The Cranebrook Terrace Revisited: Recent Excavations of an Early Holocene Alluvial Deposit on the banks of the Nepean River, NSW, and their Implications for Future Work in the Region

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Abstract

We present the results of a compliance-based excavation on the banks of Peach Tree Creek within the alluvial margin of the Nepean River, Penrith, NSW. The excavations consisted of: i) Two mechanically excavated trenches (3x1 m) in controlled 20 cm spits to depths of 4 m below surface; and ii) a subsequent stage of manual salvage excavation (6 m^2) focussing on the artefact-bearing levels indicated by the testing phase. The excavations identified two sedimentary deposits, with the lowest being part of the Cranebrook Formation, a deep alluvial deposit within which artefacts dating to >40 ka have been previously reported. We recovered four indurated mudstone/tuff and two coarse silcrete artefacts, all having characteristics of the late Pleistocene/early Holocene, and which we have OSL dated to >9.5 ka from the upper portion of the Richmond Unit of the Cranebrook Formation (3.5-3.9 m below the surface). Along with a greater understanding of the formation (only a part of which was deposited during the last 50 ka) and recent archaeological discoveries, our results lend increasing support for visitation of the Nepean river corridor by Aboriginal people as part of the initial colonisation of Australia. It remained a key locale for occupation and visitation throughout the late Pleistocene. Finally, we discuss the current NSW State government guidelines for investigating archaeological deposits and identify concerns about their effectiveness and applicability when investigating areas of potentially deep stratigraphy along the banks of the Nepean River.

Keywords

early Holocene, Nepean River, deep cultural deposits, excavation methodology

Introduction

The Cranebrook Terrace, situated on the banks of the Nepean River in western Sydney (Figure 1), was first investigated archaeologically by Stockton and Holland (1974) during a quarrying operation. As part of a wider review of the Aboriginal history of the Blue Mountains, they briefly mention recovery of a 'dozen' core and pebble tools at the base of the terrace in a gravel bed dating to >31,800 BP (Gak-3445), and in stratigraphic association with an embedded wooden log dating to 26,700 +1700/-1500 BP (35,432-27,767 Cal. BP; Gak-2014). The terrace gained greater archaeological attention when further geomorphological investigation by Nanson et al. (1987) re-dated the gravel bed using a large number of radiocarbon and thermo-luminescence samples (n=20), and indicated deposition of the gravels between ~>40-45 ka (Figure 2), making the artefacts some of the earliest evidence of Aboriginal people in Australia. In this article, they refer to only three artefacts being recovered, of which only one was found within the gravel bed (the remainder found at the base of a quarry wall). These included a rhyolitic pebble chopper, and two steep-edged scrapers, one made from chert and the other from dacite (Nanson et al. 1987). The numbers of artefacts recovered have changed in subsequent publications by the authors, with reference to 8 and 20 in later years (e.g. Stockton and Nanson 2004), although the three artefacts described in Nanson et al. (1987) appear the most accurately described given this was the first and most extensive recording of the finds. However, following these initial discoveries, researchers have been unable to replicate Stockton and Holland's or Nanson et al.'s archaeological findings, despite decades of compliance-based investigations in the region, most notably annual inspections of the same quarrying operation by Kohen between 1981 and 2004 (see Mitchell 2010 for details). Along with the lack of clear provenance for many of the artefacts, this has resulted in a number of researchers questioning the validity of the finds (e.g. Mitchell 2010; Mulvaney and Kamminga 1999; Williams et al. 2012).

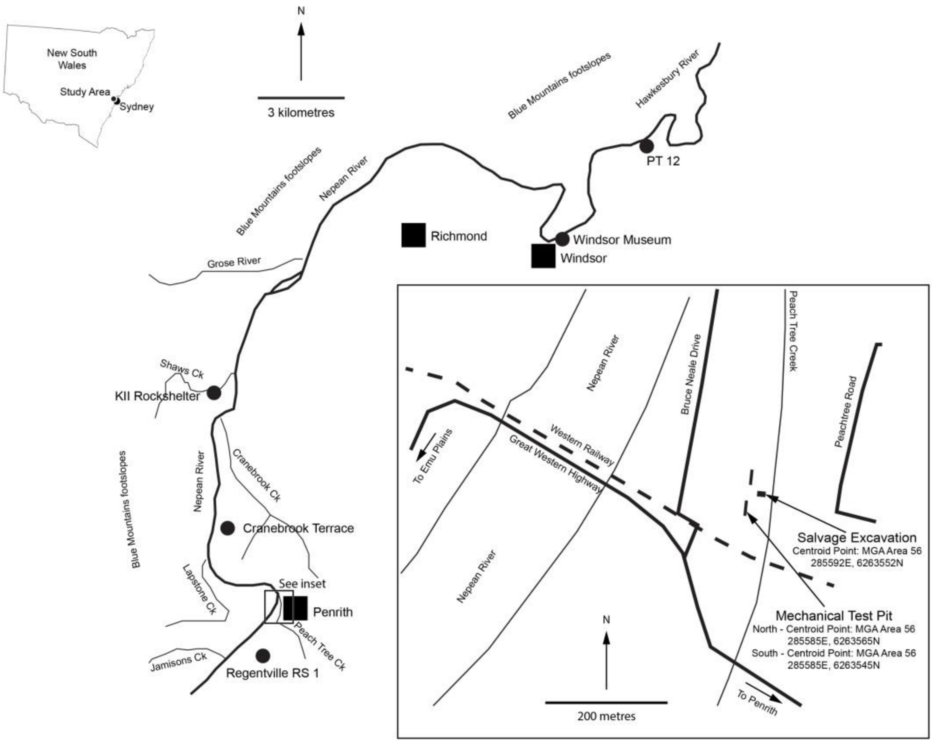

Figure 1: Map of the Sydney region showing locations along the Hawkesbury-Nepean River and discussed in text: 1 – Cranebrook Terrace; 2 – PT-12; 3 – Windsor Museum; 4 – Peach Tree Creek. Inset provides further details of the excavation along Peach Tree Creek (4).

Research over the last 30 years has, however, provided a far greater understanding of the Cranebrook Terrace, and shown a complex geomorphological history over the last 110 ka (Figure 2). Importantly, it demonstrates that only a part of the terrace – the Richmond Unit – has the potential for archaeological material to be present. The Richmond Unit is a ~20 m deep sedimentological body composed of a basal gravel bed, overlain by a sandy clay overburden, dating to ~40-50 ka and ~15-20 ka, respectively (Stockton and Nanson 2004; Mitchell 2010), with all other parts of the terrace > 50ka and generally beyond the accepted colonisation age of Australia (O'Connell and Allen 2015; cf.

Clarkson et al. 2017). This model thereby provides greater support for the findings of the 1970s and 80s with the artefacts recovered from the base of the Richmond Unit, and a reason why some later investigations (in the Penrith Unit) failed to find any archaeological material. Recent archaeological investigations along other parts of the Nepean/Hawkesbury River also support very early occupation of the river corridor. Compliance-based excavations at Pitt Town (PT12) show establishment of regional populations on the river by at least 36 ka (Williams et al. 2014), and a source-bordering dune deposit on the site of the Windsor Museum demonstrates Aboriginal visitation by 33 ka (Austral Archaeology 2011). These sites reveal substantial use of the river and its resources by Aboriginal populations prior to, and throughout, the Last Glacial Maximum, and lend support to their being present during the formation of the 20 m deep alluvial Richmond Unit.

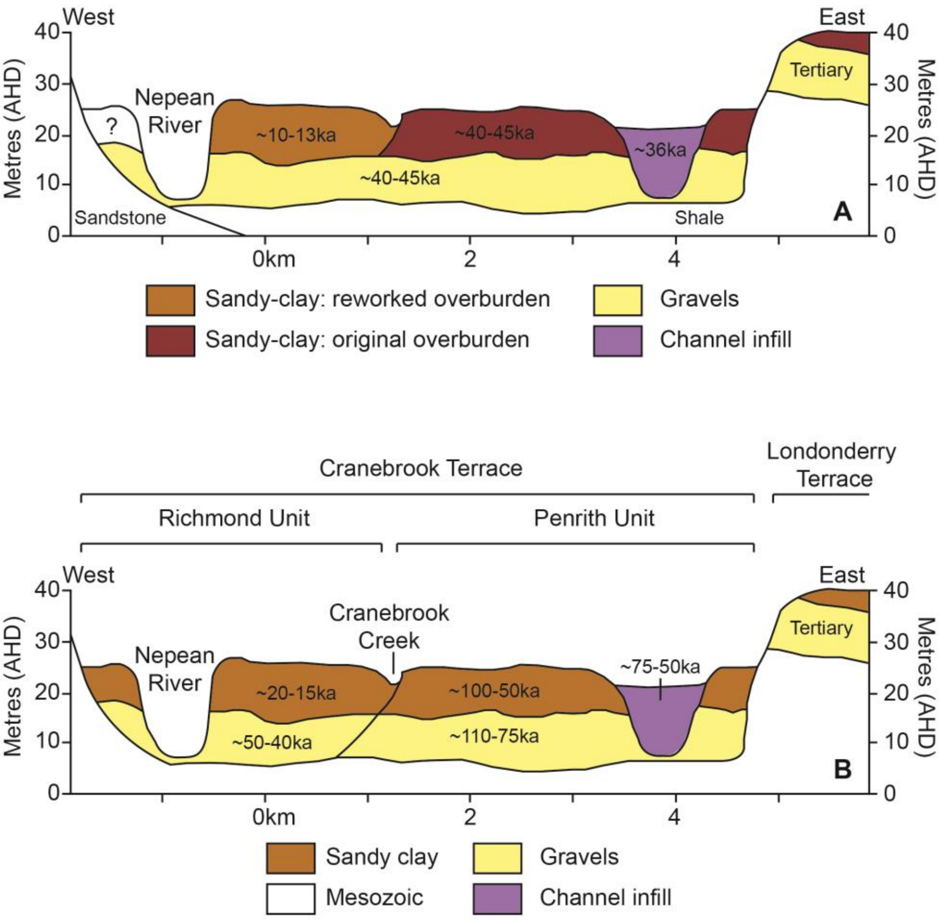

Figure 2: (A) A cross-section of the sedimentary units of the Cranebrook Terrace as they were understood in the late 1980s (adapted from Nanson et al. 1987); and (B) the same cross-section following two decades of research in the region (adapted from Stockton and Nanson 2004). Recent understanding indicates that while much of the terrace appears visually similar, it consists of two units, with only the Richmond Unit having the potential to contain archaeological material. The artefacts recovered by Stockton and Holland (1974) were probably from the gravel beds in the base of the Richmond Unit. The general location of our excavations in this cross-section is shown as a red rectangle.

In 2013, Penrith City Council proposed to undertake bank stabilisation work alongside Peach Tree Creek, a deeply incised tributary running parallel to, and within the alluvial margin of, the Nepean River, west of the Penrith town centre (Figure 1). The location of the works on elevated ground between the two watercourses prompted a legislative requirement to investigate potential impact on Aboriginal heritage before any activities could commence. Initial assessment of the site indicated that it had the potential to be situated on parts of the Cranebrook Formation, and probably the Richmond Unit. Based on these findings, Archaeological Heritage and Management Solutions Pty Ltd (now Extent Heritage Pty Ltd) undertook a program of archaeological excavations to first identify, and then characterise, the cultural material within the deposit (AHMS 2014). This paper presents a summary of the excavations, and their wider implications for the Cranebrook formation, and current archaeological guidelines in NSW.

Methods

Investigation of sub-surface archaeological deposits in NSW is commonly undertaken as part of the initial assessment of a proposed development to determine any potential impacts on Aboriginal sites that it may cause, and under what conditions it may proceed. These excavations can be undertaken without any form of government consent where they follow the established guidelines described in *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (Office of Environment and Heritage 2010). The guidelines are, however, highly prescriptive and dictate that test excavations must consist of 0.25 m^2 test pits that may have a contiguous extent of no more than 3 m^2, dug manually in 5 or 10 cm spits. Where the guidelines cannot be adopted, an Aboriginal Heritage Impact Permit (AHIP) for an alternate excavation method must be sought from the Office of Environment and Heritage (OEH). In the case of Peach Tree Creek, we determined that there was potential for archaeological material to be present at depths greater than could be achieved with a 0.25-3 m^2 test pit, and proposed an alternate approach using mechanical excavation. This was approved under an AHIP.

The initial archaeological test excavation consisted of two mechanically excavated trenches some 20 m from the bank of Peach Tree Creek (Figure 1). Each test pit was ~3x1 m in area, and was excavated to depths of 4 m below the surface in 20 cm spits (Figure 3). The depth of the test pits was determined using the final excavation levels of the proposed stabilisation works, and more practically through the reach of the excavator arm. A proportion (~15%, equivalent to ~60 kg) of each spit was dry-sieved through a 5 mm mesh for archaeological material, with the remainder (~400 kg) only processed where artefacts were recovered.

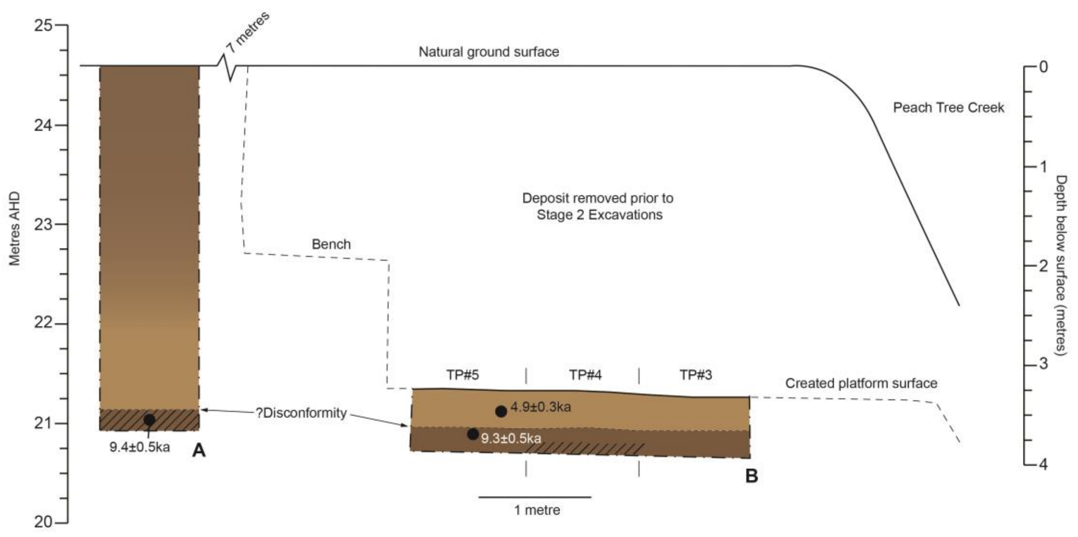

Figure 3: Section of the mechanical excavations (A) and the subsequent manual salvage excavations (B). Note that the entire soil profile consisted of a homogenous compact silt loam, but varied in colour as shown. Artefacts were recovered from hatched parts of the soil profile.

Based on the findings of the mechanical test investigations, specifically artefacts being recovered at a depth of >3 m below surface, a second phase of manual salvage excavation was undertaken to further characterise the deposits at a finer resolution, and obtain a larger assemblage. To allow safe access to the artefact-bearing deposits, the second excavation was undertaken once the council's stabilisation works had removed the upper soil profile to create a platform above the depth of interest (Figure 3). Six contiguous 1 m^2 test pits were then manually dug from this platform into the artefact-bearing deposits in close proximity (7 m eastward) to the original mechanical test pits (Figures 1 and 3). Beginning some 20 cm above the artefact bearing deposits ($\bar{x}$=21.29 m AHD (Australian Height Datum), σ =0.1 m), 10 cm spits were excavated to a depth of 10 cm below them ($\bar{x}$=20.68 m AHD, σ =0.05 m). The open area excavation was ultimately 3 x 2 m in size, and was ceased at 60 cm below the platform surface at the base of the proposed development works, where the increasingly indurated nature of the soil profile made manual excavation unfeasible. All material from the second stage of excavation was wet-sieved through a 5 mm mesh to recover any archaeological material present.

Results

Sedimentology

The excavation revealed two main soil units (Figures 3 and 4). Most of the excavated soil profile consisted of a homogenous brown (7.5YR 5/3 grading to light brown 7.5YR 6/4 at depth) compact alluvial silty clay. Below this, from ~3.5 m (21.15 m AHD) below surface, there was a slight increase in the sand component and a return to brown (7.5YR 4/4) coloured sediment, although overall the deposit remained substantively unchanged. Despite the similarities in the two units, OSL ages suggest that they may have been deposited at very different times (see below), with only the lowest stratum being contemporary with the Richmond Unit.

Figure 4: Photograph of the northern machine dug test pit. Artefacts were recovered near the base of this excavation. (Scale=50cm increments).

No laboratory soil analysis was undertaken as part of the compliance-based works, but the excavated soil profile at Peach Tree Creek appears visually and compositionally similar to the Richmond Unit as recorded elsewhere. Nanson et al. (1987:72) describe it as a 'sandy-clay orange and orange-mottled overburden', while it is presented in Stockton and Nanson (2004) as 'sandy clay'. As part of an archaeological investigation of the Penrith Lakes Development Area at Cranebrook, Mitchell (2010) variously describes the upper parts of the deposit as brown (7.5YR 4/3) or dark brown (10YR 3/4) silty clay loam to fine sandy loam, often bedded at depth. Based on these descriptions, and acknowledging the variation within alluvium on a major river system, the colour and composition of sediments, especially the lower deposit, found at Peach Tree Creek appear similar to other parts of the Richmond Unit.

Chronology

Three OSL Ages were obtained from the excavations (Table 1; Figure 3), two bracketing the artefacts recovered from the salvage excavation, and one from the centre of the 20 cm artefact-bearing spit within the northern machine-dug test pit. All samples were processed by the University of Gloucestershire (UK) using standard procedures (see Table 1 caption).

Table 1: Summary of Optical dating. Dose rate (Dr) values based on ex situ Ge gamma spectrometry (for γ and β Dr), Adamiec and Aitken's (1998) conversion factors, attenuation of present moisture content (Zimmerman 1971), current overburden and a geomagnetic latitude of 34°S (Prescott and Hutton 1994). The degree of U-Series disequilibrium was assessed by 226Ra /238U. Equivalent dose (De) values are based upon the SAR protocol (Murray and Wintle 2000, 2003) applied to twelve c. 1.5 mg (10 mm) multi-grain aliquots of fine silt quartz. Mean De values were estimated using the Central Age Model (Galbraith et al. 1999). Appropriate preheat temperatures were evaluated through Dose Recovery tests. Sensitivity correction was monitored through replicate measurements of low and high regenerative-doses. The significance of any feldspar contamination was quantified using post-IR OSL tests (Duller 2003). The occurrence of partial bleaching was assessed through signal analysis (Bailey et al. 2003). Ages are expressed relative to their year of sampling (e.g. the pre-cursor GL13 refers to 2013). All uncertainties in age are quoted at 1σ confidence and reflect combined systematic and experimental variability.

Lab Code	Sample Location	Depth (m below surface)	Depth (m AHD)	Moisture Content	$^{226}Ra/^{238}U$	Mean D_r ($Gy.ka^{-1}$)	Mean D_e (Gy)	Mean Age (ka)
GL13054	Test Pit 6	3.48	21.15	10 ± 3	0.93 ± 0.09	3.96 ± 0.16	19.3 ± 0.7	4.9 ± 0.3
GL13056	Northern Machine Test Pit	3.60	21.03	12 ± 3	0.91 ± 0.09	3.79 ± 0.16	35.8 ± 1.3	9.4 ± 0.5
GL13055	Test Pit 6	3.73	20.90	12 ± 3	0.90 ± 0.08	3.76 ± 0.16	35.0 ± 1.3	9.3 ± 0.5

The fine silt nature of the deposits precluded inter-grain D_e distribution analysis, thus age estimates are based on multi-grain aliquots of fine silt quartz. Measurement diagnostics showed no significant feldspar contamination and no impact of signal sensitivity changes during the process of acquiring D_e values. Signal analysis did not reveal any evidence of partial bleaching, though such tests do not necessarily rule out this effect. Moisture content is based on that measured from field samples and is assumed to have varied no more than 25% during burial owing to the homogenous nature of the sediment, and its height above the current river system (suggesting only intermittent flooding). No significant U disequilibrium was evident (Table 1).

The OSL ages indicate that the artefacts, which were all recovered from the lower soil unit at depths >3.5 m below surface, are dated to between ~9.4 and >9.3 ka. Given that these samples came from two phases of excavation in different locations, this lends support to the stratigraphic integrity of the deposit, and the robustness of the OSL ages. A much younger age of 4.9 ka was recovered from immediately above the artefact-bearing zone at 3.48 m below surface, and may suggest a disconformity in the sequence. As outlined above, a colour change and coarsening of sediment composition was also evident at this point indicating a potential change in depositional history. The documented *terminus ante quem* age of the Richmond Unit is ~10-20 ka (Figure 2), ages comparable with the findings of GL13055 and GL13056 (Table 1), and this strongly suggests that the lower deposit observed here may reflect the top of this geological strata, while the upper ~3.5 m of sediment probably represents later deposition.

While we acknowledge the limited number of chronological samples from the excavation, the correlation of the OSL ages with the wider geological strata and archaeological assemblage characteristics all lend strong support to their accuracy.

Lithic Assemblage

Six stone artefacts were recovered from the excavation (Table 2; Figure 5) - four from the mechanical test pits between 3.5-3.7 m below the ground surface (20.93-21.13m AHD), and two from the salvage excavation between 3.8-3.9 m below ground surface (20.73-20.83m AHD) (Figure 3). All artefacts were recovered from within the lower sedimentary unit, and below the possible disconformity.

Table 2: Location and description of artefacts recovered from the excavations.

Artefact ID Number	1	2	3	4	5	6
Test Pit	Northern Test Pit	Northern Test Pit	Northern Test Pit	Southern Test Pit	Salvage Area (TP 6)	Salvage Area (TP 6)
Depth	350-370	350-370	350-370	350-370	380-390	380-390
Artefact Type	Angular fragment	Angular fragment	Complete flake	Complete flake	Distal flake	Complete flake
Material	IMT	IMT	IMT	IMT	Coarse silcrete	Coarse silcrete
Colour	Yellow	Yellow	Yellow	Yellow	Grey	Grey
Heat	Y	Y	N	N	N	N
Termination			Abrupt	Feather	Hinge	Feather
% Cortex	0	0	1-25 Water-rolled	0	0	0
Flake Form			Indeterminate	Indeterminate	Indeterminate	Indeterminate
Exterior Platform			Flake scar	Flake scar		Flake scar
Platform			Cortical	Missing		Missing
Flake scars (*n*)			5	4		3
Max Length (mm)	19.9	46.6	54.2	37.5	35.6	34.9
Maximum Width (mm)	13	18.6	42.3	29.5	20.2	26.8
Max Thickness (mm)	4.9	7.2	23.9	7.8	10	6.7
Flake Length (mm)	0	0	37.4	35	0	25.9
Platform width (mm)	0	0	42.6	0	0	0
Platform thickness (mm)	0	0	7.2	0	0	0
Weight (g)	0.93	3.45	45.32	9.38	6.2	6.51

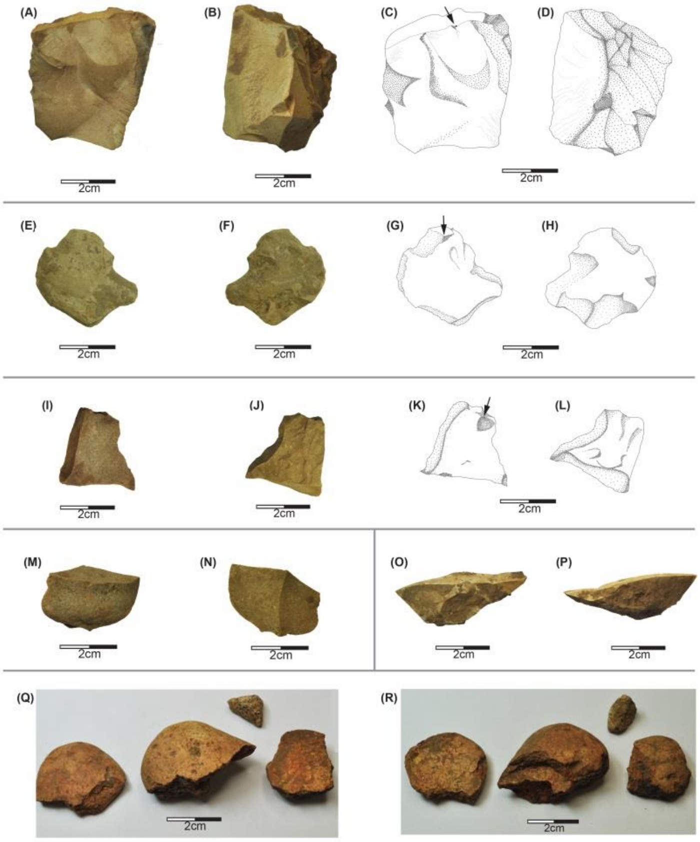

Figure 5: Photographs and illustrations of artefacts recovered from the excavations: Complete flakes - #3 (A-D), #5 (E-H) and #4 (I-L); distal flake - #5 (M and N) and angular fragment - #2 (O and P). A, C, E, G, I, K, M and O show the ventral surface, while B, D, F, H, J, L, N and P show the dorsal surface. Q and R show non-diagnostic fragments of quartzite and volcanic stone recovered in association with the other artefacts. The arrows indicate point and orientation of percussion.

Pleistocene assemblages from the Cumberland Plain are characterised by unmodified flakes with limited platform preparation and are predominantly made on indurated mudstone/tuff materials (IMT) (Corkhill 1999). Artefacts are generally larger in size than those from later assemblages; cortex when present is often indicative of the reduction of river cobbles, and scrapers are the dominant tool type present (Hiscock and Attenbrow 2005; McCarthy 1964).

The assemblage at Peach Tree Creek has similarities to other Pleistocene/ early Holocene assemblages recovered from the Cumberland Plain, such as those at the Windsor Museum (Austral Archaeology 2011) and PT-12 (Williams et al., 2012, 2014), with large artefacts derived from a relatively simply reduction strategy (often a succession of flakes being struck from river pebbles). The artefacts are heavily weathered and comprised of three complete flakes, a distal flake and two heat damaged IMT flaked pieces, showing evidence of pot-lid fractures. No formal tool types were recovered. The artefacts are comprised of three complete flakes, a distal flake and two heat damaged IMT flaked pieces, showing evidence of pot-lid fractures. No formal tool types were recovered. The complete flakes and broken (distal) flake fragments (Figure 5) retained little to no cortex. Where cortex was present, it suggested a water-rolled origin, probably from a river cobble. The artefacts are composed of IMT (n=4) and coarse silcrete (n=2), with a number of non-diagnostic fragments of quartzite and volcanic stone also recovered (Figure 5: G and I). Usewear was considered likely on several artefacts but no analysis has been undertaken to confirm this. In addition to evidence of deliberate mechanical fracture, several of the artefacts showed evidence of heat damage with crenate and pot-lid removals. As with other terminal Pleistocene sites along the river, the findings here lend support to the hypothesis of Aboriginal populations exploiting large river cobbles from exposed gravel beds during lower sea-level stands for stone artefact production.

Discussion and Conclusions

Summary and Interpretation

Overall, the excavations at Peach Tree Creek revealed a thick alluvial deposit extending to >3.9 m below the current surface. This deposit appears to consist of two different periods of deposition, with a lower unit probably representing part of the Richmond Unit of the Cranebrook Formation (Figure 2) and deposited >10 ka, overlain disconformably by late Holocene alluvium. Why the two deposits are so homogenous despite the age difference is unclear, but may reflect similar sediment-source catchments. The site is in very close proximity to the Nepean River, and the upper deposit is probably a more recent levee bank, a feature that has also been observed above the Richmond Unit along other parts of the river around Cranebrook (e.g. Mitchell 2010).

Within the lower sedimentary unit at depths of 3.5-3.9 m below current surface, a small number of tuff and coarse silcrete artefacts (n=6) were recovered. The weathered nature of these artefacts, their disparate distribution across 7 m horizontally and 40 cm vertically of deposit, and the origins of the soil profile are all indicative of their being re-worked and/or re-deposited through fluvial processes from elsewhere, rather than representing *in situ* activity. However, the large size of some of the artefacts within a fine alluvial matrix (indicative of low energy processes), suggests transportation through bed-load creep processes, and therefore they are likely to be from a relatively nearby location. This then suggests that OSL ages provide a *terminus ante quem* for deposition of discarded or lost artefacts, and indicates that Aboriginal people were occupying the banks of the Nepean River by >10 ka and during the terminal Pleistocene, if not earlier (see also Williams et al. 2013, 2014). This is further corroborated by the assemblage being in the upper portion of the Richmond Unit, a geological stratum shown to date to ~10-20 ka elsewhere (Figure 2).

While the small number of artefacts found limits our understanding of specific activities undertaken at the site, the typology (unmodified flakes) and raw material composition correlates well with other Pleistocene/early Holocene studies along the river. This includes basal occupation of KII rockshelter at ~13 ka (Kohen et al. 1984); and nearby Regentville RS1, an open site between Mulgoa Creek and the Nepean River, which contained heavily patinated artefacts dated to 3-12 ka (McDonald 1995; cf. Craib et al. 1999). Along with recent archaeological excavations at Windsor (PT12 and Windsor Museum) to the north, our findings here contribute to the current narrative of Aboriginal occupation along the Nepean River, specifically that the river had established regional populations by 36 ka, was a focus of activity during the LGM, and remained in use throughout the terminal Pleistocene (Williams et al. 2014). During these times, people were using the abundant resources of the river, which included the exploitation of exposed alluvial gravel beds for lithic raw materials, and the seasonal freshwater flowing out of the Blue Mountains from summer ice melt (Williams et al. 2013). Interestingly, a number of these archaeological sites suggest regional abandonment of the river corridor in the early Holocene, and at Peach Tree Creek we also find a potential disconformity during the same period, perhaps indicating a change in environmental or climatic conditions that may have prompted such a re-organisation of local landscape use.

These interpretations suggest that the Peach Tree Creek site is of high significance archaeologically following well-established criteria of rareness, representativeness and research potential (e.g. Bowdler 1981). While the Richmond unit may be quite extensive (as discussed below), the distribution of archaeological material within it is yet to be demonstrated, and as such it must be considered that the site is potentially rare. It also clearly has features through which we can address timely and significant research questions, in contrast with the vast quantities of late Holocene material currently excavated in New South Wales, much of which is often unstratified and/or disturbed (Mitchell et al. 2015). These findings have resulted in the artefacts being accessioned by the Australian Museum, where other researchers and the Aboriginal community can access them in the future.

Implications for the Cranebrook Formation

Our findings at Peach Tree Creek have a number of wider archaeological implications. The results provide new evidence for the Richmond Unit being present beyond the Penrith Lakes Development Area near Cranebrook. While the broad Cranebrook Formation was documented in the 1950s (e.g. Walker and Hawkins 1957), to date there have been few field investigations outside of these quarrying operations north of Penrith. Our study not only provides new evidence of the deposit beyond these limits, but also demonstrates that the strata continue southwards. Based on past mapping of the formation (Walker and Hawkins 1957) and our findings, the deposit has the potential to extend between Castlereagh (in the north) and Mulgoa (in the south) – effectively a ~20 km stretch of the river. The Richmond Unit at Cranebrook is generally found only a few hundred metres from the river's edge, whereas at Penrith, the deposit extends to at least 800 m from the Nepean River based on compliance work undertaken to the east of the football stadium (AHMS 2013). This investigation found no evidence of archaeological material, but OSL ages of a 1 m deep compact orange silt loam revealed basal ages of ~8 and 14 ka in closely spaced test pits. Assuming the Richmond Unit extends the length of the river as proposed by Walker and Hawkins (1957) and is on average ~500 m wide, the potential archaeological deposit would then extend over an area of some 8 km^2 on both sides of the river. This is an extensive archaeological landscape that is currently subject to substantial development.

Our results also provide independent verification of the latest models of river bank formation as proposed by Nanson et al. (2003) and Stockton and Nanson (2004), which divide it into two discrete units, and with only the Richmond Unit likely to be of archaeological interest. The lower deposit found in our archaeological excavations is of a similar composition to the descriptions of the Richmond Unit, and has a *terminus ante quem* age comparable with the known deposition of this strata (Figure 2), although it must be acknowledged that our ages are more comparable with Nanson et al. (1987), than more recent models suggesting a slightly earlier age (Figure 2). In addition, the height at which the lower deposit was found (~21 m AHD) correlates well with those at Cranebrook for the Richmond Unit of ~ 26 m AHD (Stockton and Nanson 2004) (Figure 2), or ~20 m AHD when removing a later overlying levee deposit (Mitchell, 2010).

Finally, our excavations provide some of the only stratigraphically recorded archaeological materials from the Cranebrook Formation since the finds by Stockton and Holland (1974) and Nanson et al. (1987). While our investigations were largely constrained to the 'overburden' of the Richmond Unit, we have been able to demonstrate that archaeological materials occur at depth within this stratum, and that 3-5 m of Holocene overburden needs to be removed before the geological stratum of interest is reached. In combination with recent findings at PT12 and Windsor Museum that show regional populations along the Nepean River by 36 ka, and visitation potentially earlier (Williams et al. 2014), our findings provide a much stronger case for previous archaeological finds to be present in the Cranebrook Formation before 40 ka as proposed by Nanson et al. (1987). While the validity of these finds will probably continue to be questioned, the Richmond Unit should continue to form the focus of future investigations as one of the few deposits in the Sydney Basin that has the potential to contain archaeological materials dating to the earliest colonisation of southeastern Australia.

Flaws with Current Excavation Process in NSW

Our excavation demonstrates that along the banks of the Nepean River, archaeological material can occur at significant depth, and that ~4 m of deposit represents only the last 10,000 years. Based on current geomorphological models, the Richmond Unit was deposited entirely within the acknowledged timeframe of Aboriginal colonisation, and is some 20 m thick. This is not an uncommon finding on the banks of the Nepean River, with excavations at PT 12 recovering cultural material at 1.3 m below surface (Williams et al. 2014), and at the Windsor Museum site to 1.8 m below surface (Austral Archaeology 2011). This raises some administrative issues with the NSW Aboriginal heritage compliance system.

Archaeological test excavations in NSW have been integrated as a discrete stage in the overall cultural heritage assessment process of a given development, and can be undertaken without external approval if in accordance with statutorily-regulated guidelines. The assessment is designed to form a complete package of information on the nature of archaeological deposits found, any potential impacts to them, and their future management for the consent authority to consider when approving the development. Unfortunately, as outlined above, these guidelines are highly restrictive as to the type of archaeological excavations that can be undertaken to inform the assessment process, limiting the extent of excavation to 3 m^2 (excavated manually as contiguous 0.25 m^2 test pits), and constraining a researcher's ability to excavate to depth. Further, workplace safety laws require shoring or benching below 1.5 m, and this is generally unfeasible in this amount of investigative space. To deviate from established guidelines requires that a permit be sought from OEH to allow an alternative excavation methodology, which due to mandatory timeframes and consent authority processing time can take ~6-12 months. This is effectively twice the length of an asssessment adopting established guidelines, and typically results in the need for multiple permits being required (i.e. one for investigation and a subsequent one for any resulting development impact). These timeframes must be considered against the backdrop of the wider assessment and approval process that ordinarily takes 12-24 months to complete, without integrating a lengthy cultural heritage approach. Ultimately, these complexities and substantial timeframes result in little support from proponents to adopt a differing approach, or for archaeologists in a competitive market to widely champion it. It appears that this situation, along the Nepean and presumably other river corridors, is detrimental to the investigation and conservation of significant archaeological deposits. Current archaeological guidelines in NSW (dating from 2010) warrant review and modification to address some of the methodological issues frequently faced following the findings of this and many other studies. They prove too prescriptive and fail to allow the researcher freedom to implement the best techniques in a given situation. There is no better example of this than the findings at Peach Tree Creek, where use of the established guidelines would have been unlikely to find the archaeological material presented here. We also stress the desperate need for the NSW State government to improve and streamline its approval process (especially in relation to test excavation) to ensure existing guidelines are not being applied to the detriment of archaeological deposits, simply to avoid the long timeframes associated with the current compliance system.

Finally based on our findings, we recommend that any researchers working within 800 m of the Nepean River carefully consider the potential depth of archaeological-bearing deposits, develop an appropriate investigative methodology, and be aware of the additional approvals and timeframes required to undertake such works.

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