

Excavations, Surveys and Heritage Management in Victoria

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Excavations, Surveys and Heritage Management in Victoria
Volume 4, 2015

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Front cover photograph

*David Clark and Jillian Garvey excavating a hearth in the late Holocene Murray River Midden,
January 2014 (photo by Anthony dall'Oste).*

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Editorial note

The papers included here were presented at the fourth Victorian Archaeology Colloquium held at La Trobe University in February 2015. As in previous years, we would like to thank all the participants whose attendance testifies to the importance of what has now become a fixture within the local archaeological calendar. It serves as an important opportunity for academics, consultants, managers and Aboriginal community groups to share their common interests in the archaeology and heritage of Victoria.

As in previous years, the papers presented at the Colloquium covered a wide range of research and community engagement involving both Aboriginal and European heritage. Many also demonstrate a variety of approaches and techniques typical of the interdisciplinary nature of archaeology.

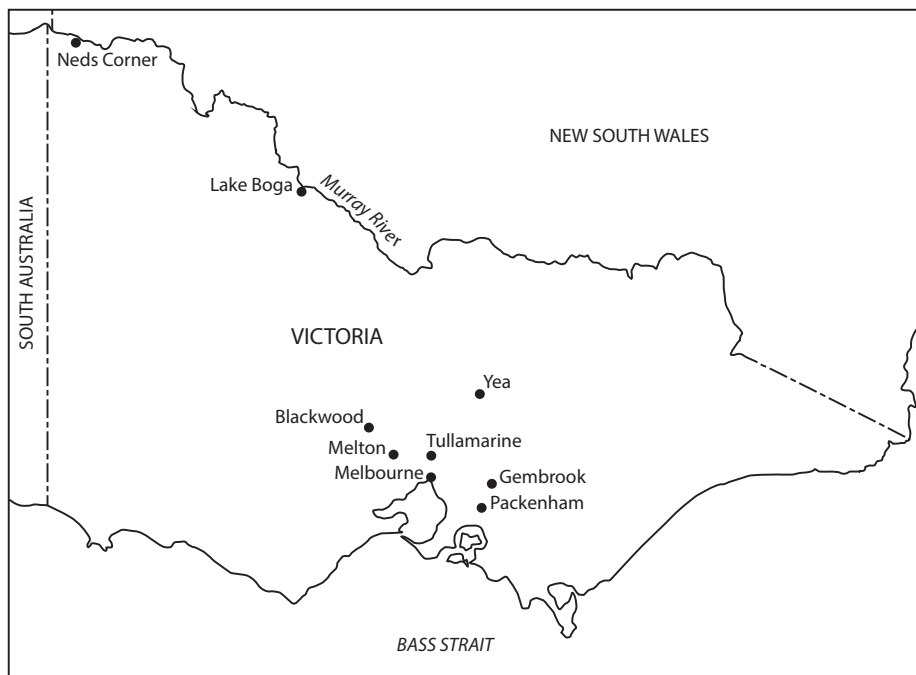
We are especially grateful to those who later were able to prepare their papers for publication. Others have allowed us to include a selection of slides taken from their PowerPoint presentations along with their abstracts. We hope that we will see at least some of these developed

into more complete studies in the future. The extended papers were refereed, and we would like to thank those who assisted with this task. Caroline Spry managed this process and much of the sub-editing of this volume. Layout, as in other years, was undertaken by David Frankel.

As with the previous volumes, the illustrations are all in black and white, although many would be clearer in their original colour. Anyone interested in having copies of these should contact the individual authors.

The 2015 Colloquium was generously supported by our Principal Sponsor, Archaeological and Heritage Management Solutions (AHMS), and other sponsors, including Ochre Imprints and Green Heritage, as well as Australian Cultural Heritage Management (ACHM), Biosis Pty Ltd and the Department of Archaeology and History at La Trobe University.

The editors and authors acknowledge the Traditional Owners of the land and heritage discussed in this book, and pay their respects to their Elders, past and present.



Investigations of a Holocene floodplain landscape on the Goulburn River valley at Yea: Preliminary results

Martin Lawler¹, Rodney Monk², Andy I.R. Herries³, Agathe Lisé-Pronovost³, Rhiannon Ashton¹, Trish Terry² and Ilya Berelov¹

Abstract

Over the past five years, investigations have been undertaken on a 30 ha section of the Goulburn River floodplain near Yea in central Victoria, in advance of a proposed gravel quarry extension. This part of the Goulburn River valley is a broad floodplain, 1 km across, with 200–300 mm of Holocene silts and clays overlying deeper Tertiary sands and gravels that infill the ancient river valley. The present river channel follows the northern rim of this broad floodplain, while to the south is a complex landscape of relict alluvial features that mark the successive migration of the Holocene river across the floodplain.

Investigations have revealed a complex of Aboriginal places occupying the former alluvial ridges of the floodplain. These offer a remarkably detailed picture of life in these former woodlands on the river floodplain. Unusually, the excavations have identified complexes of clay ball hearths or ovens, better known in other parts of the country but rarely found on pastoral farmlands in central Victoria. Typically, the hearths at Yea are found clustered along the edges of the alluvial silt ridges, close to the sources of wetland clay and stream pebbles used to create heat retainers for these hearths. As part of the ongoing investigations, a range of scientific analyses of the hearths will be undertaken, including archaeomagnetic analysis to look at heating history, palaeotemperature estimates and the recovery of palaeosecular variation data.

This paper presents the preliminary results of the archaeological investigations at Yea Quarry, as well as some of the results of the pilot archaeomagnetic analysis.

Setting

The Goulburn River, which is located to the west of Yea, is set within a broad alluvial floodplain over 1 km wide, which is framed to the north and south by a low bedrock spur that extends to the footslope or alluvial fill interface.

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This, in turn, is backed by rounded hills of eroding Humevale Siltstone which rise to a height of some 50 m above the floodplain. The river valley is deeply infilled with Tertiary gravels and sands to a depth of 30 m, and overlain by 200–300 mm of Holocene deposits (**Figure 1**).

The Holocene floodplain at this point is typical of the upper Goulburn River valley, with alluvial terracing and relict stream channels, oxbows and anabranch formations. Stream floors are often very gravelly, with quartz and sedimentary rounded pebbles.

Previously identified Aboriginal cultural heritage

This portion of the Goulburn floodplain lies within the traditional lands of the Taungurung people. Clark (1990:375) places the location of the *Waring-illam-baluk* clan in the upper Goulburn River and its southern sources, at the head of Muddy Creek, at Yea and Alexandra. Clark (1990) suggests that the Goulburn may have provided a shared resource for several clans who had lands in the surrounding hills and were able to gather in larger numbers at the river for social and spiritual purposes. The artist and naturalist John Cotton (1801–1849) documented the continuing presence of Taungurung people between 1843 and 1849 at Doogalook (or Muddy Creek) Station, some 4 km downstream from the present quarry (Billis and Kenyon 1930; Christie 1979:163). The Taungurung supplied Cotton with bark for the station; he described their encampments in detail and provided a particularly vivid account of a corroboree held there (Crombie 1927; Mackaness 1978:45).

Aboriginal scarred trees, particularly those made on river red gums, are a major part of the recorded Aboriginal cultural heritage on the Goulburn floodplain (Bird 1992). Surveys undertaken between 1996 and 2006 recorded 31 scarred trees on the floodplain within 10 km of the quarry, most of which were recorded during the Taungurung Community Investigation at Killingworth, 6 km to the northeast (Stellini 2005). A canoe scar on a river red gum (Homewood 1 Scarred Tree; VAHR 7923-0113) was recorded by Luebbers (2007) on the minor stream course of Island Creek, 150 m to west of the proposed extraction area. Luebbers also noted that a large number of mature river red gums in the area have

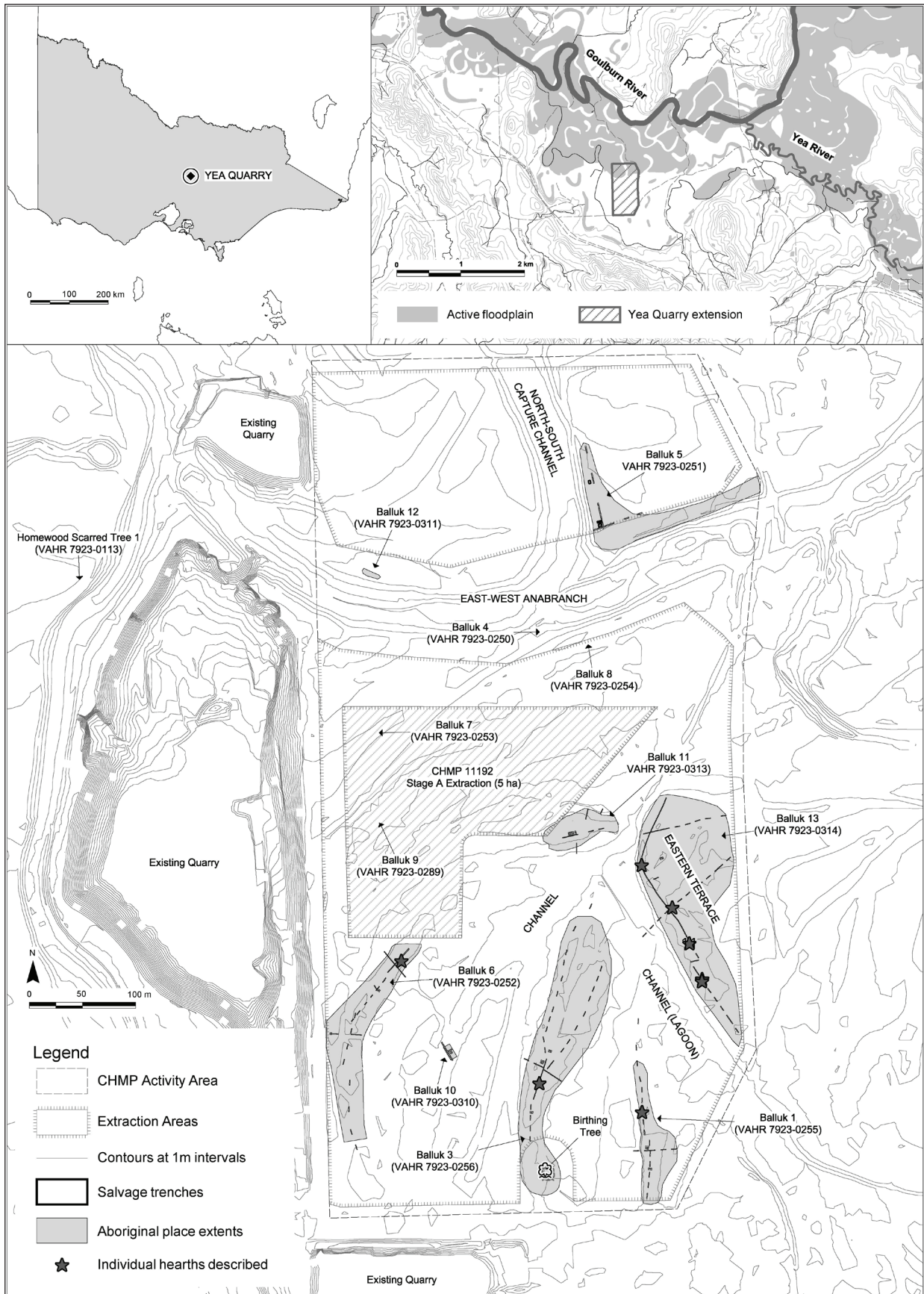


Figure 1: Yea Quarry Extension, location and site plan

been scarred repeatedly by fire.

In contrast, with few previous excavations, relatively little is known about Aboriginal places on the floodplain. A small number of surface artefacts were recorded during a survey at the Horseshoe Lagoon conservation reserve (Long 2006), and during survey and testing for the Sugarloaf Pipeline near Yea town (Costello et al. 2008). Artefacts recorded at the Horseshoe Lagoon included a flaked axe made on fine-grained black volcanic rock (also noted as river cobbles in the adjacent stream bed), and a deposit of flaked crystal quartz artefacts containing multidirectional cores and bipolar fragments. In his assessment of the Horseshoe Lagoon, Long (2006:4) commented that:

It is notable that previous assessments of the Goulburn River valley between Seymour and Yea have failed to identify significant artefact scatters or other archaeological deposits despite the apparent importance and resource diversity of this riverine corridor. Alluvial processes have probably obscured much of the past evidence for Aboriginal occupation of this floodplain landscape, and the prior assessment has been too limited in scope or methodological approach to detect such deposits.

Cultural Heritage Management Plan investigations 2010–2011

Extraction of the underlying sands and gravels from this portion of the Goulburn floodplain has been undertaken since the 1950s. Mountain View Quarry, to the west of Yea, was developed during the 1970s. The proponent, Barro Group, intends to extend the existing quarry to cover an adjoining area of 31 ha of floodplain pasture.

The area of the intended quarry extension forms an approximate rectangle, 760 m in length north-south by 400 m in width east-west. A range of well-preserved alluvial landforms survive across the study area, including ridge and swale on the southwestern side and a higher terrace to the southeast. These are separated by a former lagoon. The northern part of the study area is dissected by a former anabranch of the Goulburn River, with prominent levee banks on each side. A north-south capture channel extends to north of this. Both channels serve as seasonal ponds (Figure 1).

The pre-1750 mapping of this portion of the floodplain suggests a mixture of Floodplain Riparian Woodland (EVC 56) and Plains Grassy Woodland Mosaic (EVC 250; DSE 2015). Until drainage was undertaken in the 1950s, the proposed extraction area was a much wetter landscape than today, with alluvial ridges exposed above the lower-lying swampy pools for months at a time. The present farmer, James Hugh Homewood, recalled that his father, James Gordon Homewood, would use a boat to cross the former swampland when the Yea River had

backed up as a result of flooding along the Goulburn River, when water rising in the anabranch would subsequently inundate the lower swamp landform. Tiger Snakes were frequently sighted in the rushes and *cumbungi* reed (*Typha orientalis*) was also common within the activity area.

The planned extraction extension will leave the east-west anabranch corridor intact, with deep quarry pits to north and south of this area (Figure 1).

Investigations for a Cultural Heritage Management Plan (CHMP) for the proposed sand and gravel extraction were carried out during April–July in 2010 and October–November in 2011. The assessment resulted in two CHMPs being undertaken: CHMP 11192, for an initial 5 ha extraction area on the western side; and CHMP 11928, which covered the remaining 26.58 ha (Figure 1).

The subsurface investigations for the CHMP used a combination of 1x1m test pits, shovel probes and short (2 m long) machine transects. Investigation showed that Aboriginal cultural heritage was concentrated along the alluvial ridges and terraces, separated by lower-lying swales. In general, the most prominent rises produced proportionally greater numbers of artefacts, with most of these identified on landforms along the margins of the former lagoon in the southeastern part of the activity area, and from a prominent ridge further to the west. A total of 352 lithic artefacts were recorded at 12 Aboriginal places. Most of these were made on grey and red silcrete, with smaller proportions of white and crystal quartz artefacts, and a glossy, fine-grained rock similar to that recorded by Long at Horseshoe Lagoon (described variously as hornfels or tachylite), also present. Basalt and local siltstone was used to make grinding stones and a pebble axe.

The Birthing Tree (Balluk 3; VAHR 7923-0256)

Two of the surviving mature river red gums in the activity area showed cultural affinities. A small *coolamon*-sized scar was recorded towards the base of a dead tree in the southeastern part of the activity area (Balluk 1; VAHR 7923-0255), on the edge of the lagoon. More remarkably, an ancient but living tree with a burnt hollow was identified on the southwestern side of the lagoon, perched to one side of a narrow alluvial ridge (Balluk 3; VAHR 7923-0256). In early 2012, women from the Taungurung Clans Aboriginal Corporation (TCAC) inspected the tree at Balluk 3 and concluded that, based on traditional knowledge, the tree hollow would have been used as a birthing tree. In response to this, the TCAC has asked that the tree should be described as a birthing tree.

The weathered, burnt hollow takes up almost the entire base of this tree, with a void measuring 3.85 m by 2.09 m, and a height of approximately 1.8 m, leaving thin trunk walls only 50 mm thick in places. Excavations for the CHMP were carried out within the tree hollow

itself and surrounding the tree. Excavation of a 1x1 m test pit within the hollow revealed a succession of burnt clay and compacted clay silt horizons to a depth of 300 mm (**Figure 2**). Dating of the successive charcoal lenses provided radiocarbon age estimates of 770 ± 25 (725–590 cal BP; Wk-30818), 321 ± 63 BP (495–220 cal BP; Wk-30817) and 199 ± 32 BP (300–150 cal BP; Wk-30816).

No artefacts were recovered within the tree hollow itself, or immediately surrounding the tree, but further testing showed a distribution of red and grey silcrete items on the adjacent rise, 5 m to the west.

It was agreed between Barro Group and the TCAC that the birthing tree and surrounding land — which included part of the artefact distribution — would be excluded from extraction to a distance of 25 m radius. An additional buffer zone of 10 m will be reinstated following extraction.

In the late summer of 2014, a thin bark cladding was shed from the eastern side of the birthing tree to reveal a well-preserved scar, 2.05 m long and 0.52 m wide, which had been masked from view previously. **Figure 3** shows the eastern side of the tree in 2011 and in 2015, with its scar revealed.

Initial salvage excavations 2012

Salvage excavations commenced in 2012, initially for the smaller 5 ha area approved under CHMP 11192 (**Figure 1**). It was agreed that the salvage would be undertaken by machine excavation and machine sieving, unlike the CHMP investigation methodology which had used predominantly manual excavation in test pits and shovel probes. The 5 ha CHMP area, in the central-western part of the overall study area, had yielded little cultural material, in contrast to the larger distributions in the southeastern part of the study area. With this in mind, the agreed salvage areas for the initial CHMP salvage were limited in extent to a 5x3 m area for each of three Aboriginal places that would be impacted.

For two of the three salvage areas, the machine stripping and sieving largely confirmed the results of the testing, with small numbers of artefacts recovered of similar character to those identified during the testing. However, at the third Aboriginal place (i.e. the western portion of Balluk 11; VAHR 7923-0313), which lies on the edge of the former lagoon, it was apparent that the results of the manual testing had under-represented the archaeological deposits. Not only did the artefacts at Balluk 11 extend beyond the assessed extents indicated during the testing, but the spatial diversity of the assemblage was more complex than that previously assumed, with clusters of discrete knapping concentrations and areas of changing lithic artefact types identified. Most interestingly, two areas of burnt stone and burnt clay suggested the presence of plough-damaged hearths in the upper horizons.

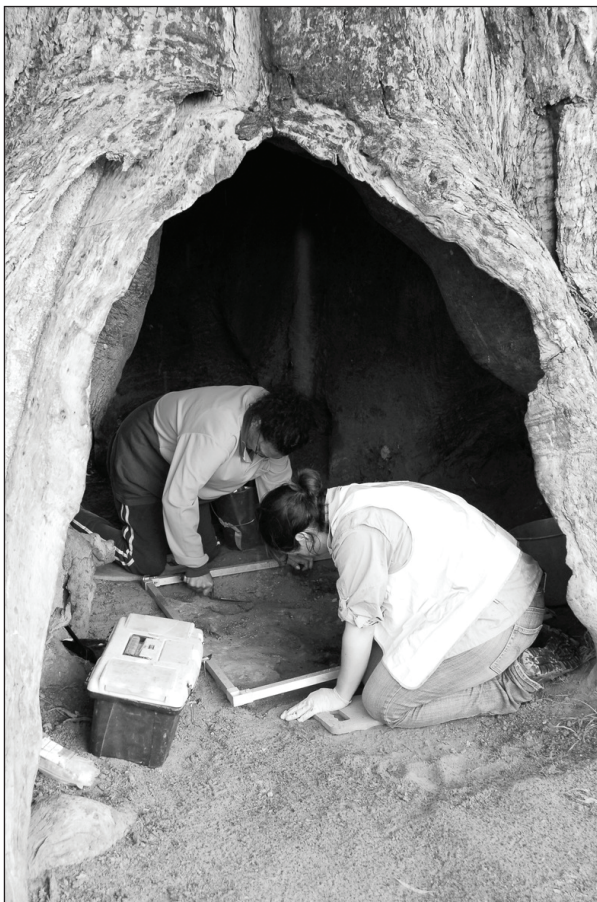


Figure 2: Excavation inside the Birthing Tree (Balluk 3, VAHR 7923-0256) in 2010 (photograph by M. Schlitz)



Figure 3: East side of the Birthing Tree in 2011 (left) and 2015 (right) showing scar revealed after shedding bark (photographs by M. Lawler)

Main salvage excavations 2013–2015

For the next stage of salvage, encompassing the greater artefact distributions in the remaining 26 ha of the study area, a salvage methodology was devised that was specifically tailored to the archaeological potential of the Aboriginal places. These would be investigated as large,

complex, stratified archaeological sites with varying activity concentrations. It had been shown that machine excavation and sieving could recover considerable data from the alluvial ridges when undertaken in controlled sections and spits. The TCAC also required that the full extents of the artefact distributions should be salvaged — that is, 100% of the artefacts from each Aboriginal place were to be recovered through machine sieving.

A three-stage salvage process was developed with the TCAC and sponsor and implemented under the recommendations for CHMP 11928.

Stage A: Axial transects

Machine transects were excavated across the length and width of each Aboriginal place. The axial transects were to be continual trenches, excavated and recorded by 1 m sections and in spits. Provision was made to break or stagger the continual transects where artefact densities were reduced. All of the material was machine-sieved, latterly using an hydraulically powered trommel sieve developed by Adam Deane (Archaeological Excavations Pty Ltd). Levels and magnetic susceptibility readings were taken in each 1 m section and for each spit. The transect soil profiles were recorded and sampled at intervals. Where dense artefact concentrations or other features were encountered, these were excavated manually. Where artefacts continued beyond the assessed extents of the Aboriginal places, the machine transects were continued until no further artefacts were found.

The objective of the axial transects was to provide, in effect, an extended 3D cross-section through the archaeological horizons over tens (or, as it turned out, hundreds) of metres across each Aboriginal place. The spatial diversity and character of each Aboriginal place was to be explored. The axial transects would capture the extents of varying artefact distributions across the alluvial ridges more accurately than would be possible using shovel probes. The axial transects would also define the optimum locations for the next stage of salvage — the Stage B area excavations.

Stage B: Area excavations

At the completion of the Stage A axial transects, a series of open-area excavations were undertaken within each Aboriginal place. The areas required for each Aboriginal place varied according to the overall size and complexity as indicated by the CHMP testing. It was intended, however, that the location and arrangement of open-area excavations at each Aboriginal place would be informed by the results of the Stage A axial transects. The resulting individual excavations ranged from 2x2 m to 4x4.5 m in area. Locations were selected based on the content and character of the axial transect results, with the greatest weight placed on the presence of hearths, quantity and diversity of lithic artefacts and evidence for stratified deposits.

The open-area excavations were designed to investigate selected locations in detail, encompassing a sufficiently large area in each case to examine the archaeological material present. The CHMP investigations had indicated that artefacts occurred at different depths within the uppermost 350–400 mm of clay silts, with even deeper deposits recorded on the prominent raised terrace to the east of the former lagoon. One of the key aims of the open-area excavations was to recover evidence for changing artefact character in the accreting alluvial sediments, and to identify stratified horizons within the soil profile at different locations across the alluvial ridges. For this reason, consistency of depth and excavation unit was considered to be the prime control for the open-area excavations.

The excavation of the open areas was intended to be undertaken manually, in 1x1 m squares and 50 mm spits. Levels and magnetic susceptibility readings were taken at each 1 m vertex for each spit. Co-ordinates of individual artefacts were not recorded, as it was recognised that the value of these is reduced when much of the assemblage is recovered during sieving. Except where specific features were excavated, the smallest excavation unit was 1x1 m and 50 mm in depth.

In practice, it was found that manual excavation and sieving of the compacted alluvial sediments could be undertaken by machine excavation and machine sieving of the same areas without much loss of data. By agreement with the TCAC, therefore, machine excavation of the open areas was substituted during the first excavation season. The greatest increase in efficiency was during the sieving process. Hand sieving of each unit was replaced by machine sieving. Excavation and sieving of the open areas was undertaken in 1x1 m squares and 50 mm spits, as intended, but using a combination of machine and manual excavation. (The deeper the spits, the more excavation was required by hand. Below a depth of 500 mm, the machine excavator bucket was used mostly as a skip for the manual excavation.)

At the suggestion of the TCAC, an additional range of deep machine trenches were excavated to explore the interface between the base of the archaeological horizons and the deeper alluvial sediments. At each Aboriginal place, a deep trench was excavated to depths of 2.5 m to record the full depth of the Holocene stratigraphy above the Tertiary gravels. These deep trenches were positioned close to the open-area trenches to allow the alluvial profiles to be correlated.

Stage C: Artefact recovery program

Currently, at the completion of the open-area excavations at each Aboriginal place, the soil horizons are being machine-stripped and stockpiled for eventual machine sieving by the TCAC to recover any Aboriginal cultural heritage. The areas for machine sieving are based on the assessed Aboriginal place extents informed by the

Stage A axial transects, and developed in consultation with the TCAC. Machine stripping of the soils from each Aboriginal place is being undertaken by the quarry company using a large 40 tonne excavator. This process is being monitored by TCAC representatives and an archaeologist. The initial stripping of the upper 150 mm of topsoil allows the underlying surface to be inspected and recorded before further excavation is carried out. Provision is made for manual salvage of archaeological deposits where these are identified.

Preliminary results of the salvage excavations

By February 2015, after four fieldwork seasons, all of the Stage A and most of the Stage B components of the Yea salvage had been completed. Just over 1 km of axial transects and 14 open-area excavations totalling 115 m² have been undertaken. The soil stripping for Stage C is complete for four of the seven Aboriginal places being salvaged. Stockpiles of the machine-stripped soils have been created for eventual sieving by the TCAC. Artefact analyses are underway, with some further fieldwork expected to be completed during the spring of 2015.

The results of stages A and B of the salvage program have augmented the information derived from the original CHMP assessments greatly. Even within the confines of a machine transect, the internal spatial patterning of each Aboriginal place is striking: areas characterised by stone knapping are interspersed with lower density artefact regions and sections containing greater proportions of tools and utilised flakes. The separation of horizons by accreting silts has provided some vertical resolution, showing different types of artefact distributions at different levels. Monitoring of the soil stripping across each Aboriginal place during Stage C will expand this linear information, allowing exposed artefact concentrations to be recorded after the removal of topsoil.

Aboriginal place extents, mapped initially on the basis of shovel probe and test pit data in relation to landforms, have been reassessed using the axial transects with significant results. In general, it must be concluded that shovel probes or test pits do not provide accurate boundaries for extensive artefact distributions, particularly where these comprise clusters of varying densities. For each of the seven Aboriginal places examined during the salvage, landforms were shown to be a more reliable indicator of an Aboriginal place's extent than shovel probe and test pit results. As an example, Balluk 6 (VAHR 7923-0256) was found to extend 180 m beyond its original assessed extent. At other locations, the model of artefact distribution based on shovel probe and test pit data agreed better with the axial transect results, but the Aboriginal place extent nonetheless required landform and contour information for definition.

Hearths and ovens

Among the most intriguing discoveries of the salvage project are a number of hearth features, including several clay-ball ovens. While flecks of burnt clay had been recorded in test pits and shovel probes, the manual testing for the two CHMPs in 2010–2011 had not provided clear evidence for hearths. In 2012, however, the first open-area salvage excavations uncovered areas large enough to reveal clusters of burnt clay and stone in the ploughsoil, flagging the potential for buried hearth features. The axial machine transects undertaken during the main salvage excavations from November 2013 showed that scatters of burnt clay and stone were very frequent on parts of the alluvial ridges. Indeed, these are as extensive and varied a component of the archaeological assemblage as the lithic artefacts themselves.

Discrete pockets of burnt orange-red clay balls, sometimes with burnt stone, were frequently encountered in the axial transects; the excavator driver became something of an expert in detecting these features on first scraping. Most hearth features on the Yea floodplain ridges occur in plough-damaged contexts within the upper 200 mm of sediment, but the appearance of dispersed clay fragments in the ploughsoil spits sometimes masked a lower horizon in which the base of the structure was better preserved.

Three types of hearth feature have been recognised at Yea, comprising:

- Dispersed spreads of clay fragments, sometimes with burnt quartz or siltstone, often found in plough-damaged contexts;
- Bowl-shaped ovens, filled with clay balls, preserved below the depth of plough impact; and
- Smaller, enigmatic clusters of burnt stone with clay balls, which may be plough-damaged remnants of larger features.

Hearth features were most frequently detected along the margins of the alluvial ridges, within 25 m of the edges of the lower-lying swales, along the anabranch channel in the northern part of the activity area, and the former lagoon to the southeast. Hearths at Yea are generally dispersed, and usually appear quite isolated (i.e. rarely within 10 m of each other). **Figure 4** shows two hearth features that lie adjacent to one another, though in different horizons.

Two bowl-shaped ovens have been uncovered, at Balluk 6 (VAHR 7923-0252) and Balluk 13 (VAHR 7923-0314). These are roughly circular, dish-shaped cut features, approximately 800 mm across and 150 mm deep, packed with clay heat retainers. Surprisingly little charcoal has been found associated with these. At Balluk 13, a thin scatter of burnt clay was detected to one side of the oven, which may be evidence for hearth management or cooking processes. In the case of the Balluk 6 oven, a channel, 180 mm across, had been scooped through

the heat retainers on the northeastern part of the oven, with dislodged clay balls extending beyond the rim of the oven on that side (**Figure 5; Figure 6**).

A third concentration of packed clay balls was found at Balluk 3 (VAHR 7923-0256). This feature is assumed to be another oven. It is linear or subrectangular in shape, and is 800 mm long and 450 mm wide. As with the bowl-shaped ovens at Balluk 6 and Balluk 11, this example has a small scatter of dispersed clay balls to one side, but is otherwise isolated (**Figure 7**).

The processes of constructing and using these ovens are still uncertain. Were the heat retainers laid as raw clay balls in the bowl oven and fired in situ, or were they introduced to the oven already fired? The absence of much charcoal suggests that the clay balls were removed after initial firing and replaced (along with the food) after the ashes were cleaned out. Some of the amorphous spreads of fired clay balls may be raked-out deposits from firings of this type.

Recognisable hearth or oven features comprise a small proportion of the burnt clay deposits detected in the axial machine transects across the alluvial ridges. In each case, careful manual investigation was required to distinguish between burnt root or stump deposits and potential hearth material. Burnt stone — particularly burnt quartz pebbles — was found at fewer locations than the larger proportion of clay heat retainers. River-washed pebbles of mixed lithology are very frequent along the active river channels on the Yea floodplain, but rarely occur in the accreting silts of the backswamps. At times, therefore, there appears to have been access to high-energy stream or river channels within practical carrying distance of the Aboriginal places identified. The specific locations and depths of burnt stone within the alluvial profile may indicate changing environmental circumstances. One concentration of burnt quartz deposits lies along the levee bank on the eastern side of the anabranch at Balluk 5 (VAHR 7923-0251; see **Figure 1**). However,

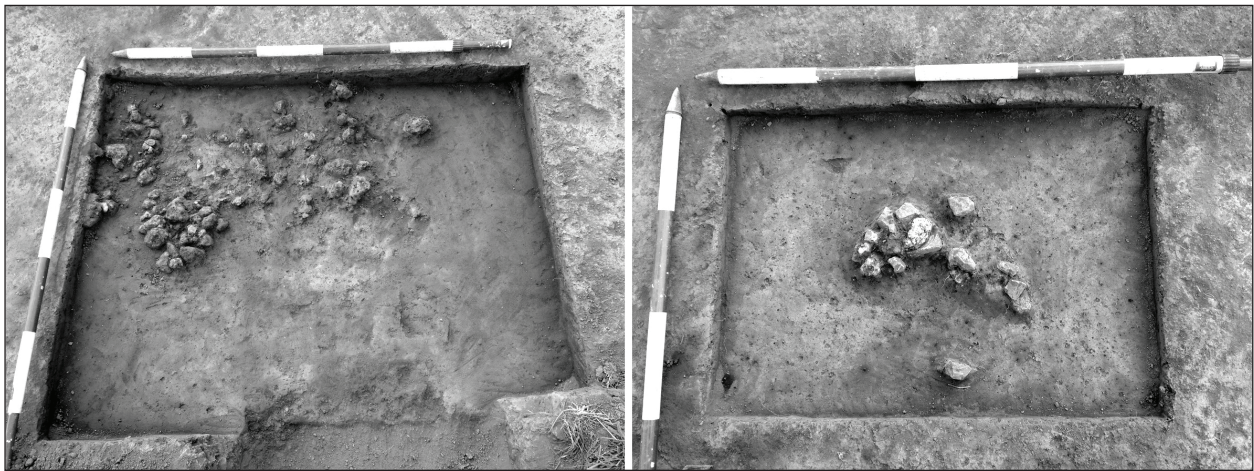


Figure 4: Adjacent hearths at Balluk 13 (VAHR 7923-0314). Feature on left has clay heat retainers, with a scorched silt base. Feature on right has clay, burnt siltstone and quartz, and may be a plough-damaged hearth (photographs by M. Lawler)

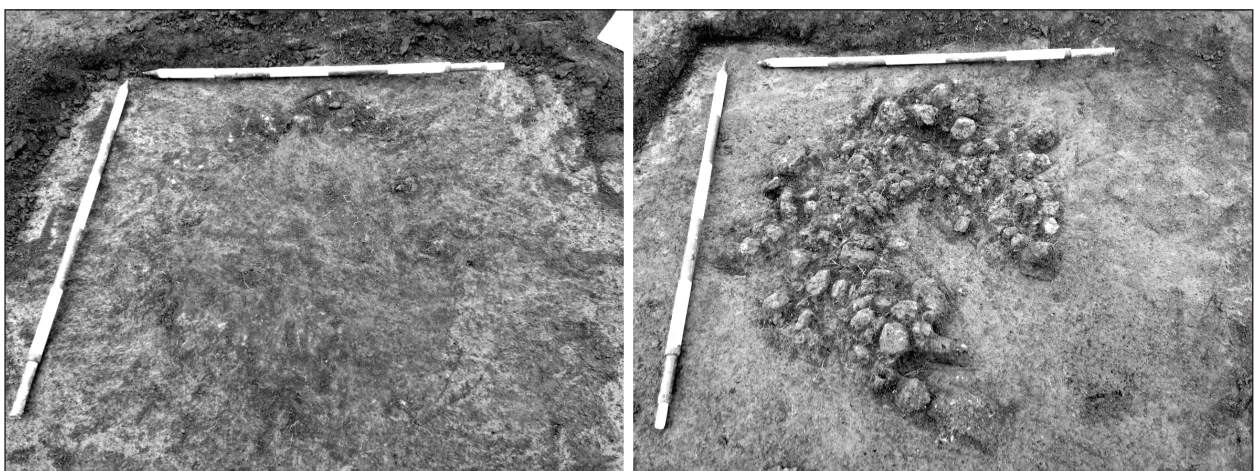


Figure 5: Bowl oven at Balluk 6 (VAHR 7923-0252), showing feature before (left) and after exposure of clay heat retainers (right). Notice the scooped-out channel and displaced clay balls to lower right (photographs by M. Lawler)

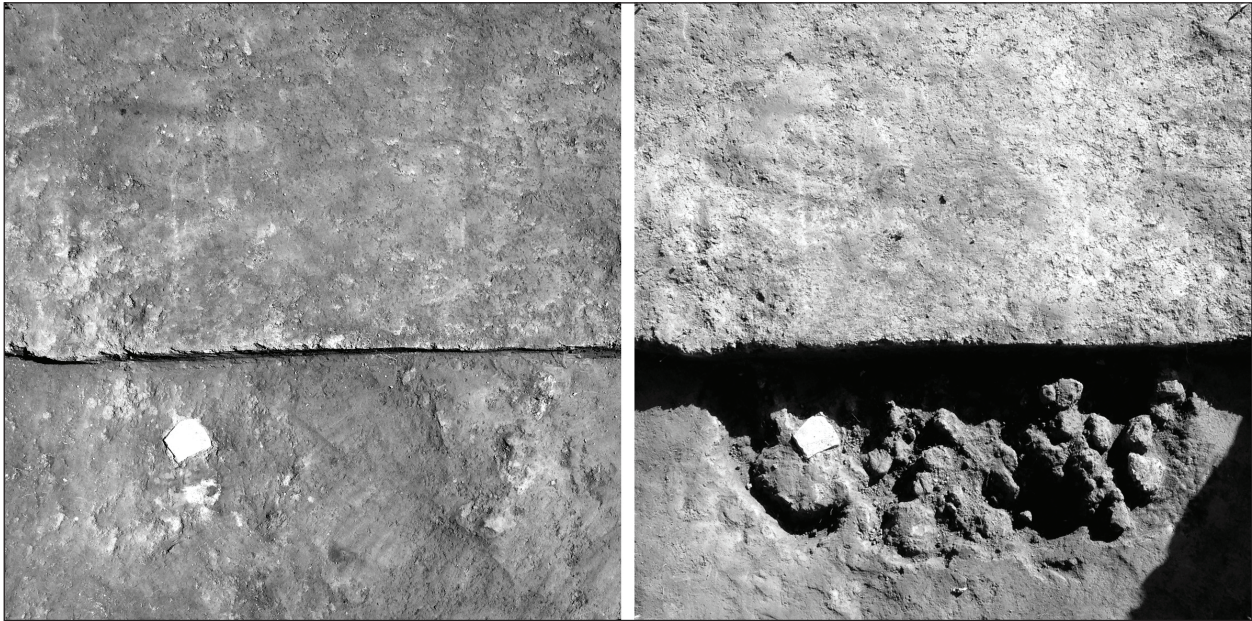


Figure 6: Bowl oven at Balluk 13 (VAHR 7923-0314). Ortho-rectified 1x1m view, showing feature before (left) and after half-section exposure (right). The bright, reflective item on the lower left is a tabular fragment of siltstone (photographs by M. Lawler)

the sparseness and limited range of artefacts along this levee suggests that the capture channel of the anabranch was a fairly short-lived feature. Deposits of burnt quartz and other stone were also found with quantities of burnt clay along the eastern side of the former lagoon. Trial excavation through the lagoon deposits shows that these are principally deep mottled clays, but it is possible that an active stream course has crossed the lagoon at some stage. The discovery of hearth and oven deposits based largely or entirely on clay retainers suggests that access to stream bed pebbles may have been sporadic, or that clay was a preferred heat retainer material for some purposes or at certain times.

Scientific investigation of the ovens and hearths

The next stage of fieldwork at Yea will include formal archaeological investigations of the ovens and hearths. This will be undertaken in partnership with Assoc.



Figure 7: Hearth at Balluk 3 (VAHR 7923-0256), using clay heat retainers (photograph by M. Lawler)

Prof. Andy Herries (The Australian Archaeomagnetism Laboratory (TAAL), Department of Archaeology and History, La Trobe University). A draft research design for the investigations has been submitted to the TCAC.

The proposed methods of investigation are summarised below.

AMS radiocarbon dating

The hearths and ovens will provide the focus for AMS radiocarbon dating. The objective will be to examine the span and concentration of human activity across this part of the Holocene floodplain.

3D scanning of in situ hearths and ovens

The in situ hearths and ovens will be recorded using an Artec Spider 3D scanner. This scanner, developed for high-quality CAD and medical imagery, can produce a full-colour render of a scanned feature with 0.1 mm accuracy, enabling photorealistic 3D-printed models to be generated for display purposes.

The 3D scanning will be conducted with the assistance of Dr Justin Adams (Monash University). Copies of these scans will be provided to the TCAC and retained by TAAL at La Trobe University. The aim is to generate 3D scans of all hearth and oven features, and to lift and remove as many of these features as possible in intact form. Some features may be consolidated to be retained by the TCAC for display purposes. Other features may be dismantled and analysed under laboratory conditions. In all cases, the Traditional Owners will be involved in decisions surrounding the study, conservation, display and custody of the hearths and ovens, and any sampled material will be returned to the TCAC upon request.

Thin-sectioning of clay heat retainers

Thin-sectioning of clay heat retainers will investigate their composition and the potential addition of tempering agents, such as sand or grass. If organic remains are identified, these will be examined for the preservation of pollen and phytoliths. Thin sections will also be used to look at the microstructure of the clay, and to see whether structures exist that indicate the clay composition and nature of its manufacture.

X-ray fluorescence

A hand-held pXRF meter will be used to characterise the mineralogy of the clay. This can be used to determine if the different hearth features used a similar clay source. It may also be possible to relate the clay to nearby sources such as the former lagoon deposits.

Archaeomagnetic analysis

A mixture of archaeomagnetic methods will be undertaken to retrieve the greatest range of data from the hearth samples (Brown et al. 2009; Herries 2009; Herries et al. 2007, 2008). Mineral magnetic analysis may also indicate differences in clay/sediment sourcing.

By looking at variations in the magnetic minerals in the sediments, archaeomagnetic analysis of the heat retainers will determine if they are still in the position in which they were fired by comparing the fossil direction of magnetisation between different heat retainers in the same structure. In many cases after firing, the new thermomagnetic remanence (TRM) does not completely overprint the ancient geological remanence in the rock, but only partly magnetises it, producing a partial TRM (pTRM). This can be used to estimate the ancient temperature of heating that a heat retainer has experienced (Brown et al. 2009; Herries 2009). Sometimes more than one secondary pTRM can be identified, and this can be used to understand the complex thermal and use history that a heat retainer or rock has experienced, including multiple heatings by re-use of the same feature, or by looking at how the heat retainer was moved between or post-heating.

The heat retainers will also record the ancient direction and intensity of the Earth's magnetic field at the time they cooled (Herries et al. 2007, 2008). Palaeodirectional and palaeointensity data will be recovered from the clay balls and in tandem with radiocarbon dating used to create some of the first data on the Southeastern Australian Archaeomagnetic Reference Curve (SEAARC), an archaeomagnetic dating curve being created by The Australian Archaeomagnetism Laboratory at La Trobe University. Once the SEAARC is established, it will provide an alternative dating method for heated archaeological material in southeastern Australia. While the hearths will not be dated using the archaeomagnetic work at Yea, variations in palaeodirectional and palaeointensity data may potentially show whether the

different fireplaces were all used during the same period, as they should record the same field directions if this were the case. This will be useful if radiocarbon dating is unsuccessful for certain features.

Preliminary alternating field and thermal demagnetisations of clay balls from the Balluk 6 oven (VAHR 7923-0252) show a strong, stable, single component of magnetisation that is ideal for archaeomagnetic analysis and the recovery of data for the SEAARC (Figure 8). The preliminary results are based on four samples, and suggest that the oven was only used once given each sample has only one component of magnetisation recorded.

Conclusions

Five years of investigation into a small section of the Goulburn River floodplain west of Yea have greatly enhanced our understanding of Aboriginal occupation on these former wetlands. From the frustratingly poor record of Aboriginal places that Andrew Long described in 2006, we now have evidence for extensive Holocene use of the alluvial ridges, interspersed between backwater swamps and channels. The artefact distributions of imported silcretes and local river lithologies show distinct spatial patterning, with potential evidence for specific activity areas along the wetland margins. Stratified assemblages such as these may provide the best archaeological record. The discovery of dateable buried hearths and ovens within the accreting alluvial sediments offers further technological and cultural insights into the lives of the people who lived here. All of this is overlooked by the ancient, living birthing tree. This is a remarkable cultural landscape.

Comparison between the results of the initial CHMP investigations and those of the salvage excavations also prompts some examination of the way that we use the empirical testing data for these places. Subsurface testing for a CHMP has a specific purpose in identifying and evaluating Aboriginal places. It must be recognised, however, that the conventional processes used in CHMP investigations in Victoria may under-represent the archaeological and cultural heritage potential of that place. We should recognise this inherent limitation in our assessment. The Victorian Aboriginal heritage legislation (with the best of intentions) prompts all of us involved in the CHMP process to place greater certainty on the available evidence than pragmatic caution would allow. We report determination of the precise boundaries of diffuse buried artefact distributions to submetre accuracy using testing data that would not support that degree of confidence on any methodological or statistical grounds. There is a need for a more realistic appraisal of the archaeological data that we gather, and a recognition of its limitations. Equally we should acknowledge that the Aboriginal places themselves may be more complex

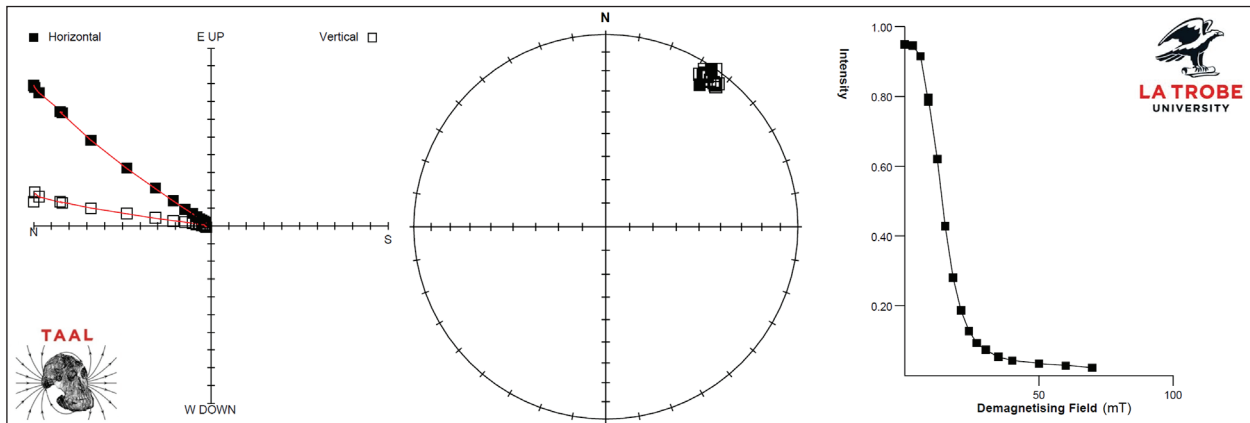


Figure 8: Alternating field demagnetisation data for an unoriented clay heat retainer from the Balluk 6 oven at Yea. The sample shows a strong tightly clustered single component of magnetisation recorded by the strong, low coercivity mineral magnetite

than the investigations indicate. This recognition of inherent limitations may not be assimilated easily into an approvals process that requires unequivocal certainty. It is, nonetheless, a pathway that may allow a better understanding of the cultural heritage before us, and a better approach to its management.

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