

**LOOKING THE OTHER WAY. A MATERIALIST/TECHNOLOGICAL
APPROACH TO CLASSIFYING TOOLS AND IMPLEMENTS, CORES AND
RETOUCHED FLAKES.**

by

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Abstract: *Coherent and consistent differentiation of the categories of tool, implement, core and retouched flake has proved difficult in lithic analysis. By applying a materialist model to re-conceptualise these categories it becomes possible to identify them with minimal ambiguity and to employ these identifications to discuss technological and use behaviours. This framework facilitates new explorations of archaeological patterning, while being of limited benefit to some conventional questions. The implications of this approach are explored using as an example the debates about the Australian 'horse-hoof' category.*

Classifications are apt to be rather the needs of the museum than the necessities of history; sometimes the classification is more curious than the curiosity it labels.
(Skertchly 1921:147)

The very question, so often asked by archaeologists, of whether a category of objects ought to be classified as cores or tools, reveals multiple, layered propositions embedded within the typological system of analysis. While archaeologists have enthusiastically used typological classifications for many decades, the limitations of that system have seldom been revealed. One reason for this is that while the methodological difficulties contained within a typological approach (to a question such as how to distinguish cores from tools) are often discussed, the underlying principles of that approach remain obscure. However the curious structure of that typological perspective becomes clearer when contrasted to the other way of looking at the issue: a materialist approach. Such a materialist classification will be neither normative or mentalist in orientation and by implication should also enhance the measurement of variation in archaeological material. In this paper a technologically-oriented materialist classification is presented, as an alternative to the conventional approach and as a means of illuminating the operation of the typological framework.

CHARACTERISING THE CONVENTIONAL TYPOLOGICAL APPROACH

Despite the much repeated rhetoric of typologists, to the effect that their work is merely the application of classification and therefore synonymous with classification, the theoretical premises of archaeological typology are surprisingly narrow. Archaeological typology is in fact a distinctive form of classification, and therefore represents a sub-set of classificatory theory and application. The functioning of typological classification is complex, and many of the claims by typologists obscure rather than clarify the actual practice; for instance even classic statements such as Spaulding's (1953:305) claim that "...classification into types is a process of discovery of combinations of attributes..." are demonstrably untrue in most instances. Nevertheless, archaeological typology is an analytical framework with a great capacity to reduce variability recognised in artifact assemblages to a point where chronological changes are

readily apparent. It does this through the application of a number of principles that are rarely discussed. There is not space here for a full exegesis, but in most instances where archaeological stone artifacts are the subject of study typological classifications share a number of traits, including but not limited to:

1. The perception that the classification is revealing natural, real divisions inherent in the material. One implication of this proposition is that only one classificatory system is valid.
2. Descriptions that are geared towards comparisons between classes, and effectively prevent or at least discourage evaluation of variation within a class. This is partly achieved through,
3. A focus on describing the central tendency (often the mode) of population distributions.
4. An interest in only a portion, usually a small portion, of an artifact assemblage. This focus is largely explicable in terms of,
5. The near universal reference to design criteria to explain the form and abundance of retouch. This principle reveals,
6. A view that examines the form of an artifact in terms the presumed purposes for which it was created.

These features of typological analysis are relevant to the basic procedures of identifying categories such as cores and tools in so much as they are all connected to ways in which typological classifications reflect mentalist and idealist propositions. This connection is most explicit and articulate in Spaulding's (1953:305) assertion that types represented those "...combinations of attributes favoured by the makers of the artifact, not an arbitrary procedure of the classifier", but have always been present in archaeological thinking. Given this view on the nature of 'types' (ie. that they replicate an ethno-taxonomy) the objective of typological classification is to subdivide the material according to the knapper's intention. Often this objective is implied to be achievable because of the discreteness of types, which are thought of as "...a group or class of items that was internally cohesive and separated from other groups by one or more *discontinuities*" (Whallon and Brown 1982:xvii). This is the setting in which we can comprehend many attempts to distinguish 'cores' from 'tools', and indeed the construction of those concepts.

This distinction has often been revealed in the practice of valuing the information contained in one part of an assemblage as far greater than that contained in the rest. In the vast majority of typological studies only a portion of the assemblage is studied in detail and forms the basis of inferences: those specimens designated as implements or tools. The terms ‘implement’ and ‘tool’ imply both design and use and are often used as synonyms. This differentiation of those things designed as tools from those that are not tools is the fundamental structure of archaeological typologies of stone artifacts (a point made by Steffen, Skinner, and Ainsworth 1998). The result is a classificatory framework centred on a system of conceptual oppositions: of end product versus production debris, used item versus unused, designed versus without design (Figure 1).

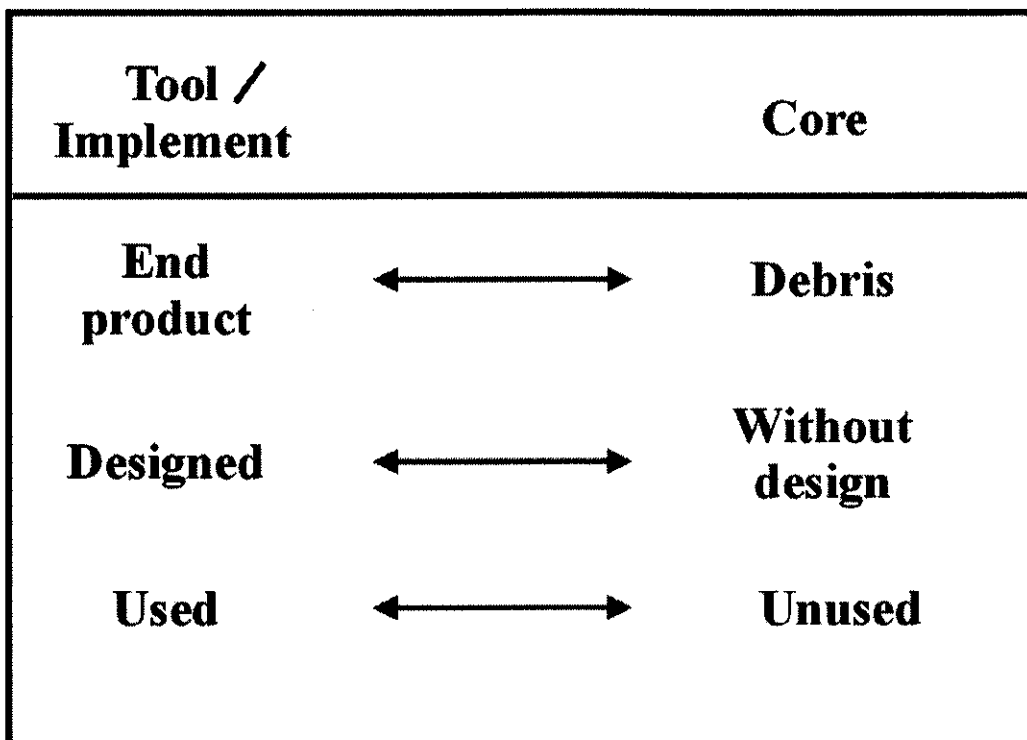


Figure 1. Oppositions in the traditional typological framework.

The result of these oppositions is the separation of two broad categories of objects that have been flaked and have produced flakes. The category taken to contain designed and used forms, labelled tools or implements, contains those items from which the flakes were removed to produce an edge for use. In contrast the category taken to contain undesigned and unused forms,

often labelled 'cores', contains those items that generate flakes that can be made into retouched flakes and/or used directly. Since both categories represent pieces of rock from which flakes have been struck, often covered in negative flake scars, the methodological problem for typologists has been how to separate them. This problem is made more troublesome by the multi-variate nature of the tool category; while one specimen might qualify as a tool because it had been used another might qualify because it is thought to have been designed to be used even if it never was used. Hence no single trait is a sufficient basis for the recognition of all tools in an implement typology. Furthermore, although the application of use wear and residue could play a dominant role in the identification process, historically it has not been central to the typological process. It is not the study of wear/residues that have been the key to typological practice but interpretations of artifact morphology.

The selection of items to be classed as tools/implements is typically based on the presence of a complex combination of morphological characteristics that are taken to be suggestive of design. These traits include the following four, any one of which *may* be sufficient for the typologists to hypothesise design:

1. repeated shapes,
2. regular (usually symmetrical) form,
3. morphological features in excess of that needed for the performance of activity, which of course begs the question of what use the item was designed for, and
4. extensive modification (retouching) of a specimen (using the proposition that the more the specimen is shaped the more obvious the design becomes).

It is the presence or absence of features such as these that has often been used to differentiate tools from cores. Additional aspects of typological practice can be seen when we look from the viewpoint of an alternate classification.

WHAT IS A MATERIALIST CLASSIFICATION AND WHY DO WE WANT IT?

A materialist classification is simply any system that divides an assemblage into categories based on the observable features of the objects without reference to notions of ideal forms, the mental predisposition of the maker, or the presumed goals of the artisan. Many different kinds of classification can fulfil these criteria, but materialist classifications will typically possess a number of characteristics, including:

1. Materialist classifications are often seen as imposed, arbitrary divisions, and hence multiple systems can be valid.
2. While typological descriptions are geared towards comparisons between classes, and effectively prevent or at least discourage evaluation of variation within a class, both inter- and intra-class variation is emphasised by materialist descriptions.
3. Consequently, materialist descriptions emphasise the variation, dispersion of individuals within a population.
4. By definition materialist classifications do not invoke mentalist propositions, such as inferences as to the dead artisans purpose, in either the description or explanation of the objects. For example, in materialist classifications repeated artifact forms are explained by reference to activities that impinge on knapping and artifact use. Hence while typological classifications typically cite factors involving design criteria to explain the form and abundance of retouch, materialist discussions might cite mechanisms such as the rejuvenation a dysfunctional edge, raw material properties, raw material availability, and the form of hafting.
5. Consequently materialist classifications lend themselves to a view that examines the form of an artifact in terms of the mechanisms by which it was created, rather than the presumed purposes for which it was created.

Employing a materialist classification will advance research objectives that require these characteristics. One of the best examples of this is the growth of cultural selectionist models in archaeology, in which mechanisms that create cultural variation are followed by mechanisms that winnow that variation through time. As Dunnell (1980), O'Brien and Holland (1990) and others have argued, the construction of Cultural Selectionist models involve

archaeologists in issues of how variation can be measured in appropriate ways, and particularly of how to measure artifactual assemblages without using normative and ideational classifications such as typology. Materialist classifications of 'core' and 'tool' may be a useful starting point in describing variation in a suitable format.

As an example of a materialist approach the following discussion examines one classification increasingly being used in Australia. This system was first published by Hiscock (1984) and has been employed in some form by a number of archaeologists working in Sahul.

A MATERIALIST CLASSIFICATION OF FLAKED STONE ARTIFACTS

This materialist classification begins by treating the classification of features related to production and use as separate phenomena. (A parallel argument is presented by Steffen, Skinner, and Ainsworth 1998). Two basic kinds of activities can be described with the following terms:

- ❑ *Artifacts* are those objects shaped by human actions. Stone artifacts are typically fashioned through flaking, grinding, pounding and so on. Artifacts are identified through the recognition of the features created by flaking, grinding, pounding etc.
- ❑ *Tools* are those objects employed by humans. Stone tools are therefore pieces of rock that are used. Tools are identified through the recognition of wear and residue distinctive of use.

Logically these two categories are unrelated. It is possible to make artifacts that are never used and to use rocks that have not been manufactured, while of course it is possible to make artifacts and then use them. Since these phenomena are distinct they can be discussed separately, and only issues of terminology in production are dealt with here.

The classification of production features is then based on observations of macroscopic scar form and superimposition. For the purposes of this discussion the following classification is applied only to those rocks larger than 1-2 mm on which conchoidal scars, initiated externally by the application of mechanical force, can be identified. The basic division is between cores and the flakes. Stripped of functional and ideational connotations these two categories can be defined as follows:

- ❑ *Flakes* have one or more positive conchoidal flake scars. These ‘positive’ surfaces may be identified using any combination of traits long recognised in the archaeological literature: ring crack, cone, bulb, concentric ripples, fracture termination, and so on. Flakes may have negative flake scars, but their presence or absence is not a character relevant to the classification of specimens as flakes.
- ❑ *Cores* have one or more negative flake scars but do not have a positive scar (ie. ventral surface).

Unless some factor extrinsic to knapping behaviour has created ambiguity, most specimens can be classified into one of these two categories. However, flakes can be sub-divided into two classes: unretouched and retouched, based on the presence or absence of additional working. These classes can be defined as follows:

- ❑ *Retouched flakes* are flakes from which further flakes have been struck. The criterion for determining this will be discussed further below, but involves the modification of the junction between distal and ventral faces.
- ❑ *Unretouched flakes* do not have further flakes removed from them, although they may have suffered other modification such as breakage.

Specimens can be classified into these categories through the use of a simply four step key shown in Figure 2. The effect of these definitions is to classify material according to morphological feature so as to trace the history of events that have created the object. This classification describes two kinds of objects that in their current state have produced flakes, but distinguishes those that have an unchanging state from those that have been transformed. A core is an item that is classifiable as a core is all visible phases of its reduction; whereas a retouched flake is an item that was a flake but was subsequently struck to produce flakes. If the objective of the classification is to record information about the production of the item then these definitions make sense, since they describe the *sequence* of states, and by implication the sequence of manufacturing actions.

1. Are there negative or positive scars?
Yes = Flaked artifact ... (Go to 2)
No = Not a flaked artifact
2. Are there missing or obscured portions that prevent identification of a ventral surface?
Yes = Ambiguous ... (Flaked Piece)
No = Unambiguous ... (go to 3)
3. Is there one or more positive scars?
Yes = Flake ... (go to 4)
No = Core
4. Where scars produced after the last ventral surface was created?
Yes = Retouched
No = Unretouched

Figure 2. Key for classifying flaked artefacts in the materialist system.

This concern for an understanding of the *sequence* of production actions recorded in the *sequence* of scars creates the imperative to distinguish flake scars created while the object was part of the core, from scars created after the flake was created. It is this distinction which underlays the division of core from retouched flake, as constructed here. Since the primary characteristic about retouched flakes is that they have been further flaked after the ventral surface was created, can be identified because in the vast majority of instances there are flake scars which:

1. Encroach onto the ventral surface (and were therefore created after that surface) and/or,
2. Derive from the ventral surface (and were therefore created by striking the existing ventral surface).

These criteria for recognising a retouched flake are quite simple, but their application can be tricky, and requires a) a high level of skill in identifying conchoidal fracture surfaces, and b) a capacity to visualise the positioning and order of these scars in three dimensions.

In this materialist classification the identification of specimens as cores, unretouched or retouched flakes, is carried out without reference to whether or not (or in what way) those specimens had been used. If use wear and/or residue studies reveal evidence that the object has been used then it may be considered a tool (in the sense that the object was used to perform a task).

In the sense in which it is commonly used by typologists, to imply design, the term 'implement' has no role. However that term can be, and often is, employed in materialist classifications to designate a repeated, regular form.

The use of the same terms (cores, implements, tools) in both typological and materialist classifications, despite their very different meanings, has been and remains a cause of some confusion. For that reason alone it would be useful to discuss the correspondence, or lack thereof, between the two systems. However such a discussion also has the advantage of drawing out features of the materialist classification.

IMPLICATIONS OF A MATERIALIST CLASSIFICATION

Some characteristics of this materialist classification can be better revealed by further discussing a number of its more obvious implications. Four issues will be briefly used to emphasise the contrast between the process of analysis in this materialist framework and the conventional typological approach: the construction of oppositions in each system, the unit of analysis for each system, the analytical focus of the different classifications, and the connection of categories to artifact use in each system.

The construction of oppositions

The concern within the typological system for differentiating cores and tools springs from the construction of classificatory categories in a way that makes the notions of 'tool' and 'implement' synonyms and places them in opposition to the category of 'core' (see Figure 3a). As explained above this opposition is founded on the multiple conceptual oppositions of end

product versus production debris, used item versus unused, designed versus without design. The category of ‘retouched flake’ in this framework in ambivalent position, since it can be either producer of flakes for use or a tool itself.

A. Typological system

Tool / Implement		
		
Core		Retouched flake

B. Materialist classification

Tool		Implement
Core		Retouched flake

Figure 3. Oppositions in conceptual frameworks applied to cores and tools.
a) traditional typology, and b) materialist classification described here.

The dramatic contrast of the materialist scheme is revealed when the relationships of those same four categories are described (see Figure 3b). No longer in opposition to ‘tool’ the class ‘core’ is now positioned in opposition to the category ‘retouched flake’, since these categories are describing mutually exclusive technological histories (ie. whether the item was

ever a flake). In this schema 'tool' and 'implement' are not synonyms nor truly in opposition, since they are not mutually exclusive, and neither term is positioned in contrast to the core - retouched flake opposition, since the traits of regular shape or evidence of use have no necessary relationship to the manufacturing patterns displayed in an assemblage.

In this way the implication of the materialist classification presented here is that 'core' and 'tool' are concepts that are unrelated rather than contrasting. They represent descriptions of independent aspects of behaviour involving stone artifacts, and clearly there is no necessary pattern of association between them: some cores may be tools while others will not be, just as some retouched flakes may be tools while others may not have been used. Such a statement seems compatible with traditional typological views, until the unit of measurement is considered (see below).

However the categories of 'core' and 'retouched flake' are opposed and mutually exclusive in this materialistic classification. In practice that means an artifact may be either a core or a retouched flake but cannot be both. As described above specimens are classified into one of these two categories solely on the basis of the presence or absence of a ventral surface, without regard to their size or shape. This contrast with common typological practices in which some technically retouched flakes are labelled as cores because it is thought the knapper intended them only to produce flakes rather than as tools. This issue will be raised again later in the paper.

The unit of analysis

One basic contrast between typological and materialist classifications is their approach to variation, and consequently the unit of analysis they employ. As explained earlier typological approaches, by definition, are normative. The reduction of variation to an ideal, or perhaps a central tendency, means that in one sense the unit of analysis employed is the 'type', as represented by the specimens to be allocated to that type in an assemblage. In practice this has often simplified analysis by encouraging the treatment of types as monothetic (even when a polythetic principle is espoused), and inherently discrete from other types. One of the most obvious illustrations of this is the way the function of implement types is commonly discussed. It is common for a particular type to be designated as suitable for, perhaps designed for, a particular use (either as the sole function or as the primary function). Individual specimens

belonging to that type are presumed to have that function, *merely because of their membership of that type*. This kind of interpretation, both monothetic and normative in nature, is seen in many of the major debate involving typology, and is equally clear in the debates about Middle Palaeolithic typological variation as it is in the Australian example presented below.

Materialist classifications are not normative in their treatment of variation. Such classifications are often as interested in measuring the variation within a population as the central tendency of that population. To achieve this the typical unit of analysis in a materialist classification is no larger than the individual specimen (although it may well be smaller). In practice this facilitates polythetically defined classes, but more importantly it means there is no *a priori* basis for assuming that artifacts of a similar form should be used in similar ways, or even used at all (although inferences of that form may be empirically derived). Hence within any class of morphologically similar specimens some may have been used (and hence are tools) while others may not have been (and hence are not tools). This removes the basis for the core-tool dichotomy and its construction as an opposition of unused-used. This issue of the relationship between morphology and use is raised again below.

Looking ‘backward’ as the way to proceed

The focus of a materialist classification is very different to that generated by the focus on intentionality in traditional typology. A way of expressing this different focus is to contrast the ‘temporal’ perspective of the analytical framework. As argued above the goal of typologists is to subdivide the material based on an interpretation of the knapper’s intention. By focusing on issues of design and intended use typologists are making statements about the final objective of the production, even extrapolating if that objective had not actually been reached. In that way we may characterise the focus of typology as ‘forward-looking’ because in examining an archaeological specimen the interest of the analyst concerns the intended (ie. future) plans for the specimen at the time of production. Furthermore, the characterisation of the material culture that results is static, a common presumption being that any single object or class of objects can represent only a single design.

In contrast we may say that the materialist framework is ‘backward-looking’ in that it eschews a major interest in intentionality and is concerned with the material recovered. Since the object itself is a result of the history of its formation, as revealed in the *sequence* of

knapping actions recorded in the *sequence* of scars, a materialist classification must be focussed on an interpretation of production process. Alternatively, or additionally, such a classification could focus on the use-history of specimens. Hence these materialist definitions are ‘backward-looking’ in the sense that they lend themselves to technological analyses aiming to trace the knapping history of each specimen. This viewpoint does not presume that objects have fixed morphological end-points, and facilitates a non-static depiction of the history of each object, in which the various transformations an artifact has undergone can be emphasised.

One of the benefits of the separation of cores and retouched flakes on technological grounds, as discussed earlier, is that these categories act as a simple statement of the history of the specimens so classified. It is this difference in the knapping history that makes cores and retouched flakes mutually exclusive categories; unlike the materialist definition of ‘core’ and ‘tool’ which are compatible notions.

Function versus technological classification

Obvious similarities exist between the materialist classification advanced here and definitions of ‘core’ used widely in the archaeological literature. This is not surprising because many analysts of stone artifacts, including typologists, are highly experienced in handling specimens and have observed the presence of negative scars as a basic characteristic of core-like things. However many superficially similar classificatory schemes are typological in nature, emphasising mentalist assertions about purpose (hence being ‘forward-looking’) and creating core-tool oppositions. Take for example this recent definitional statement, “A core is a mass of homogeneous lithic material that has had flakes removed from its surface. The primary purpose of a core is to supply flakes that can then be used for the production of various tools” (Andrefsky 1998:12). This statement echoes many previous statements about cores, and will be regarded by many readers as perfectly reasonable. Indeed it does accurately summarise the conventional views about cores. It also illustrates a number of the points made here. The first part of Andrefsky’s definition, that a core is a mass of “...lithic material that has had flakes removed from its surface” is a statement that equally applies to both unretouched and retouched flakes (using the materialist definitions given above); and hence that component of the definition works poorly. Of course this is not a practical problem, since it is the second part of the statement that holds the key to typological decision making: that the “...primary purpose of

a core is to supply flakes that can then be used for the production of various tools". Andrefsky (1998:80) also explained this as follows: "A core in this typology is best understood as a modified nucleus or mass of chippable stone rather than a tool with some particular function". It is statements such as these that makes explicit the underlaying contrasts between core and tool, as unused and used, as undesigned and designed, that prevail in the typological approach (see above, especially Figure 1). The distinction actually being made is about design decisions, ultimately framed in terms of the intentions of the dead artisan, and are often based on minor morphological distinctions in the size and shape of negative flake scars which enable typologists to recognise whether the object was 'retouched' (see discussion below). The magnitude of this division between tool and core is observable in a number of ways, including the incorporation of 'retouched cores' in implement lists, and the exclusion of those specimens from flake : core ratios.

This core-tool opposition is maintained in typological systems in spite of obvious difficulties. One problem here is the interpretation of some scars on a core as retouch. This is problematic simply because by definition a core merely consists of an object with negative scars, and the different patterning of scars may be explicable in terms of processes other than intentional design. A well known mechanism is the morphological changes that are associated with continued reduction and maintenance of an artifact (for examples see Holmes [1890], Cooper [1954]; Dibble [1984, 1987, 1995]; Hiscock and Veth [1991]; Hiscock [1994]). An example of this alternative mechanism is described for the horsehoof debate in Australia (see below). A second kind of problem for the advocate of the core-tool opposition is the complexity of an assertion that form and function are tied. Difficulties here include the capacity for virtually any form and edge to be used (eg. Crabtree 1973), and the capacity for some forms to be multi-functional.

These issues do not arise in the kind of materialist classification advocated here. As I have already explained the term 'core' refers to a particular morphology and past history of the specimen, and is not a reference to its potential future use. To link the production of this kind of object to an assertion about intended function would be a reversion to the mentalist/typological system. Separation of use and manufacture is therefore necessary in the materialist system. Hence there is no functional connotation of classifying a specimen as a 'core' or 'retouched flake' from this materialist/technological perspective. It can be applied to these artifacts

irrespective of whether the knapper used the resulting flake, the object from which it was struck (either core or retouched flake), neither, or both.

COMPARISON OF MATERIALIST AND TYPOLOGICAL CLASSIFICATIONS

The practical consequences of the two classificatory systems being discussed here can be illustrated by comparing the differing treatment of individual specimens (see Figure 4). In the materialist system the classification is referenced to the order in which scars were created, as indicated by scar superimposition. If the specimen has no positive scar it is a core; if the last surface is a positive scar the specimen is an unretouched flake; and if the last surface is a negative scar created superimposed over a positive scar the specimen is a retouched flake. No other characteristic is relevant in the classification. It matters not whether the specimen was used, whether it is large or small etc.

Materialist	Size	Typological
Core	large	Core (creator of flakes)
	small	'flake core'
Retouched flake	large	'core tool'
	small	Retouched flake (tool)

Figure 4. One example of the difference between classificatory schemes.

However in the typological system the order of scars is neither adequate, nor particularly relevant, to the classification of a specimen. The question posed of a typologist is whether the knapper intended to use the flakes removed from the object or the edge created by removing those flakes. Since, typologists do not have a metaphysical insight into the maker's intention, the distinction between those items intended for use (tools) and those not (non-tools and hence cores) must be referenced to some observable features on the archaeological specimens. In practice making this distinction often involves applying several criteria, which are emphasised or weighted differently by different researchers. An example of the sort of principle employed is illustrated in Figure 4 which uses the size of flakes struck from the object as the key attribute for distinguishing typological cores and tools. The logic implied is that the removal of large flakes indicates that the flakes removed were the objective and hence the item from which they are removed is a core (ie. non-tool). In contrast the removal of small flakes indicates that the flakes removed were not the objective but merely a reflection of the process by which a working edge was prepared, and hence the item from which they are removed is a tool. This example of typological decision making is apposite because it reveals one principle employed to identify horsehoof implements in Australia (see case study later in the paper). The same interpretations are also applied to items that are technically retouched flakes: thick specimens with large retouch scars may be classed as a generator of flakes to be used and hence treated as a core (in the typological sense).

Figure 4 reveals the difference in classifications that result from the two systems. What would be recognised in the materialist classification as cores with small scars are considered tools in the typological system, and perhaps labelled as 'core-tools' or something similar, although depending on their dimensions and morphology they may simply be added to a category such as 'steep scraper' that does not mention their core-like qualities. On the other hand, what would be recognised in the materialist classification as a large retouched flake may be labelled by typologists as a 'flake core' or perhaps simply as a 'core' because it is interpreted as a generator of flakes rather than a tool. In this way the core category in the materialist and typological classifications may contain very different specimens, although the nature of the differences may be consistent and predictable if the typological principles are known.

In practice typologists make the core-tool distinction by applying several criteria, which are often implicit and weighted differently by different researchers. In addition to the size-based

principle already discussed another commonly used criterion involves the nature of fracture termination on negative scars. For instance, when feather terminated flakes were removed this may be taken to indicate that the flakes removed were the objective, and hence the item from which they are removed is a core (non-tool). But when flakes with abrupt terminations were removed this is taken to indicate that the flakes removed are not the objective but merely a by-product of the process by which a working edge is prepared, and hence the item from which they are removed is a tool. This principle is also employed in the case of typological identification of horsehoofs in Australia (see below).

Diversity in the results of typological classification arises not only from the application of differing criteria but also from the differing ways in which they are combined. For instance, using the examples already provided a possible composite principle is that large numbers of small, step terminated scars indicate the item is a tool, whereas few large and feather terminated scars indicates the item was a producer of flakes and hence a core. Even within a typology using multiple criteria to distinguish cores and tools ambiguity often arises from the inter-observer differences in how intermediates are treated: how many small or step terminated scars are necessary? More importantly, typological classifications rarely specify the criteria used to differentiate tools and cores in this way, or specify the weighting of each criterion where several are employed, and a consequence will be unreported inter-observer variation in the application of these classifications. For these reasons the identification of those objects that will be classified as cores in a typological framework is subject to far greater inter-observer variability than the identification of cores in the materialist system outlined here.

Laid out in this way the conventional procedures employed in archaeological typologies to separate cores from tools are clearly problematic. From a technological perspective the principles used to infer intention are not reliable. For example these principles make assumptions about the knapper's objectives (for example that step terminated or small flakes would not be acceptable as tools). Yet we know ethnographically and experimentally that such assumptions are not warranted. And this typological viewpoint often assumes that there is no reason for minor edge modification other than preparing a 'working edge' for use, when in fact there are several other reasons. Depending on the criteria and weighting used in a typology, specimens in one category can have much the same morphology and reduction history as

specimens in the other category. This is sometimes acknowledged in nomenclature with terms such as 'core tool' or 'flake core' (see Figure 4).

AN AUSTRALIAN EXAMPLE

The practice of typological distinctions between cores and tools can be illustrated using an example from Australia, and critiqued from the perspective of a materialist classification. As is true of many other parts of the world typological and materialist classifications have been employed since the end of the nineteenth century (Hiscock 1998). Influential early typologies were presented by Alfred Kenyon (Kenyon and Stirling 1900) in Victoria and Etheridge (1891; Etheridge and Whitelegge 1907) in Sydney, and these gave rise to the systems of Mitchell (1949) and McCarthy (1941; McCarthy, Brammell and Noone 1946). During the last 50 years typologists have often advocated a variant of the system developed by McCarthy, and used those classes to describe culture phases. Materialist classifications advocated in the twentieth century share the premises, if not the details, of the one advanced here. For instance, frameworks previously employed by researchers such as Richard Wright (1972) and Peter White (1969) share points of similarity with the arguments presented here. An extended history of typological and materialist classifications therefore exists in Australian archaeology and one of the longest running debates in Australian typology has been whether the objects described as 'horsehoof' were cores or tools. This debate illustrates typological thinking and provides an example of the alternative materialist perspective.

The 'horsehoof core implement' has been a recognised implement type in Australia since the mid-twentieth century (see Tindale 1937 and McCarthy 1940 for early references). In their monograph on Australian implement types McCarthy, Bramell and Noone (1946:10-12) defined the 'horsehoof core implement' as follows:

The *horsehoof* nucleus is of domed or conical form. Its base is flat or slightly concave, and from round to oval in shape. The trimmed margins are usually rounded, although some portions are straight, and often bear concaves or noses. Another feature of the edge is that it is often worked back by stepped trimming from an outward to an inward angle to such an extent that the body of the implement overhangs the working edge. *Horsehoof* nuclei were probably discarded when they had reached this stage. ...*Horsehoof* nuclei

range up to more than 15 cm. in both thickness, and length or diameter, and the large examples are very heavy implements.

They cite Cooper's (1943) experiments in removing bark from a tree as an indication that this implement type was used as for heavy woodworking, particularly the removal of portions of wood and bark from standing trees. Functional designation for this class of implement was based on several kinds of arguments beyond Cooper's experiments. The stepped terminated scars were interpreted as the preparation of an edge for use. For example, Mulvaney (1969:144) described the material from Kangaroo Island as "...large, step-flaked horsehoof cores with a flat base of sub-oval which, to judge from edge fracture, were used as scrapers or choppers" (see Figure 5). More recently Akerman (1993) has argued that the "...extensive stacked or tiered step-flaking..." that helps define the type could only be produced without design by 'particularly inept knappers', and so is likely to have been a deliberate act to prepare a working edge. This functional interpretation of the horsehoof type was so well accepted that it was able to form the basis of inferences about tool-kits in the Pleistocene. For instance, in their depiction of the archaeological assemblages at Lake Mungo, Bowler, Jones, Allen and Thorne (1970) argued horsehoof cores were a dominant type, which they thought "...were probably used for pounding or heavy planing and scraping activities".

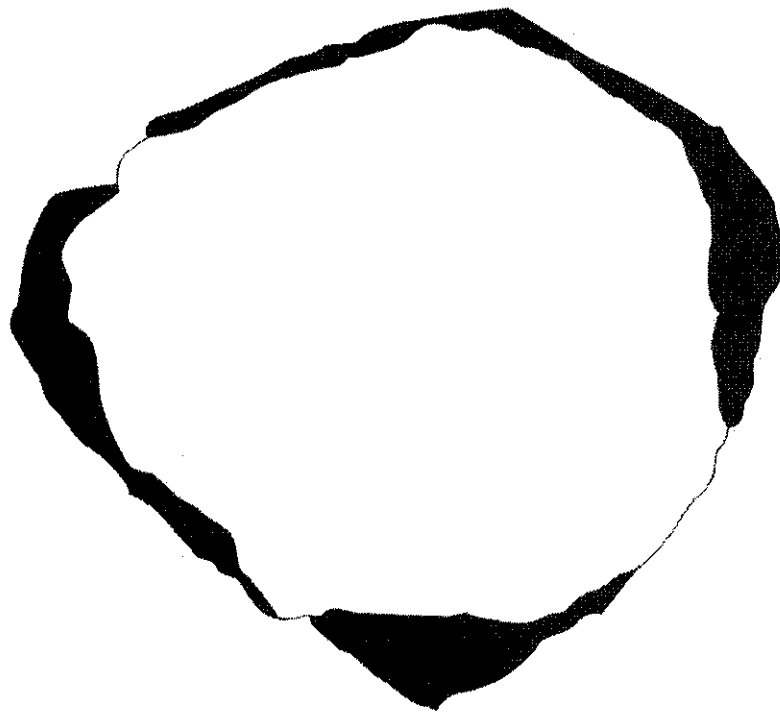
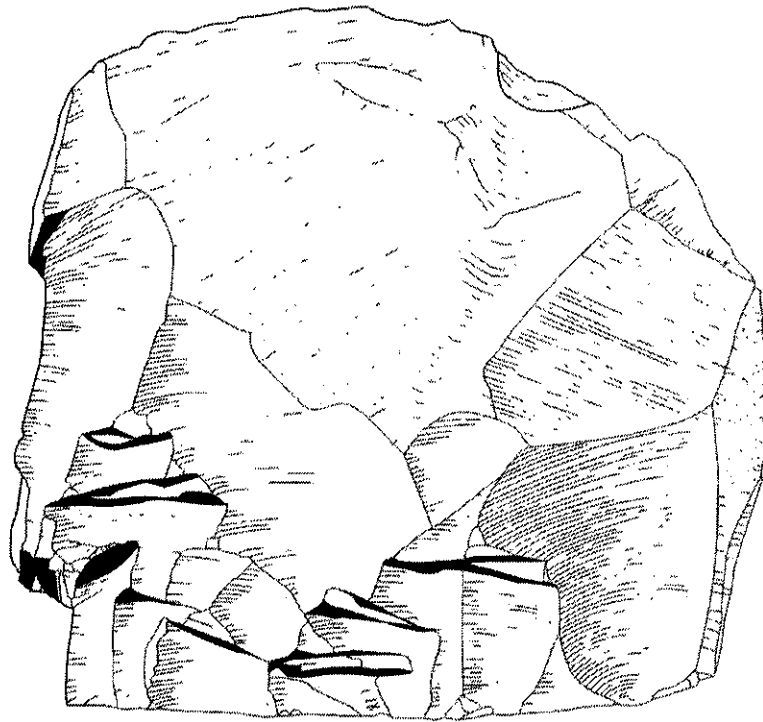


Figure 5. 'Horsehoof' core from Port Augusta, after Mulvaney (1969:145).

Kamminga (1978, 1982) provided the main alternative to this vision of the horsehoof category by arguing that specimens of this type were not used and were merely cores (in the typological sense of a non-tool). This conclusion was based partly on lack of use wear on the platform surface or edge, and partly on the poor quality of raw material employed in their manufacture. Additionally, some of the specimens identified by typologists as horsehoof tools are remarkably small to have been employed for ‘pounding or heavy planing and scraping activities’. For example, in describing the earlier assemblage at Kenniff Cave and The Tombs Mulvaney (1969:140) noted “...cores which had been utilised subsequently as scraping or chopping tools, including a horse-hoof type”. Figure 6 illustrates two of these specimens, both of which are only a few centimetres long, hardly the heavy choppers that would be held in two hands as Cooper hypothesised! Kamminga (1978) examined these specimens and failed to find any polish, striations or edge fracturing that could confidently be interpreted as a product of wear. He therefore asserted that the horsehoof type was an exhausted core.

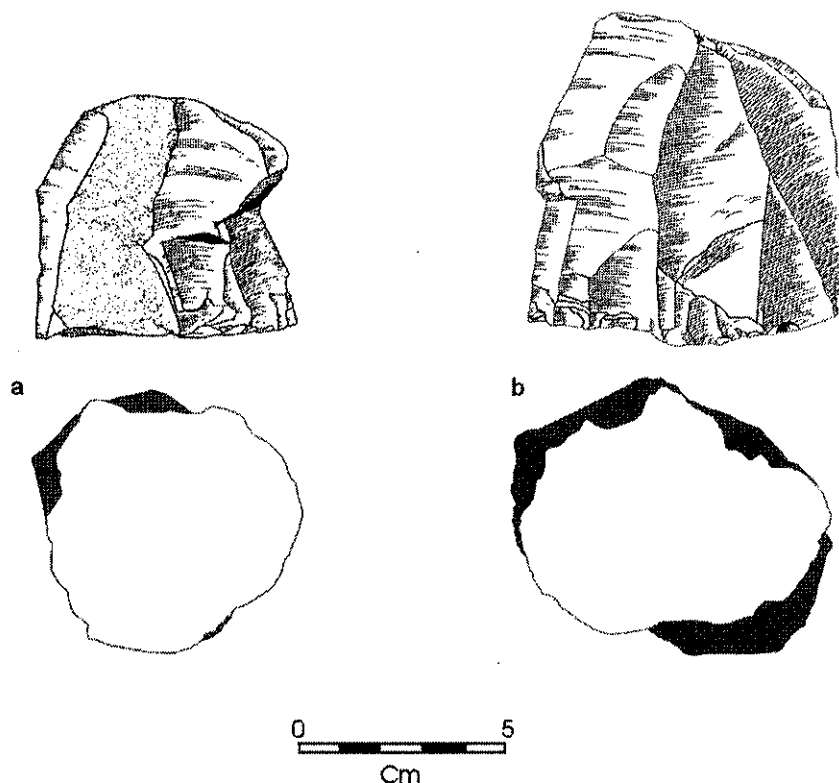


Figure 6. ‘Horsehoof’ cores from The Tombs (left) and Kenniff Cave (right), as presented by Mulvaney (1969:140).

These debates about the function of Australian horsehoofs provide an example of the operation of the typological framework. Dispute is between researchers advocating that they are tools and those arguing that they are non-tools and therefore cores. This illustrates clearly the construction of oppositions in the Australian typology. From the viewpoint of the materialist classification this conventional approach fails to allow for the combinations of activities that can exist. While an individual horsehoof specimen can be a 'core', or a 'tool', or both used and a producer of flakes, it is an error to argue that an entire typological class must necessarily be exclusively one or the other. This paradox is even acknowledged by some typologists (e.g. Akerman 1993:127) who nevertheless have maintained that the horsehoof as a class must be a tool.

Hence both sides of this typological debate involve a normative treatment of the type, in which all specimens assigned to that type are expected to be functionally identical. The presumption contained within the model that horsehoof implements are tools is that all specimens within that class are a) designed to be used, and b) were used in the same way. The opposing model, that horsehoofs are typologically cores (ie. non-tools) is that all specimens within that class were not used. Based on those propositions the debate has proceeded as each researcher modelled the function of the type on the inferences about the few specimens they examined. For example, Akerman (1993:126) argued that horsehoofs, collectively, are tools because, "My own observations of cryptocrystalline silica horsehoofs in the Great Sandy Desert show that both wear polish and striations may occur on the basal or striking platform surface". An example of researchers arguing that horsehoofs, collectively, are typological cores is Mulvaney and Kamminga (1999:45-46), who state,

In Australia, the horsehoof was always regarded as a tool, and was illustrated with its striking platform facing down rather than its normal orientation. Prehistorians suggested that it could be a pounder for smashing bones and shellfish, but later settled on hand-held wood chopping and adzing tools. From his experiments, Kamminga concluded that...most horsehoof cores probably were discarded cobble and block cores, and not tools. Many archaeologists now commonly illustrate horsehoof cores oriented with the flat striking platform facing upwards, signalling its interpretation as a core rather than tool.

This all or nothing view of the type owes directly to a normative approach, and illustrates that in effect the unit of analysis has been the implement type. For instance, use wear studies have not regularly undertaken on specimens recovered from an archaeological site; instead specimens are commonly interpreted as either a core or tool (in typological terms) on the basis of which generalisation the researcher prefers, rather than the observable characteristics on each particular specimen.

The conventional approach to typological classification, as displayed in the horsehoof debates, also hides technological variety. For instance, a substantial proportion of specimens classified as 'horsehoof cores' or 'horsehoof core implements' by Australian typologists are technically large retouched flakes. This is revealed on the surface of the single platform, which sometimes contains the positive features of a ventral surface. Other specimens assigned to this type are technically cores in the materialist scheme. This difference is not signalled in the type nomenclature because these retouched flakes are very thick (ventral to dorsal) and are considered to fulfil the same purpose as a horsehoof that is not constructed from a flake. Hence the typological classification hides the different histories of thick objects that have step terminated scars deriving from a single broad platform.

One consequence of the normative view is that specimens classified as horsehoof implements are seen as distinct from other implement types. And yet in the Australian system of typology the characteristics that separate a horsehoof from a) a flaked object that would be classed as a 'core' or b) a flaked object that would be labelled as a different kind of tool, is comparatively subtle. For instance, the specimens illustrated in Figure 7 were classified as 'Core-scrapers' by Mulvaney (1969:149). These implements are manufactured by retouching flakes but were considered core-like tools. Two or three scars terminating with feathers rather than with steps might lead Australian analysts to classify them as exhausted cores rather than as implements. Or if those specimens were either not as thick or with platform angles less steep, then they might be classified as a different form of core-like 'tool'. The capacity for the boundaries between these categories to be difficult to identify was noted in Mulvaney's (1969:150) in discussion of the Ingaladdi early industry when he wrote that "...almost all retouched artifacts are large scrapers, including rounded, domed, steeply trimmed, and concave types, while numerous cores were utilised as core-scrapers, reminiscent of small horsehoof

cores” (see Figure 7). The subtleness of these differences should make us aware of the ambiguity of the core-tool distinctions, as revealed in the potential for inter-observer variation.

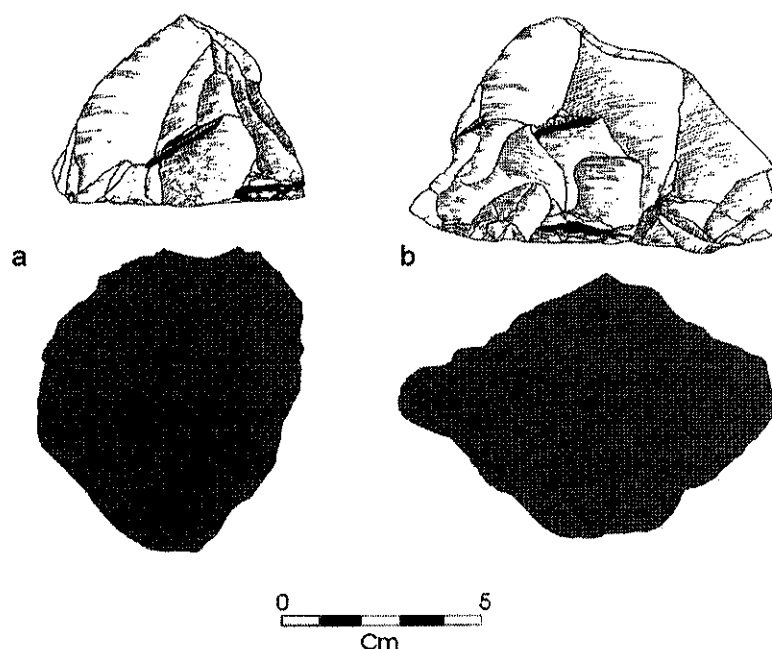


Figure 7. ‘Core-scrapers’ from Ingaladdi as depicted by Mulvaney (1969:149).

The ambiguity arising from these delicate distinctions would, in itself, not be devastating for the typological core-tool opposition if indeed the morphology could be demonstrated to reveal intent. However from a materialist standpoint these subtle differences are not necessarily indicators of design but may be dependent on chance or contingent on the economic context. An example of such a view point is the recent reinterpretation of the Pleistocene assemblages from the Willandra Lakes (Lake Mungo), one of the two Australian regions in which horsehoof cores constitute a high proportion of implements recognised by typologists. In their re-evaluation Hiscock and Allen (2000) hypothesised a number of economic/technological mechanisms that could account for assemblage differences in the Willandra Lakes region. Their analyses reveal that the landscape contains two economic zones: a raw material supply zone containing silcrete outcrops (called the ‘backshore zone’) and a sandy, landscape without any siliceous rock (called the ‘lunette zone’) which can be understood as a receiver of stone and stone artifacts. Artifact production was carried out in the backshore zone and artifacts carried to the lunette zone where they were maintained. The strategy of

provisioning the lunette landscape with stone artifacts involved preferentially transporting specimens that were thick and with a comparatively high potential for further use/reduction. In the lunette zone these items were flaked extensively, in response to the absence of replacement stone, and they became heavily reduced. At sites in the lunette zone the extensive reduction of thick specimens of coarse-grained silcrete often produced specimens with step terminated scars, creating objects with mass overhanging the platform which were designated as 'horsehoof implements' in typological studies. This process created assemblage differences across the landscape, with the highest proportional concentration of horsehoofs being found in assemblages in the lunette zone. The intriguing aspect of this process is that it is a product of a particular combination of technological strategies and would have occurred whether those items were being used merely to produce flakes, as 'tools', or both. Hence the morphology of these objects cannot be used to differentiate between 'tools' and 'cores' in the typological sense of the makers intentions for the category, but a materialist classification seeking to understand the technological history of knapping activities in its economic context has great potential.

CONCLUSION

The discussion of the materialist classification presented here has several implications. From a materialist perspective the categories 'cores' and 'tools' are not in opposition, and the construction of such oppositions in typological systems of classification are based on inferences about the makers intentions that are often untested. This perspective has also discussed some of the ways in which typological classifications are normative, functioning to suppress recognition of variation within categories. In contrast a materialist system of descriptions will lend itself to description of variation, and is therefore more suited to theoretical frameworks focused on variation such as Cultural Selectionism. Furthermore, it is suggested that typological systems will often contains greater ambiguity and may be more variable in application than the definition of 'core' and 'flake' provided by the materialist perspective discussed here. Within this materialist classification cores are defined as those specimens of flaked rock that have never been flakes, while tools are rocks that have been used. Identification of cores is based on the presence of negative scars and the absence of positive scars; while tools are recognised when convincing anthropogenic wear or residue is found on the rock. One consequence of these definitions is that the inferences involved in a materialist classification are 'backward' looking, that is they involve statements about the history of each object, and does not offer any particular insight into the predictive approach normally implied by implement typology. Hence the materialist classification is poorly suited to the task of asserting the purpose of the prehistoric actions. Conversely the typological category of 'core' is comparatively ill suited to measuring the technology by which the object was created. The materialist framework is one which is effective in tracing changes to the history of each specimen, documenting the transformations of artifact morphology, and is therefore appropriate for the analysis of prehistoric technology.

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