The Typology and Techniques of Alluvial Mining: The Example of the Shoalhaven and Mongarlowe Goldfields in Southern New South Wales

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The author undertook an National Estate Grants Program (NEGP) study in 1995 aimed at identifying and recording historic mining sites in the Shoalhaven River catchment area and selected sites on the South West Slopes of New South Wales. Both components of the study built upon earlier work undertaken by the author under an NEGP grant in 1993. This paper describes the techniques of alluvial mining (other than dredging) in the Shoalhaven and Mongarlowe goldfields and suggests a typology based on that outlined in the 1995 NEGP study and that developed by Ritchie in 1981. The typology also addresses the question of ethnicity.

The need to develop a typology as a working tool became obvious at a very early stage of the 1995 NEGP study.[1] This arose from a very real practical need to distinguish between the various techniques as a means of describing, identifying and dating the often very large and seemingly structureless and amorphous sites associated with alluvial mining within the study area of the Shoalhaven and Mongarlowe Goldfields (Fig. 1).

The most useful and comprehensive contemporary account of both the technique and typology of alluvial mining is that by Ritchie in 1981.[2] Ritchie's analysis was concerned primarily with describing and developing a typology of tailings deposits derived from the various types of alluvial mining, and where possible his descriptions have been used. As stated above the main concern in the NEGP study was to develop a typology which helped to distinguish between the different techniques as a means of identifying and recording the various sites. The concern was less with the pattern of tailings within a common sluicing and hydraulic sluicing operation, therefore, than with identifying the various features that distinguished such operations, of which the tailing mounds were only one characteristic, albeit a very important one.

A search of other contemporary Australasian literature on techniques and typology was disappointing. The recently completed NEGP study, *Australia's Mining History*, while admittedly an historical description of mining, made little distinction between the various mining techniques. Common sluicing, for example, was not mentioned and hydraulic sluicing rated only a few lines in one chapter.[3] Two of the most useful texts were Ion Idriess' *Prospecting for Gold*, written in 1934 and Averill's 1946 work, *Placer Mining for Gold in California*. Otherwise reliance was placed on a range of publications from the USA and New Zealand, many dating back to the last century, in some cases as far back as the 1860s. The most useful Australian sources from this period were Smyth's *The Goldfields and Mineral Districts of Victoria*, published in 1869, and articles appearing in the *Australian Town and Country Journal* in 1871 and 1874 and the *NSW Agriculturist and Grazier* in 1881.

From the outset it is necessary to distinguish between techniques and typology. Using Ritchie's analysis as a starting point, and with the exclusion of dredging and deep lead mining, there are three basic techniques of alluvial mining: pan and cradle, common (box and ground) sluicing and hydraulic sluicing, including elevating. The typology refers to the features associated with each technique. There was a degree of overlap between the various features. Some were however unique to a particular technique and, it will be argued, to particular ethnic groups, in this instance the Chinese. The relationship between typology and technique is set out in Table 1.

TYPOLOGY

Type A

Type A describes the heavily scoured creek beds and banks, and adjacent to this the numerous closely grouped shallow shafts or rounded piles and hummocks of wash dirt and soil, characteristic of what Ritchie has described as 'small claim' or 'pothole tailings'. Ritchie also stated that, 'Although individual working areas were very small (24 feet by 24 feet) where a number of such workings were established in close proximity ... the aggregate was quite extensive'.[4] Type A workings were typical of pan and cradle techniques in the first stage of an alluvial rush (Fig. 2).

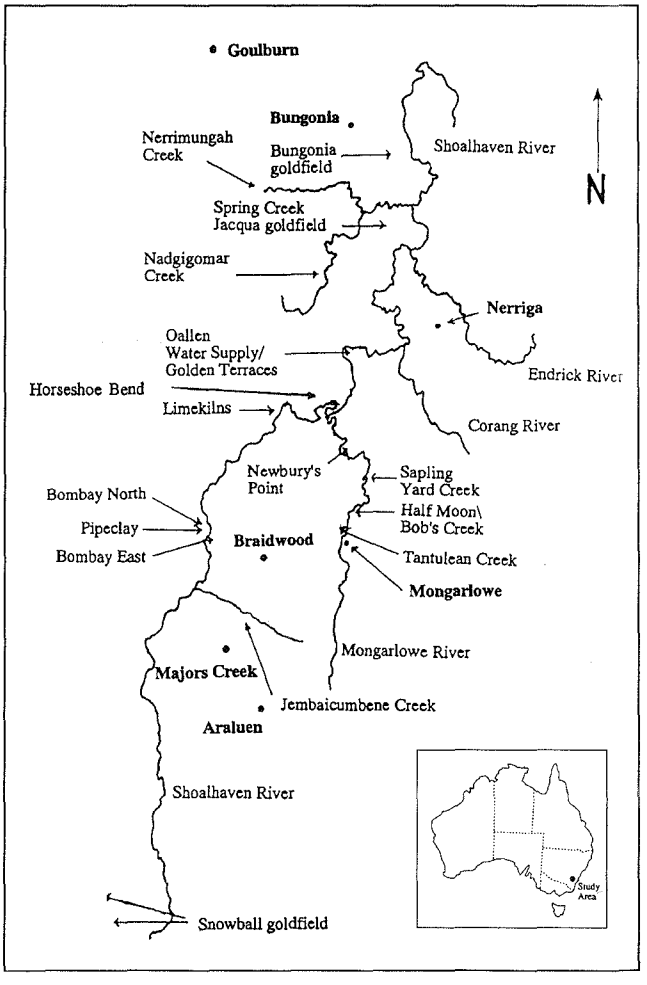

Fig. 1: Shoalhaven and Mongarlowe Goldfields.

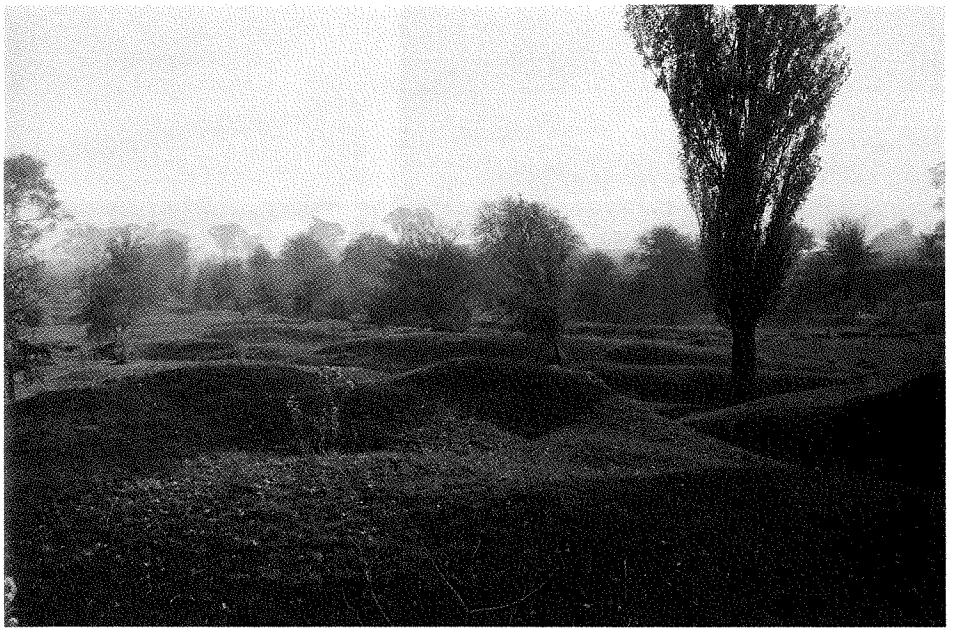

Fig. 2: Honeysuckle Flat, Jembaicumbene Creek, Type A workings (hummocks).

Fig. 3: Washed Away Creek, Type A workings (scoured floor and eroded banks).

TABLE 1: Alluvial mining techniques and typologies

	Pan and cradle	Common (box and ground) sluicing	Hydraulic sluicing
A (Shallow shafts, rounded hummocks, creek and gully workings	X		
B (Shallow surfacing)	X	X	
C (Paddocks)	X	X	
D (Tailing mounds)	X	X	X
D1 (Unstructured mounds)	X	X	X
D2 (Vertical stone packing)	X		
E (Drift shafts)	X	X	X
F (Drift tunnels)	X	X	X

Where the creek bed was worked there is often little obvious evidence of these activities. In its more intensive form, however, the workings are more obvious, the creek bed having been cleaned out to bedrock and the side of the banks washed away. In some instances drift shafts and tunnels (Type E and F) can be found in and near the banks. Where these tunnels and shafts have collapsed from the force of storm water running down the drives, they have made substantial and irregular inroads into the banks, which in turn explains much of the eroded landscape evident along such creeks and gullies (Fig. 3).

Type B

Shallow surfacing occurs where the auriferous drift has been stripped to bed rock but at a very shallow level. This feature has been classified as Type B. The area covered could be quite large but of a very shallow depth, perhaps only a few centimetres, there being few tailing mounds of any size present. Type B workings were, however, closely associated with and often adjacent to Type D workings and were sometimes worked by common sluicing. In some instances, however, the deposits were too elevated to be worked by this method.

Fig. 4: Sapling Yard Creek, drainage channel and vertical stone packings (Type D2).

Type C

Paddocking, described by Ritchie as '...a method of working a small area of alluvium by the excavation of the whole mass leaving a large pit', has been classified as Type C.[5] The Shoalhaven examples conform generally to Ritchie's description, being square or rectangular in form, measuring about 40 metres by 40 metres and seldom exceeding two metres in depth, although deeper examples have been found in the Mongarlowe area. It should be noted that the area before a face was sometimes referred to as a paddock. A shallower and sometimes smaller type of paddock occurred on the boulder strewn auriferous drifts in the Bungonia and Mongarlowe areas, with the face being between one and two metres high, these paddocks often being associated with Type B and D workings. In this typology, however, Type C refers to the rectangular paddocks located primarily on the lower river and stream terraces where the wash was generally boulder free.

Type D

Tailing mounds were characteristic of a large percentage of the workings along the Shoalhaven and Mongarlowe Rivers and have been classified as Type D workings. They comprise elongated mounds of river worn stone, piled there after working of the face and floor of the diggings. As with Type B workings they could exist independently of common sluicing operations, again on unusually high ridges well out of the reach of any viable race system.

An important characteristic of the tailing mounds is that they were not simply placements of stones but a part of the techniques used on the field itself. For example, the mounds were arranged in such a way as to facilitate drainage into the tail races (Fig. 4) and at times to dam up water supplies for washing or to keep rainwater from other areas of workings. The tailing mounds were also arranged to act either as sluices or to hold sluice boxes, and possibly to delineate different claims. Their arrangement also owed much to the general fall of land, utilising any natural gullies that may be present in the area. Factors identified by Ritchie, such as human preference or experience may also have been at play.[6]

It is argued in this study that the arrangement of the tailing mounds was also ethnically determined, or conversely that the ethnicity of a diggings, that is whether they were worked by the Chinese, can generally be determined by the arrangement of the tailing mounds. This issue came to the fore following an examination of a site near Bob's Creek on the Mongarlowe goldfield. These diggings were qualitatively different from those seen elsewhere and both oral and archival evidence supported the contention that they were Chinese, in this case Ah Hak's. As the study progressed similar sites were located, some of which could be confirmed as Chinese from the oral and archival evidence and other supporting evidence such as lease maps.[7] One such site was adjacent to Ah Hak's and used the same water race. It also became evident from the archival sources that in their hey day the Monagarlowe diggings were predominantly Chinese, so the frequency with which these sites occur is understandable.[8]

The main characteristic of Ah Hak's diggings was its small size and the presence of very low tailing mounds with vertically stone packed walls along part of their length, the walls being less than a metre, in some cases only centimetres high (Fig. 5, 6). These walls are possibly comparable to the vertically stacked wing dams described by Ritchie.[9] The floor of the diggings was completely clear of tailings, the whole area

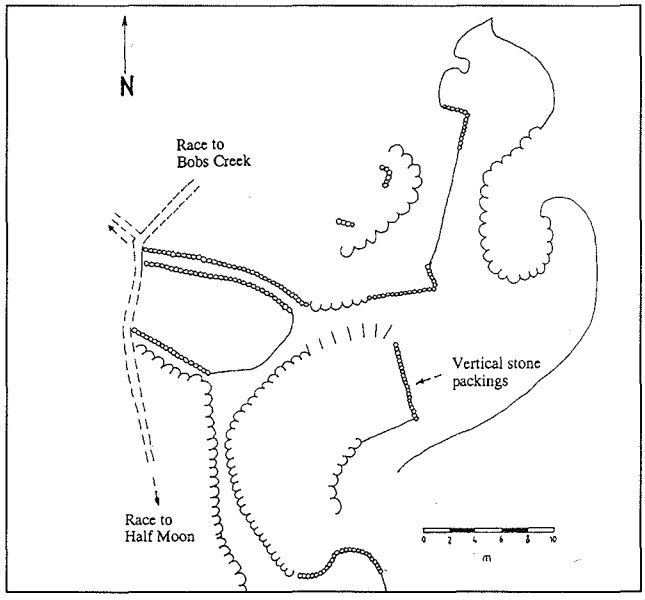

Fig. 5: Ah Hak's diggings.

Fig. 6: Ah Hak's diggings, vertical stone packings (Type D2).

having the appearance of having been intensively and meticulously worked by pan and cradle. It should also be noted that the adjacent diggings referred to above included areas of paddocking (Type C) with vertical facings and drift tunnels (Type F). It is, however, less certain that these features were exclusively or even predominantly Chinese. In this typology unstructured tailing mounds are referred to as D1 and the vertically packed mounds as D2. On the question of ethnicity Ritchie has stated that:

> Herringbone tailings and other neatly stacked tailings are commonly assumed to be the work of the Chinese miners. This is an unreliable assumption; many mining sites which have been worked only by European miners are equally tidy. Conversely the tailings in some sites known to have been worked by Chinese miners are not neatly stacked.[10]

In the Shoalhaven and Mongarlowe goldfields there were a few apparent Chinese sites where the tidy patterns described above did not appear and some apparently European ones with vertical stone packings. In addition, many sites had a mixture of Type D1 and Type D2 workings. These divergences may of course be aberrations due to subsequent reworking of Chinese diggings by Europeans or vice versa or to the use by Europeans of the more effective and thorough Chinese techniques. In any event, the evidence for some link between ethnicity and typology in the Shoalhaven area appears overwhelming. It should be no surprise that Chinese diggings have the appearance of being meticulously worked, for all commentators, whatever their prejudices, paid them this due. Indeed there were commentators who lauded the Chinese for their perseverance, meanwhile decrying the ephemeral and piecemeal approach of most Europeans.[11]

Type E

The narrow trench-like shafts (drift shafts) characteristic of high level auriferous drifts have been classified as Type E. They were dug not only at the claims to test the extent of the wash dirt but also along the line of race to test the drift in these areas as well. In appearance these shafts differ markedly from the mine shafts associated with quartz mining. They are narrower and as a rule shallower, and do not have large mullock heaps, for the drift was processed in a pan or cradle or otherwise washed away by the rain.

Type F

Drift tunnels cut into the face of the workings have been classified as Type F. They occurred primarily in common sluicing claims where it was impractical to get at the wash by any other means, particularly if the wash was very hard. They were also, however, associated with pan and cradle workings and hydraulic sluicing and were particularly prevalent in Type C (paddocking) workings. Sometimes the tunnels had wooden roof supports, but more often they did not (Fig. 7).

TECHNIQUES

PAN AND CRADLE

In its most basic and simple form alluvial mining consisted of washing river or stream dirt in a gold pan. As an advance on that, a cradle or long tom with a bucket to raise water or a short sluice was used. In its less intensive form where gullies were worked only to a shallow depth, this process was referred to as 'gully raking'. The physical evidence for 'gully raking' is obviously slight, if evident at all, notwithstanding the fact that this type of mining was almost universally indulged in by alluvial miners and many farmers and labourers, often on a family basis.

Pan and cradle techniques were used on all types of workings, including on Type D and in particular Type D2 workings. It should also be noted that the pan was used extensively with other techniques, for example, in the final clean up stage of common and hydraulic sluicing.

There are in addition certain other features associated with processing rather than mining that can also be used to distinguish pan and cradle sites. These include barrow ways, internal dams and puddlers, stones from the tailing mounds often being used to construct barrow ways and small dams in the diggings. For example, an account of the nearby Araluen diggings described the process of removing the overburden by wheelbarrow, wheeling the stripping out some distance to a tip. This process would have been used on almost all pan and cradle workings and would also have been used for removing the wash dirt to a washing site. The evidence for barrow ways is particularly strong in the Shoalhaven and Mongarlowe goldfields. Water races were used to convey water for washing. In many instances they can be distinguished from the water races used on common sluicing sites for they either exit below the face or into dams directly above or in the diggings.

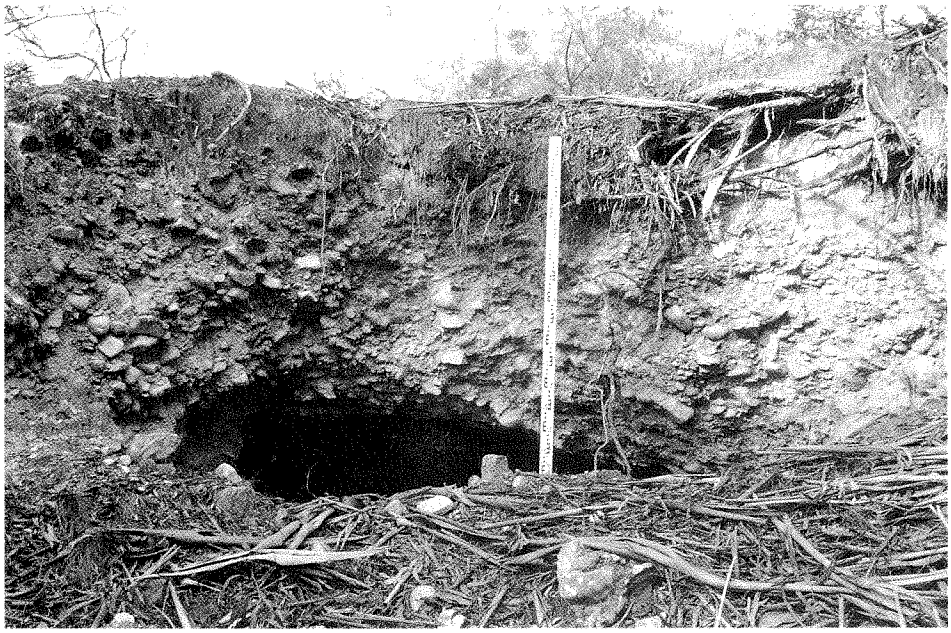

Fig. 7: Bombay North 3, drift tunnel (Type F).

Puddlers or puddling machines were used in many pan and cradle workings. They consisted of large circular holes about 15 metres to 20 metres in circumference in which the dirt and water were mixed, with perhaps a small race conveying water into the puddler. In the centre of the puddler was a mound with a tall wooden pole acting as a pivot, to which was attached a wooden shaft extending over the hole and to which a horse was yoked. Triangular harrows were attached to the shafts and as the horse walked around the outside circumference the harrow was pulled around in the hole, breaking down the wash.

COMMON (BOX AND GROUND) SLUICING

Common sluicing refers to the processing of alluvial wash by means of box or ground sluices, the first being sluices raised above the bottom by trestles and into which the earth must be elevated or carried and the second as sluices sunk in the bottom into which the excavated earth was conveyed by a stream of water.[12]

The box sluices were described as '...portable, and consist of a series of inclined troughs (known as boxes) and set on suitable trestles'. They were used primarily where the bottom of the workings was below the adjacent creek bed and where, therefore, there was insufficient fall. The number and inclination of the boxes used varied, depending upon the quantity and adhesiveness of the wash and the adequacy or otherwise of the drainage. The tougher or more adhesive the dirt and the greater the volume of dirt, the steeper the grade required. Water was conveyed into the box sluice by hose. The sluice usually ran through the claim and the wash dirt was thrown in with shovels, any stones being removed by use of a sluicing fork.[13]

On the nearby Araluen field the introduction of box sluicing appears to have coincided with the introduction of the horse and dray by which means three times as much ground could be removed as by barrow. The boxes were gradually moved back into the face and fed by tip drays drawn up from the bottom of the claims, suggesting that box sluicing was closely associated with Type C workings. Horses and drays were used extensively on the adjacent Jembaicumbene field, suggesting that box sluicing was used there.

The ground sluices were often only channels cut down to bedrock, but they were also built of sawn planks and boards. They were used only where the bottom was sufficiently high to provide the necessary fall and were the main method of working elevated ground. The process of constructing and working the ground sluice was described thus by Smyth:

> The water being led to the required spot, a channel is cut in the line of the proposed sluice, the water turned into it, and workmen standing in the channel pick up the bottom (the water carrying the earth away) until the desired depth is reached usually in the bedrock. The sluice in this state is as good for saving gold as it can be made but as the bottom whether rock or earth, is often too soft to bear the necessary abrasion and wears irregularly it is now a common practice in such cases to board the sluice before beginning to work the auriferous ground. When the sluice is ready, the earth to be washed is got or broken out of the solid pretty much in the same way as in a railway excavation but instead of being shovelled into carriages for transport a stream of water is turned over it which carries it into and down the sluice.[14]

The field evidence along the Shoalhaven River suggests that ground sluicing was used extensively. The height of the face of the sluicings varied considerably, but was rarely more than five metres in height, and was characterised by gentle debris slopes at and near the sluicing points, where the race ran over the face. The floor was covered with tailing mounds (Type D1) several metres high which were arranged to facilitate drainage and placement of boxes. As will be discussed below much of the evidence for ground sluicing along the Shoalhaven River has been affected by the subsequent reworking of the claims by hydraulic sluicing. On the Mongarlowe River, however, it is likely that the tailing mounds were more associated with pan and cradle workings, the sites being characterised by one or more of the following features, that is, the absence of sluicing points atop the face, the absence of debris slopes, the relatively constricted nature of the diggings and the presence of barrow ways and internal dams.

DESCRIPTION OF PAN AND CRADLE AND GROUND SLUICING SITES

The complexity of these sites, including the relationship between typology, technique and ethnicity are illustrated by the following examples.

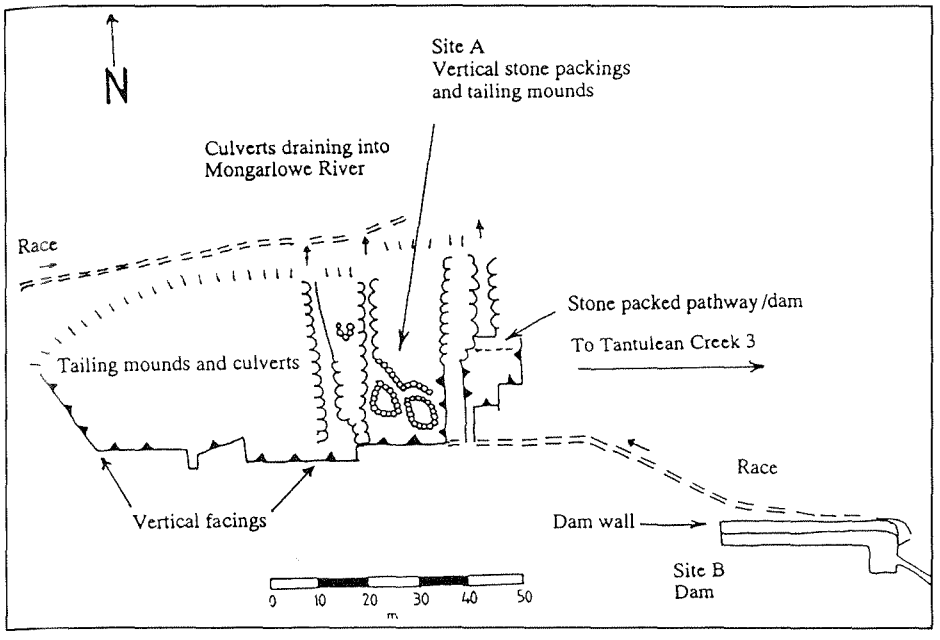

Fig. 8: Tantulean Creek 2.

Tantulean Creek

Tantulean Creek 2 is located in the Mongarlowe field. It is about 100 metres by 50 metres with a face of between two and three metres (Fig. 8). A race runs from a nearby dam over the face to a small dammed area in the diggings, the dam also constituting a barrow way. This dammed area is separated from the diggings by a drift wall. There is evidence that water was also run over the face into the diggings, however, there is only one sluicing point, which is not pronounced, and the face of the diggings is vertical. A further race and a pronounced barrow way are located below the diggings. The diggings are very constricted, and could at best have held only very short sluices. It is likely therefore that this site was worked by pan and cradle techniques.

A feature of these diggings is a small but very obvious area of nearly rectangular and vertical tailing mounds (site A), similar but larger than those observed at Ah Hak's, thus fitting our Type D2 workings and suggesting a Chinese presence (Fig. 9).

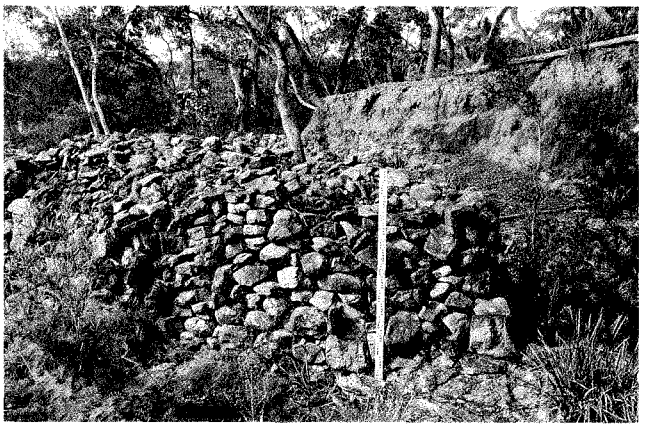

Fig. 9: Tantulean Creek 2, vertical stone packings (Type D2) and diggings face.

Sapling Yard Creek

The Sapling Yard Creek diggings are located on the Mongarlowe River. The main diggings were typical Type D workings, although closer to the river are areas akin to Type C (Fig. 10). The area of tailing mounds measures about 100 metres by 70 metres, the tailing mounds having been clearly arranged to facilitate drainage into the Mongarlowe River (Fig. 4). The water race enters a dam above the face, but there is no evidence that the water was run over the face, but rather that it was used for washing, making this a pan and cradle site. There is considerable evidence of vertical stone packings, and most of the tailing mounds can thus be classified as Type D2. Several hundred metres up hill there is another site containing good examples of Type B workings, one section having been stripped bare over an area of about 60 metres by 80 metres at a depth of only a few centimetres. Adjoining this is another area of Type D2 workings, including a dam constructed of stones.

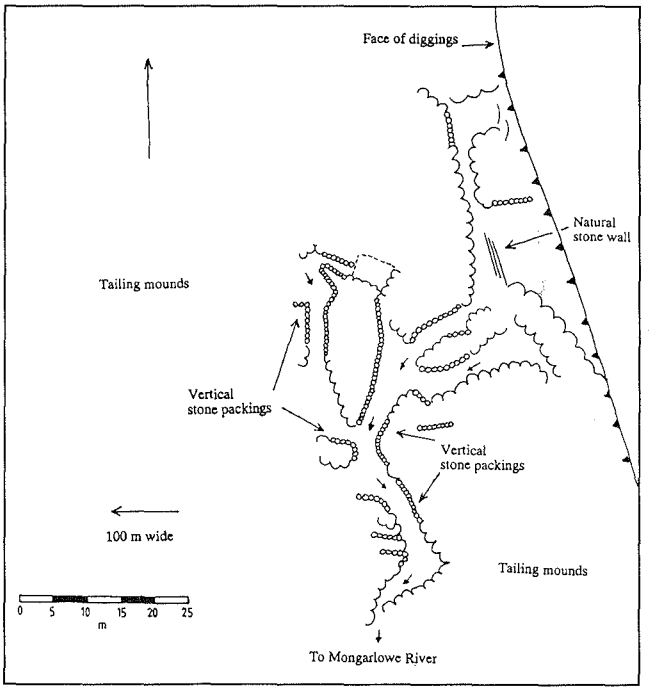

Fig. 10: Sapling Yard Creek.

Bombay North 3

The Bombay North 3 ground diggings are located near the Shoalhaven River. They are about 50 metres by 100 metres and are characterised by long tailing mounds with a number of

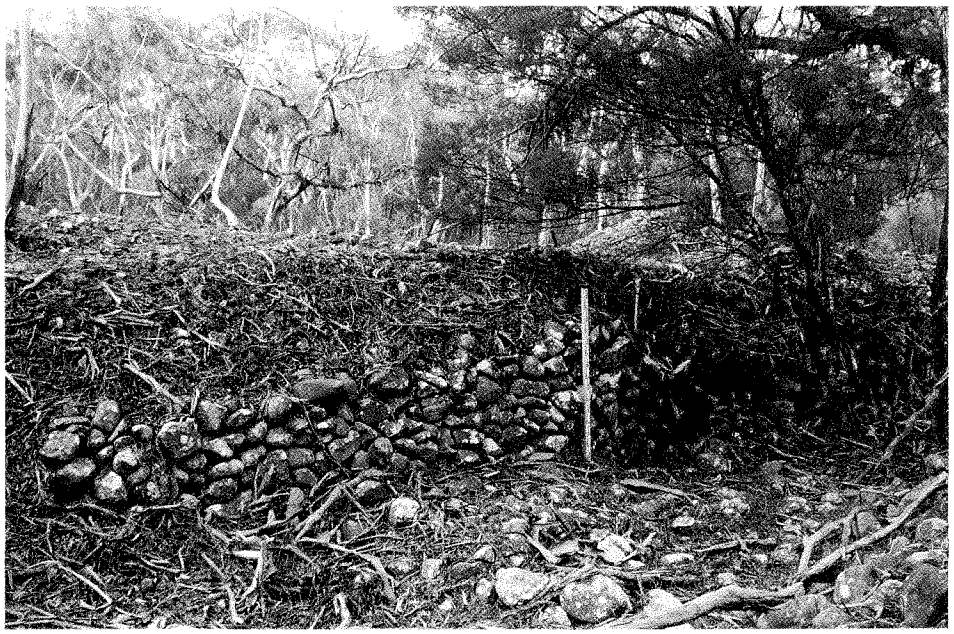

Fig. 12: Bombay North 3, vertical stone packings (Type D2).

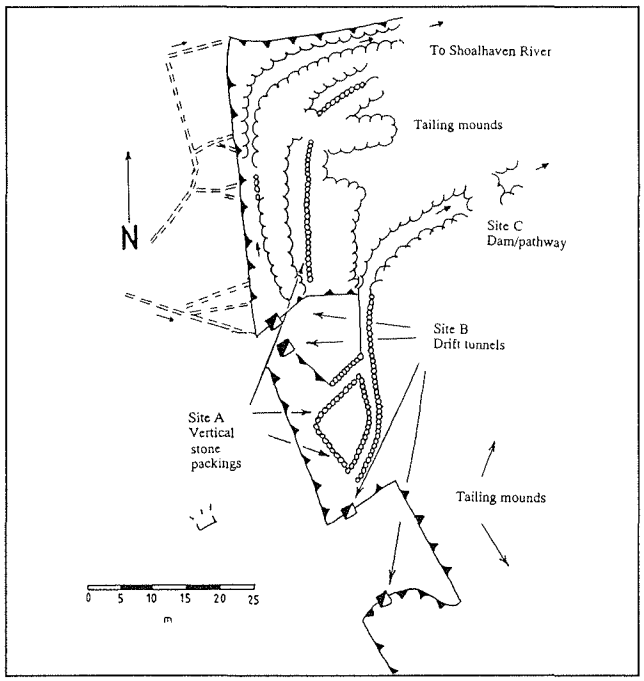

Fig. 11: Bombay North 3.

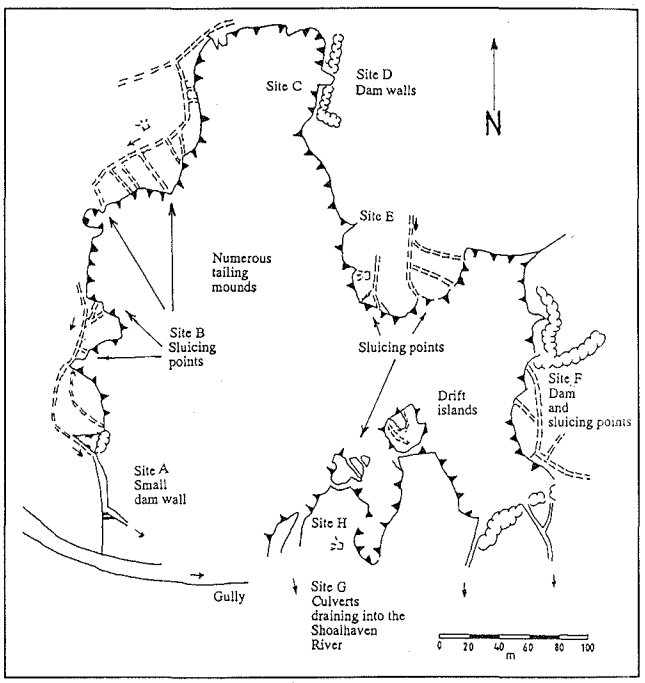

Fig. 13: Pipeclay 1.

vertically stone packed embankments typical of Type D2 workings (Fig. 11, 12). Although there are a number of race entry points akin to sluicing points, the face of the diggings is vertical and there are also a number of drift tunnels set into the face at various points. The tailing mounds are arranged so as to facilitate drainage into the Shoalhaven River, and in places run parallel to the face. The diggings are constricted in area suggesting that at the most only very short sluices would have been used, if at all. There is a very obvious footway at the base of the diggings leading to a small dam, suggesting that the dirt was conveyed to this site for washing.

Pipeclay 1

Pipeclay 1 is a ground sluicing site fed by a primary race system emanating from the Shoalhaven River and possibly Little Bombay Creek. The diggings are extensive and measure 300 metres across at their widest point and 350 metres across at their longest point (Fig. 13). The face of the diggings varies but it is in parts five metres high. Along the top perimeter of the diggings are numerous races and channels converging at sluicing points (site D). Water was run from the sluicing points down the face of the diggings, washing the excavated dirt into ground sluices or sluice boxes set between the tailing mounds. The site is characterised for the most part by gentle debris slopes at and near the sluicing points and tailing mounds (Type D) several metres high in places and of a considerable length (Fig. 14). There are no vertical stone packings in these diggings, the tailing mounds being Type D1. Type E workings are located along the west perimeter.

Proceeding down the east perimeter of the diggings is a low level embankment about 60 metres long situated very close to the face (site D). The embankment is a dam wall for retention of water prior to sluicing, this particular area perhaps being worked by low level hydraulicking or even elevating.

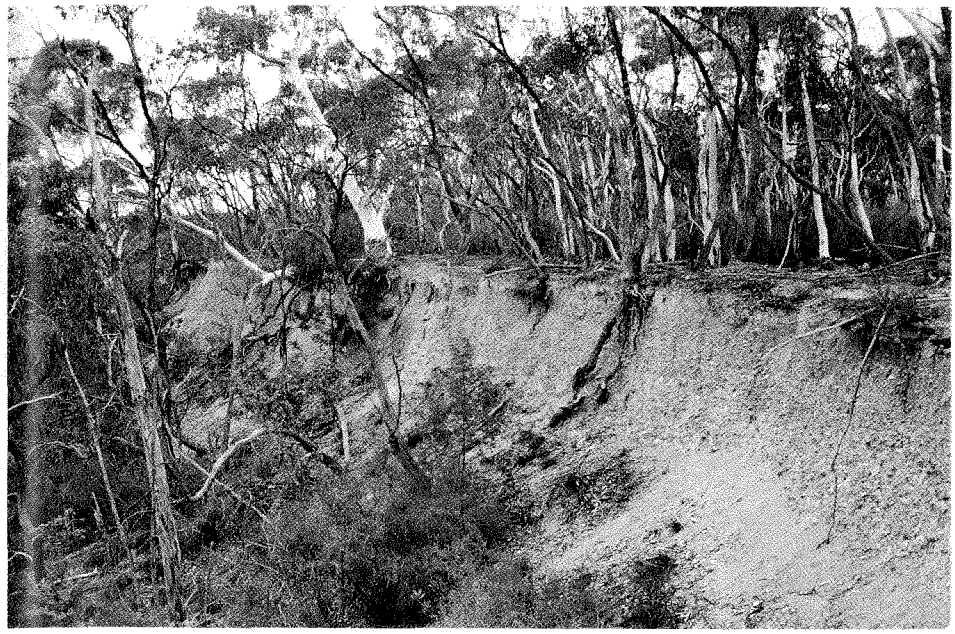

Fig. 14: Pipeclay 1, face of sluicings, gentle debris slopes.

HYDRAULIC SLUICING

Hydraulic sluicing was used primarily where the drift and overburden were too deep and often too poor to be worked by any other method. In essence hydraulic sluicing involved the removal of the auriferous drift by the use of water conveyed under pressure to a hose which would then be turned against the face of the workings, the aim being to wash the drift down to bedrock, and thence into sluice boxes. By this method much larger areas could be processed in much less time than would be the case with ground sluicing, which relied on manual labour.

A good description of hydraulic mining is contained in Averill's 1946 book. After the mine was opened up the gravel banks were undercut by the monitor, the gravel being reduced by the fall and further reduced by the monitor, which swept the disintegrated gravel towards the sluice boxes. Where the gravel was clay bound or contained lumps or streaks of clay it was washed back and forth across the pit bottom one or more times until free from the clay. A smaller diameter nozzle was used for cutting rather than for sweeping and sometimes separate monitors were used. Wing dams of timber, logs or boulders were built to guide the water and gravel into the head of the sluice. Where the size and grade of sluices permitted it all boulders that could be moved by the monitor were run through the boxes. At some operations boulders weighing three or four tons were put through the boxes. The final clean up of crevices in the bedrock was often done by using small flat hand tools. The practice of sending down whole rocks in the sluices, while breaking others with sledge hammers, was also referred to in Smyth's book.[15]

Along the Shoalhaven River hydraulic sluicing occurred on sites previously worked by ground sluicing and the resultant landscapes pose difficulties of interpretation. Both techniques have several features in common, for example water races, tail races, Type D and E workings. *Prima facie* the main differences would appear to be the overall extent and size of the workings, the height and structure of the face of the diggings and possibly the height of the tailing mounds.

The face of the workings was often very much higher than for ground sluicing, up to 20 to 30 metres, reflecting the need for a good height to allow for sufficient water pressure. As indicated by Idriess, however, the height of the face could vary substantially, depending on the nature of the wash, a lower height being associated with low pressure hosing, and not being all that much different from the height of the face on some ground sluicing claims. Similarly, while some hydraulic claims were of a very substantial size so were some ground sluicing claims. Conversely some hydraulic claims were not extensive in area, Idriess emphasising that putting together a hydraulic plant was not a big company operation but could be done with a minimal capital outlay.[16] Another possible distinguishing characteristic is the size and possibly the number of drainage culverts for disposal of the tailings, and the presence of reservoirs near the workings. Again care is needed, for these characteristics were not exclusive to hydraulic claims, large dams and drainage culverts being also a feature of ground sluicing claims.

Notwithstanding the above, a very tall face was clearly an attribute of hydraulic sluicing. In addition, the face was more vertical as well as being in some instances more irregular than in ground sluicing, this appearance arising from the practice of hosing the face from the bottom, areas of cemented drift resisting the force of water and giving rise to pinnacles, mesa tops and drift islands. Some of these characteristics have been referred to by Ritchie in his Type 9a and 9b.[17] By contrast, as we have seen with ground sluicing, the face was worked with water running over the top, giving rise to faces with gentle debris slopes near the sluicing points. With regard to tailing mounds there appears to be no set height, in most hydraulically sluiced areas there being less in the way of tailing mounds rather than more, with the main floor being often very clear of stones. Indeed, from Averill's description it is clear that an aim of hydraulic mining was to remove boulders rather than stack them. Together with the practice of sweeping the bedrock with the nozzles, these practices account for the often barren appearance of much of the floor of the hydraulic workings. While tailing mounds may be absent a related feature very much in evidence was the second or upper floor or bench, representing the earlier areas of ground sluicing.

One aspect that has only been partly resolved are the features associated with the use of suction pumps or elevators, this form of mining being referred to by Ritchie as hydraulic elevating.[18] A hydraulic elevator was used to raise gravel, sand and water out of diggings into sluice boxes, the elevator consisting of a pipe with a constricted throat and a jet which

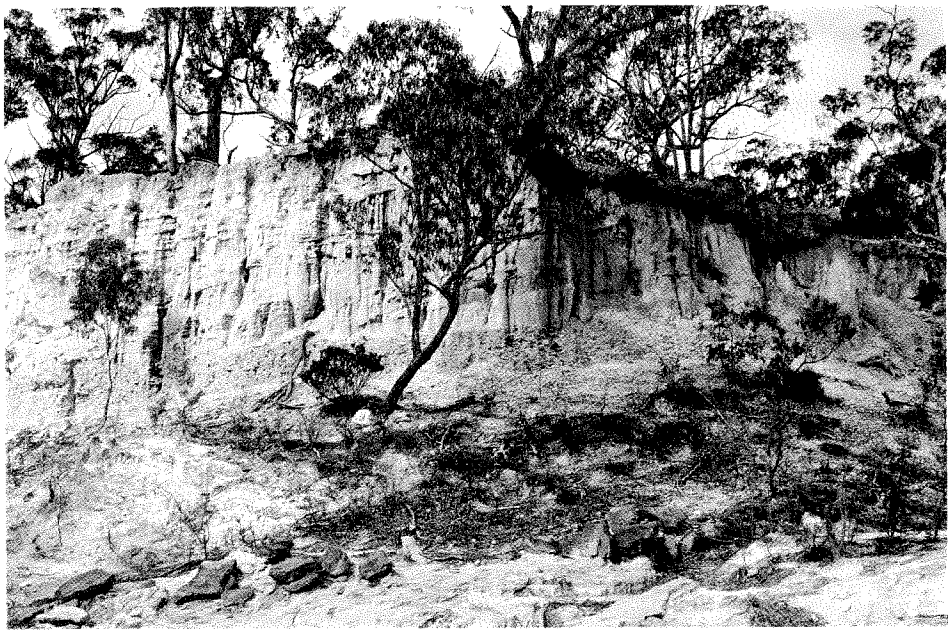

Fig. 16: Spa South, east face of sluicings.

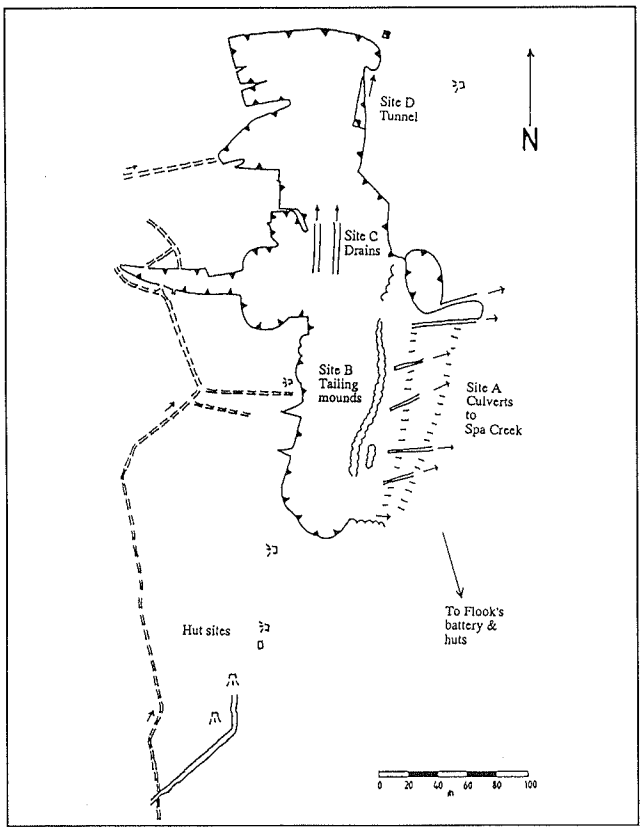

Fig. 15: Spa South, Spring Creek Jacqua.

provided a high velocity ascending column of water. A very useful account of this form of mining is included in Idriess' book.[19] The first step was to dig a paddock into which a hole was sunk with a race from the face leading into the hole. The tailings were washed into the hole from where they were blown up the elevator into the sluice boxes set on the face. We know that this technique was used in the Shoalhaven area in the early 1900s and Idriess' description suggests that the sump like sites at two of these locations would be consistent with this mode of operation. The appearance of these sites is also consistent with the description by Ritchie of '...deep holes, filled with water, surrounded by low rounded mounds of tailings', with the exception that no such tailing mounds have been located.[20] Too few clear examples of this technique were identified in the Shoalhaven area, however, to be confident about including these features in a typology.

DESCRIPTIONS OF HYDRAULIC SLUICING SITES

The examples below illustrate the relationship between typology and technique and ground and hydraulic sluicing.

Spa South (Spring Creek Jacqua)

Spa South is about 300 metres long and about 50 metres wide in places with at least two, possibly three levels, characterised at the southern end by tailing mounds (Type D1) and a series of seven narrow culverts (site A) cut through about 15 metres to 20 metres of natural hillside (Fig. 15, 16). The culverts drain into Spa Creek. Small rock walls were built around the entrance to each culvert to retain the water for washing prior to draining. The floor near the culverts is at least one to two metres above the lower floor (site C) and clearly relates to an earlier period of ground sluicing. The race system to the south west also relates to this earlier period.

The lower floor (site C) is drained by two culverts, both at different levels, and a 100 metre long two metre wide, two metre high tunnel site (site D) cut through a natural hill and ending in a waterfall into the Shoalhaven gorge some 600 metres below. The height of the face in this area is between 20 metres and 30 metres and the floor is completely clear of tailings.

Limekilns

Limekilns 2 comprises several separate areas of sluicing (Fig. 17, 18). Site A resembles a small gorge measuring 220 metres by between 30 metres to 70 metres. It is characterised by a face of up to 15 metres in places. The centre of the floor is clear of tailings, the mounds being confined to the sides of the gorge. Sites A and C are separated by a large dirt mound (site B) denoting two separate areas of working or claims. To the east of site A is another separate area of sluicings (Site E) measuring 40 metres by 70 metres with a face of

Fig. 18: Limekilns 2, sluiced gully looking towards Shoalhaven River.

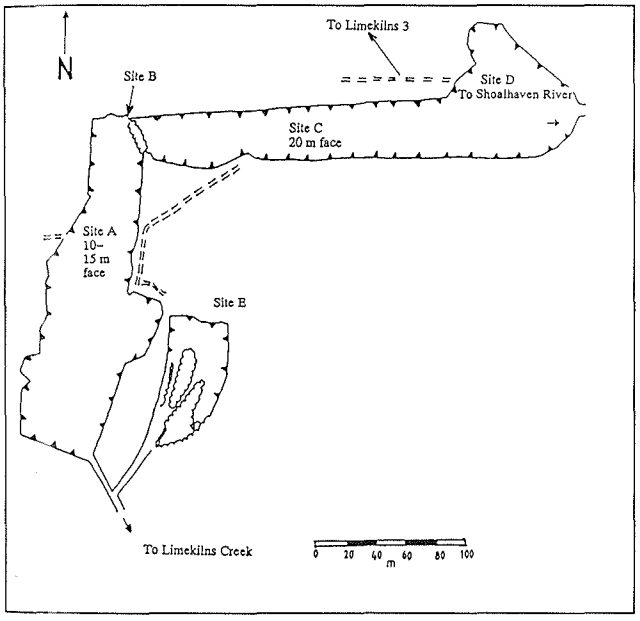

Fig. 17: Limekilns 2.

between 10 metres and 15 metres height. At the southern end of site E there is an area of tailing mounds (Type D1) which may relate to an earlier period of working, as the workings are shallow and more characteristic of ground sluicing.

Site C is very similar to site A, measuring 200 metres by 20 metres to 30 metres and with a face of up to 20 to 25 metres in height. The floor is relatively clear of tailing mounds. Site C adjoins a quarried area (site D) measuring about 90 metres by 80 metres, both sites draining into the Shoalhaven River through the same culvert.

Limekilns 3 includes at least four separate sites, the largest measuring 190 metres by between 70 metres and 90 metres (Fig. 19). On the south west perimeter the diggings have a face of at least 30 metres. The centre of the floor is clear of tailings and represents a large drainage channel, though there are tailing mounds to the sides of the floor and to the north of site A, the former clearly being a remnant bench from earlier ground sluicing operations (Fig. 20). Two culverts drain site A into the Shoalhaven River. Site B adjoins site A and is clearly a separate and possibly earlier area of shallow Type D1 workings representative of ground sluicing. Site C drains directly into the Shoalhaven River.

CONCLUSION

This is a neglected area of study, perhaps the sheer size of any detailed study having proved daunting in the past. However, this neglect is worthy of redress. By any measure alluvial sites are large, in the aggregate they are immense and they are of significance from an environmental and heritage viewpoint. For colonial Australia alluvial gold mining was the main game, transforming Australia, both economically and culturally. Probably the most significant evidence of the Chinese presence in Australia can be found in these alluvial fields, let alone any evidence from our European heritage.

An obvious conclusion from this paper is that any examination of alluvial workings requires a structured approach, particularly as many sites have been reworked over different periods and by different techniques and consequently contain a mix of techniques and typologies. It is of interest to note Ritchie's statement that while his study was regional in origins it 'may have wider application'.[21] This paper ends on a similar note, but perhaps with a more hopeful tone, for Ritchie's analysis is very clearly relevant for the Shoalhaven and Mongarlowe goldfields and elements of this paper are likely also to have wider application.

The typology discussed in this paper was developed to help in distinguishing between the various techniques, particularly where there has been superimposition, and in distinguishing Chinese from European mining. There are, however, a number of unresolved issues, some of which have been referred to above. One of these concerns the relevance of tailing mound patterns. Apart from our Type D2, is the pattern merely random and related to the morphology of the field or personal preference without any particular technological significance? Related to this is the challenge of including hydraulic elevating and centrifugal dredging in a typology and if possible distinguishing between box and ground sluicing. Finally, the applicability of a typology for alluvial gold mining to other forms of alluvial mining, for example tin, needs to be also addressed.

Fig. 20: Limekilns 3, west face of sluicings, remnant bench in foreground.

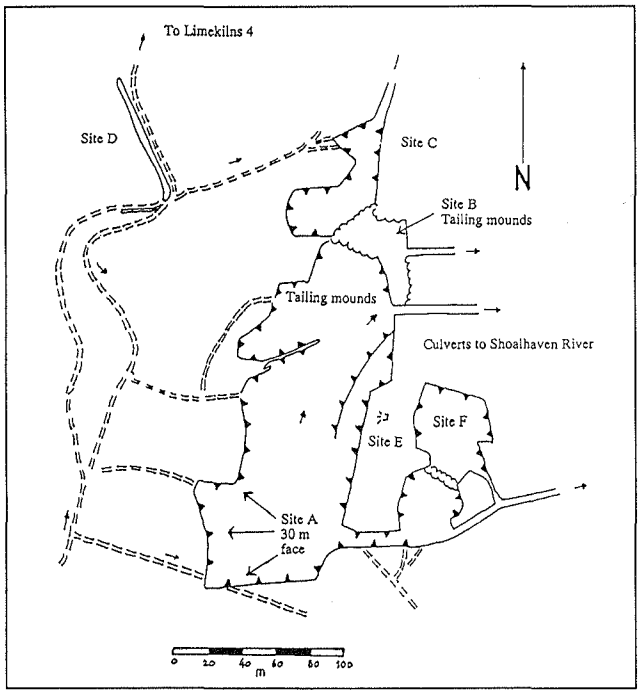

Fig. 19: Limekilns 3.

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NOTES

1 McGowan 1995:3–25; McGowan 1996:6–21.

2 Ritchie 1981:51–69.

3 Donovan and Associates 1994:172–175.

4 Ritchie 1981:62.

5 Ritchie 1981:62.

6 Ritchie 1981:66.

7 Vivian 1985: Plate 29; Ritchie 1981:78; McGowan 1995: Map folio.

8 McGowan 1996:143–201.

9 Ritchie 1981:68.

10 Ritchie 1981:55.

11 McGowan 1996:128.

12 Smyth 1869:127.

13 Smyth 1869:127–128.

14 Smyth 1979:138.

15 Averill 1946:108–115; Smyth 1869:138.

16 Idriess 1934:112–148.

17 Ritchie 1981:63.

18 Ritchie 1981:64.

19 Idriess 1934:149–154; also Averill 1946:106–108.

20 Ritchie 1981:64.

21 Ritchie 1981:64

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