The Soil and Pollen Analysis of Part of the Gardens of First Government House, Sydney

EDWARD HIGGINBOTHAM, MICHAEL MACPHAIL and BRIAN DAVEY

In 1987 during the conversion of the former Water Police Buildings in Sydney to house a Police and Justice Museum, a sealed soil profile was recognised. It not only preserved pollen from the pre-European flora of Sydney Cove, and from the Gardens and Inner Domain of First Government House, but also revealed evidence of cultivation during the historical period. The palynological evidence confirms the historical and biological evidence for Aboriginal fire regimes. While not identifying any new ornamental or cultivated plants, it also documents the success of early agricultural weeds. This interdisciplinary study was carried out by E. Higginbotham, historical archaeologist, and Drs M. Macphail, palynologist, and B. Davey, soil scientist.

INTRODUCTION

In December 1986, the New South Wales Department of Public Works commissioned an archaeological investigation of the former Water Police Court and Water Police Station, on the corner of Albert and Phillip Streets, Sydney. As a bicentennial project, the buildings have been converted into a Police and Justice Museum for the New South Wales Police Department, and were opened in mid 1988.

During the conservation works, a watching brief was undertaken to record any archaeological remains that were exposed. This paper concentrates on only one aspect of this investigation, namely the soil and pollen analysis of the soil profile under the Water Police Court, the earliest building on the site.[1]

The Water Police

As early as November 1830, the Colonial government appointed Fayette Goodwin as a Conductor of the Water Police, to be stationed at Longnose Point on the Parramatta River. His duty was to command a boat and crew of convict boatmen to prevent the escape of convicts down river.[2] By 1836 another boat and crew was necessary, in this instance funded by the Military Chest, and stationed on Goat Island.[3] These measures soon proved inadequate to cope with the policing of Port Jackson. Crews were frequently deserting ship to obtain almost double the wages on Colonial vessels. Furthermore, crimping was systematic, whereby crimps would lure sailors from their ships, conceal them, and then for a fee would offer to find crews for the masters of vessels.[4] Merchants and shipowners therefore backed the New South Wales Legislative Council, when it passed a law to remodel the Water Police in 1840.[5] However, almost overnight the economic depression of the 1840s removed the main cause of desertion, namely better wages, resulting in the good regulation of Port Jackson. After a commission of inquiry in 1843, the Water Police continued on a reduced basis until economic activity returned in 1847.[6] From 1846 onwards the Water Police were housed at Cadman's Wharf, on the west side of Sydney Cove.[7] By the 1850s these premises were falling into disrepair, while the duties of the Water Police rapidly expanded during the Gold Rush from 1851. A new Water Police Station and Courthouse were therefore urgently required.

The site

The site for the proposed Water Police Buildings was chosen by the Surveyor General in 1851, at the north-west corner of the block bounded by Albert, Macquarie, Bridge and Phillip Streets, Sydney (Fig. 1).[8] This block had been reserved for government purposes immediately after it had been laid out as part of the scheme to replace First Government House, and then to extend the city streets to the almost completed 'Semi-Circular Quay'.

From the foundation of the penal colony in 1788, the site of the Courthouse had been set aside for cultivation as part of the gardens and shrubbery attached to First Government House. The history of this building and its surrounding gardens is well documented.[9] From their early importance for the cultivation of crops and plants, and as a source of cuttings and seeds for the colony, the gardens had evolved by the 1830s into a landscaped series of paths and carriageways, set among lawns and specimen plants and trees.[10]

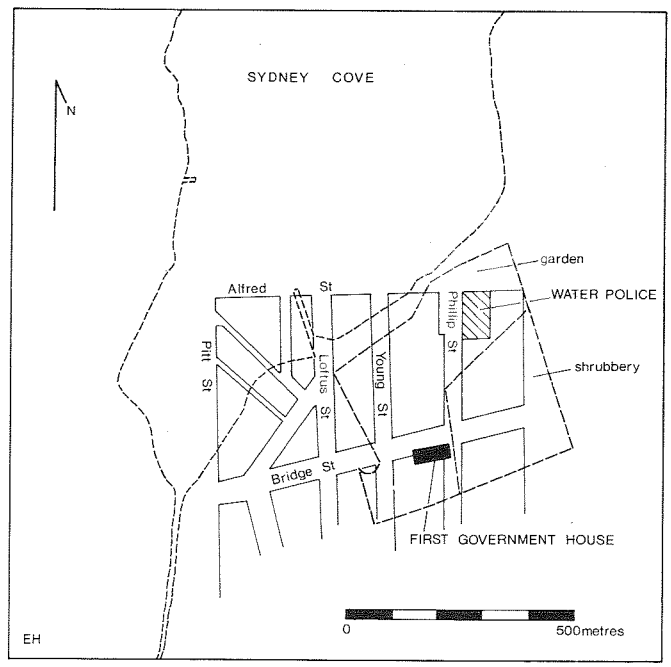

Fig. 1: Plan of part of Sydney Cove, based upon J. Meehan's 'Plan of the Town of Sydney', dated to 1807, on which the modern street layout and the location of the Water Police Court have been superimposed. The position of the Courthouse in the former gardens of First Government House is clearly indicated. Alfred Street becomes Albert Street to the east of Phillip Street.

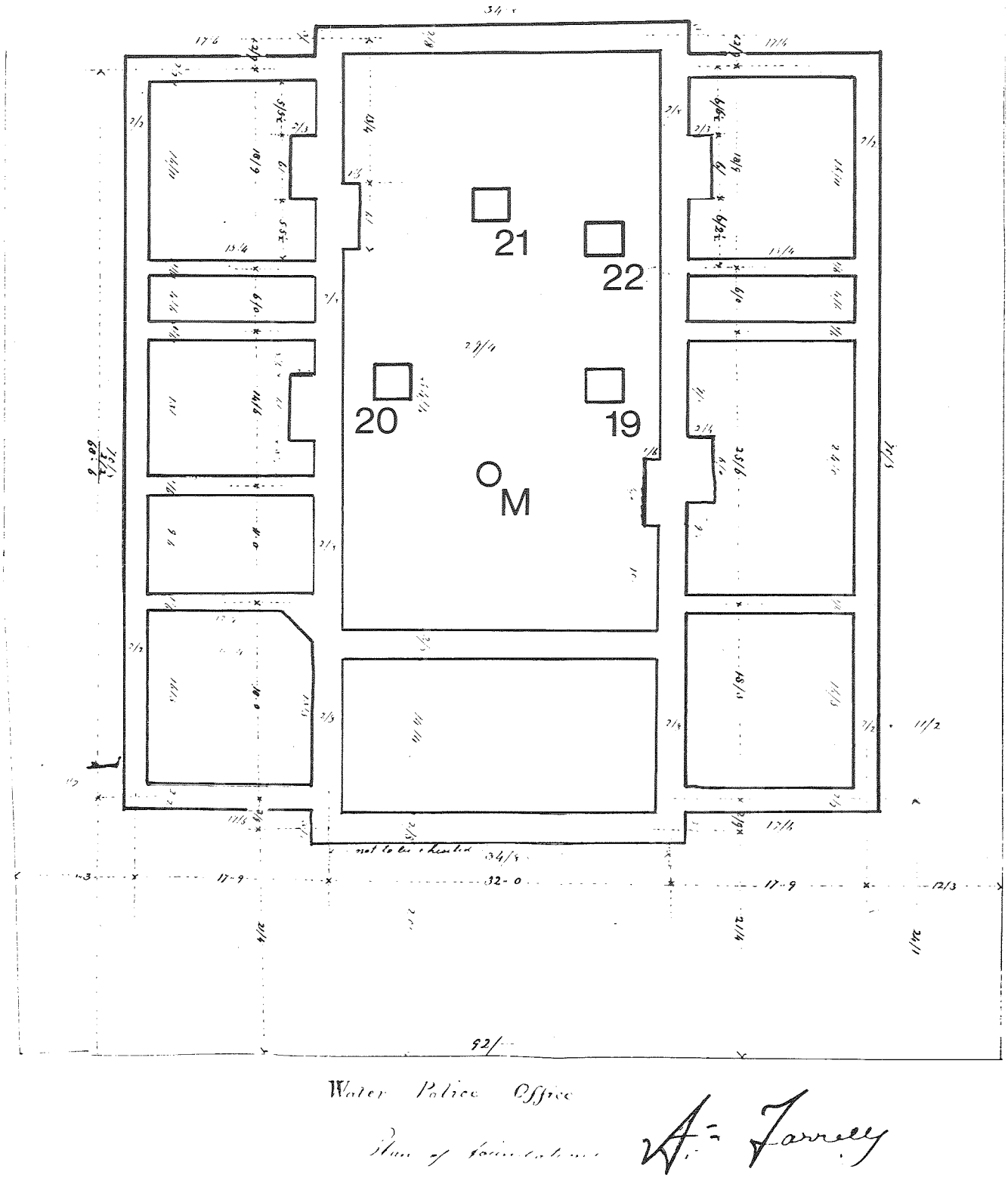

Fig. 2: Plan of the footings of the Water Police Court, signed by the contractor, Andrew Farrelly, in 1854. The locations of test-pits Nos 19–21 and the monolith (M) are indicated (Archives Office of New South Wales, 2/580).

With the removal of the Governor to his new residence at Bennelong Point in 1845, the demolition of First Government House commenced. Macquarie Street was extended towards Bennelong Point and now formed the western boundary of the Inner Domain. Only a few of the larger trees from the former gardens survived, as the new streets were laid out and the ground divided up into sections and allotments.

The Courthouse

The Colonial Architect, Edmund T. Blacket, advertised for tenders for the stonework of the new Water Police Office or Courthouse in 1852, but not having any replies, he delayed until 1853 before readvertising the work. However, even at this later date the successful contractor, George Paton, had to be released from his contract because of the expense and difficulty of obtaining skilled labour during the Gold Rush.[11] It was not until 1854 that the contract for the stonework was successfully let in two parts, one for the foundations, the other for the superstructure. All the other contracts for carpentry, slating and plumbing, joinery, plastering and painting, and finally the privies, followed in their respective order.[12] The Water Police Magistrate was able to take possession of the buildings in 1856.[13]

The archaeological context

At an early stage in the watching brief, the presence of an undisturbed soil profile was recorded under the Water Police Courthouse. The topsoil was sealed under a layer of sandstone rubble, clay and sand, up to 0.8 m thick, that had been rammed in around the sandstone footings of the building. The extensive historical documentation for the construction of the Courthouse provided an accurate date for the deposition of this layer. All the specifications except for the carpenter's contract have survived.[14] This information, together with the sequence of the contracts, limits the stage at which the work could have been undertaken. It would have been extremely difficult to dump so much material around the footings throughout the building, after the contract for the masonry in the foundations had been completed. Furthermore, it is the only contract which specifies such work, for example:

> The site of the building and twelve feet [3.7 m] clear around the outer walls to be excavated to the level of the yard ground line which is marked by the pegs on the premises...
>
> After each course of masonry shall be approved of by the superintending officer the spaces on each side of the walls will be filled in with clay to within 6 inches [152 mm] of the top of the course and rammed firm.[15]

These two clauses accurately describe the archaeological evidence, and explain the clean uncontaminated nature of the fill layer.

Mr A. Farrelly signed his contract for the masonry in the foundations on 14 January 1854.[16] The contract must have been completed by 1 June 1854, the date on which John Dingwall, the contractor for the masonry superstructure, signed a bond for completing his work within ten months.[17] The topsoil profile under the Courthouse was, therefore, sealed between 14 January and 1 June 1854.

Scientific potential

Because of the former use of the site as the gardens of First Government House, the scientific potential of the soil profile was immediately recognised. Should pollen survive in the deposits, then it might reveal evidence of the plants growing there between 1788 and 1854. An analysis of the soil profile would not only reveal evidence of human activity, but would also act as a check upon the integrity of the pollen samples. Not only are undisturbed soil profiles extremely rare in the City of Sydney, but the existence of one sealed from later contamination must be almost unique.

Dr A.R.H. Martin, of the Department of Botany at the University of Sydney, was initially invited to undertake the pollen analysis. He visited the site in December 1986 and was able to take sufficient initial samples to confirm the survival of pollen in the topsoil. With a full research programme already, Dr Martin was unable to undertake the lengthy investigation that was then necessary and recommended that Dr Michael Macphail take his place.

SCIENTIFIC INVESTIGATION

Both soil and pollen samples were obtained during a joint site visit in January 1987. A total of four test pits had been dug by contractors through the fill layer to the top of the underlying topsoil (Fig. 2). Only one test pit (Number 19) had been dug through the soil profile to sandstone bedrock. Soil samples were taken from this test pit alone, while pollen samples were taken from test pits Numbers 19 to 22. At a later date in January 1987, a monolith was extracted from the soil profile on the northern side of a large pit, dug for an underground plant room for air-conditioning equipment.[18]

Description of the soil profile

The analysis of the soil samples revealed the presence of a classical yellow earth profile (Table 1), typical of those found on gentler sloping and relatively flat terrains where Hawkesbury sandstone is the parent material.[19] The pH of the soil ranged between 6.19 and 6.86, which is slightly acidic, and indicates that the profile had not been contaminated by lime, mortar, and plaster, as is common on other building sites.

However, when the monolith was prepared, a number of features became apparent that had not been so obvious when the profile was moist and studied in the poor light of the Courthouse. Taking measurements from the base of the sandstone overburden, the monolith shows a very clear separation at 16.5 cm depth. The material above this line is very dry, powdery and incoherent when dried (the structure is apedal single grain); this contrasts with the massive apedal structure of the layers below. Pieces of charcoal or humified plant material (up to 5 mm diameter) or both, can be seen mixed throughout the surface layer. The distinct break in the monolith and the apedal single grain structure of the soil above it, indicate that it has been modified, probably by horticulture or cultivation. It is necessary to recognise that the top 16.5 cm of the profile have been thoroughly mixed and any pollen in this horizon would have been dispersed throughout.

The 16.5–29 cm layer is mottled and greyness increases with depth. Some voids appear to have been filled with material from other places in the profile, perhaps from above. Some of these voids are up to several millimetres in diameter and in some instances can be followed across the surface of the monolith for several centimetres. These features suggest bioturbation either by insects, worms or plant roots. A larger infilled root channel at 37 cm depth has the remains of a root in it, about 2 cm in diameter and most likely belonging to a woody plant. Another filled root channel is found at 53.5 cm depth and is 1.2 cm in diameter. The amount of biotic activity decreases with depth and is almost absent below 71 cm; perhaps because the profile below this depth was saturated over much of the year and therefore inhospitable to roots.

At about 74 cm there is a moderately well developed zone of ironstone nodules and a few large angular pieces of milky quartz. The iron nodules were perhaps developed *in situ*, because they lie just above the pallid zone where Fe^{3+} is reduced to Fe^{2+}. The nodules could be the consequence of re-oxidation of the reduced iron. The pallid zone lies just above the weathering rock and is whitish in colour because all of the Fe^{3+} has been removed following reduction. Much of this iron will have moved downslope away from the site.

It is also possible that the stone line resulted from downslope creep of the soil profile or perhaps even from a different depositional cycle. The development of the yellow earth profile above the pallid zone suggests that the material has been in place for a considerable time, sufficient to allow the development of the classical yellow earth profile over Hawkesbury sandstone.

In conclusion, the upper 16.5 cm of the profile has been modified, by horticulture or cultivation. This would have thoroughly incorporated any pollen in this layer. The soil below this depth does not appear to have been disturbed and any pollen is likely to have found its way into the voids and channels, made by insects or plant roots, that have been filled with soil. The diminishing number of voids with depth explains why only small amounts of pollen are found lower in the profile.

Pollen analysis[20]

Four soil samples from the top of the buried soil and a sequence of eight samples taken down the soil profile in test pit Number 19 were processed and palynomorph concentrations estimated using standard palynological procedures.[21] Relative abundance values were made on whole mounts, most of which contained in excess of 2000 fossil spores and pollen. This required the elimination of much of the associated charcoal, but subjectively these particles were most abundant in the top 11 cm of the profile. In keeping with its aim, the study included the preparation of reference pollen slides of some eighty useful, food and ornamental exotic species planted at Sydney Cove before c. 1800.[22] It should be noted that a number of important introduced species produce pollen that cannot be easily distinguished, if at all, from pollen produced by native species of the same genus or family. Examples include the grains and bamboo (Gramineae); lettuce, artichoke, chicory, endive, chrysanthemums, cineraria, dahlias, marigolds and zinnias (Compositae); and cress, mustard and turnips (Cruciferae).

All samples yielded abundant but mostly crumpled spore-pollen in a matrix of macerated plant tissue and residual charcoal particles (Table 2). The diversity was uniformly low, with native trees (*Casuarina*, *Eucalyptus*) and two herbs (*Gonocarpus*, Gramineae) constituting over 90 per cent of each fossil assemblage. Although an additional twenty-five native tree, shrub and herb pollen types were present in trace amounts (less than 1 per cent), only *Banksia*, *Monotoca*, Compositae, Cyperaceae and Liliaceae were consistently recorded. All samples contained spores but only two taxa, *Culcita dubia*, a fern common in sandstone cuttings, and *Selaginella*, a fern ally common on wet, peaty soils including gardens, reached values in excess of 1 per cent. Notable omissions from these assemblages include pollen of *Acacia* and *Dodonaea triquetra*, both of which are well represented in Recent palynofloras in the Sydney Basin.

Only two definite exotic taxa were recorded, with all specimens recovered from the upper 11 cm of the soil profile: *Pinus*, which is a widely planted genus of northern hemisphere conifers, and *Plantago coronopus/lanceolata*-type, which are common weeds of cultivation. Another six types, occurring in trace amounts, are unlikely to have been part of the local pre-European flora at Sydney Cove, although they are all native to the region. These are *Cyathea* and *Dicksonia*,

Table 1: Soil profile from Test-pit No. 19.

–14 cm 10YR 6/2 (dry) light brownish grey; 10YR 3/2 (moist) very dark grey brown; LS, loamy sand, field texture group 1, the sands; apedal massive; MM2 CR (1–2 mm); pH 6.5; porous, insect or root channels present; large macro pores; piece of a sea shell present at 5 cm; some larger pieces of charcoal or humified plant remains (5–8 mm); diffuse change to —	**–63 cm** 10YR 6/4 (dry) light yellowish brown; 10YR 6/6 (moist) brownish yellow, whole coloured; SC, sandy clay, field texture group 5, the light clays; apedal massive; MM1 (1CR–1 mm); pH 6.5; porous but no sign of roots or channels; clear boundary to —
–31 cm 10YR 7/2 (dry) light grey; 10YR 3/2 (moist) very dark grey brown; 10YR 4/3 (moist) brown, 10% mottle colour; SL, sandy loam, field texture group 2, the sandy loams: apedal massive; MM2 CR (1–2 mm); pH 6.0; porous (<1 mm); some filled root/insect channels; the remains of a root were noted at 36 cm; gradual change to —	**–76 cm** 10YR 8/2 (dry) white; 10YR 8/1 (moist) white; 10YR 5/8 (moist) yellowish brown, 10% mottle; SC, sandy clay, field texture group 5, the light clays; pH 6.5; weathering rock was present at the bottom of the profile; the profile was saturated in the pallid zone.
–42 cm 10YR 5/2 (dry) greyish brown; 10YR 6/3 (moist) pale brown; 10YR 3/2 (moist) very dark grey brown, 10% mottle; SCL, sandy clay loam, field texture group 4, the clay loams; apedal massive; MM2 (1CR–2 mm); pH 6.5; porous, worm casts with faecal pellets, mottling could be consequence of biotic activity; diffuse change to —	Depths measured from surface of topsoil.

Table 2: Relative pollen abundance, calculated as percentage of total dryland pollen and spore count.

Sample no.	1	2	3	4	5	6	7	8	9	10	11	12
Test-pit no.	20	21	22	⊢				19				⊣
Depth below surface of topsoil (cm)	0-1	0-1	0-1	0-1	5-6	10-11	15-16	19-20	24-25	35-36	49-50	70-72
Biostratigraphic unit	⊢		1			⊣	⊢		2			⊣
A. COMMON TAXA												
Casuarina	22	11	12	15	20	48	27	41	34	31	(38)	(50)
Eucalyptus	51	34	37	31	20	31	47	40	41	35	(45)	(23)
Gramineae	20	39	31	32	45	7	16	9	16	18	(8)	(10)
Gonocarpus	2	12	13	15	8	8	6	6	4	8	(1)	(5)
Selaginella	+	+	2	2	1	1	+	1	+	3	(4)	(5)
Culcita dubia	1	+	+	+	+	+	+	+	+	+	-	-
B. EXOTIC TAXA												
Pinus	x	x	x		x	x						
Plantago coronopus / lanceolata	x											
C. POSSIBLE EXOTIC TAXA												
Podocarpaceae						x			x			
Microseris / Taraxacum	x	x	x	x	x							
Rumex cf. *R. crispus*							x					
Calystegia			x									
Dicksonia				x								
Cyathea		x	x	x	x	x	x					
Pteris cf. *P. umbrosa*										x		
D. NATIVE TREES AND SHRUBS												
Dodonaea - viscosa-type		x										
Monotoca	x		x	x	x	x	x	x	x	x		
Epacridaceae T-type							x					
Banksia marginata-type	x	x	x			x	x	x	x	x		(4)
Banksia serrata-type				x	x		x	x	x	x		
Comespermum		x										
Lomatia					x							
Indet. Proteaceae		x		x	x		x	x	x	x		
Leptospermum			x		x							
Indet. Myrtaceae	x		x	x	x							
Coprosma-type			x									
Pomaderris aspera-type			x									
Goodeniaceae		x										
Chenopodiaceae-Amaranthaceae	x	x	x				x					
Compositae (Tubuliflorae)	x	x	x	x	x	x	x	x	x	x		x
E. NATIVE HERBS												
Plantago			x			x	x					
Pelargonium									x			
Caryophyllaceae		x										
Umbelliferae				x			x	x	x			
cf. *Anguillaria*	x		x		x	x	x	x	x	x		
Liliaceae sp. A							x	x	x	x		
Cruciferae	x	x	x		x							
Cyperaceae	x	1	1	1	1			x				
Restionaceae									x	x		
Typhaceae	x	x	x		x							
F. FERN AND FERN ALLIES												
Lycopodium varium-type							x					
Davallia-type	x		x	x		x	x	x				
Todea barbara			x									
cf. *Schizaea*	x	x	x	x	x	x						
Indet. Trilete Fern Spores	x	x	x	1	x	x	1	x	x	x	(3)	(2)
Indet. Monolete Fern Spores	x	x	x	x	x	x	x	x	x	x		
Riccia type			x	x	x	x						
Indet. Hepaticae spores			x	x	x							
% damaged pollen (unidentifiable)	11	10	11	8	8	3	8	2	6	4	3	-
Pollen sum	528	539	477	495	519	584	558	554	558	596	(87)	(78)
Pollen concentration 10^3 grains/cc	586	195	524	264	699	567	50	85	195	12	0.6	0.6
Av. pollen concentration	⊢		470 x 10^3			⊣	⊢		85 x 10^3	⊣	0.65 x 10^3	

\+ = percentages less than 1% x = trace values

Where the pollen concentration is extremely low, percentages have been placed in brackets.

tree ferns confined to wet gullies and rainforest, a *Pteris* species with a similar habitat preference, the common weed genera *Microseris*/*Taraxacum* and *Rumex*, and Podocarpaceae, a southern hemisphere conifer family, which includes two species on the New South Wales coast. Out of a total of twenty-two grains for the possible exotic taxa, only four occur below the upper 11 cm of the soil profile. Pollen of Cruciferae, which might represent introduced species, are also confined to the upper 11 cm.

Broad trends in the relative abundance and pollen concentration data, as well as the stratigraphic distribution of definite or possible introduced taxa, indicate that two biostratigraphic units are present. Unit 1 (0–11 cm) is characterised by approximately equal proportions of tree and herb pollen and encompasses all definite and most possible introduced pollen taxa, while all pollen assemblages in Unit 2 (15–36 cm) are dominated by woody taxa, and have markedly lower concentrations of pollen and possible charcoal particles.

The distribution of exotic pollen taxa indicates that the two biostratigraphic units are of a different age, Unit 1 post-dating and Unit 2 pre-dating European settlement. Palynofloras in Unit 2 reflect open sclerophyll forest in which grasses, not shrubs, formed the ground cover. The abundance of charcoal indicates this vegetation was repeatedly burnt, but most fires were likely to be 'cool' given the prevalence of fire sensitive *Casuarina* and grasses. Such a fire regime is likely to be associated with Aboriginal rather than European activity. In Unit 1, grasses were the dominant plant cover across the site, although scattered remnants of the native forest flora appear to have persisted in the vicinity. The presence of pines and tree ferns suggests that the site was part of a park. High levels of charcoal may reflect intensive burning or reflect forest clearance activities by the European settlers: values of *Casuarina* pollen decrease from as high as 50 per cent in Unit 2 to as low as 11 per cent in Unit 1. The relative lack of change in the cryptogam flora between the Units, indicates that moist situations and sandstone outcrops remained a local feature of the site.

DISCUSSION

In most respects the pollen and soil analyses provide consistent evidence, although the difference between the depth of soil modification at 16.5 cm and the division between Units 1 and 2 at 11–15 cm requires some explanation. Both pollen and soil samples were taken from test pit Number 19, but the break in the soil profile was noted only in the extracted soil monolith. The fact that the evidence was obtained from two locations explains the slight discrepancy in depth. The gentle slope of the site towards Sydney Cove, and the varying survival of the soil profile as a result of site levelling for the construction of the Courthouse, must also be taken into account. Unit 1, therefore, coincides with the layer of soil modification, whereas Unit 2 accounts for the pollen below this layer in the undisturbed soil profile.

The soil and pollen data make a contribution towards the historical and archaeological evidence in three main aspects, namely the pre-European environment, the concepts and decisions of Governor Arthur Phillip and other officers of the First Fleet, and finally the changing environment of the Domain and Sydney Cove in the early years of settlement from 1788 to 1854.

The palynological analysis confirms the historical and biological evidence recently reviewed by S. S. Clark and L. C. McLoughlin, for the existence of Aboriginal fire regimes in the Sydney region right up to the arrival of the First Fleet in 1788.[23] This pollen profile is of importance not only because it reflects the vegetation at Sydney Cove, the focus of the early European settlement of New South Wales, but also because it provides an independent method of verifying the documentary evidence.

It is thus likely that the tall open sclerophyll forest and grassland, an environment that was the result of long-term Aboriginal husbandry, influenced Governor Arthur Phillip and the other officers exploring Port Jackson in January 1788. Sydney Cove was chosen for the settlement, not only because it had a safe anchorage close to shore, and a fresh stream of water, but also because the vegetation gave them the impression of fertile soil. On 15 May 1788, Governor Phillip wrote in his first despatch:

> The necks of land that form the different coves, and near the water for some distance, are in general so rocky that it is surprising such large trees should find sufficient nourishment, but the soil between the rocks is good, and the summits of the rocks, as well as the whole country around us, with few exceptions, are covered with trees, most of which are so large that the removing them off the ground after they are cut down is the greatest part of the labour; ...[24]

The concept that tall trees signified fertile soil was embedded in the minds and experience of the officers of the First Fleet, with their European background. The fact that on closer inspection it proved totally untrue, was one of the first lessons to be learned in adapting to their new and alien environment. Surgeon Arthur Bowes Smyth wrote the following on Botany Bay:

> Upon the first sight one wd. be induced to think this a most fertile spot, as there are great Nos. of very large & lofty trees, reachg. almost to the water's edge, & every vacant spot between the trees appears to be cover'd wt. verdure:

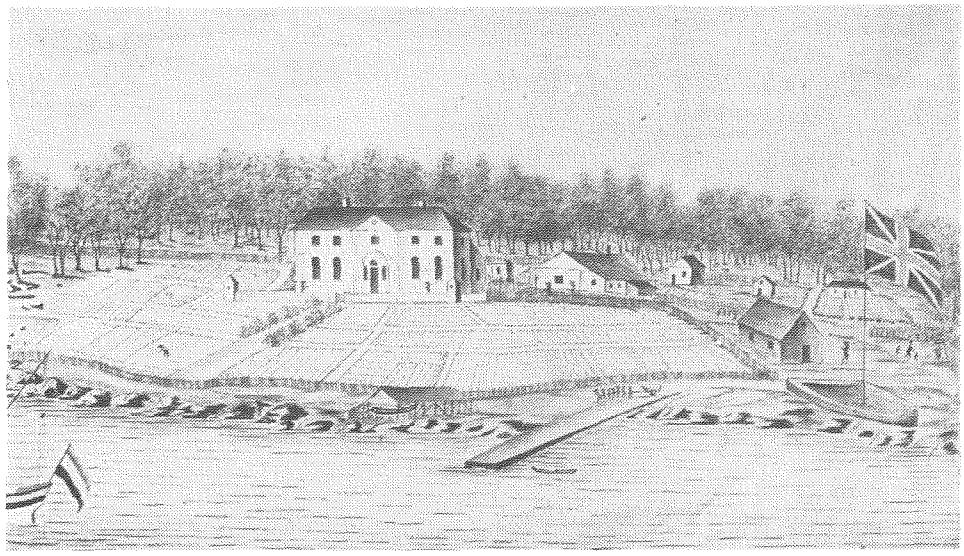

Fig. 3: The extent of garden cultivation in front of First Government House, in January 1791, is clearly visible in William Bradley's 'View of the Governor's House at Sydney in Port Jackson, N.S.W.' (Mitchell Library).

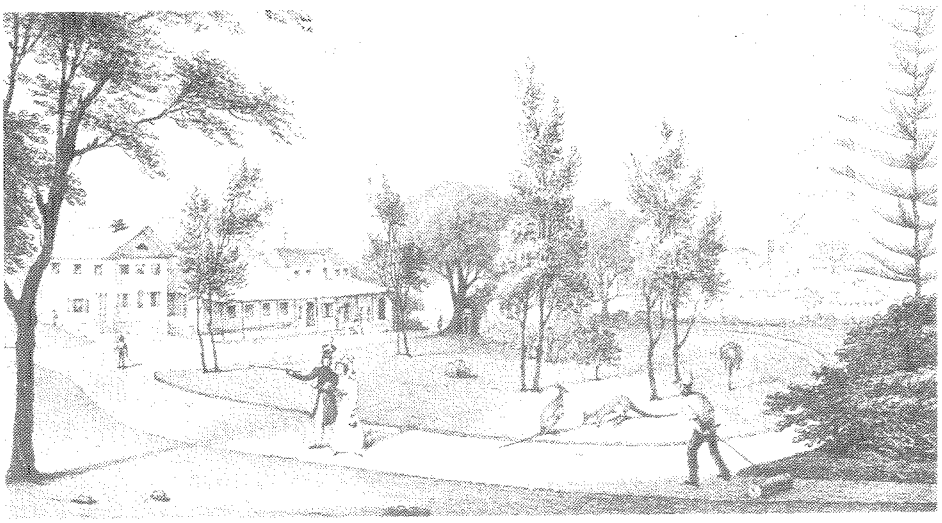

Fig. 4: August Earle, 'Government House, and Part of the Town of Sydney' from his Views in New South Wales and Van Diemen's Land, *published in London in 1830. This view of Government House indicates the complete conversion of the former regular layout of the gardens to a landscaped design, banishing all previous evidence of cultivation (Dixson Library).*

> but upon a nearer inspection, the grass is found long & coarse, the trees very large & in general hollow & the wood itself fit for no purposes of buildg, or anything but the fire...[25]

The same was found for Port Jackson and Sydney Cove, causing Surgeon George Worgan to exclaim: 'Happy were it for the Colony, if these Appearances did not prove so delusive as upon a nearer Examination they are found to...'[26] The unsuitability of Sydney Cove and the neighbouring Farm Cove for agriculture was soon realised, the soil being described as 'little better than black sand'.[27] In June 1790, Governor Phillip was able to justify his mistake in locating the settlement as follows:

> I had little time to look around me when I first arrived, for my instructions particularly pointed out that I was not to delay the disembarking the people, with a view of searching for a better situation than Botany Bay might afford. I was obliged to look further, but I did not think myself at liberty to continue my research after I had seen Sydney Cove. Had I seen the country nearer the head of the harbour I might have been induced to have made the settlement there, but we knew nothing of that part of the country until the creek which runs to Rose Hill was discovered in a journey I made to the westward three months after we landed; although I was then fully satisfied of the goodness of the soil, and saw the advantages of that situation, most of our stores and provisions were landed.[28]

The pollen and soil analyses also make a significant contribution to the historical evidence for the changing environment at Sydney Cove, resulting from European settlement. The development of First Government House and its gardens is well documented and illustrated in a series of views of Sydney Cove from 1788 onwards.[29] The gardens were first used for the cultivation of those useful plants introduced by the new settlers (Fig. 3), and later became an important source for the seeds and plants required by the growing body of settlers. However, Governor Bligh initiated and Governor Macquarie completed, the transformation of the gardens and the Domain into the landscaped parkland with carriageways and clumps of trees (Fig. 4), that remained up to the completion of the new Government House in 1845.[30]

The association of the modified layer of topsoil with the introduced pollen species, indicates that it is a result of the activities of the European settlers. Broadly, this evidence of horticulture or cultivation may be dated by historical evidence between 1788 and 1854. However, the palynoflora is more representative of the landscaped parkland of the Domain developed from 1806 onwards, so that the modified soil layer may be best explained as preparation for the sowing of grass.[31] Many factors may have resulted in the absence of pollen of food species, so that earlier cultivation cannot be ruled out.

While the soil and pollen analyses were instigated principally to obtain evidence on the introduced flora, the results have provided a more enigmatic and subtle picture of the changes to the environment over time. The palynological data have confirmed the historical and biological evidence for Aboriginal fire regimes in the Sydney region. While it has not added to the list of useful or ornamental species recorded as being introduced into New South Wales, the pollen analysis has thrown light upon plant stowaways which are not mentioned in the early accounts. It has demonstrated the early success of agricultural weeds, such as plantain, which were unwittingly sown with the seeds of grain and vegetable crops. Finally, the figures and percentages of pollen species provide independent evidence of the environment, so that there is no longer a total reliance on the sometimes subjective contents of early historical accounts.

ACKNOWLEDGEMENTS

The archaeological investigation of the former Water Police Court and Police Station was funded by the New South Wales Department of Public Works. The authors would like to thank the Department, and specifically Ian Sansom, project architect, for their co-operation and responsible approach to our heritage.

Much of the floral material for the preparation of the exotic pollen herbarium was kindly provided by the Herbarium, Royal Botanic Gardens, Sydney. The interest of the scientific staff of the Herbarium, in particular Drs B.G. Briggs and S. Jacobs and Mr A. Rodd, is gratefully acknowledged.

This study would not have been possible without access to the palynological facilities of Dr A.R.H. Martin, Botany Department, University of Sydney.

Mr J.T. Corbett, Senior Technician, Department of Soil Sciences, University of Sydney, prepared the impregnated soil monolith.

The authors gratefully acknowledge the Dixson and Mitchell Libraries, State Library of New South Wales, and the Archives Authority of New South Wales, for their permission to publish various historical documents in this paper.

The site records are held by the Police and Justice Museum, Phillip Street, Sydney.

NOTES

1. Higginbotham 1988; Macphail et al. 1988. It should be noted that the second of these references refers to the present paper by a different title from the one actually used.
2. Colonial Secretary 1830.
3. *H.R.A.* 21: 359; *H.R.A.* 22: 402–3; Colonial Secretary 1837.
4. Evidence of William S. Deloitte to the Select Committee on 13/10/1843, question 13; evidence of Charles Mallard to the Select Committee on 16/10/1843, question 21. In Legislative Council, N.S.W. 1843: 692, 708; *H.R.A.* 21: 150–1.
5. Legislative Council N.S.W. 1840.
6. Colonial Secretary 1847.
7. Higginbotham 1988: 10–11.
8. Colonial Secretary to Colonial Architect, 17/11/1851, A.O.N.S.W. 2/580.
9. McCormick 1988: *passim* .
10. Gilbert 1986: 9–16.
11. *N.S.W.G.G.* 1852: 997; Colonial Secretary to Colonial Architect, 6/10/1852, A.O.N.S.W. 2/580; Higginbotham 1988: 16–17.
12. Higginbotham 1988: 18–19.
13. Colonial Secretary to Colonial Architect, 23/4/1856, A.O.N.S.W. 2/580.
14. Colonial Architect, A.O.N.S.W. 2/645, 2/580.
15. Colonial Architect, Specification, 14/1/1854, A.O.N.S.W. 2/580.
16. ibid.
17. Colonial Architect, Bond, 1/6/1854, A.O.N.S.W. 2/580.
18. Higginbotham 1988: Appendix 3.1.
19. Davey 1987.
20. Macphail 1987.
21. Moore & Webb 1978; Birks & Birks 1980.
22. Macphail 1987: Appendix 1; Bligh 1980; Gilbert 1986.
23. Clark & McLoughlin 1986.
24. Governor Phillip to Lord Sydney, 15/5/1788, *H.R.N.S.W.* 1(2): 123.
25. Fidlon & Ryan 1979: 57.
26. Worgan 1978: 10.
27. Hunter 1968: 267.
28. Governor Phillip to Under Secretary Nepean, 17/6/1790, *H.R.N.S.W.* 1(2): 348–9.
29. McCormick 1988.
30. Gilbert 1986: 15–25.
31. ibid.: 15.

BIBLIOGRAPHY

Published sources

BIRKS, H.J.B. & BIRKS, H.H. 1980. *Quaternary palaeoecology*, Edward Arnold, London.

BLIGH, B. 1980. *Cherish the earth: the story of gardening in Australia* , David Ell Press, Sydney.

CLARK, S.S. & McLOUGHLIN, L.C. 1986. Historical and biological evidence for fire regimes in the Sydney region prior to the arrival of Europeans: implications for future bushland management, *Australian Geographer* 17(2): 101–12.

FIDLON, P.G. & RYAN, R.J. (eds) 1979. *The journal of Arthur Bowes Smyth: Surgeon,* Lady Penrhyn, *1787–1789* , Australian Documents Library, Sydney.

GILBERT, L. 1986. *The Royal Botanic Gardens, Sydney: a history, 1816–1985* , Oxford University Press, Melbourne.

Historic Records of Australia , Series 1 (*H.R.A.*).

Historic Records of New South Wales (H.R.N.S.W.).

HUNTER, J. 1968 [first published 1793]. *An historical journal of events at Sydney and at sea, 1787–1792* , Bach, J. (ed.), Royal Australian Historical Society and Angus and Robertson, Sydney.

LEGISLATIVE COUNCIL, N.S.W. 1840. *An act for the further and better regulation and government of seamen, within the Colony of New South Wales and its Dependencies, and for establishing a Water Police* , 4 Vic. No. 17.

LEGISLATIVE COUNCIL, N.S.W. 1843. Report from the Select Committee on the Water Police Act Amendment Bill with minutes of evidence, *Journal* : 685–715.

McCORMICK, T. 1988. *First views of Australia, 1788 to 1825,* David Ell Press, Sydney.

MACPHAIL, M.K., HIGGINBOTHAM, E. & DAVEY, B.G. 1988. An early colonial garden landscape at Sydney Cove: Pollen and soil evidence from the Phillip St Water Police Court Site, *Search* 19(3): 141–6.

MOORE, P.D. & WEBB, J.A. 1978. *An illustrated guide to pollen analysis* , Hodder and Stoughton, London.

WORGAN, G.B. 1978. *Journal of a First Fleet surgeon* , William Dixson Foundation Publication No. 16. Library Council of N.S.W., in association with Library of Australian History, Sydney.

Unpublished sources

Colonial Architect, N.S.W. Special Bundles, Water Police, Archives Office of New South Wales (A.O.N.S.W.) 2/645, 2/580.

Colonial Secretary, N.S.W. 1830, 1837, 1847. Blue Book of the Colony. A.O.N.S.W.

DAVEY, B. 1987. Morphological and other properties of the soil profile beneath the old courtroom, Phillip Street Police Station, Sydney, Department of Public Works, N.S.W.

HIGGINBOTHAM, E. 1988. Historical and archaeological investigation of the former Water Police Buildings, Phillip and Albert Streets, Sydney, N.S.W. Department of Public Works, N.S.W.

MACPHAIL, M. 1987. An early colonial garden landscape at Sydney Cove: pollen evidence from the Phillip Street Police Court site, Department of Public Works, N.S.W.

Newspapers

New South Wales Government Gazette (N.S.W.G.G.).