Experiment of bukit bunuh handaxes manufacturing technology

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Abstract

The Bukit Bunuh site is one of the Palaeolithic site in Lenggong Valley in the meteorite impact area, which is located 10km from Lenggong town, in the hulu Perak district. This site discovered a handaxe tools which is the important findings that will change the "Movius Line" theory that reflects the different levels of technology between Southeast Asia and the West. The experimental of manufacturing technology is conducted to reconstruct the techniques used by ancient people at Bukit Bunuh site to produce these tools. The experimental result proved that Bukit Bunuh handaxes also

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produced handaxe tools and have its own manufacturing techniques and comparable with other regions.

Keyword: *Palaeolithic; Bukit Bunuh site; Handaxe*

1. Introduction

The handaxe was a lithic tool which is associated with the Archulean cultural. The early human's ability to produce the handaxes tools were considered to have high technology and the expertise in the stone tools' production. This is probably because, compared to the other tools manufacturing technology, the handaxes were related with the symmetrical feature. Based on Wymer (1968), the symmetry of handaxes is often exaggerated beyond any possible benefit it could give the tools and can perhaps be interpreted as the beginnings of an aesthetic sense applying in producing their daily tools. While in terms of manufacturing, based on Kelly (1988) In general, a handaxe is aflake or core blank that has been reduced on both faces from two parallel but opposing axes through percussion. According to Andrefsky (1998), the handaxe is the the tool that has two surfaces that meet to form a single edge that circumscribes the tool. Both faces usually contain flake scars that travel at least halfway across the face.

The discovery of handaxe tools at Bukit Bunuh site in 2002 (Mokhtar, 2004) proved that the group community that lived there also have the skills to produce this tools which means that they have the technology in the manufacturing of the equipment. However, the invention of handaxes tools at Bukit Bunuh site was contradicted to the "Movius Line" theory which was introduced by Movius in 1948. The theory established a line between the modern world of India and East and Southeast Asia with the handaxe tools sites in Africa, western Europe, Eastern Mediterranean, and India, while the "chopper-chopping" tools at the East and Southaest Asia (Lycett and Bae, 2010; Jeffrey, 2013). The palaeolithic societies in Southeast Asia and East Asia also said to be inferior because they doesn't produce handaxe tools (Jeffrey, 2013).

Although this theory by Movius can be assumed as outdated and the discovery of the handaxe tools in the areas where they don't produce this tools, for examples at Liang Bau Indonesia (Moore et al., 2009) and Arubu at Philippines (Pawlik, 2004), this theory is still maintained until now because there are some scholars like Keates (2002), Lycett (2007), Norton et al. (2006), Lycett dan Norton (2010) dan Mishra et al. (2010) that still dispute the similarity between the handaxes tools founded in Africa and East Asia and Southeast Asia.

Thus, this study was conducted using the analysis and experiment methods to reconstruct the technique that has been used by the ancient people of Bukit Bunuh site to produce the handaxes tools. Through this method also they can prove whether the handaxes manufacturing technology at Bukit Bunuh sites is similar with other site or have its own manufacturing techniques appropriate to the environment and material culture.

2. Statement issues

The study was conducted based on the issues and problems outlined below:-

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1. The existence of handaxe tools in Southeast Asia and East Asia is still debated and disputed by some scholars (Keates, 2002; Lycett, 2007; Norton et al., 2006; Lycett and Norton, 2010; Mishra et al., 2010). Were the handaxes tools founded here doesn't have any similarities with the manufacturing technology with the other regions?

2. How does the Bukit Bunuh handaxes producing technique. Is the technique comparable with the other region or vice versa?

3. Is the environment and material culture affected the production techniques of handaxes tools in Bukit Bunuh.

3. Objective

This study will generate important data about the technology of handaxes tools in Bukit Bunuh based on the outlined objective below:-

1. To identify the techniques and the technology to produce the handaxes of Bukit Bunuh based on the tools morphological analysis.

2. To reconstruct the manufacturing techniques of handaxes in Bukit Bunuh by using experimental methods.

3. Support to the existence of handaxes tools in Southeast Asia and East Asia.

4. Methodology

The study was conducted based on the methodology outlined below.

4.1 *Analysis of the manufacturing technique of the handaxe tools in Bukit Bunuh*

The analysis of manufacturing techniques of the handaxe tools of Bukit Bunuh were conducted based on Roe (1968) and Mc Nabb et al. (2004) approaches. The analytical methods by Roe (1968) is designed to determine the handaxe tools classification and technologies using the metrical measurements, while the approach by Mc Nabb et al. (2004) aims to classify the large cutting tools from the South African Acheulean. The result of the both analysis are expected to make an initial overview of Bukit Bunuh handaxes tools manufacturing technology.

(i) The Roe metrical analysis (1968)

The Roe's (1968) metrical technique combined the traditional measures of maximum length (L), maximum width (B), and maximum thickness (Th), with the measurements such as distance from the butt to the point of maximum width (L1), the width at $1/5^{th}$ (B2) and $4/5^{th}$ length (B1) and the thickness tip (T1) (Figure 2). From the measurement, the calculation according to the Roe method (1964) and McPherron (1994, 1995). Calculation method and hypothesis by McPherron are shown in Table 1.

Table 1: Calculation method and key components of McPherron's (1995) hypothesis.

Ratio	Calculation	Relevance and description
Pointedness / Planform	L1/ Length	1. Use to separate handaxes into Points and Ovates

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		2. That low values for Tip Length (TL) and vice versa. This indicates that Ovates have smaller TLs than Points.
Elongation	Width/Length	1. That high values for elongation will have low values for TL and vice versa \. This indicates that handaxes that are long compared to their width (narrow, elongated) will have longer TLs than handaxes that are wide compared to their length (Wide, not elongated).
Refinement	Width/Thickness	1. Both patterns are possible and have different implications. Handaxes will either have high Refinement values and low TL values (and vice versa) or high Refinemet values and high TL values (and vise versa).

Source: (Roe's, 1968; McPherron 1994, 1995; Emiry, 2010)

(ii) *Sub-classifications analysis by Mc Nabb et al. (2004).*

In the analysis, Mc Nabb et al. (2014) has divided into 4 stages of analysis which is important to classify the Archulean large cutting tools, including tip shape, the extent and pattern of flaking, symmetry, and the extend of edge working.

4.2 *Experiment*

Two sets of experiments outlined in this study based on the following goals:-

Table 2: The Experimental method performed

Experiment	Methods	Objectives
A	Using cores and hammerstones from Bukit Bunuh site material :- **Core** (i) Suevite (5) (ii) quartzite (5) (iii) Quartz (5) (iv) Chert (5) **Batu pemukul** **(**i) Quartz (ii) Suevite (5)	(i) To reconstruct the techniques that been used by ancient people at Bukit Bunuh site to produce handaxe tools (ii) Relevance between the material and the handaxe tools production technique.
B	Using cores and hammerstones from the Sungai Rui pebble.	

5. Result

5.1 *Bukit Bunuh handaxe tools*

There are variety of impact materials of Bukit Bunuh handaxe tools such as suevite (16%), quartz (28%), quartzite (37%) and chert (19%). The results of the classification analysis for metrical Roe (1968) and Sub-classification by Mc Nabb et al. (2004) are discussed below: -

5.1.1 *Clasification based on Roe metrical analysis (1968)*

The result from Roe metrical analysis (1968) can be summarized as the following table (Table 4):-

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Table 4: Summarized result of Bukit Bunuh handaxes tools based on Roe metrical analysis (1968)

<table>
<tr><th>Ratio</th><th>Summarized</th></tr>
<tr><td>Planform</td><td>- The Planform value of Bukit Bunuh handaxe tools is between 0.2 to 0.58.
- The handaxe tools can be divide to types of handaxes based on the value of planform:-
<table>
<tr><td rowspan="2">Material</td><td colspan="2">Types (%)</td></tr>
<tr><td>Ovate</td><td>Pointed</td></tr>
<tr><td>Suevite</td><td>12</td><td>3</td></tr>
<tr><td>Quartz</td><td>24</td><td>7</td></tr>
<tr><td>Quartzite</td><td>17</td><td>17</td></tr>
<tr><td>Chert</td><td>15</td><td>5</td></tr>
<tr><td>Total</td><td>68</td><td>32</td></tr>
</table></td></tr>
<tr><td>Elongation</td><td>- Low elongation values between 0.46 - 0.92</td></tr>
<tr><td>Refinement</td><td>- Low refinement values between 0.37 - 1.5</td></tr>
</table>

5.1.2 *Mc Nabb et al. (2004) sub-clasification analysis (2004)*

The result of sub-clasification analysis based on Mc Nabb et al. (2004) can be summarized as the following table (Table 5) :-

<table>
<tr><th>Content</th><th>Summarized</th></tr>
<tr><td>Tip shape</td><td>- The Bukit Bunuh handaxe tools analysis can be divide into four tip shape as follows:-
<table>
<tr><th>Types</th><th>Percentage (%)</th></tr>
<tr><td>Markedly convergent</td><td>66</td></tr>
<tr><td>Convergent with a squared-off tip at right angles or nearly</td><td>5</td></tr>
<tr><td>Convergent with an oblique tip</td><td>29</td></tr>
<tr><td>Total</td><td>100</td></tr>
</table></td></tr>
<tr><td>Extent and pattern of flaking</td><td>- The extent and patern of flaking can be devide to:-
<table>
<tr><td rowspan="3">First face</td><td colspan="10">Opposite Face</td></tr>
<tr><td colspan="2">Complete</td><td colspan="2">Complete marginal</td><td colspan="2">Partial marginal</td><td colspan="2">Partial</td><td colspan="2">Subststial</td></tr>
<tr><td>c</td><td>D</td><td>c</td><td>d</td><td>C</td><td>d</td><td>c</td><td>d</td><td>c</td><td>d</td></tr>
<tr><td>Complete</td><td>2.9</td><td>-</td><td>5.7</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Complete marginal</td><td>-</td><td>-</td><td>5.7</td><td>-</td><td>2.9</td><td>-</td><td>8.6</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Partial marginal</td><td>-</td><td>-</td><td>-</td><td>-</td><td>5.7</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Partial</td><td>-</td><td>-</td><td>11.4</td><td>-</td><td>11.4</td><td>-</td><td>5.7</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Substantial</td><td>-</td><td>-</td><td>8.6</td><td>-</td><td>14.3</td><td>-</td><td>-</td><td>-</td><td>17.1</td><td>-</td></tr>
</table></td></tr>
<tr><td>symetry</td><td>- The Bukit Bunuh symmetrical score can be devide to 8 :- 1 (26.6%), 2 (17.1%), 3 (9.7%), 4 (12.2%), 5 (5%), 6 (12.2%), 7 (2.4), 8 (14.6%).
- however, In the test of symmetry by eye, overall of handaxe tools are near-symmetry.</td></tr>
<tr><td>Extent of edge working</td><td>- The extent of edge working of handaxe tools are very low.</td></tr>
</table>

5.2 *The Bukit Bunuh handaxe tools manufacturing technique and technology.*

The experiment conducted based on analysis of the artifacts showed that the Bukit Bunuh handaxe tools' manufacturing technique is composed by two important stages.

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First, the selection of a suitable material, second flaking to thin and shape the artifact then flaking to trim the edge.

(i) *Stage 1: Selection of a suitable material*

The selection of material takes into account several important aspects such as type of material, the core shape and size. From the manufacturing aspect, the knapper should have social and material circumtances knowledge to produce the tools (Hopkinson and White, 2005).

(ii) *Stage 2: Flaking stage*

The flaking stage involves two stage of flaking. First, the flaking on the both side for thinning and shaping of the artifact and second to trim the edges.

(a) *Level 1 : Flaking to thin and shape*

This flaking stage is to thin and shape the core were done on both sides. The size of flaking on the first level is large in size (> 1.5cm). Whether it is intensively flaked on the first surface then followed on the second surface or flaking alternately on both surface based on suitable core material. Thin stone terraces or less thick were usually flaked intensively on the surface and followed by flaking on the surface again. Whereas, the circular shaped stone terrace and slightly thicker stone were flaked alternately on both sides of the surface.

(b) *Level 2: Flaking for trimming the edge points.*

The second stage of flaking is for trimming the edge points. However, from the analysis result, it shows that the Bukit Bunuh handaxe tools have less trimmed edge points. The flaking size of this stage is small (< 1.5cm). This flaking sometimes were done only one surface or both, as appropriate. However, the flaking on this stage is not as intensive as the first stage.

5.2.1 *The effect of material on Bukit Bunuh handaxes tools manufacturing techniques*

Material seems to play important roles in the manufacturing techniques of the handaxe tools. The use of impactit material could possibly affect the production technology of the Bukit Bunuh handaxe tools. This study examines the effect of the Bukit Bunuh impactit material and river pabbles (quartzite) to the planform, refinement and elongation aspect of the handaxe tools.

(i) Refinement

The experiment result showed that the refinement of impactit material handaxes is less refined compared to the use of river pebble material. In fact, the refinement of experimental using impactit material is very similar to Bukit Bunuh handaxes tools' refinement (Figure 1).

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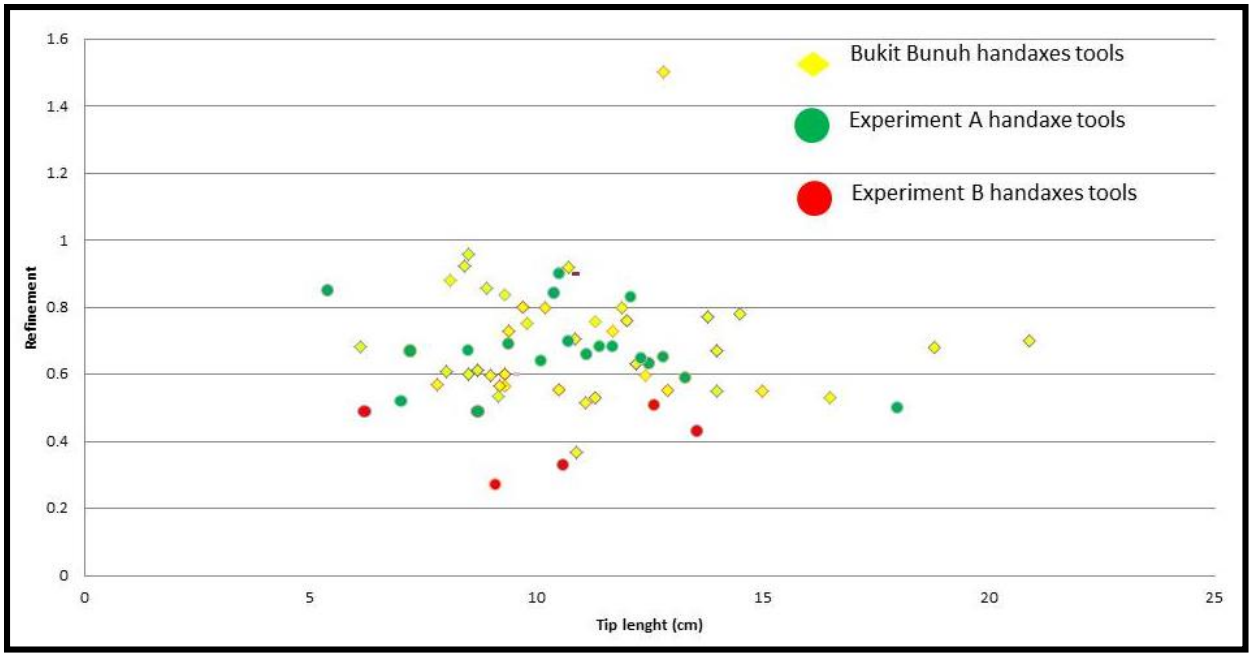

Figure 1: Comparison of experimental and Bukit Bunuh Handaxes tools refinement result diagram.

(ii) Elongation

The Elongation aspect also showed that the impactit material handaxes is less elongation than the river pabble material handaxes. In fact, the elongation of experimental using impactit material is very similar to Bukit Bunuh handaxes tools elongation (figure 2)

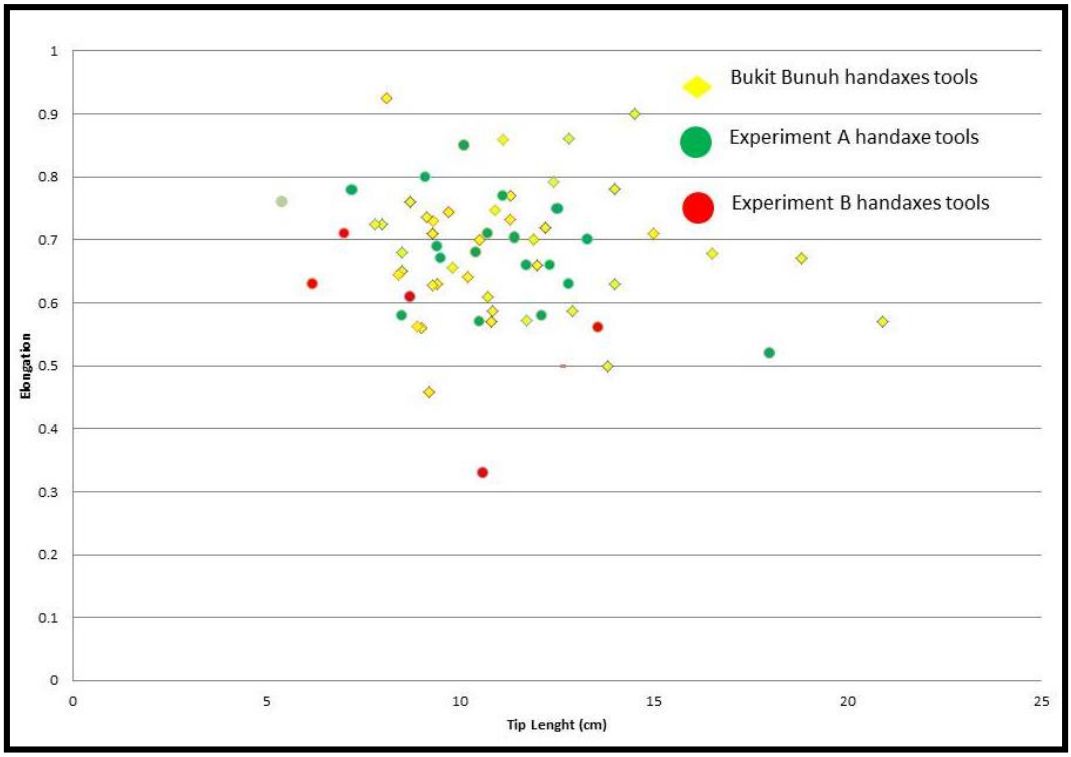

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Figure 2: Comparison of experimental and Bukit Bunuh Handaxes tools elongation result diagram.

6. Discussion

Analysis and experiments conducted showed that handaxe tools of Bukit Bunuh have its own manufacturing techniques and comparable to the handaxe in other areas. From the analysis, it is showed that Bukit Bunuh handaxe tools manufactured meet the essential features of this tool as the symbolism of the formation of the tip, the flaking levels and symmetry tools.

The conducted experiments also support the production techniques of Bukit Bunuh handaxe tools. The manufacturing of Bukit Bunuh handaxes tools were also influenced by material choice, and it can be concluded that material culture of an area give a big impact to the early man at Bukit Bunuh to choose the suitable technique for producing Handaxes tools. It is thus proved that the earlier man at Bukit Bunuh, have a high level of thinking to manipulate existing raw materials sources.

From the refinement aspects of the tools and the flaking stage to extend the edge of Bukit Bunuh handaxes tools were seem very low and it could be related with the raw material chosen to manufacture the handaxe tools. This is because, the selection of impactit material will produce sharp edge (Nor Khairunnisa, 2013). The first stage to flake and trim the tools produced the sharp edge without the extend of edge working stage. Second, the hardness scale of the impactit material scale is high (Nur Asikin, 2013) and it is used to manufacture the Bukit Bunuh handaxe tools. As a result, the core stone used were unable to be refined until the the highest level and has reached the limit where flaking can’t be done on both sides.

7. Conclusion

The results of this study proved that the Bukit Bunuh, Lenggong, Perak also produces the handaxe tools. This can be proved with the manufacturing technology of Bukit Bunuh handaxes tools which is comparable with other region. Even the Bukit Bunuh handaxes tools manufacturing technique were also adapted to the site material culture that uses the impactit material as the basic source material to produce daily tools. Therefore, they require a different technique to manipulate the basic material that they selected and used.

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