

Excavations, Surveys and Heritage Management in Victoria

Volume 14

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Front cover:
Darren Griffin, Dyurrite

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Editorial note

The 14th Colloquium was even more successful than earlier ones with some 387 people meeting at La Trobe University on 7 February 2025. In addition another 173 registered to watch sessions on-line. We were pleased to have a Welcome to Country by Wurundjeri Elder Perry Wandin and a Conference opening/Welcome to La Trobe University by Emeritus Professor David Frankel.

For more than a dozen years the Colloquium has been invaluable for developing a sense of community amongst archaeologists, consultants, academics, government agencies, and Traditional Custodians. The continuation of hybrid events has ensured that access and participation continue to be possible across a diverse range of groups and locations. This diversity was again reflected in the wide range of topics and approaches addressed in the 24 papers presented in 2025. We are grateful to Bek Kurpiel for managing the online component of the process and to the volunteers who contributed to the smooth running of the Colloquium.

This year is marked by two historic events for First Peoples in Victoria: the conclusion of the Yoorrook Justice Commission and the commencement of Statewide Treaty. The Commission, led by First Peoples, was the first formal truth-telling inquiry into historical and ongoing injustices against First Peoples. The recommendations of the Commission are far-reaching across diverse areas. For cultural heritage management, recommendations include increasing self-determination for Registered Aboriginal Parties; autonomy for the Victorian Aboriginal Heritage Council; recognition, protection and conservation of Aboriginal cultural heritage (both tangible and intangible); and funding research and strategic mapping of Aboriginal cultural values and landscapes. Treaty establishes the First Peoples' Assembly as a permanent representative body to provide advice to government under a new statutory corporation called Gellung Warl. Gellung Warl will also include a truth-telling body (Nyerna Yoorrook Telkuna) and an accountability body (Nginma Ngainga Wara) that will ensure the government upholds its commitments to Closing the Gap. The Victorian government is currently

working through the Commission recommendations and what Treaty will mean for Victorians.

The Victorian Department of Premier and Cabinet is currently reviewing cultural heritage management processes and policies. Possible developments include new Cultural Heritage Management Plan guidelines, increased funding for the Certificate IV in Aboriginal Cultural Heritage Management, and funding for an additional three to five Registered Aboriginal Parties to undertake a Strategic Aboriginal Heritage Assessment (SAHA) (cultural mapping) – following the completion of the SAHA pilot program by Wurundjeri, Djaara and Gunditj Miirring.

This issue of *Excavations, Surveys and Heritage Management in Victoria* again provides an opportunity for participants in the Colloquium to publish their presentations. It includes seven more developed papers along with 15 abstracts of other papers given at the Colloquium, illustrated by a selection of the slides taken from the participants' PowerPoint presentations. We hope that many of these will also form the basis of more complete studies in the future.

All papers were refereed by the editorial team. This year Deb Kelly managed this process and the sub-editing of this volume. Layout was again undertaken by David Frankel.

Previous volumes of *Excavations, Surveys and Heritage Management in Victoria* are freely available through OPAL:

<<https://opal.latrobe.edu.au/rch?q=Excavations%2C+Surveys+and+Heritage+Management+in+Victoria>>

We are – as always – grateful to the Colloquium's major sponsors: ArchLink; Biosis, Heritage Insight, Jem Archaeology, Ochre Imprints; sponsors: Andrew Long and Associates, AACAI, Australian Cultural Heritage Management, Dr Vincent Clark Archaeology and Heritage, EMM, Extent, GML Heritage, Matrix and La Trobe University. We would like to thank them and all others involved for their generous contributions towards hosting the event and preparing this publication.

We note with sadness the passing of the late Darren Griffin. A session of the Victorian Archaeology Colloquium was dedicated in his honour. This session

included papers by those who worked with Darren over the years in private consultancy and at Registered Aboriginal Parties. We share our condolences with Darren's family, friends and work colleagues. Darren will be greatly missed.

The editors and authors acknowledge the Traditional Custodians of the lands and heritage discussed at the Colloquium and in this volume, and pay their respects to their Elders, past and present.

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Deb Kelly
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Analytical methods in shell midden analysis: discussing best-practice in modern archaeological methodology

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Abstract

Shell middens are places of spiritual, cultural, and archaeological importance, and are regularly recorded along our coastline and inland waterways. Traditionally, shell midden analyses focus on methods that are time-efficient but data-poor due to a combination of time pressure and large volumes of material. This typically results in only base-level information such as shell weights and higher-level taxon identification, meaning we often miss out on important details that middens can provide about how people were living on Country, and the important role of shellfish for First Peoples.

This paper will discuss and argue for the use of improved methods in the analysis of shell middens, including the Non-Repetitive Element (NRE) protocol for shell quantification, which will increase the accuracy of Minimum Number of Individuals (MNI) counts. Furthermore, the inclusion of palaeoenvironmental reconstruction methods (using proxies such as pollen, phytoliths, charcoal, and macrobotanicals) and geochemical analyses (such as sclerochronology) when analysing shell middens helps to formulate a stronger picture of the past environment, landscape history, and seasonality. Two new up-and-coming techniques are also discussed; thermo-microstratigraphic analysis, which can identify methods of cooking, and shell palaeoproteomics, which can identify mollusc species from their protein signatures.

Introduction

Shell middens are commonly found along coastal shorelines and inland waterways across what is now known as Victoria. These landscapes contain a vast number of Aboriginal shell middens, defined as accumulations of shell formed through cultural activities (Bowdler 2006; Claassen 1998; Waselkov

1987). The locations of these middens and their surrounding areas represent modified cultural landscapes, shaped and enhanced over time by the regular and adaptive presence of people on Country.

Each midden holds an important and irreplaceable record of people's lives along coasts, rivers, estuaries, and lakes. Despite the significant insights they offer into how people lived on Country—and their potential to reveal past environmental conditions—many shell middens are often analysed with efficiency as the primary goal, rather than with an emphasis on comprehensive data collection.

This paper will discuss current methodological innovations in archaeological and scientific analyses of shell midden material that can help generate information about people's activities on Country, and environmental conditions and the health of Country from deep time until present. By utilising these methodologies, we can improve the quality of analysis and provide much better information about the rich cultural heritage of our coastlines and inland waterways, which can help to reset, heal and care for Country.

In Victoria, there has been extensive research undertaken on many Aboriginal middens in the last 50 years. This includes (but is not limited to) studies at Moonlight Head on Gadubanud Country (Frankel 1998, 1991), Glen Aire II on Gulidjan and Gadubanud Country (Fullegar 2011, Mulvaney 1962), Clinton Rocks, Point Hicks (Coutts & Witter 1977), and Nooramunga (Rogers et al. 2025) on Gunaikurnai Country, Discovery Bay (Godfrey 1984), Cape Duquesne (Richards 2012), and Cape Bridgewater (Lourandos 1983, 1997) on Gunditjmarra Country. On Bunurong Country, there have been substantial archaeological surveys on the Mornington Peninsula (Sullivan 1981), and excavations at Stinker Bay (Gaughwin & Brennan 1986), Western Port Bay (Gaughwin and Sullivan 1984), Phillip Island (Gaughwin and Sullivan 1984), and Seal Point (Bowdler and Lourandos 1982, Lourandos 1980, 1983). Riverine middens along the Murray have also been investigated at Neds Corner (Garvey 2017, Prendergast et al. 2009) and in Yanga Nowie (Murray Sunset National Park) (Garvey 2017) on Ngintait, Latji Latji, and Nyeri Nyeri Country. Please refer to Hall and McNiven (1999) for further examples of Australian coastal archaeology.

There have also been a number of commercial

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projects that have involved Victorian middens; however, confidentiality prevents specific reference here. Increasingly, we are “racing a rising tide” (Erlandson et al. 2008) to preserve information about sites along the coastline before they are lost, be it either from environmental influences such as sea level rise and erosion, or from human impact such as foot traffic, damage from vehicles, and civic and utility services infrastructure construction. Therefore, our professional responsibility should require us to complete our work to the highest standard possible by employing the most comprehensive and data-rich methodologies.

It is important to acknowledge that there are significant time pressures placed on many working archaeologists, and it is unrealistic to expect busy professionals to be completely familiar with all sub-specialties of archaeology. Archaeomalacology (the study of archaeological molluscan remains) is a relatively niche sub-specialty of archaeology, but one that often deals with tremendous quantities of material from a wide variety of marine, freshwater, lacustrine, and estuarine environments.

The identification, excavation, and analysis of shell middens can be complex, and the inclusion of midden specialists in the archaeological investigation of these sites is greatly beneficial. Aboriginal shell middens are highly diverse, and vary in their form, structure, positioning within the landscape, size, shape, purpose, function, distribution, and context. They are located in different types of coastal and inland landforms, where the formation of the deposit is influenced by the context of the landform and how people effectively and efficiently adapted to the landform. For example, the formation of a midden within a primary coastal dune along a beach system is created differently to a midden located on top of a sandstone coastal headland, and they both differ to a midden along a volcanic coastline where beaches are absent. Due to this diversity in size, scope, and distribution, a one-size-fits-all approach to shell midden analysis is not appropriate.

Typical Western studies of shell middens are concerned with the archaeological investigation of the shell, artefacts, bone, plant remains, and other organic materials. These generally follow prescribed scientific methodologies, and can inform how people interacted with Country, what past environmental and climatic conditions were like, and provide insight into diet and nutrition, shell use (cultural activity), modification (tools and equipment) and seasonality (Bowdler 2006, Claassen 1998, Coutts 1984, Coutts and Witter 1977).

Data obtained from these analyses are also useful in historical ecology, which uses environmental data from sites like shell middens to inform present-day land management (Rick 2023, Szabó 2015). Middens are ecological indicators and cultural markers. They are story points within the landscape, connection points across country and, on Bunurong Country, spiritual connection points to Whales and Dolphins. From perspectives through a lens of an ecological installation, coastal middens stabilise the caps of

primary and secondary dune systems, creating rich organic soils, that contribute to soil nourishment processes of a dune ecosystem. Coastal shell middens serve as an example of conservation and biodiversity management approaches (Caring for Country), where soil nourishment processes from a midden contribute to seed bank regeneration and healthy habitats.

Currently, shell midden analysis is undergoing an exciting period of innovation and methodological advancement. However, many of these new developments have yet to work their way into conventional professional practice. For example, traditional midden faunal quantification methods used in many commercial analyses have not kept up with the quantification improvements (such as the Non-Repetitive Element (NRE) protocol) now common in specialist research analyses. Here, several innovative techniques that could reasonably be applied to commercial shell midden analyses will be outlined in addition to introducing a few exciting up-and-coming methods in the field.

It is important to note that the best way to understand how people were living on Country in the past is by working in collaboration with Elders and communities and ensuring that research is co-designed and co-led. This enables Traditional Ecological Knowledge (TEK) and cultural knowledge to be incorporated (Tutchener et al. 2021; Garvey and Blake 2024; Gibbs et al. 2024) into archaeological analyses and interpretations. Furthermore, none of the Western scientific methods discussed here can provide information about the cultural values or spiritual significance of these sites. Shell middens are not just places of study and research for archaeologists, they are also “places of meaning, memory making, and identity for Indigenous communities” (Rick 2024).

Coastal shells middens are one of many cultural elements of a cultural landscape and need to be considered in the context of all of Country.

Excavation, dating, and sieve size

Although the primary focus of this paper is post-excavation laboratory processing techniques, a crucial component when analysing a shell midden is considering excavation methodology and sampling procedures. This will be discussed very briefly here, but for a comprehensive overview please see Bowdler (2006). Shell middens are often sites of such expanse and quantity of material that sampling needs to be very carefully considered, as it is usually neither possible nor desirable (especially as preservation, rather than wide-spread destruction of cultural heritage, is ideal) to excavate an entire midden. Bowdler (2006) discusses several options aside from whole-site excavation, one being long, continuous trenches sectioning the site, collecting solid (unsieved) samples in each excavated spit or unit, and/or collecting regularly spaced column samples post-excavation (Bowdler 2006, Claassen 1998). Ideally, there will at least be a series of unsieved samples for processing in the laboratory. This makes

it possible for methods such as flotation to collect charcoal and macrobotanicals to occur.

When sieving shell midden material, sieve size bias must be considered. A large sieve fraction is unlikely to retain delicate taxa such as rodents, small fish, or birds (Nagaoka 2005, Muckle 1994, Vale and Gargett 2002). While very small sieve sizes (1mm) may not retain substantial material identifiable to species (as identified by Vale and Gargett (2002) in their experimental study on fish-bone retention), it is important to retain if recording shell by weight as small fragments can contribute to the overall weight (Muckle 1994).

Analytical units

Determining the analytical units for the midden sequence is also crucial for understanding rates of change over time. Analytical units can be derived from cultural stratigraphy, natural stratigraphy, or during later analysis, and both structure the data and predetermine explanations by drawing artificial boundaries to the data (Frankel 1988). Frankel (1988) identified two main approaches to defining assemblages, firstly, using external features such as soil matrices, arbitrary excavation units such as spits, or stratigraphic features. The second looks at the features of artefacts (such as stone tool typology) to determine the unit. The size of the analytical unit is also important, as small units may provide finer-resolution data, but may also smooth the curve of change to the point where it looks artificially gradual. Conversely, large units may not accurately capture small variations over time. Analytical units are important, but can be complex to formulate, and further reading can be found in Frankel (1988).

Dating

Dating is another important consideration, and the Marine Reservoir Effect (MRE) has a significant impact on the way we must calibrate radiocarbon dates from marine sources. Marine samples can exhibit much older dates than contemporaneous terrestrial samples due to differing levels of carbon-14 (^{14}C) in the marine and terrestrial environment (Ulm 2006, Ulm et al. 2023). Whilst ^{14}C is evenly distributed throughout the terrestrial atmospheric reservoir and produced at a rapid pace, ^{14}C in the deep sea often resides at great depths for long periods of time, and mixes unevenly with surface waters via upwelling (Ulm et al. 2023). The magnitude of the mixing of deep waters upward with surface waters depends on latitude, coastline shape, local climate and wind, trade winds, and ocean bottom topography, resulting in spatial variability across different coastlines. As a result, the time value we need to correct for is known as the ΔR value.

In the past, Gillespie's (1975; Gillespie and Temple 1977; Gillespie and Polach 1979) early work established a set of ΔR values by dating of six marine shell specimens from four areas around the Australian coast. This work found little variability in MRE, and following recommendation from Gillespie and Polach (1979), shell dates were generally corrected by

subtracting 450 ± 35 ^{14}C years.

Currently, we have much larger datasets available, and the Australian ΔR Calculator (<https://delta-r-calc.jcu.io>) can provide the appropriate ΔR value for Australian coasts (where data exists).

For further information, please refer to Ulm et al. 2023 for a comprehensive overview.

Additionally, there has been some research into riverine/lacustrine reservoir effects near the Willandra Lakes (Gillespie et al 2009), however, results so far seem to indicate that a much smaller correction value (between $+100 \pm 16$ to -34 ± 27 years) is needed, and is not likely to greatly affect Late Pleistocene dates in that region. However, further research in varying riverine and lacustrine environments is needed.

The location to finding an early date of a coastal shell midden on an elevated bluff or headland is the furthest point at the tip of the bluff or headland. Over time, the midden deposit extends both directions from the tip of the bluff or headland along the cliff tops, so dating should be taken at intervals from the tip in both directions. Middens would generally extend 20m back from the cliff face, even further and would generally interface with a walking track. These areas along the cliff tops were essentially coastal gardens beds, soil mounds and compost heaps contributing to soil stability, plant health and soil nourishment processes.

Improvements in shell identification, taxonomy, and nomenclature in official documentation

Generally, the first step in shell midden analysis (after the excavation, cleaning, and sieving of the material) is determining the taxon of mollusc, where possible, for each shell fragment. Identifying shell taxon can investigate as to whether there are any specific preferences in the types of mollusc collected, if taxa selection changes over time, and generally provide information about diet and lifestyle along waterways. Taxonomic identification of archaeological shell provides important information besides diet and subsistence, such as data on where the mollusc lived. Some species require a specific substrate type, water temperature, vegetation, amount of sun, and intensity of wave action to thrive. In addition, considerations such as the diet of the mollusc are important, as predatory and herbivorous molluscs have different behavioural patterns, could potentially present different nutritional profiles. Land snails are commonly used to reconstruct past environmental histories, as each species requires a specific micro-habitat with specific food, vegetation cover, moisture, shade levels, competitors, and predators (Evans 1972; Allen 2017). The presence of those certain species then informs about local environment, climate, shore type, vegetation, and water conditions. Subsequently, any change in in shell taxon may also indicate change in the palaeoenvironment.

There is room for significant improvement in the way that we identify and record shells and shell middens in Victoria. This is especially relevant when

looking at official resources provided to Victorian archaeologists by governing bodies such as First Peoples-State Relations (FP-SR).

The Victorian Aboriginal Heritage Register (VAHR) shell midden component form and the FP-SR “Guide to Shells Commonly Found in Victorian Aboriginal Shell Middens” (hereafter referred to as the FP-SR Shell Guide) provide outdated and/or incorrect options for the taxonomic of the most common mollusc genera in Victoria (**Figure 1**) markings.

Shell Species List

Rocky Platform

1. Turbo	9. Conus	16. Paphies	Freshwater
2. Cabestana	10. Nerita	17. Polinices	22. Velesunio
3. Abalone	11. Mytilus	18. Glycymeris	23. Alathyria
4. Austromytilus	12. Scutus	Estuarine	
5. Thais	Sandy Shore	19. Ostrea	24. Unknown
6. Chiton	13. Mactra	20. Anadara	
7. Limpet	14. Donax	21. Saccostrea	
8. Austrochonchlea	15. Katelysia		

Figure 1. Shell genus list available in the VAHR Shell Midden Aboriginal Place Component Form. Highlighted yellow are genera referred to with outdated names (*Turbo* > *Lunella*, *Thais* > *Dicathais*, *Donax* > *Latona*). Blue indicates common names, not scientific names. Red indicates a genus misspelled (likely meant to be *Austrochonchlea*). (Image adapted from First Peoples-State Relations 2025)

In terms of the use of the FP-SR Shell Guide as a tool for species identification, the exclusive use of black and white illustrations and information from decades-old sources (MacPherson and Gabriel 1962, Beesley et al. 1998 and Smith and Kershaw 1979) instead of modern colour photography and contemporary species names has the potential to impede successful speciation. This is especially important as many shells, especially those from younger middens, will retain their identifiable coloured markings.

One of the most common species in south-eastern Australian shell middens serves as an example of the complicated taxonomy of molluscs in archaeological analyses. The Warrenner (*Lunella undulata*) is often recorded as *Turbo undulatus* or *Turbo*, as it is identified as such in both the VAHR component form and the FP-SR Shell Guide. Due to a change in taxonomy, this name has not been the accepted species name since 2011 (**Table 1**).

If archaeologists are expected to provide up-to-

date information on the ecology and environment of these species in site reports, the correct taxon must be used as the most recent malacological research will use these names. It is also important to maintain consistency and accuracy with scientific names to ensure that the species will be identifiable to a broad audience, as the correct scientific name will be used internationally. In contrast, common names are highly localised (**Table 2**) and can vary depending on language or community. The World Register of Marine Species (WoRMS) (<https://www.marinespecies.org>) is a useful online search tool that can provide the most up-to-date taxonomic information, even when searching for species names that are out of date by decades.

The VAHR component forms are also lacking when considering species diversity (Garvey and Perry 2015). For coastal middens, the lack of an option for the common *Diloma* top shells is likely due to *Austrochonchlea* top shells being expected to represent all top shells. In freshwater environments, currently only the Southern River mussel (*Alathyria jacksoni*) and the Billabong mussel (*Velesunio ambiguus*) are available as options to record. Notably, freshwater gastropods such as the Barka or Darling River snail (*Notopala sublineata*) are not included as an option for freshwater midden species, despite evidence as to their dietary importance to people living in freshwater Country (Garvey 2017).

Previously, it was believed that *Notopala sublineata* snails were too small to be utilised as a food source and were present in middens only as by-catch (Walker 1996). However, this is at odds with archaeological research of the past decade (such as Garvey 2017), which found that people would have been deliberately targeting them, as the ecology of the snails shows that they live in a different part of the river system to the mussels. Even if these species did not yield a large amount of flesh, that flesh may have been especially delicious and/or nutritious.

Furthermore, not all molluscs are collected for dietary purposes. Shell can be utilised in a variety of ways, including but not limited to: medicinal practices where mussel shells were being used as phlebotomes (blood-letting knives) (A.A.C Le Souëf in Smythe vol. 1 1878: 296); fishhooks; adornment (Backhouse 1967, Labillière 1878, Jones 1965; Hook et al. 2024); cloak-making (Howitt 1904 741–742); tool-making (Weston

Name	Author	Status
<i>Turbo undulatus</i>	Lightfoot, 1786	Unaccepted
<i>Turbo ludus</i>	Gmelin, 1791	Unaccepted
<i>Turbo anguis</i>	Gmelin, 1791	Unaccepted
<i>Turbo samson</i>	Tenison-Woods, 1877	Unaccepted
<i>Lunella (Subnina) undulata</i>	Lightfoot, 1786	Alternate representation
<i>Lunella undulata</i>	Genus author: Röding, 1798 Species author: Lightfoot, 1786	Accepted as of 2011

Table 1. Changing taxonomy for *Lunella undulata* over the years (World Register of Marine Species 2025)

Common name variants	Record
Bidharrun/Warrinha	Bunurong name
Periwinkle	Personal observation and conversations with Traditional Owners and archaeologists in Victoria and Tasmania
Warrener	
Wavy Periwinkle	Codes for Australian Aquatic Biota (CAAB)
Common Warrener	Atlas of Living Australia (ALA)
Lightning Moon	ALA
Common Warrener	Australian Faunal Directory (AFD)
Wavy Turban	AFD
Lightning Turban	AFD

Table 2. Common name variants for *Lunella undulata*

et al. 2017; Roberts et al. 2021); drinking vessels (Robinson 2008); making shell necklaces, and as an ingredient that contributes to making resin. Therefore, it is important that we record all molluscs that appear in middens, even if they do not seem to be significant economically.

As discussed previously, it is unreasonable for the average archaeologist to be an expert in every field, and only an archaeologist that specialises in faunal studies would have or need an exhaustive knowledge of the local fauna and flora for every given environment. Consequently, when species are omitted from reference material specifically designed to bridge that gap, it can lead to these animals going unrecognised as a product of cultural activities. This in turn leads to bias in the archaeological record (Garvey 2017).

Quantification: improving methodology and data accuracy

A key component of any archaeological midden analysis is quantifying (counting and measuring) the excavated shell. This is usually a substantial undertaking, as even a single 50 x 50 cm test pit can yield a large amount of shell midden material depending on the density and distribution of the deposit.

Contemporary professional analyses usually consider taxon (often not identified to species level), shell weight, shell condition (restricted to recording if the shell is visibly burnt), and occasionally the total number of fragments or Number of Identified Specimens (NISP). To quantify further, the Minimum Number of Individuals (MNI) may have been calculated by looking at left and right valves on a mussel and choosing the highest number, or by using complete gastropod shells or apices only for MNI. This typically results in only base-level information, meaning we often miss out on important details about diet, resource selection, economy, landscape use, and any change over time that middens can

provide when we collect sufficient data concerning species identification, abundance, distribution, and habitat. This is crucial, as middens are important for understanding how people were living on Country and the important role of shellfish. Comparatively, a research-focused analysis may consider additional sets of data, such as shell size with multiple measurements, shape and structural properties of the shell, degree of preservation, as well as employing more detailed methods of quantifying MNI using multiple variables.

There have been long-standing debates about the use of MNI compared to weights in shell midden analyses. Early analyses considered only shell weight, as it was time- and cost-effective (Waselkov 1987). Mason et al. (1998) argue for weights to be discarded in favour of MNI as a standard, as weights alone assume horizontal midden homogeneity, ignore shell degradation, and are time consuming when sorting small fragments. Glassow (2000) stated that using MNI is insufficient, and that defining and identifying NRE in highly fragmented assemblages would be too difficult, so weights should be the preferred standard. Claassen (2000) suggested that no methodology is all-encompassing and argues for absolute frequencies (being abundance supplemented with non-shell values such as depositional rate, aerial extent of settlement, and quantities of artefacts). Therefore, a combination of techniques is the ideal way to approach a midden analysis.

There is a distinct difference in the amount of time a research analysis of a midden and a commercial analysis of a midden can devote to quantification. Here, a time-effective method of calculating MNI that can reduce the gap in data-richness between research and commercial data quality will be outlined.

To improve the accuracy of the MNI calculations, the Non-Repetitive Element (NRE) protocol following Harris, Weisler and Faulkner (2015) can be used. In this protocol, NRE are defined as a restricted range of diagnostic features that do not appear more than once per individual, such as the operculum associated with gastropods. Using multiple NRE for shell fragments increases the likelihood of accurately identifying species abundance within the assemblage as there is no reliance on one specific attribute to formulate species counts. Methods such as these have been used for many years when examining animal bone, but it is only in the last decade that expanding diagnostic criteria beyond simply one element (often the umbo in bivalves or apices in gastropods) has been considered. Kneppers (2024) found that when using Harris, Weisler, and Faulker's (2015) protocol, overall, there was a 3% increase in general MNI values, particularly in relation to Gastropoda.

Counting multiple NRE, instead of one part of the shell, improves the quality of our data. Preselecting an NRE that hypothetically would be the most abundant (i.e., the apex on a gastropod or left valve on a mussel) can underrepresent MNI as the selected NRE may not be the most consistently abundant or may return inaccurate MNIs of zero when the selected element is

not present whilst other fragments are (Giovas 2009). To avoid this, all NRE should be counted, then that taxon should be quantified by selecting the most abundant NRE per sample, rather than restricting to one NRE. The difference in results obtained by using multiple NRE has been demonstrated as statistically significant when calculating MNI (Gutiérrez -Zugasti 2011).

Harris et al. (2015) found that calculating some NRE was time consuming and difficult while showing little MNI improvement, such as calculating bivalve adductor scars. These specific NRE could be dismissed, while retaining the NRE that provide more valuable data (such as gastropod NRE).

In terms of using these methods in commercial settings, once trained, selecting multiple NRE and sorting the shell accordingly is fast whilst simultaneously providing higher quality information-but it is up to both educators and working professionals to train graduates in these skills, and to ensure that these methods are employed in professional settings.

These newer methods are being taught in tertiary institutions where there are staff who are trained and specialise in this field. However, there are no standardised curriculum or resources available that outline the most appropriate methods. Furthermore, methods taught to students during their undergraduate studies will have little impact if graduates are unable to utilise them in professional settings.

Importantly, using improved MNI calculations will not affect comparability to previous studies, if NISP and weights are taken.

Improving data quality: reconstructing the palaeoenvironment

Shell midden analyses are not just focused on the shell material, but rather aim to unify analyses of the shell, stone, bone, plant remains, and other materials from the site in order to gain a more complete picture of the landscape and how people lived on Country in the past (Álvarez et al. 2011; Bailey 1975). Understanding the micro-organics of a midden deposit is still yet to be explored in many sites. One method to do this is by looking at multiple environmental proxies (preserved materials that can be analysed to infer past environmental conditions) to formulate high-resolution palaeoenvironmental records. These analyses have shown to be successful even in high-density shell matrices (Moss et al. 2019).

Palynology (pollen analysis) and phytolithology (phytolith analysis)

Palynology (the study of pollen) involves isolating and identifying plant pollen from sediment cores and using the proportions of different types of pollen present within the sample to ascertain what the local climate and vegetation would have been like in the past (Fægri and Iversen 1989; Moore et al. 1991). Pollen survives well in cool, dark, and anaerobic environments (Twiddle and Bunting 2010), and is particularly useful

when looking at swamp or wetland environs.

Similarly, phytolithology looks at the micro-remains of silica bodies found in plant cell walls. However, phytoliths can survive acidic or aerobic conditions where other fossils like pollen are rarely preserved (Piperno 2006). Like pollen, phytolith analysis can provide valuable information about past vegetation and plant use. However, there is also a need for increased production of phytolith reference materials, as local reference collections for Australasian flora are incomplete (Turnbull et al. 2023).

Both of these methods are also useful for looking at human impacts on the landscape over time (Bakels 2020, Moss et al. 2019),, such as fire-burning events or targeted plant cultivation. A sediment core is preferred for sampling and can be collected with a hand-operated peat or 'Russian' corer, and the sample kept refrigerated until analysis.

To identify and enumerate the individual pollen grains or phytoliths in the sample, the desired botanical remain must be isolated from all other organic material in the sample. This technique requires a specialised laboratory, as each sample is treated with a series of chemical pretreatment steps to dissolve unwanted organics. The exact method and chemicals used varies according to the composition of the sediment and specific botanical remain targeted, but all methods require stringent safety precautions and protection from cross-contamination. Therefore, use of a dedicated laboratory is necessary. By identifying the vegetation present within the samples, we can ascertain what the terrestrial and aquatic vegetation would have looked like in the past, how it may have changed over time, and potentially examine subsistence and dietary habits. This is crucial for the overall understanding of a shell midden site, as their composition and location are dictated by environment.

Macrobotanicals

Macrobotanical studies involve examining the seeds, nuts, fruits, leaves, and other floristic parts of plants (excluding charcoal) found in archaeological soils (Carmichael 2019; Dilkes-Hall et al. 2019). By examining the non-woody remains of plants, which can be recovered from soil samples via flotation, we can determine which species of plant were present in the past, if species distribution had changed over time, and which species were likely to be of economic significance. This can then inform palaeoenvironment, history of plant use, diet, and seasonality (VanDerwarker and Peres 2010).

Anthracology (wood charcoal analysis)

Anthracology (wood charcoal analysis) provides information about past environments, subsistence strategies, land use, and management of Country by identifying the taxon of charcoal particles preserved in sediments (Crawford and Belcher 2014; Dotte-Sarout et al. 2015, King et al. 2022, Thomas et al. 2017). By identifying the species of wood macro-charcoal remains in shell middens, we can determine which

plant species were used as fuel in hearths and identify land use patterns (seen in wood gathering patterns), and past fire regimes (such as cultural burns) (King et al. 2022).

In the field, soil samples are sufficient, and this method is suitable for fragments at least 2mm in size. To identify the species of wood, a high-powered microscope is required.

Geochemical studies

Geochemical analysis of shell to identify resource use and reconstruct coastal palaeoenvironments is a relatively common method (Canti 2017, García-Escárga et al. 2019, Godfrey 1994, King et al. 2025, Mannino and Thomas 2002; Prendergast et al. 2016; Prendergast and Schöne 2017; Prendergast et al. 2017) but are often under-utilised in commercial analyses due to the additional expense and time required. However, these methods are becoming increasingly affordable with techniques such as Laser Induced Breakdown Spectroscopy (LIBS) providing rapid and cost-effective screening methods.

Sclerochronology

To examine the palaeoenvironmental conditions and seasonality of shell middens, sclerochronology can be employed. Sclerochronology is defined as the study of physical and chemical variations in the accretionary hard parts of organisms and the temporal context in which they formed (Trofimova et al. 2020). Sclerochronology can estimate the ontogenetic ages (years relative to the age of the animal) of calcium carbonate (CaCO_3) accreting molluscs, as the shells of these animals grow in increments, like rings on a tree. Analysis of growth increments in the shell can tell us season of harvest, which in turn can tell us about seasonality of resource and site use (Prendergast et al. 2018; Alidoostsalimi et al. 2025).

These increments also contain biogeochemical signatures that relate directly to variations in the immediate environment. These can be analysed via stable oxygen isotope analysis, which uses the $\delta^{18}\text{O}$ shell (oxygen isotope composition of shell carbonate) to reconstruct past environmental conditions. This is done by examining the isotopic composition of the shell, which varies according to the local water temperature and its isotopic composition (Kennett and Voorhies 1995). This technique can be used on both marine (Prendergast and Stevens 2014) and freshwater (Stringer and Prendergast 2023) species. Analysing the chemical compositions of the final growth portion of mollusc shells can also provide more accurate information of the seasonal harvesting of shellfish resources than analysing the growth increments alone (Alidoostsalimi et al. 2025). However, this method can be expensive, and the sample preparation and extraction time-consuming.

Diagenesis, which is the dissolution and recrystallization of carbonate in shells in response to taphonomic influences (such as depositional soil pH or thermal alteration via heating), can affect stable isotope

and trace element values (Stringer and Prendergast 2023). To investigate the extent of the effect, screening is required and can incur additional expenses.

A new method, Laser Induced Breakdown Spectroscopy (LIBS), looks at shell biogeochemistry by using a short laser pulse to create a micro-plasma on the sample surface (Hausmann et al. 2023). This plasma emits light containing characteristic spectral lines which can be used to map the elemental composition of the sample. This can then be used to rapidly screen shell assemblages for variations in their temperature records over time. This technique is affordable, fast (requiring only a few seconds per sample to take measurements) and minimally invasive and with little sample prep required (King et al. 2025).

New techniques

Not all methodological innovations can be practicably used in contemporary commercial shell midden analyses. For example, to the authors' knowledge no Australian laboratory is conducting shell palaeoproteomics or thermo-microstratigraphic studies for a commercial audience. These techniques are new, require further testing in Australian contexts, and have too few specialists able to conduct such studies on a broader scale. However, this may not always be the case, and as such these techniques are outlined here as an example of future potential in the discipline.

Thermal alteration of shell

When investigating the dietary contribution of shellfish, it is important to consider how these foods may have been prepared. Cooking allows tough plant foods and meats to be modified into easily digestible forms by rendering down fibrous or connective tissues to more palatable materials (Birch et al. 1986). However, depending on species, molluscs can be consumed both raw and cooked (Meehan 1977, Waselkov 1987). Often, the cooking of these foods is less concerned with breaking down muscle fibres to tenderise the flesh, but more about improving aroma, taste, texture, and adding warmth. Cooking can also assist with removing flesh from the shells, as it helps to open bivalves, and makes flesh removal easier from coiled gastropods by releasing the muscle attachment. Cooking of shellfish can also affect the nutritional properties of shellfish, namely the levels of trace elements and distribution of fatty acids (Frost 2023). In addition, roasting gastropods that contain toxins on very hot coals, clay balls, or other heat-retaining elements (such as rocks) could potentially reduce toxicity (such as the apex predator of an inter-tidal reef – the whelk which were targeted for eating and common in middens). Lawrence et al. (1994) found that cooking lobster *Homarus americanus* decreased the percentage of paralytic shellfish poisons present in the hepatopancreas by percentages ranging between 60-100%. Evidence of cooked molluscs in shell middens can be difficult to discern, as the presence

of visibly burnt shells does not necessarily denote cooking. Mollusc shell can be thermally altered during other fire activities, such as by fires being lit on top of already-deposited shell beds (Simões and Aldeias 2022). Furthermore, many molluscs cook quickly over low temperatures (Frost 2023) and may not reach a high enough heat to visibly alter the exterior of the shell.

There are a variety of methods that look at thermal alteration of shell. Staudigel et al. (2019) argues that it is possible to distinguish boiling from roasting using carbonate clumped isotopes (Δ_{47}). Samples were found to have been heated up to 200°C and cooked unevenly, which is suggestive of roasting, rather than boiling, which would max at 100°C – a temperature that is not high enough to change the mineralogy of shell.

Another method is thermo-microstratigraphic analysis, which combines micromorphological analyses with microscopic Fourier transformed infrared (FTIR) spectroscopy to identify instances of in-situ fire events that are otherwise invisible macroscopically (Simões and Aldeias 2022). Specifically, this method looks at the thermal conversion of aragonite (one of the primary forms of shell calcium carbonate) into calcite. When applied to shell, this method aims to distinguish between cooking and burning of shell by examining mineralogical alterations caused by heat, as different temperatures cause different mineralogical changes. This is then combined with micromorphological analysis of archaeological thin sections to determine if the burning occurred pre-deposition or in-situ.

Another commonly employed method to detect thermal alteration in mollusc shells due to cooking or fire activity is Raman Spectroscopy. This method can be used to detect alteration of primary aragonite to calcite, which generally occurs in temperatures >300°C but may vary from species to species. In a study of the topshell *Phorcus turbinatus*, Milano et al. (2016; 2018) found that boiling had no effect on shell microstructure or geochemistry but once shells were heated >300°C, their microstructures began to change, and primary aragonite altered to calcite.

Shell palaeoproteomics

Shells in archaeological assemblages are often found highly fragmented, often to the point of being completely unidentifiable to species. If the main identifiable features of the shell such as the morphology and surface ornamentation are missing, it may be impossible to determine shell taxon macroscopically.

One potential solution is shell palaeoproteomics, dubbed ‘palaeoshellomics’ by Sakalauskaite et al. (2019). This method can identify otherwise completely indeterminable shell fragments by analysing the intracrystalline shell proteins and then characterising them using mass spectrometry techniques to create a ‘molecular barcode’ (Sakalauskaite et al. 2020, Alarashi et al. 2023). This ‘molecular barcode’ can then be used to identify the species of shell by comparing it to reference collections, provided relevant protein sequences of the candidate species are available.

While palaeoproteomics is a well-established technique for bone, it is less common in shell analyses. This is likely due to the small amount of protein in shell (over 300 times lower than in bone), as well as an overall limited understanding of shell protein sequences at this stage (Sakalauskaite et al. 2019). However, recent successful protein extraction by Sakalauskaite et al. (2020) on both modern and archaeological shell demonstrates that this method has potential.

This method will require testing on species local to south-eastern Australia, and there is some work that will be required before this technique is ready to use in any commercial application. Overall, this is an emergent technique but may become more prominent in the coming years.

Discussion and Conclusion

We have a professional responsibility to conduct our technical analyses to the highest possible standard within a reasonable and justifiable time frame. As it stands, the current recording, identification, and quantification methods for shell midden analysis are outdated. Fortunately, some methods (such as the Non-Repetitive Element protocol) outlined in this paper are simple improvements that can be easily implemented into modern commercial analyses with minor training and no additional field time, equipment or resources (Table 3). Others, such as palaeoenvironmental studies that involve sediment coring, specialist laboratory facilities, and/or additional time spent in the analysis stage, are more involved, and require additional planning and funding.

The additional information these analyses generate is vast, and if we are to maintain scientific rigour in our field then we must aim for best-practice. This will involve additional effort from archaeologists to disseminate up-to-date information, provide training opportunities to junior staff, and to ensure that there is appropriate time and funding allotted to employ up-to-date and data-rich methodologies.

Shell middens are of spiritual, social, cultural, and archaeological importance, and it is imperative that they are given the same quality of analyses as other sites. Unfortunately, as outlined in this paper, currently this is not the case due to a combination of a lack of knowledge and/or training opportunities, sub-standard recording and identification resources, and most crucially, substantial time pressures and large volumes of archaeological material.

There are efforts underway to update the official materials used for identifying and recording middens, which should also integrate Traditional Owner Knowledge Systems, still absent from Victorian Aboriginal Heritage Site Recording Cards (other than a section for Traditional Owner comments). We acknowledge that at the time of writing this, there is still a tremendous amount of potential data that is being missed, and there is a clear need for change. This paper has presented a variety of

	NRE	Pollen/ Phytoliths	Charcoal	Sclerochronology	Palaeoproteomics	Thermo- microstratigraphy
Additional field time		x	x	x		
Additional lab time	x	x	x	x	x	x
Specialised laboratory		x	x	x	x	x
Commercially available contractors	x	x	x	x		

Table 3. Requirements for each method in shell midden analysis outlined in this paper

potential methods to increase the data-richness of our analyses of shell middens. While some (such as shell palaeoproteomics and thermo-microstratigraphy) are still in the experimental stage, quantification methods such as the NRE protocol are simple to apply without any additional cost. By employing such methods, we can improve our analyses, produce higher-quality information about the rich cultural heritage of our coastlines and inland waterways, and try help heal and restore Country.

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Breaking barriers in zooarchaeology: A simplified approach to faunal skeletal analysis

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Abstract

Zooarchaeological analysis in Australian consulting archaeology is often constrained by limited specialist expertise, fragmented assemblages, and restricted access to reference collections. This paper presents a simplified cataloguing framework designed to enhance faunal data collection by non-specialists in resource-limited contexts. The method employs four core categories to facilitate consistent and scalable analysis: element group, taxonomic class, assumed size, and standardised measurements. While acknowledging reduced taxonomic resolution, the framework improves data accessibility and comparability, supporting broader archaeological interpretation. Its integration with emerging digital resources and collaborative research initiatives positions it as a practical tool for advancing zooarchaeological practice in heritage management.

Introduction

Zooarchaeology is essential for understanding past human-animal relationships in Australia. At its most basic, it involves the analysis of animal remains from archaeological sites to interpret human-animal interactions and environmental relationships (Davis 1987; Reitz and Wing 2008). The discipline extends beyond ecological studies to include cultural dimensions, examining both natural and cultural histories (Serjeantson 2009). While traditionally focused on vertebrate bones and teeth (Davis 1987), modern zooarchaeology increasingly incorporates invertebrates and other biological materials such as hair, feathers, DNA, and isotopes (Reitz and Wing 2008; Serjeantson 2009). Despite its broad scope and relevance, scientific research in Australia is currently limited by inconsistent data collection, particularly within consulting archaeology.

Zooarchaeology originated in the nineteenth century as a branch of prehistoric archaeology, with early research focused on animal domestication and largely conducted by individuals trained in zoology or palaeontology rather than archaeology (Gifford-

Gonzalez 2018). The discipline was formalised in the 1960s–70s, aligning with the rise of processual archaeology and the development of specialised methodologies and theoretical approaches for analysing faunal remains (Gifford-Gonzalez 2018; Lyman 2012a; 2012b). In Australia, zooarchaeology gained momentum between the 1970s and 1990s, establishing key research themes such as taphonomy, subsistence strategies, and megafaunal extinctions (Cosgrove 2002). Contemporary studies have since expanded to explore the role of animals in social and economic networks, responses to climate change, and the application of advanced computational techniques (Smith 2018; Tourigny and Gordon 2023). Resources such as field guides (Fillios and Blake 2015) and digital 3D models of Australian National University (ANU) collections have enhanced analytical support and broadened access to reference materials (Australian National University 2020; Mein and Manne 2021). However, the increasing complexity of zooarchaeological analysis continues to pose challenges for its broader integration within Australian archaeological practice.

Australian consulting archaeology faces several challenges that affect the quality and usefulness of zooarchaeological data. One major issue is a shortage of trained specialists, which means that faunal analysis is often carried out by non-specialists who may not have the training needed to accurately identify animal remains, especially among Australia's diverse marsupial species. Many small marsupials have become extinct or endangered since European settlement and are rarely represented in reference collections, making it harder to compare and identify bones (Burbidge 2023; Woinarski, Burbidge, and Harrison 2015). This problem is made worse by limited access to comparative collections and few formal training opportunities in the field (LeFebvre and Sharpe 2018; Ulm et al. 2013). Time and cost constraints further exacerbate these issues, often resulting in superficial analyses and significant data loss. Highly fragmented bone assemblages and limited access to robust identification resources make accurate identification difficult, even for trained specialists. Methodological inconsistencies in quantification and a lack of transparent reporting impede data integration

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across projects (Baker and Worley 2019; Gifford-Gonzalez 2018).

Few Australian universities offer in-depth zooarchaeological training as part of undergraduate degrees, leaving emerging practitioners reliant on informal mentorship or overseas programs, which are often inaccessible. Legislative and client-driven limitations also prioritise compliance over research, with minimal requirements for faunal reporting or retention, undermining long-term research potential and opportunities for reanalysis (Ireland et al. 2013; Mein and Manne 2021). These challenges are not unique to Australia; similar concerns have been raised globally, particularly regarding the undervaluation of modern-era deposits and the lack of institutional support for their analysis (Tourigny and Gordon 2023). The COVID-19 pandemic further exposed vulnerabilities in the archaeological workforce, including specialist shortages, limited training access, and precarious employment conditions (Mate and Ulm 2021).

To help address these challenges, this paper proposes a simplified framework for cataloguing faunal remains. The approach aims to improve engagement with zooarchaeological material, support the collection of comparable data, and enable future research, particularly in contexts where specialist expertise is unavailable.

A simplified methodological framework

In consulting archaeology, zooarchaeological questions which frequently arise typically focus on whether faunal remains are human or non-human, native or introduced, and whether they reflect subsistence practices, domestic use, or background environmental deposition. Assemblages encountered are often small, highly fragmented, and lack the structural integrity of extensive, stratified deposits, meaning consultants are generally tasked with establishing broad taxonomic identity and contextual relevance rather than conducting detailed analysis.

The simplified framework proposed is particularly suited to single-context, short-term occupation sites with limited faunal diversity, offering a practical foundation for preliminary identification and interpretation where access to comprehensive reference collections or specialist expertise may be limited. However, this method becomes less effective in more complex archaeological sites such as multi-context sites with diverse taxa or historically layered activities where high-level categorisation may obscure critical nuances. In such cases, finer resolution through species-level identification, taphonomic assessment, or behavioural inference requires specialist input.

This framework seeks to enhance the capacity of non-specialist to contribute meaningful zooarchaeological data in resource-limited settings, while acknowledging

the indispensable role of specialist analysis in complex investigations. Drawing on foundational principles outlined by Fillios and Blake (2015) and Kausmally and Western (2024), it focuses on four key identification categories: elemental group, taxonomic class, assumed size, and standardised measurements.

Element group classification

The approach simplifies faunal skeletal identification by categorising bones into four basic groups: long, short, flat, and irregular. A high-level description of the key identifiers of each group has been provided.

Long bones are characterised by a length that significantly exceeds their width, typically with a length-to-width ratio of 3:1 or greater. They feature a cylindrical shaft (diaphysis) along with two expanded ends (epiphyses) (Hillson 2016; White and Folkens 2005). Examples include the humerus, femur, and phalanges.

Short bones are roughly cube-shaped, with length, width, and thickness within 20% of each other, lacking a distinct diaphysis and metaphysis (Hillson 2016; White and Folkens 2005). Examples include carpal (wrist) and tarsal (ankle) bones. Although some classify patellae (kneecaps) and sesamoid bones separately, this method categorises them as short bones due to their shape and composition (Hillson 2016; White and Folkens 2005).

Flat bones are thin and often curved, with a thickness-to-width ratio of 0.2 or less and consist of two compact bone layers sandwiching a spongy layer (Hillson 2016; White and Folkens 2005). This includes cranial bones, scapulae, sternum, and ribs. This approach also classifies the mandible and pelvic bones as flat bones.

Irregular bones do not conform to consistent dimensional ratios and are identified by their complex morphology, including projections and indentations (Hillson 2016; White and Folkens 2005). Examples include vertebrae, facial bones, and sacrum.

Taxonomic class classification

While traditional zooarchaeology emphasises precise taxonomic identification, this simplified approach focuses on class-level classification, requiring basic knowledge of key class differences. As this has been developed for Australian assemblages, the following information relates to commonly identified classes: mammals, birds, and fish.

Mammal bones are dense and robust, showing a clear distinction between thick cortical and spongy cancellous bone. Their shape and size vary greatly by species, and they often have well-defined joints and teeth (Reitz and Shackley 2012). Bird bones are lightweight and hollow,

an adaptation for flight. Key identifiers include their thin-walled, honeycomb structure and distinctive sternum shape (Serjeantson 2009; Kausmally and Western 2024). Fish bones are generally low-density and fragile. Their wide shape and size range, unique vertebrae, and delicate spines and fin rays distinguish them from other classes (Wheeler and Jones 1989). Another discerning feature is the often translucent appearance of the thin sheets of fish bones (Kausmally and Western 2024).

In archaeological assemblages, mammals are often the most common class, likely due to their durability compared to the more fragile bones (Fillios and Blake 2015; Reitz and Shackley 2012). In historic Australian contexts, Bovidae are frequently dominant, reflecting both preservation biases and their role as an important food source (de Souza and Costa 2018). Whilst site dependent, this information may provide a useful starting point for the determination of classes present.

Assumed size classification

This method uses a size-based classification for animals, categorising them into five length-based groups: very small, small, medium, large, and very large. While size is a measurable attribute, developing reliable categories is challenging due to continuous variation within and between species, and the influence of biological and ecological factors (Ricklefs and Relyea 2014). Sexual dimorphism, age, individual variation, and geographic location further complicate classification, often resulting in specimens that fall between defined categories (Hillson 2016). Despite these complexities, the system provides a practical framework for initial classification, while acknowledging natural variability.

Australia's mammals range from small marsupials to large kangaroos and introduced ungulates, necessitating meaningful biological cut-offs. The size classification system presented by Fillios and Blake (2015) has been used as the basis for this framework.

For birds, defining discrete size categories is particularly difficult due to the diversity of body forms. Flightless birds such as emus are "very large" by height, while wingspan is more relevant for flying birds in the "large" category. The classification system draws on resources from BirdLife Australia (2025) and Cornell University (2025) to establish practical thresholds.

Fish are typically classified by total length, a standard metric in both archaeological and fisheries contexts (Morales & Rosenlund 1979; Wheeler and Jones 1989). This system incorporates established fisheries management size ranges to support consistent classification.

While class-level identification combined with assumed size can help infer taxonomic identity, it is important to recognise the limitations of this approach for non-specialists. Fragmented remains, especially

isolated long bone shafts, can make it difficult to determine whether a specimen belongs to the forelimb or hindlimb, or to distinguish between closely sized taxa. In such cases, misclassification is likely if contextual clues or comparative reference material are unavailable.

Based on field experience and supported by experimental and methodological studies, it is estimated that non-specialists may confidently assign size categories to approximately 30–50% of faunal specimens, depending on the degree of fragmentation and anatomical familiarity (Morin et al. 2017). Even trained specialists face significant challenges when working with highly fragmented assemblages, as identification success is strongly influenced by the presence of diagnostic features and the nature of bone modification, with long bone shafts and undiagnostic fragments often remain indeterminate, regardless of expertise (Doyon et al. 2021). Lyman (2019) emphasizes that anatomical traits used for taxonomic identification vary in reliability, and that regardless of experience analysts must be cautious in their interpretations.

To minimise guesswork and reduce analytical bias, this framework encourages practitioners to record uncertainty and avoid over-interpretation, especially in cases where size-based distinctions are unclear or not supported by definitive morphological evidence. Where possible, users should incorporate relevant site background information to better understand the likely faunal assemblage. This contextual knowledge can significantly assist in determining which taxa are most probable at a given site.

Table 1 provides the ranges used for assumed size classification. These are intended as guides rather than strict thresholds.

Standardised measurements

Accurate and consistent bone measurements are essential for archaeological research, supporting taxonomic classifications, sex and age determination, stature estimation, and the study of skeletal variation across time and sites (Lyman 2019). As archaeological bone specimens are frequently fragmented or incomplete due to taphonomic processes (Faith and Thompson 2018), standardised measurement approaches are critical (Hillson 2016; White and Folkens 2005). Without consistent protocols, variation in measurement techniques and anatomical landmark interpretation can compromise data reliability and comparability (Buikstra and Ubelaker 1994; White and Folkens 2005). To address this, a simplified protocol is proposed, focusing on bone completeness, greatest length, and greatest breadth, with proximal and distal breadths recorded for long bones. This approach supports consistent and scientifically sound data collection.

Class	Very Small	Small	Medium	Large	Very Large
Mammal	<15 cm Mouse	15-60 cm Rabbit	60-120 cm Sheep	120-200 cm Horse	>200 cm Elephant
Bird	<15 cm Weebill	15-30 cm Willie Wagtail	30-60 cm White Ibis	60-120 cm Pelican	>120 cm Emu
Fish	<5 cm Western Carp Gudgeon	5-30 cm Southern Pygmy Perch	30-100 cm Barramundi	100-200 cm Murray Cod	>200 cm Whale Shark

Table 1 Assumed size classifications.

Completeness assessment

The first step is assessing bone completeness, as preservation directly affects measurement accuracy (Rowbotham et al. 2017). Standardised completeness evaluation ensures consistent reporting and informed data interpretation. Without it, measurements may be ineffective due to missing landmarks. Traditional methods use subjective descriptors, leading to inconsistencies (LeFebvre and Sharpe 2018; White and Folkens 2005). This approach uses broad percentage categories (1–25%, 25–50%, 50–75%, 75–99%, 100%) to estimate the proportion of the original bone present. Only bones with sufficient completeness should be measured. Fragments with less than 25% of the original bone are unlikely to provide useful information for analysis unless they include clear and identifiable features.

Measurement procedures

Greatest length refers to the maximum linear distance between two anatomical points on a bone, measured along its longest axis (von den Driesch 1976). This measurement is essential for estimating stature and overall body size (Buikstra and Ubelaker 1994).

Greatest breadth is the maximum linear distance between the lateral edges of a bone, typically taken perpendicular to its length (von den Driesch 1976). In long bones, proximal and distal breadths offer detailed information about the epiphyses, which are valuable for studies on taxonomy, sex estimation, and robusticity (Hillson 2016; White and Folkens

2005). If epiphyses are absent, standard breadth measurements should be used.

Where element type is known, standardised measurements from von den Driesch (1976) for faunal remains or Buikstra and Ubelaker (1994) for human skeletal material should be applied. Unidentifiable fragments of similar characteristics may be grouped, with minimum and maximum dimensions recorded. The number of remains (NR) must be tallied for each entry, especially when grouping fragments.

Table 2 illustrates this framework using a partially intact feline femur exhibiting post-depositional gnawing. Additional observations, including taphonomic indicators and NR counts, should be included. Zooarchaeological data must be interpreted within the broader archaeological context of the site to support future comparative research.

Discussion

The simplified zooarchaeological framework proposed in this paper offers a practical and accessible solution to the challenges commonly faced by Australian consulting archaeologists. In contexts where specialist expertise, time, and resources are limited, this method enables non-specialists to contribute meaningfully to faunal data collection. By focusing on broad taxonomic categories, skeletal element groups, and standardised measurements, the framework facilitates the efficient capture of archaeological faunal data. This approach is particularly effective for single-context, short-term occupation sites with limited faunal diversity, or where rapid assessment is required and detailed analysis may

ID	Excavation	Context	Class	Size	Element	Completeness	NR	Length (cm)	Breadth (cm)	Comment
001	T001	001	Mammal	Small	Long	75-99%	1	8.32	2.94	Missing distal epiphysis Minor tooth-like marks observed

Table 2 Practical application of the method

not be immediately feasible.

The framework enhances consistency and comparability across datasets, supporting regional synthesis and broader heritage management applications. However, its reliance on high-level categorisation introduces limitations in more complex archaeological settings. Fragmented assemblages, morphological ambiguity, and the absence of diagnostic features can obscure critical taxonomic and taphonomic nuances. These challenges may lead to misclassification or overinterpretation, particularly in multi-context sites with diverse taxa or stratified deposits. As such, the framework should be understood as a preliminary tool, with its outputs ideally supplemented by specialist analysis when finer resolution is necessary.

Practitioners seeking to strengthen their skills in taxonomic and morphological comparison are encouraged to engage with a range of foundational and digital resources. Fillios and Blake's (2015) field guide provides essential identification criteria for commonly encountered native and introduced species. Barnett's (1978) manual offers detailed illustrations of the neurocranium, dentary, and premaxilla across 27 fish families, making it a valuable reference for comparative analysis. Kausmally and Western (2024) have produced a comprehensive guide to faunal skeletal remains, which includes practical guidance on the appropriate handling of material during excavation. In addition to these printed resources, open-access digital platforms are playing an increasingly central role in zooarchaeological practice. The ANU Digital Bone Library, accessible through the Skullbook Project (Dixson et al. 2018; Grant et al. 2018), provides high-resolution 3D models of Australian vertebrate remains, enabling remote study and morphological comparison. Fishboneviz, developed by Lambrides et al. (2024), expands this digital toolkit with a specialised 3D database focused on fish remains from Australian and Pacific Island contexts. Complementing these resources, Ozboneviz (Weisbecker et al. 2025) offers a multi-institutional repository of skeletal imagery that supports broader comparative efforts and helps bridge the methodological divide between simplified and specialist approaches.

The advantages of the framework lie in its accessibility, its ability to increase participation in faunal analysis, and its potential to improve data quality and comparability across consulting projects. Nevertheless, its limitations must be acknowledged. Reduced taxonomic resolution can hinder detailed interpretations, and the method requires appropriate training and contextual understanding to avoid misapplication. It is not intended to replace specialist analysis, particularly in research-driven or ecologically nuanced studies.

The future of zooarchaeology in Australia is increasingly defined by collaboration between consulting and academic research. In consulting, scalable and standardised frameworks are improving data quality and enabling broader cooperation, while co-designed projects with Indigenous communities are fostering culturally appropriate and inclusive

practices. Research directions are expanding to include underrepresented faunal assemblages, particularly from modern-era deposits and endangered species. Emerging technologies such as digital modelling, isotopic analysis, and ancient DNA offer new avenues for ecological and cultural insight. Realising these opportunities will depend on institutional support, targeted training, and stronger partnerships across universities, government agencies, and heritage consulting firms to build capacity and ensure zooarchaeological data informs both archaeological research and heritage management.

Conclusion

This simplified zooarchaeological framework offers a practical solution to the challenges faced in Australian consulting archaeology, enabling non-specialists to contribute meaningful data in resource-limited contexts. By focusing on broad classifications and standardised measurements, it enhances consistency and accessibility while acknowledging limitations in taxonomic resolution. The framework is best applied as a preliminary tool, with outputs ideally refined through specialist input. Its integration with emerging digital resources and collaborative research initiatives positions it as a valuable step toward more inclusive, scalable, and contextually informed zooarchaeological practice.

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Archaeology from above: Applications of LiDAR in Australian archaeology and cultural heritage

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Abstract

LiDAR (Light Detection and Ranging) is a remote sensing technique that has significantly advanced the field of landscape archaeology globally. This paper explores the potential for LiDAR to contribute to archaeology and heritage management in Australia. LiDAR uses pulsed laser light to create high-resolution 3D models of the landscape, penetrating vegetation to reveal hidden archaeological and topographic features. This enables the identification of otherwise obscured or inaccessible archaeological features, including the subtle features that sometimes characterise Aboriginal places, at a landscape scale. It can also be used to model landscape change over time that has occurred as a result of natural and/or cultural processes, thus contributing to a better understanding of archaeological potential in different settings.

Introduction

The application of LiDAR (Light Detection and Ranging) technology in archaeological research has revolutionised site detection, recording, and survey methodologies. When deployed from aerial platforms, this technology facilitates the efficient high-resolution 3D mapping of remote or difficult to access environments and potentially extensive and complex landscapes (Benjamin et al. 2018, 2020; Chase et al. 2011; Hale et al. 2023; Rouhani et al. 2024). Bare-earth digital elevation models (DEMs) generated by removing non-ground data from LiDAR point clouds are particularly valuable for archaeological interpretation. When paired with data visualisation tools, bare-earth DEMs can support the identification of archaeological features characterised by subtle surface variations that are often difficult to detect through traditional ground-based survey methods, even in heavily

forested environments (Campana 2020:13; Vinci et al. 2024:82). This capability has enabled archaeologists to identify previously undocumented cultural sites and to contextualise them more effectively within their broader spatial and environmental setting (Auld-Thomas et al. 2024; Estrada-Belli et al. 2023; Evans et al. 2013). LiDAR datasets can also be used to model landscape transformations over time, resulting from both natural and anthropogenic processes. In this way LiDAR can contribute to more nuanced assessments of archaeological potential across diverse settings and support the development of informed cultural heritage management strategies (Bofinger and Hesse 2011; Cody and Anderson 2021). In addition, LiDAR can be used to document complex structures such as heritage buildings (Zlot et al. 2014) and can also be implemented to produce spatially accurate 3D representations of excavation trenches and stratigraphic contexts (Adamopoulos et al. 2023).

In Australia, LiDAR is emerging as a powerful tool for identifying and documenting Aboriginal cultural landscapes (Rachcoff et al. 2025) and patterns of land use modification (Davies et al. 2016; Lawrence et al. 2023). Although the use of LiDAR in Australian archaeology has grown in recent years, access to this technology has historically been constrained by the significant resource requirements associated with data acquisition, processing, and interpretation. However, recent advancements in sensor miniaturisation and affordability, the proliferation of cost-effective deployment platforms, and the development of user-friendly data processing software have significantly improved access to LiDAR for archaeological research (Campana 2017:275; Law 2024) and cultural heritage management (Kurpiel et al. 2018). This 'democratisation' (Opitz 2016) of LiDAR technology not only reduces logistical barriers but also has implications for community-led archaeological research, including projects initiated by Aboriginal communities in Australia. In such contexts, the growing availability, and community-led use of LiDAR can contribute to more inclusive, ethical, and participatory research practices (Wilson 2007).

This paper examines the potential for LiDAR to

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contribute to archaeological research in Australia, with particular emphasis on its role in cultural heritage management and in advancing our understanding of relationships between people and Country. The paper begins by outlining the technical principles of LiDAR and methodological considerations in data acquisition, processing, and interpretation. A review of recent applications in Australia are then presented. Finally, the paper considers future directions for LiDAR applications in Australian archaeology, including technological advancements, integration with other remote sensing techniques, and potential contributions to community-led research initiatives.

What is LiDAR and how does it work?

Key components of an integrated LiDAR system include a sensor that transmits laser pulses and records reflected energy, a Global Positioning System (GPS) that identifies the x, y, z location of the sensor and an Inertial Measurement Unit (IMU) that provides the orientation of the system (referred to as roll, pitch, and yaw) (Dong and Chen 2017). The application of LiDAR technology involves five key stages: data acquisition, point cloud classification, terrain/elevation model creation, visualisation, and analysis (Opitz 2016:35; Štular et al. 2021:2).

During data acquisition, LiDAR sensors direct rapid laser pulses toward a target area, with advanced systems capable of transmitting and recording several hundred thousand pulses per second (Campana 2020:13). After striking objects such as trees, buildings, or the ground, laser pulses are reflected back to the sensor, which calculates distance by measuring the time taken for the pulses to return (Dong and Chen 2017:30). Each 'return' from a laser pulse is recorded as an individual data point to produce a dense point cloud.

Sequential binary laser (LAS) format is the industry standard for storing LiDAR point cloud data and includes spatial coordinates, classification values, and other meta data. This includes return intensity, indicating the reflectivity of surfaces struck by the laser pulse, and return type, which refers to the position of the return within a sequence of multiple reflections from a single emitted pulse (e.g., first, intermediate, last) (Dong and Chen 2017:45). Depending on their density, LiDAR point clouds can support a range of analyses such as vegetation mapping, building footprint extraction, 3D modelling, and the generation of bare-earth DEMs (Dong and Chen 2017:47).

Algorithms are used to analyse the spatial coordinates and metadata of each point in the LiDAR point cloud, to assign them to categories such as ground, vegetation, waterbodies, or built features (Dong and Chen 2017:47). Once classified, non-

ground points, such as those representing vegetation, can be filtered out to create bare-earth DEMs in raster format (Doneus et al. 2020). This capacity to digitally remove surface obstructions and expose the underlying terrain is a significant advantage of LiDAR over passive remote sensing techniques such as satellite or aerial photography.

Following classification, visualisation tools can then be applied to raster datasets to enhance topographic features and facilitate archaeological interpretation (Hesse and Kokalj 2017:16; Kokalj et al. 2011). Techniques such as hillshading, slope analysis, aspect mapping, and sky-view factor can accentuate different types of archaeological features, making them more readily visible and interpretable during analysis (Bennett et al. 2012; Challis et al. 2011; Kokalj and Somrak 2019). Significantly, topographic features associated with natural geomorphological processes, agricultural activity, and modern land use can be difficult to differentiate from archaeological signatures. Therefore, the process of ground truthing LiDAR data via field survey or archaeological excavation is required to determine the origin of identified features, and to evaluate the interpretive capability of the data (Reese-Taylor et al. 2016).

Applications of LiDAR in Australian archaeology

Archaeological prospection, or identification of cultural features

LiDAR has emerged as a powerful tool for identifying, documenting, and interpreting cultural landscapes across Australia. The analysis of bare-earth DEMs has proven particularly advantageous for identifying subtle variations in surface elevation that sometimes characterise Aboriginal places, which are often difficult to detect using traditional ground-based survey methods or satellite imagery.

On Wurundjeri Woi-wurrung Country near Sunbury, Victoria, LiDAR technology has been employed to prospect for circular earth features possibly associated with Aboriginal cultural and ceremonial activities. The analysis of bare-earth DEMs that have been digitally enhanced to accentuate the visibility of low-relief archaeological features has facilitated the interpretation of 28 features as potential earth rings, comparable to those previously recorded on Wurundjeri Woi-wurrung Country. The features are present across a range of landforms and environmental contexts, suggesting that earth rings may be more widespread across Country than previously thought (Rachcoff et al. 2025). In this way, the application of LiDAR technology can aid in the protection of cultural features from the ongoing pressure of urban development, by expanding knowledge of the landscape

context in which earth rings may be found (Rachcoff et al. 2025). This example shows how scientific knowledge can be incorporated by Traditional Custodians to deepen their own understanding of Country, as part of their own cultural, social and research goals (Rachcoff et al. 2025).

In the Murray-Darling Basin, LiDAR was applied to identify Aboriginal mound sites and to analyse their spatial relationships with shallow depressions and palaeochannels, offering insight into water-focused settlement patterns in southeastern Australia. At Pollack Swamp, LiDAR enabled the detailed mapping of 153 earth mounds in relation to subtle topographic and hydrological features such as levees, meander scrolls, and flood channels (Pardoe and Hutton 2021:21). By defining the spatial organisation of mound clusters within this low-relief floodplain landscape, LiDAR data contributed to the interpretation of village-scale settlement patterns of the Barapa Barapa people. Further archaeological analysis of the distribution, size, and environmental context of the mounds suggests long-term, seasonal habitation at Pollack Swamp, centred around wetland productivity and aquaculture (Pardoe and Hutton 2021). This research illustrates the capacity of LiDAR to resolve small-scale archaeological features and demonstrates the value

of LiDAR data in analysing the spatial relationships between sites and contextualising them within their broader environmental setting.

In the Victorian goldfields, LiDAR has proven effective in detecting the material traces of marginalised communities (**Figure 1**). At Surface Point, 20 km southwest of Ballarat, the analysis of bare-earth DEMs visualised using a hillshade relief tool revealed rectilinear patterns of furrows, ditches, and structural footprints, illustrating the spatial organisation of a Chinese mining camp (MacNeill 2024). This research demonstrates the capacity of LiDAR to identify the archaeological remnants of communities largely erased from the visible landscape, demonstrating its value for both archaeological interpretation and heritage recognition.

Beyond terrestrial applications, LiDAR has contributed to the identification of submerged palaeolandscapes preserved under rising sea levels. In the Dampier Archipelago, airborne topographic and bathymetric LiDAR was used to map palaeoshorelines and shallow seabed morphology to c. 12 m depth (Benjamin et al. 2020). This research combined LiDAR data with sidescan and multi beam sonar to conduct predictive modelling and define areas of elevated archaeological potential. Targeted diver surveys in these

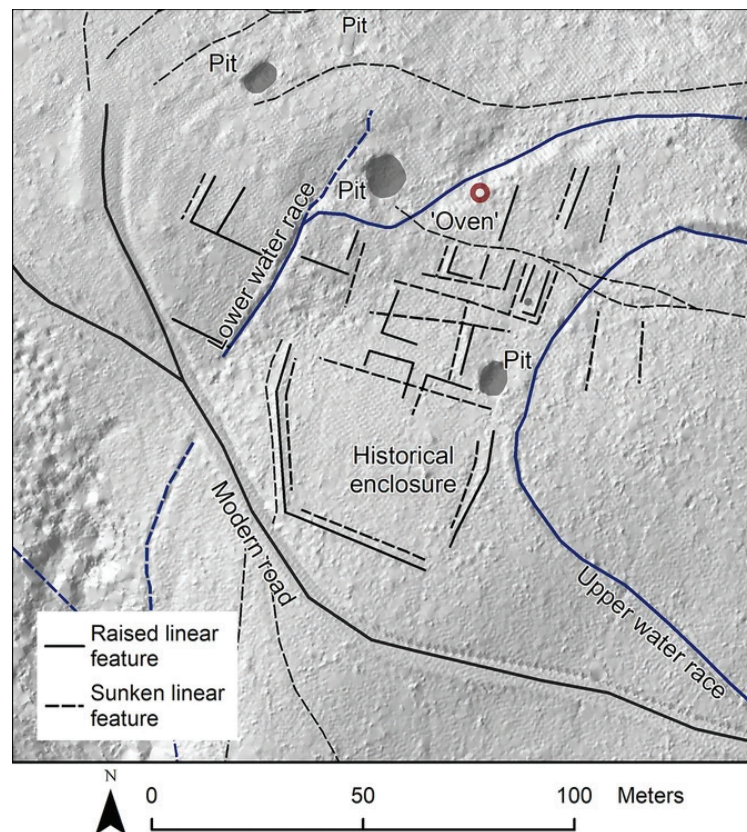


Figure 1. Rectilinear features associated with a Chinese mining camp at Surface Point can be identified in this LiDAR derived DEM with hillshade visualisation applied (Image: MacNeill 2024).

areas ultimately identified in situ lithic artefacts at Cape Bruguieres and Flying Foam Passage, demonstrating evidence of human occupation of these landscapes prior to inundation (Benjamin et al. 2018, 2020). These discoveries represent the first confirmed underwater archaeological sites on Australia's continental shelf and underscores the value of combining LiDAR with other remote sensing techniques to guide underwater archaeological research.

Collectively, these applications demonstrate the versatility and growing importance of LiDAR as a method for mapping, preserving, and interpreting cultural landscapes at both regional and site-specific scales.

Modelling landscape change

LiDAR data has also been used to model patterns of cultural landscape change. In central Melbourne, DEMs derived from LiDAR were combined with historical records of elevation to model changes in ground surface elevation associated with nineteenth and twentieth century urban development, revealing areas where archaeological deposits are more likely to be buried beneath imported fill materials (Hil et al. 2021). Similar techniques were applied in Ballarat to identify 'buried blocks'—zones of preserved archaeological potential resulting from post-mining landscape infill and other landscape change activities (Hil et al. 2023). By integrating LiDAR with ground-penetrating radar and historical records, this approach offers a predictive framework for evaluating the archaeological sensitivity of urbanised and modified landscapes, with direct implications for heritage management planning.

In the Victorian goldfields, LiDAR has been

instrumental in mapping extensive networks of nineteenth century mining infrastructure, including water races, dams, and habitation sites (Davies et al. 2016). In this case, the analysis of DEMs derived from LiDAR has contributed to a more comprehensive understanding of the spatial organisation and technological processes of historical mining complexes (**Figure 2**). Similarly, analysis of LiDAR data from the Loddon River valley in Victoria has been used to identify the terraforming processes of past mining activity at a regional scale (Lawrence et al. 2023).

Cultural landscape analysis

A significant, ongoing application of LiDAR in the context of Australian archaeology has been at the Budj Bim Cultural Landscape in southwestern Victoria, where LiDAR mapping enables detailed, landscape-scale analysis of the complex aquaculture systems established over 6600 years ago by the Gunditjmara people (Armstrong et al. 2024; McNiven et al. 2012; Smith et al. 2019). In 2019–20, the Department of Transport and Planning (2020) conducted detailed mapping across the UNESCO World Heritage-listed landscape on behalf of the Gunditj Mirring Traditional Owners Aboriginal Corporation (GMTOAC). The survey produced 10 cm-resolution true-colour aerial imagery and high-density LiDAR data, with an aggregated point density of approximately 80 points per square metre (Department of Transport and Planning 2020). These data are now used to identify previously undocumented fish traps and remnant stone structures, thereby enhancing understanding of the site's cultural and archaeological significance (Armstrong et al. 2024). Importantly, the LiDAR dataset

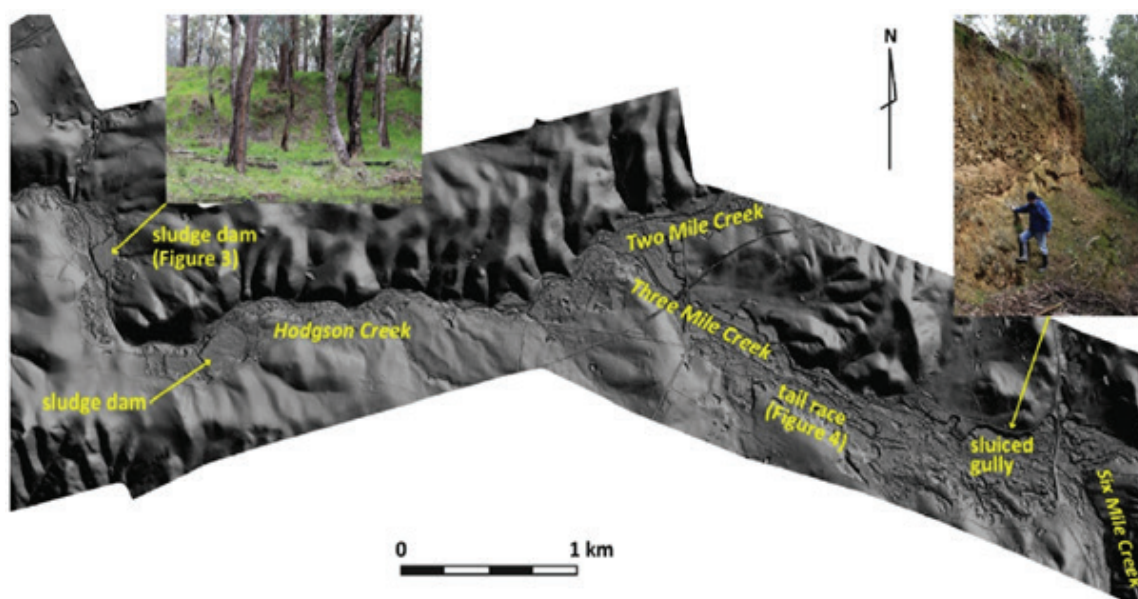


Figure 2. LiDAR derived DEM showing evidence of landscape modification associated with nineteenth century alluvial mining activities at Three Mile Creek, Victoria (Image: Davies et al. 2016).

is owned by the GMTOAC and continues to support ongoing land management practices (Department of Transport and Planning 2020). This custodianship of data ensures that its use aligns with community priorities and affirms the principle of Indigenous data sovereignty.

The growing accessibility of LiDAR for archaeological research and cultural heritage management

Traditionally, LiDAR systems are deployed via satellites, fixed-wing aircraft, or helicopters. While these platforms can efficiently capture large-area data, they involve substantial financial and logistical resources. Recent advancements in sensor miniaturisation, along with the widespread availability of affordable and user-friendly deployment platforms such as unmanned aerial vehicles (UAVs) have made LiDAR significantly more accessible (Campana 2017). Concurrently, the development of intuitive, open source, archaeology-focused point cloud processing and data visualisation software has reduced reliance on specialised technical expertise (Butler et al. 2021; Campana 2017:7; Zakšek et al. 2011). As a result, individual researchers can now conduct high-resolution, landscape-scale LiDAR surveys using drone-mounted systems in just a few hours and generate interpretable visualisations soon after data collection.

Accessibility has also been enhanced by the increasing availability of government-funded LiDAR datasets often released through open-access portals alongside aerial imagery and other geospatial data. Repositories such as the Digital Twin Victoria (DTV) LiDAR project and the Coordinated Imagery Program (CIP) allow researchers and communities without the capacity to collect their own data to draw upon existing resources for archaeological and heritage applications. This development is particularly significant for community-led research, as both affordable collection methods and open-data initiatives enable LiDAR to be applied in smaller, site-specific contexts and to support community-defined research priorities and land management goals. Moreover, LiDAR has the potential to transcend its role as a technological tool and become a platform for community empowerment to document, interpret, and safeguard cultural landscapes in accordance with community-defined priorities.

Conclusion

LiDAR is reshaping archaeological practice and cultural heritage management in Australia. Its ability to survey remote or obscured environments, identify archaeological features, and model landscape change

has made it an indispensable tool for interpreting cultural landscapes across a range of settings. From the aquaculture systems of Budj Bim to the buried urban deposits of Melbourne, LiDAR facilitates engagement with complex historical narratives embedded in the land.

The case studies presented in this paper underscore that LiDAR is not merely a technical innovation, but a methodological and ethical opportunity, supporting integrated research approaches, participatory practice, and Indigenous-led heritage work. As the technology becomes more affordable and accessible through both drone deployment and intuitive software, as well as the increasing availability of government-funded open-access datasets, it offers growing potential for community-led research and cultural mapping initiatives. However, meaningful application of LiDAR still requires a degree of technical expertise for data processing and interpretation, which remains an important consideration for both researchers and communities.

Looking ahead, future directions include the integration of LiDAR with machine learning, GIS-based spatial modelling, and complementary remote sensing techniques. Together, these innovations will continue to expand the analytical possibilities available to archaeologists and support more inclusive and context-sensitive heritage management frameworks.

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Capped Country: Assessing the presence and implications of historical gold mining and sludge for Aboriginal Cultural Heritage Management—with an example from Wadawurrung Country

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Abstract

Historical gold mining activities dramatically reshaped Victoria's landscape, sometimes burying pre-colonial ground surfaces beneath mining waste or 'sludge.' While the destructive impacts of mining are well-documented, this paper explores its unintended role in preserving Aboriginal and historical cultural heritage. Drawing on research conducted for the Western Victoria Transmission Network Project (now called the Western Renewables Link), this study employs a qualitative predictive modelling approach that integrates historical records, GIS-based spatial analysis, and geoarchaeological data to assess the likelihood of sludge deposition and mining impacts across culturally sensitive landscapes. Results demonstrate that intact archaeological deposits may lie beneath anthropogenic sediments across thousands of hectares in Victoria. Additionally, a recent example of Aboriginal cultural heritage identified within the context of gold mining sludge is reported on as a case study example. Together, these findings have significant implications for cultural heritage management, highlighting the value of early-stage predictive assessments in improving heritage outcomes and informing land use planning.

Introduction

Mining activities during the nineteenth and early twentieth centuries transformed Victoria's landscape, which has significant implications for assessing archaeological potential today. Whilst extensive research has documented the economic and societal changes brought about by the gold rush (including the effect of mining waste on the environment (Garden 2001; Lawrence & Davies 2014; 2018; 2019; Peterson 1996)), less attention has been given to its implications for tangible Aboriginal cultural heritage (Annear 1999; Attwood 1999; Blainey 2003; Cahir 2012; Lawrence et al. 2018). And, whilst the relationship between mining

and the distribution of Aboriginal cultural heritage can be complex, the outcomes of those activities are highly relevant for its management (Hil 2022).

Typically, historical mining is considered through a lens of destruction due to the high potential of resource extraction to directly disturb archaeological deposits. However, any form of excavation also produces a material volume equal to the size of the hole, which has to end up somewhere (Harris 1979). During the nineteenth century, before the invention of rock trucks or environmental regulations, that material often ended up burying and capping ground surfaces in adjacent or downstream areas, thus offering those areas increased protection from subsequent surficial impacts (Hil 2022; Hil et al. 2020; 2021; Lawrence et al. 2018). Moreover, in recent years an increasing number of archaeological test pits have identified intact pre-mining ground surfaces beneath mining waste deposits (i.e., sludge) in Victoria, including examples where Aboriginal cultural heritage has also been identified (Chamberlain 2017; Filihia 2018; Hil 2022:71–121; Oatway et al. 2018).

This paper explores the potential of predictive modelling to classify areas of land according to their likelihood of being capped by gold mining sludge or affected by other mining-related impacts. By integrating GIS-based spatial analysis with historical research, this proactive approach facilitates the tailored design of fieldwork programmes, leading to more effective identification of Aboriginal cultural heritage and, therefore, better outcomes for that heritage. This approach builds upon theoretical considerations provided in a previous Colloquium Proceedings paper, which considered the use of land use histories more generally within Aboriginal Cultural Heritage Management (Hil et al. 2020).

The findings presented here are based on a desktop review conducted as part of Cultural Heritage Management Plans (CHMP) undertaken as part of the Western Victoria Transmission Network Project (WVTNP) by Jacobs and sponsored by Ausnet. The WVTNP footprint spans 190 kilometres from Bulgana to Sydenham, crosses five Registered Aboriginal Parties (RAP) areas, and dozens of named waterways. To understand the potential for sludge deposits and mining impacts across the activity area and the implications

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for Aboriginal cultural heritage, Jacobs commissioned La Trobe Archaeology Research Partnerships (LTARP) to undertake a detailed landscape-level predictive assessment. Wadawurrung Traditional Owners Aboriginal Corporation have kindly given permission for the results of their sections of the activity area to be shared here.

Historical background: Mining and environmental change in Victoria

The Victorian gold rush began in the early 1850s and attracted thousands of prospectors from all corners of the globe. To extract gold from excavated paydirt miners typically combined water with some form of mechanical energy. Initially, individual miners used simple techniques such as panning and cradling, but soon more industrialised methods (e.g., sluicing, puddling, and hydraulic mining) became dominant (Lawrence & Davies 2014:390). These activities generated prodigious volumes of sediment, which entered local river systems, and steadily filled-up creek and riverbeds (Davies et al. 2018). As a result, many waterways downstream of mining activities, including those within Wadawurrung Country, became choked with mining waste, causing catastrophic flooding and the inundation of surrounding floodplain areas under thick deposits of ‘sludge’ (Lawrence et al. 2022).

Sludge, a byproduct of mining, consisted of fine clay particles, quartz sand, and gravel that entered Victoria’s waterways in volumes hundreds of times greater than natural sediment loads (Davies et al. 2018). During flood events this material spread over large areas, burying pre-existing ground surfaces. Contemporary records describe entire floodplains covered in thick layers of mining waste, at times exceeding several metres in depth (Royal Commission 1859; Select Committee 1890; Shakespeare et al. 1887). Research undertaken as part of the Australian Research Council (ARC)-funded Rivers of Gold project has shown that those sludge deposits can now be found capping ground surfaces more than 60 kilometres downstream of mining activities (Colombi et al. 2024:247; Hil 2022:106).

Implications for Aboriginal Cultural Heritage

For tens of thousands of years, Victorian waterways like Werribee River and its tributaries provided essential resources for Aboriginal communities, including freshwater, food, and materials for tool-making (Frankel 2017). Waterways and their surrounding floodplains have long been recognised as ‘Areas of Cultural Heritage Sensitivity’ for their higher relative potential for buried Aboriginal cultural heritage, with middens, hearths, mounds, artefact scatters, and burials frequently found within such contexts (Canning 2003). If mining sludge has capped former ground surfaces between the mid-

nineteenth to early twentieth century, those cultural heritage materials could remain intact but hidden beneath anthropogenic sediment layers.

In the context of walkover surveys or subsurface testing undertaken as part of a CHMP, if former ground surfaces were capped during the late-nineteenth century, those anthropogenic materials may now be further buried by topsoils or masked by vegetation. Unless the potential for capped former ground surfaces is considered during planning stages, a CHMP could wrongly associate surficial or near-surficial sterile deposits with lower potential for buried cultural heritage, when that area could still contain highly significant cultural deposits and features at depth (Hil et al. 2020). Generally speaking, fieldwork is most effective when it is informed by detailed and accurate desktop research.

Methodology: Predicting the presence of sludge and former mining activities

To predict the potential impact of mining activities and sludge on Aboriginal cultural heritage across the WVTNP footprint, a multi-pronged approach was utilised which dovetailed archival research, geoarchaeology, and geospatial analysis. This approach was largely based on techniques developed by the ARC-funded Rivers of Gold project (Grove et al. 2019; Lawrence et al. 2023) and doctoral research outlined in Hil (2022:61).

In order to effectively manage the activity area’s large spatial footprint, it was first split into 107 focus areas. These focus areas were primarily Areas of Cultural Heritage Sensitivity associated with named waterways or clusters of previously recorded Victorian Aboriginal Heritage Register (VAHR) Places. This approach focused the assessment onto areas adjacent to waterways that have the highest potential for sludge deposits. A qualitative predictive model was then used to individually assess the likelihood of historical mining activities and the potential for residual sludge deposits across each Focus Area.

Datasets relating to Victorian mining were retrieved from online databases including GeoVic (<https://gsv.vic.gov.au/>) and Data.Vic (<https://www.data.vic.gov.au/>) and were imported into GIS. These data sources included, but were not limited to, shapefiles relating to known areas of shallow gold working (Data.vic.gov), historical mineshafts (GeoVic), publicly accessible borehole data (Data.Vic), and historical mine sites listed on the Victorian Heritage Database (VHD). A 10-metre-resolution Digital Terrain Model (DTM) was paired with a watercourse polyline to establish relationships between prior mining activities and the sub-catchments of investigated creek and river systems (both available through Data.Vic).

Historical maps and gold mining plans were retrieved from online databases and georeferenced within

GIS including Trove (<https://trove.nla.gov.au/>) and Geological Survey of Victoria's (GSV) Search Assistant (<https://gsv.vic.gov.au/SearchAssistant2/>). These maps provided an additional source of information about mining impacts, such as the probable paths of gold leads or areas of previously observed mining activities or impacts. The maps were also checked to investigate whether there was evidence suggesting the course of each waterway had shifted over time. Further sources of historical mining information came from historical newspapers (via Trove), expired and current mining exploration licences (GSV's Search Assistant), gold mining literature (physical and digital libraries), and governmental reports and inquiries into mining impacts (via Parliamentary Papers - https://pov.ent.sirsidynix.net.au/client/en_GB/parl_paper/).

Sludge assessment

Each focus area was assessed for the likelihood that sludge had been deposited based on a combination of the following natural and cultural factors:

1. The presence, type, and intensity of upstream mining activity

Some techniques employed by miners produced greater volumes of sludge than others. Methods of mining that relied heavily on the use of water to extract gold from alluvium (such as ground sluicing, puddling, and hydraulic sluicing) produced greater quantities of sludge than shallow gold workings (e.g., mineshafts and prospect pits) or deep lead mining (Davies et al. 2018).

2. The position of a focus area within a river catchment or sub-catchment

Areas situated higher up in a catchment have fewer potential upstream sources of mobilised mining sediment, whereas a river that is fed by a significant number of smaller creek and river systems has a greater likelihood of being impacted by sludge.

3. The focus area's local topography

Water flows faster through a steep, narrow river valley than a wide, open floodplain. Higher energy (faster flowing) sections of a river system provide less opportunity for sludge deposition than areas of lower energy/waterflow.

These three factors were considered alongside archival research and GIS analysis to rank each focus area as having: Negligible potential; Some potential; Moderate potential; or Evidenced potential. 'Evidenced potential' is the assessment result allocated to focus areas where specific evidence for sludge impacts was identified (e.g., a newspaper article reports that sludge has impacted a property within or adjacent to that focus area). The other rankings (negligible, some, or moderate) were assessed qualitatively. For example, if historical newspapers describe high-intensity alluvial

mining upstream of a focus area, that area could be given a 'moderate' ranking in the absence of specific evidence that sludge reached the locality. A 'some' potential for sludge was often assigned to localities with numerous mine shafts immediately upstream of a focus area, but where no further information about those mining activities was available. A 'negligible' ranking was applied to focus areas with a limited number of upstream sources of mining or where local topographic conditions were unsuitable for sludge accumulation.

Mining assessment

A four-tier ranking system was also used for assessing the potential for mining impacts within each focus area.

'Negligible potential' was used in situations where no evidence of mining within or in the vicinity of a focus area was identified in mining datasets, the VHD, or through historical research.

'Some potential' was used in situations where a particular waterway or general location was known to have been worked by miners, but there is no evidence to suggest it took place within the focus area.

'Moderate potential' was applied when mining took place within close vicinity of a focus area and the historical record does not rule out that it may have occurred within its footprint.

'Evidenced potential' was reserved for examples where evidence was identified that strongly suggested mining took place specifically within a focus area.

Case study: The Werribee River System

The Werribee River system, located within Wadawurrung Country, was selected as a case study due to its historically evidenced upstream mining activities. This section presents the findings from focus area ID-73, where historical records, geospatial analysis, and predictive modelling suggest a moderate potential for sludge deposition. Figures 1 and 2 show the results of that analysis, including the presence of identified upstream mining activities and the suitability of downstream areas for the accumulation of sludge deposits.

Numerous historical mining operations were identified upstream of the Werribee River focus area, including shallow alluvial workings, deep lead mines, and hydraulic sluicing sites. These operations were concentrated in Blakeville and along Korweinguboora Creek, Spargo Creek, and Musk Creek (Baragwanath 1946:109) (Figure 1). In 1872, a newspaper article noted the 'discolouration of the waters' of the Werribee River by upstream mining operations by people living in Ballan. In 1898, the 'Haphazard Reef,' situated along the eastern side of Werribee River (upstream of the focus area) was worked through a 70 feet (21 metres) shaft with an 8-head stamper battery for crushing

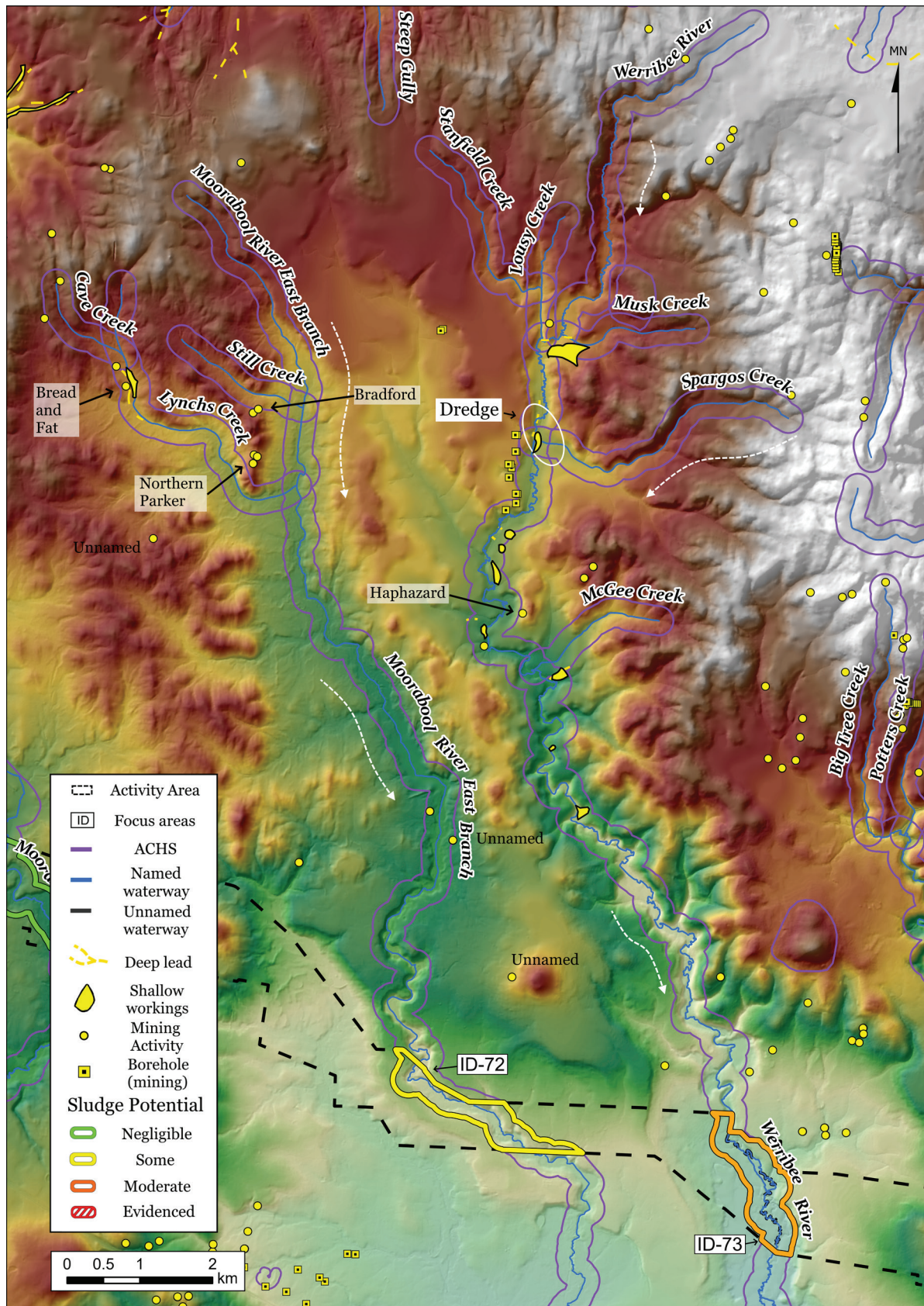


Figure 1. Results of the predictive assessment centre on the Werribee River catchment, with historical mining features shown in relation to the localised topography (image: Hil & Kurpiel 2021).

quartz, with the owner stating he was ‘willing to crush for the public’ (Lidgley 1898:1). Between 1906 and 1908, a dredge operated at the intersection of Spargo Creek and Werribee River (The Ballarat Star, 2 October 1906), which had the capacity to process ‘300 yards per day’ of paydirt. However, that newspaper article indicated that the dredge operators used settling dams to limit the amount of pollution entering Werribee River. The dredge was shut down in 1908 due to poor returns (The Argus, 11 August 1908).

GIS-based assessment and historical flood records indicate that the Werribee River’s low-lying floodplain morphology made it an ideal environment for sludge accumulation (Figure 2). However, due to a lack of explicit evidence for sludge accumulation and no identified records of historical mining in the immediate vicinity this focus area was given a ‘moderate’ risk ranking for sludge and a negligible ranking for the presence of historical mining.

Overall, out of the 107 focus areas, the predictive modelling assessment identified five focus areas with ‘evidenced potential’ for sludge, five with ‘moderate potential,’ and ten with ‘some potential.’ In terms of mining impacts, four had ‘evidenced potential,’ one had ‘moderate potential’ and 13 had ‘some potential.’

Wadawurrung Case Study

Whilst the previously outlined predictive modelling was confined to the WVTNP activity area footprint, ground truthing of subsurface profiles across other flood zones on Wadawurrung Country demonstrates the high potential for sludge deposits across other parts of Victoria. An emergent case study from a commercial archaeological excavation in the Bonshaw region of northwestern Victoria evidences the predicted relationship between waterways and sludge deposits and further shows the benefit of early sludge assessments.

The activity area for Cultural Heritage Management Plan (CHMP) 19937 (Almeida et al. n.d.) is located 6 km southwest of Ballarat and is comprised of agricultural and pastoral greenfields. Dissected by Bonshaw Creek, the activity area sits within the broader Yarrowee River system. While there is an evidenced relationship between the Yarrowee River system and deposited mining sludge in flood zones (Lawrence and Davies 2019), CHMP 19937 is also located in close proximity to several historic goldmines, one of which, the Albion Consol, was the largest mine in the Ballarat Goldfields region (Mindat 2024). Given this, there was an assumed moderate-to-high potential for sludge deposits within the activity area. In the case of CHMP 19937, the

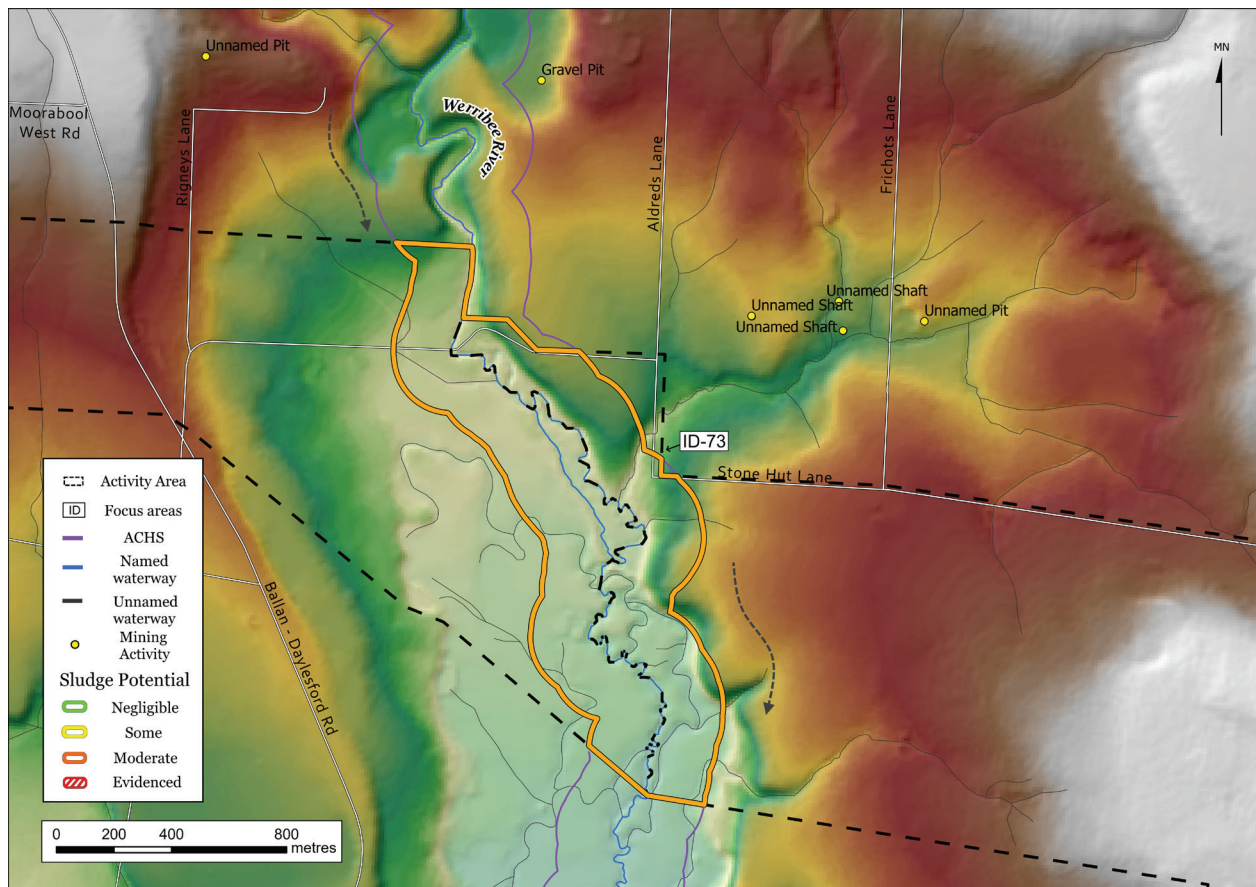


Figure 2. Focus Area 73 along Werribee River, with a 10-metre Digital Terrain Model (DTM) highlighting the suitability of the localised terrain to sludge accumulation (image: Hil & Kurpiel 2021).

desktop background research did not initially identify a demonstrable relationship between the activity area and the moderate-to-high mining sludge potential.

Once archaeological excavation had commenced, a context of pinkish grey quartz-rich silts endemic to the vicinity was identified consistently across the activity area, which was tentatively suggested to be mining sludge based on the frequency of European artefacts. Initially complicating a positive identification was the presence of both European and Aboriginal lithic artefacts dispersed throughout the stratigraphic profiles, with a moderate quantity of Aboriginal lithic artefacts in the potential sludge deposit (n=33); whether the Aboriginal lithic artefacts were dispersed throughout the context via bioturbation or secondary depositional processes has not yet been determined. To aid in the identification of the deposit's nature and origin, a micromorphological analysis was conducted, which concluded that the most likely source was indeed from light industrial processes such as gold mining (Morley and Hernandez 2024:9). The new contextual information provided necessary insight into the site formation process of the Aboriginal Cultural Heritage Place, which in turn allowed for more informed and appropriate harm mitigation but ultimately resulted in significant delays to the delivery of the project and unforeseen additional costs to the Sponsor.

The case study demonstrates that the use of early predictive modelling in a commercial context gives heritage practitioners and Traditional Owners the advantage of anticipating sludge deposits and creating responsive excavation methodologies. In turn, this minimises the chance of inappropriate excavation methodologies, data loss, and incorrect site formation analyses. Beyond cultural heritage management practices, the predictive modelling allows for a more holistic narrative of Victoria's gold rush; one that demonstrates an unbroken connection to Country that persisted and even formed a critical component of it. Finally, the case study also demonstrates that ground truthing (i.e., geotechnical testing with augers) will strengthen the outcomes of predictive modelling in early project planning stages prior to archaeological excavation.

Discussion

The findings of this study have important implications for the management of Aboriginal cultural heritage, particularly in the context of planning and development. The integration of predictive modelling into early-stage project planning offers a proactive tool for identifying areas with increased archaeological potential due to historical gold mining and sludge deposition before works commence. By understanding where intact pre-mining ground surfaces are likely to have been capped

by anthropogenic sediments, heritage advisors and project developers alike can make better informed, cost-effective decisions with better outcomes for cultural heritage. Within the scope of CHMPs undertaken as part of the Western Renewables Link Project, the findings and mapping from this predictive assessment informed both the Standard Assessment (ground survey) and Complex Assessment (subsurface excavation), helping heritage advisors assess where archaeological deposits were likely to be identified within the landscape and the potential depth of those deposits. The modelling also proved beneficial when preparing for fieldwork, as the presence of chemicals and metals in the sludge meant that any archaeological excavation within contaminated soils had to address relevant occupational health and safety (OHS) requirements.

In terms of limitations, the employed qualitative modelling approach relied on historical records or spatial datasets that were often compiled by third parties and typically derived from the same archival sources. Not all historical mining activities were well-documented, and it is possible that some assessed focus areas could maintain significant deposits of sludge, and yet still be classed as having 'negligible' risk. However, it is worth noting that all predictive models are wrong, but some are useful. Additionally, some mining areas, particularly around contemporary regional population centres, have since been heavily redeveloped. Areas once excavated or capped by mining activities may have been subsequently infilled or levelled by bulldozers. Those types of site-specific site formation processes are outside of the scope of the predictive modelling employed here but highlight the need for archaeologists to be thoughtful and comprehensive in their land use history assessments.

In terms of opportunities, this research demonstrates the potential for capped, archaeologically relevant ground surfaces across thousands of hectares of land throughout Victoria, and likely across other states as well. If mining waste deposits are identified capping undisturbed pre-colonial ground surfaces (i.e., as 'remade ground' (Hil 2022:35–36), and development activities necessitate salvage excavations, there is significant potential for new insights about the past to be generated, including the relationship between First Nations communities' continued connection to Country during and beyond Victoria's gold rush. Sludge is an anthropogenic deposit and can act as a chronostratigraphic marker, delineating the timing and extent of mining-related landscape modifications and providing a datable horizon separating pre-mining and post-mining archaeological contexts. Sludge is also allogenic (derived from materials that originate outside its immediate depositional environment) and thus Aboriginal cultural heritage identified within

sludge may represent redeposited material transported from upstream sources (Hil 2022:175). It is in this manner that additional archaeological inferences can be generated through sludge when viewed through a lens of site formation.

The implications of sludge for archaeologists also extends to historical archaeological fabric that were capped by thick deposits of sludge during the mid-to late-nineteenth century. Historical newspapers and government-enacted Royal Commissions frequently report structures, properties, and mine features submerged by metres of sediment during sludge inundation events (Royal Commission 1859; Shakespear et al. 1887). The application of similar predictive assessments across other study areas could help archaeologists and heritage planners to identify where such burial and preservation may have occurred.

Conventional CHMP assessments often approach historical mining and other historical earthmoving activities through a lens of destruction, emphasising disturbance caused by excavations. While these activities did irreversibly alter parts of the Victorian landscape, this study reinforces a more nuanced understanding—that overall historical mining may have inadvertently preserved more land than it disturbed.

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- THE ARGUS
- THE BALLARAT STAR

An archaeological signature for ceramic dealers in nineteenth century Melbourne

Natalie Paynter¹

Abstract

Archaeological signatures for nineteenth century retail and commercial businesses within an urban setting continue to be developed in Melbourne's archaeological literature. This paper presents a signature for Melbourne's ceramic dealers from the Metro Tunnel Project CBD North site. This unique assemblage had clear characteristics identifying it as discarded retail stock, offering the opportunity to study multiple sets and services in a variety of decorations and colours, present in volumes far beyond the quantities required for a domestic setting. These items have provided insights into commonly imported goods, stocked by ceramic dealers, contributing to a forgotten piece of Melbourne's history.

Introduction

Archaeological signatures for Melbourne's nineteenth century retail and commercial businesses continue to be studied. While signatures for domestic, working classes and industrial assemblages have been explored, a signature for retail and commercial businesses in an urban setting are largely unconsidered due to a lack of opportunity and research. An archaeological signature is essentially the unique characteristics of onsite activities, expressed through the attributes of the excavated assemblage. Recreating ceramic sets and services stocked for sale including dinner, breakfast and tea, dessert services, food preparation items, hygiene sets and fancy goods contributed to defining a signature.

The assemblage

The Metro Tunnel Project CBD North site excavation at the State Library station entrance on La Trobe Street, Melbourne took place in 2018. The recovery of artefactual material from two Victorian Heritage Inventory sites (VHI H7822-2129 and H7822-2130) made up the assemblage (**Figure 1**). Two ceramic dealers, John Oakley and later Thibou and Co., were part of the hundreds of businesses during the nineteenth century that occupied this part of the city block. The two dealers tenanted different buildings at the site between 1863 and 1871 (**Figure 1**).

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Figure 1: Showing the study area and tenanted stores from ceramic dealers during 1863–1871 (Public Record Office Victoria VPRS 8168/P0003 MELBRL 12, Bibbs T.S, 1856 edited by N. Paynter 2025)

Site formation revealed the presence of underfloor deposits and bulk discard of dumped unmovable stock. These deposits provided an opportunity to explore shop inventory of items broken during transport, unpacking or at the time of sale. Dumped deposits were indicative of a transient and unstable market that pushed dealers to insolvency.

Archaeological signatures have been previously developed for Melbourne's domestic assemblages of the upper and middle classes (Hayes 2014, 2018) for

working classes (Myers et al. 2023; Porter and Ferrier 2006; Williamson 2006), and industrial sites (Ellis and Woff 2017; Myers et. al. 2020; Stanin 2021; Wolswinkel 2021).

Domestic signatures noted incorporate multiple material types, considering ceramics as a contributor to the broader analysis. In contrast, industrial assemblages focussed more closely on a single material type, usually associated with the production of materials or the sale of goods. For example, glass provided a signature for the bottle washing industry (Ellis and Woff 2018), and the use and reuse of soda water bottles (Wolswinkel 2021). Myers et al. (2020) presented a signature for an iron foundry, focusing on extensive structural remains and hundreds of specialised metal foundry tools (Myers et al. 2020:88). Stanin (2021) presented an initial discussion of lead printers' type from a Melbourne print shop. Similarly, this paper focuses on ceramics from a commercial context allowing in depth analysis and interpretation of a single material type.

What was a ceramic dealer?

Importing ceramics into Victoria for sale began in the early 1840s when Melbourne was a small developing city of around 20,000 people (State Government Victoria 1863). James Dredge, former Assistant Protector of Aboriginal people for the Northeastern district of Victoria, resigned from the job after seven months. He decided to go into the glass and ceramic trade, 'considered a very respectable affair' and opened the first store 'much needed in the Province' importing objects of 'taste and elegance, as well as those of general utility' (State Library of Victoria, 1840).

Dealers imported a variety of objects to meet local demands with 'china' and 'earthenware' accounting for the main imports. China included fine-bodied goods manufactured from porcelain or bone china like fancy goods or items associated with fine dining. Imported in larger volumes, earthenware met the basic needs of the developing city. Everyday items for kitchen use, dining, tea and hygiene were stocked at a cheaper price point.

Recreating sets and services

An approach by Staniforth and Nash (1998) in their analysis of Chinese export porcelain from the wreck of the *Sydney Cove* provided a basis for the analysis of discarded retail stock. Staniforth and Nash considered form and decoration, and focused on three main groups - toiletry, dinner and teawares.

Building on this approach, the Metro Tunnel CBD North dataset was investigated to include the same three main groups, along with food preparation items and fancy goods. This methodology contextualised the assemblage through a retail lens, allowing for the estimation of sets and services stocked for commercial sale. It also helped to determine what was present or

missing within a set or service.

Trade and manufacturing catalogues from the early 1800s (Don Pottery Pattern Book 1807, Greens, Clarks and Co 1983), and from the mid to the end of the nineteenth century (Silber and Fleming 1860, Silber and Fleming 1880, Silber and Fleming 1885; Storey and Son 1862) revealed items advertised for sale as a set or service and also those sold individually to supplement sets. Identified forms in the assemblage were aligned to sets and services advertised using these advertisements as a guide.

Data selection of the 67,782 ceramic fragments recovered excluded stratigraphic contexts falling in outlying phases of site occupation (before 1853 and after 1925) focussing instead on those associated with retail and manufacturing activities (Andrew Long and Associates 2025). Materials excluded were Kaolin pipe clay, terracotta and any unidentified. Data discrimination focused on form, resulting in the exclusion of small ceramic finds, building materials, architectural components, and stoneware containers. This resulted in 31,741 artefacts, just under 52 per cent of the whole ceramic assemblage, forming a subset of data used to explore stock. Due to the close footprint of Oakley (1863–1865) and Thibou and Co.'s (1867–1871) shops, their period of occupation, similar goods and excavation within the same VHI site, (**Figure 1**), there was very limited ability to differentiate stock between the retailers.

Sets or services were defined as two forms of the same fabric and decoration (Hayes 2014:29), for example transfer printed with the same identified pattern, or undecorated whiteware or dyed body earthenware. The exception was breakfast and tea sets, where three items were considered a set and cup and saucers were investigated separately as pairs. Not all items in the subset data formed sets or services, as some were represented individually. Others were identified as bulk items of interest - multiples of a single form, indicating bulk purchase. Overall, a minimum of 1668 items and 41 different forms were associated with sets and services and bulk items of interest (**Table 1**). These are discussed below.

Dinner services

Twelve different dinner service forms were recorded, essential for setting a functional and well-presented table. Setting the table was a significant ritual in a household, especially when hosting guests. Consideration was given to layout, arrangements, centrepieces and the use of dinner services, matching glassware and cutlery sets to provide an ornamental and sometimes elaborate look. In accordance with English tradition, the dinner service was continuous in its decoration with every piece on the table sharing the same pattern (Whitehead 1903:145).

Dinner services accounted for 13,954 fragments, forming 489 items making 29 dinner services. All services were earthenware except an undecorated white granite service. Over 90 per cent of services

Recorded sets and services	Forms	Fragments (n)	MNI
Dinner services	Bowl, dish, drainer, ladle, mustard pot, pepper pot, plate, platter, salt cellar, sauce boat, tureen, tureen plate	13,954	489
Breakfast and tea services	Can, creamer, cup, eggcup, 7" plate, saucer, sugar bowl, teapot	11,368	798
Food preparation sets	Baker, dish, milk pan, mixing bowl, unidentified hollowware and bowl, pudding bowl	864	90
Toilet sets	Basin, candle stick, chamber pot, ewer, eye bath, patch pot, slop bowl, soap dish, toilet box	3017 2425	165 100
Fancy goods	Figurines, quill holders, unidentified hollowware, vases	113	26
Total		31,741	1668

Table 1. Overview of identified sets and service forms in the assemblage

were either transfer printed or flow decorated, or blue free-spatter decoration on whiteware, aligning with Australian consumers' preference for colourful wares (Lawrence 2003:25).

Decorated dinner services included common transfer printed patterns Agriculture, Albion, Aleppo, Ancona, Asiatic Pheasant, Chantilly, Euphrates, Fibre, Floralia, Genevese, Kulat, Loretto, Marble Modern Athens, Napier, Pearl, Rhine, Rousillon, Seaweed Floral Fibre, Valencia, Vignette, Walmer, Wild Rose, Willow along with flow transfer printed Hindostan, Fibre, Willow, and undecorated whiteware and white granite. All had an MNI count of less than 20 items, except undecorated whiteware, with 34 items and Willow with a staggering 260 individual items. It is likely that each service was stocked once, except Willow where multiple dinner services were probable.

Plates and platters

Within sets a variety of sizes of platters and plates were offered for sale. Plates were present in larger service sizes of 11" and 12", meat and soup plates in 10", twifflers in 9", tart or pie plates in 8" and cheese plates in 6 inches. Willow transfer printed plates were stocked with a minimum of one plate in every size, however 10" meat plates, a standard dinner size, were represented by 14 items stocked as individual pieces.

Ceramic manufacturers produced a variety of graduated sizes from 9 to 22 inches. This provided variety across the table setting, accommodating foods of various shapes and sizes (Figure 2). In this way, graduated platters provided the etiquette requirements for a meal (Abbott 1864:141).

A total of 69 platters were recorded, available in different decorations and sizes. Close analysis of platter fragments revealed impressed numbers from "9" to "20" under the base of Willow and Floralia transfer printed fragments, identified as vessel size. Building on this, where an impressed mark on the base was absent, rim size was recorded and subsequently used to calculate the vessel size. A minimum of eleven

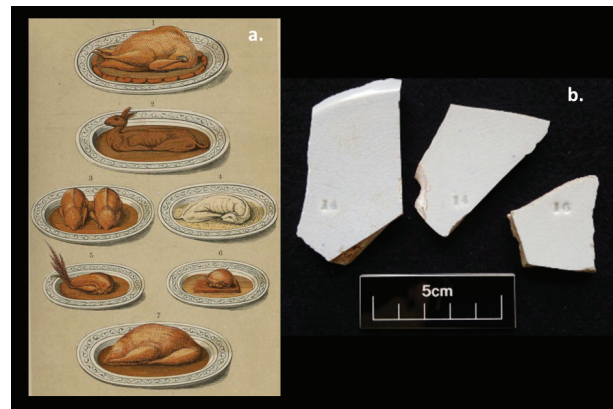


Figure 2: (a) The use of different platter sizes to plate meat and game (Abbott 1864:133), (b) 14- and 16-inch platters (MN3 03211) (Photograph: ArchLink Archaeologists)

platters decorated in Floralia pattern were present in 10", 12" and 20", while Willow was in 9", 10", 12", 13", 14" 16", 18" and 20". Hayes (2014) recorded 14 platters in the Viewbank assemblage, with a minimum of two white granite platters decorated in Berlin swirl pattern, and two transfer printed in Queens pattern (Hayes 2014:30). There is no discussion as to whether these platters were the same size or formed part of a set.

Other pieces recorded were stocked for sale as separates. A minimum of 40 multi-sided flow plates were decorated in Berlin Groups pattern, manufactured by William Adams and Son (1819–1864). Plates were commonly stocked by the dozen, with at least three dozen present in this assemblage. During the 1860s, William and Thomas Adams were producing specifically for the export market, with most of their trade headed to Brazil, Cuba, America, Java, Indonesia, Singapore and the US (Jewitt 1878:426). Although Australia is not specifically listed, global trade probably provided an easy route.

Breakfast and tea services

Trade catalogues show a breakfast service included

a teacup or coffee cup and saucer, a 7-inch muffin plate, and an egg cup per person along with a slop bowl, sugar basin, milk jug and a pair of bread plates for table service. Additional pieces to supplement the basic breakfast set included a tea pot, butter dish, toast rack, and egg stand to be purchased individually (Silber and Fleming 1860, Siber and Fleming 1885). The presentation of food and how it was served on the breakfast table was considered important. A nicely presented table with appetizing food ensured a day of good temper and harmony, while a bad breakfast was enough to 'derange the temper and digestion' (Jewry 1868:65). Acquiring items for good presentation from a local ceramic dealer would have been a good start to a peaceful morning table and subsequent day.

The assemblage contained a variety of tea and breakfast items (**Table 2**). The most common were cups and saucers forming 94 per cent of identified forms, followed by egg cups, and cans used for coffee or cocoas. The style of cup purchased by the consumer may have also been a personal preference, with some people preferring to drink from a thicker or thinner cup or use a different shape. Teapots were also well represented with 33 individual items.

Cup and saucer pairs

A total of 142 matching cup and saucer pairs were recorded. These formed 94 per cent of breakfast and tea service forms. They were standalone pairs, their only presence in the assemblage as matching duos. We know from English traditions that taking tea was an important and popular genteel practise. Tea was a staple commodity by the nineteenth century and provided a civilised middle-class ritual of taking tea. One commentator suggested it gave 'moral reform and social improvement' and where tea was lacking, particularly in the colonies 'barbarous manners are ... predominant' (Ritchie 1848:65).

Most were decorated with transfer printed patterns (87 per cent), with at least 14 different patterns available for purchase. Fibre was the most represented with 71 pairs. Other identified transfer prints included

Aleppo, Crystal, Floralia, Foliage, Medina, Pearl, Rousillon, Seaweed floral fibre, Star, Two Temples and Willow. Three unidentified patterns were present in large numbers. Other pairs were noted in gilt banded whiteware, porcelain with gilded tea leaf, undecorated white granite and Berlin Swirl, dyed body in blue and sprigged bone china with rose and thistle decoration, flow on whiteware, and underglaze painted vertical stripes on whiteware.

Of the transfer printed pairs, seven were present in more than one colour (**Figure 3**). They were recorded in a multitude of colours, including blue, black, brown, green, grey and purple. Interestingly there is no red recorded across these pairs. Perhaps this colour was popular and sold quickly, or it was stocked in smaller volumes. Fibre cups and saucers were recorded in 5 varying colours, black, blue, brown, green, and grey, providing variety to consumers in a pattern found commonly across Melbourne deposits (Brooks 2005:45).

Setting the breakfast table

Breakfast and tea services were identified with three or more forms in the same decoration or ware. A total of 26 different breakfast sets were recorded. Services were present in undecorated bone china, porcelain, whiteware and blue-dyed body, forming a plain addition to the table. Decorative techniques included flow, gilding, sponge spatter, sprigged and transfer printed. Transfer-printed Willow had the most diverse forms, represented by can, cup, eggcup, saucer, sugar bowl and 7-inch plate.

Blue-dyed body service was the only one to include a teapot. Brooks notes that dyed body vessels are widespread, often with one to two items in each assemblage (Brooks 2005:30). The presence of 166 fragments forming a minimum of seven items – teapot, cup, saucers and egg cups is not a large number but in the context of a single service offered for purchase, it is significant.

Trios

Closer analysis of these sets shows there were several trios present. These included combinations of can/ cup/ saucer (11 per cent of trios) followed by cup/ saucer/ eggcup (55 per cent of trios). Cans, commonly seen in Victoria's archaeological record, offered a sturdy coffee or cocoa cup. The option of a can, alongside a more delicate teacup, provided drinking options, while trios of cup/ saucer/ eggcup were fit for a sturdy, basic breakfast.

Historically, there is evidence of trios acquired from manufacturers. Don Pottery's 1807 catalogue offered a choice of chocolate cup shapes, either a can or shorter rounded shape (top row **Figure 4**), followed by a choice of low handled or unhandled teacup (middle row **Figure 4**). A single saucer to fit both chocolate and teacup choices finished the trio (Greens, Clarks and Co 1983). This reveals that manufacturers deliberately produced trios for the retail market.

Evidence from domestic archaeological sites around

Tea and breakfast service forms	Fragments (n)	MNI
Can	161	37
Creamer	11	1
Cup	5232	399
Eggcup	130	47
7" Muffin Plate	44	9
Saucer	5465	310
Slop pail	6	1
Sugar bowl	4	2
Teapot	293	33
Total	11,368	798

Table 2. Overview of identified stock forming sets and services in the assemblage

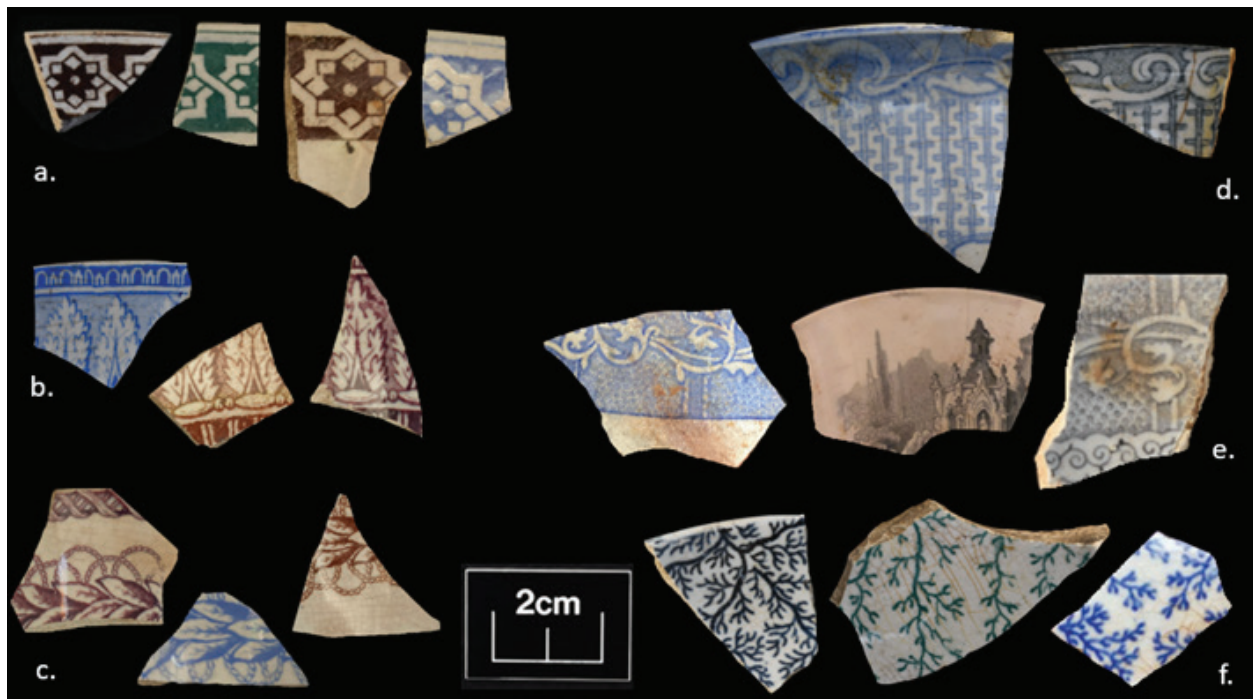


Figure 3: A sample of transfer printed colour variations across the assemblage showing (a) star (b) a stylised acanthus (c) laurel (d) crystal (e.) rousillon (f) fibre patterns (Photographs: ArchLink Archaeologists)

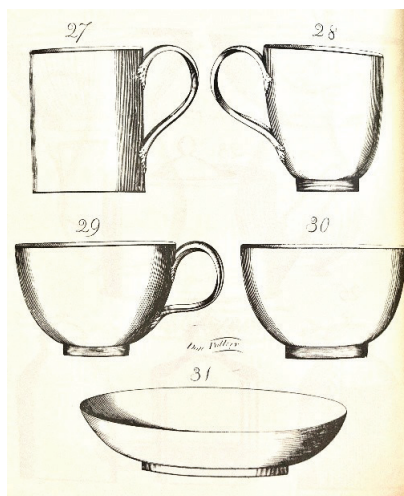


Figure 4: Trios offering cups in different shapes (Greens, Clarks and Co 1983-Don Pottery Pattern Book 1807)

Melbourne have identified piecemeal purchases of teaware by the working class (Ricardi 2017:142), rather than purchasing or replacing full trios. This may represent lower income households replacing items on an as-needs basis. It is unclear how often trios present themselves in the domestic archaeological record, highlighting gaps for further investigation in different social classes.

Teaware can offer insights into social themes, and in a domestic context, Brooks (2005) notes it can be used to explore gender, domesticity and regional identity (Brooks 2005:52). However, in a retail setting,

teawares allow exploration of social desirability, market oversupply or consumption. These themes are interrelated and can contribute to the way these items are interpreted in a domestic setting.

Food preparation sets

Food preparation items such as nests of bakers, bowls, dishes, mixing bowls, pudding bowls, unidentified yellowware and milk pans comprised 885 fragments and 89 individual items. Over 96.6 per cent of these items were yellowware, 2.2 per cent whiteware, 0.6 per cent red earthenware and 0.5 per cent stoneware. Bakers were the most common form with 47 individual items present.

Silber and Fleming (1885) advertised nests of bakers for purchase, varying in size, generally oval or circular in shape, with no footring (Figure 5). They advertised four decorative types; undecorated, sponged, transfer printed and undecorated whiteware along with cane (yellowware), purchased in nests with 5–8 vessels per set. Fireproof or heatproof bakers, are advertised in both ‘cane’ and whiteware, tending to have a flat flared rim for functional purposes, assisting with handling a hot dish.

Graduated nests in this assemblage include whiteware bakers decorated with transfer printed pattern Willow, along with two types of yellowware bakers – one undecorated and the other lightly moulded and manufactured by Sharpe Brothers, Swadlincote (Figure 6). Although there was nine Willow transfer printed bakers, many had individual distinctive panel motifs on the external edge of the vessel, focussing on different elements of the Willow



Figure 5: Nests of serving and baking dishes advertised for purchase (Silber and Fleming 1885:496)

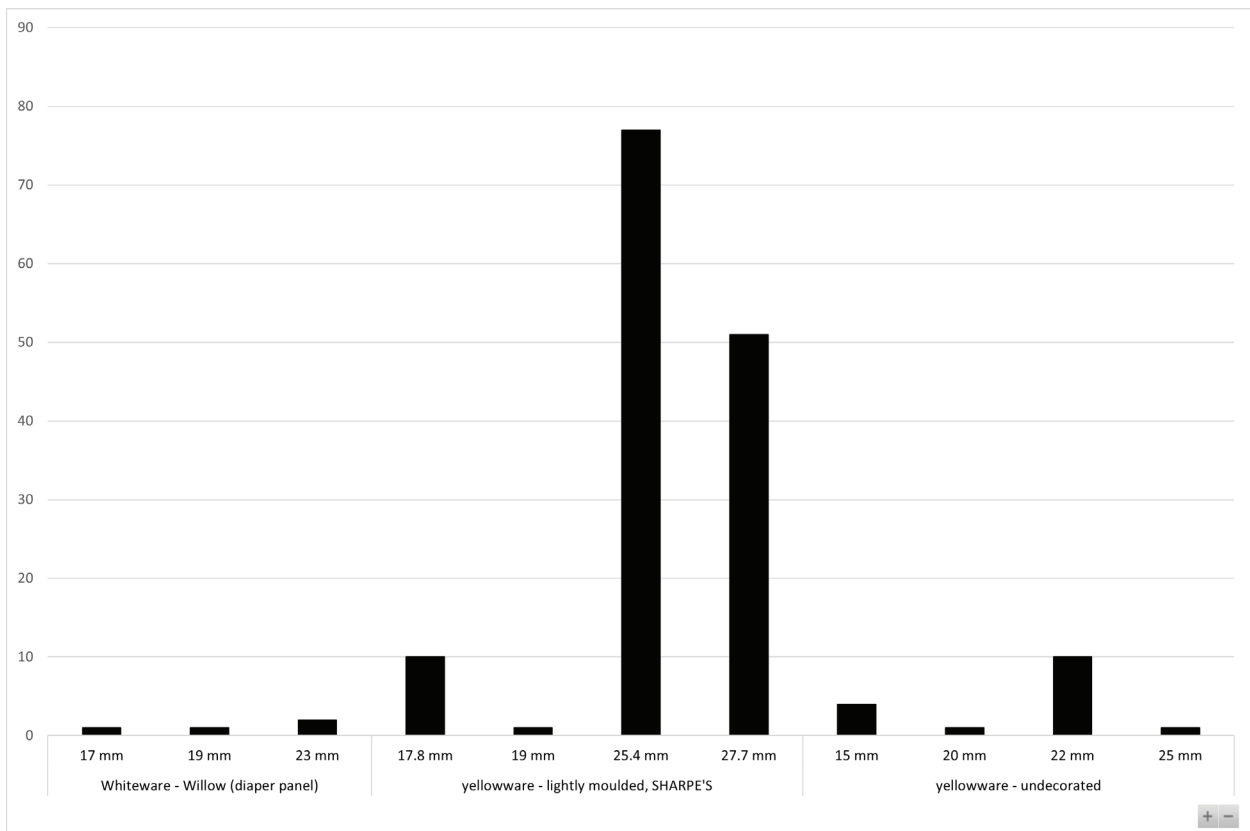


Figure 6: Baker nests showing differentiating rim sizes by fragment count (graph: N. Paynter 2025)

pattern. Some were geometric in their design, while others had natural or landscape themes, including a pair of birds, trees, pagoda and boats. Six different panel motifs were recorded, probably produced by different manufacturers. All were represented by a single baker, except for a nest of three, forming a set with a geometric style diaper on the side panel.

The light moulding on Sharpe's bakers was an attempt to give traditionally unfashionable yellowware an ornamental and decorative appearance (Figure 7). A visitor to the Sharpe's factory in 1848 noted 'a moulded Gothic heading' below the rim provided graceful curves on a pie-dish (Chambers and Chambers 1848:315). Similarly, Beeton's household management manual notes that bakers could be sent straight

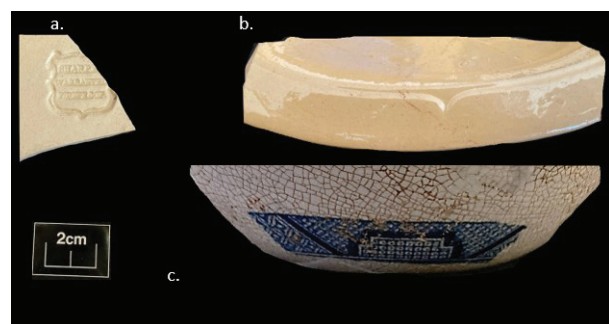


Figure 7: a). Sharpe Brothers impressed makers mark (MN1 03576); b) light gothic moulding on the rim of a Sharpe's baker (MN1 03577) and c) willow baker diaper (MN1 13551) (Photographs: ArchLink Archaeologists)

from the kitchen to the table as they were ‘decidedly ornamental’ (Beeton 1907:74). Subtle decoration on the rim of Sharpe’s bakers provided an elegant lift for a utilitarian item.

Utilitarian dishes for food preparation are under-researched in the archaeological literature with excavations in Melbourne documenting a limited presence, especially in domestic and urban settings. Food preparation items noted in the record are mainly the odd milk pan, mixing bowls and occasionally a dessert or jelly mould (Hayes 2014:25). Bakers are uncommonly reported in the archaeological record. The wreck of the “Josephine Ellis” 1856 bound for New Zealand had several Willow transfer-printed bakers in the cargo stock (Davenport 2016:15). Similarly, the barque “Eglinton” wrecked in 1852 off the Western Australian coast had a yellowware baker, along with a Willow transfer printed baker (Stanbury 2003: 90,118). While “Eglinton” presented individual items, there is no further information available if bakers from “Josephine Ellis” were the same size or formed part of a nest. Locally, deposits towards the base of a Queen Street cesspit in Melbourne’s CBD, recorded a likely yellowware baker (Hayes 2018:38). This is one of the few examples outside of this assemblage.

Local advertisements during the 1860s, contemporaneous with this assemblage, show auctions aimed at Melbourne’s ceramic dealers advertising bakers as consigned goods. Grieg and Murray offered 12 dozen Willow pattern bakers along with eight dozen unspecified bakers in the same lot as covered dishes and nappies (*The Argus*, 4 August 1860:2). Bakers were infrequently advertised and perhaps imported in lower numbers. As they turn up infrequently in the historic and archaeological record, they were probably a valued kitchen item, discarded only when broken, requiring infrequent replacement.

Toilet sets

Typically, a toilet set was made up of five pieces; an ewer, basin, chamber pot, brush tray and soap container

(Silber and Fleming 1860:52). These vessels formed the basic set an individual might need to maintain cleanliness and personal hygiene on a day-to-day basis. Additional pieces could be added to supplement the set including a slop jar, foot bath, supply jug, chamber lid, small mouth ewer and basin (Silber and Fleming 1880:679).

The assemblage contained a total of 3009 fragments represented by 169 items and 8 different forms. Chamber pots were the most common with 2526 fragments forming 111 individual items, followed by 25 individual basins, 22 ewers and small representations of soap dishes and toilet boxes, along with a patch pot, eye bath and candlestick. No chamber lids, slop bowls or foot baths were identified. The low numbers of toilet and soap boxes suggest these were sold as individual pieces, rather than part of complete hygiene sets.

Uncommon bedroom pieces, although not technically part of a toilet set, were items related to hygiene and personal care. They sat on a dresser and comprised a jewellery stand, lidded dishes, such as patch pots, candlesticks, a tray and perfumes (Silber and Fleming 1885:58). They were for display, exemplifying fashion and wealth. A patch pot for storing black beauty spots was present in the assemblage.

Sets were recorded as two or more forms of the same ware or decorative pattern. Ten different bathroom sets were identified (**Table 3**). While ten seems like a small number, it is representative of what was broken or discarded, suggesting a high turnover of these items. Undecorated whiteware made up just over 55 per cent of hygiene sets, with nine different forms present, including a candlestick and a rare eye bath for medicinal purposes.

Remaining transfer printed sets comprised trios with a basin, chamber pot and ewer, with the highest MNIs attributed to Chantilly (John Thomson and Sons 1826–1883), Genevise (Minton 1793–1873) and Kulat (Pinder Bourne and Hope 1851–1862) patterns.

The importance and necessity of items of hygiene have been identified by Young (1994) and Williamson

Decoration	Forms	Fragments (n)	MNI
Transfer printed – Chantilly	Basin, chamberpot, Ewer	312	17
Transfer printed – Genevise	Basin, chamberpot, ewer	428	11
Transfer printed – Kulat	Basin, chamberpot, ewer	187	8
Transfer printed – Marble	Chamberport, ewer	14	5
Transfer printed – Neva	Basin, chamberpot	38	2
Transfer printed – Rhine	Basin, chamberpot	9	2
Transfer printed – Venice	Basin, chamberpot, ewer	73	4
Transfer printed – Walmer	Chamberpot, ewer	19	2
Undecorated whiteware	Basin, chamberpot, candlestick, ewer, eye bath, soap dish	1339	47
Stoneware – moulded, lead glazed	Basin, chamberpot	6	2
Total		2425	100

Table 3: Hygiene sets by decoration and form

(2020), as objects associated with personal hygiene and cleanliness related to disease prevention. Young's investigation into South Australian insolvency registers in 1859, revealed washstands and toilet sets were representative of minimum living standards, as 82 per cent of insolvents with a household value of under £30 requested their retention (Young 1994:73). Her later work, on insolvency records in the 1840s in Sydney, looked at gentility and discovered that the only inventoried household furniture item consistently present was the washstand (Young 2004:219). Young's integral work reveals the need and value associated with these objects, considered essential assets across all socioeconomic households.

Chamber pots

Chamber pots were stocked within sets but also as individual items. A minimum of 14 undecorated pearlware chambers, seven transfer printed, a free sponge decorated, and a yellowware chamber pot with annular decoration, were present as standalone items. Pearlware represents older stock, as its manufacture was gradually phased out by 1830 (Brooks 2005:31). Here, it may be an example of older imports, or items acquired from one retailer to another by circular trade through shop closures.

The use of chamber pots was relied on for the collection of night soil with contents later disposed in cesspits (Harris 2025:72). They were essential for daily life and maintaining hygiene. The large number of disposed chamber pots possibly indicated a change in the requirement of Melbourne's sewerage. Earth closets became more popular in the late 1860s and the forced closure of cesspits from the early 1870s (Minchinton and Hayes 2018:63–64). This timing correlates with the assemblage.

Of note, both the pearlware and undecorated whiteware chamber pots were identified in three different sizes, the smallest suited to children. Similarly, cargo intended for New Zealand on the "Josphine Ellis" included three sizes of chamber pots (Davenport 2016:16). Locally, at the former Geelong Orphan Asylum and Common School, chamber pots were recorded in two sizes - a large and a small size for children's use (Kay and Hayes 2022). These size variations are rarely recorded and highlight a pattern of catering for social needs and hygiene standards in the British Empire.

Fancy goods

Advertised fancy goods included a variety of ceramic vessels, such as ornaments, vases, jardinières, baskets, spill vases and figurines. Fancy goods commonly depicted social themes of the time, rural life, romanticised daily activities, told the story of entertainers, Royals, politicians, heroes, sports people, criminals or celebrated natural beauty through birds, exotic animals or flowers. These objects were used in many contexts in the household setting, as table decorations, on the mantelpiece or dresser.

Only 18 fancy good vessels were recorded,

represented by 104 fragments from quill holders, figurines, vases and unidentified hollowware. No baskets, fancy flowerpots or jardinières were recorded. Just over a third were made from earthenware, with the rest manufactured from porcelain. Parian, an unglazed hard-paste porcelain, imitating Italianate marble accounted for 77 per cent of porcelain present.

All items found were single pieces, except for a pair of deer forming quill holders. A range of other animal figurines were present, including an earthenware Staffordshire dog, a goat and bird. All of these were ties to European species providing comfort for those across the Empire. Other novelties include three figurines of well-dressed men, one with a dark blue cobalt-glazed coat, a commonly used colour for decoration. The second had a coat and long hair in colourless moulded porcelain and the third was wearing a jacket decorated with a worn-off over-glazed painted blue jacket on top of a green shirt and cravat. It is also notable that this figure does not have an under-glazed dark blue or cobalt coloured vest, a commonly used colour for clothing from the mid-1840s. His blue vest is a lighter royal blue colour. This overglaze painting using enamels became routinely used from 1865, when the use of underglaze cobalt virtually ceased (Harding 2000:20).

In a nod to politics, a figurine base fragment with the numbers '1286' on masonry probably reflected the death of Scottish King Alexander III (Figure 8). The King was inaugurated on the famous Stone of Destiny or Stone of Scone in 1249 (Broun 2007), bringing prosperity and reuniting of land to a country in conflict. The death of Alexander III in 1286, was without succession, leading to the Wars of Independence from 1296 to 1329. Many centuries later in 1853 the Scottish National Association for the Vindication of Scottish Rights was established (*The Spectator*, 5 November 1853:5). The group's observations were published that year, noting that 'Scotland was a Kingdom with a long line of crowned and hereditary monarchs on her throne ...We look back to those old historic days with honest pride' (T.S. 1853:8). The Association held large meetings, produced publications and petitions aiming for additional Scottish representatives in the House of Commons (Tyrrell 2010:88). Although short lived - the Association wound up within three years - it did put pressure on Parliament. This small figurine is probably a reflection of Scottish political aspirations, outdated by the time it sat on the shelves

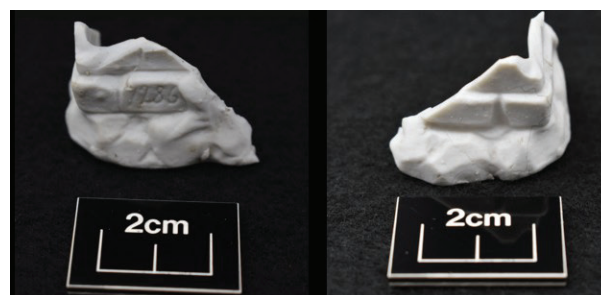


Figure 8: Moulded parian figurine with '1286' on masonry (MN1 01035) (Photograph: ArchLink Archaeologists)

for purchase in Melbourne. However, to the Scottish people, it represented steps towards nationalism. Its production, celebrating royals and military heroes, was not uncommon and was a popular subject for Staffordshire figures (Scott and Scott 1986:6).

Silber and Fleming (1880) advertised a case of decorative items for bulk purchase, ideal for complete decoration of the home. Their set contained 11 pieces, curated as single items or pairs, allowing them to add 'the latest novelties' to the order, keeping the customer in fashion. The items included a basket, tray, candelabra, centrepiece, two pairs of vases and a pair of figurines. In addition, they offered a case packed with up to 26 figurines all in different patterns forming a nice assortment for a shop. The variety and unique features of this dataset pinpoint it as a retail assemblage, curated with mostly single items, in a range of subjects and forms.

An archaeological signature

Two main patterns of site formation - the presence of underfloor deposits from shop breakages or during transport, along with the bulk discard of dumped unmovable stock - provided an opportunity to explore shop inventory. Dumped deposits were indicative of transient and unstable markets, resulting in insolvency. These actions were influenced by imperial controls and economic responses affecting imports and business longevity. Viewing these actions through a temporal framework speaks to the freshness and replenishment of stock and its distribution. The presence of pearlware chamber pots, up to 40 years old, prior to Oakley's first imports represent dated stock. Although an outlier in the dataset, it is important to note that colonial markets were probably receiving discounted or outdated stock at sale prices, because worlds away, these products were difficult to move off the shelf. Contributing local factors include economic and local health reforms.

This unique assemblage has clear identifiers that distinguish it from a domestic assemblage including multiple sets and services far beyond the expected quantities required for a domestic setting. Key examples are the presence of 29 dinner services, 26 breakfast and tea sets including 142 cup and saucer pairs, notable breakfast trios, food preparation nests, hygiene sets and huge numbers of individual chamber pots, and curated fancy goods. Not only are the quantities of these sets significant, many were duplicates. For example, transfer printed Willow was probably stocked multiple times as a dinner set. In addition, both undecorated whiteware and transfer printed Willow were present across dinner services, breakfast and tea sets, toilet sets, and food preparation items, meeting all household needs. Transfer printed patterns Chantilly, Genevise, Kulat, Marble and Rhine were recorded across dinner, breakfast and tea and toilet sets and services. These, along with undecorated whiteware could be identified as a household staple.

Large volumes and bulk goods are indicators of shop stock. Other unique characteristics include

multiple stock with the same form and transfer printed pattern offered in multiple colours. The commonly produced Rhine transfer printed pattern was stocked in five colours, Kulat in four, and tea sets decorated with Fibre also in four colours. Many others were available in two or three colours. The variety of colours and patterns offered for purchase is a standout feature of the assemblage.

While stocked ceramics tried to meet the needs of the Melbourne market, many goods could be described as generic: produced, transported and consumed within the British Empire. Oakley's insolvent estate describes he stocked 'the ordinary assortment of earthenware kept by the trade' (*The Argus*, 5 September 1867:8) amongst other items. This statement referred to commonly identified set and service patterns in this assemblage including Willow, Asiatic Pheasant, Wild Rose, Fibre, and sprigged bone china, often unearthed across Melbourne and throughout other British colonial markets. British-made ceramics were transported to nearly every continent, reflective of the modern world. Similar, generic goods are identified in the United States (Ewins 1997), South and Central America (Brooks and Rodriguez 2012; Cheek and Gonzalez 1988; Elkin and Frere 2021; Gaitán-Amman 2011; Guillermo 2019; Rodriguez & Brooks 2012), Africa (Croucher 2011), Asia and Indo China (Barry 2007, 2009), just to highlight a small number.

Figure 9 summarises the commercial ceramic assemblage, with a particular focus on sets and services highlighting its unique characteristics of the shop stock. Oakley and Thibou and Co.'s stores kept common and uncommon goods of the trade, catering for the Melbourne market. The rising middle class, who modelled gentility and distinguishing themselves from the working class were probably attracted to these goods (Harris 2025:23). The ceramic stock offered variety – a choice of multiple sets and services, sizes, purchase of individual items in many colours. This variety contributed to the unique characteristics of the assemblage.

Conclusion

The Metro Tunnel Project CBD North assemblage provided insights into Melbourne's commonly imported ceramic goods stocked by nineteenth century ceramic dealers. Distinctive characteristics of the assemblage identified common and uncommon elements that differentiate it from a domestic or industrial assemblage. This included high volumes of sets and services, some individually stocked items, a variety of transfer printed patterns and colours and the presence of outdated stock. These findings contribute to a growing body of work on retail assemblages. An archaeological signature for ceramic dealers has developed through analysis of this assemblage shedding light on a formerly buried piece of Melbourne's history.

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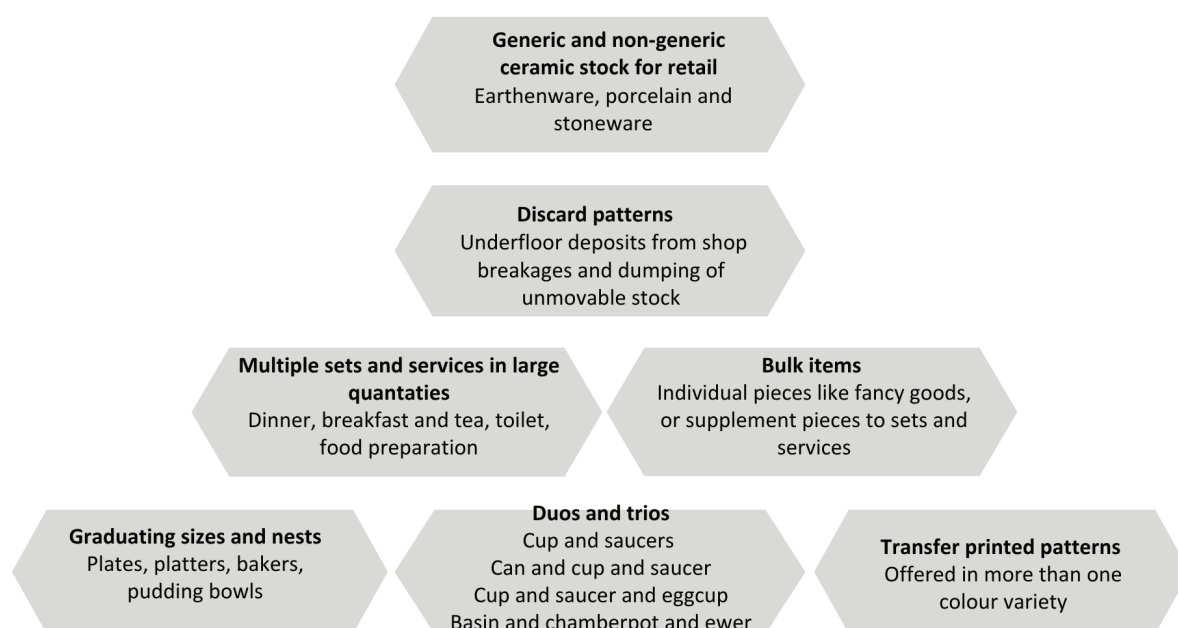


Figure 9: Summary of an archaeological signature for a ceramic dealer relating to sets and services

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The archaeology of marginal communities in the Literature Lane Archaeological precinct

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Introduction

The Literature Lane archaeological precinct (LLAP) consists of three sites listed on the Victorian Heritage Inventory (VHI):

- H7822-2143 (12-14 Little Latrobe Street)
- H7822-2144 (16 Little Latrobe Street)
- H7822-2145 (18-20 Little Latrobe Street)

These sites are located on the north side of Little Latrobe Street, west of Swanston Street. Two of the sites also border Literature Lane (**Figure 1**). At the start of the project the sites were each occupied by small two-storey commercial buildings.

The post-demolition excavation of these sites uncovered features and artefacts associated with occupation, reflecting the formalisation of the township of Melbourne and its development from the gold rush period onwards. The excavations uncovered a series of stone and brick-built remains, which were representative of the northward expansion of the Hoddle grid in 1849. Development from the gold rush period through to the commercial and economic development of Melbourne's 'Boom' period was not specifically reflected in the archaeological record here, potentially signalling the lower socio-economic conditions which typified Melbourne's urban fringe



Figure 1. Location of the LLAP sites in the Melbourne CBD (Plan: Goulding and Lane 2024)

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at that time. For the most part residential occupation persisted across all three VHI sites, with small-scale commercial operations, including basket makers, general grocers and merchant businesses, existing alongside residential occupation.

Perhaps unusual in the results of the excavations is an unexpectedly large component of Chinese-associated artefacts recovered from contexts dating to prior to the known occupation of the area by ethnically Chinese people. This paper discusses these findings.

General site history

Located in the northern portion of the CBD, the LLAP sites sit on land that was not part of the original series of land sales nor the original configuration of Melbourne's Hoddle Grid. Land in and immediately surrounding the LLAP study area was first sold in 1849. The first purchasers of the properties were wealthy men who were, no doubt, made more wealthy by their purchases. Albert Thome Ozanne and Thomas Budds Payne together bought the lion's share of Section 37 and quickly set about subdividing it into smaller lots and creating rights of way (RoW), including Little Latrobe Street and the RoW to the north, now known as Literature Lane. Part of this property was redistributed amongst themselves (with part of the LLAP site going to Payne), and part was sold to another investor, Hugh Glass, who acquired the remaining portion of the LLAP properties (PROV VPRS 18873). Both Payne and Glass became extremely wealthy men in subsequent decades. By 1862, Glass was thought to be the richest man in Victoria (Senyard 1972).

Over the decades following the initial land sales, the houses on Little Latrobe Street accommodated numerous families and individuals, with many staying for only a few years. Many of the residents owned businesses and practiced trades, either from other premises in the city or directly from their houses. Like much of Melbourne's population during the gold rush and subsequent decades, many of the residents of Little Latrobe Street were migrants seeking a new life in Melbourne (see site histories outlined in de Rochefort and Lane 2024a, 2024b and Lane 2024).

The mixed-use of residential and commercial spaces was a defining characteristic of the neighbourhood in the nineteenth century, reflecting the development of the northern Melbourne fringe as a commercial and residential hub. This character mirrors the wider development of the local area as neither a slum nor a purely retail/commercial centre. Little Latrobe Street and its surrounds certainly never reflected the wealth or status of the early landowners, but nor does it seem to have fully carried the stigma of the notorious 'Little Lon' slums (at least not until into the later nineteenth century). In terms of 'respectability,' many of the residents may have fallen into the morally dubious category, even if only due to a family structure that diverged from what was considered respectable (Poulton 2011:99–100). The Melbourne press of the 1870s seems to have viewed the Little Latrobe Street

area as an uneven mix of respectability outnumbered by poorer and/or criminal elements:

The locality is one of the worst quarters of the city, and is largely inhabited by men and women of the Bill Sykes and Nancy character... Little Latrobe street is a dark, narrow thoroughfare running parallel with the larger and more respectable street which has been called after his Excellency Sir Charles. The houses are mostly small, rather old and inhabited, generally speaking, by some of the poorer classes, or the most degraded and criminal of the community. Some decent looking houses, occupied by respectable persons, are scattered through the street, but thinly...Off Little Latrobe street branch several lands and alleys, which form a miniature labyrinth of dirty, sour-smelling [thoroughfares]...upon either side of which is ranged miserable looking dwellings with which some of the inhabitants...are in perfect uniformity (*Herald*, 11 September 1872:3).

Historical records indicate that by the early twentieth century, ethnically Chinese households had become more common within this area. This paper focusses on the archaeological evidence for Chinese residents and the distribution of Chinese-associated artefacts (particularly ceramics) in the LLAP sites.

Chinese occupants in the records

The historical records provide evidence of Chinese inhabitants moving into the LLAP area around the turn of the century, at which time there is a relatively sudden appearance of Chinese names (or in some instances just the notation 'Chinese') in rate books or street directory listings (see site histories in de Rochefort and Lane 2024a, 2024b and Lane 2024, also Poulton 2011: 99). While information concerning these individuals is scant, some of them are recorded as cabinetmakers in the street directories, suggesting the possibility that Chinese furniture making businesses were present in the street, but physical evidence for this in the archaeological record is somewhat tenuous.

Between 1880 and 1930, 'Chinese furniture factories constituted a substantial part of Australia's furniture industry' (Gibson 2022:xiv). Business premises could range from a small single workspace, sometimes run out of a shed or 'makeshift structures, little more than back yards covered over in corrugated iron,' to much larger complexes containing multiple workshops or workspaces allowing for administration, woodworking, polishing, and cooking to be carried out separately (Gibson 2022:46).

Gibson's discussion of Chinese furniture factories in Sydney and Melbourne clarifies that such factories varied widely in size and layout according to financial resources, the size of the workforce, and the use of machinery. Smaller factories usually contained one

workspace; however, larger factories contained several work areas. Storage spaces were also standard in most factories where timber was stocked to be dried before production. Kitchens and yards were specific to Chinese factories, as were dormitories. Factory living (boarding and feeding the employees) was a cultural practice imported to Australia by Chinese migrants (Gibson 2022:45–48). Dormitories were common within the furniture factories in the nineteenth century until the 1896 Factories and Shops Act in Victoria made factory dormitories illegal, ‘prompting manufacturers to house factory staff in nearby buildings’ (Gibson 2022:30–48).

Markus’ account of the anti-Chinese measures and lobbying in the furniture trade suggests that the 1896 Factory Act had the effect of increasing the number of small-scale Chinese-owned and staffed factories:

The Factory Act had two effects on the Chinese. First, their hours of work were...reduced, thus reducing their pay... Second, when the determination of the Wages board came into force, the employers complied with the demand to pay the minimum rate of wages [but dismissed workers who were slow or considered incapable of earning the wage]. Some of those thrown out of work started in business for themselves – ‘new factories with one, two and three workers sprung up like mushrooms’ (Markus 1974:9).

It is in the environment of increasing property vacancies during the economic recession of the 1890s and the expansion in the number of small Chinese furniture-making establishments, that the historical records first indicate the presence of Chinese tenants in the LLAP properties.

Is there evidence for Chinese furniture factories at LLAP?

It is tempting to see the spread of furniture factories as the explanation for the apparent sudden appearance of Chinese tenants in rate or street directory listings at the turn of the century at 12 and 14 Little Latrobe Street (H7822–2145), in 1901 at 16 Little Latrobe Street (H7822–2144) and from 1900 at 18 and 20 Little Latrobe Street (H7822–2143)(see site histories in de Rochefort and Lane 2024a, 2024b and Lane 2024).

Each residence in the LLAP area included a house and yard that could individually meet the space requirements of a smaller factory. The leasing of more than one house/property on Little Latrobe Street by a single individual, as suggested by the names recorded in the rate books (i.e. How Kee was listed in the rate books as being at both 12 and 16 Little Latrobe Street for several years starting in 1901), would most likely have satisfied the separate quarters accommodation requirements made necessary by the 1896 Act and may have also meant that working areas were spread across the properties.

Limited evidence of built or structural remains that demonstrated the presence of a potential workspace

was preserved in the archaeology. For instance, while all three properties contained yard spaces and outbuildings, these spaces simply contained preserved areas of paving and former shed spaces. Both of these features are common elements of most residential built arrangements.

There is, however, archaeological evidence for Chinese individuals being present on the properties. For the most part, this comes in the form of artefacts. Many of the deposits and fills excavated across the LLAP contained items manufactured in China that were traditionally used by Chinese people. These include ceramics notable for their traditional Chinese forms. That is, rather than forms regularly used in European colonial societies, such as handled cups and plates, we find small handleless teacups, celadon spoons, an unusual, recessed teapot lid, small bowls or hollowware, and a large variety of Chinese brown glazed stoneware (CBGS) bottle and jar fragments. It has been noted that the ceramics used by the Chinese settlers or migrants differ from Chinese export porcelain in form, decoration, place of manufacture, and period of export (Muir 2003:42).

Utilitarian provincial wares such as brown-glazed grey-bodied stoneware and lead-glazed coarse stoneware were primarily used for medium to large storage vessels such as jars and other containers. Chinese immigrants favoured these vessel types as it was thought to be similar to wares used in their homeland (Madsen and White 2016). CBGS was produced in Canton, a southern province of China and has been made in the same style for 200 years or more. These items were all food containers originally but could have been used to store all manner of things after their original contents were used (Hellman and Yang 1997).

Numerous examples of these vessel types existed in all three sites in Literature Lane. These included ginger jars, liquor bottles, wide-mouthed jars, globular jars and fragments of indeterminate vessels. Liquor bottles held either of two Chinese liquors known as Ng Ga Py and Mui Guai Lo, used both for drinking and in cooking (Hellman and Yang 1997). The wide-mouthed jars held preserved tofu, sweet bean paste, black, brown, and white beans, pickled turnips, cabbage, and shrimp paste and may have been later used to store sugar or various condiments (Hellman and Yang 1997).

Globular jars may have held liquor and oil when sold but may have subsequently been used to store soy sauce, pickled carrots, scallions, salted cabbage, melons, cucumbers, ginger and thousand-year-old eggs (Hellman and Yang 1997). Ginger jars were sold with preserved ginger inside but may have later been used to store a number of other food items.

Celadon, also known as Winter green, is a blue-green feldspathic glazed porcelain and is found in a variety of forms such as plates, bowls, spoons and cups. On the Literature Lane sites, spoons and small bowls were found with the celadon glaze; one spoon fragment is shown in **Figure 2**.

A stunning example of a small handle-less teacup

and a round domed 'lid' with a grooved rim is shown in **Figure 2**. This was decorated with the well-known 'Four Flowers' pattern. While the lid was fragmentary and not well preserved, the cup was of high quality with delicate design and bright colours. The flowers represent the four seasons: plum blossom for Winter, lotus for Summer, peony for Spring, and chrysanthemum for Autumn (Muir 2003:44). Elsewhere, a prominent peach is also described as part of this pattern, also known as 'Four seasons' (Kang 2013). This peach can be seen in the image of the cup in **Figure 2**, below. The pattern is purported to be more costly than others in the Chinese tableware market due to the elaborate nature of the decoration (Sando and Felton 1993). It was also not intended for European export (Hellman and Yang 1997).

A small amount of bottle glass was recovered from the LLAP, including a 'single dose' style medicine bottle and a small colourless medicine vial with Chinese characters embossed on the base (Figure 2). The characters may relate to a place name in China, or the properties or benefits of the contents.

Two Chinese coins, known as Tongbao, were recovered from the H7822–2145 property. Tongbao translates to 'a treasure with a hole through it' and has been produced in China for well over 2000 years (Hellman and Yang 1997:199). These coins would have had no monetary value in Australia. They have been argued to have been used in fortune telling, as good luck charms, and for gambling particularly in the game fantan and have been found across many historical sites in which Chinese people were known to have been (Hellman and Yang 1997). They are understood to be part of the signature of the Chinese diaspora in areas of migration.

The carved bone fish shown in **Figure 2** is a gaming token dating from the early eighteenth to early nineteenth centuries (Foundling Museum 2023). While this token is not necessarily Chinese in origin, in Chinese culture the fish represents the wish for 'more' (in relation to good luck, long life, children, etc.) (Ashkenazy, 2023). This token was found at the H7822–2144 property.

In addition to the presence of Chinese-manufactured ceramic and glass vessels retrieved from the LLAP excavation, there was some evidence in the faunal assemblage (animal food bones) that may also reflect a typically ethnically Chinese diet. Extensive reviews of Australian and American historical faunal assemblages (animal food bones) have identified some characteristic features of a faunal assemblage associated with Chinese food preferences. The reviews undertaken by Bowen (2012), Johnson (2017) and Porcasi (2017) identified a set of characteristic features of such assemblages. For example, common butchery practices included the breaking down of bones into small portions that enabled the use of chopsticks, evidence for the extraction of bone marrow with the ends of long bones cut off, and evidence for the chopping and hand sawing of bones. Time constraints did not enable a detailed examination of bone



Figure 3.(Left and middle) Femur with chop marks. (Right) irregular saw marks indicative of hand sawing (photo: de Rochefort et al. 2024)

recovered from the LLAP sites in terms of detailed butchery characterisation but evidence for chopping and hand sawing of bones was identified (**Figure 3**).

Timing of possible Chinese occupation at LLAP

Artefacts considered likely to be associated with Chinese people were found across all three LLAP sites (**Figure 4**). This result is not surprising considering the known occupation of those sites by Chinese individuals. More unexpected was the finding of Chinese-associated material in contexts interpreted as dating to decades before the known occupation of the site by Chinese people.

Table 1 presents a phased summary of artefact bearing contexts from all three VHI sites, which contained Chinese-associated material. In many instances these contexts are reflective of the documented early twentieth century occupation of the properties, by Chinese people - both in situ and re-worked deposits. For example, much of the Chinese material retrieved from H7822–2144 was associated with sub-floor occupation deposits, which represented a conflated accumulation of material through time. Similarly, of the 284 Chinese ceramics contained within the H7822–2143 artefact assemblage, the vast majority of material (86%) may be associated with early twentieth century occupation deposits and later phased re-worked deposits.

At site H7822–2143, where the majority of the Chinese artefacts were found, a proportion (12.5%) of the Chinese material was associated with nineteenth century deposits ranging from c.1861 to c.1895, with many of the items identified within sealed refuse deposits, which were set below the c.1866 stone and brick cottages. These deposits pre-date the historic documentation of Chinese people occupying the property, as there is no indication in the rate book and street directory searches undertaken for this project of Chinese people inhabiting the LLAP properties or nearby properties before the turn of the century (de Rochefort and Lane 2024a: 210).

Some of the material contained within the mid-



Figure 2. Selection of Chinese manufactured items typically used by ethnically Chinese people. Images from left to right in descending order include a handleless porcelain tea cup decorated with the Four Seasons pattern, a carved bone fish gaming token, a rough glazed serving dish or pan, a porcelain teapot lid (recessed or seated), a CBGS liquor bottle, fragments of a green glazed ginger jar, a Celdon spoon fragment (complete spoon shown for reference, original image from Wards 2024), a glass vial with Chinese characters, CBGS wide-mouthed jar, a Chinese coin, a stoneware ginger jar lid, a four seasons porcelain lid, and the Four Seasons porcelain cup. (images: de Rochefort et.al. 2024 unless otherwise noted)

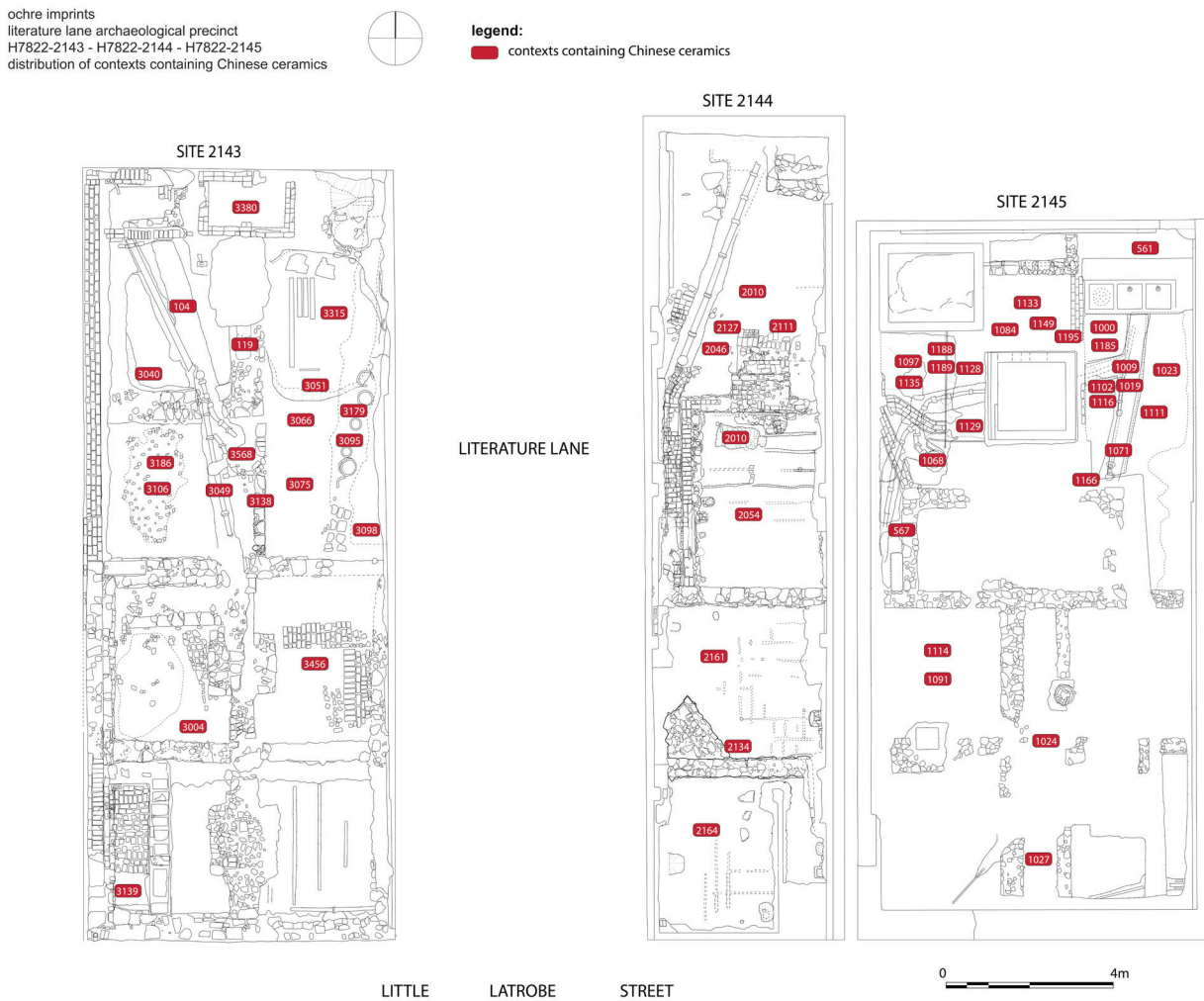


Figure 4. The distribution of contexts containing Chinese ceramics at the Literature Lane sites (plan: de Rochefort et al. 2024)

nineteenth century deposits may relate to vessels that were manufactured in China and exported for the European market, and this may account for some of the Chinese-manufactured items in these fills. We do note that it is not uncommon to find some ceramics of Chinese origin in historical urban sites in Melbourne (for example see Murray and Mayne 2003). These fills, however, also contain items that were manufactured in China and considered more likely to be used by Chinese people. The presence of Chinese-manufactured vessels in the stratified and sealed waste-bearing deposits dating to this time period potentially reflects undocumented ethnic diversification within the neighbourhood or the interaction between ethnically Chinese people and European households.

Alternative explanations

A possibility that could account for some of the Chinese material in the area hinges less on Chinese individuals being residents of the area, and more on the probability of Chinese people being simply present in and part of the life of nineteenth century Melbourne. Certainly, it is clear that Chinese people

arrived in relatively large numbers in Victoria during the gold rush years. Gibson has noted that even post-rush Chinese immigrants were attracted by economic opportunities in Victoria, particularly following the 1860s repeal of restrictions on the numbers of Chinese migrants (Gibson 2022:19). In cities and towns, many Chinese men worked as hawkers and, in so doing, became an essential part of the urban environment and economy:

The Chinese population of is about 500, and of the suburbs 380. Of tea and general hawkers there are 109. The tea hawkers purchase three fourths of their tea from European merchants, and the wares of the general hawker are almost wholly of British or German manufacture. The fish hawkers purchase at the Melbourne Fish Market from £100 to £120 worth of fish per week, and Mr Richie, the fish salesman, is reported to assert that for the last twenty years the Chinese have been the chief support of the fish market (*The Ballarat Star*, 10 June 1880:4).

Bagnall has attempted to outline and characterise the relationship between Chinese hawkers and their

Site/context	Probable Context date range	Chinese made ceramics	Glass	Other
H7822–2143		284 items	I item	
104	reworked occupation (20 th C.)	1 spoon - celadon		
119	reworked occupation (20 th C.)	1 bowl or spoon - celadon 1 hollowware - porcelain HPOG		
3004	reworked occupation (20 th C.)	180 fragments of CBGS liquor bottle 47 fragments of CBGS wide-mouthed jar 2 fragments of unidentified - porcelain		
3040	reworked occupation (20 th C.)	4 fragments of CBGS jar	1 single dose	
3049	c.1895	18 fragments of liquor bottle - CBGS 1 fragment globular jar - lead glazed		
3051	reworked occupation (20 th C.)	1 fragment porcelain jar 1 fragment lead glazed jar		
3066	1860s (potentially intrusive)	1 fragment hollowware - porcelain HPOG		
3075	1860s+	1 fragment flatware - porcelain blue HPUG (possible export porcelain used in the European market) 1 fragment lead glazed jar		
3095	possibly 1900+	1 fragment flatware - porcelain blue HPUG (possible export porcelain used in the European market)		
3098	1860s (potentially intrusive)	1 spoon fragment - celadon 1 fragment flatware - porcelain blue HPUG (possible export porcelain used in the European market)		
3106	c.1861–1895	5 fragments bowl or spoon - celadon		
3138	c.1861–1866	1 fragment ginger jar – porcelain (possible export porcelain used in the European market)		
3139	1860s –1920s	1 fragment jar - CBGS		
3179	1900+	1 fragment jar - CBGS 1 fragment plate - porcelain blue HPUG (possible export porcelain used in the European market)		
3186	c.1861–1866	6 fragments ginger jar - porcelain HPUG (possible export porcelain used in the European market) 1 fragment cup or small bowl - porcelain HPUG		
3315	1850s (likely intrusive)	1 fragment globular jar - lead glazed		

Table 1: Contexts of Chinese-made ceramics and other artefacts at LLAP sites.

Site/context	Probable Context date range	Chinese made ceramics	Glass	Other
3380	Pre-1895	1 fragment hollowware - porcelain HPOG 1 fragment dish - porcelain blue HPUG (possible export porcelain used in the European market)		
3456	1860s–1920s	1 fragment jar - CBGS		
3568	Pre-1895 (may be intrusive)	1 fragment jar - CBGS		
H7822–2144		84 items	16 items	3 items
2010	Pre-1913 (disturbed)	6 frags CBGS container 9 frags CBGS liquor bottle		1 resin hand
2016	1913+ (disturbed)	2 frags CBGS liquor bottle		
2046	1872–1895 (likely disturbed)	1 brown glazed redware container	1 (single dose medicine vial)	
2054	c.1852–1913 (conflated occupation)	1 porcelain HPUG teapot lid 1 four season HPOG lid	13 (punched out bottle base)	1 Chinese button
2063	1852–1913 (conflated occupation)		1 (punched out bottle base)	
2111	c.1861–1866	2 green glazed ginger jar frags		
2127	c.1861–1866	1 CBGS container frag		
2134	Pre-1913 (disturbed)	2 green glazed Chinese ginger jar fragments		
2161	c.1852–1913 (conflated occupation)	1 Chinese HPUG porcelain cup rim 12 Four flowers/Four seasons porcelain teacup 9 brown glazed low sided Chinese stoneware bowl fragments 28 green glazed Chinese ginger jar fragments	1 (punched out bottle base)	
2164	c.1852–1913 (conflated occupation)	6 fragments stoneware shallow dish or lid of ginger jar, and green glazed stoneware ginger jar		1 fish gaming token
H7822–2145		40 items	1 items	2 items
1000	1890s–1920s	2 fragments celadon small bowl/spoon		
1009	1890s–1920s	2 celadon spoon/bowl		
1023	1850s–1890s	1 HPUG porcelain ginger jar		
1027	1920s+ (disturbed)	1 HPUG porcelain ginger jar		
1068	1890s–1920s	1 CBGS shallow dish		
1084	1890s–1920s	3 CBGS jar		

Table 1 (continued): Contexts of Chinese-made ceramics and other artefacts at LLAP sites.

Site/context	Probable Context date range	Chinese made ceramics	Glass	Other
1091	1920s+ (disturbed)		1 Chinese medicine bottle	1 tongbao
1097	1890s–1920s	1 CBGS jar		1 tongbao
1102	1890s–1920s	2 celadon small bowl		
1111	1850s–1890s	1 HPUG dish 2 CBGS globular jar		
1114	1850s–1920s			
1116	1850s–1890s	2 CBGS ginger jar 3 CBGS jar		
1128	1890s–1920s	1 CBGS jar		
1133	1870s–1890s	6 CBGS jar and liquor bottle frags		
1135	1850s–1890s	1 CBGS jar		
1149	1850s–1890s	2 CBGS jar		
1166	1850s–1890s	2 CBGS ginger jar lid		
1185	1850s–1870s	1 CBGS jar		
1188	1850s–1890s	1 CBGS jar		
1195	1850s–1860s	1 CBGS jar		
Abbreviations: HPUG = hand painted under glaze, HPOG = hand painted over glaze, CBGS = Chinese brown glazed stoneware. Blue highlights denote years prior to occupation by individuals with Chinese names according to rate book data (PROV VPRS 5708)				

Table 1 (continued): Contexts of Chinese-made ceramics and other artefacts at LLAP sites.

European clientele. She notes that while the Victorian middle class was preoccupied with boundaries between races, classes and spaces, ‘legal, social and community demarcation lines created by white Australians clearly excluded Chinese from a place within the imagined Australian community’. At the same time, ‘white women were subject to a different set of boundaries, both ideological and physical’ and their opportunities for participation in the public sphere were generally limited (Bagnall 2002:11). The business of the hawker of household goods, however, brought Chinese and non-Chinese individuals together on a regular basis and made the doorsteps of white homes a ‘contact zone’ in which ‘many white women interacted with Chinese men’ (Bagnall 2002:13). This regular contact opened up the possibility of a sort of relationship between the householder and the hawker, and there are accounts of hawkers who ‘spoiled the children with a lolly or brought a jar of ginger at Christmas’ (Bagnall 2002:26, see also Figure 5).

While such interactions probably resulted in only a



Figure 5. Image of a Chinese pedlar giving presents to a non-Chinese child in Melbourne (*The Graphic* (London) 24 December 1887: 684)

small amount of material transfer between ethnically Chinese people and European households and would not be adequate to explain large numbers of Chinese-associated material in the Little Latrobe assemblages, they do perhaps highlight the importance of the unrecorded small scale interactions that occurred across different facets of the population of early Melbourne and serve as a reminder that divisions may not have been as hard or fast as we commonly perceive.

Another way in which Chinese people had the potential to be intimately involved in the households of the LLAP and would have contributed to the archaeological assemblage without necessarily being listed as occupants is through romantic partnerships or intimate relations between white women and Chinese men.

Chinese men were almost always without their wives and families due to a high poll tax paid for any Chinese person on entry to Australia, £10 per Chinese passenger arriving in Melbourne (Macgregor 2015: 60). Sexual relationships between Chinese men and white women are hinted at in the documentary evidence. Markus records that in one Chinese furniture-making establishment, 'the bookkeeper lamented that the men squandered their money on European women' (Markus 1974:7).

There was a general belief that interracial couplings were driven by economic necessity (Cronin 1975) and a prejudice-led belief that assumed that any women that had relations with men of other races during the nineteenth and early twentieth centuries was likely to be a sex worker (Piper 2015:450). However, there is clear evidence to the contrary that indicates that these interracial partnerships were often entered into voluntarily and for romantic reasons rather than as a transaction.

Lydon, in her study of Chinese and white relations in the Rocks, Sydney, in the late nineteenth century, discusses the cohabitation of marginalised white women and Chinese men, often forming 'stable, mutually beneficial relationships' (Lydon 1999: 237). It is clear that racial prejudice and the common Victorian preoccupation with the virtue and vulnerability of women to moral corruption, led to many misconstrued notions that women were lured into liaisons with Chinese men rather than entering into them willingly. Lydon quotes an article from the Chinese Australian Herald in which Sun Johnson wrote to refute the reports of alleged drugging and seduction of virtuous girls by the Chinese:

I have spoken to several, and they all say that they went there without any persuasion whatever on the part of the Chinese, but they are well treated, and that they prefer living with the Chinese than with white men (*Chinese Australian Herald* 24 March 1893, quoted in Lydon 1999: 135).

Lydon notes that relationships with Chinese men were a means of material and emotional benefits when white women were 'unable or unwilling to conform to their own society's expectations of appropriate female behaviour' (Lydon 1999:185). According to Victorian notions of respectability, a woman who had been abandoned or was living in a household without a male head may be at risk of being considered lacking in respectability.

Historical records certainly attest to such women being present in the LLAP area. Many of the female-headed households appear to have consisted of women who had been widowed or who ran legitimate businesses from the properties, but there were also known female criminals such as Charlotte Matthews, who lived at 14 Little Latrobe Street in the mid 1890s and had a criminal record associated with her involvement in robberies (*Herald* 7 March 1894:3), and Adelaide Caston, who, prior to living in Little Latrobe Street in the 1890s had spent some time in gaol for breaking into houses (*Police Gazette, Victoria* 27 May 1885:177).

That said, we have no documentation of Chinese men living in or being closely associated with the evidently female-headed households in the nineteenth century and remain in a situation where the historical record (as examined to date) does not provide a clear explanation as to the likely origin of much of the possibly Chinese-associated material excavated from contexts dating to earlier than the turn of the century. Perhaps the presence of this material is an indication of a more open and cosmopolitan (or simply pragmatic) trade in household goods amongst some of the residents in nineteenth century urban Melbourne than has generally been recognised.

While relationships of varying kinds between two groups of people who could each be described as living outside of accepted Victorian norms may provide some explanation as to the transfer of unexpected examples of Chinese-associated material culture into these sites, a clear explanation remains elusive. This can perhaps be regarded as another example of the ability of historical archaeology to raise questions and considerations not explained or elucidated by the historical record.

The project and acknowledgements

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THE BALLARAT STAR

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THE HERALD

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Heritage Victoria's Maritime Heritage at Risk Program: 10 Years On

Dario De Bortoli¹

Abstract

Heritage Victoria's Maritime Heritage at Risk program commenced in 2016 to identify and protect Victoria's most significant historic shipwrecks at risk. The Program uses a quantifiable methodology to assess and prioritise shipwrecks according to significance, community value and risk criteria. The most important wrecks are included in a Shipwreck Risk Register, through which site management activities are conducted to better safeguard the wrecks from human and environmental interference.

Program achievements include extensive community-based monitoring (600 site visits) and 110 site inspections focussed on assessing wreck condition. The program has led to compliance and conservation activities, particularly at the City of Launceston wreck, and site management activities, such as at the Amazon wreck. In addition, it has included new assessments, monitoring of diver and artefacts websites, media and public reporting.

Key observations and learnings note much focus has been spent on a small number of wrecks, and that the Risk Register needs updating more dynamically to remove wrecks that have been buried for an extended period. The future direction of the program will expand to include submerged aircraft wrecks.

Introduction

At the present time, 324 shipwrecks have been found in Victoria, with many threatened by environmental and human activity.

Heritage Victoria's Maritime Heritage at Risk Program commenced in 2016 to identify and prioritise the State's most significant shipwrecks and assess their current and future risk. The program also aims to focus attention on Victoria's fragile underwater cultural heritage by protecting the State's most significant shipwrecks at the greatest risk. The program assesses shipwrecks according to significance, community value and risk criteria. Based on this assessment, the most important at-risk wrecks are included in a Risk

Register and site management activities for protecting those wrecks are initiated. Activities include diver site inspections, conservation measures, monitoring, compliance and community involvement in observing and reporting human activity.

In addition, data are collected on the current condition, condition trend and the degree of vulnerability of wrecks to inform future actions to protect the wrecks. Wrecks are removed from the Risk Register if they are deemed to have stabilised or the risk is reduced. The program regularly reports to the public on the status of the activities undertaken.

The program adopts a comparative approach ranking shipwrecks comparatively rather than treating them in isolation and is based on a similar program implemented by English Heritage (now Historic England) for their terrestrial and maritime heritage sites (Dunkley 2008).

Objectives

The key program objectives are to:

- Deliver a systematic, quantifiable approach to assessing shipwreck sites.
- Identify and prioritise the most significant Victorian shipwrecks.
- Protect and conserve the shipwrecks at the most risk.
- Provide an objective basis for the allocation of resources.
- Enable site management initiatives to reduce the types and degree of risk to wreck sites.
- Raise the status of conservation management as a key area of maritime archaeology activities.
- Communicate the status of site management activities to government and the community.

Strategies

The key program strategies are to:

- Focus on the key shipwrecks that need the most urgent attention.
- Actively monitor shipwrecks in conjunction with the local community.
- Collect data to enable informed decision-making in the conservation of shipwrecks.

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- Include the local community and other government authorities in site management activities.
- Provide a transparent basis for the allocation of resources.
- Progressively develop site management plans.
- Provide regular public reporting of activities.

Methodology

The program commenced as a result of Heritage Victoria's (HV) reassessment of its strategic direction regarding underwater cultural heritage management. This was primarily based on the need to adopt a more systematic approach to maritime heritage management and to focus finite resources on the key activities that would provide the most important cultural heritage and community outcomes.

The program methodology assesses shipwrecks according to the criteria listed in **Table 1**.

All the criteria in **Table 1** have numeric scores whereby a wreck is graded on a scale of '0' for no social-economic significance to '5' for national significance (**Table 2**). For example, the Significance Criteria includes an assessment of the wreck's socio-economic association. This category evaluates the direct association of the wreck with the social history of an area or community in Victoria.

Based on the aggregate scores obtained from the assessments, wrecks are classified for site management actions based on a significance-risk matrix (**Figure 1**). Sites where risk and significance are low to medium are allocated to the No Action (green) category. High significance wrecks assessed as medium risk and medium significance wrecks assessed as high risk are included on the On Watch (yellow) list. Periodic

Category	Description
<i>Significance</i>	
Historical Association with People and Events	Rates the wreck's historical association with important people and events at the local, state or national level.
Type and Construction	Considers if the wreck is a rare or uncommon example of its type and construction. For example, early Australian built ships, rare vessel types and early submarines.
Function	Assesses if the wreck is a rare or uncommon example of a particular function. For example, whaling ships, hospital ships and former slave ships.
Technology and Innovation	Appraises the importance of the wreck with regard to changes in technology, design innovation or ship construction.
Socio-economic Association	Evaluates the direct association of the wreck with the social history of an area or community. For example, loss of life, community development and major economic events.
Archaeological Research Potential	Relates to the level of research information that the wreck provides or can provide.
Age (Date of Build)	Classifies the wreck under six date of build ranges covering the period 1797 to post 1939. The scoring is higher for the oldest wrecks to reflect their importance in early periods where little is known of shipbuilding and use.
<i>Community Value</i>	
Visibility	Evaluates the level of structural remains that are visible at the site.
Accessibility	Assesses the restrictions associated with divers visiting the site.
Interpretation	Appraises the level of interpretative material associated with the site.
<i>Risk</i>	
Intactness	Scores the site on the percentage of the wreck that has survived.
Current Condition	Provides an assessment of the overall current condition of the wreck.
Condition Trend	Seeks to provide a rating of how the condition of the wreck is expected to change in the future.
Corrosion Level (if applicable)	The category evaluates the level of corrosion that has impacted the shipwreck over time. Primarily used to assess iron and steel wrecks.

Table 1. Maritime Heritage at Risk Program criteria (De Bortoli 2017:37)

Grading		Description	Score
National	5	National socio-economic significance.	
State/National	4	Primarily State with some National significance.	
State	3	State socio-economic significance.	
Local/State	2	Primarily Local with some State significance.	
Local	1	Local socio-economic significance.	
None	0	No social-economic significance.	
Guidelines: Direct association with the social history of an area or community (e.g., instrumental in the settlement of an area). Direct relationship between the wreck and loss of life, remembrance, or existing public interest (e.g., World War 2). Contributed to regional / local community development (e.g., provided essential link between area and major urban centres). Directly linked to major economic events (e.g., migration, gold rush, etc).			

Table 2. Significance Criteria, socio-economic association (De Bortoli 2017:39)

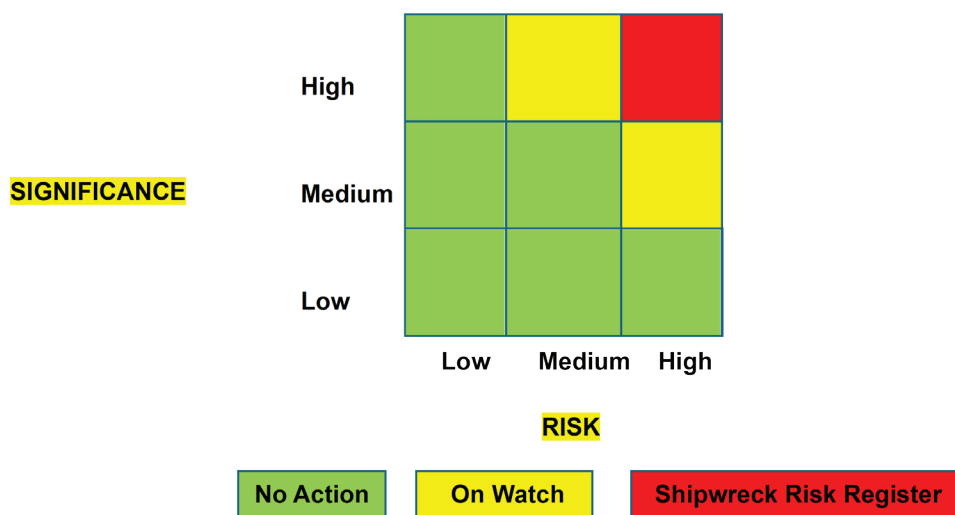


Figure 1. Significance-Risk matrix (De Bortoli 2017:34)

monitoring is then conducted at these On Watch wrecks, given that preventative action is likely to be less resource demanding than when a wreck has been allocated to the Risk Register. Wrecks assessed as high significance and risk are allocated to the Risk Register (Red). These wrecks are pro-actively managed with the aim of minimising further deterioration to the site (Heritage Victoria 2023). For a further discussion of the methodology used in the Maritime Heritage at Risk Program see De Bortoli 2017:34.

As of June 2024, there were 25 shipwrecks in the Shipwreck Risk Register shown in **Table 3** and 16 in the On Watch list (Heritage Victoria 2024).

Outcomes

Monitoring

Heritage Victoria commenced the Community Shipwreck Monitoring Program in November 2018 to monitor human activity at selected shipwreck sites.

The program allows coastal community groups to be directly involved in the protection of their local underwater cultural heritage sites by conducting regular patrols at wreck sites. This enables Heritage Victoria to respond more rapidly to reports of damaging human behaviour that could put historic shipwrecks at risk. It also provides funding and support for the operations

Priority	Shipwreck	Location	Date Lost
1	Amazon	Surf Beach, Inverloch.	Dec 1863
2	S.S Conside	Lonsdale Reef, Port Phillip Heads.	Sep 1852
3	Loch Ard	Loch Ard Gorge, east of Port Campbell.	Jun 1878
4	Monumental City	Tullaberga Island, near Gabo Island and Mallacoota.	May 1853
5	Thistle	Port Fairy.	Dec 1837
6	Barbara	Rye, Port Phillip Bay.	Aug 1852
7	H.M.V.S Cerberus	Half Moon Bay, Port Phillip Bay.	Sep 1926
8	Cheviot	Waterloo Bay, Wilsons Promontory.	Mar 1854
9	S.S City of Launceston	North of West Channel, Port Phillip Bay.	Nov 1865
10	Nautilus	Cape Liptrap.	Jan 1856
11	H.M.V.S Countess of Hopetoun	Swan Island, Port Phillip Bay.	Nov 1924
12	P.S Thistle	West bank of Port Albert entrance.	Nov 1859
13	William Salthouse	North of Popes Eye, Port Phillip Bay.	Nov 1841

Priority	Shipwreck	Location	Date Lost
14	Alert	Bass Strait, between Cape Schanck and Port Phillip Heads.	Dec 1893
15	S.S Cambridge	Bass Strait, 3.7 miles south-east of Wilsons Promontory.	Nov 1940
16	Carlisle	Bass Strait, near Crocodile Rock.	Aug 1890
17	Lady Mary Pelham	Port Fairy.	Aug 1849
18	M.V City of Rayville	Bass Strait, off Cape Otway.	Nov 1940
19	T.S.S Coramba	Bass Strait, off Phillip Island.	Nov 1934
20	S.S Glenelg	Bass Strait, near Lakes Entrance.	Mar 1900
21	S.S Gulf of Carpentaria	Between Cleft and Anser Islands, Wilsons Promontory.	Sep 1885
22	S.S Kanowna	Twelve miles south-west of Cleft Island, Wilsons Promontory.	Feb 1929
23	S.S Queensland	Bass Strait, 15 miles north-east of Wilsons Promontory.	Aug 1876
24	S.S Casino	Apollo Bay.	Jul 1932
25	H.M.A.S Goorangai	South Channel, Port Phillip Bay.	Nov 1940

Table 3. Shipwreck Risk Register (Maritime Heritage at Risk Program Annual Report 2023/24)

of worthy community organisations such as Volunteer Coast Guard flotillas and Surf Life Saving Clubs.

The program currently consists of Queenscliff, Werribee, Port Albert and Port Welshpool Volunteer Coast Guards and Inverloch and Port Fairy Surf Life Saving Clubs. The participants are responsible for monitoring 18 wreck sites including six protection zones and two port facilities.

Patrols are on the look-out for any damaging activities including anchoring, fishing and diving in protection zones which can cause irreversible damage to the most sensitive wrecks. Reports of non-compliance at protection zones are referred to Heritage Victoria.

Participants have provided over 600 reports from the program's commencement to December 2024. Most reports were for vessels detected fishing in the

S.S City of Launceston and Clarence Protection Zones.

In 2019 the program was expanded to include Port Albert and Port Welshpool Volunteer Coast Guards (**Figure 2**). This was in response to the increased level of recreational deep diving activities culminating in the looting of previously undisturbed deep-water shipwrecks in Victoria.

As well as visiting deep-water wreck sites, both coastguards also monitor vessels that may be involved in diving operations operating from their port facilities. Professional fishers are active at the locations with instances of diver activity investigated.

In addition to site-based monitoring, diver and artefact website monitoring commenced in March 2022 and currently covers eight dive and five artefact websites. The aim of the monitoring is to obtain information on diver activity at wreck sites,



Figure 2. Port Welshpool Volunteer Coast Guard vessel (photograph: J Smith 2021)

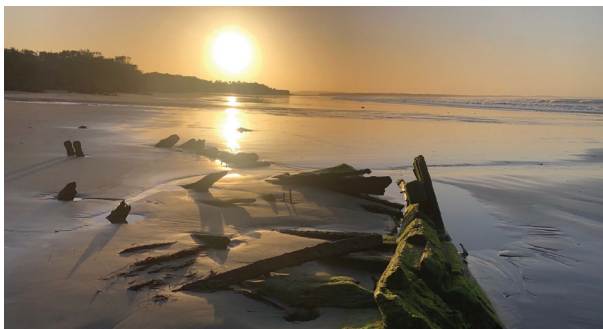


Figure 3. Amazon wreck, Inverloch (photograph: W. Cook 2019)

particularly protection zones, and any websites that directly or indirectly encourage the collection and sale of unregistered artefacts.

Inspections

To December 2024, 110 site inspections of shipwrecks, submarines and aircraft wrecks were conducted, mostly by Heritage Victoria staff, with other inspections undertaken by professional divers. Observations made during inspections indicate that wreck condition varies significantly between wrecks. For instance, the J7 submarine is in very good and stable condition primarily due to its secure and sheltered location in a yacht club marina in Port Phillip Bay, while inspections of the S.S *City of Launceston* wreck showed sections of hull plate have fallen to the seabed and there has been significant degradation of the bow.

The shipwreck *Barbara* was surveyed, photographed and recorded as a three-dimensional model available on Sketchfab (Heritage Victoria *Barbara* 2025), with sand, sediment and bacteria samples collected for analysis. However, some wreck

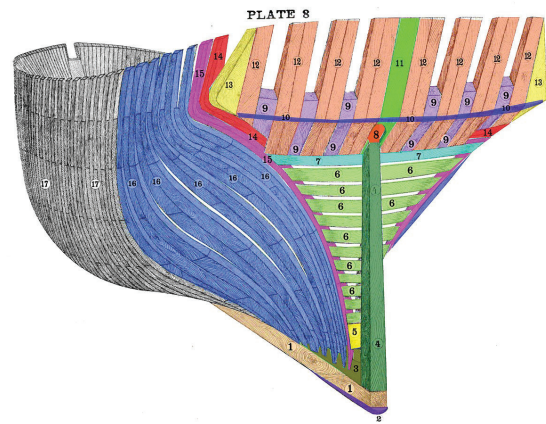


Figure 4. Deadwood: The solid timbers in the bow and stern, just above the keel where the lines narrow down so that separate side timbers will not fit. They are firmly fixed to the keel to add strength. See number 3- olive (drawing: H. Paasch 1904)

sites could not be inspected, for example, two Fairey Firefly aircraft wrecks that could not be located due to poor visibility.

A biodiversity survey was conducted of the marine life on the *City of Launceston* wreck in December 2021. Five divers were deployed in the survey and completed 15 dives on the wreck. The focus of the dives was on marine species primarily found on the deck and the exposed superstructure of the wreck. The survey discovered an abundance of marine life, including 15 species of fish as well as crabs and sea stars, with many hard surfaces encrusted with mussels, oysters, scallops and sponges (Chamberlain 2021).

Conservation

Given its exposed position on the beach, the *Amazon* wreck as undergone major changes in sand cover and wreck exposure over recent years (Figure 3), culminating in the wreck being significantly exposed in September 2024 with a large section of hull floating 70 metres along the beach to a new location.

Heritage Victoria, in conjunction with Inverloch Surf Life Saving Club, has been regularly monitoring the wreck, with the Amazon 1863 Project Inc community group also involved in monitoring and conservation activities. A Heritage Victoria Living Heritage Program grant was provided to the community group to conserve a piece of deadwood (Figure 4) which went on display at the Inverloch Community Hall in December 2021. Conservation of copper sheathing and a deadeye was also completed by Grimwade Conservation Services, and a section of the trail board is being considered for conservation. Heritage Victoria collaborated with Parks Victoria to remove large sections of the wreck washed up on shore, with fragments of the wreck temporarily stored in a purpose-built bath at Parks Victoria's facilities.

Photogrammetry was conducted on exposed sections of the wreckage and selected artefacts, providing three-dimensional models for use in public education or future museum displays. A Conservation Management Plan is in preparation that will assess current and future risks to the shipwreck and artefacts and provide principles for ongoing management.

Ongoing Heritage Victoria site conservation activities at the *City of Launceston* and *HMVS Cerberus* wreck sites include the installation and maintenance of zinc anodes to prolong the survival of the iron fabric and delay collapse of the wrecks.

Data

Data collection is facilitated by the Wreck Condition Report form completed by site inspectors. The form captures information on the site environment, seabed sediment and how vulnerable the wreck is to fishing, natural processes and socio-economic activity. An assessment is also made of the current condition and condition trend of the wreck.

The data collected by these reports enables a comparison of the wreck site's condition over time. For instance, there are currently six years of monthly data on the condition trend of the *Amazon* wreck, showing the changes associated with the impact of sand erosion. The *City of Launceston* wreck was inspected in January 2021, December 2022 and May 2024 during this period, the condition trend has changed from stable to deteriorating. The information included in the reports guides the site management activities that can be implemented to reduce deterioration of the wreck.

Public reporting

A key requirement of the program is to regularly report on the progress of its key activities. This is done by updating the Risk Register and reporting site management outcomes to the public through an annual report. This provides a measure of accountability for the funding of activities and increases public awareness of the risks associated with shipwrecks and what has been done to safeguard them.

Annual reports have been published since 2019. The reports can be accessed on the Heritage Victoria website (Heritage Victoria 2025). Reporting has also been disseminated nationally through the Australasian Institute of Maritime Archaeology website and annual reports have been provided as part of Heritage Victoria's involvement in the Australian Underwater Cultural Heritage Program run by the Commonwealth Department of Climate Change, Energy, the Environment and Water.

Wreck assessment

As new shipwrecks are discovered, they are assessed under the program's methodology. To date, five new shipwreck assessments have been conducted. In

addition, two aircraft wrecks have been provisionally included on the On Watch list due to the previously reported presence of human remains.

A key attribute of the program is flexibility, enabling wrecks to transition between the Risk Register and On Watch list based on a reduction of risks to the site due to site management activities and/or changes in environmental conditions.

In addition, newly discovered wrecks and existing wrecks with new information are included or reclassified in the program. For instance, *PS Clonmel* and *Clarence* have been removed from the 2024 Risk Register because they were buried for an extended time.

Compliance

Compliance visits are conducted by Heritage Victoria in conjunction with boating and diving operations. HV has a boat which is used by its staff to undertake routine visits to specific wreck sites (particularly Protection Zones) with the aim to identify any vessels illegally in the location.

Those aboard vessels within protection zones are initially educated about not entering the zones without a permit. This is particularly the case for recreational fishing at the *City of Launceston* and *Clarence* wreck sites. In repeat cases, infringements are referred to Heritage Victoria's compliance team for follow-up action in accordance with Heritage Victoria's Compliance and Enforcement Strategy. In some cases, they are referred to Victoria Police. HV also uses a number of methods to monitor vessel activities in wreck zones which do not require the use of the boat.

Coast Guard vessels involved in the Community Shipwreck Monitoring Program actively advise vessels in protection zones that they are being monitored. This strategy appears successful, as many vessels that are illegally in the zones depart as soon as a Coast Guard vessel approaches.

Media

The program's media activities include print media and community engagement. Victorian Government media releases have been reported in newspaper and on-line articles in regional newspapers including the Geelong Advertiser, Queenscliffe Herald and South Gippsland Sentinel Times. Articles have also appeared on the Victorian Heritage Council and Australasian Institute for Maritime Archaeology websites (Australasian Institute for Maritime Archaeology 2023).

Community engagement activities include a community day with the Amazon 1863 Project Inc. group held in August 2022 with a presentation and artefact display.

Funding

It is important to note that many of Victoria's



Figure 5. *Barbara* wreck (photograph: Flinders University 2020)

shipwrecks reside in Commonwealth waters. For this reason, funding for the program is provided by the Commonwealth Department of Climate Change, Energy, the Environment and Water. Commonwealth funding supports the Community Shipwreck Monitoring Program and other program activities.

Fieldwork

Three fieldwork trips have been conducted, two with Flinders University and one with Parks Victoria.

A joint archaeological project between Heritage Victoria and Flinders University (South Australia) was held at the *Amazon* wreck in November 2018. The fieldwork comprised the limited excavation and recording of the site, including a visual and metal detecting survey.

A drone was also used to take aerial imagery (McAllister et al. 2019).

In February 2020, Heritage Victoria, Flinders University and the Maritime Archaeology Association of Victoria conducted a field school at the *Barbara* wreck site (**Figure 5**). The fieldwork included wreck identification, surveys, excavation and underwater photogrammetry. Three small sections of the wreck were excavated, providing information on the vessel's construction. Wood samples showed that the vessel was very well constructed using a variety of timbers sourced from different Australian states. The field school provided detailed information on an early Victorian-built shipwreck as well as introducing students to the techniques of underwater archaeological survey and excavation (Heritage Victoria 2020).

In March 2024, Heritage Victoria in conjunction

with Parks Victoria conducted an archaeological survey at Wilsons Promontory. The primary aim for the maritime archaeology team was to assess the *Cheviot* shipwreck, which sank in 1854 and is a rare example of an ex-whaling vessel in Australia. Diving was primarily focussed on obtaining videos for a digital three-dimensional photogrammetric model of the wreck site now available to the public on Heritage Victoria's Sketchfab page (Heritage Victoria *Cheviot* 2025).

Learnings

When the Maritime Heritage at Risk Program was developed, the intention was to have regular movement of wrecks to and from the Shipwreck Risk Register as new data became available. Once a wreck was confirmed to be stabilised, it would be removed from the Risk Register and included on the On Watch list. However, there has been hesitancy in removing shipwrecks from the Register, as seabed conditions may change and re-expose the shipwreck to risk. With hindsight, this has prevented other shipwrecks from receiving attention.

Another learning is that some site management activities have been restricted to a relatively small number of shipwrecks. This is primarily due to factors such as significant environmental impacts on a site, public pressure and logistical difficulties in accessing other wrecks. For example, the *Amazon* site has been subject to major sand erosion over time, exacerbated by storm events, with significant parts of the wreck becoming suddenly highly visible and at risk of human interference. This has generated a high level of public

interest and the need for reactionary activities when attention was planned for other shipwreck sites.

Future directions

The primary future direction of the program is the inclusion of submerged aircraft wrecks. To date, 106 submerged aircraft wrecks have been identified in Victoria, and some will be subject to a modified Maritime Heritage at Risk methodology and subsequent site management activities (De Bortoli 2024).

In addition, it is proposed to survey Risk Register and On Watch wreck sites that have not yet been visited.

Conclusion

The Maritime Heritage at Program is a broad program introduced by Heritage Victoria in 2016 with the aim of identifying and protecting the State's most significant shipwrecks; providing an assessment of their current and future risk and implementing a site management program to better safeguard them.

The program also allows coastal communities to be directly involved in the ongoing protection of local underwater cultural heritage so that future generations can enjoy and learn from these heritage assets.

In the past 10 years the program has achieved significant outcomes. This includes extensive monitoring of wrecks in conjunction with local communities and site management activities such as inspections focussed on wreck condition. Other program activities include conservation, compliance, data collection, media and public reporting.

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A functional analysis of Culturally Modified Trees at Snape Reserve, Wergaia Country: In memory of Darren Griffin

Abby Cooper^{1, 2}, Michael Douglas³ & Aunty Sandra Knight³

Over the past few years, Barengi Gadjin Land Council Aboriginal Corporation (BGLC) and Cooper Heritage Management have collaborated with the Snape Reserve Committee of Management to document and safeguard the Aboriginal cultural heritage values at Snape Reserve in Western Victoria. This work includes a Preliminary Aboriginal Cultural Heritage Assessment conducted by BGLC in 2022, led by the late Darren Griffin, during which over 40 culturally modified trees (CMTs) were recorded within the 846-hectare reserve. This presentation will provide a functional analysis of these CMTs using a category system recommended by Griffin and Cooper (2019), illustrating how this approach enhances our understanding of the ways in which Aboriginal peoples have used this cultural landscape.

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Functional analysis of CMTs

CMTs based on their function

Categories proposed by Griffin and Cooper (2019)

Categories describe functions of CMTs most commonly recorded on Wotjobaluk Country and are directly relevant to SE Australia

Assess the purpose and meaning behind each modification

Category	Category Name
1	Ring Trees
2	Habitation Trees
3	Marked and Carved Trees
4	Resource Extraction and Preparation Trees
4a	Toe hold scars
4b	Smoke holes
4c	Access holes
4d	Smoking/Cooking preparation holes
5	Bark Removal Trees
5a	Curved (pre-form) bark removal
5b	Bark slab/sheet removal
5c	Possum skin curing boards
5d	Bark strip removal
5e	Wood removal

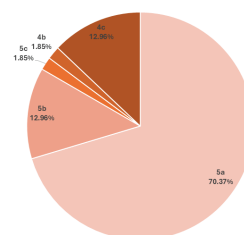
Functional categories for CMT modifications

Griffin, D. and A. Cooper 2019 'Scarred for Life': A preliminary comparative functional analysis of culturally modified trees at Kromelak (Outlet Creek), Ross Lake and northern Gurru (Lake Hindmarsh) on Wotjobaluk Country, Western Victoria, Australia. *Journal of the Anthropological Society of South Australia* 43:94-133.

Functional analysis of CMTs at Snape Reserve

54 modifications

- 70.37% (n=38) are curved pre-form (5a)
- 12.96% (n=7) are bark slab removal (5b)
- 12.96% (n=7) are access holes (4c)
- 1.85% (n=1) are possum skin stretching board removal (5c)
- 1.85% (n=1) are smoke hole (4b)



Insights from the functional analysis



Smoke hole



Curved pre-form (canoe)



Possum skin curing board



Access hole



Bark slab

Why are functional categories for CMTs important?

Aids our understanding of the diverse uses and cultural significance of CMTs

Provides structured way to document CMTs

Allows for more detailed and meaningful archaeological analysis

Each functional category reflects a specific cultural practice and tradition

Can aid in management and conservation of CMTs



Mapping Wurundjeri Woi-wurrung cultural values: A reflection of cultural mapping on Wurundjeri Country and outcomes through mapping, modelling and knowledge recording in Wurundjeri Woi-wurrung Cultural Values Studies and Cultural Values Assessments and a Traditional Custodian-led Strategic Aboriginal Heritage Assessment of Wurundjeri Woi-wurrung Country, Melbourne

Catherine Keneley ¹, Garrick Hitchcock ¹, Caroline Spry ^{1, 2}, Wendy Morrison ¹, John Coomans ¹, Zara Lasky-Davison ¹, Wurundjeri Woi-wurrung Elder Allan Wandin ¹, Wurundjeri Woi-wurrung Elder Bobby Mullins ¹, Wurundjeri Woi-wurrung Elder Auntie Di Kerr ¹, • Wurundjeri Woi-wurrung Elder Ron Jones ¹, Martin Tomko ³, Brian Armstrong ³, Zexian Huang ³, Stephen Morey ⁴ & Andrew Tanner ⁴

For the most part, Cultural Heritage Management Plans determine past occupation and cultural heritage significance through the presence or absence of artefacts and/or other cultural features. However, this ignores the fact that all Country is important for Wurundjeri Woi-wurrung people and has cultural values (intangible heritage), most of which have not been adequately identified and understood through archaeological survey and excavation alone. Recording and mapping of Wurundjeri Woi-wurrung cultural values demonstrates the presence of community narratives that speak to custodianship, beliefs and customs, spiritual connection to Country, the archaeological record, land management, and aesthetic and environmental attributes. This paper provides an overview of Wurundjeri's Strategic Aboriginal Heritage Assessment (SAHA) Project, with a focus on the mapping of cultural values studies and assessments and recording of Aboriginal Cultural Places with Elders and community members. The results highlight the diversity and significance of intangible cultural heritage for Wurundjeri Woi-wurrung people and will support the ongoing management and protection of Wurundjeri Country.

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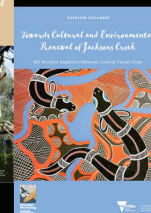
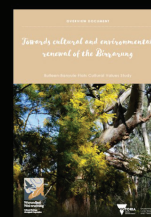
Why map intangible cultural heritage (cultural values)?

- Cultural heritage significance and occupation determined as artefacts/cultural features only (e.g. stone tools, boomerangs, rock art, scarred trees, shell middens, fireplaces, etc.) and not cultural values
- Aboriginal Heritage Act 2006 (Vic.) mapping of Aboriginal heritage values most commonly required in CHMPS geared towards "whether Aboriginal cultural heritage is, or likely to be, present in the activity area"
- Cultural values = stories, customs, beliefs, associations, practices, knowledge, skills and language. Mapping and documenting cultural values = presence of community narratives = together form part of a living, dynamic Wurundjeri cultural heritage

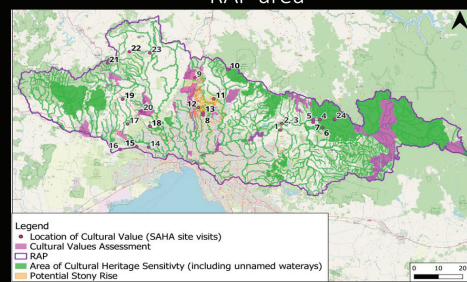


Recording and mapping Wurundjeri Woi-wurrung cultural values

- Partnerships and Indigenous Cultural Values recording within Victoria: the Merri Creek Cultural Values Project
- Bulleen-Banyule Burring Dalga Bik Ngarrgu Yiaga Bulleen-Banyule Flats Cultural Values Study
- Biik wurrda Jacksons Creek Regional Parklands Cultural Values Study
- Strategic Aboriginal Heritage Assessment (SAHA) pilot program. Funded by Victorian Government (First Peoples – State Relations)

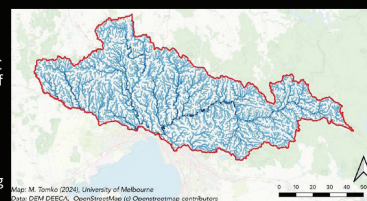


Mapping cultural values of Wurundjeri Woi-wurrung RAP area



Mapping waterways

- University of Melbourne's Department of Infrastructure Engineering collaborated with WWCHAC to identify and map areas of unnamed streams across the Wurundjeri Woi-wurrung RAP area
- The map shows streams in the Wurundjeri Woi-wurrung RAP area, including named rivers and creeks, and unnamed streams



Bringing it all together

- The Wurundjeri SAHA project has identified new Aboriginal Cultural Places, mapped culturally significant landforms, and refined our understanding of the likely locations of tangible Aboriginal places – and highlighted the lack of intangible heritage recording and gaps in legislation and policy
- Wurundjeri will register Aboriginal Cultural Places recorded by Elders on ACHRIS, and ask the Victorian Government to recognise stony rises, unnamed waterways, and areas of expected activity traces as "areas of cultural heritage sensitivity" in the *Aboriginal Heritage Regulations 2018*
- Wurundjeri SAHA results will inform planning authorities, responsible authorities, land managers, developers to enable early land-use planning
- Wurundjeri SAHA results will promote opportunities for education and awareness of the Wurundjeri Country cultural landscape and have real benefits for Wurundjeri community in terms of land management and ongoing protection of tangible and intangible cultural heritage values

Strengthening collaborative heritage management: Amplifying Indigenous worldviews, ownership and stewardship

Jake Goodes¹, Mel Marshall², [†]Darren Griffin³, Chrystle Carr³, Michael Douglas³, Amber Munkara³, Billy Briggs⁴, Nathalia Guimaraes⁴, Emily Corris⁴, John Clarke⁴, Troy Lovett⁵, Leroy Malseed⁵, Bill Bell⁵, Wendy Luke¹, Dave Lucas¹, Lloyd Pigram² & Cissy Gore-Birch⁶

“Gariwerd is a member of our family — like our grandmother, mother, sister, or daughter. This is important to us. This is not just park management to our people. This is the return of a stolen family member. This is why it is so important to decolonise the management of land, water, fire, wildlife, and place names of our bio-cultural landscapes. Our reunion with Gariwerd reaffirms our obligations to look after our family member, our Country.” — John Clarke (Eastern Maar). Building on the successful 2023 Gariwerd Rock Art Management Forum, this presentation explores embedding diverse narratives into heritage management, centering cultural agency, authority, and responsibility. We will discuss how holistic approaches, blending cultural and scientific perspectives, can inform improvements and collaboration, guided by the forthcoming Practitioner’s Guide for Indigenous Rangers in the Management of Rock Art in Cultural Landscapes.

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Acknowledgement of Country

We acknowledge the First Peoples across Australia, notably the Djab Wurrung, Jadawadajali and Gunditjmarra peoples of the Gariwerd Cultural Landscape, the Wurundjeri Woi-wurrung people on whose Country this conference is being held and to all other Aboriginal and Torres Strait Islander people in attendance here



Borengi Gadjin Land Council
Managing Country Together

Eastern Maar Aboriginal Corporation
Traditional Owners

Gunditj Mirring Traditional Owners Aboriginal Corporation
Traditional Owners

Nulungu Research Institute
Research Institute

Parks Victoria
Managing Country Together

Partners

Borengi Gadjin Land Council Aboriginal Corporation
The Gariwerd Cultural Landscape is central to the identity of our people and the natural and cultural values of Country are unique and irreplaceable (John Clarke)

Eastern Maar Aboriginal Corporation
This gathering has encouraged First Peoples to assert sovereignty over rock art in accordance with their own respect for Country (John Clarke)

Gunditj Mirring Traditional Owners Aboriginal Corporation
Our ancestors tell us that for as long as they are still here with us, their identity and connection to Country through rock art in Gariwerd... show a deep connection to Country (Bill Bell)

Supporting Managing Country Together
Traditional Owners and the National Research Institute (University of Notre Dame Australia)




Call to Action...

1. A Call to Action: The need for a collective effort to protect and preserve rock art
2. Self-Determination, Cultural Authority and Agency: Acknowledging the rights and responsibilities of Indigenous Peoples in caring for rock art
3. Empowering Younger Generations: Empowering the next generations to assume responsibility of their cultural heritage
4. Integration of Knowledge: Incorporating oral histories, narratives, and languages to understand and care for cultural landscapes
5. Building Cultural Heritage Teams: Encouraging collaboration and knowledge exchange
6. Equitable Resource Commitment: Allocating resources for the protection of cultural heritage
7. Public Education: Educating decision makers and the broader public about the significance of rock art
8. Developing a National Framework: Establishing a rock art framework based on Indigenous worldviews
9. Indigenous Leadership: Forming Indigenous State-based or National Councils to lead the management of rock art
10. Future Forums: Planning for future rock art management forums to ensure sustained progress



Key challenges...

- Delivery of commitments to Traditional Owners is limited by bureaucracy (roles, responsibilities, resourcing)
- Actions in plans are underfunded
- Weak and/or underutilized legislation
- Self-determination of Traditional Owners is limited
- Racism, abuse, threats to First Peoples and cultural values
- Lack of government commitment
- Corporations are not resourced for culture and heritage specific work to care for Country

The outcomes from the Gariwerd Rock Art Management Forum have direct benefit for the Traditional Owners of Gariwerd – the Djab Wurrung, Jarawadajali (Woiwobak Nations) and Gunditjmarra peoples – speaking directly to the authority and agency to look after, conserve and manage both the tangible rock art and intangible intrinsic narratives illustrating the significance of this place.



Where to next?

Positives of working together are demonstrated through the Gariwerd Rock Art Management Initiative. Through this we will continue to advance:

- Responding to the Call to Action from the Gariwerd Rock Art Management Forum
- Develop and secure ARC funding towards self-determination of First Peoples ownership of rock art conservation and management

Together with the Gariwerd Traditional Owners seek commitment from governments to work together to address:

- Equitable resourcing and self-determination of governance processes, positions and activities
- Government act to address systemic and online racism



Gariwerd is a member of our family — like our grand-mother, our mother, our sister, our daughter. This is important to us. This is not just park management to our people. This is the return of a stolen family member. This is why it is so important to decolonise the management of land, water, fire, wildlife and the place names of our bio-cultural landscapes. Our reunion with Gariwerd reaffirms our obligations to look after our family member, our Country.

Practitioner’s Guide...

Informed by the presentations and discussions that occurred during the Gariwerd Rock Art Management Forum, the ‘Practitioner’s Guide for Indigenous Rangers in the Management of Rock Art Cultural Landscapes’ will include:

- Introduction (background to Forum, partners and broader initiative)
- Culture
- Governance
- Physical Conservation
- Management
- Looking forward (Call to action, Men’s/Women’s discussions and where to from here)

“You know there is a voice in this room. How do we use this voice to our advantage, to be able to make a change moving forward?” (Cissy Gore-Birch (Day 5 session))

First Nations Knowledge Exchange, Brazil

- **Pernambuco National Park, Brazil**
Established as a national park due to its rich archaeological significance, particularly its remarkable rock art. We were accompanied by the Traditional Owners and heard their stories about their connection with rock art and the park.
- **Research Collaboration (Federal University of Minas Gerais Museum)**
The visit was accompanied by archaeology professors from the Federal University of Minas Gerais. Their research centre has been conducting studies in the park for nearly 50 years.
- **Cultural and Historical Context**
The park holds deep archaeological and cultural importance but also represents a history of Indigenous displacement. The area is traditionally Kaxikabá land.
- **Engagement with the Kaxikabá People**
Visited the Kaxikabá Territory to explore their perspectives on the park and their relationship with park authorities.
- **Comparative insight with Gariwerd**
The visit aimed to draw parallels and contrasts between Pernambuco and Gariwerd, recognising similar challenges in cultural heritage management, alongside distinct approaches and histories.
- **Key Discussion**
Dialogues covered cultural identity, the impact of colonisation, land and water rights, cultural heritage management, as well as the challenges, achievements, and ongoing efforts to revive traditional practices.



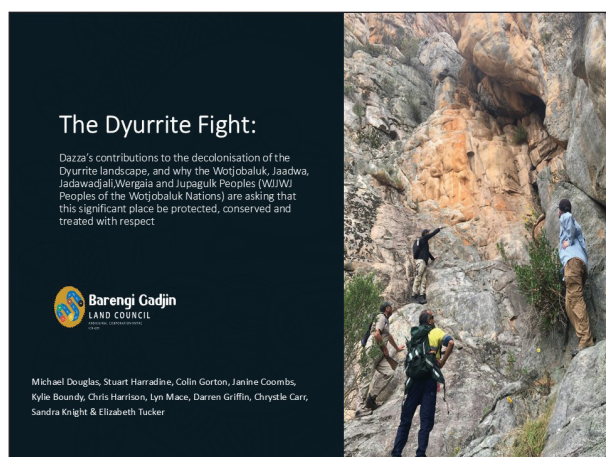
The Dyurrite Fight: Dazza's contributions to the decolonisation of the Dyurrite landscape, and why the Wotjobaluk, Jaadwa, Jadawadjali, Wergaia and Jupagulk Peoples (WJJWJ) Peoples of the Wotjobaluk Nations) are asking that this significant place be protected, conserved and treated with respect

Michael Douglas ¹, Stuart Harradine ¹, Colin Gorton ¹, Janine Coombs ¹, Kylie Boundy ¹, Chris Harrison ¹, Lyn Mace ¹, [†]Darren Griffin ¹, Chrystle Carr ¹, Sandra Knight ¹ & Elizabeth Tucker ¹

Dyurrite falls within the north western limit of the Gariwerd Cultural Landscape and is jointly managed by Barengi Gadjin Land Council Aboriginal Corporation (BGLC) and Parks Victoria (PV). BGLC represents the rights and interests of the Wotjobaluk, Jaadwa, Jadawadjali, Wergaia and Jupagulk Peoples (WJJWJ) Peoples of the Wotjobaluk Nations), the Sovereign First Peoples of the Wimmera, Mallee and Gariwerd regions of so-called Victoria. Between November 2020 and February 2023, BGLC and PV conducted numerous cultural heritage and environmental surveys of rock-climbing routes within the Dyurrite Cultural Landscape to assess the impact of rock-climbing activities on cultural values. These surveys revealed significant rediscoveries relating to the cultural heritage of the area including over 300 separate quartzite quarrying locations and associated stone-tool manufacturing floor; a number of newly rediscovered rock art panels; and intangible values including a significant women's place.

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¹ Barengi Gadjin Land Council Aboriginal Corporation



Formulating intangible cultural heritage registrations: Insights from Wadawurrung Country

Siobhan Privitera ¹, Kristen Ellis ¹, Cemre Ustunkaya ¹, Billy-Jay O'Toole ¹, Kyle O'Toole ¹, Kaelan Morrison ¹ & Alexandra Fagan ¹

The Victorian Cultural Heritage industry has increasingly considered intangible heritage over the past six years, resulting in the broader use of cultural values assessments and amplified understanding of cultural landscapes in the overall heritage process. The WTOAC Heritage Unit has contributed to this through internally developed and implemented cultural values assessments, more active consideration of intangible heritage throughout the CHMP process, and – most importantly for this presentation – exploration of intangible heritage registrations. However, the scarcity of intangible heritage registrations within the Victorian cultural heritage landscape means that requirements for undertaking this work are currently under-developed. This paper aims to highlight insights that the WTOAC Heritage Unit have gained from our initial work on Wadawurrung Country to rectify this current industry deficit. It considers how we have aimed to undertake Community-led, culturally appropriate and sensitive research, discussion, and compilation of intangible cultural heritage values for the purposes of registration.

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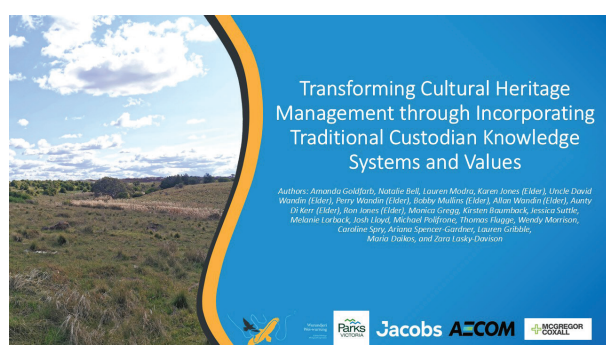
Transforming cultural heritage management through incorporating Traditional Custodian knowledge systems and values

Amanda Goldfarb¹, Natalie Bell², Lauren Modra², Karen Jones², David Wandin², Perry Wandin², Bobby Mullins², Allan Wandin², Aunty Di Kerr², Ron Jones², Monica Gregg¹, Kirsten Baumbach², Jessica Suttle³, Melanie Lorback³, Josh Lloyd⁴, Michael Polifrone⁵, Thomas Flugge⁵, Wendy Morrison², Caroline Spry², Ariana Spencer-Gardner², Lauren Gribble², Maria Daikos² & Zara Lasky-Davison²

The State Government is proposing to create three new parks in the suburbs of Deanside, Wyndham Vale, and Clyde. This paper presents a case study of how Traditional Custodian Knowledge Systems and values have been incorporated into the Kororoit Creek Regional Parkland's masterplan development. Parks Victoria are working closely with Wurundjeri Woi-wurrung Cultural Heritage Aboriginal Corporation to develop a masterplan that incorporates Wurundjeri Woi-wurrung cultural values, alongside historical and biodiversity values. To achieve this, a Cultural Values Assessment and Aboriginal and historical heritage surveys have been conducted. By undertaking Walks on Country, Knowledge Recording sessions, environmental studies, and archaeological surveys, an understanding of Wurundjeri Woi-wurrung Country and its values has been developed, allowing measures for the avoidance and minimisation of harm to significant cultural and biodiversity features to be incorporated into the masterplan design. This case study highlights an alternative and best practice approach to cultural heritage management in Victoria.

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¹ Jacobs, ² Wurundjeri Woi-wurrung Cultural Heritage Aboriginal Corporation, ³ Parks Victoria, ⁴ AECOM, ⁵ McGregor Coxall



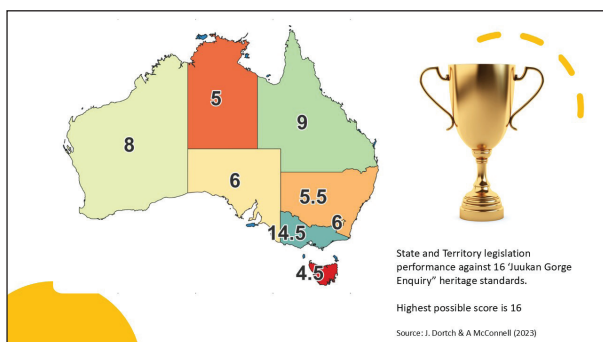
Putting the Culture back into Cultural Heritage Management Plans

Renee McAlister & Jake Ferguson ¹

In this paper we ask how we can add cultural value to the CHMP process and help empower Traditional Owners to protect their cultural heritage. This paper is intended to facilitate an ongoing discussion around the some of the fundamental issues with the Cultural Heritage Management Plan (CHMP) process and the unintended negative results. This paper presents a review of many of the common issues in CHMPs and presents options and suggestions for both writing better CHMPs and getting more positive outcomes for cultural heritage.

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¹ Bidjigal-Dharawal, Bundjalung, Biripi and Wailwan



CHMP Fundamentals

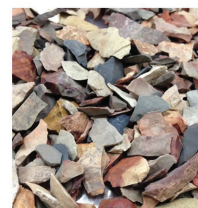
This list presents common issues identified in the CHMP process and suggestions for improvement.

- Less cut and paste in the desktop assessment.
- Specific detail relevant to the activity area is better than generic statements.
- Site prediction model that considers both the tangible and intangible.
- Think beyond the artefact, consider cultural values and assets.
- Identify landforms and use contour mapping.
- Talk to your field reps about more than just footy and gossip.
- Ask your Sponsor for other specialist reports e.g. Geotechnical and Environmental.
- Review flora and fauna assessments that might have cultural significance.
- Share information gained on cultural values and assets with the RAP for review and comment.
- Participate in cultural awareness training.
- Encourage participation of Aboriginal archaeologists.
- Go beyond the minimum CHMP consultation requirements. Ask the RAP if more consultation would be beneficial.



Salvage (if harm cannot be avoided)

- Can a salvage add cultural value. Every RAP is different, but for every salvage, ask yourself:
 - Are the research questions appropriate?
 - Will the results have cultural value to the community?
 - Can the goals be driven by Traditional Owner-led research priorities?
 - Are there training and capacity building opportunities for the RAP (e.g. provision of training in conducting artefact analysis)?
 - Are there benefits greater than adding an artefact catalogue?
 - How will the results be communicated to the RAP? Consider an easily accessible plain language format.



Some things we've seen done well in CHMPs include:

- Creation of cultural heritage parks and community spaces
- A cultural values assessment can both inform the CHMP and provide ideas on how to represent cultural values in an urban environment.
- Management conditions that include opportunities for training and building capacity in cultural heritage management for Traditional Owners.
- Incorporating traditional ceremony into fieldwork.
- Production of plain English reports and presentations to present the results of archaeological research in an accessible way to RAPs.
- Creation of project partnerships and educational/ capacity building opportunities.



It can be more than a check box exercise

ABORIGINAL HERITAGE ACT 2006 - SECT 1

Purposes

The main purposes of this Act are—

- to provide for the protection of Aboriginal cultural heritage and Aboriginal intangible heritage in Victoria; and
- to empower traditional owners as protectors of their cultural heritage on behalf of Aboriginal people and all other peoples; and
- to strengthen the ongoing right to maintain the distinctive spiritual, cultural, material and economic relationship of traditional owners with the land and waters and other resources with which they have a connection under traditional laws and customs; and
- to promote respect for Aboriginal cultural heritage, contributing to its protection as part of the common heritage of all people and to the sustainable development and management of land and of the environment.

Remember the Act is the minimum we are supposed to do, not the maximum.

Section 5 (Aboriginal Heritage Act 2006)

What is an Aboriginal place?

- For the purposes of this Act, an Aboriginal place is an area in Victoria or the coastal waters of Victoria that is of cultural heritage significance to Aboriginal people generally or of a particular community or group of Aboriginal people in Victoria.
- For the purposes of subsection (1), "area" includes any one or more of the following—
 - an area of land;
 - an expanse of water;
 - a natural feature, formation or landscape;
 - an archaeological site, feature or deposit;
 - the area immediately surrounding any thing referred to in paragraphs (c) and (d), to the extent that it cannot be separated from the thing without diminishing or destroying the cultural heritage significance attached to the thing by Aboriginal people;
 - land set aside for the purpose of enabling Aboriginal ancestral remains to be re-interred or otherwise deposited on a permanent basis;
 - a building or structure.

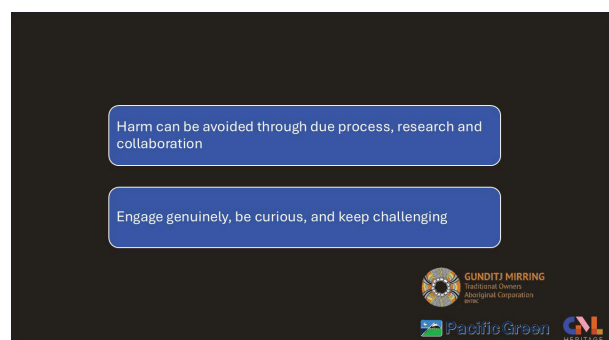
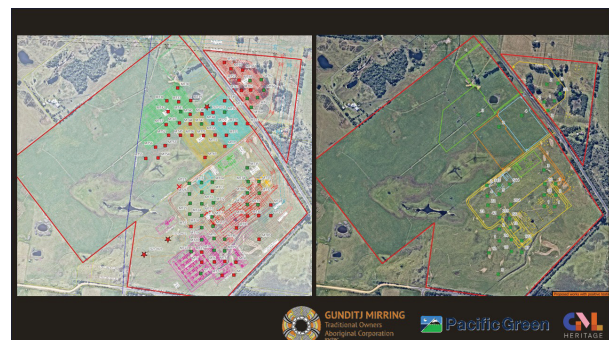
Roadmaps to zero-harm under Section 61 – a different perspective

Leah Tepper¹, Adam Black² & Joel Alexander³

Under Section 61 of the Aboriginal Heritage Act 2006, a CHMP must consider whether the activity will be conducted in a way that avoids harm or minimises harm to Aboriginal cultural heritage. Too often, the emphasis for Sponsors is on the ‘minimising’, resulting in harm to Aboriginal cultural heritage. This also leaves Registered Aboriginal Parties in the position of managing damage to Aboriginal cultural heritage, rather than protecting it. What would happen if the Sponsor’s vision was for a zero-harm approach too? Pacific Green, Gunditj Mirring Traditional Owners Aboriginal Corporation and GML Heritage present a case study of how collaboratively considering the results from each stage in the CHMP process significantly reduced impacts from the activity. The outcomes of aiming for a zero-harm approach from the outset is presented from a different perspective from that of a Sponsor and highlights the positive aspects of this approach for industry, cultural heritage and working towards reconciliation.

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¹ GML Heritage Victoria, ² Gunditj Mirring Traditional Owners Aboriginal Corporation, ³ Pacific Green



AACAI Victoria Presentation

Jim Wheeler ¹

AACAI will present a brief update on their activities, including upcoming training workshops and advocacy work planned in 2025

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¹ Australian Association of Consulting Archaeologists Inc




Victoria Chapter
2025 Update



Why should you join us ?

- Full AACAI Membership provides automatic qualification to work as a HA in Victoria
- If you want to provide confidence to your clients and government agencies that you have been independently assessed and accredited by your senior peers.
- If you want to provide confidence to stakeholders and Aboriginal communities that you are accountable to a set of ethical standards.
- If you feel a lack of agency practicing as an archaeologist in Victoria. That your professionalism and expertise is not respected and valued.
- If you want to join with your peers to ensure your voice is heard in shaping policy that directly affects the work you do and your future career and livelihood in cultural heritage management.
- If you want training and mentoring opportunities with some of the leading experts in the state.
- We currently have approx. 65 members in Victoria. This is less than 20% of the professional workforce in the state ! We need strength in numbers if we want to have a real impact and shape the way archaeology is done in this state and more broadly across Australia.



What we have planned this year ?

- An AACAI cultural values mapping training workshop, convened by leading experts in the field and in partnership with Traditional Owners.
- An AACAI workshop on conflict and dispute management, run by external experts in the field.
- Proactive advocacy for archaeologists working in Victoria, taking our views directly to government heritage agencies and working closely with RAPs.
- Public outreach and advocacy. Incl during National Archaeology Week.
- Regular social events to network and catchup with friends and colleagues.



Introducing our new executive

- Jim Wheeler – Chair
- Erica Walther – Deputy Chair
- Leah Tepper – Secretary
- Josara DeLange – Treasurer
- Chris Clark – NEC Delegate
- Kym Oataway – Alternate NEC Delegate



We would love to hear from you !

Visit our website (incl membership application pages):

<https://www.aacai.com.au/>

Email our Chair or Secretary:

jwheeler@extent.com.au Leah.Tepper@gml.com.au

Come and have a chat – we have an info booth set up in the foyer.



What is AACAI ?

- AACAI are the peak professional association for archaeologists in Australia, with a proud history dating back to the late 1970s.
- AACAI develops best practice, promotes training and communication and provides support for its members.
- We provide independent accreditation and a transparent code of ethics. We are accountable.
- We provide advocacy on behalf of professional archaeologists – we make sure your voices are heard and the profession has a seat at the table when policy decisions are made by government.
- We offer training, mentoring and skill development.

Deep sand dilemmas: Diggy McDigFace and the terrible, horrible, no good, very bad CHMP conditions

Jen Burch ¹

In recent years, the use of mechanical excavators for archaeological investigations in Victoria has become preferred by many RAPs for complex assessments and salvage excavations. Mechanical excavation has obvious benefits, however, the practical aspects of undertaking large-scale, open area mechanical salvage excavations in deep sand deposits can be highly problematic. These methodological issues are too commonly misunderstood, poorly considered, or entirely unconsidered in the establishment of CHMP conditions. Using a case study of a 900m² mechanical salvage excavation undertaken on Bunurong Country, this presentation seeks to provide an assessment regarding a variety of practical matters that must be considered when formulating methodologies for mechanical salvage excavations in deep sand deposits. These include, but are not limited to, proper consideration of soil types and depth of excavation together with excavator size/weight/reach and trench collapse management. By sharing the challenges and learnings encountered on the project, this presentation aims to encourage the industry to consider these practical issues when formulating mechanical salvage methodologies in CHMP conditions.

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Davey Street Artefact Scatter (7921-1705 [VAHR])

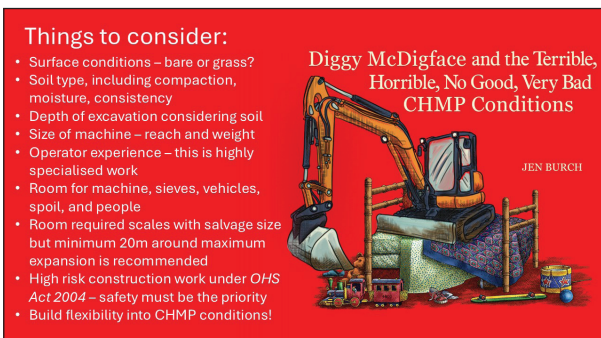
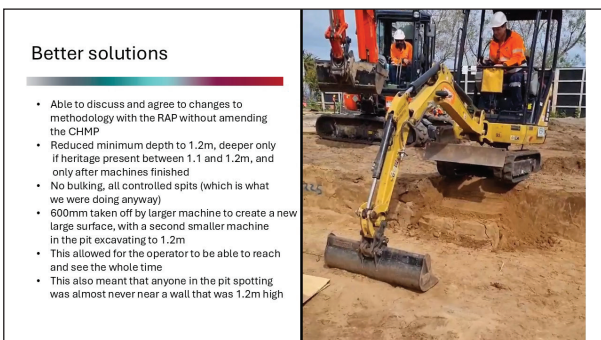
Original CHMP 15221 Conditions

- Salvage to occur following demolition and 200mm strip
- Perimeter concrete piling
- Minimum 400m² maximum 900m² salvage in a 2,013m² area
- Mechanical and manual salvage to a minimum depth of 1.8m and maximum 2.1m
- Bulk 500mm mechanically, then either 100mm or 50mm spits manually
- 4x1m horizontal units but triggers for densities in 1x1m units
- Benching and shoring permitted

Amendment CHMP Conditions

- Salvage to occur following demolition and 200mm strip
- Minimum 400m² maximum 900m² salvage in a 2,013m² area
- Mechanical salvage to a minimum depth of 1.5m and maximum 1.7m if heritage present between 1.4 and 1.5m
- Bulk 500mm then either 100mm or 50mm spits – manual only for features
- 1x1m horizontal units
- Benching and shoring permitted
- Ability to alter layout and methodology for practical or OHS issues if agreed to in writing by the RAP management team

Bunurong Land Council
ABORIGINAL CORPORATION



Lithic refitting, 3D GIS interactive visualisation and radiocarbon dating: combining methods to understand site formation processes on Wadawurrung Country

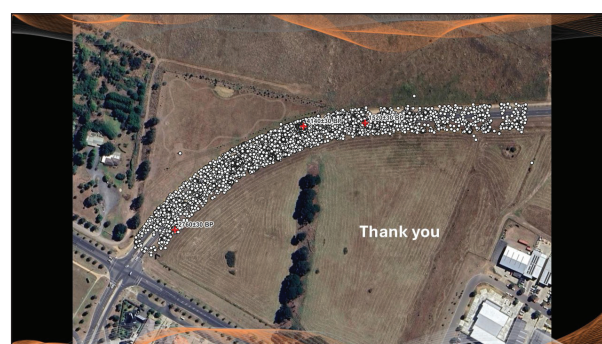
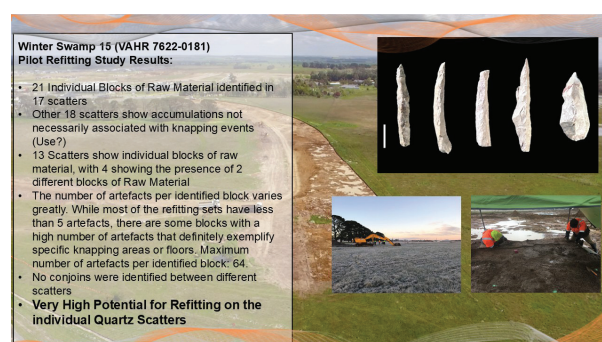
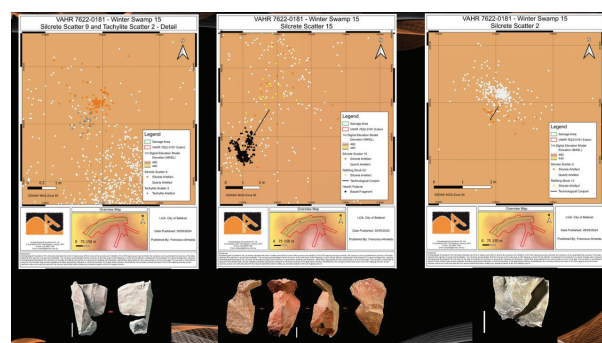
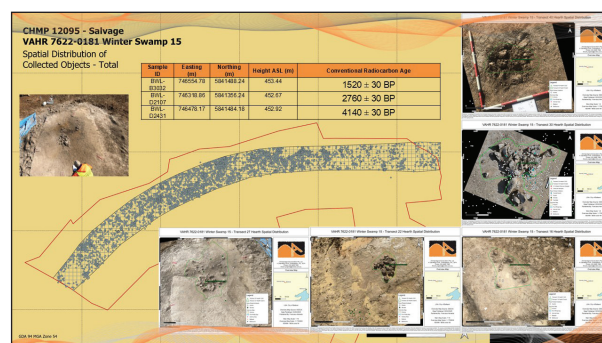
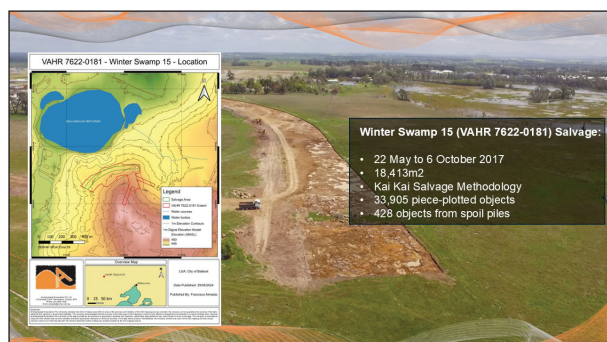
Francisco Almeida ¹, Greg Hil ², Rebekah Kurpiel ², Kristen Ellis ³, Billy-Jay O'Toole ³, Kyle O'Toole ³, Kaelan Morrison ³ & Alexandra Fagan ³

This presentation explores the integrated application of lithic refitting, 3D GIS interactive visualisation, and radiocarbon dating to investigate site formation processes at an Aboriginal place situated near Ballarat, Victoria. Through the meticulous refitting of lithic artefacts it has been possible to identify spatially discrete knapping areas within the site. The vertical distribution of artefacts within each knapping group provides information about the extent to which artefacts have moved vertically through the profile since they were created. Radiocarbon dating results contribute further to an understanding of stratigraphic integrity, as well as revealing that people were making tools during the late Holocene. Processing and presenting the refitting and knapping group analysis in an interactive 3D GIS allowed accurate measurements to be taken for multiple knapping group attributes, and for the knapping groups to be visualised in relation to site topography and stratigraphy. For the Wadawurrung Traditional Owners this technique visualises intergenerational cultural practices of their ancestors in a way that cannot be achieved with two-dimensional outputs. The results of this study highlight the potential for combining these methods to generate more robust interpretations of archaeological sites in Victoria and beyond.

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³ Wadawurrung Traditional Owners Aboriginal Corporation



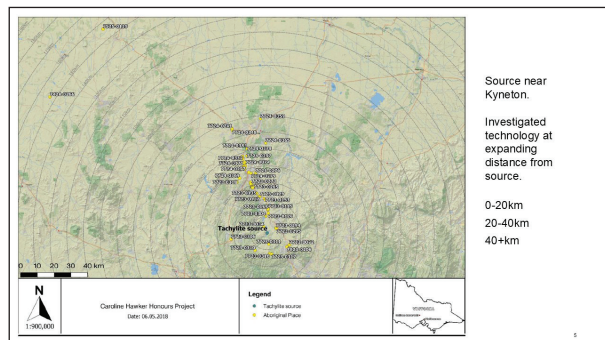
Investigating the distribution of tachylite across time and space

Rodney Carter ¹, Michael C Westaway ² & Rebekah Kurpiel ³

The Dja Dja Wurrung people of Djandak (Country) have their homelands in Central Victoria, where they utilised a unique stone in the form of an opaque volcanic glass called tachylite. Rare materials scattered across archaeological landscapes of SE Australia have provided valuable insights into the connections between Aboriginal communities across vast distances. Pioneering studies, such as the initial work of Isabel McBryde on greenstone axes has helped build a clearer understanding of social networks, revealing new information on the complexity trade and exchange. The strong emphasis on recording detailed contextual information for archaeological assemblages as currently legislated in Victoria means that there is an opportunity to explore both the spatial and temporal distribution of tachylite. Accounts of volcanic material possibly representing tachylite in past excavations provide an exciting opportunity to explore the early (Pleistocene) origins of trade. We provide a review of existing data and consider its implications. By sharing datasets across the state, we have the potential to build a firm understanding of tachylite's trade across the state and perhaps beyond.

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¹ Dja Dja Wurrung Group, ² Archaeology, School of Humanities and Social Sciences, University of Queensland, ³ La Trobe University



Technology and distance from source

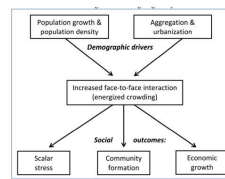
- Cores with cortex present even in the most distant group of assemblages (usually cortex removed early in reduction).
- Trend towards more core rotation with distance (which may be associated with additional working as expected with distance).
- However, cores did NOT have more flake scars with increasing distance from source.

Overall, not all the observations suggest the usual 'distance decay' model where things are getting smaller and more intensively worked with increasing distance from source.

Perhaps suggestive of trade, with a Pleistocene antiquity?

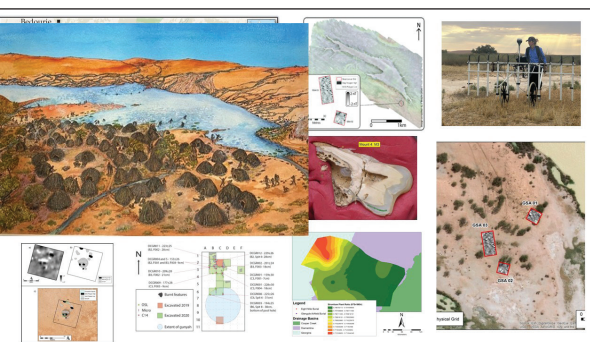
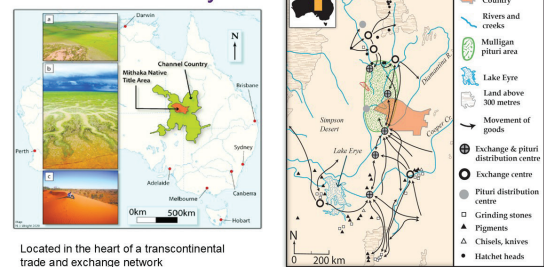


Energised crowding

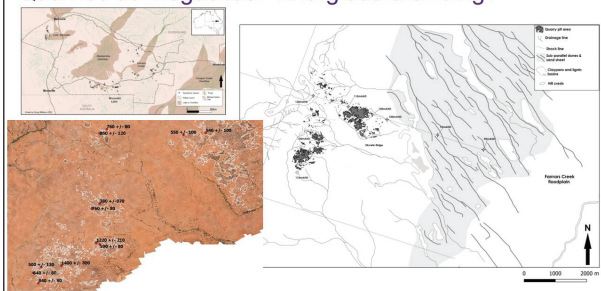


"Such meetings provided fuel for the dissemination for ideas, of new materials and new items of material culture" – Isabel McBryde (1984)

Mithaka country



Quarries as megasites? Energised crowding?



Future directions?

- If other RAPs are interested, an opportunity exists to investigate patterns in tachylite distribution and technology beyond Djaara Country.
- With more dating being incorporated into heritage investigations, may also be able to look at patterns through time.
- How does those possibly relate to energised crowding? No idea at the moment but if it can be demonstrated that there is a complex trade network that dates back to the late Pleistocene it significantly changes our understanding of the antiquity of the complex systems.
- Who wants to do a PhD?

THANK YOU

Clay Pipes at Lyttleton Terrace, Bendigo

Peggy Lucas¹

This presentation analyses the assemblage of 19th Century recreational clay smoking pipes recovered at Lyttleton Terrace, Bendigo and demonstrates how they are valuable archaeological artefacts in Australian contexts. Manufacturer marks, pipe styles, and decorative elements can be used to narrow the dating of archaeological deposits, whilst also situating them in broader social and economic contexts. Specifically, the clay smoking pipes at Lyttleton Terrace reflect socioeconomic status, English and Irish nationalist ideologies, patterns of pipe usage and disposal, and the popularity of different clay pipe manufacturers. Additionally, this presentation identifies manufacturers and tobacconists that have not been explored in scholarship, supplementing prior knowledge about clay pipes in Australia. The data for this presentation was provided by Christine Williamson Heritage Consultants (Project Manager: Nadia Bajzelj) and Eco Logical Australia (Project Manager: Zak Jones).

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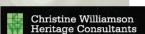
¹ Christine Williamson Heritage Consultants

Lyttleton Terrace Project



Eco Logical Australia
Overall project management
Archaeology team

Project Manager – Zak Jones



Christine Williamson Heritage Consultants
On-site artefact management
Artefact catalogue

Project Manager – Nadia Bajzelj

This presentation

Internship at Christine Williamson Heritage Consultants

Student project (University of Melbourne)

Context and Importance in Archaeology

Makers marks

- Dating
- Place of manufacture

Pipe style

- Socioeconomic classifications
- Regional trends in style

Symbolic and decorative elements

- Ethnic and national identity

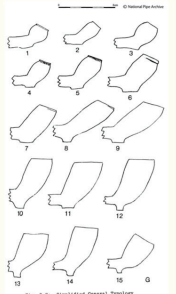


Fig. 3.10: Stippled bowl shapes. Topology

Regional Smoking – Stippled bowl shapes. Copyright A. J. 1970 Clay Pipes for the Archaeologist, British Archaeological Reports, 14, p. 207

Lyttleton Terrace Lot 19.3

Allotment 19.3.	Room/Location	Pipes
- Meeting house and Masonic Hall (1858) - House and workshop (1859) - Residential dwellings (1862)	Northwest room (1863 addition)	31 pipes
	Northeast room (1863 addition)	20 pipes
	Hallway between new room additions	9 pipes
	Yard	19 pipes
	Central West room	3 pipes
	Central East room	13 pipes
	Southeast/Southwest Room	8 pipes
Allotment 19.4		
- Excavated area of allotment 19.4 was a stone lined cesspit (built before 1867) - The cesspit would have serviced all the properties on lot 19.3 and lot 19.4.		

Allotment	Clay Pipes
Lot 19.3	112
Lot 19.4	23
Total	135

Breakage and Fragmentation

	19.3	19.4	Total
0-10%	98	5	103
10-25%	12	2	14
25-50%	3	6	9
50-75%	1	2	3
75-90%	1		1
90-100%		3	3
100%		2	2




Example of reshaped mouthpiece



Duncan McDougall (1846-1967), Glasgow



Thomas White & Co, (1823-1876), Edinburgh



Glasgow Clay Pipe Co. (1876-1882), Glasgow

Manufacturer	Year	Location
Thomas Reynolds	1833	Glasgow
Thomas Reynolds	1879	Glasgow
Virginia, USA with factories in Sydney, Melbourne, and Brisbane.	Importing from 1865	



Theophilus Miso (1860-1870), London and the Strand



Thomas Reynolds (1853-1892), Birmingham

Starlight and Smoke






"Starlight Tobacco," *The Bendigo Advertiser*, February 21, 1885.

Irish Identity



CORK



DUBLIN



Irish Navy or dudeen



Irish harp motif

Heel/spur, thick-walled and short stemmed with a milled bowl rim

Cutty Pipe – the workman's pipe







Notched button mouthpiece with teeth marks

Popular style of pipe, shorter stem, spurless, rounded bowl – standard form that was popular from mid 19th century onwards

Melbourne’s first dump: The first archaeological discovery of an 1813 New South Wales 15 pence ‘Dump’ coin in Melbourne, Australia, utilising Reflectance Transformation Imaging (RTI) and Portable X-Ray Florescence (PXRF) analyses

Maxwell A. Kalman

The research, discussion, and conclusions presented details the identification of one of Australia’s’ first two coins, the 1813 New South Wales 15 pence ‘Dump’ from the archaeological site of 9-11 Swanston Street H7822-1904. This find is significant as it is the first of Australia’s first two coins to be found in Melbourne and for the whole of Victoria. Presented is a history on Australia’s first two coins, information on the archaeological site that the coin was found in, details of the methods utilised, physical inspection, RTI, and PXRF and a discussion on the significate, explanation, and issues brought up for the find.

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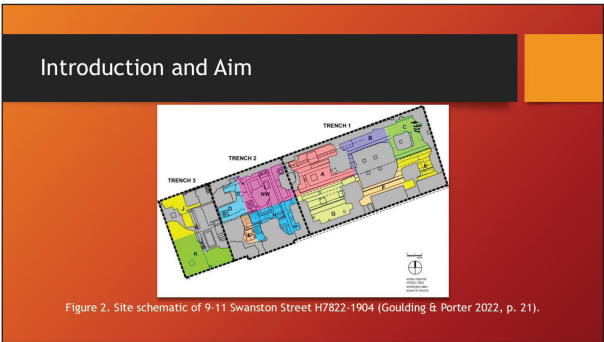


Figure 2. Site schematic of 9-11 Swanston Street H7822-1904 (Goulding & Porter 2022, p. 21).

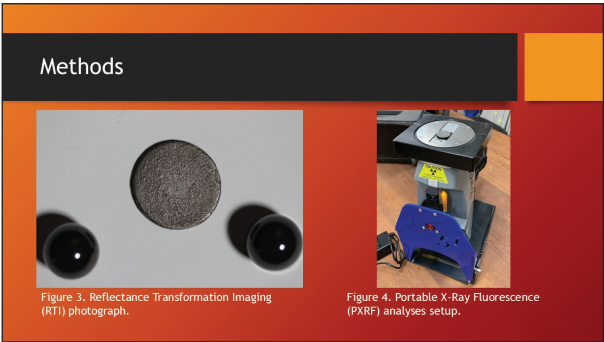


Figure 3. Reflectance Transformation Imaging (RTI) photograph.

Figure 4. Portable X-Ray Florescence (PXRF) analyses setup.

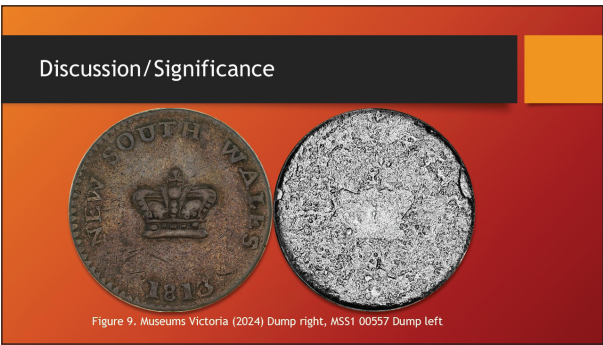


Figure 9. Museums Victoria (2024) Dump right, MSS1 00557 Dump left

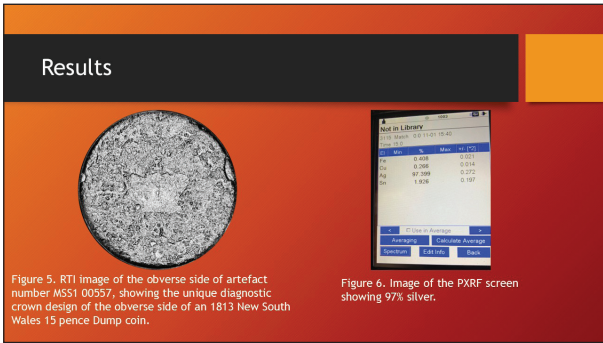


Figure 5. RTI image of the obverse side of artefact number MSS1 00557, showing the unique diagnostic crown design of the obverse side of an 1813 New South Wales 15 pence Dump coin.

Figure 6. Image of the PXRF screen showing 97% silver.

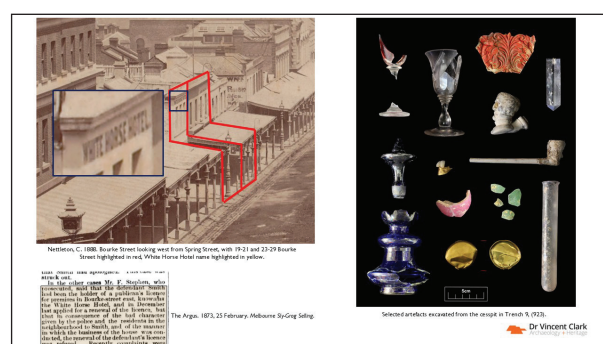
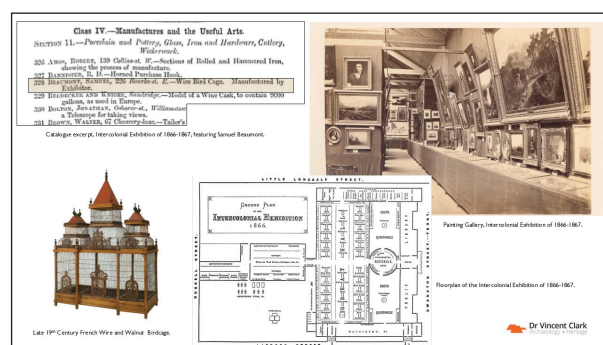
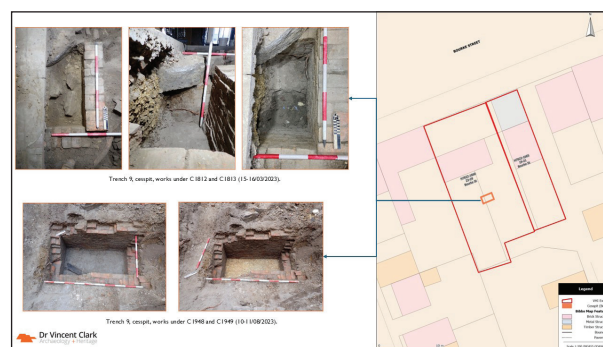
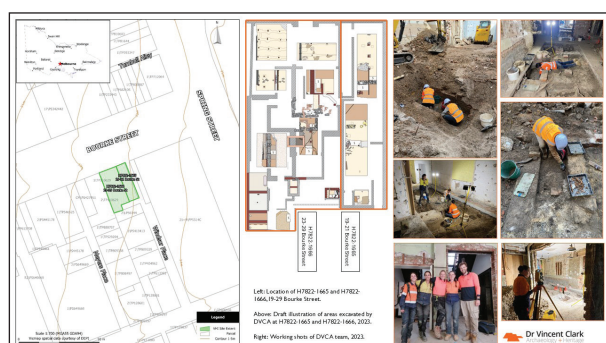
Bourke Hill: The art of an assemblage

Ramona Angelico¹, & Jarrad Paul¹

This paper presents preliminary findings of excavations undertaken by Dr Vincent Clark Archaeology & Heritage at 19-29 Bourke Street by focusing on a key and unexpected aspect of the excavations: a brick-lined, leakproof cesspit, dated to between 1860 and the early 1870s. The cesspit produced a unique assemblage that included Bohemian opaline glassware, elaborate hand-blown decanters, faceted stemware, figural smoking pipes, an array of decorated ceramic serving and tableware, and pharmaceutical, personal hygiene, and grooming items. Through an analysis of the distinct cesspit artefact signature, this paper will employ a multi scalar approach to understand the material culture of the site by considering the wider cultural context of the surrounding Bourke Hill Precinct. By doing so, this will allow the current archaeological interpretation to work with the wider historical record and consider artefacts as signifiers of global colonial entanglements.

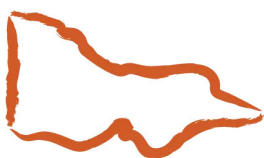
rangelico@vincentclark.com.au

¹ Dr Vincent Clark Archaeology & Heritage



This 14th issue of *Excavations, Surveys and Heritage Management in Victoria*, like the earlier volumes, presents the results of fieldwork, research and other related activities by archaeologists, heritage managers and Traditional Owners. Alongside seven more fully developed papers the volume includes abstracts of other presentations from the annual Victorian Archaeology Colloquium held at La Trobe University in February 2025.

VICTORIAN
ARCHAEOLOGY
COLLOQUIUM



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