ARCHAEOLOGY IN NEW ZEALAND

BIPOLAR TECHNOLOGY IN NEW ZEALAND

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INTRODUCTION

Recent salvage excavations at site M35/622, at Waikuku, 20 km north of Christchurch, have produced a distinctive assemblage of late Archaic artefacts (Witter, in prep.). The site was on a sand dune on the south side of the Ashley River estuary and consisted of a midden with an adjacent house floor. The site was dated by cockle carbonate calibrated at 95.4% probability to AD 1317–1485 (WK 38741). Consistent with a late Archaic date, the floor contained an argillite workshop, highly fragmented non-industrial moa bone, fragments of a slate ulu and no nephrite. Obsidian, marine flint, silcrete and greywacke were the main stone materials in addition to argillite. The site also featured the manufacture of bird spear points and awls from wing bones, and the faunal remains were dominated by parakeet with tūī in which the body bones missing. It is inferred that the site was primarily a birding camp to preserve parakeets and tūī for storage.

During the lithic analysis it was noted that there were two bipolar cores of obsidian. Other pieces of obsidian as well as some flint also showed bipolar attributes. I am not aware of any previous mention of bipolar core reduction in New Zealand. For example, in the detailed analysis of the obsidian assemblage at Kohika there is no reference to bipolar cores or flakes (Holdaway 2004: 182–186). Nor have I seen it mentioned for other lithic analyses such as Leach 1979, Harsant 1985, Smith et al. 1996, or Jacomb 2000.

The purpose of this article is to report the presence of the bipolar technique in New Zealand archaeology. Examples from the site at Waikuku are described and mention is made of another example at the Rakaia River mouth site.

TECHNOLOGY

Bipolar reduction techniques occur worldwide (Andrefsky 1998: 147). The bipolar method differs from free-hand percussion flaking in the use of

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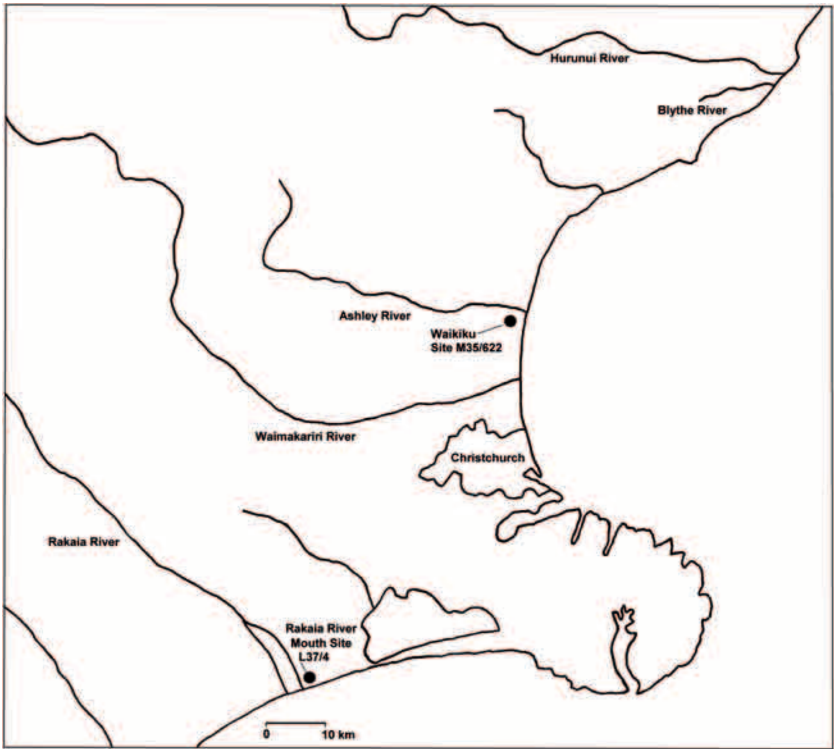

Figure 1. Location of the Waikuku site.

an anvil, as illustrated by the schematic diagram in Figure 2. The objective piece (core) is held between the thumb and forefinger and stood vertically on an anvil. The top is then struck by a hammerstone. It is usually advisable to initially tap the top and the sound and feel helps to indicate if the objective piece is square on the anvil. Otherwise, it may twist when struck and the hammerstone is likely to hit the thumb. Repeated blows may be needed, and there may be conchoidal flakes produced on the exterior (dorsal) surface. Such hammering also gives the top and bottom ends a battered look. When the force from the hammerstone passes through the centre of mass the result is usually a bipolar split. The shape of these flakes is difficult to predict, but the result of sharp-edged pieces is relatively dependable. It may then be possible to put one of the bipolar flakes on the anvil again and continue to obtain another bipolar

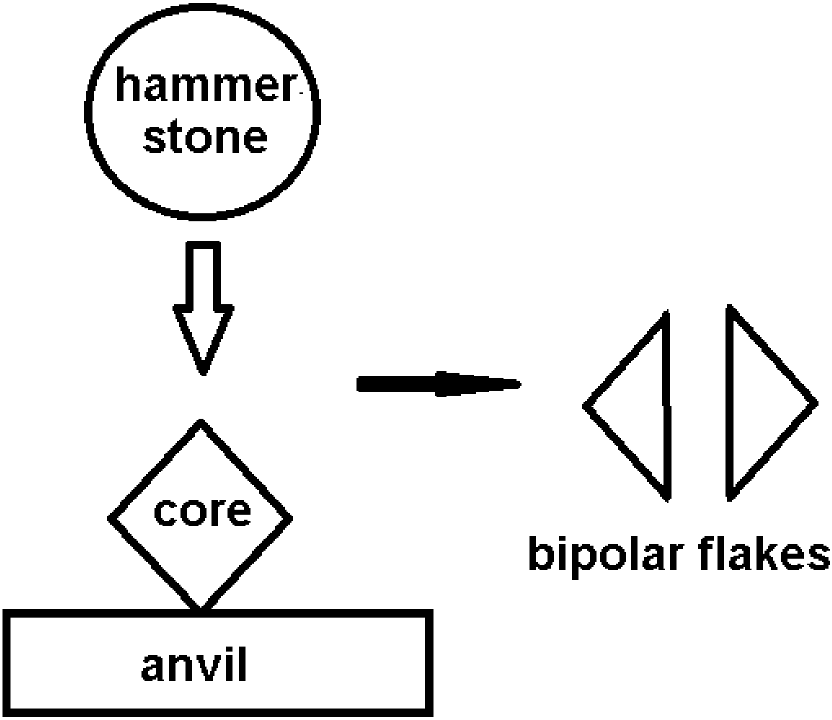

Figure 2. Schematic showing the method of bipolar core reduction.

split. Eventually, any attempt to proceed further is likely to cause injury to the thumb or finger.

The fracture process has been termed "wedging" (Cotterell and Kamminga 1987). With the familiar conchoidal type of flaking, the fracture process is in two steps. It is started (initiated) by a small conical crack (the Hertzian cone) formed by the force. The fracture is then propagated to detach the flake. With the bipolar fracture the Hertzian cone splits simultaneously at both ends and continues through the centre of the objective piece. The interior (ventral) surface of the flakes produced in this way does not show bulbs of force, although there may be crushing or shattering at the ends. On fine-textured materials internal compression rings may be visible (Andrefsky 1998: 121).

The change from free-hand percussion flaking to bipolar generally seems to be due to the effect of the inertia threshold (Hiscock 1982, 2009: 87).

This is when the force of a blow serves to move the hand, rather than being transmitted into the objective piece and thus fails to result in a fracture.

The anvil-rested technique can also be used when the inertia threshold has been reached. This is when the objective piece is placed partly on an anvil to hold it steady. The terminal end of the flake to be removed is not in contact with the anvil, and the fracturing process is similar to free-hand flaking, and not wedging.

Bipolar flaking can be recognised by a variety of attributes. This includes crushing at one or both ends, the lack of conchoidal features on the ventral surface, pronounced compression rings, and external flake scars originating from opposite ends. The discard form of a bipolar core that failed to split is distinctive, with crushing or battering at opposite ends. Bidirectional external flake scars are usually present and there may be compression rings.

The technique is commonly used to flake pebbles that have a coarse texture and rounded platforms. It is an effective way of obtaining cutting edges, although the waste rate is relatively high. I had considerable experience seeing the bipolar technique used in central New South Wales, Australia, where the main lithic material was quartz pebbles.

Another use is if the supply of a high quality raw material was limited, it is possible to continue reduction beyond what would have been an expended hand-held core (Andrefsky 1988: 149, 227). With the Kohika material analysed by Holdaway above, he showed how the method of core rotation was used to produce obsidian flakes as small cutting tools, and the rotated cores when expended (at their inertia threshold), were discarded. If obsidian was relatively inaccessible at that site, it would be expected that bipolar reduction also would be employed. It would seem predictable that for some New Zealand sites this would be the case.

WAIKUKU EXAMPLE

The Waikuku M35/622 assemblage had no rotated cores, but there was evidence of bipolar flaking of obsidian and flint. The obsidian consisted of 57 pieces of microdebitage (under 10 mm), and 59 larger pieces of which 19 showed bipolar attributes. There were two obsidian bipolar cores which are illustrated here.

The first, shown in Figure 3, is from the 1 x 1 m square E96 N93 on the house floor (Witter, in prep). It was 20 x 19 x 4 mm (orthogonal measurements) in size. It shows that originally a distal flake had been used as a core and split on the anvil. One of the flakes was then put back on the anvil to be split again. This was probably after one edge had acquired its microscopic usewear. However, after a few tentative blows it was discarded as a core.

The view in Figure 3 to the left (a) is the external (dorsal) surface, and flake scars can be seen originating at both ends. The previous objective piece was a relatively thick distal flake and the ventral surface and the hinge termination on the right side is evident. One lateral side was placed on an anvil and the opposite side was struck several times. The internal (ventral) surface of the split that took place can be seen in the sketch to the right (b). There is no bulb of force present. The small top and bottom flake scars show an attempt at further bipolar core reduction. The bipolar crushing at one end is best seen from an end-on view. The other end has collapsed and shows shattering instead of crushing. Such shattering is expected for a material as brittle as obsidian.

The other bipolar core is shown in Figure 4. This was from square E99 N96, and was 19 x 11 x 3 mm in size. The two views (a & b) show flake scars originating from both ends. One end has light crushing that is not apparent from the side-on view, and shows shattering at the other end.

The maximum length of the core in Figure 4 is 19 mm. Since the width at the tip of my thumb is 18 mm, any attempt for me to work an objective piece this small would have been at a high risk as is shown in Figure 5. I suggest that it was made by someone with more slender fingers. Using something like tongs is a possibility, but I feel that fingers would be preferred for a sufficiently secure grip and to seat it on the anvil properly.

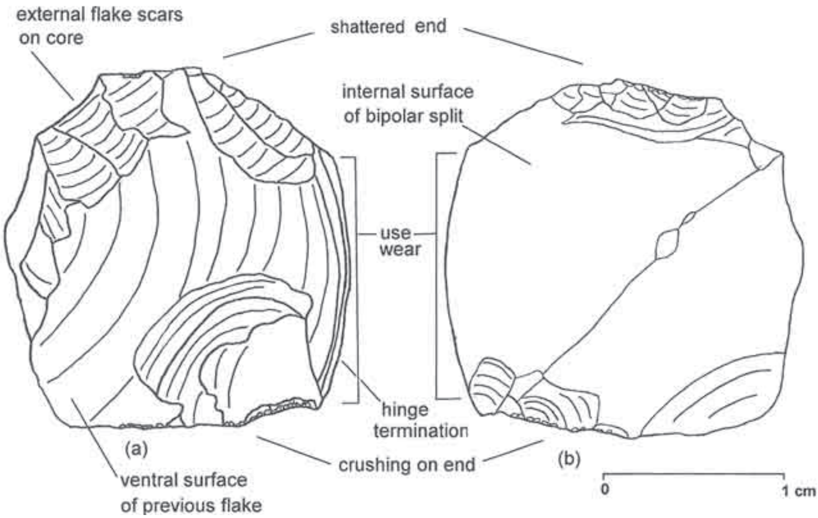

Figure 3. Bipolar core from site M35/622, square E96 N93.

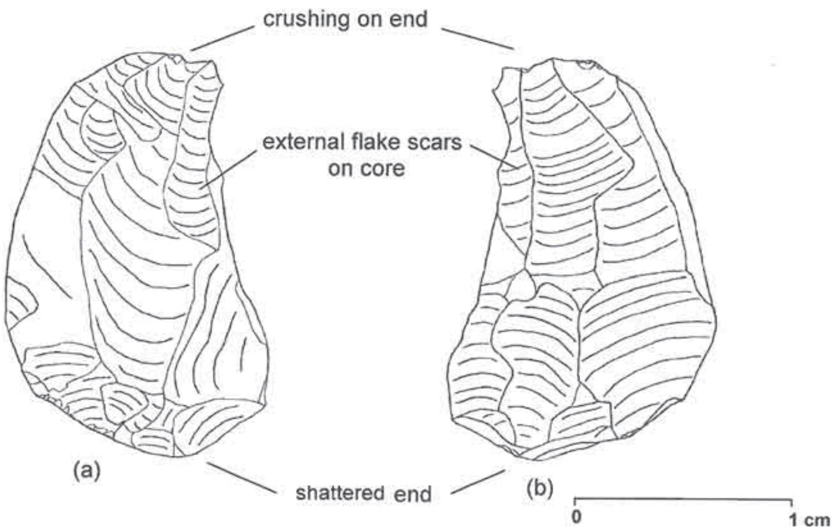

Figure 4. Bipolar core from site M35/622, square E99 N96.

Figure 5. The bipolar core shown in Figure 4 gripped for further reduction between my thumb and finger.

Flint is a glassy material almost as fine-textured as obsidian, and can produce similar flakes. The flint consisted of 60 pieces of microdebitage (under 10 mm), and 56 larger pieces, 15 of which were angular fragments broken up by fire. Of the flint , six showed bipolar attributes but no bipolar cores were found. There also was a drill point and a stone saw (or attrition saw).

An important distinction between the flint and obsidian was size. This is shown in Figure 6. The orthogonal measurements length x width x thickness were multiplied to obtain an indication of volume in cubic centimetres (apart from microdebitage). Most of the pieces of both materials were very small, but the flint shows a component of larger pieces. There probably would have been a higher proportion of larger flint pieces had some not been broken up by fire. Thus although there may have been overlap between the use of flint and obsidian, the flint had a wider range of uses, and was not so intensively reduced as obsidian.

It would appear that distance to source was a factor. The source of the obsidian, which was grey in transmitted light, has not yet been identified, but would have been in the North Island. The Amuri limestone is reported to contain flint (Thompson 1915), and according to the geological map (Rattenbury et al.2006) the nearest out crop of this formation is near the mouth of the Blithe River, about 65 km to the north. Other outcrops occur up the Kaikoura coast and inland.

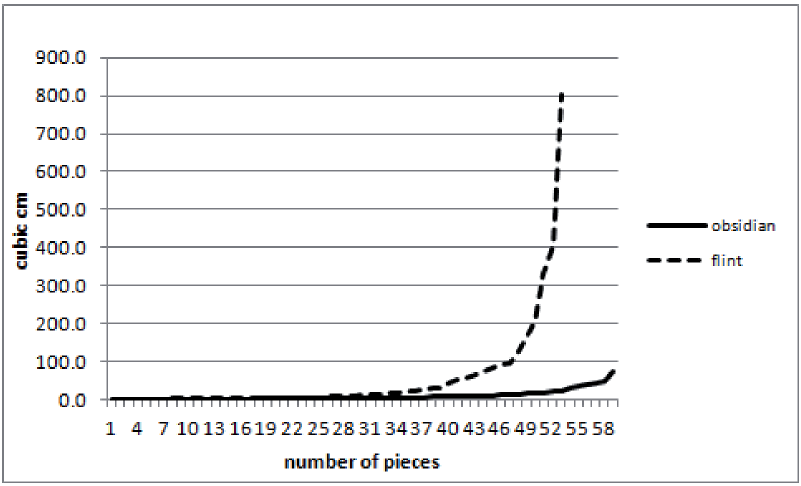

Figure 6. Graph showing the numbers and sizes (in cubic centimetres) of flint and obsidian pieces over 10 mm in size for site M35/622.

The implication is that the supply of obsidian, which previously seems to have been readily provided during the South Island Archaic (e.g. Shag River mouth, Smith et al. 1996) was more difficult to obtain at this later time, and more reliance on flint was necessary.

A low power stereoscopic microscope was used to look for usewear for the lithic assemblage, mainly to identify tools. The functional interpretation of usewear observations, however, is risky. It is best done with a detailed experimental reference collection or other references for different types of stone used on various materials and with particular kinds of actions. The only published New Zealand published I have found for microscopic usewear analysis on obsidian is Davidson (2011:57-59). She has suggested uses such as cutting, woodworking, drilling, and flax scutching for 28 artefacts.

The obsidian artefacts in the assemblage included 18 with microscopic usewear. Of these, 16 were described as microscalar, nine as rounded, and six as microstep. Considering the tendency of obsidian to readily acquire edge damage, I feel that these tools show relatively light wear, rather than much use on hard materials such as wood. There were six pieces of flint which had evidence of usewear (apart from the drill and stone saw); all had microscalar usewear, two with rounding, and one with microstep scars. My impression for all of these is mainly use for cutting on soft materials. For example, a sharp tool was needed to make the cut in the fleshy underside of a flax leaf as the first step before scutching with a shell. A sharp flake would be needed for cutting most fibres used for weaving and textiles, and probably served well for preparing bird skins.

Small sharp flakes of obsidian or flint were probably important for a variety of women's crafts, and would be a tool frequently made by them. The size of hand indicated by the two obsidian bipolar cores is consistent with this.

RAKAIA RIVER MOUTH

As mentioned above, the bipolar technique in other parts of the world was used to reduce coarse textured materials with rounded platforms that resisted free-hand percussion. On the south Canterbury coast are abundant flat greywacke beach cobbles which were frequently worked by producing a very large, flat, thin and usually oval flake. This was done by striking the edge of the cobble on an anvil without using a hammerstone (Witter 2006). I have referred to these as impact flakes, but they are also called tesua or spalls. This technique, however, is limited by the inertia threshold. If the cobble is too small, it does not have the necessary mass and will bounce off the anvil without detaching a flake. To overcome the inertial problem the bipolar technique is needed. I encountered two examples of relatively small (50 and 42 mm) greywacke beach pebbles at the Rakaia River mouth site while monitoring for a sewerage installation at 100 Pacific Drive, Rakaia Huts (Witter 2012 :23-24). These both showed evidence of impacts and crushing on opposite ends.

CONCLUSION

The bipolar technique was part of the repertoire of Māori stone technology. The occasions in which it was used can assist in the interpretations of various aspects of an archaeological site.

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