The first successful application of Optically Stimulated Luminescence Dating to a colonial era (<0.25ka) archaeological site in Australia.

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Abstract

While exploration of Australian post-colonial (≤0.25 ka) OSL dating is well established in a range of natural sedimentary contexts (e.g. fluvial, aeolian, coastal), to date there have been no successful examples of the technique applied to archaeological sediments of this era. Here we present the results of a multi-phase compliance-based archaeological excavations of a new bridge crossing the Hawkesbury-Nepean River (northwest Sydney). These works identified a Last Glacial Maximum (LGM) aeolian deposit through which a colonial era drainage system had been excavated. Historical documents reveal the construction of the system occurred between 1814 and 1816 CE. An opportunistic range-finding Optically Stimulated Luminescence (OSL) sample was obtained from anthropogenic trench backfill – composed of reworked LGM deposits – immediately above the drainage system. Minimum and Finite Mixture age models of single grain quartz OSL provided a date of 1826 CE (1806-1846 CE), in close agreement with the documented age of construction. These findings provide the first evidence of a colonial structure reliably dated using OSL, and demonstrate the feasibility of wider deployment of OSL dating to other archaeological sites of the recent era (≤0.25 ka). We propose that such environments associated with large volumes of sand-rich backfill, in particular, likely heighten OSL dating success. We propose that well-documented historical archaeological sites in Australia also have the potential to provide a robust testing ground for further evaluating the accuracy of OSL dating in a range of young archaeological sedimentary contexts, potentially to sub-decadal levels.

Keywords: colonial era, Windsor (Sydney, NSW), compliance-based archaeology, anthropogenic backfill, single-grain OSL

Introduction

The use of Optically Stimulated Luminescence (OSL) dating has become widespread in archaeological contexts, and none more so than Australia. The abundance of quartz dominated landscapes and the poor preservation of organic remains for other radiometric techniques has resulted in a dominance of the approach in recent literature (e.g.; Fitzsimmons et al., 2014; Fu et al., 2017; Hughes et al., 2014; Williams et al., 2014, 2017). To date, however, the technique has largely focussed on Indigenous archaeological sites, often of considerable age (Dortch et al., 2016; Veth et al., 2017). There have been fewer OSL studies on the arrival and early settlement of Europeans (1788 CE; 0.23 ka), with all research consigned to dating the impact that these populations had on their environment (e.g. Bartley et al. 2018; Kemp et al. 2015; Page et al. 2007), rather than dating the archaeology.

There are several reasons for this, including the more frequent occurrence of materials suitable for radiocarbon dating, and/or the presence of cultural debris that can provide an absolute or relative chronology (e.g. ceramics produced during a known period) within colonial sites. However, while Australian colonial sites dating to the mid-19th century onwards often contain ubiquitous cultural material, earlier archaeological deposits often lack such debris, and developing and/or refining a reliable chronology can be problematic. Even where present, typological chronologies of artefacts are governed by the unreliability of median dating - the 'lag effect' of the ongoing use of material goods and the reliance on the *terminus post quem* of the latest-made artefact within a stratigraphic layer (Adams, 2003; Miller et al., 2000); and which the ongoing use of similar technologies through the 18th and 19th Centuries strongly influences any developed chronology. More broadly, there is also a general misconception, or perhaps fairer to say a lack of knowledge, in the archaeological community that OSL techniques can be applied to the last few hundred years.

Indeed, until recently the application of OSL to the last few hundred years was considered largely unfeasible owing to four factors summarised by Madsen and Murray (2009); 1) partial bleaching (inadequate resetting of the time-dependent signal prior to burial); 2) thermal transfer (a signal created during laboratory measurement) leading to significant age-overestimation; 3) low signal to noise ratios (insufficient luminescence sensitivity) leading to age imprecision or failure to produce an age; and 4) post-burial changes in deposits (depth and composition) leading to age underestimation. However, since the turn of the millennium marked by the advent of the single-aliquot regenerative-dose protocol (Murray and Wintle, 2000) and improvements in signal stimulation technology (e.g. Bøtter-Jensen et al., 1999, Duller et al., 1999, Ballarini et al., 2005), the number of reliable, young quartz OSL age estimates has increased substantially. In their review of quartz OSL dating of waterlain and aeolian deposits formed in the last 1 ka, Madsen and Murray (2009) collated evidence from 30 studies and demonstrated close agreement with independent age controls. In Australia, there have been similar studies of recent natural sedimentary sequences, mainly focussed upon land degradation and associated changes to hydrological regimes in the pre- and post colonial period (e.g. Bartley et al., 2018; Kemp et al., 2015; Page et al., 2007). However, whilst OSL dating in a range of archaeological contexts has been undertaken in other parts of the world (cf. Liritzis et al., 2013), there have been few equivalent studies in Australia (e.g. OSL dating of burnt stones within fluvial sediments by Rhodes et al., 2010), nor have any of these studies explored anthropogenic sediments in the post-colonial era.

Here, we present the results of an OSL age opportunistically recovered as part of a compliance-based archaeological program from colonial deposits in Sydney, New South Wales (NSW). It provides a demonstration of the feasibility of applying OSL to colonial era archaeological sediments in Australia, and with potential to extend this proof of concept to comparable anthropogenically modified deposits elsewhere across the world.

Background and the Excavations

Between 2016 and 2018, we undertook two phases of archaeological excavation in advance of proposed re-development of a bridge crossing the Hawkesbury-Nepean River in Windsor, western Sydney, NSW (Figure 1). The existing bridge crossing was constructed in the late 19th Century, and is situated on a deep meander of the river. The south of the crossing is characterised by a steep (~10°) slope where the river abuts a hard Tertiary geological substrate (Londonderry Clay) (AAJV, 2017a). Historically, the southern slope near the crossing was encompassed within a public park (Thompson Square) established in the early 19th Century, and was believed to have been subject to limited development.

Archaeological excavations initially consisted of a series of test pits (~2 (L) x 1.2 (W) x 2.3 (D) m) on a grid across the park; followed by a large-scale salvage excavation focussed on a single 150 m^2 locale where significant cultural material was identified within the projected development impact (Figure 1) (AAJV, 2017a). The investigative test pits were dug mechanically in controlled excavation units (10cm spits) to either the under-lying geological substrate, or more commonly the practical limits of the excavator (≤2.5 m below surface). While all sediment was sieved for archaeological (Indigenous and European) material, the deep depths of the excavations made *in situ* investigation and sampling problematic. However, a range of *in situ* chronological samples were recovered from depths ≤1.7 m below surface in a number of test pits.

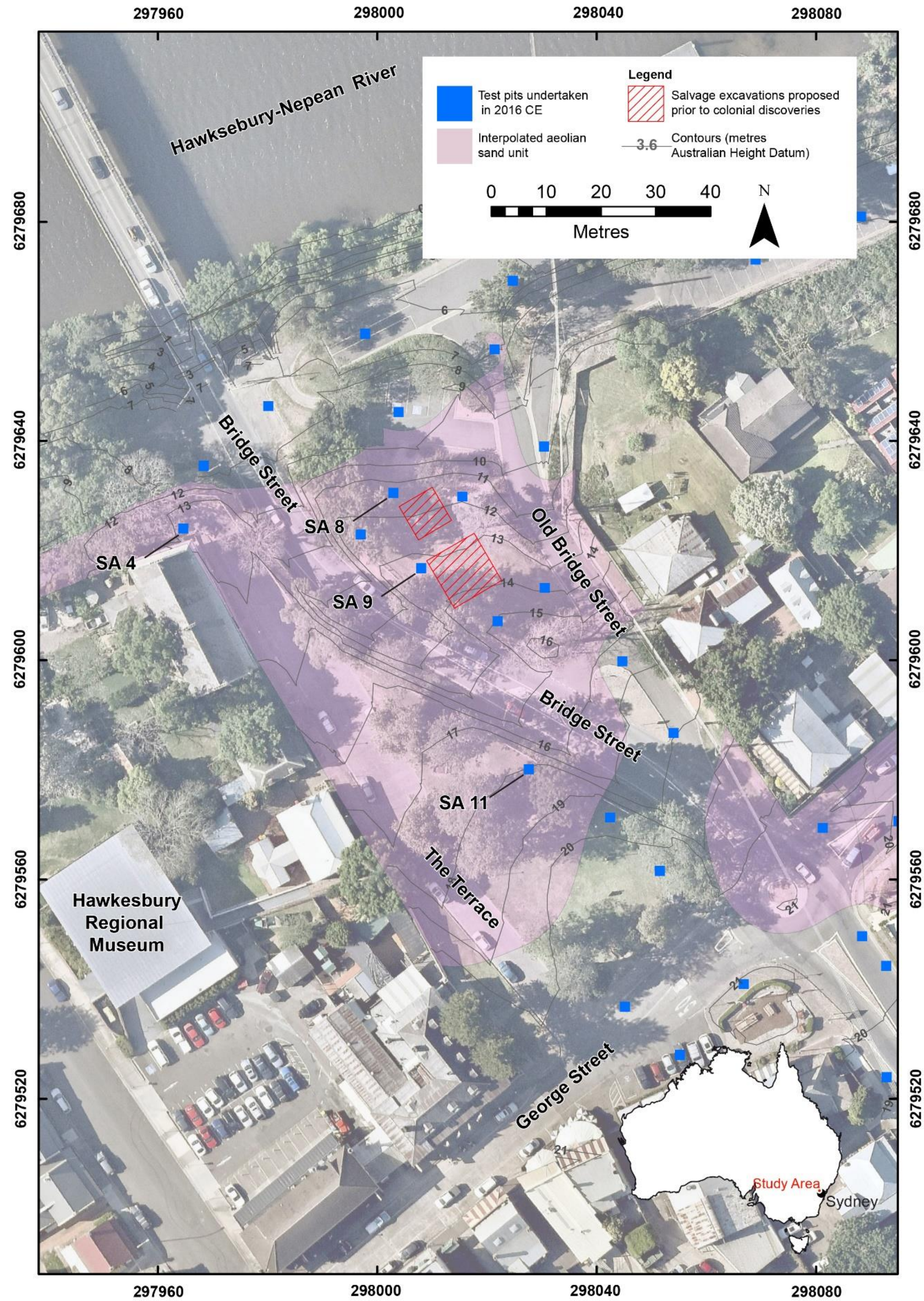

Figure 1: Location of the study area showing the distribution of the test excavations undertaken in 2016CE, and the interpolated distribution of the aeolian deposit based on these works. To the north and south of the aeolian unit was low energy alluvial silts and clays, and shallow texture contrast soils, respectively. Test pits discussed in text are labelled.

The investigative phase found a light yellowish brown (10YR 4/6) fine to medium sand at the base of the excavations (Figure 2), which appeared to extend across much of the park (generally between ~≥1 and 2.3m below the surface). This was interpreted as an aeolian deposit that likely formed on the southern slope through ramping of finer sediments from the adjacent floodplain by the prevailing westerly winds (AAJV, 2017a). OSL ages recovered from this unit indicate deposition beginning by 82±7 ka, but with formation and/or reworking primarily during the Last Glacial Maximum (LGM) between 27.6±4.4 and 18±2 ka, and during which time large quantities of cultural material were discarded – suggestive of increasing Indigenous visitation of the river at this time (Table 1; Figure 2) (AAJV, 2017a; Williams et al., 2014). Under-lying this deposit, in the eastern parts of the park was a coarse to medium strong brown (5YR 5/6) and reddish yellow (7.5YR 6/8) sand with sub-rounded gravels (2-5cm Ø) – a slackwater or levee deposit that formed >82±7 ka during the onset of the last Glacial in Marine Isotope Stage (MIS) 5 (Figure 2). Under-lying the entire stratigraphic sequence - the aeolian unit in the west, and levee/slackwater unit in the east - was the Tertiary substrate, Londonderry Clay, which is composed of an indurated strong brown (7.5YR 5/6) heavy clay. Immediately above the natural soil profile, and extending to the surface (usually ~0.8-1m) was 19th and 20th Century disturbance – often incorporating re-worked sediments from the under-lying aeolian and levee/slackwater deposits.

Table 1: OSL Data for the geological substrate (GL16115-16118, 16054 and 16055). CAM – Central Age Model; ages are expressed relative to their year of sampling (2016 CE). All uncertainties in age are quoted at 1σ confidence and reflect combined systematic and experimental variability.

Lab Code	**Depth (m beneath modern surface)**	**Moisture content (%)**	Ge γ-spectrometry (*ex situ*)			**^{226}Ra/^{238}U**	**Total D_r (Gy.ka^{-1})**	**CAM D_e (Gy)**	**CAM Age (ka)**
			K (%)	**Th (ppm)**	**U (ppm)**				
GL16116	1.05	6 ± 1	0.64 ± 0.06	5.01 ± 0.41	1.22 ± 0.12	1.11 ± 0.20	1.31 ± 0.08	7.4 ± 0.6	5.7 ± 0.6
GL16054	1.30	6 ± 1	0.64 ± 0.03	6.10 ± 0.48	1.53 ± 0.09	0.71 ± 0.14	1.49 ± 0.07	26.7 ± 2.8	18 ± 2
GL16118	1.55	6 ± 2	0.52 ± 0.06	5.80 ± 0.45	1.45 ± 0.12	0.90 ± 0.14	1.29 ± 0.08	29.6 ± 2.0	22.9 ± 2.1
GL16115	1.80	5 ± 1	0.71 ± 0.06	5.48 ± 0.43	1.32 ± 0.12	1.11 ± 0.19	1.42 ± 0.09	39.3 ± 5.8	27.6 ± 4.4
GL16055	2.05	5 ± 1	0.82 ± 0.03	6.33 ± 0.49	1.62 ± 0.09	0.75 ± 0.18	1.68 ± 0.08	138.7 ± 10.2	82.4 ± 7.1

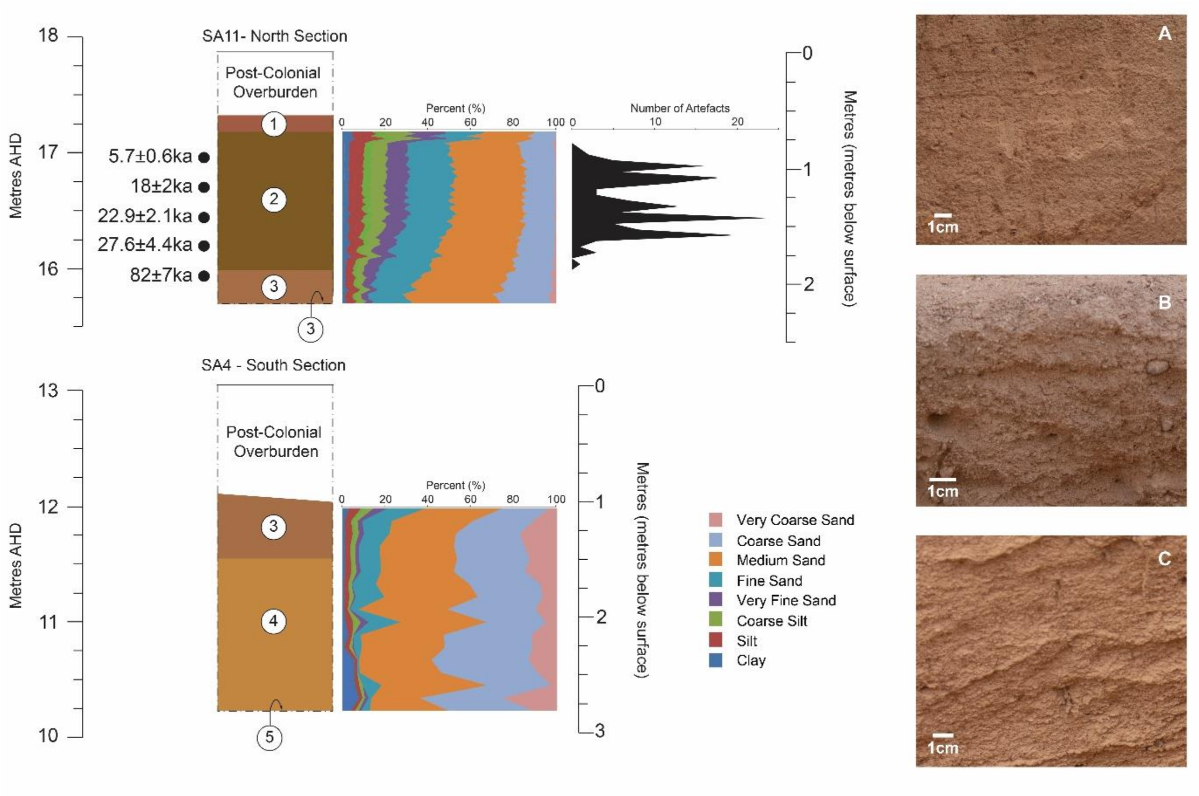

Figure 2: A composite sedimentological record of the *in situ* soil units within the study area based on test pits SA 11 and SA 4, including general stratigraphic units and depths, particle size analysis, OSL ages (Table 1) and recovered stone artefacts. Test pit SA 11 contained the upper part of the soil profile, while SA 4 contained the lower parts; the overall thickness of unit 3 is uncertain, but subsequent salvage excavations indicate ~1m, and suggest some minor truncation as presented here. Stratigraphic units include: 1) very dark greyish (10YR 3/2) loamy fine sand and silt – colonial topsoil; 2) light yellowish brown (10YR 6/4) fine sand and silt (photograph A) – aeolian unit; 3) strong brown (5YR 5/6) coarse/medium sand and gravels (sub-rounded, 2-5cm Ø) – slackwater/levee deposit (Photograph B); 4) as (3), but increasing heavy clay components and reddish yellow (7.5YR 6/8) in colour (Photograph C); and 5) strong brown (7.5YR 5/6) indurated heavy clay – Londonderry Clay.

The salvage excavations were undertaken to further interrogate and recover the archaeological material, and to gain better access to the lower deposits that could not be readily investigated in the previous phase. These works, therefore, undertook a large open area excavation that initially sought to remove the upper 19th and 20th Century disturbed units with an excavator (Figures 3 and 4), before manual excavation of contiguous 0.25 m^2 test pits dug in 5 cm spits were undertaken across the area of interest (AAJV, 2017b). (The findings of these works will be the subject of future publications.) During the salvage excavations, it became apparent that a significant part of the aeolian unit in this location had been disturbed and/or reworked by deep colonial anthropogenic activities, notably the installation of a large brick drainage system. This system was situated ≥3.6 m below surface, and involved the original excavation of a 5-11 m wide trench through the aeolian unit across the park (Figures 3 and 4).

Figure 3: The alignment of the drainage system running through the centre of the study area. The key excavations discussed, and the direction of the photographs in Figures 4 and 5 are also presented.

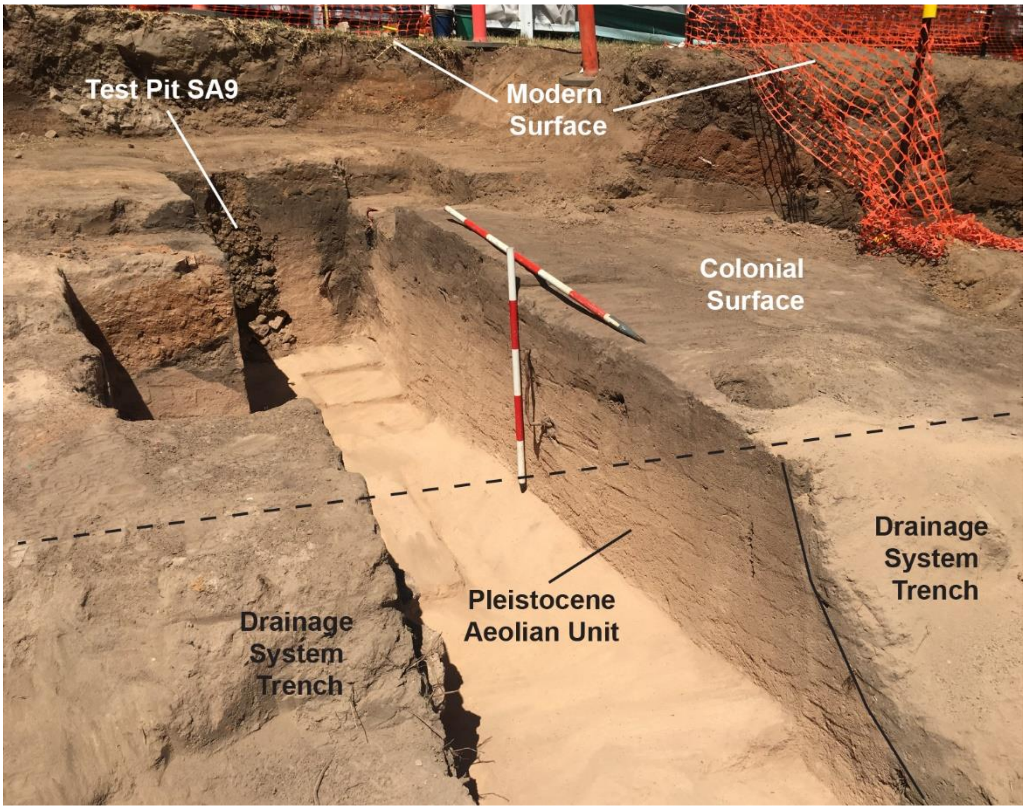

Figure 4: A part of the salvage excavation showing the *in situ* Pleistocene aeolian dune deposit and its truncation by the colonial drainage system trench, looking west. The modern and pre-colonial land surfaces are shown. An investigative test pit, SA 9, is evident in the background, from which an OSL age near the top of the aeolian unit as presented here returned a multi-aliquot age of 17±2 ka (GL16056), and suggest some truncation has likely occurred in places. Scale = 20cm.

The trench then appeared to be backfilled with a mixture of the stratigraphic units through which it was excavated. While, elements of this trench were identified in the investigative phase, they were not interpreted as such due to: i) their significant depth below other colonial activities, and the excavations not extending to the structure itself; and ii) the original aeolian sediment was used to backfill the trench shortly after the construction, thereby minimising evidence of the activity. Ultimately, this finding meant that parts of the investigative phase were recovered from the colonial trench backfill, rather than the surrounding Pleistocene aeolian/slackwater units as originally believed. Specifically, a single-grain quartz OSL age, sample GL16120, was recovered from part of the reworked aeolian unit, some 50 cm above the main trunk drain (Figure 5).

Colonial Drain System

Earlier phases of the project had identified the potential for a drainage system to be in the vicinity of the bridge crossing. However, neither historical documents, subsequent ground penetrating radar, nor investigative excavation, provided any information as to its location (AAJV, 2017b).

Subsequent salvage excavations revealed the drainage system, and showed that it consists of a single large trunk main running down (~12°) the southern slope to discharge into the river (Figure 3). The trunk main is a poorly constructed ovoid/ellipsoid shape, some 1.3 m in diameter, situated in the base of a V-shaped trench. About 1 m above the trunk main are a series of smaller box drains (each ~0.5 m wide) running perpendicular to the slope and feeding into it through a series of strategically placed sumps (Figure 5). The sediments of the V-shaped trench reveal multiple phases of re-burial of the structures, with a lower very dark gray (7.5YR 3/1) 20 cm sandy clay band immediately above the trunk main, overlain by a mixture of the Pleistocene aeolian sand unit and an under-lying last Glacial levee/slackwater sand unit; and within which the box drains are situated (Figure 5). This mixed backfill deposit was generally ≥2 m in thickness and filled the trench cut to its original colonial surface, which was broadly comparable to the surface of the *in situ* aeolian dune deposit (~1-1.5 m below modern surface) (Figure 5).

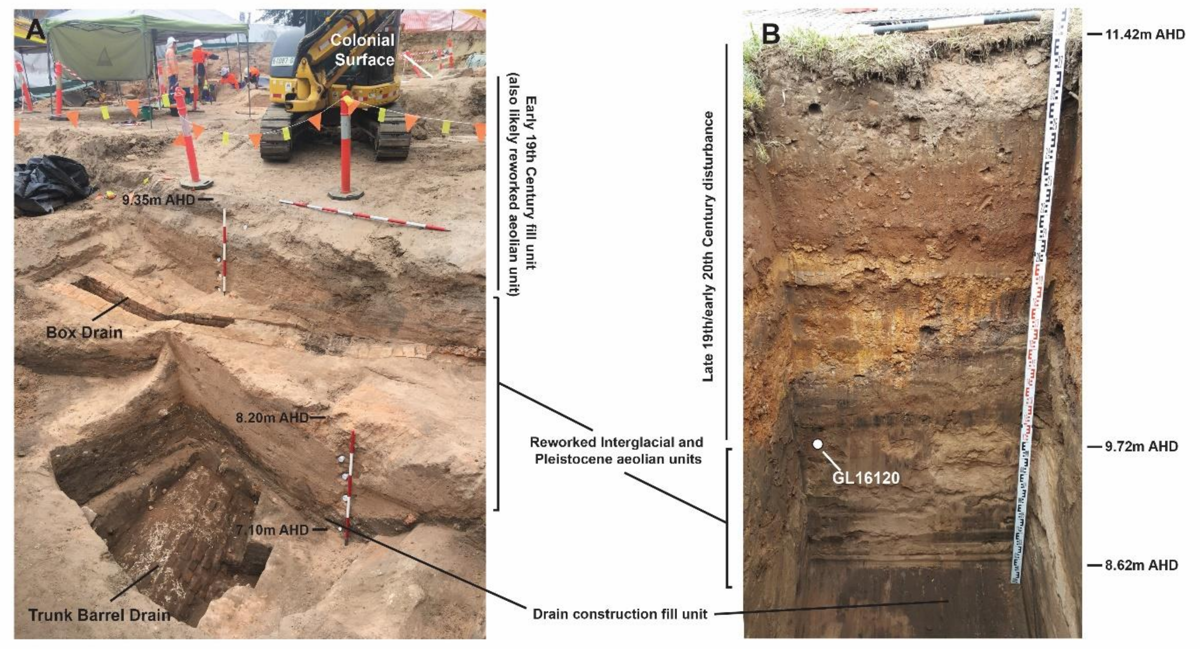

Figure 5: The relationship between OSL sample GL16120 and the colonial drainage system. A) The drainage system exposed and showing the overlying dark black/brown sandy clay construction fill unit and reworked Interglacial/Pleistocene aeolian unit; and B) the northern section of test pit SA8 showing the same two geomorphological units and the location of GL16120. The elevations of these units in SA 8 are higher, but this is due to the test pit being situated ~5m upslope and on the edge of the excavation undertaken for the trunk main, rather than the base of this feature as shown in (A). Scale = 20cm.

Based on historical documentation, we know that the drainage system formed part of a larger government contract awarded to John Howe and James McGrath in August 1814 CE to establish a wharf (adjacent to the current bridge crossing) and for earthworks in the park (State Library of New South Wales, John Howe papers 1810-1849, MLMSS106: Article 37). The contract identified that a 'sewer' with a system of feeder channels was to be completed within 12 months. While we cannot establish the exact completion date of the sewer, concerns over the quality of the work in March 1816 CE (State Records of New South Wales Colonial Secretary's Papers. March, 1816) suggest that the drainage system was buried by this time. We can therefore determine that the drainage system and associated trench was excavated and re-established over a two-year period, between 1814-1816 CE (202 –204 years ago), and likely took several months to complete.

Methods

OSL samples were recovered in daylight under shade, gently hammering an 80 cm^3 (20 cm long x 4 cm Ø x 0.5cm thick) opaque plastic tube into cleaned vertical sediment sections. Each tube was removed, capped at both ends and covered in black plastic and stored in an opaque box before delivery to the laboratory for analysis. All samples were opened and prepared under controlled laboratory illumination provided by Encapsulite RB-10 (red) filters. To isolate that material potentially exposed to daylight during sampling, sediment located within 2 cm of each tube-end was removed. The remaining sample was dried at 40°C and then sieved. The fine sand fraction was segregated and subjected to standard quartz isolation procedures; 10% HCl acid digestion of carbonates, 15% H_2O_2 alkaline dissolution of organics, 60 minute etch using 40% HF to remove the α-irradiated rind, 10% HCl to remove acid soluble fluorides, re-sieving to remove any remaining feldspars, and density separation at 2.68$g.cm^{-3}$ to remove heavy minerals. Six hundred 180-250 μm quartz grains were then sited into individual 300 μm (diameter and depth) holes drilled as a 10x10 grid into anodised aluminium discs (Duller et al., 1999) for measurement.

Equivalent dose (D_e) values were quantified using a single-aliquot regenerative-dose (SAR) protocol (Murray and Wintle 2000; 2003) facilitated by a Risø TL-DA-15 irradiation-stimulation-detection system (Markey *et al*., 1997; Bøtter-Jensen *et al*., 1999; Duller *et al*., 1999). Within this apparatus, optical signal stimulation of single grain aliquots emanated from a focussed solid state 532 nm (green), 10 mW stabilised laser (Laser 2000 LCL-LCM-T-11ccs) scanned across grains by means of mirrors mounted on and moved by motorised linear stages. For Infrared (IR) stimulation, provided by 6 IR diodes (Telefunken TSHA 6203) stimulating at 875±80nm delivering ~5 $mW.cm^{-2}$, was used to indicate the presence of contaminant feldspars (Duller, 2003). Stimulated photon emissions from quartz aliquots are in the ultraviolet (UV) range and were filtered from stimulating photons by 7.5 mm HOYA U-340 glass and detected by an EMI 9235QA photomultiplier fitted with a blue-green sensitive bialkali photocathode. Aliquot irradiation was conducted using a 1.48 GBq $^{90}Sr/^{90}Y$ β source calibrated for single grain aliquots of 180-250 μm quartz against the 'Hotspot 800' ^{60}Co γ source located at the National Physical Laboratory (NPL), UK. In calibrating single sand grain aliquots, no significant spatial variation in dose rate from the β source was found.

For each single grain aliquot, six different regenerative doses were administered to produce a dose response curve. De values for each aliquot were then interpolated, and associated counting and fitting errors calculated, by way of exponential plus linear regression. A preheat temperature of 260°C for 10 seconds was selected through dose recovery tests (Murray and Wintle, 2003). Acceptance criteria were applied to the single grain D_e values, including production of a detectable natural signal (>3σ background), regenerative-dose and post-IR OSL ratios consistent with unity (0.9-1.1), and a regenerated zero dose signal not exceeding 5% of the natural signal (Murray and Wintle, 2000; 2003; Duller, 2003). Dose rate (D_r) values are based on *ex situ* Ge gamma spectrometry (for γ and β D_r, using Ortec GEM-S high purity Ge coaxial detector system, calibrated using certified reference materials supplied by CANMET), 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). β and γ contributions were estimated by laboratory-based γ spectrometry using an Ortec GEM-S high purity Ge coaxial detector system, calibrated using certified reference materials supplied by CANMET. The level of U disequilibrium (^{226}Ra /^{238}U) was also estimated by Ge γ spectrometry, and assessed as negligible. OSL age estimates are based on the quotient of D_e and mean D_r values, with errors based upon analytical uncertainty, quoted at 1σ confidence and accounting for the propagation of systematic and/or experimental (random) errors.

Results and Discussion

The central age model (CAM; Galbraith et al., 1999) for sample GL16120, recovered from the trench fill immediately above the trunk main, produced a date of 1766 CE (1736-1796 CE; 0.25 ± 0.03 ka. Table 2; Figures 5 and 6).

Table 2 OSL data for the colonial drainage system. MAM – Minimum Age Model; FMM_{Min} – minimum age population within the Finite Mixture Model (k=1, P=91.1%); FMM_{Major} – age population with majority of grains within the Finite Mixture Model (k=1, P=91.1%); CAM – Central Age Model. Ages are expressed relative to their year of sampling (2016 CE). All uncertainties in age are quoted at 1σ confidence and reflect combined systematic and experimental variability.

Lab Code	Depth (m beneath modern surface)	Moisture content (%)	Ge γ-spectrometry (*ex situ*)			$^{226}Ra/^{238}U$	Total D_r ($Gy.ka^{-1}$)	MAM D_e (Gy)	FMM_{Min} D_e (Gy)	FMM_{Major} D_e (Gy)	CAM D_e (Gy)	MAM Age (ka)	FMM_{Min} Age (ka)	FMM_{Major} Age (ka)	CAM Age (ka)
			K (%)	Th (ppm)	U (ppm)										
GL16120	1.70	11 ± 3	1.15 ± 0.08	9.43 ± 0.57	1.96 ± 0.14	0.85 ± 0.10	2.06 ± 0.14	0.4 ± 0.0	0.4 ± 0.0	0.4 ± 0.0	0.5 ± 0.1	0.19 ± 0.02	0.19 ± 0.02	0.19 ± 0.02	0.25 ± 0.03

This predates the arrival of Europeans in this region. Overdispersion of single grain D_e values was significant (σ=76%), driven by a small number of quartz grains with substantially higher absorbed doses. However, minimum age and finite mixture models (Galbraith and Laslett, 1993; Galbraith and Green, 1990) both returned a date of 1826 CE (1806-1846 CE; 0.19 ± 0.02 ka), coeval with the documented period of drain construction. Within the finite mixture model, the minimum age was defined by ~91% of the grain population (Figure 4). The overestimation of age by the CAM is likely rooted in less successful bleaching of ~9% of grains from the original Late Pleistocene unit. Considering the four general limiting factors in OSL dating of young deposits, the key characteristics for success here are, firstly, the relatively high signal sensitivity (~ 2,800 counts.s^{-1}.Gy^{-1}) typical of most Australian OSL studies. Secondly, limited thermal transfer, though this is inferred from the accuracy of the dose recovery test and age estimate rather than directly measured by preheat tests on the natural signal at the single grain level. Thirdly, the rapid infilling of the trench limiting error in cosmic dose rate estimation and likely precluding significant pedoturbation (cf. Gliganic et al., 2016). Moreover, in reference to the fourth and final factor, the large scale of successful bleaching is notable given the anthropogenic mode of reworking, with likely ad hoc removal and turnover on the surface by manual labour techniques during drain construction. To our knowledge there are no OSL studies of archaeological backfill. Kemp et al. (2014) have undertaken an investigation of OSL bleaching within 'mock' grave excavations. However, in that study the minimum age models significantly overestimated the timing of the excavation, in contrast to our findings. Though the sand-dominated texture of their graves was similar to the trench in this study, the dimensions of their excavations were far smaller (~0.11 (L) x 0.5 (W) x ~0.65 (D) m for each grave, compared to the colonial drainage system of >40 (L) x ~5-11 (W) x >3 (D) m). The explanation for the success of bleaching in this study may, therefore, relate to the geometry of the trench, with grains experiencing greater travel distance and dispersion through the air during excavation and in-filling promoted by a wider, deeper cavity. We believe that this is the first time anthropogenic sediments from a colonial archaeological site have been demonstrably, and effectively, dated using OSL.

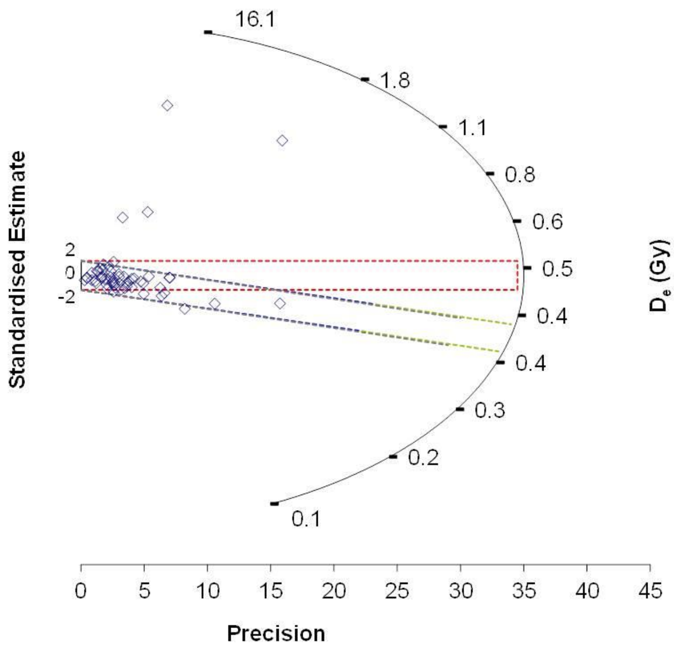

Figure 6: Radial plot (Galbraith, 1990) of single grain D_e values for sample GL16120. Four estimates of post-burial D_e values are illustrated based on the Minimum (in grey), Finite Mixture (Minimum Population; in green), Finite Mixture (Majority Population; in blue) and Central Age (in red) models.

While we had good documentation for the construction of the colonial features here, this will not always be the case. This is not an uncommon problem for early colonial sites in Australia, where archaeological remains are dominated by wooden structures that rarely survive the harsh climatic conditions, sediment infilled ditches/channels, and/or where personal goods (chronological indicators) were infrequent, sparse and/or exhibit lag effects (e.g. Adams, 2003; Donolon et al., 2008; Rodrigues and Prall, 2009; Starr, 2015). Colonial and post-colonial era Indigenous sites have similar issues (e.g. McNiven et al., 2017; Wallis and Collins, 2013; Wallis et al., 2017). Our results, therefore, provide a successful proof of concept for using quartz OSL to date anthropogenic sediments at archaeological sites of the colonial era (i.e. ≤0.25 ka) in Australia, where such historical documentary evidence is not readily available. We consider similar situations are likely to exist in other parts of the world where colonial era archaeology is present. While more commonly, archaeologists attempt radiocarbon dating techniques in these situations, it should be noted that radiocarbon and OSL dating for this period have comparable absolute errors – in the order of 10-20 years (Hogg et al., 2013). We also highlight that a radiocarbon plateau in the calibration curve is present in the colonial era (Madsen and Murray, 2009; Williams, 2012), which further increases uncertainty in the accuracy of radiocarbon dating of this interval.

In conclusion, archaeological excavations on the banks of the Hawkesbury-Nepean River have provided a unique opportunity to apply OSL dating to a colonial era site known to have been constructed in the early 19th Century. Though opportunistic, the application proved highly successful, reliably reproducing the known age of construction. Whilst the lack of thermal transfer, the focus on a site with rapid and deep infilling, and the presence of quartz OSL of relatively high sensitivity contributed to this success, it is the proportion of well-bleached grains that suggests single grain OSL dating of post-colonial archaeological sediments in Australia may warrant wider deployment. We would recommend that such deployment extends to colonial era sites of other parts of the world where similar conditions exist. We note the contrast in the degree of OSL bleaching between our trench and the experimental graves created by Kemp et al. (2014), and suggest that texture and cavity dimensions may be key considerations in the accuracy of single grain OSL dating of archaeological trenches and graves. We further demonstrate that reworked sediments in *documented* historical contexts likely in both Australia and elsewhere provide a potentially good resource for further evaluating the accuracy of OSL dating in a range of young archaeological contexts, potentially to sub-decadal levels.

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