Section 9.6

POLLEN ANALYSIS OF SAMPLES FROM
710-722 GEORGE STREET, HAYMARKET,
SYDNEY

by

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Microfossil remnants of the 1788 forest vegetation on Brickfield Hill?

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Casey & Lowe Pty. Ltd., Marrrickville

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1. INTRODUCTION

George Street which extends from Circular Quay to Haymarket (Fig. 1), has been a (if not the) principal thoroughfare in Sydney since 1788. As such, archaeological sites along its length are in many ways an archive of its commercial history.

Historical archaeological sites in the Haymarket district on the southern slopes of Brickfield Hill are strategically located to mirror this history. For example as recently as the late 1830s, the area was located at the interface between three contrasting early Colonial environments – the relatively densely settled areas to the north of, and around Brickfield Hill where bricks, tiles and pottery were manufactured until the 1820s; 'farmed' open country to south of Campbell Street; and swampland at the head of Cockle Bay/Darling Harbour, which acted as a buffer between Sydney Town and large Colonial estates such as that occupying the Ultimo Peninsula on the western side of Darling Harbour up to c. 1850 (Fig. 2).

Importantly, the relative small scale of commercial developments in the Haymarket district (Fig. 1) has allowed remnants of the early Colonial landscape as well as built structures dating to the 1830s-1880s to survive under late nineteenth and early twentieth century buildings at 710-722 George Street, Haymarket (www.caseyandlowe.com.au/site:710.htm). These include:

- **Thomas Ball's Pottery** (c. 1806-1823): The study area is adjacent to the kilns and the remains of three large pottery pits predating the 1820s were uncovered at 718 and 722 George Street. The infill included kiln furniture such as clay stilts and wedges as well as thousands of lead-glazed sherds.

- **Woolpack Inn** (c. 1830-1890): The sandstone footings of this inn and associated remnants such as a brick fireplace, underfloor deposits and a cesspit were uncovered at 720-722 George Street.

- **Other built structures**: The well-preserved remains of nineteen century building and associated structures were found the other allotments making up the study area. Examples are: (a) The remains of an early 19th century building and a cesspit and c. 4 m deep, infilled well at the rear of a 1860s building at 710 George Street. (b) Sandstone footings of early 19th century buildings and cesspits of later early 19th century buildings at 712-716 George Street. (c) The brick fireplace, postholes and an underfloor deposit of an early 19th century building as well as the cut sandstone-lined cesspit of a later building at 718 George Street.

**Fig. 1**: Locality map (north is on RHS of diagram)
Fig. 2: Map showing the European buildings and other in the vicinity of 710-722 George Street in 1836. [red triangle shows the approximate area encompassed by study area]

Fig. 3: Archaeological 'footprint' of Nos. 716 and 718 George Street (2008 Excavation Summary)
1.1 This report

The report discusses fossil spores, pollen and other plant microfossils preserved in remnant topsoil and cultural deposits preserved at 710-722 George Street (hereafter Site), on the corner of George and Campbell Streets (Figs. 1, 2).

1.2 Aims

The primary aim was to determine whether fossil pollen and spores (miospores) were preserved and, if so, to use the microfossil data to:

- Reconstruct the local landscape at the time of first European occupation ('1788' soil samples)
- Provide an independent test of the archaeological typing of the samples (built contexts)
- Explore links between environmental change and commercial and residential developments.

1.3 Samples

Six (6) samples from three areas of the Site - Areas A (720-722 George Street), Area B (712-718 George Street) and Area C (710 George Street) were submitted for pollen analysis. These range in age from potentially as early as 1788 into the 1880s (Table 1).

Table 1: Sample data (from Abi Cryerhall and Mike Hincks, Casey & Lowe Pty. Ltd.)

<table>
<thead>
<tr>
<th>AREA</th>
<th>Sample</th>
<th>CTX</th>
<th>Inferred age</th>
<th>Archaeological context</th>
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<tr>
<td>A</td>
<td>1</td>
<td>7323</td>
<td>1830s-1880s</td>
<td>underfloor deposit, front room of Woolpack Inn</td>
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<tr>
<td></td>
<td>11</td>
<td>7324</td>
<td>1830s-1880s</td>
<td>underfloor deposit, rear room of Woolpack Inn</td>
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<tr>
<td></td>
<td>29</td>
<td>7449</td>
<td>1820s-1830s</td>
<td>malodorous deposit at base of a large pit</td>
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<tr>
<td>B</td>
<td>49</td>
<td>7386</td>
<td>c. 1788</td>
<td>topsoil modified during the 19th century?</td>
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<tr>
<td></td>
<td>47</td>
<td>7472</td>
<td>c. 1788</td>
<td>topsoil sealed below Wall 2, modified during the 19th century?</td>
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<tr>
<td></td>
<td>67</td>
<td>7569</td>
<td>1860s?</td>
<td>basal fill in a c. 3-4 m deep well</td>
</tr>
</tbody>
</table>

1.4 Phasing

Casey & Lowe (2008) have identified four occupation phases between 1788 and 1890 (Table 2). These are preceded by two earlier phases (Natural Landscape and Indigenous Occupation):

Phase 3 (1788-c. 1823) during which activities in the area included brick and pottery manufacture, activities included small farming and market gardening
Phase 4 (c. 1823-c. 1840) during which the area was occupied by former convicts and their families.
Phase 5 (c. 1840-1860s) during which previous structures were converted or rebuilt into small shops. The area was considered to be one of the least desirable in Sydney due to low living standards and vice.
Phase 6 (1860s-1890) during which the 'cleansed' area was rebuilt for larger scale commercial activities.
2. SUMMARY

- All samples yielded statistically robust numbers of fossil pollen spores and other microfossils in organic extracts that are otherwise dominated by strongly humified and/or well-preserved plant detritus.

- The fossil assemblages are unusual in being wholly dominated by casuarina (*Allocasuarina/Casuarina*) pollen. This can be explained in a number of ways but, apart from the subfloor samples from the Woolpack Inn, the data point to tree species of casuarina being prominent, if not dominant in forest or woodland growing on the south-facing slope of Brickfield Hill at the time of first European settlement.

Contrary to early observations, there is no pollen evidence that the understorey in these forests were dominated by shrubs in 1788.

- Individual casuarina trees may have survived into the 1820s or casuarina timber was used in the construction of dwellings on the Site, e.g. to make roofing shingles. The interpretation is supported by independent evidence from the Family Court Site on corner of Bathurst and Castlereagh Streets (apex of Brickfield Hill) where the stump of a casuarina is preserved in at the rear of a 1820s laundry.

- Most samples preserved significant numbers of fern and fern ally spores and trace numbers of sclerophyll shrub pollen. The sources may have been plant communities growing on the banks of two nearby creeks, which drained rainwater off Brickfield Hill into the swamp at the head of Cockle Bay (Darling Harbour). Whether the Site at 710-722 George Street was prone to flooding is unknown.

- The "malodorous" sediment at the base of an 1820s-1830s pit at 720-722 George Street (Area A CTX 7449) preserves microfossil evidence of raw sewage but not in sufficient numbers to confirm that this was the primary function of the pit.

- Microfossils preserved in sediment at the base of the c. 4 m deep well at 710 George Street mirror those recovered from cesspit contexts elsewhere in Colonial Sydney and Parramatta. Whether the deposit is the result of an accidental spillage, an unusual event, e.g. flooding of the site, or the well began life as a cesspit is unknown.
3. SETTING

3.1 Natural landscape

For the last 6000 years, Sydney Harbour has consisted of steep-sided sandstone promontories (some capped by shale outcrops) separated by narrow bays and valleys drained by small freshwater streams flowing into the estuary. Although now extensively reshaped by infilling and levelling over the past 200 years, the pre-1788 landscape of the low-lying Haymarket district, which includes 710-722 George Street, is likely to have differed from areas further to the north along George Street in several important ways:

- Wianamatta Shale, not Hawkesbury Sandstone, was the dominant bedrock, resulting in relatively subdued (rounded) landforms in contrast to the CBD peninsula where steeper hillsides descend via a series of structural benches.
- These Triassic shales weather to form iron- and clay-rich podzolic soils that tend to be deeper but also less pervious and probably less fertile than those formed on sandstone.
- Clay- and silt-rich alluvium will have accumulated along the sides of small creeks draining Brickfield Hill and formed a more extensive 'delta' around the head of Cockle Bay. Two creeks flowing downslope into Cockle Bay crossed George Street near present day Goulburn and Hay Streets (Obed West cited in Marriott 1988: 17).
- The pre-1788 dryland vegetation is predicted to have been Eucalyptus-dominated dry sclerophyll forest, with Casuarina glauca swamp forest and mangroves occupying the foreshore around Cockle Bay (see Macphail 2010). Except on the alluvial flats, which are likely to have supported open grasslands due to Indigenous fires, the understorey in dry sclerophyll forests and woodlands on the slopes of Brickfield Hill is predicted to be dominated by shrubs (Benson & Howell 1990).
- Observations made by Obed West (ibid: 19) indicate that ti-tree (Leptospermum?) scrub covered vacant land to the south of Campbell Street into the 1820s. Other early accounts, e.g. P. Cunningham (1827 cited in Benson & Howell ibid: 16) emphasise the density of the scrub understorey in forest growing on clayey and ironstone soils in the general area.

3.2 Site History

The Colonial history of the Haymarket district is typical of Sydney in general, viz. clearing, subdivision, urban consolidation and environmental degradation. The occupation history of the study area, however, is complicated by reshaping of George Street during the later nineteen century and contradictions in the various plans depicting buildings occupying the two allotments comprising the Site during the mid-late nineteenth century. An important but unknown palaeoenvironmental consideration is the elevation of the site in relative to the two ephemeral? creeks crossing George Street at Goulburn Street (north) and Hay Street, some 100 m to the north and 80 m to the south, respectively.

Key developments identified by Casey & Lowe (2008) are:

Pre-1823 (Phase 3): As part of the brickfields, the earliest structures built in the vicinity are likely to predate 1810. By the 1820s, Obed West (cited in Marriot 1988: 18-19) records a weatherboard "skillion place" and "a large block of ground [with] a wattle and daub house with a thatched roof" owned by a miller/shopkeeper George Richards, on the southeast corner of Goulburn Street to the north of the Site: The Government brickyards, public pound, military barracks and a large paddock occupied the Hay Street-Haymarket area to the south. Beyond this there "were no houses in George Street….it was there that Dickson's Pond [pond providing water to Dickson's flour mill on the foreshore of Cockle Bay] commenced" and although "George Street West" (sic) was considered to be "quite out of the town", the area was gardened by soldiers to supply vegetables to the barracks (ibid: 19).

1823-1840s (Phase 4): Houses shown fronting onto George and Campbell Streets in Hodell, Larmer & Mitchell's (1831) and Caporn's (1936) maps of Sydney Town (Fig. 1) are considered to have been built in the 1820s (Casey & Lowe 2010: 23). At this time most of the Site was owned by Thomas Ryan and occupied by buildings, including the Woolpack Inn erected c. 1830. The northern part of the Site was part of the larger allotment owned by George Richards (see above) but apparently still vacant land.
The Site appears to have remained unchanged into the 1840s despite substantial 'building-up' of the George Street frontage and subdivision and construction of houses on the area to the northeast between Pitt and Goulburn Streets. One 1830s tenant on the site of 712-720 George Street was a baker.

1840s-1860s (Phase 5): By the mid 1850s six closely spaced (see Fig. 3) and mostly single-storey building aligned to face George Street occupied the Site. All were shops with shingle roofs. By the mid 1860s, these had been extended, presumably for commercial reasons, now occupied much of the area encompassed by the two 1830s allotments. By 1845, wooden stabling and other sheds had been built at the rear of the two storey brick building on the site of 710 George Street.

1860s-1890 (Phase 6): By 1880, items being sold by retailers, presumed to have lived above their shops on the site, included saddles, boots, tobacco, toys, music and confectionary. Other occupations include tent- and watch-making. Most buildings on the Site, including the Woolpack Inn, were demolished and replaced by more substantial commercial premises in the 1890s.

3.3 Archaeological Contexts

Archaeological contexts sampled for this report are given in Table 1.

4. POLLEN ANALYSIS

4.1 Age Control

Inferred ages are based on the combined archaeological and palynostratigraphic data. Recent results from the Darling Walk Site on Cockle Bay has allowed the first appearance of some widely dispersed exotic pollen types, in particular cereal, dandelion (Liguliflorae), pine (Pinus) and plantain (Plantago-lanceolata-type), to be calibrated using independently-dated archaeological evidence from this site (Macphail 2010).

4.2 Processing

Approximately 15 grams of soil were processed by a commercial laboratory, CoreLab Australia (Perth) using standard mix of chemical and heavy liquid techniques (see Macphail 1999). Fossil pollen and spores (miospores) were concentrated by filtering the organic extracts through 5µm sieve cloth to remove the much higher yields of very small (~ 2µm) organic particles.

4.3 Taxonomy

Fossil miospores were identified using a comprehensive modern pollen herbarium of native and introduced plants. A number of fossil pollen types can represent either native or introduced species, e.g. the crucifers (Brassicaceae), daisy (Asteraceae), grasses (Poaceae) and samphire (Chenopodiaceae) families.

4.4 Pollen representation

The majority of sclerophyll shrubs and herbs are under-represented in that their pollen (gymnosperms, angiosperms) or spores (ferns, fern allies, mosses, fungi) are seldom recorded as unless the parent plants were growing close to or on the site. Exceptions are exotic pines, in particular Pinus and other introduced pines, samphires and the four native genera that dominate open sclerophyll forest, woodlands and grasslands on Hawkesbury Sandstone around Sydney Harbour, viz. casuarina (Allocasuarina/Casuarina), eucalypts (Eucalyptus/Angophora), and grass (Poaceae). Well-represented native shrubs are rare but include broom-heath (Monotoca).

4.5 Casuarina & eucalypt pollen counts

Caution is needed when interpreting microfloras dominated by casuarina and eucalypt pollen for three reasons. Firstly, pollen produced by tree species in dry sclerophyll forest are identical to grains produced by shrub species growing in heath, on cliffs and by Casuarina glauca growing in swamps. Secondly, all casuarina species produce pollen in astronomical numbers and these are dispersed by wind over long distances away from the parent plant. Finally, even though eucalypts are insect-pollinated, their pollen also are dispersed in large numbers over long distance by wind. Accordingly, both pollen types can be abundant
5. RESULTS

All samples yield strongly humified to well-preserved plant detritus with statistically significant number of pollen and spores. Preservation of the latter was equally variable with many specimens being in a weakly to strongly corroded condition (see Appendix 1).

5.1 AREA A

Samples: Three samples were from Area A (720-722 George Street) were submitted for pollen analysis. Two of these are subfloor deposits from the Woolpack Inn; the third is an anoxic deposit preserved at the base of "large pit" dated to the 1820s-1830s.

Context Number: 7323
Phase: 4-6
Sample Number: 1
Archaeological setting: underfloor deposit, front room of Woolpack Inn

Common taxa: Allocasuarina/Casuarina
Frequent taxa: Poaceae, Eucalyptus, Liguliflorae, Gonocarpus, Chenopodiaceae, Calochlaena
Definite exotics: Pinus, cereal
Probable exotics: Cassinia arcuata-type, Liguliflorae, Brassicaceae, Chenopodiaceae

Comment: The very high relative abundance in this (and other samples) from Area A is unusual given (i) the high value placed on casuarina for roofing shingles, (ii) the relatively late date of construction of the Woolpack Inn (c. 1830) and (iii) the accumulation of the underfloor deposit in a what is presumed to be comparatively sealed environment.

Because of the sparse yield, at least four hypotheses may explain the high relative abundance of casuarina (Allocasuarina/Casuarina) pollen: These are in chronological order: (a) Forest oak (Allocasuarina torulosa) or another tree species were still growing in the vicinity before construction of the Woolpack Inn. (b) Sediment from Cockle Bay - where swamp oak (Casuarina glauca) was growing into the 1820s - was used to make market gardens on, or level, the Site in the 1820s. (c) Flowering casuarina branches were carried onto the site to make roofing shingles for the Inn c. 1830. (d) The count is a long-term accumulation from the regional pollen rain over Sydney during the mid-late nineteenth century. The various merits of these ‘explanations’ is assessed in the Discussion (Section 6).

Pollen of exotic and probable exotic taxa such as pine (Pinus), cereals, Chinese bush (Cassina arcuata-type) and dandelions (Liguliflorae) could have accumulated at anytime between 1830 and before or after c. 1890 when the Inn was demolished. For example, ‘high’ relative abundances of grass (Poaceae), dandelion and other members of the daisy family (Asteraceae), samphire (Chenopodiaceae) and raspwort (Gonocarpus) pollen are typical of assemblages accumulating on waste ground. In this context, Permo-Triassic gymnosperm pollen and spores almost certainly come from excavated shale.

The ‘waste ground’ reconstruction is inconsistent with the presence of pollen of the prickly conesticks (Petrophile sessilis) and spores of mesophytic ferns such as the tender brake (Pteris) and rainbow fern (Calochlaena), all of which are more likely to have been growing along the creek banks in the area. Possible explanations are these come from sediment imported from a nearby creek,
deposited naturally on the site during a flood, or carried in in domestic water. The high relative abundance of fungal spores is evidence for either or both damp conditions and spillage of nutritious waste through a poorly fitting floor boards.

An unusual feature of the assemblage is the presence of 'feather-like' skeletal material, suggested (B. Keaney pers. comm.) to be the setae of an insect living in the damp subfloor space (Appendix 1). Significant numbers of dental plates from an unknown burrowing insect point to the same (damp) environment.

**Context Number:** 7334  
**Phase:** 4-6  
**Sample Number:** 11  
**Archaeological setting:** underfloor deposit, rear room of Woolpack Inn

**Common taxa:** Allocasuarina/Casuarina  
**Frequent taxa:** Gonocarpus, Poaceae, Liguliflorae, Calochlaena, trilete fern spores  
**Definite exotics:** Pinus (1%), cereal  
**Probable exotics:** Liguliflorae, Chenopodiaceae

**Comment:** Not surprisingly, the sparse assemblage recovered from the rear room of the Woolpack Inn closely matches that recovered from the front room (CTX 7323) and is subject to the same constraints on its interpretation (see Discussion). Oleaceae pollen occurs in trace numbers. Privet (Ligustrum) is one of several possible sources.

Numbers of the putative setae are lower than in CTX 7323 but he sample yielded well preserved remains of the insect presumed to bear these feather-like structures (see Appendix 1). Reworked Permo-Triassic pollen also are slightly more frequent, higher, possibly because the rear of the building had been benched into waste from the brick-pit or pottery.

**Context Number:** 7449  
**Phase:** 4  
**Sample Number:** 29  
**Archaeological setting:** "malodorous" sediment at the base of a large pit dug c. 1820s and infilled by the late 1830s.

**Common taxa:** Allocasuarina/Casuarina  
**Frequent taxa:** Gonocarpus, Eucalyptus  
**Definite exotics:** Polygonum aviculare-type  
**Probable exotics:** Liguliflorae

**Comment:** Unlike previous samples, CTX 7449 yielded abundant casuarina in a matrix dominated by well-preserved plant detritus (see Appendix 1). Given the inferred date, it is unlikely that the casuarina count comes from the regional pollen rain – strengthening the probability that these pollen come from trees growing on the site before c. 1830, or that flowering branches of a casuarina species had been carried onto the site for building material and/or fuel at about this time.

Apart from the native 'weed' raspwort (Gonocarpus), other pollen and spores types are uncommon to rare, although the diversity is relatively high, and include taxa that are unexpected given the Woolpack Inn was located on the interfluve between two creeks. Examples are spores of the tree-fern Cyathea, pollen of two banksia (Banksia) spp. and a member of the milkwort family Polygalaceae (Appendix 1), and spores of a fungus (Tetraploa sp.) that is typically associated with grassland.

Low to trace numbers of hornwort (Cingulatisporites bifurcatus), liverworts (Rudolphisporis rudolphi), swamp selaginella (Selaginella uliginosa) and fern
spores, and cord-rush (Restionaceae) and sedge (Cyperaceae) pollen are evidence of locally damp conditions, either within the pit or more probably due to the low elevation of the Site. Unusually for an apparently densely settled site (see Fig. 3), disturbance taxa such as dandelions (Liguliflorae) and samphires (Chenopodiaceae) are rare.

What is certain is that in the 1820s-1830s, the pit was used to dispose of raw sewage and a not-implausible explanation is the plant material carried up from a local creek was used to cover "malodorous" human waste. Whether the pit was a de-facto latrine is unknown.

5.2 AREA B

Samples: One sample from Area B (712-718) George Street was submitted for pollen analysis

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<thead>
<tr>
<th>Context Number:</th>
<th>7472</th>
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<tr>
<td>Phase:</td>
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<tr>
<td>Sample Number:</td>
<td>47</td>
</tr>
<tr>
<td>Archaeological setting:</td>
<td>1788 topsoil, modified during the nineteenth century?</td>
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</tbody>
</table>

Common taxa: Allocasuarina/Casuarina

Frequent taxa: Eucalyptus, trilete ferns, Poaceae, Gonocarpus

Definite exotics: -

Probable exotics: [Cyathea, Cassinia-arcuata-type]

Comment: Like samples from Area A CTX 7449, the assemblage is wholly dominated by casuarina pollen and also incorporates miospores of non-local native plants that are unexpected given the date and presumed relatively dry position of the Site. Examples are spores of the tree-fern Cyathea, pollen of a banksia resembling the Old Man Banksia (Banksia serrata) spp. and trace to frequent numbers of fern spores, including a filmy fern (Hymenophyllaceae).

Both the casuarina and much lower (3%) eucalypt counts include immature and corroded as well as fully-mature grains. Since definite exotic pollen types are absent, this phenomenon strengthens the case that Allocasuarina/Casuarina - Eucalyptus forest or woodland with a grassy rather than shrub-rich understorey was growing on the site in 1788.

5.3 AREA C

Samples: Two samples from Area C (710 George Street) were submitted for pollen analysis. One of these (CTX 7386) is a correlate of CTX 7472 in Area B; the other comes from the base of a c. 4 m deep well.

<table>
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<th>Context Number:</th>
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<tr>
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<td>Sample Number:</td>
<td>49</td>
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<tr>
<td>Archaeological setting:</td>
<td>1788 topsoil, modified during the nineteenth century</td>
</tr>
</tbody>
</table>

Common taxa: Allocasuarina/Casuarina

Frequent taxa: Eucalyptus, Gonocarpus, Liguliflorae, Calochlaena, trilete ferns

Definite exotics: Pinus

Probable exotics: Liguliflorae

Comment: The assemblage very closely resembles that CTX 7472 in that it includes immature, corroded and mature casuarina and eucalypt pollen grain but, unlike that sample, preserves unequivocal evidence for subsequent 'modification' in the form of pine (Pinus) and dandelion (Liguliflorae) pollen. The combined data indicate the overlying wall (Wall 2) was built on weed-infested ground. Fern spores, including those of the rainbow fern (Calochlaena), are frequent –
suggesting either the site was occasionally flooded, the soil was sufficiently damp to support ferns, or (preferred) ferns were established on nearby damp stone- or brickwork and/or along the banks of a nearby creek.

**Context Number:** 7569  
**Phase:** 4 to? 6  
**Sample Number:** 67  
**Archaeological setting:** basal fill in c. 4 m deep well

**Common taxa:** Allocasuarina/Casuarina, Poaceae, Cereal  
**Frequent taxa:** Eucalyptus, Fabaceae, Gonocarpus  
**Definite exotics:** Cereal, Polygonum aviculare-type, Fagopyrum-type  
**Probable exotics:** Fabaceae, Liguliflorae

**Comment:** Casuarina pollen, although common, are much less abundant (36% vs 61-86%) that in other samples analysed in this study. Whether or not the structure was built to supply water for domestic/commercial activities or to water stock, the assemblage strongly resembles those recovered from nineteenth century cesspits in Sydney and Parramatta (see Macphail 1999, Macphail & Casey 2009). For example cereal pollen and members of the pea-flower (Fabaceae) and cabbage (Brassicaceae) families comprises 23% of the totals spore-pollen counts other grass (Poaceae) also comprise 23% of the count. Unusual spore records for this context include peat-moss (Sphagnum). Well-preserved specimens of the sewage indicator Cloacasporites occur in trace numbers.

Whether sewage contamination was the result of a natural event, e.g. flooding of the site shortly after the well was dug, an accidental spillage, or for part of its 'life' the structure was used as a cesspit, is unknown.

An analogous situation – sewage contamination of a well – is recorded on the Quadrant Development site further south along George Street where the coincidence heavy rain and high tides caused abattoir waste and sewage to flood into the backyards of late nineteenth century terraces along Blackwattle Creek (see Macphail 2003a, 2003b).

**6. DISCUSSION**

Despite the number of archaeological sites excavated in the Sydney CBD over the past 30 years, very few of these preserve in situ deposits that can be firmly dated to 1788 or even the first decade of European Settlement (cf Macphail 2008, 2010). Heightening the importance of this Site is its location in an area that is underlain by Wianamatta Shale (allowing the native vegetation to be compared that growing on Hawkesbury Sandstone) and which was ‘open’ albeit dug-over land into the 1820s.

As noted in Section 4.5, it is highly unusual for fossil pollen assemblages to be dominated by casuarina (Allocasuarina/Casuarina) pollen unless the parent plant(s) were growing on the site or the site was virtually devoid of other plants. Unlike sites on Hawkesbury Sandstone where shrub species (Allocasuarina distyla, A. nana, A. paludosa) can be locally common in heath, the source(s) of this pollen type at 710-722 George Street are likely to be one or more of the four tree species found in growing in the vicinity of Sydney Cove and Darling Harbour – the forest oak (Allocasuarina torulosa), the black she-oak (Allocasuarina littoralis), the drooping oak (Allocasuarina verticillata) and swamp oak (Allocasuarina glauca). Fairley & Moore (1989) note that A. littoralis is typical of open forests and sandy heaths often on stony ridges, A. torulosa is widespread in the Sydney region but prefers comparatively fertile soils in sheltered slopes, whilst A. verticillata occurs on shale soils in exposed localities along the coast but also occurs on stony ridges further inland: A. glauca was one of two tree dominants in swamp forest around the head of Cockle bay below Brickfield Hill.

Of the five casuarina-dominated contexts recorded in this study:
Area A (CTX 7232, 7234): The evidence for locally growing casuarinas (presumably Allocasuarina torulosa or A. verticillata) is equivocal, chiefly because the sparse yields and significant relative abundance of dandelion (Liguliflorae) pollen makes it possible the microfossil assemblages are the result of some 50 years accumulation following construction of the Woolpack Inn in c. 1830. Given the high value placed on casuarina wood as roofing material (shingles) and its excellent burning properties, it is implausible that remnants of the former forest or woodland will have survived on the southern side of Brickfield Hill as late as c. 1830. Nevertheless there is nothing in the fossil pollen data that excludes the count representing trees growing on the site before this date (relict or replanted) or sediment being imported from Cockle Bay for gardening or levelling purposes.

Area A (CTX 7449): Unlike CTX 7232 and 7324, the high yield of casuarina pollen and other well-preserved plant remains is reliable evidence that the CTX 7449 incorporates sediment that had accumulated close to or under Allocasuarina/Casuarina forest or woodland. Possible sources are forest or woodland growing on Brickfield Hill or around the head of Cockle Bay around the time of first European settlement, casuarina wood and/or sediment from the swamp in Cockle Bay imported onto the site during the construction of the Woolpack Inn, or (preferred) local detritus from any of these sources was used to cover human sewage deposited in the pit. Reasons for preferring the 'waste' explanation is the paucity of exotic weeds and the relatively diversity and ecology of uncommon to rare taxa in assemblage.

Area B (CTX 7449) and Area C (CTX 7386): High yields of casuarina pollen in these two topsoil samples provide the most convincing evidence that the '1788' vegetation on the southern slope of Brickfield Hill was Allocasuarina-Eucalyptus forest/woodland with a predominantly grassy (drier sites) or fern (damp sites) understorey. This challenges the interpretation (Benson & Howell 1990:16-17) that the understorey in forests growing on relatively impervious, clay-rich soils (such as those developed on Wianamatta Shale) are more likely to have been shrub-rich than grassy before European clearing of the area.

If correct, then the dense scrub communities observed by Obed West and Peter Cunningham in the 1820s (see Section 3.1) almost certainly were regrowth whose development reflects the change from frequent/cool (Indigenous) to infrequent/hot (European) fire regimes after 1788.

The fossil pollen data are equivocal as to whether tree-sized Allocasuarina/Casuarina survived on or near to the Site into the 1820s-1830s. At present, the only independent evidence that casuarina was growing on Brickfield Hill at that time is the stump of a large casuarina preserved in growth position on the Family Court Site at the corner of Castlereagh and Goulburn Streets. Here, abundant casuarina pollen (mature and immature) was recovered from a pit dug in the 1820s at the base of this stump and used to dispose of raw sewage (Macphail 1990).

7. REFERENCES


**Table 2:** Relative abundance data

### A. Trees and shrubs

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**Definite exotic taxa**

- **Pinus**
  - +
  - 1%
  - +
  - 1%

- **Cereal**
  - +
  - +
  - 15%

- **Fabaceae cf Fagopyrum**
  - +

- **Oleaceae**
  - +

- **Polygonum aviculare-type**
  - +

**Probable exotic taxa**

- **Asteraceae (high spine types)**
  - Brassicaceae
    - +
    - 2%
  - Chenopodiaceae
    - 3%
  - +
  - Fabaceae
    - 6%
  - Leguilliflorae
    - 4%
    - 2%
    - +
    - 4%
    - 1%
  - unknown tricolpates
    - +
    - +
    - +
  - unknown tricolporates
    - +
    - +
    - 1%
    - 1%

**Non-local natives**

- **Cynather**
  - +
  - +

- **Cassina arcuata-type**
  - +
  - +

**Native trees & shrubs**

- **Allocasuarina/Casuarina**
  - 61%
  - 72%
  - 86%
  - 73%
  - 72%
  - 36%

- **Banksia marginata-type**
  - +
  - +

- **Banksia serrata-type**
  - +
  - +

- **Epacridaceae T-type**
  - +
  - +

- **Eucalyptus (mature grains)**
  - 3%
  - 1%
  - 3%
  - 6%
  - 8%
  - 9%

- **Eucalyptus (immature grains)**
  - +
  - 4%
  - 1%

- **Goodeniaceae**
  - Hakea/Grevillea
    - +
  - Hibbertia-type
    - +
  - Myrtaceae (Leptospermoideae)
    - +
    - +
  - Monotoca
    - +
    - 1%

- **Persoonia**
  - Petrophile sessilis-type
    - +

- **Pimelea**
  - Polygalaceae
    - +
  - Rutaceae
    - +

- **corroded Proteaceae**
  - +

**Native herbs**

- **Apiaceae**
  - +

- **Asteraceae (low spine)**
  - 1%
  - 1%
  - 1%
  - +

- **Cyperaceae**
  - 1%
  - +
  - +

- **Gonocarpus**
  - 4%
  - 9%
  - 6%
  - 2%
  - 5%
  - 2%

- **Lilaceae**
  - +
  - +

- **Poaceae**
  - 13%
  - 6%
  - 4%
  - 1%
  - 23%

- **Restionaceae**
  - +
**Table 2 (cont.)**

**B. Cryptogams and other microfossils**

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APPENDIX 1

Photomicrographs of selected fossil pollen spores and related plant microfossils

All photomicrographs taken at x1000 magnification unless otherwise stated.
casuarina (Allocasuarina/Casuarina) eucalypt (Eucalyptus) pollen

Banksia (corroded) pollen Banksia serrata-type pollen milkwort (Polygalaceae) pollen

hornwort (Cingulatisporites) spore filmy fern (Hymenophyllaceae) spore rainbow fern (Calochlaena) spore

Kangaroo fern (Microsorium) spore grass (LHS) pollen and Kangaroo fern (Microsorium) RHS spore
Fungal spore (*Tetraploa*) associated with grass pine (*Pinus*) pollen

olive family (Oleaceae) pollen dandelion (Liguliflorae) pollen

peatmoss (*Sphagnum*) spore tree-fern (*Cyathea*) spore Chinese bush (*Cassinia arcuata*) pollen

sewage indicator (*Cloacasporites sydneyensis*)
cereal pollen

pea-flower (Fabaceae) pollen
cabbage family (Brassicaceae) pollen

body part of an unidentified insect

setae? of an unidentified insect