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THE LITHIC INDUSTRY IN THE MAKAPANSGAT LIMEWORKS BRECCIAS AND OVERLYING SURFACE SOIL

By Brian Maguire

ABSTRACT

The excavations directed by Professor Dart at the Makapansgat Limeworks, and conducted mainly by myself at the site since 1960, were concerned during the 1963-1965 field seasons with an examination of the surface soil overlying the consolidated pink breccias, and of the contents of the abundant solution cavities which penetrate the underlying breccia mass to depths of up to 15 feet or more.

The shallow soil, overlying and mainly derived from the consolidated australopithecine breccias, contains an abundance of crude artefacts which are largely composed of chert, a material native to the dolomitic cavern site. The most characteristic tools are various kinds of notched scrapers which are more particularly described. The undoubted relationship of these artefacts to those occurring in the underlying breccias is also discussed.

INTRODUCTION

The Site

Covered rather uniformly by a thin dark layer of very rubbly surface soil which only ranges up to 12 or 18 inches in depth, the calcified infill of the vast ancient Limeworks cavern extends as an uninterrupted and highly consolidated huge mass over an area of more than three acres on the north-west facing Limeworks hillside (Brain 1958). Surface erosion has removed the roof of the ancient cavern and worn down the consolidated infill to general conformity with the moderately sloping dolomite hillside, the remaining infill extending to a depth of 50 or 60 feet below the present surface. This consolidated infill accumulated upon a limestone floor sometimes of great thickness and frequently of great purity. The extensive limeworkers quarries and underground excavations (fig. 1) which almost completely encircle the whole deposit, and have exposed so much of the breccial infill, were designed to exploit the underlying limestone (travertine) forming the ancient cavern floor, and which ranged up to 40 or 50 feet in thickness. Until the removal of most of the vegetation in 1961 and 1962, the Limeworks site was covered by a fairly close growth of trees and shrubs resembling that covering the neighbouring slopes (Dart 1965b; Maguire 1965).

By far the largest volume of the calcified deposit is composed of pink breccia. Occasionally shallowly outcropping through the thin layer of surface soil, this breccia covers the entire area of the deposit, and extends downwards to depths of 30–50 feet or more.

The older and more extensive of the two rather ill-differentiated pink breccias is the pale pink and very highly calcified *upper phase* 1 *breccia* of Brain

(1958) which contains abundant blocks and smaller fragments of dolomite and chert, and scattered, mainly primate, fossil remains. Sometimes resting directly upon the ancient cavern floor, it may represent at such points the full depth of the breccial deposit. This breccia occupies the entire area between the main and east quarries and the back wall of the ancient cavern (fig. 1), but at the site of the cone mouth, and thinning considerably at the same time, it dipped fairly steeply beneath a 35 ft. depth of the later-formed, darker and generally less heavily calcified *phase* 2 *breccia* (Brain 1958).

The area defined by the cone mouth was extensively undermined by miners in search of the underlying cavern travertine some 30 years ago, resulting in the collapse of most of the relatively small deposit of phase 2 breccia, together with a 15-ft. thick underlying layer of upper phase 1 breccia, on to the floor of the underground workings some 70 feet below the present surface. The cone mouth is the 80-ft. wide circular opening to the surface formed at the site of the

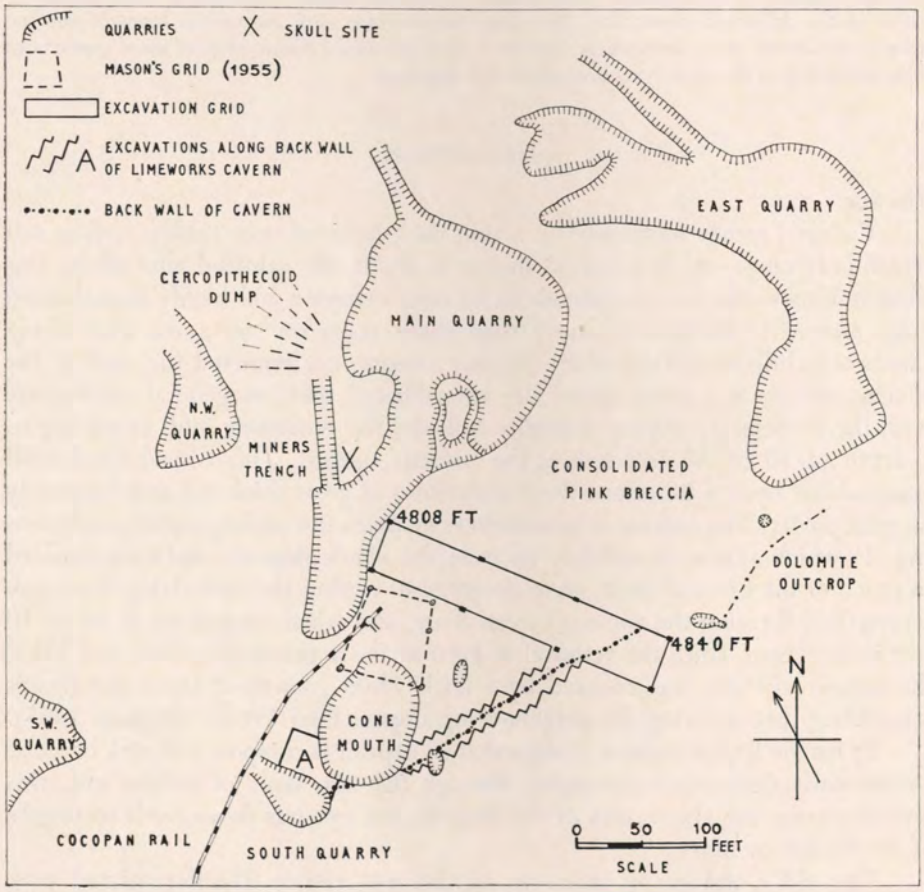

Fig. 1

collapse, the cone being the 15,000-ton conical hillock of collapsed pink breccia now resting on the floor of the limeworkers underground excavations.

The large numbers of dolomite and chert artefacts extracted in 1960 from the collapsed phase 2 breccia of the cone (Maguire 1965) are mainly referable to the two broad pebble ('gravel') bands represented in this breccia, and will be later discussed.

The most basal and oldest of the Limeworks breccias completely underlie the pink breccias. These two strongly calcified layers, comprising the *lower phase 1 breccias* of Brain, are the sparsely bone-bearing calcified red muds ranging up to 20 feet or more that accumulated on the lowest-lying parts of the ancient cavern floor, and the 1–3 ft. thick, exceedingly richly bone-bearing layer of grey breccia that formed in places upon these muds.

The faunal content of the grey breccia, while widely varied, is mainly (92% bovid, and the many thousands of utilised bones, teeth and horn cores extracte from it have been described at various times by Professor Dart (Dart 1957) The most extensive exposure of grey breccia is that preserved some 30 fee below the present surface, beneath the overhanging dolomitic west wall of th main quarry, and generally opposite the more northerly end of the grid (fig. 1). This dolomitic overhang, incidentally, formed part of the western wall and roof of the ancient cavern. The point at the edge of the main quarry marked with a cross is where J. W. Kitching found a loose block of pink breccia containing the larger part of an australopithecine skull in 1955 (Dart 1959). This block of upper phase 1 breccia must have been blasted by miners from the adjacent main quarry, the weathering on one of its faces indicating that it had formed part of the present breccial surface.

The unconsolidated surface materials and the recent excavations

The thin dark layer of surface soil overlying the breccias averages only about 12 inches in depth, and is extremely rubbly. The rocky fraction, which in volume about equals or even considerably exceeds the earthy fraction, is composed almost exclusively of weathered chert fragments ranging up to about 8 or 10 inches in length. Due to surface weathering, smaller dolomite fragments of any kind are rare.

The preliminary work during the 1963–1965 excavations involved the stripping and examination of the surface soil from the entire excavation grid (fig. 1) and from an area approximately one half as great extending along the back wall of the ancient cavern (a total area of 1500 square yards or 1250 square metres). The subsequent excavation, at 6-inch intervals, of the unconsolidated filling of 120 of the solution cavities on the grid clearly revealed the underlying very highly consolidated upper phase 1 pink breccia throughout the length of the grid.

The irregular-shaped mouths of the abundant vertically-descending solution cavities closely reticulate the strongly eroded but exceedingly compact, breccial

surface. Generally only 2–4 feet across, and tapering downwards, these solution cavities penetrate the breccia to depths of 15 feet or more.

The unconsolidated filling of the solution cavities comprises a red earth with a variable fraction of small rock fragments and is regarded primarily as a decalcified breccial residue. Apart from its reddish colour, and the slightly poorer state of preservation of its lithic components (almost exclusively chert) the uppermost foot or more of this filling closely resembles the very rubbly surface soil. The stony fraction diminishes fairly rapidly with increasing depth, at the same time becoming progressively more poorly preserved. Upwards, the red filling is fairly abruptly succeeded by the overlying dark surface soil.

Apart from the recovery of cultural or fossil material in the surface soil, the main purpose of the excavation work along the back wall of the ancient cavern was to define the exact extent of the cavern infill in the area lying between the excavation grid and the cone mouth.

More than 16,000 suspected chert artefacts were extracted from the surface soil of the grid and from the excavations along the back wall of the cavern, together with some 16,000 fragments of vein quartz; and, representing materials geologically foreign to the dolomitic cavern site, 1,977 pebbles and fragments of quartzite. Lesser, but quite comparable numbers of suspected fragments composed of the same materials, were retrieved from the red earthy contents of the 120 solution cavities of the grid.

After a stringently objective analysis of the 16,139 suspected chert fragments extracted from the surface soil, nearly 7,000 were considered to be definite artefacts, and of these a special group of 2,328 was selected as being the best preserved and most demonstrative of artificial fabrication and utilisation. A total of 1,881 of these selected specimens was recovered from the excavation grid (see Table 1), their description forming the main object of this paper.

These chert tools are relatively crude, and ranging in length from ½–7 inches are very variable in size. Both technologically and morphologically, however, they exhibit considerable uniformity, and are characterised by the following features:

1. The major preparatory fracturing has involved splitting (often along natural fracture surfaces) and crude, occasionally more precise, flaking quite opposed to natural surfaces of fracture.
2. The abundant minor damage attributable to trimming rather than utilisation is almost entirely unifacial. This often strictly uni-directional damage is usually displayed with striking clarity.
3. Many of these artefacts (perhaps one half, or more) are clearly multiple-purpose tools.
4. Notched scrapers alone comprise almost half of the entire assemblage, and outnumber the three next most important groups combined. In order of importance these smaller groups are planes, convex scrapers and straight-edged scrapers (figs. 2–4).

Earlier excavations and the artefact content of the breccias

The completely basal red breccia is virtually devoid of rocky inclusions, and no suggestive lithic fragments have yet been recovered from it.

In the extremely ancient and bone-rich grey breccia, however, stalactites and very occasionally fragments of other lithic materials displaying signs of deliberate use (Dart, 1965a; Partridge 1965) occur intermixed with the enormous numbers of utilised and unutilised bones (Dart 1957). The native lithic fragments comprise stalactites, shale, chert and dolomite; materials geologically foreign to the cavern site are represented by several small fragments of grey quartzite, one of these being wedged in the interarticular cleft of an antelope metatarsal that was removed from a block of this grey breccia.

The upper phase 1 breccia (the first and major stage in the accumulation of the huge mass of pink breccia) is extremely compact, and due to the problem of extracting a sufficient number of artefacts undamaged from the rocky matrix, a picture of tool-making in upper phase 1 times is incomplete.

Sufficient material is however available to show that the deliberate splitting as well as crude flaking and trimming of the native chert and dolomite was certainly practised. Quartzite riverbed pebbles were introduced into the cavern mainly for percussional activities, but seemingly only at a late stage in the accumulation of the upper phase 1 breccia, and only in small numbers.

Brain's profile 10 was sited on the vertical to overhanging northern wall of the cone mouth, where a 15-ft. layer of upper phase 1 breccia rests directly upon the travertine of the ancient cavern floor. Above this layer, and traversed by two broad pebble bands, 35 feet of the darker phase 2 breccia extends to the present surface (Brain 1958). The pebbles forming these two bands average about 1–5 inches in diameter, but range up to 10–14 inches in diameter, most of them being composed of dolomite. The proportion of chert pebbles is small, while pebbles and fragments of quartzite are comparatively rare.

In 1954 Brain extracted 129 suspected artefacts from the base of the phase 2 breccia in profile 10. Professor C. van Riet Lowe considered 17 of these specimens to be Kafuan-type artefacts, 15 of them being deeply leached dolomite, one of vein quartz and one of dark grey quartzite (Brain *et al*, 1955). In 1960 A. R. Hughes and I extracted 22,000 pebbles, almost all of them composed of dolomite or chert, from 1,600 tons of the collapsed phase 2 breccia forming a part of the cone adjacent to profile 10. I estimated that between 15% and 30% of these pebbles exhibited signs of artificial damage although only 346 specimens were then selected for further examination (Maguire 1965).

It is readily evident that these crude, sometimes massive, cleaver and hand-axe-like tools, and the usually lighter planes and great variety of convex, straight and concave scrapers, have their counterparts in the surface collections. Despite their crudity and the indifferent state of preservation of many of the more dolomitic of these tools, I was then struck by, and noted (unpublished MS. 1960),

exactly the same features that distinguish the presently described surface collections, viz.

1. The splitting and crude flaking of the native raw materials had very frequently been practised. Most, or at least many of the slabs or fragments providing these raw materials had suffered some degree of weathering *prior to their use for tool-making.*

2. The abundant fine damage attributable to trimming and/or utilisation is characteristically unifacial.

3. Many of the smaller tools are multiple or compound, and had evidently subserved more than one function.

4. Concave scrapers and planes constitute important elements in the assemblage.

The chert artefacts are usually well-preserved, but most of the dolomitic specimens, which constitute by far the greater percentage of the assemblage, are heavily weathered, their surfaces sometimes being white and chalky. However, in all but the most excessively weathered of these artefacts from the phase 2 breccia, *there should generally be no difficulty whatsoever in recognising the nature of the grosser fracturing damage they have suffered, or of appreciating the characteristically unifacial and repetitive nature of the damage done to working edges, even where much of the finer detail has been lost* (Maguire 1965, figs. 1 and 2).

A very much smaller number of quartzite pebbles and fragments has been recovered from the phase 2 breccia, almost half of them (60) being either very crude flakes, or demonstrating crude flaking damage. Many of them are waterworn pebbles that have been scarred and quite frequently fractured by deliberate pounding, the fragments generally appearing to have resulted from the deliberate or accidental fragmentation of the waterworn pebble pounders. The fresh-looking, 4½ inch long, coarsely and unifacially trimmed triangular quartzite artefact illustrated by Partridge (1965) from the phase 2 breccia, and described by him as an 'irregular artefact', has lately been partially reconstituted by the addition of a missing fragment. This irregular artefact is now recognisable as the one half of a very broadly ovato-triangular deliberately struck flake with a prominent bulb. The small added fragment was intentionally pointed at one end, and trimmed at the other end into a scraping edge, subsequent to its seemingly accidental detachment.

The artefact content and derivation of the surface soil

In 1965 I described the recovery during 1961 and 1962 of more than 1,300 deliberately and repetitively percussed quartzite river-bed pebbles and pebble fragments from the thin layer of vegetation soil covering the consolidated breccias (Maguire 1965). I referred also to similar quartzite artefacts embedded within, and protruding from, the weathering surface of the strongly calcified pink breccias (mainly phase 2) about the cone mouth (fig. 1), as well as to the very definite concentration in this vicinity of both the surface specimens and those *in situ* in the breccias.

These surface-soil quartzite artefacts were found to be *locally confined to the cavern site* and to be *between twenty and forty times more abundant at, and about the cone mouth, than over the entire more northerly half of the deposit.* This marked concentration, in the vicinity of the cone mouth, has been confirmed by the recent excavations.

Almost half of these very crude quartzite artefacts were simply referred to as regular and irregular pounders, while the remainder, on the basis of shape and presumed function, were described as scrapers and planes. Those possessing one or more marginal notches and frequently a utilisable point as well, were by far the most abundant and characteristic of the scraping tools, and were termed "notch and point scrapers".

The abundance of repetitive percussional damage evidenced throughout the assemblage led me to conclude that the artificial fragmentation of many of these pebbles was entirely incidental or accidental. It seems probable, however, that a small percentage of such fragments represent deliberately struck, albeit very crude, flakes *and are therefore not altogether fortuitous fragments.* The close examination and reconstruction of the long-separated parts of some 40 quartzite pebbles and artefacts (or their fragments) that have been excavated to date from the surface soil overlying the breccias, and the varied and invaluable evidence furnished by them, is briefly referred to in the discussion. *These parts, for example, prove conclusively that the pounding and fragmentation of waterworn quartzite pebbles was carried out on the site.*

Of the 1,977 quartzite pebbles and fragments recovered during the recent stripping of the surface soil from the grid and back wall of the ancient cavern, only 8% appear to be deliberately struck flakes or flaked artefacts, or their fragments. These often very crude and indeterminate, but generally Acheulean-type artefacts, include two handaxes and two cleavers (?). The last mentioned four tools are bifacial and show considerable though mainly poor preparation.

The 94 fragments of other foreign materials (mainly irregular utilised mudstone fragments, and very much weathered diabase spheroids) include four felsite fragments of Middle Stone Age facies.

Vein quartz is a material native to the site, although very much less abundant than the chert. In view of the particular difficulty of immediately recognising the unnatural damage suffered by fragments of this material, all available fragments (some 16,000) were extracted from the excavated soil for later examination. While probably one third of this number have been utilised and variously fractured, the raw material is extremely rough and intractable, and either by intention or lack of skill on the part of the users, very few of them appear to have been specially shaped.

The most definitely shaped artefact in vein quartz so far recovered is, however, an unusually good example of the notch-and-point scraper. (An equally noteworthy specimen was later excavated from a solution cavity.)

These utilised rough vein quartz fragments were frequently used percussionally, probably as fabricating tools. While a quite undoubted polyhedral-

spheroidal pounder, some 3 inches in diameter and with adherent phase 2 breccia matrix, has lately been recovered from a dump of mining waste, rounded vein quartz pounders of this size are rare in the surface soil. The many fragments that have not been used primarily for percussional activities have been crudely pointed, notched, or used as straight-edged or convex scrapers.

It should be remembered that there has been a virtually total recovery of every fragment of quartzite and other foreign materials upwards of $\frac{3}{8}$ inch in length (or diameter) from the 1,500 square yards of excavated surface soils. The inherent difficulty of extracting the frequently crude chert artefacts from this rubbly soil is obvious, since more than one half (by volume) of this soil solely comprises variously weathered chert fragments ranging up to about eight or ten inches in length.

Some idea, therefore, of the almost negligible role played by quartzite as compared with the overwhelming dominance of chert as a toolmaking material in the deposit can be gained from the following figures:

The careful working of the single grid square A13 (78 x 78 inches), resulted in the recovery of 879 chert artefacts (212 *of which were worthy of special selection for the present analysis*) and 673 probable artefacts. Only 18 quartzite pebbles and fragments (mostly pounders or their percussed fragments, but all of them unflaked and conventionally indeterminate) were recovered.

The number of chert artefacts recovered from this grid square, even excluding probable tools, therefore outnumbers the total number of quartzite fragments of every description by nearly fifty times. Furthermore, the total of 1,552 definite and probable chert artefacts retrieved from this single grid square outnumbers the total number of quartzite fragments of every description (1,414) recovered from the surface soil of the entire excavation grid, *an area* 216 *times as great!*

The occurrence throughout the surface soil overlying the breccia of large numbers of chert tools unmistakably resembling the artefacts of chert and dolomite extracted from the phase 2 breccia, strongly suggests that the surface soil (and certainly its heavier fractions), primarily represents a decalcified breccial residue. This conclusion is quite independently confirmed by the distribution both in the pink breccia and in the overlying surface soil of the repetitively percussed artefacts that have been derived from waterworn quartzite pebbles. This conclusive evidence may be briefly summarised:

1. The more than 1,300 repetitively percussed quartzite artefacts that were recovered from the surface of the deposit were locally confined to the cavern site. Incontrovertible evidence demonstrates that a number (at least!) of these percussed artefacts were artificially fragmented on the site.

2. These artefacts have been derived from waterworn quartzite pebbles which are geologically completely foreign to the dolomitic cavern site and must have been carried into the ancient cavern by human or protohuman means.

3. The artefacts occurring *in situ* in the pink breccia, as well as those recovered from the surface soil, have suffered the same kind of artificial damage by repetitive percussion.

4. Both the breccial and the surface artefacts were very strongly concentrated at, and near, the cone and cone mouth (Fig. 1).

That these artefacts displaying the same unusual kind of unnatural damage, and made from the same kind of foreign stone, are locally confined to the cavern site, and furthermore, that both the breccial and the surface specimens are concentrated in the same area on the cavern site, are facts of crucial importance. It can only be concluded that the repetitively percussed quartzite artefacts in the surface soil were inclusions of an integral part of the ancient cavern infill that overlay the present deposit of pink breccia, i.e. they have been derived from the upper part of an originally thicker deposit of breccia that has been completely decalcified by weathering.

The upper phase 1 breccia is represented uninterrupted over more than 90% of the breccial surface of the deposit, being overlain by the phase 2 breccia only at, and about the cone and cone mouth.

Therefore, the original deposit probably comprised a greater depth of both these breccias. However, the phase 2 breccia, besides being thicker, was probably also much more extensive and was not confined as at present to the cone and cone mouth vicinity, but overlay the original deposit of upper phase 1 breccia over a considerably larger area.

It is not impossible that the extra depth of original cavern infill included breccia(s) of a different type. However, it is evident from the numbers of quartzite artefacts recovered from the surface soil that, whatever the nature of the overlying infill, percussed quartzite artefacts must have been inclusions of at least part of it.

A comparison of the cone and grid areas, based in each case on the ratio of the number of quartzite pebbles and artefacts recovered from the surface soil to the number of such objects visible on the surface of the underlying breccia, indicates that a disproportionately large number of pebbles and artefacts was recovered from the surface soil of the grid. This suggests that the more richly (quartzite) artefact-bearing phase 2 breccia originally extended over the upper phase 1 at the site of the grid. Therefore, part of an originally much more extensive deposit of phase 2 breccia, that was subsequently completely decalcified by weathering, seems to have been the main source of the unexpectedly large numbers of percussed quartzite artefacts found in the surface soil overlaying the upper phase 1 breccia on the grid site.

The extremely slow rate of downhill movement (if any) of quartzite pebbles and artefacts on the cavern site subsequent to their release by weathering from the breccia mass and incorporation in the surface soil is demonstrated not only by the above evidence, but also by the disposition of such elements in the surface soil along the back wall of the ancient cavern. Numbers of quartzite artefacts, both with and without adherent breccia matrix and evidently very long separated from the parent breccia mass, were recovered within a foot or two of the well-defined and up-slope back wall of the cavern.

For these many reasons, the surface soil overlying the consolidated breccias, and at least its heavier (non-earthy) fraction, has been regarded primarily as a decalcified breccial residue.

The Recovery of the Chert Artefacts from the Surface Soil Overlying the Pink Breccias, and the Method of Analysis

Altogether 16,139 suspected chert artefacts and fragments were extracted rom the surface soil excavated from the grid and an area approximately half as reat along the back wall of the ancient Limeworks cavern, during the 1963–1965 eld seasons of excavation at Makapansgat.

All of the excavated surface material was put through a $\frac{3}{8}$-inch sieve and, to facilitate the extraction of artefacts, the sieved materials were first sluiced through water. The procedure was rendered somewhat laborious by virtue of the fact that an attempt was made to recover not only all of the foreign stones present, but also all suspected artefacts composed of the local materials viz. chert, dolomite and vein quartz.

The first stage of the critical examination of the excavated chert material was conducted during September and October 1966 at Makapansgat.

The procedure adopted was more objective than that normally employed in examining an artefact assemblage. While the deliberate flaking of some of the chert artefacts has proved acceptable to many competent observers, and a small number of outstandingly clear examples were extracted for final analysis, I employed neither this feature, nor that of tool-shape, as the main criteria in my examination. The overwhelming majority of suspected objects was selected almost solely on the basis of the minor damage present i.e. the perceptible (and usually abundant) fine chipping and wear that could be attributed to trimming or utilisation or both. The nature and distribution of this damage on every fragment was meticulously examined with a view to assessing its probable artificiality or not.

The following combination of features relating to the fine chipping and perceptible wear exhibited by the individual objects was regarded as particularly suggestive of artificial damage:

1. An abundance of such chipping or fine damage.
2. The contemporaneity of all such damage as assessed by the patination characteristics of the individual specimen.
3. The definite concentration (and especially complete confluence) of chipping and other scarring.
4. The noticeable restriction of such repetitive damage to well defined working features, such as entire edges, notches, or points.
5. The blows or pressures responsible for the fine chipping have been of equal intensity, or otherwise suggestively regulated, and also definitely controlled or patterned in their spacing and direction.

By such methods, the 16,139 chert specimens proved separable into three groups:

Definite artefacts (6,787).

Probable artefacts (5,991).

Doubtful, much weathered and other reject material (3,361).

Finally 2,328 of the best-preserved and most illustrative specimens from the group termed "Definite artefacts" were extracted for the purpose of the final analysis which was carried out at the Bernard Price Institute for Palaeontological Research in Johannesburg.

I felt that attempting the systematic arrangement into categories of tools of a large group of this size, *all of whose members displayed definitely unnatural kinds of contemporary and differential damage* (over and above whatever deliberate flaking had occurred) would clearly demonstrate whatever recognisable types of tools, if any, were present in the assemblage. Most of the selected specimens, many of them individually recognisable as artefacts, fell fairly readily into one of the limited number of groups listed in Table 1; a smaller number, having clearly subserved two or more separate uses and being of compound or multiple nature, were obviously classifiable only with some difficulty.

Table 1 refers to those 1,881 of the 2,328 finally selected specimens that were recovered from the vegetation soil of the excavation grid.

TABLE I

		Numbers of Tools		Percentages	
I	*SCRAPERS*				
	1 NOTCHED	842		44·8	
	2 POINTED	75		4·0	
	3 CONVEX	224		11·9	
	4 STRAIGHT EDGED	173		9·2	
	5 BLUNT-NOSED	29	1343	1·5	71·4
II	*PLANES*				
	1 STRAIGHT EDGED	39		2·1	
	2 CONVEX	64		3·4	
	3 POINTED	77		4·1	
	4 NOTCHED	100		5·3	
	5 COMPOUND	73		3·9	
	6 MISCELLANEOUS	49	402	2·6	21·4
III	*POUNDERS*		13		0·7
IV	*ANVILS*		1		0·1
V	*CORES*		39		2·1
VI	*UNUTILISED AND LITTLE-USED FLAKES AND FRACTURED FRAGMENTS*		83		4·4
			1881		100·1

TOOL SIZES IN INCHES	$\frac{1}{2}$–1	1–2	2–4	4–8
NUMBERS	81	875	808	117

It was apparent, on investigating the fracturing properties of the local chert, that *most of the major, usually multiple fractures suffered by these chert tools were opposed to the natural surfaces of fracture.* Prior, however, to describing the fracturing characteristics of the local chert, brief reference will be made to but two of the many features independently corroborating the artefactual nature of these tools.

1. The best-defined and most evident of the elementary cores present, and all of the many tools that are very densely and evenly manganese-stained, have clearly suffered no perceptible further damage whatsoever in the deposit subsequent to their manufacture (or staining). Beyond perhaps the almost imperceptible faint blunting or smoothing due to natural weathering in the deposit, there is not the faintest trace of palpable suggestive damage to the edges of the cores, or of damage of any kind to the edges of the evenly black-stained tools.

2. Some 90% of these chert tools have been trimmed in a very consistently unifacial (unidirectional) manner. This damage is almost invariably displayed with unusual clarity and sharpness of definition, due mainly to its unnaturally strict confinement to a working edge, and its abrupt and total absence on an adjacent face. Many of the notched scrapers (which comprise almost half the total assemblage), evidence this feature so remarkably that it seems attributable not only to a very specific type of preparation, but also to a very specific kind of use.

I could only conclude after my analysis of the whole assemblage that *the incidence of readily perceptible natural damage resembling in any way that attributed to deliberate trimming and utilisation is so low as to be completely negligible.*

The Fracturing Characteristics of the Native Raw Materials

The native rock in the immediate vicinity of the Limeworks cavern, and within which the ancient cavern was formed, is Transvaal System Dolomite. This minutely granular or crypto-crystalline blue-grey dolomite (impure dolomitic limestone) yields a conchoidal to uneven or flat fracture. It is unfortunately extremely susceptible to weathering processes, hence while artefacts of dolomite and cherty dolomite have sometimes been well preserved in the phase 2 breccia, and almost invariably so in the upper phase 1 breccia, no well preserved or sufficiently conclusive specimens have so far been retrieved from the relatively small number of dolomite fragments occurring in the overlying vegetation soil.

Chert bands ranging up to four or six inches, or perhaps even a foot in thickness, are abundantly interbedded in the local dolomite. This chert is usually crypto-crystalline and whitish to greyish or very pale blue and, being essentially siliceous, resists weathering to a far greater degree than the dolomite. It weathers free from the dolomite generally in the form of slabs, those surfaces that were in contact with the dolomite being characteristically rough and dark coloured. Such rough natural cortex has frequently been retained on some part(s) of the tools derived from these *weathered slabs*. Both sides of the planes pictured in figs. 2 and 4 are of natural cortex, and in fig. 3, the viewed face of the single-notched scraper seen in the top row (extreme left).



Fig. 2

The natural break-up of weathering chert slabs occurs along well-defined fracture surfaces which are generally flat or flattish. These surfaces, although typically smooth-textured and flat, will be referred to as *fracture surfaces* rather than fracture planes. The fracture surfaces comprise not only the very abundant parallel bedding planes (fig. 3, the second specimen from the left, in the top row), but also numerous planes inclined at various angles to the bedding planes and running in a variety of directions.

A weathering slab of chert that was excavated together with the artefacts from the rubbly surface soil of the grid, is illustrated in fig. 2 (the middle specimen in the top row). Natural disintegration has resulted in the loss of nearly all of the rough natural cortex and produced the sharply angular and straight-edged appearance of this slab. The fine dark lines seen on the pictured face (and also similar lines lying parallel with the upper and lower surfaces that are present along the sides of the slab) indicate incipient and potential natural surfaces of fracture.

The stout notched plane, pictured rather obliquely and from above (fig. 2, top on left), was excluded from the listed tools, since it did not clearly demonstrate repetitive artificial damage, although both the notch and the two shoulders on either side of it have been artificially abraded.

The specimen is of comparatively coarse-grained chert, rough natural cortex being seen on the obliquely exposed side (right). The smooth flat upper face represents a natural fracture surface; this may have been a pre-existing feature, but it appears to have been derived by deliberately fracturing (splitting) along a natural fracture plane. The roughish-textured and irregularly conchoidal flake scar forming the notch contrasts strongly with the other two viewed surfaces. This flake scar resulted from the deliberate detachment of a small stout flake by a sharp and forceful localised blow delivered on the lower surface of the tool, and is opposed to any natural fracture surfaces.

A fairly stout cortical flake of fine-grained chert is also illustrated in fig. 2 (top row on the right). Considerable force was required to detach this flake whose rather conchoidal fracturing is clearly contrary to the natural surfaces of fracture.

The very predominantly unifacial and uniform nature of the damage suffered by the artificially prepared concave and convex margins of chert tools throughout the assemblage, is also shown in fig. 2 (the three specimens in the bottom row.)

The small stout plane of fine-grained chert, on the left, is viewed obliquely from below, to show the comparatively flat planing base; the steeply-prepared, regularly convex and finely damaged planing edge is seen towards the top. While the two sides (one of which is seen on the right) are of dark natural cortex, all the other surfaces of this tool, including the flattish base, have been produced by bold fracturing contrary to natural fracture surfaces.

Two notched scrapers are seen on the right (fig. 2). Note the abundance of consistently very fine chipping along the concave working edge of the larger, dorsally flaked specimen. (This tool has also been utilised at both extremities.) The notch of the smaller slab-like specimen (on the right), displays very similar damage and wear, evidenced by the multiple almost imperceptibly fine "stepping" extending from within the notch and on to the upper surface.

General Description and Statistical Analysis of the Tools

The types of tools, their numbers and their relative proportions are reflected in Table 1.

For the present purpose this table has been considerably simplified, the number of tools occurring in the different size groups not being given here. Also, the relatively small numbers of larger tools (4 inches or more in length) have been classified in the same manner as the smaller. Some of the large convex and straight-edged scrapers might more properly be classified as cleaving or chopping tools.

1. *Scrapers*

These tools, provided with scraping or cutting edges, comprise the bulk of the artefact assemblage (70.8%), and have been separated from the planes usually by their lesser stoutness and relatively greater breadth. Five categories have been described, *viz.* notched, simple-pointed, convex-edged, straight-edged and

blunt-nosed; the first, third and fourth of these groups, respectively, being the most important.

(i) Notched

These scrapers are distinguished by the presence of one or more marginal notches or concavities, and are extremely varied both in shape and size, as well as in the position, shape and size of the prepared marginal indentation(s).

The preparatory fracturing by splitting, crude flaking and chipping is frequently opposed to the natural surfaces of fracture, in which respect they differ from the plane-like tools where naturally flat surfaces have often been incorporated into the tool.

While the one or more notches are very variable in their position and size, and range from very narrow (and more strictly notch-like) to widely concave, they display, almost without exception, *definite signs of preparation and (or) considerable wear by use*. It is the almost total confinement to the notches of this fine damage by utilisation, or preparation, or both, that so clearly characterises these scrapers as deliberately made tools.

I am discussing these notched scrapers in some detail, not only because of their great dominance in numbers, but also to illustrate generally the nature of

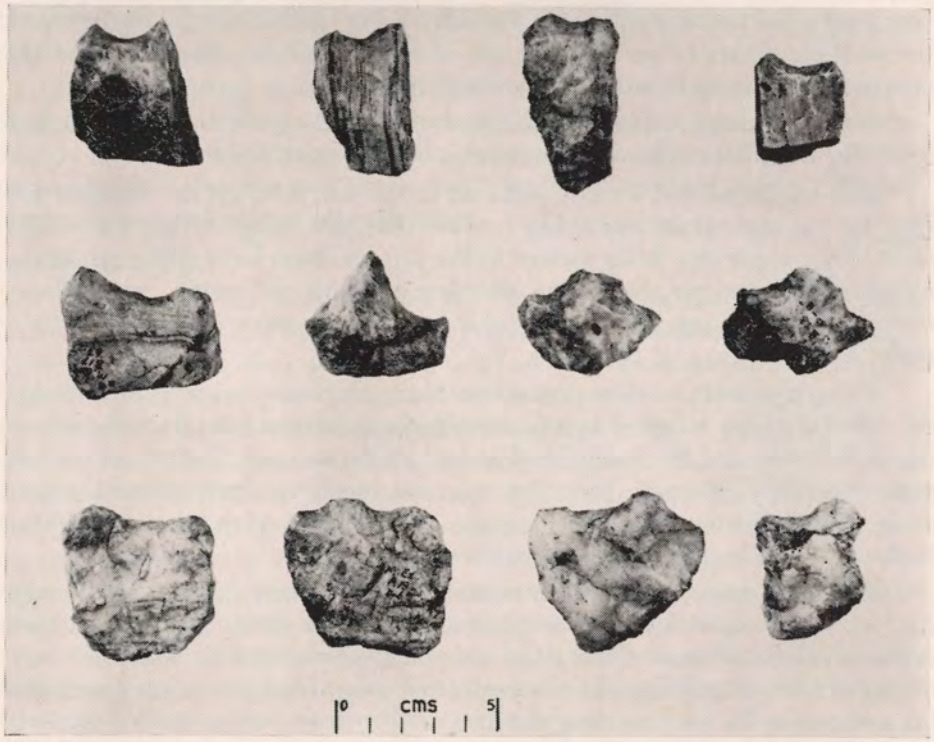

Fig. 3

the artificial damage suffered by chert tools throughout the assemblage. The accompanying plates have therefore been almost entirely devoted to illustrating scrapers of this type. The two specimens pictured in figure 2 (in the bottom row on the right), the twelve specimens pictured in figure 3, and the three top specimens in figure 4, demonstrate the wide range in form of these notched scrapers.

The 842 specimens comprise 332 single-notched scrapers, 414 double-notched scrapers and 96 specimens of rather point-like form, and constitute 44.8% or nearly one half of the total assemblage. Outnumbering the planes, the next most important group, by more than twice, they are by far the most abundant of the chert tools.

Six single-notched and six double-notched scrapers are illustrated in the third figure. The four single-notched specimens are those occupying the top row, and the extreme left specimens in the middle and bottom rows respectively; the remainder are double-notched. Each has been pictured with the assumed dorsal (upper) face uppermost, the notched working edge(s) being seen in profile at the top.

The small stout specimen in the bottom row, on the extreme right, is actually a thrice-notched strangulated scraper, the most heavily worn notch being seen at the top end, the other two on the adjacent sides. This completely prepared scraper which is provided in addition with a sharp-edged broad point (top right), and two acutely convergent sharp edges (bottom left), well illustrates the multiple nature of perhaps one half or more of all the chert tools and the consequent difficulty in satisfactorily classifying them.

Notched scrapers sometimes show rough natural cortex on both faces, but generally it has been removed from one or both of these surfaces.

The single notched scraper pictured in the top row, on the extreme left (fig. 3), was made from a spall-like cortical flake, the rough cortex that covers most of the upper face being viewed in the picture. Both faces of the remaining eleven tools, however, have been denuded of all natural cortex by splitting, coarse and fine flaking, and chipping that has generally been opposed to natural surfaces of fracture.

This preparatory work has sometimes been completely overall, and included the removal of the marginal cortex as well (the third specimen from the left in the middle row, and the strangulated scraper on the extreme right in the bottom row). Generally, however, the rough marginal cortex has been retained, either along the back of the tool, or sometimes (as in the case of the three specimens in the top row, on the right) along one or both sides.

A striking exception is that illustrated on the extreme right in the top row (fig. 3), where the fullest possible advantage has been taken of natural fracture surfaces. All the surfaces of this thin once-notched slab, with the exception only of part of the working edge, have been derived either from pre-existing naturally flat surfaces, or by fracture along them.

The preparation of all of the individual notches of the scrapers seen in fig. 3 has been in the unifacial (or uni-directional) manner characteristic of the working edges of some 90% of all the cutting, scraping and planing chert tools. This work has been directed towards the upper face (towards the observer), in all but three of the figured specimens. One of the exceptions is the small triple-notched strangulated scraper already referred to (in the bottom row on the extreme right); the other two are the third specimens from the left, in the middle and bottom rows respectively, where the right hand notch of each has been worked in the reverse direction (i.e. towards the lower surface, or in a direction away from the observer).

The three rather larger notched scrapers illustrated in fig. 4 (the top row) are well-preserved, despite their staining by manganese and their somewhat crude appearance. The bold fracturing involved in their manufacture has been extensive, but mainly confined to their upper faces which are viewed in the picture. While rough natural cortex may be seen on the back of the somewhat compound specimen on the right, the remainder of its perimeter provides a continuous series of concave to convex scraping edges.

The presence of one or more useful points in addition to the notch(es) is evident in the accompanying illustrations and a common feature of these tools. This compound or multiple feature occurred so frequently in the originally described quartzite specimens retrieved from the surface soil, that they were referred to as *notch-and-point scrapers* rather than merely notched scrapers.

(ii) Simple-pointed

This small group of scrapers resembling sharp- or blunt-tipped points is represented by only 75 specimens or 3.4% of the artefact total. They are frequently rather stout and irregular, and may have been used for boring or piercing purposes, but in the presence of their well-developed scraping edge(s) they have primarily been regarded as scraping tools.

(iii) Convex-edged

This group of 224 scraping tools (11.9% of the total number of artefacts) is exceeded in size only by two other groups, the notched scrapers and planes. While it includes scrapers of rounded, oval and even fan-shaped or sectorial plan form, the great majority are plain-backed side-scrapers.

The fairly large backed side scraper illustrated in fig. 4 (bottom row, on the right) is a broad specimen, and is viewed from above. The dorsal and ventral surfaces are equally fresh, though very slightly weatherworn. The unifacially and fairly steeply prepared long cutting or scraping edge is seen on the left side, and the completely plain or unworked back, which is of rough natural cortex, on the right. Most of them retain the rough natural cortex along the back which is often straight and usually shows no signs of special preparation or use.

These backed scrapers range from narrowly crescentic or lunate, to broadly semi-circular or D-shaped in plan form, many of them being slightly to quite definitely pointed at one, or even both extremities.

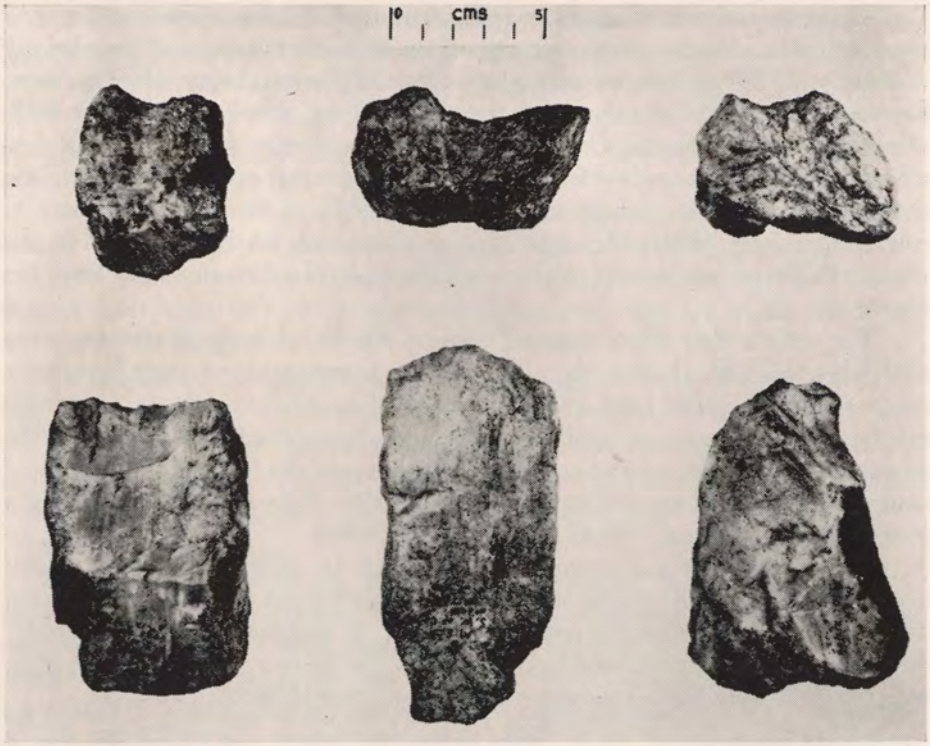

Fig. 4

(iv) Straight-edged

The 173 straight-edged scrapers constitute 9.2% of the artefact total. Mainly comprising crudely quadrilateral or nearly quadrilateral forms showing preparation and scraping use along one, two, three, or all of their four sides, they form a group almost as large as that of the convex scrapers. Some show extensive though elementary preparation, but quite frequently the ventral or dorsal surface, or sometimes even both, may be of natural cortex. They have often been distinguished from the planes only by their lesser stoutness, their relatively greater breadth, or by means of the working edge(s), which is generally less robust and less steeply prepared.

(v) Blunt-nosed

This ill-defined small group of 29 scraping tools constitutes only 1.5% of the total assemblage. Of varied shape and usually moderately stout, they are chiefly characterised by a rather projecting or distinctly terminal scraping edge which is sometimes straight, but more frequently convex.

2. *Planes*

Those tools described as planes, by analogy with a carpenter's plane, are second only in importance to the notched scrapers. The planes are relatively

stouter tools than the scrapers, often of cuboidal or wedge-like form, and range from squat and compact to narrow and chisel-like.

The first four of the six categories described include the simpler forms, which are distinguished by the nature of the terminal working edge *viz.* straight-edged, convex, pointed and notched. The two remaining categories, the compound and the miscellaneous (together comprising some 25% of the total number of planes) are frequently provided with additional working features such as lateral or transverse planing or scraping edges, or prepared points, or they may be merely somewhat irregular in form.

Either by its direct incorporation into the tool, or by fracture along it, advantage has usually been taken of a natural fracture plane in the raw material to provide the relatively smooth flat base characteristic of most of these tools. The working edge may be provided simply by the convergence of a second such fracture plane with the flat base, and (or) by unifacial, usually steep, crude marginal flaking or trimming.

The sides are usually of rough natural cortex, as in the case of the two fairly large specimens pictured in fig. 4 (the first two specimens in the bottom row), and the two planes which have already been described i.e. *the breadth of this tool is usually dependent on the thickness of the weathered chert slab from which it was fabricated.*

The working edges of the two specimens pictured in fig. 4 are seen at their top end, that of the first being very slightly concave, and that of the second distinctly convex. The working edge of the pointed planes may be merely more exaggeratedly convex or pointed than that of the last-mentioned specimen, or it may run obliquely (and not at right angles) to the length of the tool.

The comparatively large group of notched planes (100) comprises rather inconspicuously and terminally, once or twice notched forms, and some of them, despite their relative stoutness, are virtually indistinguishable from the very prolific notched scrapers.

3. *Pounders*

The thirteen pounders included in the present analysis range from nearly spheroidal to completely irregular. This small number, only 0.1% of the total number of chert tools, is no true reflection of the actual number present in the surface soil overlying the breccias. The subjection of these tools to repetitive and vigorous percussion has rendered the working faces very susceptible to weathering processes, and because of their frequent lack of clearly diagnostic repetitive damage, large numbers of such suspected fragments were excluded from the present analysis despite the obviously, sometimes grossly, damaged condition of their percussed surfaces. The very characteristic damage by repetitive percussion suffered by the more weather-resistant quartzite pounders has usually been well preserved (Maguire 1965).

4. *Anvils*

These stout tools, like the pounders, have suffered very repetitive percussion, and for the same reason all but a single slab-like specimen were excluded from the present list of tools.

A second stout narrow slab, similar in shape and size (and weighing approximately three pounds), was retained from the materials excavated from the back wall of the cavern. Each displays gross damage at the end of one long face, the damage extending over about half the length of the tool.

5. *Cores*

The 39 cores listed in Table 1 represent but a small fraction of those actually present in the surface soil overlying the breccias, since only the most evident specimens were retained for analysis. A few are rather globular or polyhedral, but most are quite irregular. Up to five or seven larger flakes or fragments have been struck from many of them, and in most cases in a manner contrary to the natural surfaces of fracture.

In marked contrast to the 1,670 scrapers and planes, the edges of these cores are generally strikingly free of palpable damage, whether it be artificial or natural.

6. *Utilised and little-used flakes and fractured fragments*

As in the case of the pounders, anvils and cores, only the most demonstrable and indisputable flakes and deliberately fractured fragments were retained for analysis. Some of these fragments probably represent elementary cores. While the fracture scars very rarely show the characteristic features usually attributed to deliberate flaking, they are readily diagnosable, in the manner earlier described, as the scars resulting from the deliberate fracturing of the native chert.

The edges of nearly all of the 83 selected specimens (4.4% of the artefact total) are fresh or comparatively fresh looking, and display no damage whatsoever that is suggestive of human interference.

Discussion and Conclusions

The very great age of the Limeworks cavern deposit, possibly one or more million years, implies that whatever stone tool-making occurred there during the accumulation of the infill, and particularly as evidenced at the lower levels, was of a low order, and perhaps not easily recognised. This is not altogether so, and my main reason for exhaustively examining the well-preserved and large collections of crude chert artefacts from the surface soil overlying the consolidated breccias was firstly to establish clearly their artefactual nature, and secondly to compare them with the often less well-preserved but abundant phase 2 artefacts, and the well-preserved but small collection of artefacts extracted from the extremely compact upper phase 1 breccia.

The chert tools comprising the assemblage extracted from the surface soil overlying the breccias display such uniformity throughout, that they can be

collectively described as representing a single industry. Furthermore their undoubted similarity to the abundant artefacts of chert and dolomite occurring in the pink breccias suggests that both the superficial and the breccial specimens may be regarded as facies of the same lithic industry.

The pink breccia that has been exposed over the entire area of the grid by the recent excavations is Brain's upper phase 1, and it would therefore appear that all of the chert tools recovered from the overlying surface soil should be referred to a late stage in the accumulation of this breccia. It is quite possible, however, that the phase 2 breccia, which at the present day overlies the upper phase 1 breccia only in the vicinity of the cone, may originally have extended over part, or even the whole, of the grid area. (An opinion confirmed by Brain—1965—after a re-assessment in 1962 of his original geological interpretation of the Limeworks deposit.) The possibility exists, therefore, that the artefacts have been derived by weathering from both the upper phase 1 breccia and part of an originally more extensive deposit of overlying phase 2 breccia.

The phase 2 pink breccia is generally regarded as having been a relatively rapid accumulation, and there is no evidence of any major temporal unconformity between it and the often rather poorly differentiated upper phase 1 pink breccia (Brain *et al* 1955). Therefore, whether derived from only one, or from both phases of the pink breccia, there should be no very significant variation in the ages of the chert tools extracted from the surface soil of the excavation grid.

The absence of identifiable dolomite artefacts in the rubbly soil overlying the breccia may be attributed to the great solubility of the local dolomite. Being only slightly less soluble than the breccia matrix itself, the usually abundant dolomite inclusions in the upper phase 1 pink breccia become heavily eroded, or even completely dissolved, while still partly embedded in the decalcifying breccia mass. Therefore, while large numbers of chert artefacts, which are relatively insoluble, have been preserved in the shallow layer of soil derived from the underlying breccia, smaller dolomite fragments of any kind are rare.

The utilised bones and bone flakes preserved in the grey breccia enormously outnumber the utilised stalactite and other lithic fragments associated with them, hence the Limeworks cavern deposit, in its entirety, demonstrates a transition from the prolific and virtually exclusive use of bone as a tool-making material to the abundant use of stone, and perhaps ultimately the almost complete replacement of bone tools by those of stone. Moreover, it is significant that the raw materials used for toolmaking, as they successively appear to have been used in the cavern breccias, provide a sequence very closely expressing both their availability and their tractability. Thus:

The prolific *bone* tools in the grey breccia occur together with, but perhaps generally precede, the occasional utilised fragments of cavern *stalactite* (and possibly *shale*). Artefacts of the harder and more durable native lithic materials, *dolomite* and *chert*, then make their appearance in the upper phase 1 pink breccia. Relatively intractable *quartzite*, in the form of waterworn river-bed pebbles, is introduced into the cavern at a late stage of the accumulation of upper phase 1

breccia. *Vein quartz*, although a native material, is not only relatively scarce, but also extremely intractable. It seems to have been first used for tool-making about contemporaneously with the introduction of the quartzite pebbles into the cavern, although it appears to have been used abundantly only at a very late stage in the cavern's history.

It should be strongly emphasised that *there has been an overwhelmingly preponderant usage of the native chert and dolomite as stone tool-making materials throughout the Limeworks deposit*, while the part played by quartzite (at least in terms of numbers) is by comparison virtually negligible.

Nevertheless the introduction of quartzite river-bed pebbles into the cavern at a more terminal stage of the accumulation of the pink breccia (in later upper phase 1 times) is for several reasons of particular importance.

1. The foreign, readily identifiable nature of these artificially damaged stones was the most important single feature ensuring their practically total recovery from the excavated areas, and enabling their distribution throughout the deposit to be determined. In demonstrating that their very markedly unequal distribution in the breccia was directly reflected in the overlying surface soil, they were thus directly responsible (to a greater extent than the chert artefacts), for conclusively demonstrating the crucially important feature that the surface soil (at least its heavier fractions) primarily represents a decalcified breccial residue.

2. Very few chert fragments have been reconstituted from their isolated and separately-discovered parts during the excavation of the surface soil overlying the breccia. However, quite invaluable information has been obtained by the examination and reconstitution of some 40 quartzite pebbles and artefacts (or their fragments) from their separately-discovered parts.

Such information relates not only to technological features and damage by utilisation, but to the manner and rate of natural weathering of quartzite artefacts in the surface soil overlying the breccias.

In the course of their long separation from each other, none of the edges of the matched (last-separated) surfaces has suffered natural damage resembling in any way that attributed to deliberate trimming or utilisation, thus independently corroborating, yet again, the observations made during the analysis of the chert artefacts. Excepting those few instances where the raw material used was a weakly-compacted grit or sandstone, rather than a quartzite, there has usually been no palpable weathering of the matched surfaces.

Finally, these lithic parts furnish conclusive proof of the deliberate pounding and artificial fragmentation of the quartzite pebbles on the cavern site.

3. The transport to the cavern of these quartzite pebbles displays an awareness on the part of the users of possibly more desirable extraneous raw materials for tool-making or tool-using (at least for certain purposes), as well as the expenditure of effort in obtaining them.

4. This less tractable material was handled in a manner obviously commensurate with the limited abilities of tool makers accustomed only to the more

tractable materials calcite, chert and dolomite which are native to the cavern site.

While the dolomite and chert tools frequently display deliberate splitting and crude flaking, the solely percussional damage sustained by many of the quartzite pebbles suggests that they were generally employed in cultural activities of a consistently low order.

Most of these fragments that have obviously been employed more specifically, despite their crudity, closely resemble the notched scrapers and planes fabricated from the more tractable native materials dolomite and chert that predominate throughout the deposit above the grey breccia. These demonstrate yet further the repetitiveness of these tool forms and their successful reproduction in a material both less tractable, and with different fracturing properties.

5. Because of their extremely durable and weather-resistant nature, and the very characteristic type of damage they exhibit when repetitively percussed, these quartzite pebbles and fragments have provided a virtually permanent record of early percussional activity on the site, extending from later upper phase 1 times onward (Maguire 1965).

6. The fragments resultant from pounding activities, sufficiently shapely to describe as more specific types of tools, were previously regarded as quite fortuitous. Some of them at least were probably deliberately struck, though very crude flakes, and it is likely that these may represent, at the Limeworks site, the beginnings of definitely flaked tools made of materials more durable and efficient than the native dolomite and chert.

The differences between the types of deliberate damage generally evidenced by tools of quartzite, and those of dolomite or chert on this site, are fairly readily recognisable, and quite diagnostic, and acquaintance with these differences is considered to be essential to any understanding of the lithicultural history of the Limeworks deposit (and most probably of other dolomitic australopithecine sites as well).

Both types of damage have been simulated experimentally (that by pounding to quartzite being also plentifully illustrated in the Bernard Price Institute for Palaeontological Research by comparative material ranging in age from Middle Stone Age times onward to the present).

Lately conducted experiments, using a stone anvil, and a quartzite river-bed pebble as a fabricator, demonstrated the difficulty of detaching flakes possessing a clearly defined or conventional bulb of percussion from the local chert. Furthermore, the brittle splintery nature of the local chert and the presence of abundant, variously orientated natural fracture surfaces making control of the core difficult, may be the reason for the often irregular and very elementary nature of the Limeworks cores.

However, these experiments reproduced exactly the type of fracture referred to throughout this paper as 'crude flaking' or 'deliberate fracturing contrary to

the natural fracture surfaces', and also the fine and very clearly defined unifacial trimming characteristic of the Limeworks chert artefacts.

The fine unifacial trimming was simulated with comparative ease, but since it demanded the employment of deliberately controlled manual activities, its artificial nature would be readily assessed by the criteria used in my analysis of the Limeworks artefacts.

A further (hitherto unmentioned) deliberate feature of the Limeworks chert artefacts became evident in the course of experimental work, when it was found that the margins of the experimentally produced tools could be trimmed with approximately equal facility either towards the assumed upper face, or towards the flatter and more regular lower face. The Limeworks artefacts have almost invariably been trimmed in the direction of the upper face, while tools consistently trimmed towards the flatter lower face are very rare, constituting less than 1% of the total assemblage.

The elementary nature of the Limeworks cores, rather than suggesting some specific lack of ability on the part of the makers, is more suggestive of ignorance of any special core technique. In contrast to the relatively crude cores, many of the tools exhibit relatively delicate trimming, and on occasion natural chert slabs barely $\frac{1}{8}$ inch in thickness were selected for tool making. The makers of these tools were, therefore, manifestly capable of precisional work demanding a relatively high degree of manual dexterity. However, although the major fracturing involved in producing the Limeworks artefacts often demonstrates considerable ability, it often does not closely resemble, nor has it been regarded as, accomplished or precisional flaking. This preparatory major fracturing has therefore been referred to as deliberate splitting or crude flaking.

The repeated appearance of certain tool types, and especially of those tools termed notched scrapers and planes, is regarded as a consistent and traditional feature of stone tool making throughout the deposit. The distinctive notched scrapers are particularly abundant, both within the breccias and in the overlying soil, and have been fabricated from all the available lithic materials *despite their widely varying fracturing properties*.

No conclusion has certainly been reached concerning the use of these notched scrapers, although many were probably used as decorticating tools during the preparation of wooden tools. They range from extremely small-notched specimens less than one inch long and showing fine wear, to very coarsely used large-notched tools four to five or more inches in length or breadth, which suggests that they may have been used for a variety of purposes.

Australopithecine remains (some forty or more fragments) have been recovered from all of the Limeworks breccias, above, and including the rich basal bone bed of grey breccia. The fact that no remains of other hominids have yet been found indicates that australopithecines may have been the only hominid occupants of the ancient Limeworks cavern, and the makers of all of the Limeworks artefacts. This is especially probable in view of the consistently crude nature of the lithic artefacts, and the seemingly total absence of even Earlier

Acheulean artefacts throughout the consolidated breccias, and, with the below-mentioned exceptions, throughout the overlying surface soil as well.

The small number of crudely (usually) but definitely flaked quartzite artefacts retrieved from the soil overlying the breccias at the Limeworks appears to represent an accumulation over a very long period extending up to Middle Stone Age times. While all evidence strongly indicates that the later of these represent contaminating elements in post-breccial times, the earlier may have been derived by weathering from an extremely late stage of the original accumulation of the phase 2 breccia.

Mason refers to the "immense segment" of the Stone Age record that is missing from the Transvaal sequence. This period spans the time between the Limeworks bone industry and the Earlier Acheulean (Earlier Chelles-Acheul) artefacts extracted from the Sterkfontein middle (or red-brown) breccia and also represented at Klipplaatdrif (Mason and Robinson 1962).

This segment, or a facies of that segment, would appear to be that represented by the wealth of crudely (not precisionally) flaked chert, dolomite and vein quartz artefacts (and more occasional quartzite percussion tools), occurring both within the pink breccias and in the soil overlying and derived from these breccias at the Makapansgat Limeworks. I feel it is extremely likely (and in much the same manner as at Makapansgat) that parts of this segment will also be represented at the other dolomitic australopithecine sites in the Transvaal. I would again stress, however, the overwhelming dominance of the native chert and dolomite as stone tool-making materials at the Makapansgat Limeworks site.

Acknowledgments

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EXPLANATION OF TEXT FIGURES

Fig. 1 Diagram of the Makapansgat Limeworks quarries. The more easterly part of the back wall of the ancient cavern is approximately defined by the dolomite outcrop.

Fig. 2 A series of six specimens illustrating the natural fragmentation and crude flaking and trimming of chert.

Top row (left to right)

A stout plane deliberately notched by the removal of a terminal flake. Note the coarse texture of the somewhat conchoidal flake scar. The main viewed face is a smooth flat natural fracture surface.

A naturally disintegrating slab of chert. Note its angular appearance, the undamaged edges and also the fine dark lines traversing the viewed face indicating potential natural lines of fracture.

A deliberately struck stout cortical flake of fine-grained chert showing the conchoidal cleavage face.

Bottom row (left to right)

A small, stout, steeply trimmed convex plane, seen obliquely and from below; and respectively, a larger and a smaller notched scraper. The single-notch scrapers show the assumed dorsal face; note the fine artificial damage by preparation and/or wear within the notches.

Fig. 3 A series of twelve smaller notched scrapers in chert, showing their assumed dorsal faces and the notching of the top edges. The six single-notched scrapers are those occupying the top row, and the extreme left specimen in the middle and bottom rows respectively. The remainder are double-notched, the extreme right specimen in the bottom row actually being a triple-notched strangulated scraper. The first specimen in the top row was made from a spall-like flake and is the only tool shown here that retains most of the natural cortex on the dorsal face.

Fig. 4 A series of six medium- and large-sized chert tools. The three notched scrapers occupying the top row all show their dorsal face, the notch(es) being seen on their top edge. In the bottom row are seen from left to right: a shallowly notched plane, a convex plane and a convex (backed) side scraper. Note the unworked back of rough natural cortex (right side) of the convex side scraper.