Post-Medieval Archaeology **37/1** (2003), 1–28

The excavation and analysis of an 18th-century deposit of anatomical remains and chemical apparatus from the rear of the first Ashmolean Museum (now The Museum of the History of Science), Broad Street, Oxford

By GRAHAM HULL

with contributions by PAUL BLINKHORN, PAUL CANNON, SHEILA HAMILTON-DYER, CHRIS SALTER and BILL WHITE

SUMMARY: Rescue excavation during refurbishment at the Museum of the History of Science in Oxford recovered deposits which appear to have been placed in the later 18th century and comprise human and animal skeletal parts, domestic pottery, chemical apparatus, clay tobacco pipe, glass, food refuse, fuel and building material. A synthesis of the archaeological and historical information particular to this site has provided unusually fine resolution to the activities at the Old Ashmolean Museum in the late 17th and 18th centuries. The material appears to represent the disposal of unwanted equipment and specimens from the first Ashmolean Museum and the chemical laboratory which shared the premises, probably when the latter was renovated in 1781.

INTRODUCTION

As part of the refurbishment and extension of the Museum of the History of Science, Broad Street, Oxford (SP 5149 0645) (Figs 1 and 2) drains were laid to the rear of the building after the removal of limestone slabs that paved the basement terrace adjacent to the cellar of the building. The presence of human remains immediately below the slabs caused the contractors to alert Mr Michael Thrift, Surveyor for the University of Oxford, who then requested that Thames Valley Archaeological Services excavate and record the revealed archaeological deposits.

The building that later became the Museum of the History of Science was built as the Ashmolean Museum in 1679–83 adjacent to the Sheldonian Theatre and on the south side of what was then Horsemonger Street. Elias Ashmole (1617–92), the founding benefactor, intended that inductive method and utilitarian aims should be the guiding principles of his museum.[1] Archaeological work in the vicinity and an evaluation to the front of the museum suggest that the building was constructed over the medieval town ditch following its backfilling after the Civil War.[2]

The site code is MHSO98/68. The artefacts, remains and archive have been deposited with the Ashmolean Museum and the accession no. is 1999.205. A descriptive, and profusely illustrated, catalogue of the artefactual material and history of the 'First Museum' has been published by the Museum of the History of Science.[3] This publication accompanied a museum display that included the excavated material discussed in this report and following the opening of the refurbished museum in 2001.

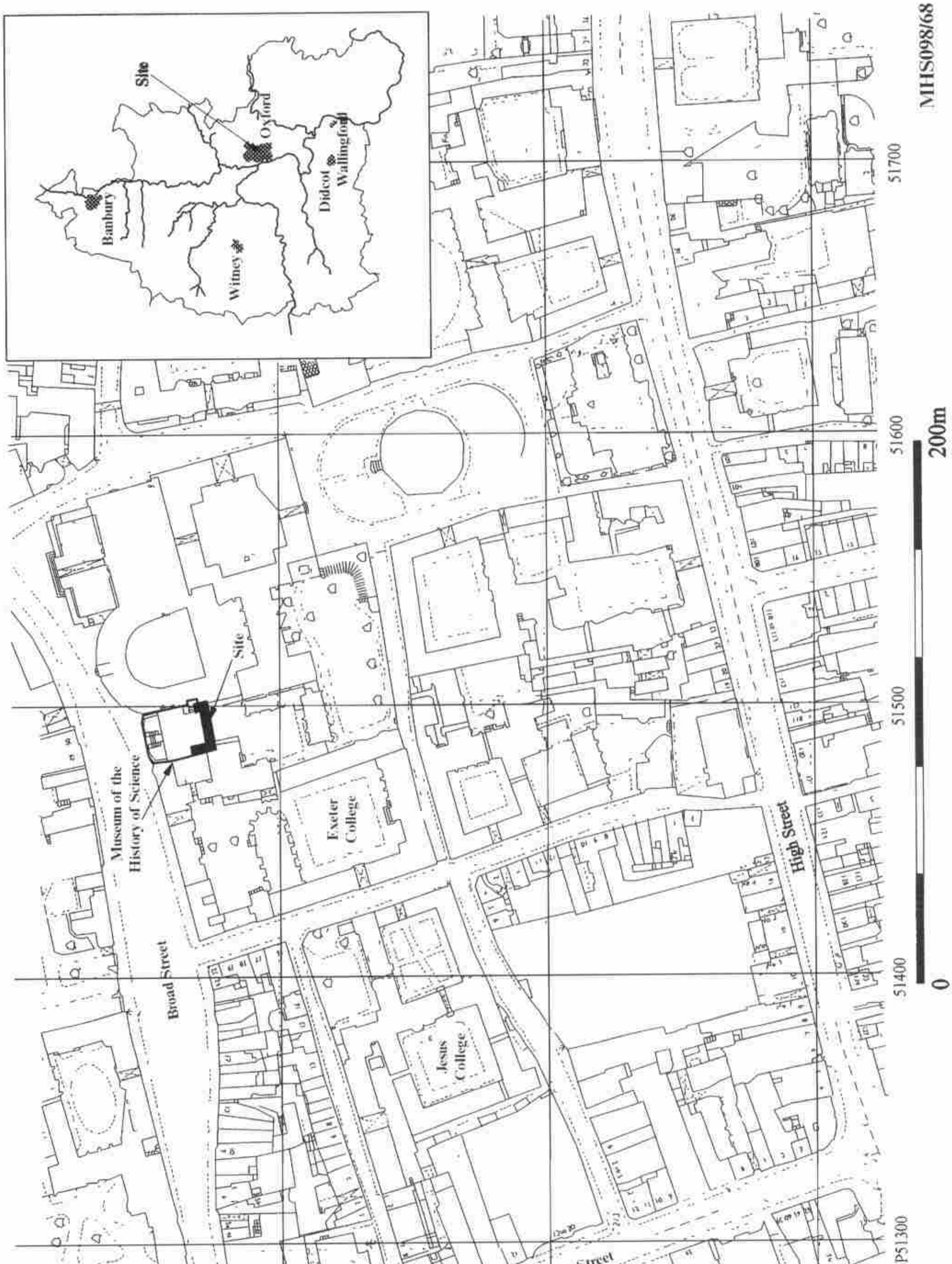

FIG. 1
Location of site.

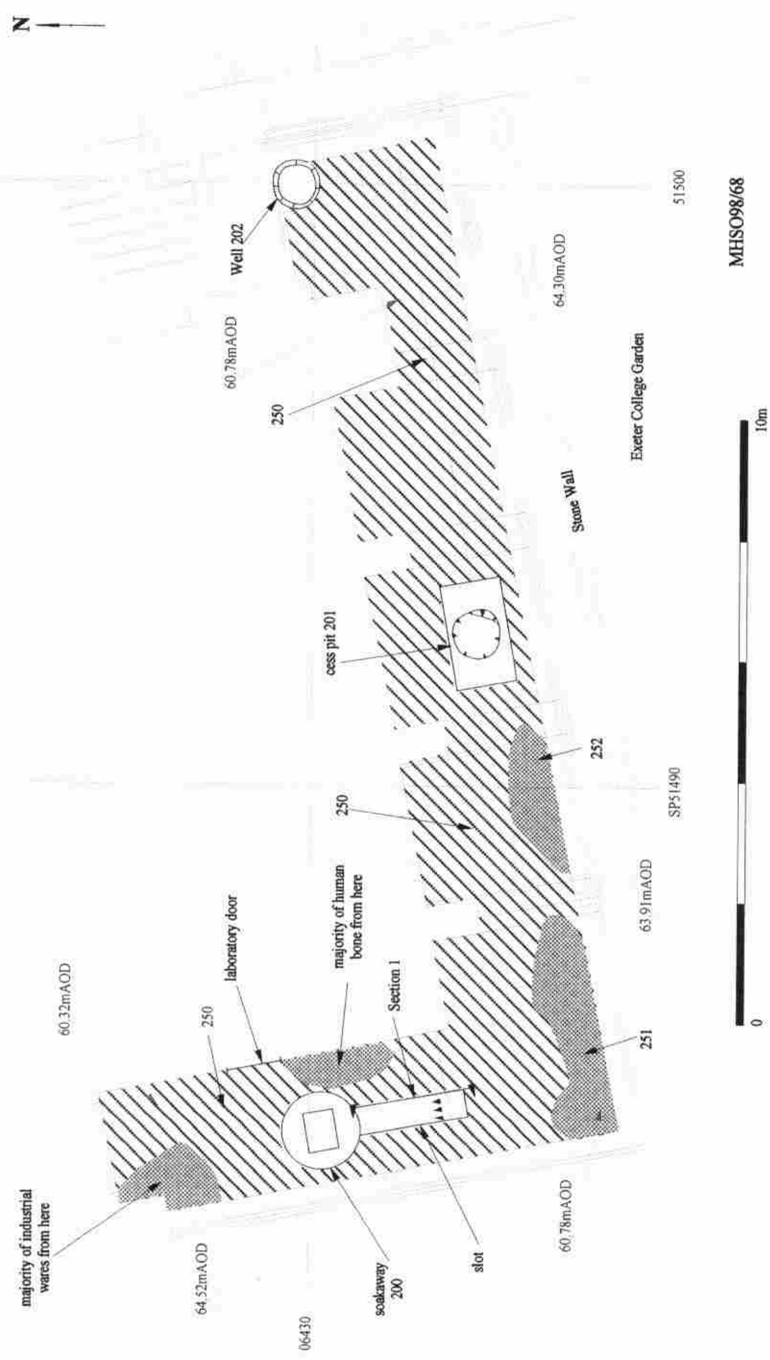

FIG. 2
Location of excavated area.

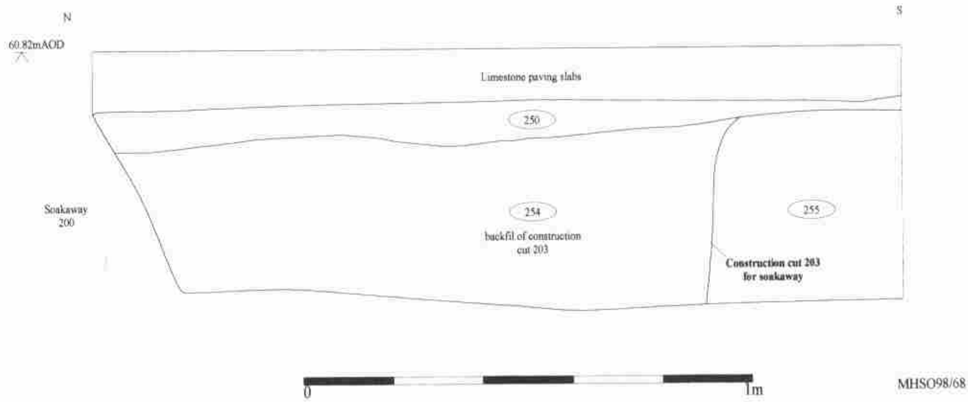

FIG. 3
Section 1.

THE EXCAVATION

A narrow basement terrace to the south of the Museum of the History of Science was examined during April and May 1999 (Fig. 2). The terrace was L-shaped, 2.25m. wide, with the longer arm being 16.75m. long and the shorter arm being 8.25m. long. The base lay *c.* 3m. below the surrounding ground surface and the paving slabs that formed the floor of the terrace were 60.8m. above Ordnance Datum. The basement terrace was bounded to the south by Exeter College Garden.

The paving slabs were removed by the construction contractors and a considerable quantity of human bone and earthenware vessels was collected by them before archaeological staff were alerted. The basement terrace of the building appeared to have been used as a dump for material associated with the later 17th- and 18th-century function of the first Ashmolean Museum and its laboratory. This dumping included human and animal bone, pottery, clay tobacco pipe, glass, ceramic and metal chemical vessels. Three contexts were initially ascribed to differentiate what at first appeared to be relatively discrete dumping [250, 251 and 252]. Upon closer inspection it was apparent that the entire basement terrace was used as a dump and, while there was certainly clustering of artefact types, this was thought to reflect the nuances of removal and deposition of material from within the Ashmolean rather than relating to any broad-phased activity. This layer was *c.* 0.5m. thick in places and was stratigraphically sealed by the ubiquitous limestone paving slabs [253]. The dump [250] was removed in its entirety by hand.

Stratigraphically preceding the dumping of deposit [250] were three cut features that probably relate to the original construction of the building: a soakaway [200], a cess pit [201] and a well [202].

The soakaway was lined with unfrogged bricks and had vertical sides and a flat base. It was circular, being 1.3m. in diameter and 2.1m. deep. It was accessed via a modern cast-iron inspection cover and modern material was found at the base. The bricks themselves would suggest a date of manufacture after the Restoration and before the late 18th century. A slot excavated to the south of the soakaway located the edge of the construction cut [203] for this feature. After the soakaway had been constructed the cut was backfilled with a silty clay that contained building rubble [254] (Fig. 3).

The cess pit was rectangular at the top, measured 1.05m. by 1.8m. and was brick built. Below six courses of brick, the pit was circular, 0.8m. in diameter and 1.9m. deep. This shaft was lined with limestone rags. A brick culvert discharged from the museum into this cess pit, which could be accessed via an inspection slab that post-dated the limestone paving. Modern deposits were found in the remaining 0.1m. of silt at the bottom of the cess pit.

The well was sealed by the limestone paving and was 0.72m. in diameter and in excess of 2.5m. deep. It was constructed of limestone blocks and an internal inspection below the waterline established that it had been constructed by steining. This process obviates the need for a large construction cut involving, as it does, the cutting of a well shaft by a metal-shod wooden ring (the curb) and undercutting the stonework built on the ring.[4]

THE FINDS

POTTERY

BY PAUL BLINKHORN

The assemblage comprised a large group of near-complete ceramic crucibles and other laboratory equipment, along with a smaller group of less specialist pottery (Figs 4–7). To facilitate analysis, the assemblage has been divided into two categories: *domestic*, encompassing the utilitarian and tablewares found in association; and *industrial*, comprising the crucibles and retorts. It is the former group which has provided the date for the whole assemblage.

The domestic wares

The pottery assemblage comprised 110 sherds with a total weight of 2869g. The minimum number of vessels, by measurement of rimsherd length, was 3.14. The pottery occurrence by number and weight of sherds per context by fabric type is shown in Table 1. The wares are all types that are well known in Oxford. Where appropriate, the 'OX' prefixed coding system and chronology of the Oxford type-series[5] has been used, as follows:

OXAM, *Brill/Boarstall ware*, AD 1200–1600
Martincamp flask, 1475–1550
OXST, *Frechen Stoneware*, AD 1550–1700
OXFH, *Border wares*, 1550–1700
OXDR, *Red Earthenwares*, 1550+
OXCE, *Tin-glazed Earthenware*, 1613–1800
OXFI, *Chinese Porcelain*, *c.* 1650+
Nottingham Stoneware, 1690–1800
OXFM, *Staffordshire White-glazed English Stoneware*, 1730–1800
Later English Stoneware, *c.* 1750+
Creamware, 1740–early 19th century
Pearlware, 1785–19th century
Blue Transfer-printed Earthenwares, 1790—1800

Chronology

The chronology of the assemblage is based entirely on that of the domestic pottery. There is some residual material; the Brill/Boarstall wares are of a type which had fallen from use by the end of the 16th century,[6] and the German stoneware is likely to date from the 16th or 17th century. The assemblage included a fragment of a Frechen vessel with a bearded face-mask (*Bartmaske*), a form of decoration that had fallen from use by the end of the 17th century.[7] The sherds of Border Ware are types that ceased to be made in the early years of the 18th century.[8]

The pottery, which can be regarded as broadly contemporary, comprises a fragment of a Staffordshire white salt-glazed mug, English tin-glazed Earthenware, Pearlware and Creamware vessels. The earliest mass-production of Staffordshire salt-glazed stoneware is uncertain; it is known it was patented in the later 17th century but the earliest dated piece is from *c.* 1720.[9] A vessel of that date is kept in the Nelson Gallery of the Atkins Museum, Kansas City.[10] Archaeologically, the earliest dating for the ware in Oxford are vessels from St Ebbe's, which were found in direct association with a red earthenware vessel inscribed with the date 'Octobr ye 13 day 1739'.[11] A salt-glazed vessel from the same site was inscribed with the date '1762'.[12] White salt-glaze stoneware continued to be made throughout the 18th century and at numerous centres apart from Staffordshire. It is also known that John Wood of Burslem was still making the material in the 1780s, although the latest dated piece is from the period 1776–78. However, plates and mugs were still in use as late as 1810.[13]

Creamware was first manufactured in the 1740s and was made in a range of highly decorated forms until around 1780, when Pearlware became the favoured medium for such enhancement and Creamware production concentrated on simpler

TABLE 1
Pottery occurrence by number and weight (in g.) of sherds per context by fabric type, domestic wares

Ctxt	*OXAM*		*Martin*		*OXST*		*OXFH*		*OXDR*		*OXCE*		*OXFI*		*Notts*		*OXFM*		*ESton*		*Cream*		*Pearl*		*Blue*		*Date*
	No.	*Wt*	*No.*	*Wt*	*No.*	*Wt*	*No.*	*Wt*	*No.*	*Wt*	*No.*	*Wt*	*No.*	*Wt*	*No.*	*Wt*	*No.*	*Wt*	*No.*	*Wt*	*No.*	*Wt*	*No.*	*Wt*	*No.*	*Wt*	
250	5	78	1	3	7	230	4	71	35	783	2	209			2	54	1	27	2	13	14	169	4	17	1	4	1785+
251					1	16	2	102	8	307	1	18	2	17									1	5			1785+
252									1	19																	16thC+
254			1	4			1	95	5	115	1	12	1	17							3	22	3	7			1785+
Total	5	78	2	7	8	246	7	268	49	1224	4	239	3	34	2	54	1	27	2	13	17	191	8	29	1	4	

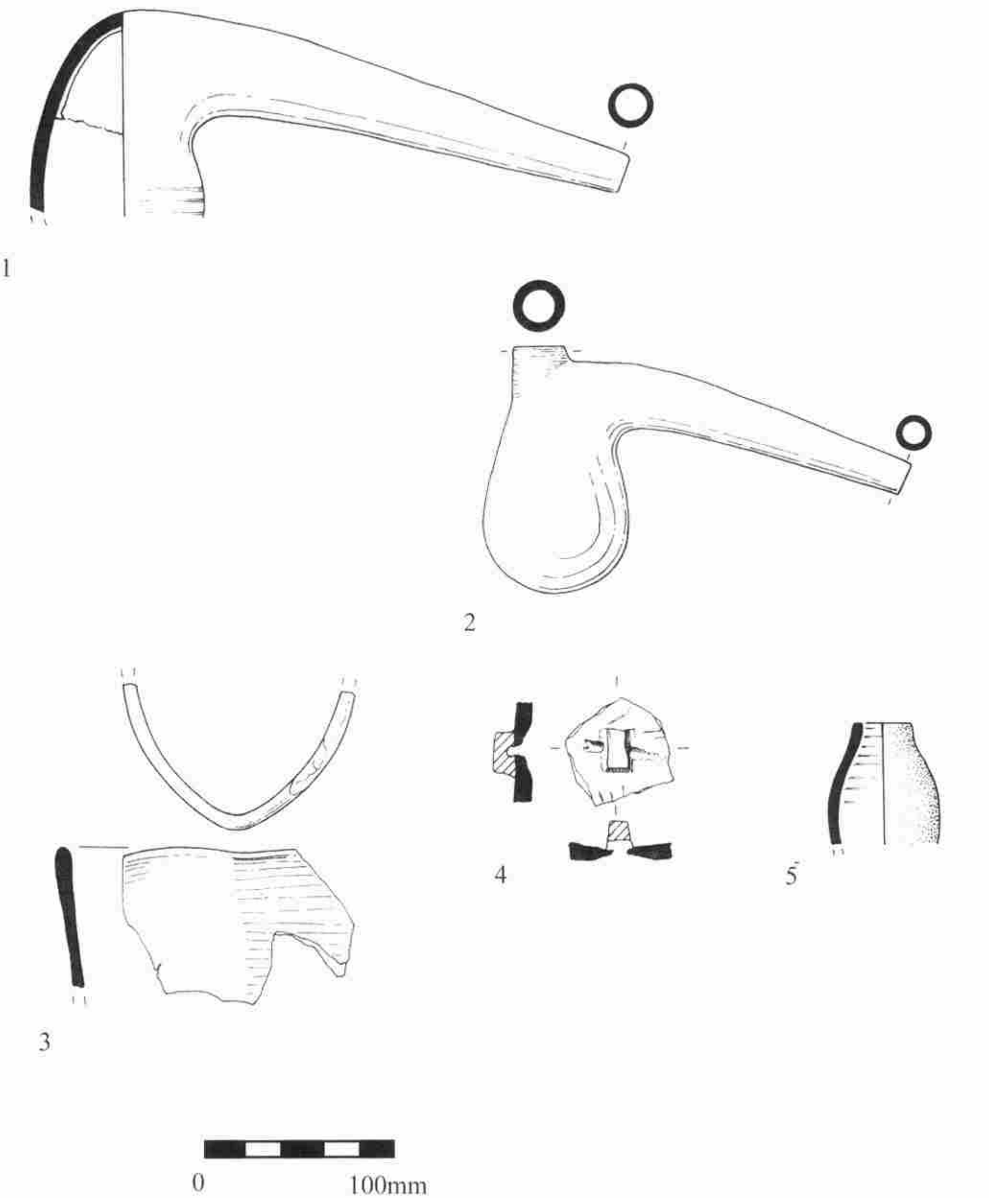

FIG. 4
Industrial wares and 'drug jar'.

utilitarian vessels. For example, decorative techniques such as sprigging and moulding, which were relatively common on the earlier Creamwares, all ceased to be used on the material during the 1770s and 1780s. Production declined at the end of the 18th century, although Creamwares were still in use as late as the 1820s.[14] It is worthy of note that the few Creamware sherds from this assemblage are all simple, undecorated forms.

The Tin-glazed Earthenware assemblage included a small near-complete 'drug jar' (Fig. 4.5) of a type that occurred in a late 17th-century context at St Ebbe's, Oxford.[15] However, the vessel from this site is rather abraded, suggesting it had

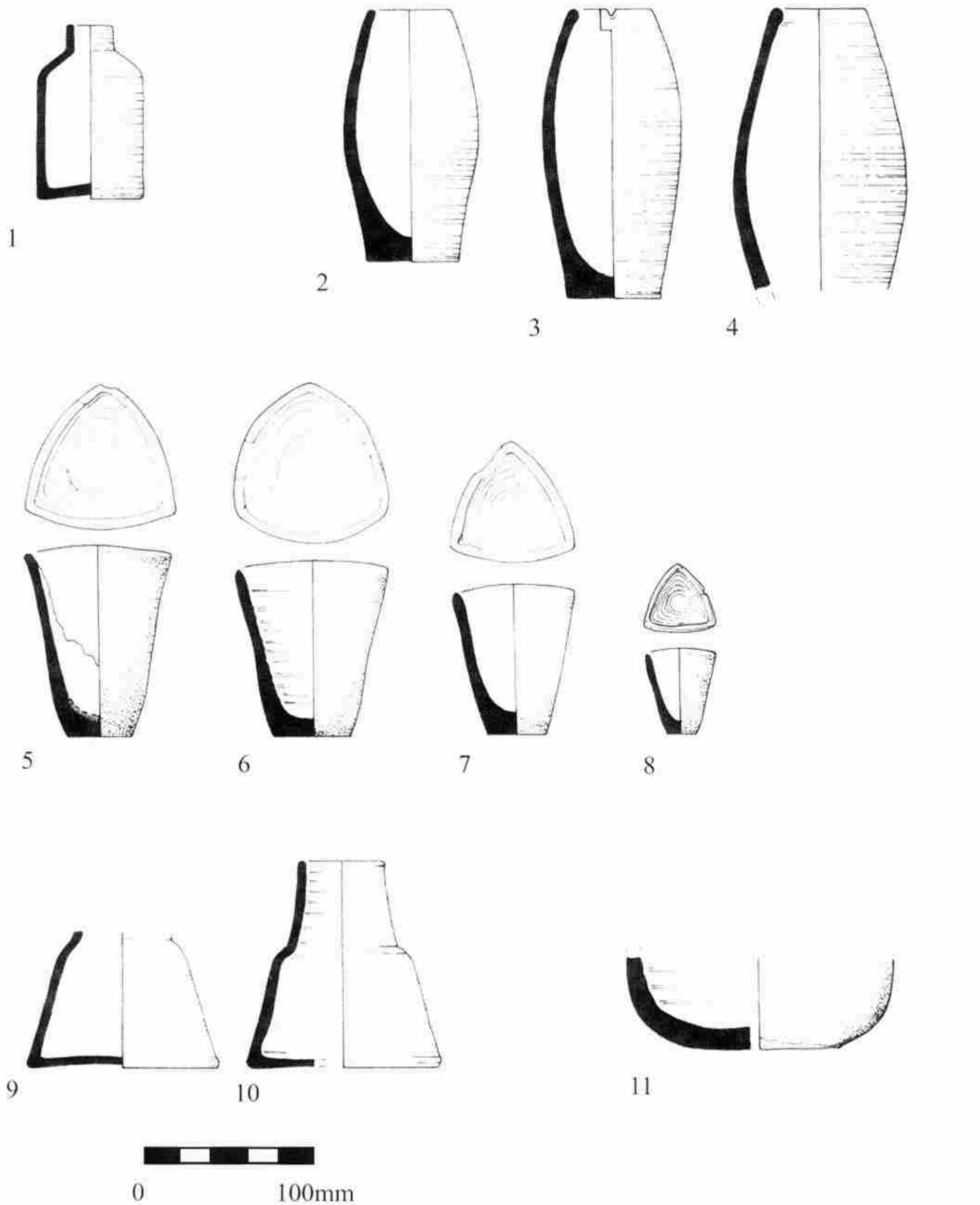

FIG. 5
Industrial wares.

been in use for some time before deposition. Such vessels appear to sometimes have had a long life, as a similar vessel, said to be redeposited, occurred in the backfill of a well at Bishop's Waltham, which was dated to 1790–1800.[16] The Science Museum assemblage also included two decorated sherds from context 250, which appear to be from one vessel and are decorated with a Chinese-style scene executed in cobalt blue. The designs on the two sherds can be almost exactly paralleled by two vessels from Oyster Street, Portsmouth, dated 1780–1800,[17] although the Portsmouth vessels are bowls with the design painted on the interior.

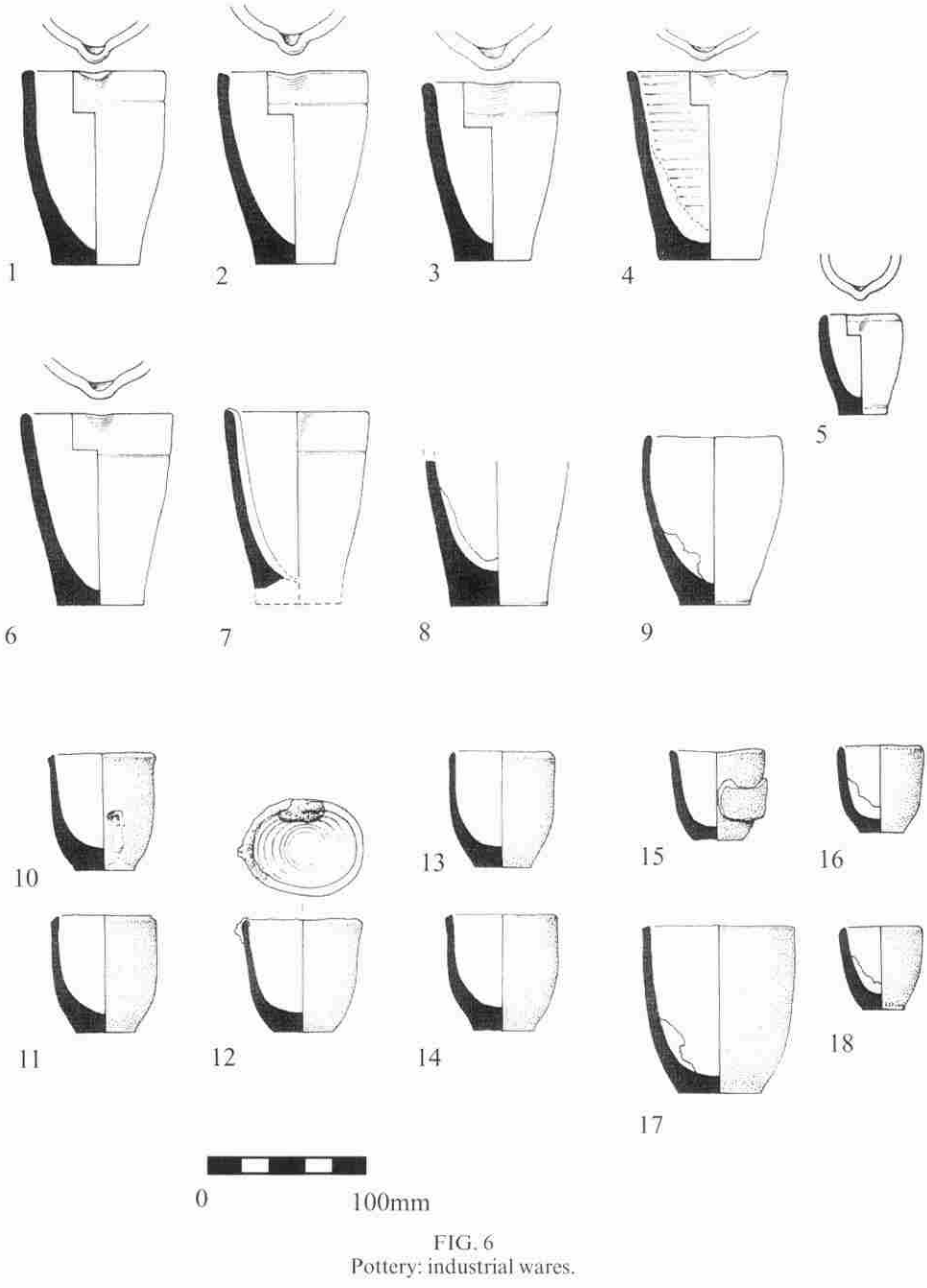

FIG. 6
Pottery: industrial wares.

The crucial dating evidence is the small assemblage of Pearlware. Production of this material, which was basically Creamware with small quantities of Cobalt added to the glaze, started in the 1770s, with the earliest dated pieces being from 1775.[18] The ware became increasingly common during the 1780s, and was dominant during the period 1790–1830. Dated Pearlware plates from the last two decades of the 18th century are known from Oxford.[19]

Finally, a single small sherd of Blue Transfer-printed Earthenware also occurred. This may be intrusive and, with the lack of control over the early stages of this discovery, this cannot be discounted, but such pottery came into use *c.* 1790[20] and thus the assemblage could be dated to the 1790s. Otherwise, the lack of such material indicates that the assemblage was deposited not long after this date. Certainly, the lack of coloured Transfer-printed Earthenwares shows that it dates to before 1825, when such pottery came into widespread use.

A smaller group of material occurred in context 251 and, although it did not contain quite as broad a range of wares as context 250, it can be similarly dated to the end of the 18th century. It comprised German stonewares, Border ware, Chinese Porcelain and Red Earthenwares, but also a single sherd of Pearlware, again datable to after 1775. A few sherds of crucibles were also noted, as was a single sherd of residual Roman samian ware.

The pottery assemblage from the interface between context 250 and the fill of the soakaway cut [254] contained a similar range of pottery types, including Creamwares and three small sherds of blue-decorated Pearlware. This further reinforces the general date given to the group, as all contexts produced Pearlware with the exception of [252], which only yielded a single sherd of a red earthenware, a pottery type that was in use right up to the 19th century. A single small sherd of yellow earthenware was retrieved from the environmental sample taken from this deposit. Such wares came into production *c.* 1785,[21] although the small sherd-size means that it, like the transfer-printed example, may be intrusive.

Overall, the range of wares present in this group would indicate a deposition date no earlier than *c.* 1770 based on the known chronology of Pearlware. However, it is possible that it could be a decade or two later. The domestic pottery assemblage, the Red Earthenware skillet apart, comprises mainly small sherds, which are almost certainly a product of secondary deposition. The small size of the assemblage also presents problems. The date of 1770 assumes that Pearlware was available in quantity in Oxford from that date, but the material only became common during the 1780s. It is possible that the colleges and laboratories of Oxford may have had access to the material from an earlier date, but there is no archaeological evidence for this. In addition, the small quantities of salt-glaze and Creamwares indicates that such material was in decline by the time of deposition of the assemblage and the sherds of transfer-printed earthenware and yellow-glazed earthenware could date the assemblage to *c.* 1790, although intrusiveness cannot be ruled out, especially when the circumstances of the initial discovery of this assemblage are taken into account. Consequently, the assemblage can only be dated to after 1770 and before 1825, with the weight of evidence suggesting that it most likely dates to *c.* 1780, and possibly as late as after 1790.

The industrial assemblage

The industrial assemblage comprises a series of crucibles that occurred in a number of form and size categories, along with two retorts (Figs 4.1–4.2). There are 18 open crucibles (Figs 5.4; 6.1–6.7, 6.9–7.18), which had rim diameters ranging from 45–95mm. and a height range of 35–100mm. Two complete closed crucibles, presumably for the heating of volatile metals such as mercury and zinc[22] also occurred (Figs 5.2–5.3), as did five triangular crucibles, with one small example with a side-length of 38mm., and four larger examples, three of which had sides which ranged between 75–100mm. long (Figs 4.3, 5.5–5.8). A complete flask (Fig. 5.10) was noted, along with another with the neck and rim missing (Fig. 5.9). A fragment of a lid (Fig. 4.4), possibly for a crucible, also occurred. Finally, a stoneware bottle (Fig. 5.1) made up the assemblage. This may have been used for ink or for chemicals; even nowadays, stoneware is often used in Germany for the storage of strong acids, as it is more resilient than glass.

Fragments of other vessels of these types were found and are listed in the archive.

Fabric

Most of the vessels had the same fabric and colour: very hard, white, semi-vitrified fabric with moderate sub-rounded quartz up to 1mm. and sparse sub-rounded red and black ironstone up to 0.5mm. Reddish-brown to white outer surfaces. High-silica fabrics were the most common types used for the manufacture of post-medieval crucibles.[23] The exception is a single sherd from a vessel made from a high-graphite clay (not illustrated). The retort fabric appears typical of that of English Stoneware of the later 18th and 19th centuries.

Discussion

Exact parallels for the industrial ceramics have been extremely difficult to find. In the case of the crucibles, the forms are long-lived, with the exception of the closed vessels, for which exact parallels could not be found from archaeological contexts.

The open crucibles are a type that was introduced in the 14th century and are still in use today. Some 16th-century examples are known from Legge's Mount at the Tower of London.[24] They cannot be dated with precision on morphological or petrological grounds.

The tall triangular crucibles, or Hessian Wares, are nearly as long-lived. They appear in engravings and paintings from the early 16th century onwards and have been found at several locations around Britain. The earliest record of their manufacture in Britain is at John Dwight's Fulham Pottery, between 1673 and 1680/5, and by John Fox of Sheffield between 1710 and 1720.[25] Other, as yet unknown, sources doubtless also existed.

The small fragment of the graphite crucible is worthy of note. Such vessels were probably not introduced into Britain until the mid 18th century and few examples of that date are known, although two vessels with graphite fabrics from Canterbury Barracks may date to around the late 18th or early 19th century. Such vessels were known to have been made in Cornwall from around the beginning of the 19th century and were probably imported from south Germany or Austria before that time. The English vessels are macroscopically indistinguishable from the imported wares.[26]

Triangular crucibles are known to have had a wide variety of uses in the factory and the laboratory, particularly in processes involving copper, brass, silver and gold. They were also used for the preparation of glazes for pottery and by apothecaries, physicians and glassworkers.[27]

Catalogue of illustrated vessels

Domestic wares

Fig. 4.5: Tin-glazed earthenware near-complete 'drug jar'.

Retorts

Fig. 4.1: R1. Fine, smooth grey stoneware fabric lacking any of the inclusions found in the fabrics of the other vessel types. White inner surface, brown ironwash on outer surface.

Fig. 4.2: R2. Fabric and colour as Fig. 4.1.

Fig. 5.11: OX1404. Sherd from a large globular vessel of uncertain form (?retort body). Purple iron-wash salt glaze on both surfaces. Standard fabric.

Open crucibles

Fig. 5.4: OX1426 and OX1428. Joining sherds from vessel with base missing. Rim 55mm.

Fig. 6.1: T1. Height 100mm., rim 85mm., base 55mm.

Fig. 6.2: OX1402. Height 100mm., rim 90mm., base 47mm.

Fig. 6.3: OX1418. Height 90mm., rim 85mm., base 47mm.

Fig. 6.4: S1430. Height 100mm., rim 95mm., base 65mm.

Fig. 6.5: OX1400. Height 48mm., rim 46mm., base 30mm.

Fig. 6.6: S1432. Height 100mm., rim 90mm., base 50 mm.

Fig. 6.7: OX1440. Two non-joining fragments from the rim and body, base missing. Thick bluish-green glassy residue on the inner surface.

Fig. 6.9: OX1422. Height 90mm., rim 80mm., base 43mm.

Fig. 6.10: OX1401. Height 55mm., rim 65mm., base 35mm.

Fig. 6.11: OX1405. Height 55mm., rim 62mm., base 35mm.

Fig. 6.12: OX1406. Ovoid rim. Height 55mm., rim 70 x 55mm., base 35mm.

Fig. 6.13: OX1407. Height 55mm., rim 60mm., base 33mm.

Fig. 6.14: OX1415. Height 55mm., rim 65mm., base 35mm.

Fig. 6.15: OX1413. Height 45mm., rim 53mm., base 22mm. The vitrified rimsherd adhering to the outer surface appears to be from a different vessel.

Fig. 6.16: OX1412. Height 40mm., rim 45mm., base 27mm.

Fig. 6.17: OX1420. Height 90mm., rim 80mm., base 50mm.

Fig. 6.18: S1431. Height 35mm., rim 45mm., base 25mm.

Closed crucibles

Fig. 5.2: S1429. Height 140mm., rim 50mm., base 55mm.

Fig. 5.3: S1433. Height 160mm., rim 50mm., base 60mm.

Fig. 6.8: OX1411. Lower half of closed crucible.

Triangular crucibles

Fig. 4.3: T3. Rim from large triangular crucible. Exact dimensions unknown.

Fig. 5.5: OX1403. Height 100mm., rim (max.) 85mm., base 40mm.

Fig. 5.6: OX1417. Height 95mm., rim (max.) 95mm., base 47mm.

Fig. 5.7: OX1414. Height 75mm., rim (max.) 65mm., base 38mm.

Fig. 5.8: T2. Height 35mm., rim (max.) 38mm., base 17mm.

Flasks

Fig. 5.9: OX1408. Flask, neck and rim missing.
Fig. 5.10: OX1409. Height 115mm., rim 50mm., base 115mm. The fabric of OX1409 is similar to that of the other vessels, except the quartz is rose-pink rather than clear.

Lid

Fig. 4.4: T4. Context [251]. Lid, broken, diameter uncertain. Standard fabric.

'Bottles'

Fig. 5.1: S1434. Height 90mm., rim 25mm., base 65mm.

Copper-alloy vial

Fig. 7:

Not illustrated

OX1419: Crucible base of vessel, 60mm. diameter.

Rimsherds from three large triangular crucibles, dimensions uncertain.

Rimsherd from closed crucible, 70mm. diameter.

Rimsherd from closed crucible, extremely coarse fabric, 30mm. diameter.

Basesherds from five different vessels, all uncertain types.

Bodysherds from thirteen different vessels, all uncertain types, including a small fragment of a graphite crucible.

CHEMICAL RESIDUES

By CHRIS SALTER

The collection consisted of three main types of industrial vessels, two different types of open crucibles, and triangular 'Hessian-type' crucibles. The two open crucible types varied in both form and fabric. The first type had a tapering profile and was present in a greater variety of sizes than the second. This first class is typified by a small example OX1400 (Fig. 6.5). This form of crucible had a slightly smoother surface texture and was of a buff colouration compared with the other type of open crucible. The second form had a near hemispherical internal bottom and again was present in at least two different sizes (e.g., OX1401, Fig. 6.10). The fabric was slightly coarser than that of type one crucibles, but of a slightly cleaner white colour. In addition to these main crucible types one crucible is of particular interest (OX1422, Fig. 6.9) as this was made from a graphite-filled fabric and had a maker's mark on the base.

An initial visual survey showed that a most of the crucibles had been used, with most showing the effects of heat in the form of external surface glaze and spot melting due to impurities within the crucible. The spot melting being characterized by the formation of dark glazes and, in one case (OX1401, Fig. 6.10) erosion of the crucible body had almost penetrated through the crucible wall. This could well be the type of defect that Pryce[28] was complaining about in the last quarter of the 18th century when he stated that hardly one in two of the imported crucibles were sound. Although Percy, in 1861,[29] notes the use of graphitic-fabric crucibles, Pryce, writing in 1778, does not mention their use in Cornwall and it is clear that use of kaolin-based local crucible was a recent successful invention.

The preliminary X-ray fluorescence analysis (XRF) survey using the XRF set at the Research Laboratory for Archaeology and History of Art, University of Oxford, showed that these glaze spots were very iron rich. These zones were no doubt the result of iron rich impurities in the fabric.

Most of the crucibles had relatively clean interiors with very little sign of chemical attack by molten metal, nor any obvious meniscus lines. Some vessels did have white or off-white crystalline material in their bases, or adhering to their surfaces. This material is problematic in that much of it is in a form (as hydrated compounds) that is not compatible with temperatures to which the crucibles and other ceramics have been heated. At this stage it is thought that these crystalline compounds are the result of post-depositional reactions between the original contents of vessels and the calcium and carbonate-rich ground water. Ground water that is likely to have been rich in lead, zinc and sulphur given the soil analysis. The heavy contamination of the area with these elements makes the interpretation of surface XRF results difficult. It was attempted to overcome this problem by comparing the results from areas of interest (glazes, adhering materials, etc.) with those from control areas from the same vessel, or from another vessels of similar body. XRF analysis of 22 vessels or vessel fragments was carried out and revealed a number of interesting observations.

A high proportion of the crucibles showed the presence of zinc in varying quantities both on the inside and outside of the crucible fragments. In some cases (1400, 1404, 1408 and 1412; Figs 5.9, 5.11, 6.5, 6.16) very high zinc X-ray peaks were recorded. Sample 1404 was of particular interest, in that it clearly had been sitting on top of another vessel, probably acting as a lid. The region that was in contact with the vapour from the lower vessel had been glazed white by the action of zinc-rich vapour, whereas the rest of the exterior of the vessel had a dark coloured glaze, with some areas that appeared to show reduced copper colouration.

The bottom of crucible 1410/19 was coated with a white powdery glaze, which produced a very strong zinc signal, with a minor amount of lead.

A similar pattern was seen in the lead distribution, with most samples recording some lead, but the two conical flasks (1408 and 1409; Fig. 5.9–5.10) had particularly high levels of lead. This in part might explain why these vessels had a distinct yellow colouration compared to the rest of the refractory-ware. Almost certainly, these vessels had been used to sublime a lead compound. The crucible 1411 (Fig. 6.8) also had a thick coat of white, lead-based glaze.

Two vessels (crucible 1403, Fig. 5.5 and stone ware vessel 1404, Fig. 6.11) showed minute traces of mercury and two crucibles (1400 and 1402, Figs 6.5 and 6.2) showed traces of antimony.

A number of crucibles showed X-ray peaks that indicated that it is likely that there were higher than usual amounts of strontium present. In addition, possible traces of rubidium were noted.

A few crucibles had white crystalline deposits coating their interior. These, in general, only produced a calcium X-ray signal, sometimes with traces of strontium. Based on this chemistry and the crystal morphology these deposits are thought most likely to be gypsum crystals (hydrated calcium sulphate), although there may also be some carbonate present.

An 'ingot' shaped piece that clearly had solidified in the bottom of a crucible, proved, on present analysis, to be elemental sulphur.

Most crucibles produced a peak characteristic of zirconium, and one spot on sample 1415 (Fig. 6.14) produced a signal characteristic of tungsten.

Sample 1413 (Fig. 6.10) is interesting in that it is clear that a slightly larger crucible was being used as a cover for a smaller crucible. As the crucible had been heated to the point where the surfaces had begun to glaze, the two had stuck together.

Discussion

The contents

Usually, the open crucibles of the type seen from the Museum of History of Science site are associated with metal working and the melting of metals in particular. This does not seem to be the case here. It is clear that many of the crucibles and some of the other industrial ceramics have been subject to intense heating, some to the point where they have begun to soften. However, the evidence of adhering metal or metal-oxide slag that would be expected if they had been simply used to melt metals is largely absent. The small amounts of mercury and antimony detected on some of the small crucibles may indicate some metallurgical activity, but the presence of these elements could also be the result of external contamination. The predominant metals involved, zinc and lead, melt at relatively low temperatures, 420°C and 328°C respectively, but it is clear that the crucibles have been heated in excess of these temperatures. The appreciable quantities of lead and zinc present on the surface of the conical flasks (1408 and 1409, Figs 5.9–5.10) suggest that these had been used to sublime or distil zinc and/or lead metal or compounds.

The material adhering to samples 1410/1419, 1411 (Fig. 6.8) and in one of the un-numbered fragments, looks much more like deliberately formed glasses or glazes, than accidental reaction products. It may have been that the lead and zinc chemistry was associated with the production of lead-silicate glazes.

The area of chemistry that seems to be represented is that associated with sulphur and sulphates. Clearly sulphur had been melted and solidified, but it is not clear if the sulphates have formed as the result of post-depositional processes. However, the traces of strontium and barium are interesting as these are elements that can be associated with gypsum and anhydrite (calcium sulphate) deposits. In which case, some work on sulphur or sulphates may have been carried out. Alternatively, both the presence of the sulphates and traces of strontium and barium may be simply a result of the local ground water chemistry.

The crucibles

All the crucible fabrics seem to have rather higher zirconium contents than a normal terracotta fabric. Whether this is normal for this type of material is difficult to tell without comparative analytical data. However, it does suggest that the crucibles were manufactured from kaolin-based clay, as these form from decomposition of igneous rocks, which tend to have higher zirconium contents than other rocks. Although tungsten was only noted once, it is an element associated with acid igneous activity. If the crucibles were manufactured in Britain, this would suggest that the clay used came from either the east Dorset (Poole) basin, or a south-western source, rather than a midlands location (Stourport). However, on the basis of this crude XRF analysis, there were no obvious chemical differences between the triangular crucibles, thought to be of foreign manufacture, and the two types of round crucibles.

Summary

The present analysis of the material adhering to, or combined with, the industrial ceramics indicates that a high proportion of these had been used to work with zinc compounds. There is also evidence that work was being carried out on lead-silicate glasses, or more likely glazes. The presence of what are probably gypsum crystals and the sulphur 'ingot' suggest that work was being carried out on the chemistry of sulphur or sulphur compounds.

HUMAN BONE

By BILL WHITE

The human bone was sorted from the animal bone and found to consist of just over 2050 disarticulated elements, most of the bones being incomplete. This total includes unidentified cranial fragments and 70 unidentified post-cranial bone fragments. The bone assemblage weighed 26.226kg. Detailed metrical data and a catalogue are to be found in the site archive.

Minimum number of individuals

In the first instance it was necessary to consider the probable number of individuals represented among the disarticulated material. This involved the same general approach as for *charnel* material. Bone elements were identified by side and by position and were counted. There was a general absence of bones such as those of the sternum, the hands, the tarsals (except calcanei and tali) and the phalanges of the feet. A bias toward survival (or of collection) of the long bones and of the long bones of the lower limb in particular was evident. Otherwise, bone survival seemed quite haphazard. Bone was found from both sexes and of age groups from foetal through to elderly. Bones of the pelvis exceeded those of the pectoral girdle and both far exceeded those of the spine. There were only nine cervical, 24 thoracic and 21 lumbar vertebrae. They were manifestly as well as numerically from several individuals, at least one of whom was immature.

The bones of the broken skulls indicated the presence of eight mandibles and a similar number of calvaria — not necessarily from the same individuals. In the absence of the bones from the facial region of the skulls it was impossible to match any jaws to the remainder of the skull. It was hoped that the wire attachments would provide guidance that would allow accurate reconstruction of some skulls, but unfortunately this has not proved to be the case.

There were equal numbers of femora from the left and right sides (15 each). In three instances it was possible to pair them off on the grounds of morphology, texture, colour and size. If the bones from three foetuses are added, this provides a minimum number of eighteen individuals present, and up to twenty-seven. This is much larger than in the burials of William Hewson's anatomical collection in Benjamin Franklin's cellar,[30] but only a fraction of the size of the collection from Newcastle Infirmary.[31] Even if the original collection included some complete skeletons this is no longer the case.

Pathology

There were osteoarthritic changes of several joints including sterno-clavicular, wrist, elbow, hip and ankle but quantification would not be illuminating owing to the differential survival mentioned above. Similarly, exostoses appeared on several of the thoracic and lumbar vertebrae, where they were probably the accompaniment of ageing. Two thoracic vertebrae exhibited Schmorl's nodes.

Very few teeth survived in the jaws and none was diseased. Among the empty sockets there was no example of a dental abscess. In the jaws of the elderly, however, the considerable number of teeth lost during life was suggestive of the sequel to dental caries infection.

A piece of cranial vault showed a thickening that could have been the result of Paget's disease. However, for accurate diagnosis, access to the remainder of the skeleton is necessary. This proved impossible and, indeed, there were no manifestations of potential Paget's disease in any of the remaining bones in the assemblage.

The shaft of a right humerus showed evidence of infection (osteomyelitis) just below the head of the bone.

In what was probably a pair of femora from a single individual there was an exaggerated curvature of the shafts. This may represent the outcome of healed rickets but none of the tibiae or fibulae from the site showed any such bowing.

A left tibia showed a slipped-head epiphysis. That is to say, at some time during childhood a trauma had been experienced that damaged the left knee (?or both knees) causing the proximal epiphysis to fail to fuse into the correct position at puberty. This appears to have happened with some shortening of the limb because maximum tibia length of the bone was only 306mm. Furthermore, the shaft of this leg bone was extremely slender. The latter may have been the consequence of atrophy, with the other limb taking on most of the weight-bearing duty,[32] causing a limp (whether or not the tibiae were of different lengths). The missing right tibia could not be identified with certainty.

Discussion of the nature of the sample

The human part of the buried osseous assemblage is not only disarticulated but very deficient in bones from the original skeletons. Whether or not the bones were obtained by illegal exhumation[33] or from criminals executed on the Oxford gallows,[34] either the bones (re)buried were of incomplete skeletons from an anatomy collection or many of the original bones have not survived burial conditions. There is also the problem of the source of the foetal and juvenile bones. In fact, only the smallest bones of the skeleton have not survived (and this may include the missing parts of foetal and infant skeletons), the remainder generally appearing to be in excellent condition. It is likely that the deposited assemblage genuinely represents originally incomplete skeletons.

The collection certainly does not appear to have had a freakish element since there are bones neither of dwarves nor of giants — although the ethnological part of the collection had included the skeletons of African pigmies.[35] Indeed, the longest femur in the assemblage measures a mere 470mm., appropriate to a man 1.73m. or 5ft. 8in. tall — i.e., close to the 17th-century mean of 1.72m.[36] Nor from the surviving examples of pathology does the collection appear to have been dedicated to the illustration of disease processes affecting bone. In general, few diseases that affect bone lead to accelerated decay upon burial so the rare pathology observed probably reflects faithfully what was buried. Of course it could have been the case that there were prize specimens of pathology that were retained rather than being disposed of by being buried with the bulk of the bone here.

Based upon what has survived it is possible that, at least in the latter part of the history of the human bone, it formed part of a teaching collection on the *growth and development* of the skeleton. The collection of bones examined would be consistent with this because, for example, for a long bone it could be seen how the bone grew *in utero*, in childhood, in adolescence (with the epiphyses beginning to fuse), in early adulthood (exhibiting epiphyseal lines where union occurred a relatively short time earlier), through to degeneration of the elderly examples. The anomalous tibia discussed above could fit into this picture because the observed slipped-head epiphysis is by nature a developmental disorder. A bilateral example is known from the current excavation of the large medieval hospital cemetery of St Mary Spital, London, where again it appears to be the result of a serious accident during childhood.[37] On the other hand, could the leg bone be that catalogued confusingly as, 'The tibia or thigh bone [*sic*] of a man who liv'd at Thame (lame several years) growing perfectly together in the joynt'?[38]

Also listed is, 'A woman's skull, with the Suture called Sutura sagittais continued quite to the Nose'.[39] What is intended here is the non-metric trait better known as a persistent medio-frontal or metopic suture.[40] Unfortunately, none of the intact frontal bones show this trait and all attempts at partial cranial reconstruction using the many fragments of skull vault have failed to reveal a metopic suture. Another example, this time of pathology, was, 'The Under-jaw of a Woman, with a large wen upon it'.[41] Most of the mandibles had the chin region preserved but in no case was this (?)benign tumour observed.

The practice of dissection of a human body was prohibited by the church at various times and was generally illegal in England before 1832,[42] the exception being the bodies of executed criminals. The observed instances of sawing open the cranium among the assemblage from Oxford date from before 1832. Certain other bones were sawn but not apparently the clavicles or ribs, which at Newcastle had been the means to gain access to the organs of the thorax, especially the heart.[43] The drilling of holes through the bones and the insertion of wires for suspension and/or display occur at both Nottingham Hospital[44] and Dublin's Trinity College[45] and is not unique to the Oxford laboratory.

Comparative material comes largely from collections that also demonstrate dissection or autopsy examination. Chamberlain mentions several examples but the bulk of the evidence for dissection before its being made legal comes from the south-east of England. Thus, from Christ Church Spitalfields, London, there were seven autopsied burials,[46] while a similar number were found in the lower churchyard of St Bride's Fleet Street,[47] all of 18th- to early 19th-century date. At the late 18th- to early 19th-century pauper's burial place of the Cross Bones Burial Ground, Southwark, there were two skeletons showing autopsy; in one the skull had been sawn open, in the other the neural arches of the vertebrae had been excised in order to gain access to the spinal cord.[48] Recently, a small sample of disarticulated autopsied bone has come to light from Romsey, Hampshire[49] and a single example of an autopsied skull is known from the cemetery of St Benet Sherehog, City of London.[50]

A reference collection displaying gross pathology or signs of amputation has been excavated at Nottingham General Hospital and was collected prior to the establishment of the 1832 Anatomy Act. This Act may have precipitated the reburial.[51] Finally, from Dublin's Trinity College, the bones of *c.* 250 individuals, some with cut and saw marks, and dating to the 18th and 19th centuries were excavated.[52] A small metal canula for dissection was also found.

ANIMAL BONE

By Sheila Hamilton-Dyer

Method

Identifications were made primarily using the modern comparative collections of the author. Confirmation of the identity of exotic species was carried out at the Natural History Museum, London. The excavation was mainly carried out by hand and the contractors had also retrieved bones, with the result that some bones were broken and small bones and pieces were not retrieved. Freshly broken bones were reconstructed where possible but in many cases the missing portions had not been recovered. The bones have been recorded to species and anatomy where possible. Undiagnostic mammal fragments have been classified as horse-/cattle-sized (LAR) and sheep-/pig-sized (SAR). Most of the dog bone fragments were identifiable by general appearance and colour, even when very fragmentary, but it is accepted that a few fragments may have been included in the sheep-size classification. A check was made of all ovicaprid material for diagnostic bones of sheep and goat following Boessneck[53] and by direct comparison with recent material. Measurements were taken using a vernier calliper and are in millimetres. In general these follow the methods of von den Driesch[54] Shoulder heights of the dogs were estimated using the factors given by Harcourt[55] The archive gives further information on the individual bones including butchery, ageing, sex, and measurements not fully detailed in the text.

Results

In total 852 individual bones were recorded, including 52 from a sieved sample (Table 2). The material was assigned to four contexts and has been recorded with these divisions. However, the contexts appear to be essentially the same deposit with some broken bones found to fit across contexts. Several dog bones also appeared to have matching pairs occurring in different contexts. The remains have therefore been analysed as a single assemblage for this report. The material can be treated as three more or less distinct groups:

a) The remains of 'normal' domestic activities and kitchen waste

b) A large group of dog bones

c) Wild species

The domestic remains (excluding dog)

Horse, cattle, sheep/goat, domestic and wild bird and fish bones were recovered. This assemblage represented domestic waste and is fully detailed in archive.

Nine cat bones were found and, apart from one maxilla, are all femora or tibiae. Most bones of cat are quite small and more may have been present and not collected, although the humerus and ulna are of similar size to the hind limb bones. All of the recovered bones are of adult animals. At least three individuals are represented, one with long slim bones. Cat remains are commonly encountered in small numbers in medieval and post-medieval urban deposits, either as scattered individual remains or as complete carcasses. For this

TABLE 2
Species distribution summary

Context	*Horse*	*Cattle*	*Sheep/ goat*	*Pig*	*Cattle-size*	*Sheep-size*	*Dog*	*Cat*	*Badger*	*Raccoon*	*Rabbit*	*Manatee*	*Fowl*	*Goose*	*Duck*	*Plaice*	*Total*
250?	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	***1***
250	7	27	34	3	29	68	590	8	8	5	1	1	3	3	2	1	***790***
250/254	1	1	2	–	1	2	12	–	–	–	–	–	–	–	–	–	***19***
251	3	4	2	–	–	–	13	1	–	–	–	–	–	–	–	–	***23***
252	–	2	–	–	–	–	17	–	–	–	–	–	–	–	–	–	***19***
Total	*11*	*35*	*38*	*3*	*30*	*70*	*632*	*9*	*8*	*5*	*1*	*1*	*3*	*3*	*2*	*1*	*852*
%	***1.3***	***4.1***	***4.5***	***0.4***	***3.5***	***8.2***	***74.2***	***1.1***	***0.9***	***0.6***	***0.1***	***0.1***	***0.4***	***0.4***	***0.2***	***0.1***	

reason the cat bones have been placed in this group, however they do have the same light and pale appearance as the dog bones (see below).

Dog bones

Bones of dog are usually included in analysis of the minor domestic species; here, however, the large number of remains justifies separate analysis, particularly in view of their possible association with laboratory activities.

The dog bones account for the majority of all bones at 632 out of a total of 852. The bones are light in comparison with the density of the cattle and sheep bones and are pale brown or have an almost bleached appearance. Two bones had green staining indicating the proximity of copper alloy, but the staining was generalized on the shafts and not associated with holes for wiring as is the case for some of the human material. Although all or some of the dogs may have been deposited as complete skeletons the bones were largely jumbled in the deposit. Many bones were recovered incomplete with recent damage. The smaller elements are grossly under-represented with only eleven phalanges and a single calcaneum present, whereas the larger limb bones are well represented with 64 complete or partial femora. At least four of the dogs were male, as evidenced by the presence of four baculae. In view of the high number of broken and missing bones it is difficult to ascertain how many dogs were originally present, indeed some may not have been complete when originally deposited. The minimum number of individuals (MNI) represented was calculated by counting the numbers of left and right individual bone elements (Table 3). Broken bones were taken into account, but small portions that may have derived from already counted specimens were ignored. Subjective adjustments were also made for bones of distinctive size or shape that could not be paired. The MNI calculated from tibia, femur and jaws thus gives the highest figure of at least 23 or 24 individual animals. The true figure is, however probably nearer 30 as many bones could not be paired and some were extremely fragmentary.

Almost all of the remains are of mature animals with fused epiphyses but at least one was juvenile, though not a very young puppy. Dog teeth do not display wear as obviously as do the ungulates, cattle and sheep for example, but it can be seen that the teeth in some jaws are well worn and that some teeth have been lost with the alveolus healing over, indicating old animals.

Apart from this slight oral pathology most of the bones show no abnormalities. One femur from a relatively large dog has a distally swollen and bent shaft, suggestive of a developmental disease such as rickets. One of the tibiae appears to have been broken and subsequently healed, leaving the bone bent laterally and with the fibula fused onto the tibia shaft. One of the least fragmented skulls also exhibits pathological damage from trauma, this has a healed depressed fracture in the upper part of the maxilla, in front of the eye. Damage of this type is not uncommon in archaeological material, injuries to the head were probably caused by a kick or being hit with a stick. One of the lumbar vertebrae was abnormal with an extra backwardly projecting lateral process. This has been observed in other dog material and in foxes, it is thought to be a minor developmental aberration. The few other pathological bones exhibit largely age related arthritic changes. A femur shows eburnation of the distal joint with extra bone growth around the edges. Two humeri also have slight lipping of the bone around the distal joint, another has eburnation and porosity of the proximal joint surface. A distal radius shows similar changes.

There are five dog bones with cut marks. One femur and two tibiae have marks across the distal end indicative of disarticulation of the joint. A

TABLE 3
Anatomical distribution of dog

Anatomical element	*NISP*	*%*	*MNI*
skull and maxilla	50	*7.9*	–
Jaw	38	*6*	23
Atlas	3	*0.5*	3
Axis	2	*0.3*	2
other vertebrae	123	*19.5*	–
Ribs	83	*13.1*	–
Sternum	6	*0.9*	–
Scapula	25	*4*	9
Pelvis	33	*5.2*	16
Humerus	41	*6.5*	20
Radius	31	*4.9*	15
Ulna	23	*3.6*	11
Femur	64	*10.1*	23
Tibia	47	*7.4*	24
Fibula	5	*0.8*	5
Astragalus	2	*0.3*	2
Calcaneum	1	*0.2*	1
other carpal/tarsal	2	*0.3*	–
Metacarpus	29	*4.6*	–
Metatarsus	9	*1.4*	–
Phalanges	11	*1.7*	–
os penis	4	*0.6*	4
Total	*632*		

Number of individual specimens (NISP)
Minimum number of individuals (MNI)

humerus has marks across the middle of the shaft and a scapula had been cut along the process, both probably from defleshing. Two of the pelves, both left, had been sawn through the shaft of the ilium, just above the acetabulum. This is unusual and the purpose is unknown.

Although a lot of the bones had suffered damage, many were still measurable, some after reconstruction. It is possible to calculate an estimate of the shoulder height of dogs from the length measurements of the limb bones. The estimated heights from the bones in this collection vary from 0.317m. to 0.713m. (dog shoulder height estimations are detailed in archive). The estimates and other measurements represent quite a wide range of sizes but are concentrated on those of 'small' to 'medium' size by today's standards. A few bones, including a partial skull, appear to have belonged to a single large, well-built dog of approximately 0.71m. This is just a little smaller than a modern Great Dane. The smallest animal is estimated to have been approximately 0.31m. at the shoulder. This is similar to many of the smaller breeds today, the Jack Russell for example. Most of the limb bones are of 'average' proportions, neither slim nor heavily built. Comparison of the length and shaft width of tibiae is given in archive. While most of the values group quite closely there are a few outliers, the two largest values are those thought to be a pair, from the largest dog. The shortest tibia is noticeably broader in comparison with the others. This bone is also slightly bent, as are a pair of short sturdy humeri as well as a radius and ulna. These bones may all be from a single individual. Several small breeds today have this type of stocky build with slightly bowed legs and it has been noted in British material at least as far back as the Roman period.

While many lower jaws were recovered with minimal damage there are few intact skulls and upper jaws. Those that survive, or could be reconstructed, represent a variety of sizes and types, though again, as with the limb bones, there are few extreme examples. The largest may belong to the same individual as the pair of large tibiae. Some of the crania have relatively small dorsal crests, which give the individual animals a slightly rounded head. The smallest, and one of the best preserved, of the skulls was found with jaws. This animal had a rounded head with almost no dorsal crest and a foreshortened muzzle. As is common with short-faced dogs, some of the teeth are maloccluded. This skull is comparable in size with a modern Yorkshire terrier but with a slightly broader head; it does not have the extreme form of the Pekinese but is perhaps closer to a King Charles spaniel or similar type.

It should be stressed that possession of certain traits that can be seen in modern breeds does not imply that these remains were of animals of the same appearance and direct ancestry; modern pedigree breeds are the result of intensive selection over a long period of time. Variation in dogs has been observed and encouraged by selective breeding for many centuries world wide.[56] Nevertheless, many contemporary art works do illustrate a variety of dogs from large hunting hounds to small lap dogs. It is, therefore, extremely interesting to examine a group of material from a short period of time that can be subjectively analysed.

Despite its fragmentary and incomplete nature this assemblage of dog material has potential for further metrical and morphological study.

Wild mammals

There are fifteen bones of wild mammals in the collection. The single bone of rabbit could be classed as wild or domestic as this species was deliberately introduced and managed in warrens. By the post-medieval period it had escaped and established itself as part of the British fauna. Bones of rabbit are not uncommon in medieval and post-medieval deposits but have to be treated with caution; as the rabbit can easily burrow though older deposits some bones may be intrusive.

The most numerous of the bones are eight of badger, assumed to be the native European badger. At least two individuals are represented, one subadult another fully mature. The bones recovered are the larger, more easily noticed elements of the legs and pelvis. The two humeri, from different individuals, and one of the pelves had been cut by a knife. The marks do not appear to be from skinning or disarticulation but were probably made during removal of flesh. This animal has long been exploited for its coarse fur, used as brush bristles, but the fat and meat have also been used. The badger has also been subject to the practise of baiting with dogs.

There are five bones of a similarly sized animal: the left mandible, pelvis, femur, tibia and part of the right tibia. Morphologically these bones are clearly from a member of the Carnivora. In some respects the bones are similar to badger, but with proportionally longer legs. The mandible is smaller and distinctive. The dental formula is the same as the badger with all four premolars but only two molars. Unlike the badger, the first molar, the carnassial, is short and broad and the last molar in the jaw, M2, is almost as large with two distinct root spaces (the actual tooth is lost). The canine, 4th premolar and first molar all show considerable wear. The first and second premolars had been damaged antemortem, while the third premolar and second molar had been present but were not recovered. The limb bones all have fused epiphyses. The remains were compared with carnivore material at the Natural History Museum and it was found that they compare well with specimens of the common raccoon, *Procyon lotor*. This species is extremely variable and the excavated bones are similar in size to the smaller specimens and are more sculptured than some (the amount of sculpturing may be related to age and diet). The raccoon is a native of North America and is widely found there.[57] This animal, with its distinctive bandit mask, and ringed tail is an inquisitive omnivore, which lives up to ten years or more. It would have been relatively easy to keep alive on a long sea journey and to keep in captivity, the worn teeth certainly indicate that it had a long life but not how much of this was spent in captivity. Like most mammals the raccoon can be eaten and the fur utilized. The pelvis and femur have several clear knife cuts. On the pelvis these are round the acetabulum and are consistent with removal of the femur, which has corresponding cuts around the caput. The femur also has diagonal cuts across the front of the shaft, perhaps from flesh removal. This type of disarticulation mark can be seen in butchery for meat but could also result from preparation of a carcass for a skeleton collection.

The final bone in the collection is also unusual. It is the right radius of an immature animal with both epiphyses unfused but the bone is very dense, unlike the bones of most young animals. There are two diagonal knife cuts on the medial aspect of the shaft. This bone is thought to belong to a member of the Sirenia, the manatees and dugong, commonly known as sea cows. These animals have dense bone, sometimes lacking marrow cavities, for balance in shallow water.[58] There are four living representatives of this group, a fifth was discovered and rendered extinct in the 19th century. The bone was checked with recent material held at the Natural History Museum and found to match *Trichechus senegalensis*, the African manatee. This animal is found around the coast of West Africa. Sea cows have been exploited for oil, meat, hide and teeth. It has also been suggested that these animals are partly responsible for tales of mermaids.[59] An inventory of the anatomy school *c.* 1675 mentions a number of exotic animals including 'Sirenis manus', in Hearne's list of 1705–9 the specimens are mainly given in English and number 162 is listed simply 'Sea calf'.[60] Cole[61] states that Caspar Bartholin (1655–1738) described the forelimb of a 'Syren' and one was held at 'the Anatomy School at Oxon'. It is tempting to suppose that this bone represents the last remnants of this specimen, although there are no remains of any of the other exotic species listed and the inventory does not contain dogs.

Discussion

The collection appears to derive from distinct sources. Firstly there is a group of material similar in nature to other assemblages found at most medieval and post-medieval sites in Southern England. This is mainly of cattle and sheep with some fragments of other animals including horse, pig, cat and poultry and results from domestic and other 'normal' activities.

The rest of the material is more difficult to interpret. The two exotics, raccoon and manatee, are clearly not from the usual sources of kitchen and butchery waste, nor of the indigenous environment. It seems highly likely that these are curios of some type and probably directly related to the laboratories of the anatomy school. In the 18th century there was extensive trade both with the west coast of Africa and with America, particularly involving slavery, and both of the exotics could have been collected directly or traded as curios. The racoon may have arrived as a live specimen, perhaps even a pet. Given the problems of keeping a large aquatic mammal alive, the manatee is more likely to have arrived as a prepared specimen.

To the author's knowledge this is the first reported occurrence of these two species from a British archaeological site. Exotic species are rarely encountered, but there are a few instances, for example turtle and a capuchin monkey from London.[62]

Given the rarity of the manatee bone (perhaps a unique find) and the references to manatees described above, it seems highly likely that the bone does indeed represent the specimen listed as part of the Anatomy School Collections.

Interestingly, the excavation of a similarly dated human anatomy collection from Dublin's Trinity College also produced evidence of exotic animals; this Irish site included camel bones.[63]

The group of dog bones is perhaps the most difficult to place. Dog skeletons are not uncommon in archaeological material, either from natural mortalities or the results of purging a surplus in the local dog population. However, the sheer number of animals, at least 24 and probably more, is unusual. The appearance of these bones is also comparable with the human remains, whereas the bones assumed to be of domestic refuse are more typical of other material from Oxford and other urban sites.[64] The number of limb bones and jaws suggests that the remains were of complete animals, the missing feet and other elements being overlooked by the various excavators because of their small size. The bones do not, however, represent whole carcasses as parts of some bones were recovered from different contexts and probable pairs were also found dispersed. If these bones do result from laboratory activities they do not appear to be from mounted skeletons. Unlike the human skeletal material there is no evidence amongst the dog bones of drilled and wired specimens, and it would be very difficult to present a skeleton without some method of connecting the bones together. Copper staining occurred on only two of the bones, most probably from contact with items in the deposit and is not an uncommon occurrence. The two sawn pelves are, however, unusual and some of the human bones had been sawn. The lack of young dogs and puppies (bar one immature animal) does not suggest a collection illustrating development. A variety of forms and sizes is represented, although most of the material is of 'average' dogs and the whole group might easily represent the population in the local area. The group, therefore, remains enigmatic but on balance is probably associated with laboratory activities.

CLAY TOBACCO PIPE

By PAUL CANNON

Thirty-one fragments, weighing 164g., were recovered from contexts immediately below the paving slabs within the basement terrace to the rear of the building (Table 4). The material included several complete or nearly complete bowls. At least one of these seem to match Oswald's Oxford Type B.[65] These have a distinctive angled profile, 'button' finished rims with rouletting and chunky, rather clumsily finished spurs, *c.* 1650–90. Other bowls include one in the form of a London Type 14/15,[66] *c.* 1660–80, plus several incomplete bowls of similar dates. Two fragments of thinner bowls with *cut rims* were also recovered. The change from rounded button-finished rims to straight cut rims occurred *c.* 1700. Unfortunately, both are too small to say precisely what bowl forms they represent, but they can no doubt be placed somewhere in the broad period *c.* 1700–70. If the pipe material is part of a single dumped deposit the earliest date at which this could have occurred is therefore *c.* 1700.

Only one maker's mark was found and this was from an imported pipe from the Broseley area, Shropshire. The bowl, which survives virtually intact, is of Atkinson's Type 4B.[67] It has a long well-formed spur stamped on its base with the initials AB in a small circular mark. This is one of several marks known to have been used by Andrew Bradley *c.* 1690–1720.[68] Another feature of this pipe is that it is beautifully and evenly polished all over. The presence of high quality, marked Broseley pipes can also be seen at St Ebbe's, Oxford.[69] Stroke polishing is a feature on approximately half of the pipes recovered from the Ashmolean site. Polished pipes cost more to produce and their presence, along with the Broseley example, reflect the more expensive tastes of smokers in Oxford generally.

TABLE 4
Clay tobacco pipes: summary information

Context	*Stems*	*Bowls*	*Marks*	*Dates*
250	20	5	–	*c.* 1660–1770
251	2	2	AB	*c.* 1660–1770
250/54	1	1	–	*c.* 1650–90

Metalwork

Eleven pieces of metalwork were recovered: six heavily corroded iron hand-cut nails that pre-date the 19th century; a piece of lead 48mm. long and 8mm. wide; a copper-alloy rod 80mm. long and 2.5mm. in diameter; a piece of copper-alloy sheet 25mm. by 21mm. and less than 1mm. thick; and two pieces of copper-alloy sheet folded in half and corroded together. The two pieces were 56mm. square and less than 1mm. thick.

In addition, a copper-alloy vial, 112mm. long with an everted lip and a mouth diameter of 14mm. (Fig. 7), is very likely to have been part of the laboratory equipment of the later 17th to 18th centuries.

Ceramic building material

Sixteen pieces of brick weighing 6.47kg. were recovered. These pieces are all unfrogged and probably pre-date the 19th century. A single whole brick was recovered, measuring 220mm. x 104mm. x 50mm. (9 x $3\frac{3}{4}$ x 2in.). These dimensions and the known construction date of the Old Ashmolean would suggest a date of manufacture in the last half of the 17th century. Harley[70] has noted that Sir Christopher Wren (1632–1723) favoured 'rubbed and guaged' brickwork, in which bricks, originally $2\frac{1}{2}$in. thick, were rubbed down flat to about 2in. and used with very thin mortar joints. It is known that Wren and Ashmole moved in the same social circle and it is possible that Wren provided advice to the architect Thomas Wood (*c.* 1643–95).[71]

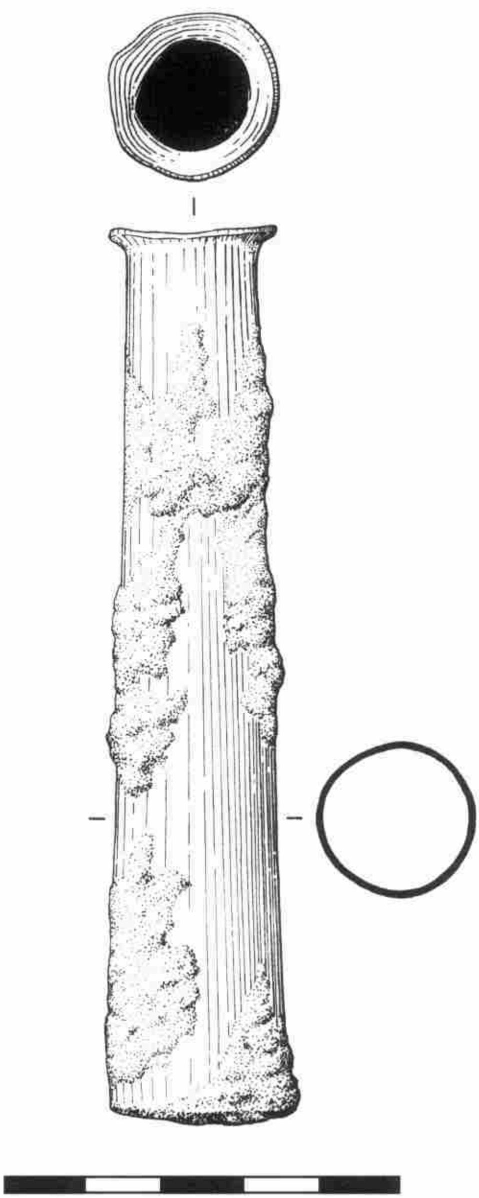

FIG. 7
Copper alloy vial.

Glass

Forty-seven pieces of glass weighing 696g. were recovered. Of this total, 30 were small pieces of window glass and can only be broadly dated as post-medieval. A further sixteen were either pieces of green wine bottle or parts of clear wine glasses. The multipiece manufacture of one of the wine bottles suggests a date from the 17th to early 19th century. Also recovered was a single, broken, clear glass hollow rod (weight 28g., length 90mm., external diameter 13mm. and internal bore 5mm.). This piece does not seem to have had a domestic function and should perhaps be considered part of the laboratory equipment from the later 17th or 18th centuries.

Shell

Eight pieces of scallop shell weighing 88g. were recovered. These are common in medieval and post-medieval contexts and should be regarded as food refuse.

Stone

Three pieces of stone weighing 702g. were removed from the site. Two were pieces of limestone, perhaps associated with the construction of the Old Ashmolean, and the third was a piece of quartz with a gold or pyrites inclusion, which may have been a discarded geological specimen from the Museum.

Coal

The total of 336g. of coal, charcoal and clinker found on the site could have come from a variety of sources, including the furnaces of the laboratory.

GENERAL DISCUSSION

The deposits recovered from the rear of the Museum appear to have been placed in the later 18th century and comprise human and animal skeletal parts, domestic pottery, chemical apparatus, clay tobacco pipe, glass, food refuse, fuel and building material. A synthesis of the archaeological and historical information particular to this site has provided unusually fine resolution to the activities at the Old Ashmolean Museum in the late 17th and 18th centuries. The material is discussed by artefact type and an attempt has been made to embed archaeological data within a local historical context.

It is important to emphasize that the Ashmolean Museum and School of Natural History were housed on the floors above the *Officina Chimica* or Laboratory and that there was no internal connection between the two parts of the building before the 19th century. It should also be borne in mind that chemistry was taught in the context of medical education in the 17th and 18th centuries and was studied alongside anatomy in the basement.[72]

Anatomical remains were probably first exhibited in the Old Ashmolean from at least 1683/4 when the building was opened and the Philosophical Society of Oxford was founded. The 'List of Objects Exhibited in the Anatomy School', drawn up *c.* 1675,[73] notes three human skeletons and a cranium amongst the collection. It seems that part of this collection was brought to the newly opened Ashmolean just after 1683, and lectures were also given in a room in the Museum.[74] 'An Italian' is known to have taught anatomy in the basement as early as 1691[75] and a fuller description of an anatomy lecture conducted in 1710 was given by Zacharias Conrad von Uffenbach:

> In the afternoon [of August 28, I was taken] to their countryman, Dr. Lavater of Zurich, . . . to hear the beginning of a Cursus Anatomicus. As he had only recently obtained a license to lecture, and had no corpses to dissect, (which he was hoping to obtain from London), he began with Osteology. He certainly gave an excellent account of the production, nutrition and classification of the bones, and he is said to have uncommon knowledge and skill in Anatomy. Among other things he showed the production of bones on the skull of an embryo very clearly, how, the fibres are quite soft at first and only in time acquire hardness and a bony nature per accretionem; and further how the fibres for greater consistency and firmness, all run from the centre to the periphery . . . The place devoted to this Cursus Anatomicus is a small vaulted room under the Ashmolean and behind the laboratory, and well adapted to Anatomy on account of the coolness.[76]

Anatomy was taught at the Old Ashmolean until the middle decades of the 18th century, the last teacher being John Smith.[77] It is noteworthy that Dr Lavater was hoping to import corpses from London and that his osteology lecture demonstrated skeletal growth and development (see also White, this article).

The collection, scientific use and disposal of human remains was a sensitive social issue in the 17th and 18th centuries and, perhaps to a lesser degree, remains so today. There are a number of possible scenarios that might explain the presence of more than 2000 human bones recovered from a refuse dump, below paving slabs, near the basement door of the Old Ashmolean Museum.

Illegal exhumation, directly sanctioned by the University, seems the least likely source of human remains for dissection (but see White, above). The University of Oxford would not need to resort to body snatchers for its supply of cadavers; in the 17th and 18th centuries, a Royal Act gave legal access to corpses fresh from the Oxford and Abingdon gallows. An Act of Charles I states that:

> . . . the Tomlins lecturer is impower'd every spring, to demand the dead body of any condem'd Malefactor, suffering death within one and twenty miles round Oxford, before it is interr'd by directing his Precept or Warrant to the Sherriff, Under-Sheriff, or his Bailiffs, etc for procuring and delivering up the same; which Body shall be dissected by a skillful Chirurgeon in the presence of this Professor, who is publickly to read thereon, and to shew and describe the Situation, Use, Nature and Office of all the parts of the Body, at four distinct Lectures, as prescrib'd in the Statute made for this purpose. This Lecturer is also every Michaelmas term to read three distinct Lectures on a Skeleton, and to give an account of the Bones and their Office, Situation etc.[78]

The stipulated catchment radius of 21 miles neatly excluded the towns of Reading and Newbury, yet managed to encompass most of the old county of Oxfordshire.

This corpse gathering practice continued in Oxford, and elsewhere, through the 18th century. More bodies were made available to anatomists by a 1752 Act of Parliament giving discretion to judges to substitute dissection for gibbeting in chains for '. . . better Preventing the horrid Crime of Murder'.[79] It is recorded, for example, that in 1777 the pelvis of a murderer named Strap was dissected at the Christ Church Anatomy School. Strap was hanged two years earlier, in March 1775, at Oxford.[80]

Public abhorrence at this body gathering and dissection was articulated in various ways. William Harvey, in *The Conclave of Physicians* 1686, reports criticism of anatomists thus:

> They flay dogs and cats; take livers, lungs, calves-brains, or other entrails, dry, roast, parboil them, steep them in vinegar, etc, and afterwards gaze on little particles of them through a microscope;-then obtrude to the world in print whatever false appearances gleamed into their eyes; and all this to no end, than to beget a belief in people that they who have so profoundly dived into the bottomless pores of the parts, must undeniably be skilled in curing their distempers.[81]

J. Bellers, an 18th-century Quaker, noted the problems faced by students attempting to obtain a body to dissect at Oxford in 1714 on account of 'the mob being so mutinous'.[82] One particularly disturbing account of attempts by Oxford students to press their rights under the statutes is given by Hearne in 1721 'When the body of a criminal was not released by relatives, the students seized the cadaver within its coffin as it was being carried for burial by the dead persons parents, and took it to Exeter College for dissection'.[83]

The denial of a grave for an executed wrong-doer was an integral part of the punishment, and dismemberment by anatomists made them *de facto* agents of the law. Consequently, early medical researchers received royal indulgence and encouragement but were viewed by the wider public with revulsion.[84] Dissection was described by the 1752 Act as a 'further Terror and peculiar Mark of Infamy'.[85] The taking of a body from the gallows for dissection not only denied relatives the social functions of burial but prevented the curative properties that a gallows corpse was felt to give.[86]

Negative contemporary reactions must be set against the establishment of empirically-based knowledge of nature and the improvement of the human condition. The 17th-century antiquary Anthony Wood commented on experimental natural philosophy in relation to the Ashmolean foundation 'the designe of this building being not onlie to advance the studies of true and real philosophy but also to conduce to the uses of life and the improvement of medicine'.[87]

Other human material may have been donated, though not necessarily by will of the deceased. Foreign trading acquisitions, surgeons, mid-wives and abortionists may have contributed to the stock of bodies required by Oxford's scientists, and of course purchase from 'Resurrection Men' cannot be entirely ruled out. The remains of children and foetuses could have also been obtained by sale from parents and it is recorded in the 1790s that a gang of 'Corpse-Stealers' in Lambeth, London was selling children's bodies for 'six shillings for the first foot, and nine [pence] per inch for all it measures more in length'.[88]

The human remains may have been obtained by physicians associated with the Ashmolean. At least two of the Keepers in the later 18th century were also Governors of the Radcliffe Infirmary (William Huddesford, 1755–72, and William Sheffield, 1773–95).[89] John Smith, the last anatomy teacher at the Ashmolean, was one of the original physicians at the Radcliffe when it opened in 1770.[90] Earlier in the century, Richard Frewin (1681–1761) was chemistry professor at the Ashmolean in 1708 and was also Oxford's leading general practitioner.[91] An advertisement in Jackson's *Oxford Journal* of 18 August 1753, read, 'to inform the Publick That on the first Day of Michaelmas Term next, there will begin at the Laboratory under the Museum, A Course of Anatomy By Richard Lummy, formerly Bone-scraper to several eminent Anatomists, and now Retailer of Scandal to the Old Interest'.[92] The satirical article goes on to berate the lecturer for having 'taken no degree in Physick, nor ever studied the Science of Anatomy in the vulgar mechanical Way'.[93] Simcock has identified 'Lummy' with Frewin.[94]

Some of the human bone recovered from the excavation seems to correspond with a published catalogue of the collection in the Anatomy School in October 1709, some of which is clearly donated and some is from judicially killed individuals. It is possible that item 376 corresponds with the left tibia with slipped head epiphysis already discussed (see White above). Those entries marked with 'P' were also present in Pointer's *Oxoniensis Academia*, 1749.[95] It may be that some material was transferred to the Ashmolean at a later stage.[96]

P175. Two sceletons in Green Frames, the one of a Man, the other of a Woman that had 18 husbands. [These were seen by Evelyn at their former home of St John's College Library and said to be 'finely cleansed and put together']
176. Artificial sceleton [Hearne in 1706 noted that 'One of the sceletons in the Anatomy schoole was wired by one Wells, a smith in Cat Street; by which he became an eminent bone-setter and a good surgeon.']
178. Sceletons of a man and woman.
189. A sceleton according to the natural motion made up by Theophilus Poynter [a surgeon also living in Cat Street] with the skin taken from it, whereon is the hair and nails. [Donated by Sir Robert Viner, Lord Mayor of London 1683–84]
25. A Woman's skull, with the Suture called Sutura sagittalis continued quite to the Nose.
P203. Skull of a man out of which there grew 5 horns.
P204. An Irish skull with moss upon it.
319. A piece of the skull of a man, who had his head cleft.
37. The Under-jaw of a Woman, with a large wen upon it.
177. Arm of a man cutt off, and the man living afterwards. [Donated by Charles Atkins, chirurgeon in Oxon, August 1696] (Right Arm of a Woman) [?] Dns. Richardus Dashwood, juvenis summae spei, Dni. Roberti Dashwood Eq. Aur. filius, ex amore erga rei medicae atque antiquariae studiosus, dono dedit, brachium dextrum feminae cujusdam elegantissimae, morte immatura praerepte in Italia erutum. Annos autem ccc ut fertur sepulta fuerat.
315. Several bones of a Man, hung up on the South part.
376. The tibia or thigh-bone of a man who liv'd at Thame [lame severall years] growing perfectly together in the joynt. [Donated by John Williams, sexton of Thame, 1709]

212. A Pigmy. [Seen by Bentham in 1694]

Item number 37 was noted again in 1710 by Uffenbach and described as the 'Lower jaw of a woman, with a great swelling as big as a Welsh nut. She is said to have suffered severe toothache'. Item number 204 was probably seen in 1710 and described as either 'A petrified skull, more encrusted than the one at Cambridge' or 'A Fine Cranium overgrown with moss'. Item number 175 was seen by Uffenbach and described as the 'Skeleton and stuffed Skin of a Woman who had eighteen husbands, and, because she killed four of them, was hung'.[97]

Two further recorded human specimens that were acquired by the Ashmolean collection in the 18th century are 'Os monstrosum (forsan) humani capitis [donated by L. Horner in *c.* 1757]' and 'Cadavar infantis Balsamo conditum [donated by Isaac Hughes, merchant, London, Crutched Fryars in 1766]'.[98]

Anatomy continued to be taught at the Museum until the Christ Church Anatomy School was founded in 1767 and John Smith retired.[99] It would seem reasonable to suppose that the anatomical teaching collection held at the Museum then became redundant. Some of the prize specimens of pathology may have been dispersed, perhaps to the new Anatomy School, and other less instructive, or simply old, human remains may have been discarded. The remains excavated in 1999 very likely represent parts of the 17th- and 18th-century demonstration collection and perhaps discarded anatomy specimens used at the laboratory of the Ashmolean. The dumping of these objects in the basement terrace in close proximity to the laboratory door probably occurred after 1767 when the Christ Church Anatomy School opened and immediately before the laying of the paving slabs. It is very likely that human remains, so obvious that the modern building contractors recognized them as such, would not be allowed to lie exposed to view for long. There is a problem if we accept the probable date of deposition of the pottery (Blinkhorn above), as the earliest date for some of the pottery is post-1770. Perhaps the redundant skeletal parts were stored in the Museum for a few decades until a suitable opportunity to dispose of them arose, such as the renovation of the laboratory that occurred on the appointment of Martin Wall as first holder of the new Readership in Chemistry in 1781. Wall gave his inaugural 'Dissertation on the Study of Chemistry' on 7 May 1781.[100] The revival in chemistry teaching at this time was associated with the foundation of the Radcliffe Infirmary, which was opened in 1770.[101]

The antiquary Smart Lethieullier wrote to the newly appointed Keeper of the Ashmolean, William Huddesford, in 1755 stating, 'I cannot help expressing the pleasure I have in hearing yt you earnestly apply yourself to the Digesting into some order the confus'd heap of natural Bodies which are under your care in the Musaeum. You are no stranger to my having long wish'd to see that Repository in order'.[102] Huddesford seems to have tidied the Museum by 1768 when a letter congratulating him was received from A. C. Ducarel, 'I cannot conclude this letter without acquainting you with the infinite satisfaction I lately had in seeing the great improvements you have made in the Museum since it has been under your care'.[103]

The improvements and possible clearing out that occurred at this time refer to the Museum at the top of the building rather than the Laboratory in the basement, but it is significant that this correspondence occurred just one year after the removal of the Anatomy School. It is conceivable that Huddesford had unwanted human remains gathered together and did not have the inclination to throw them out as if they were regular refuse. The author has encountered similar sentiments: where undertakers took the opportunity of disposing of unwanted human ash in an archaeological trench dug on their premises rather than 'throwing it away'.

As with the human bone, it would seem that some of the animal remains formed part of the anatomy and dissection collection of the Ashmolean Museum and Laboratory in the 17th and 18th centuries. The domestic animals represented (sheep, cattle, rabbit, piglet, plaice and probable horse) could be explained as food waste, especially as clear butchery marks were visible on some of the sheep and cattle. The cats could have been pet burials but, in the context of the Old Ashmolean as a teaching school, these were more probably anatomy specimens and might be considered with the remains of at least 23 dogs. Hamilton-Dyer (see above) has noted the 'bleached' appearance of both the dog and cat bones.

Some of the dog remains appeared to be articulated at the time of excavation and these animals would have provided a readily available and less morally charged source of anatomy material (see William Harvey's comments above). The badger remains were probably also part of the anatomy collection.

The two exotic species, common American raccoon and African manatee, are unique examples in British archaeology and indicate the worldwide aspect of 17th- and 18th-century collecting by the Ashmolean. The single manatee bone is from a fore limb of a young animal and may correlate with the *Sirenis manus* listed as part of the 'Objects Exhibited in the Anatomy School' *c.* 1675[104] and with an item in the 'Account of the rarities in the anatomy School', 1709, *A Mermaid's hand*.[105] This object is listed with the human remains, parts of which are suggested to have formed an element of the archaeological record (above). Uffenbach noted, 'The Hand of a supposed Siren, dried. It is about half the length of a man's hand, and is quite like one' when he visited the Anatomy School in 1710.[106] The Danish anatomist Bartholin also mentions the Oxford manatee fore limb and states that a specimen 'is also kept in the Anatomy School at Oxon'.[107]

The animal anatomy exhibits and the domestic food refuse were very probably deposited under the paving slabs within the basement terrace at the same time as the human remains were disposed of, that is, around 1781.

The pottery assemblage provides the strongest strand in the contention that the majority of the artefact and remains collection was deposited in the later 18th century, and more specifically *c.* 1780 (see Blinkhorn above). There are, however, a number of chronological problems peculiar to the role of the Old Ashmolean at the forefront of pottery innovation and experimental science in the later 17th and 18th centuries.

John Dwight of Christ Church, Oxford, made significant discoveries in the production of salt-glazed Stoneware and his Fulham factory was making sufficient quantities in 1676 for the London Company of Glass-Sellers to contract themselves to buying Dwight's English wares at the expense of foreign wares.[108] Dwight sued Aaron Wedgwood in 1693 for infringing his patents of 1672 onwards. It is likely that Dwight learned the basics of the salt-glaze process from the provincial peasant potter Aaron Wedgwood, in true obedience to the Boyle-Plot dictum of gathering utilitarian scientific knowledge from the noble master craftsmen (or to put it another way — stealing from the illiterate).[109] Robert Plot (1640–96), the first Keeper of Ashmole's Museum, noted furthermore that Dwight 'hath discovered also the mystery of the Hessian wares, and makes vessels for retaining the penetrating Salts and Spirits of the Chymists, more servicable than were ever made in England, or imported from Germany itself'.[110] Considering the close links between Dwight and the Boyle-Plot circle of chemists in Oxford immediately prior to the founding of the Ashmolean *Officina Chimica* in the basement laboratory in 1683, it is highly likely that Dwight supplied the laboratory's original ceramic equipment, and that the tall triangular crucibles of Hessian Ware and perhaps the salt-glazed Stoneware mug, excavated from very near the door of the later 17th- and 18th-century laboratory, were of Dwight's manufacture and may even pre-date the earliest known English made examples. The chemical analysis of the residues in the recovered vessels (see Salter above) would support the idea that experimental work into glazes for pottery was indeed being carried out at the Ashmolean laboratory prior to 1781. It is further suggested that the presence of barium and strontium sulphates, found on the recovered vessels might reflect the interest of later 18th-century chemists in fireworks. The sulphates can be used to produce coloured effects and it is on record that James Sadler, assistant in the Laboratory in the 1780s, lectured on 'philosophic fireworks' in Oxford in 1789.[111]

The fractious relationship between John Dwight and Aaron Wedgwood did not hinder Josiah Wedgwood's interest in laboratory science and he was associated with a circle of scientists in the Lunar Society throughout his career, including the Ashmolean chemist Thomas Beddoes (1760–1808) in the mid to later 18th century.[112] Wedgwood's Creamware was used to manufacture both commercially successful tablewares and a range of scientific wares. The domestic wares were chemically perfected in 1763 and marketed as Queensware, although the simpler cheaper versions of it were probably still produced for the staple mass market.[113] Blinkhorn (above) has noted that domestic Creamwares were decorated until the 1770s and 1780s. The seventeen sherds from the excavation were all plain and, if they did have a scientific function, then they might be a decade or two earlier.

When Martin Wall became the first holder of the new Readership in Chemistry in 1781, the Laboratory was renovated and unwanted anatomical remains, chemical vessels and domestic refuse were probably covered up by limestone paving slabs. Wall's father, John, had studied at the Ashmolean laboratory, graduating in 1739, and his learning there allowed him to set up the Royal Porcelain Works in Worcester.[114] As Simcock[115] has noted 'Economic Geography' was a staple and recurrent part of Oxford chemistry courses from the later 17th century to the early 19th century. It may be relevant that John Wall's porcelain works used Cornish kaolin from the mid 18th century onwards and it is also possible that the excavated crucibles were manufactured from a similarly sourced clay.[116]

The assemblage of chemical vessels differs from the domestic pottery assemblage in that the former are mostly complete (any breakage tended to occur immediately prior to archaeological intervention), while the latter are generally small sherds from vessels broken before deposition. It is known that the basement terrace and the Museum were constructed over the medieval town ditch that was backfilled after the Civil War. Work on the building lasted from 1679 to 1683.[117] The pottery that predates the Museum's completion could come from a variety of sources; residual pieces from the town ditch, broken vessels within domestic refuse dumped into the basement terrace from either the Museum, or from neighbouring Exeter College. Keepers and teachers of the Old Ashmolean, as well as their families and cooking servants, were sometimes resident in the building in the early 19th century[118] and this may also have been occurring in the 18th century. The single piece of Roman pottery may be simply residual, but could have come from the Museum's collection of antiquities.

The recovered clay tobacco pipe falls into four chronological groups: 1650–90; 1660–80; 1690–1720; and 1700–70. A clay pipe was a fragile object and could be expected to last only a few weeks of use.[119] Disregarding the three later pieces (that may have been deposited by people smoking outside the laboratory in the 18th century), it is not unreasonable to presume that these pipes were smoked by workmen engaged in the construction of the Museum.

The generally unbroken retorts, crucibles, flasks and bottle would seem to have been placed outside the laboratory immediately prior to the laying of the paving slabs, which probably occurred in 1781. These vessels are not in themselves accurately datable. The open crucibles could date from the 14th century onwards, the tall triangular Hessian Ware crucibles could have been made from the 16th century onwards (but see the discussion above). Only a single fragment of graphite crucible is more closely datable, not being previously known in Britain until the mid 18th century. However, given the known international links between European laboratories in the 17th and 18th centuries, this date must be treated with caution.

On its completion in 1683, the laboratory was described by Anthony Wood (1632–95), who probably drew on the 1684 edition of Edward Chamberlayne's *Angliae Notitia*:[120]

> [The elaboratory is] . . . perchance one of the most beautiful and useful in the world, furnished with all sorts of furnaces and all other necessary materials in order to use and practice, which part is with very great satisfaction performed by Mr. Christopher White, the skilful and industrious operator of the University, who, by the direction of the Professor [Robert Plot], shows all sorts of experiments chiefly relating to that course, according to the limitation established by the order of the Vice-Chancellor.[121]

Robert Plot, the first Museum Keeper, writing on 8 October 1695, to Edward Lhuyd (1660–1709), the second Keeper, described the equipment in the laboratory:

> As for the Goods or Utensils in the Laboratory: the great Alembic, Barrel and Worm were bought by the University: and so were the great Pewter and small Copper Heads of the Balneum Mariae, and all the Iron pots at the bottom of the Chappel Furnaces. All the ironwork of the Alkanor, and Great Reverberatory was also bought by the University, and all the Furnaces buylt at their charge. The great iron digester at the West end of the Laboratory is also theirs; and perhaps some things more that are now out of my mind, the small earthen and Glasse-vessels being onely Mr. Whites. If I were with you I could determine this matter with more accuratly.[122]

Twelve years earlier, Plot was paid £17 9s. for 'some vessels etc. for the Laboratory', and White received £44 17s. for 'Tin Copper and Iron Vessels similarly'.[123] The possibility that some of these objects may have been recovered cannot be overlooked, and should be seen as the smaller components within the context of the large apparatus of an impressively equipped laboratory. A good idea of the cost of these smaller vessels is given by the diary of Abraham De la Pryme, writing in February 1694, 'This day I recieved twelve little retorts and three receivers from London, to try and invent experiments, and all things that I do I intend to put down in a proper book. The retorts cost me 4d. a piece . . . and the receivers 6d.'.[124]

In conclusion, it would seem that the deposition of artefacts and remains in the basement terrace of the Old Ashmolean is best interpreted as a clear-out of unwanted equipment and specimens relating to the function of the building as both museum and experimental laboratory. The finds date to the 17th and 18th centuries and were most likely placed here in 1781. Later renovations to the fabric of the building could conceivably have provided a disposal opportunity. John Kidd, a chemistry teacher from 1801–22, lived with his family in the basement and wrote to the Vice-Chancellor in June 1817, thanking the university for fitting the laboratory as a temporary residence, and agreeing to return it in *statu quo*.[125] The pottery assemblage could, arguably, date to the early 19th century, but it is the relocation of the Anatomy School to Christ Church in 1767, the opening of the Radcliffe Infirmary in 1770 and the appointment of Martin Wall to the Readership in Chemistry in 1781 that would indicate a later 18th-century deposition.

The recovery and analysis of archaeological deposits from Britain's oldest public museum has an ironic resonance of Ashmole's foundation Statutes in that a measure of 'the knowledge of Nature' has been acquired through 'the inspection of Particulars'.[126]

ACKNOWLEDGEMENTS

The authors would like to thank the following individuals and organizations: Michael Frith, Surveyor's Department, University of Oxford, for commissioning the work; Jim Bennett and Tony Simcock, curator and librarian of the Museum of the History of Science; Peter Morris of the London Science Museum and Paul Craddock of the British Museum for their helpful discussions with respect to the industrial ceramics from this site. Further thanks go to Chris Cumberpatch for the provision of information in relation to the chronology of the domestic wares; to the Mammal Group, at the Natural History Museum, London; and to Lesley Collett, who drew the artefacts. At Thames Valley Archaeological Services: Jamie Preston and John Saunders contributed to the fieldwork; Leigh Torrance produced the illustrations; Steve Ford and Melanie Hall-Torrance edited the text; and Nicola Powell, Jennifer Lowe and Kate Taylor prepared the finds and archive for deposition.

NOTES

[1] Josten 1966, IV, 1821, no. 9.
[2] Daniel 1939, 153–61; Sturdy 1958, 134, and 1963, 91; Ashdown and Hassall 1975, 133–40; Werner 1998.
[3] Bennett *et al.* 2000.
[4] Loudon 1839.
[5] Mellor 1984, 181–219; Mellor 1994, 17–217.
[6] Mellor 1994.
[7] Gaimster 1997, 208–10.
[8] Pearce 1992, 102.
[9] Barker 1999.
[10] Jennings 1981, 222.
[11] Mellor 1984, 198 and figs 24–25.
[12] Ibid., note 11, 216 and fig. 29, no. 5.
[13] Barker 1999.
[14] Ibid., note 13.
[15] Mellor 1984, 195.
[16] Barton 1969, 170 and fig. 65.33.
[17] Fox and Barton 1986, 31–256, fig. 102.
[18] Barker 1999.
[19] Mellor 1984, 207–09 and pl. 4.
[20] Mellor 1984, fiche II, G7.
[21] Mellor 1984, fiche II, GI.
[22] P. Craddock, pers. comm.
[23] Cotter 1992, 256–72.
[24] Bayley 1992, 5, figs 5 and 6.
[25] Cotter 1992.
[26] Ibid., note 25.
[27] Ibid., note 25.
[28] Pryce 1778, 32.
[29] Percy 1861.
[30] Hillson *et al.* 1999, 13–15.
[31] Chamberlain 1999, 6–7.
[32] White 1988.
[33] Richardson 1989; Chamberlain 1999, 6–7.
[34] Gunther 1925, 108–09.
[35] Ibid., note 34, 263, 266.
[36] Werner 1998.
[37] Brian Connell, pers. comm.
[38] Gunther 1925, 266?
[39] Ibid., note 38, 265.
[40] Brothwell 1981, 93.
[41] Op. cit., note 38, 265, 275.
[42] Chamberlain 1999.
[43] Ibid., note 42.
[44] Chapman 1997.
[45] Kehoe 1999.
[46] Molleson and Cox 1993.
[47] Conheeney and Miles, forthcoming.
[48] Brickley *et al.* 1999.
[49] Dr Linda O'Connell, pers. comm.
[50] White, unpublished MoLAS report.
[51] Chapman 1997.
[52] Kehoe 1999.
[53] Boessneck 1969, 331–58.
[54] Von den Driesch 1976.
[55] Harcourt 1974, 151–75.
[56] Clutton-Brock 1987.
[57] Whitaker 1996.
[58] Kaiser 1974.
[59] Reynolds and Odell 1991; Ripple and Perrine 1999.
[60] Gunther 1925, 260, 268.
[61] Cole 1949, 205.
[62] Armitage and McCarthy 1980, 8–16; Armitage 1983, 262–70.
[63] Kehoe 1999.
[64] Wilson *et al.* 1989, 258–68.
[65] Oswald 1985, 253.
[66] Atkinson and Oswald 1969, 177 and figs 1, 14 and 15.
[67] Atkinson 1975, 29–30.
[68] Ibid., note 67, 46.
[69] Oswald 1985, 259.
[70] Harley 1974, 75.
[71] Simcock 1984, 5.
[72] J. Bennett, pers. comm.
[73] Gunther 1925, 260–63.
[74] Ibid., note 73, 256.
[75] Simcock 1984, 19; Gunther 1945, 135–36.

[76] Simcock 1984, 109–10; Gunther 1923, 55.
[77] Simcock 1984, 19.
[78] Gunther 1925, 110–11.
[79] Richardson 1989, 35.
[80] Gunther 1925, 115–16.
[81] Ibid., note 80, 109.
[82] Gunther 1925, 111.
[83] Ibid., note 82.
[84] Richardson 1989, 35–37.
[85] Ibid., 36–37.
[86] Ibid., 53; Gittings 1984, 68.
[87] Gunther 1925, 46.
[88] Richardson 1989, 57.
[89] Simcock 1984, 35, no. 88.
[90] Ibid., note 89, 9.
[91] Ibid., note 90.
[92] Gunther 1925, 113.
[93] Ibid., note 92, 113.
[94] Simcock 1984, 34, no. 86.
[95] Gunther 1923, 264–66.
[96] Bennett and Simcock, pers. comm.
[97] Gunther 1925, 275–77.
[98] Ibid., note 97, 367.
[99] Ibid., note 98, 114–15; Simcock, pers. comm.
[100] Gunther 1923, 61.
[101] Simcock, pers. comm.
[102] Gunther 1925, 330.
[103] Ibid., note 102.
[104] Gunther 1925, 260.
[105] Ibid., note 104, 264.
[106] Ibid., note 104, 277.
[107] Cole 1949, 205, 260.
[108] Plot 1677, 230–31.
[109] Simcock, pers. comm.
[110] Op. cit., note 108.
[111] Bennett *et al.* 2000, 33.
[112] Simcock, pers. comm.
[113] Ibid., note 112.
[114] Gunther 1937, 291.
[115] Simcock, pers. comm.
[116] Gunther 1937, 291; and Salter above.
[117] Weaver 1998.
[118] Gunther 1923, 71–72.
[119] Cannon, pers. comm.
[120] Simcock, pers. comm.
[121] Gunther 1923, 45–46.
[122] Gunther 1923, 50–51.
[123] Ibid., note 122, 45.
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This paper was funded with a grant from Thames Valley Archaeological Services Ltd.