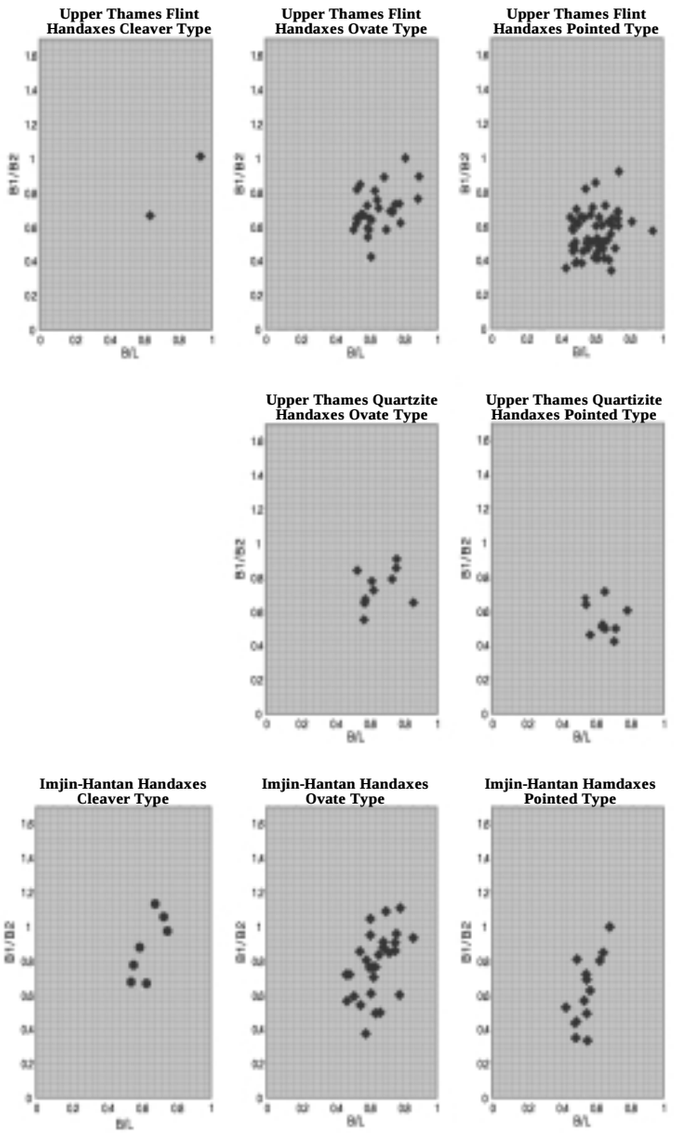


Fig. 5. Handaxe Distribution Diagrams for Different Sources

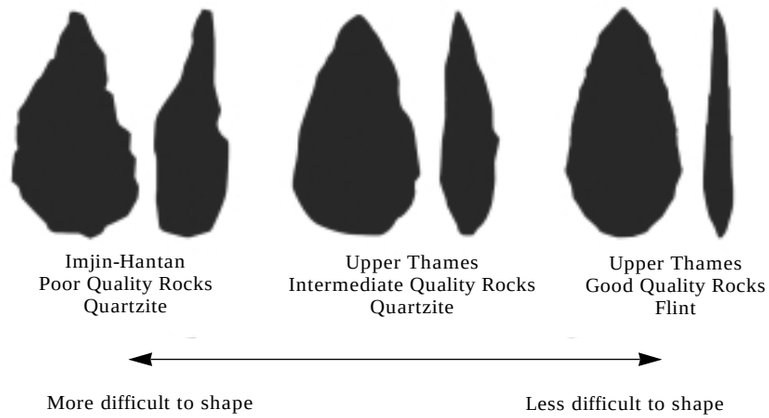
Although it is still not yet clear whether these features are significantly important or not, these two points are visually distinctive.

In the Upper Thames quartzite handaxes, none of the sites report the presence of the cleaver type. The cleaver type is a minor one even among flint tools, and the case of the quartzite tools also follows this feature. However, some handaxes from the Imjin-Hantan site were shaped into the cleaver type. Of a total of 49 handaxes, 7 of them are classified as cleavers. In terms of the pointedness variation, the Imjin-Hantan handaxes show a widely diverse range. However, the Upper Thames flint and quartzite handaxes give a more or less clustered distribution in regard to pointedness and broadness.

It explains why the raw material quality does not significantly affect the artefacts' shape in the context of the Upper Thames Valley. However, that kind of feature does not extend to the Imjin-Hantan context. Consideration of this point reveals an important aspect of handaxes in Korea. The problem of raw materials should be carefully reviewed. If the quartzite quality from the two areas are nearly the same with one another, the reason behind the morphological differences does not lie in the raw material itself. But if the quartzite quality from the two areas is significantly different, the raw material is again an important factor towards determining the morphological differences.

On the basis of an actual examination that included an experimental component, the quartzite and its equivalent material between the two areas cannot be exactly the same. According to Moloney and others, some of the quartzite in the Oxfordshire (the Upper Thames) is remarkably good at control knapping, and the quality is close to flint (Moloney et al. 1988). But the quality of the quartzite in the Imjin-Hantan Valley is far from that, although there is an exceptional case in Gyeonggi-do province (Yoo 2003). Because of the coarse grain structure and anisotropic quality, a roughing-out manufacture is feasible, but retouching or soft hammering is very hard to perform (see figure 6).

Considering this point helps us arrive at an important realization about handaxes in Korea. One of main reasons why the Korean han-



Note: The handaxes that come from quartzite material of the Imjin-Hantan Valley, quartzite material from the Upper Thames, and flint material from the Upper Thames.

Fig. 6. The Tendency of Shaping Difficulty

daxes are not like the typical Acheulian type is the absence of good quality rocks. The quality of rocks is interrelated with an artefact function. From the evolution of lithic technology, one of key distinguishing point is that of artefact flatness. Toolmakers had to continue knapping until a suitable edge was produced. Usually, a thinner edge indicates better quality work. It is likely that the flatness differences could be due to the raw material problems, as poor quality rock usually requires a harder knapping sequence and even the final products cannot achieve a more refined form. Therefore, the Imjin-Hantan handaxes and the quartzite handaxes from the Upper Thames can be compared.

The flatness calculated by Th/B highly depends on the quality of rock. Since it is very difficult to control knapping in poor quality rock, a tool made of poor quality rock has not only a poor shape but also poor flatness, so it cannot achieve a more refined form. Three

different groups (quartzite handaxes from the Imjin-Hantan, quartzite handaxes from the Upper Thames and the flint handaxes from the Upper Thames) can be compared by the mean value of flatness (see figure 7). It can be said that different quality rock could be made into a similar handaxe shape, but a similar flatness is hard to accomplish. Since the quartzite quality of the Upper Thames is intermediate between the Upper Thames flint and the Imjin-Hantan quartzite, the flatness value is also in the middle

Going back to the tripartite diagrams, the morphological distribution pattern of Imjin-Hantan handaxes can be partly recognized. However an unsolved question still remains. The question is whether the distinctive handaxe shapes of the Imjin-Hantan Valley can be regarded as their own distinctive culture or not. Moreover, one wonders whether these handaxes are entirely unique not only from the handaxes from the Upper Thames Valley but also from all of the handaxes from Britain. The Upper Thames handaxes are a small part in comparison with a whole handaxes in Britain. In order to attempt to ascertain how unique and how much they deviate from called "typical handaxes," a large-scale comparison becomes highly necessary. The artefacts should be viewed on both large and small scales at the same time. On the small scale, each site or area has different features, so different patterns of handaxes are apparent, but on the large scale these differences may differ.

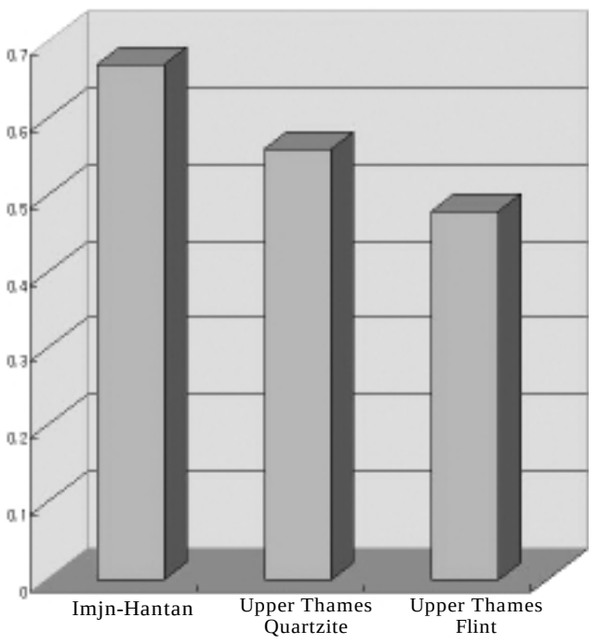


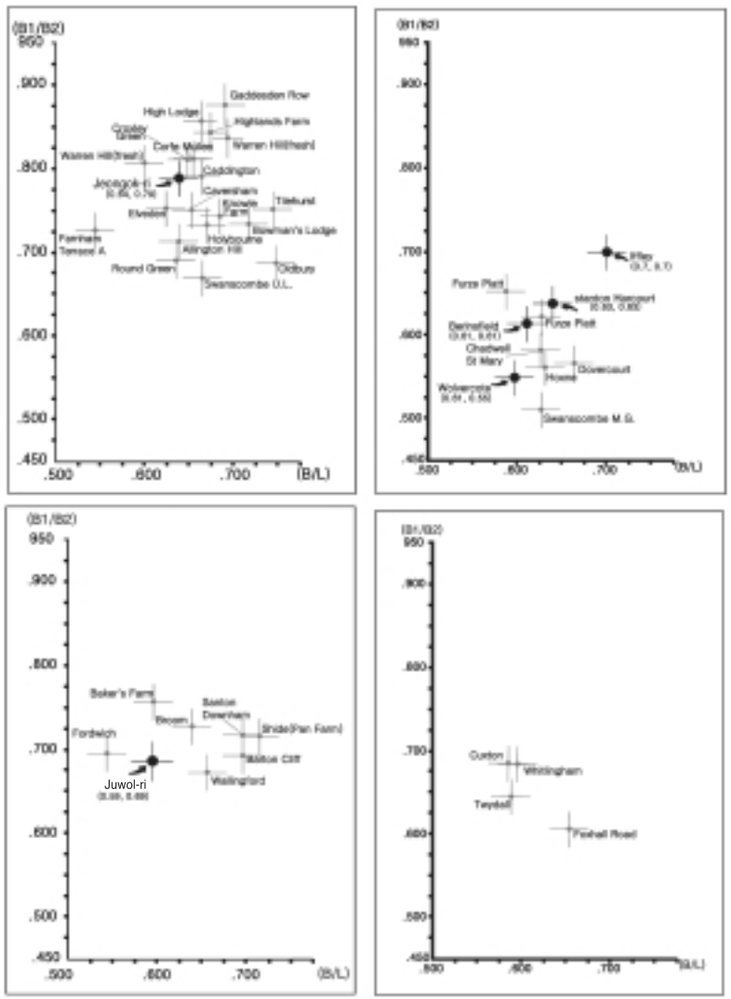
Figure 7. The Result of the Mean Values for Flatness

Large-Scale Metrical Study of Handaxes

A small-scale variation between the Imjin-Hantan and the Upper Thames artefacts has been observed. The problem is that this variation cannot be properly represented as a whole cultural significance.

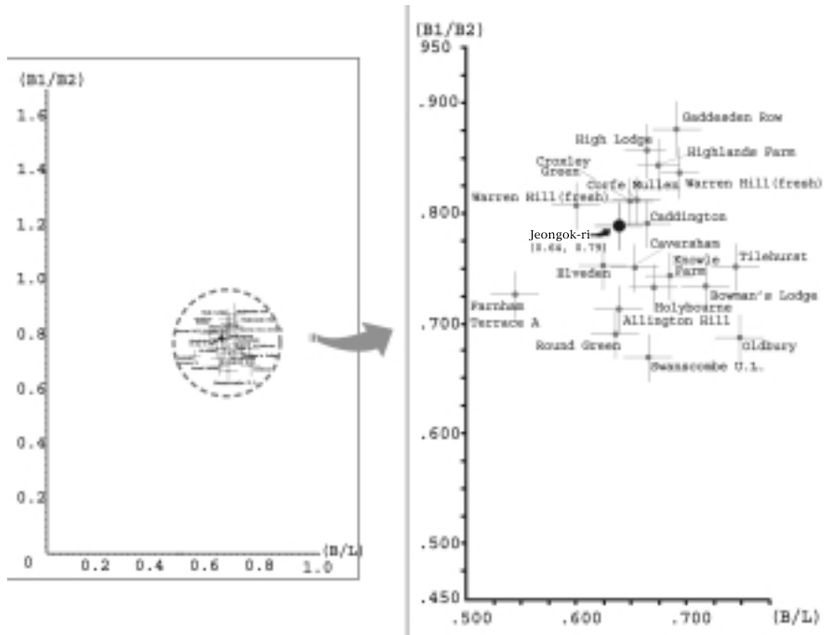
Unlike in the Imjin-Hantan sites, all the Upper Thames sites have pointed dominated pattern and clustered distribution patterns. But it is not necessary to suggest that such features represent a general guideline for all British handaxes. According to Roe (1968, 1981), many important Lower Palaeolithic sites such as Warrenhill, High Lodge, and Highlands Farm show more than 60% of their handaxes falling into the ovate section. If all the British handaxe groups are pointed dominated, the Upper Thames handaxe groups are a representative entity for British handaxe industries. However the archaeological data tells a different story.

In regards to the Jeongok-ri, which has a dominance of ovate handaxes, it can be treated as a small-scale idiosyncrasy. Even more, the dominance pattern is varied in the same area. The Juwol-ri handaxes do not show any dominance. For a reference, some sites that are Wallingford, Broom and Barton Cliff are classified into so-called intermediate group because of an absence of any dominated handaxe type. This means that all the Imjin-Hantan sites resemble one or another site from Britain.



Note: From the top left, No. 1: an ovate dominated group, No. 2: pointed dominated group, No. 3: an uncommitted group (ovate tendency), No. 4: an uncommitted group (pointed tendency), modified (including site data) from Roe (1968, 1981), and Lee (2001b).

Fig. 8. Shape Diagrams for Mean Values for B/L and B1/B2 in Major British Sites and Jeongok-ri and Juwol-ri



Note: (Actual size) left, (magnified size) right, modified (including site data) from Roe (1968, 1981).

Fig. 9. Shape Diagrams for Mean Values for B/L and B1/B2 in Major British Sites and Jeongok-ri (an ovate dominated group)

The shapes of the Imjin-Hantan handaxes also differ from the Upper Thames ones. But such a pattern can also be observed at other British sites, such as Boundstone and Gravel Hill Channels, Fordwich, Holybourne Down etc. Therefore, this pattern is not a unique feature for only the Korean handaxes culture. It seems reasonably clear that the different shape preferences between Korea and Britain are not because of a geologically divided cultural problem, but because of the idiosyncrasies of each site. That is to say, the handaxe shape generated by B/L, B1/B2 and L1/L from Imjin-Hantan are also

a part of the ones seen in typical handaxe groups in Britain.

In order to verify this point of view, the mean values of each site can be analysed. Fortunately, many British sites have already been explored by Roe (1968, 1981). On the basis of his data, he already generated four different diagrams (see figure 8): No. 1: an ovate dominated group, No. 2: a pointed dominated group, No. 3: an uncommitted group (ovate tendency), No. 4: an uncommitted group (pointed tendency).

The mean values of the Jeongok-ri handaxes are 0.45 (L1/L), 0.64 (B/L) and 0.79 (B1/B2), and the values of the Juwol-ri ones are 0.38 (L1/L), 0.59 (B/L) and 0.69 (B1/B2). Of the four diagrams, Jeongok-ri falls on the ovate dominated diagram and the site is placed at almost the mid part (see figure 9). It allows us to assert that the Jeongok-ri handaxe shape does not seriously deviate from that of British handaxe groups. In the case of Juwol-ri, it is classified into the uncommitted diagram's ovate handaxes. It is also placed within the range of the given handaxe groups. Therefore, the Imjin-Hantan handaxes are generally almost identical with the British ones. From this point, the Imjin-Hantan handaxes are not totally unique, so it is hard to say that they do not belong to the typical handaxe tradition which is assigned by a British standard.

By adopting the series of analyses, only minimal differences are observed. It can be confidently asserted that the handaxes between the two regions (Korea and Britain) have a consistency in shape. In other words, no matter which site and what the distribution patterns are, the range of lithic shapes does not vary widely. More or less regular and repeated shapes were produced throughout the place and time. The similarity between the two regions is examined, although more data beyond Imjin-Hantan is required for a concrete answer.

However, this analysis is solely based on a morphological attribute. When considering the other attributes, such as the functional point of view, the explanation might differ from that. As interpreted earlier, a functional aspect is highly dependent on the quality of rocks. And the function between those from the Imjin-Hantan and the Upper Thames is different. This makes possible the assertion that

the functional inconsistency on a larger scale is expected, if the majority of rock types are different from one other. Due to the fact that available data for this analysis is limited, a larger-scale metrical analysis is difficult to carry out. However, one certainty is that the majority of rock from Korea and Britain is substantially different. According to Lee (2001a), the Palaeolithic sites in Britain are very closely related to flint-rich areas. This distributed rock pattern indicates that the preferred raw material during the Palaeolithic period was flint in Britain. In other words, most British handaxes during the Palaeolithic period were made of flint. But such a good quality rock is hardly available in the case of Korea. Most handaxes in Korea were made of poor quality rock such as quartzite. Since the majority of rock types for making handaxes is quartzite in Korea, the related function could not be exactly the same as those from Britain.

Conclusion

As regards my summary account of handaxes variation in the Imjin-Hantan and the Upper Thames Valley, a morphological characteristic feature was examined by means of a metrical test. Between the two areas, an overall similarity between handaxe shapes is found. Even though some variations are to be expected, these variations have been found not only in regions but also in sites. Especially in that a large section of British data shows a wide range of broadness and pointedness variations, the values from the Imjin-Hantan sites fall into a given range. On the large-scale, categorically observed handaxe shapes in the Imjin-Hantan area might not be so unique. For this reason, the recurrent shape should be regarded as a very general design implication that occurred everywhere.

However, not the overall shape similarity but the overall functional similarity is still in question. It is worth asking what kind of intention the toolmakers in the Imjin-Hantan Valley had. It is still doubtful what the most important point in making handaxes was: shape, function, or something else. In order to verify, more systemat-

ic approaches, including consideration of the functional aspects, are required. Especially, the matter of flatness, which is related to a functional purpose, shows a slightly deviated result from that of broadness and pointedness. Due to a lack of data, a functional analysis has not been fully conducted yet. However, a significant difference is accounted for on the small scale. As explained above, the Imjin-Hantan handaxes mostly fall into the ranges of the shapes from the Upper Thames. However their flatness never reaches that of the Upper Thames artefacts. It is probable to assert that better quality rocks made for more refined handaxes; as a consequence, the quartzite-made handaxes from the Imjin-Hantan area could not be made to have nice flat forms of shapes. Further analysis with more data is expected to provide a clearer picture for understanding the Korean handaxe group.

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