

Excavating a *parchmenerie*: archaeological correlates of making parchment at the Pictish monastery at Portmahomack, Easter Ross

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ABSTRACT

A number of associated features and artefacts in the workshops at Portmahomack (Ross-shire) can be related to the preservation and finishing of hides, and it is argued here that this included the preparation of parchment for the production of manuscripts. The archaeological correlates of making parchment and methods for distinguishing it from other types of leather-working are discussed.

INTRODUCTION

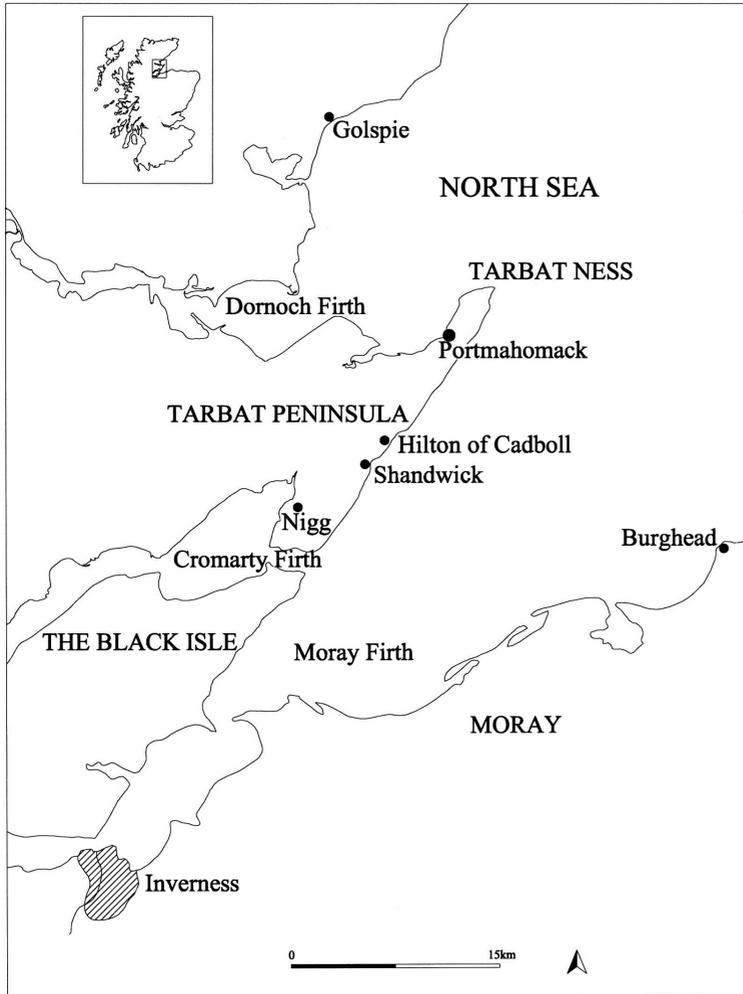
Recent archaeological research on the Tarbat peninsula, Easter Ross, north-east Scotland (illus 1) has located the site of an early monastic foundation at Portmahomack, and proposed that the whole peninsula had become a single monastic estate by the end of the eighth century (Carver 2004). The monastery at Portmahomack is surrounded by a ditch, C-shaped in plan like that at Iona, and defined by over 200 pieces of carved stone, showing strong links with Iona and Northumbria. The early cemetery, on the site of the present church of St Colman, features cist graves and ‘head-support’ burials that have been radiocarbon-dated from the later sixth century to the ninth. Middle-aged and elderly males dominated this early population. To the west of the burial ground ran a paved, kerbed road (built ‘in the Roman manner’) either side of which were situated workshops, some of which were refining and casting bronze, silver and probably gold, and using moulds appropriate to the manufacture of sacred vessels and liturgical equipment. Farther south was a dam forming

a mill-pond, and farther south still a kiln-barn radiocarbon-dated to the mid eighth century (illus 2).

Our current hypothesis is that this was an establishment initiated by St Columba during his expedition into Pictland in the late sixth century (Sharpe 1995, 30) on the nearest approximation to an island that the saint could find at the farthest end of the Great Glen from Iona. This peninsula was adapted as a *Tarbat* (portage) in the western manner. The initial community may have been small, cultivating with the use of plough-pebbles, but workshop activity had probably begun during the seventh century and it expanded mightily during the eighth. The settlement as a whole seems to have been damaged by fire, and it saw the breaking-up of some of its monumental cross-slabs in an incident that has been provisionally dated to the ninth century and ascribed to the Vikings. Although it was briefly to recover, the area was abandoned during the 10th century and only revived in the early 12th as a parish church. Among the carved stones associated with the church of St Colman’s, one of the most celebrated is that

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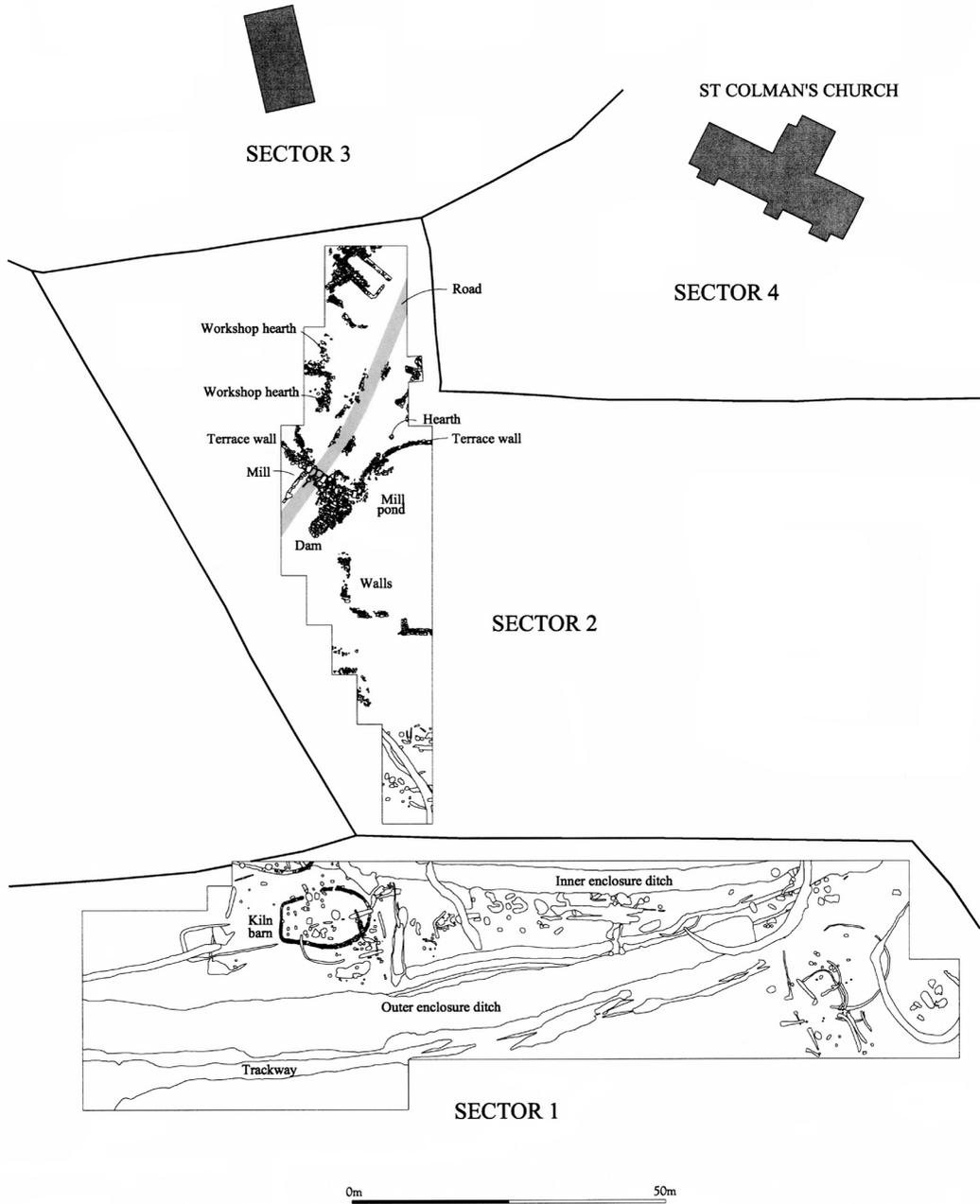
ILLUS 1 Location of Portmahomack and the site of the monastery

found in the 19th century set into the garden wall of the manse. This piece is especially notable because it carries one of Pictland's few Latin inscriptions, a text announcing that it comes from a 'cross of Christ' and commemorates an unidentified person whose name begins 'REOL'. The recent campaign has shown that this fragment belongs to a large highly decorated cross-slab perhaps 1m wide and 3m high, which carried images of the apostles. This monument resembles in many particulars those erected at the neighbouring sites of Nigg,

Shandwick and Hilton of Cadboll, with which it is thought to form a set of boundary markers, demarcating the territory of the eighth-century monastery (Carver 2004, 26).

The inscribed stone has not only suggested to scholars that there was a monastery at Portmahomack, but that insular manuscripts may have been made there. In 1972 Julian Brown commented: 'One or more court monasteries or churches must have existed among the Picts; and if we cannot say where they were, the groups of stones from St Andrews, Meikle, Aberlemno, St Vigeans and the Tarbat-Nigg area ... show what sort of work they were able to do. The Pictish cross-slabs make just as good a monumental background for the [Book of Kells] as the crosses of Northumbria or Iona' (Brown 1972, 241). Ten years later John Higgitt remarked more

specifically: 'At Tarbat or somewhere very close by was an ecclesiastical centre with contacts that went beyond Pictland ... This centre was capable of producing books' (Higgitt 1982; cf also Henderson 1975, 106). Higgitt later emphasized that lettering carved in stone that so closely resembles the forms used in manuscripts is very rare and reinforces the probability of a scriptorium in the neighbourhood (Higgitt 1990). These expectations have received a gratifying endorsement from the recent archaeological campaign. The Portmahomack site has many of



ILLUS 2 Map of the excavations to 2004

the documented attributes of an early monastic establishment and we are learning of others that help to furnish this kind of settlement and put the monastic project into a wider context: the agricultural base, the facilities for drying the crop, the watermill, the development of the portage, the demarcation of the estate, the broad range of sculptural production, and above all the range and intensity of craft-working. It would be no surprise now, therefore, if this place had, in the eighth century, also produced great books. However, direct evidence for such production is notoriously elusive.

In this paper, we will first review evidence from documentary sources and contemporary practice and then describe and interpret the findings on site at Portmahomack, attempting finally to construct equations between the two. Our initial expectations of an assemblage associated with book production included objects associated with writing, such as the styli of bone, silver or copper-alloy found at Whitby or Flixborough (Webster & Backhouse 1991, nos 69, 107), the numerous fragments of inscribed slates found during the excavations at the early monastery of Nendrum (O'Neill 1997, 70–1), the six writing-tablets of yew found at Springmount Bog, Co Antrim (Webster & Backhouse 1991, no 64) or the quills, ink and colours (indigo, verdigris, red lead, white lead, yellow orpiment, chalk, azurite and carbon) thought to have been used in the writing and illumination itself (Brown et al 2003, 439–46). These we have diligently searched for but without avail. If this was initially disappointing, the reason soon became apparent: these items belong to a *scriptorium*, while the workshop we were excavating at Portmahomack was dedicated to the making of parchment – a *parchmenerie*. In similar vein, the next-door workshop at our site was found to be manufacturing ingots of precious metals, silver studs inlaid with glass and glass escutcheons destined for assembly into chalices, patens and reliquaries (Carver 2004). Thus in both cases we have the 'smelly end' of the process, and our workshops were

no doubt supplying more senior craftsmen in premises nearer the church with their prepared materials. These premises (now inaccessible beneath the modern graveyard) should certainly have included a *scriptorium*.

PREPARING AND PRESERVING HIDES

Parchment is a general term employed loosely to mean the material used to make medieval books, and it refers to thin, clear, untanned skins of sheep or calf (although other animals were also used; Brown, J 1993a). In the Insular world (fifth to eighth centuries in Britain and Ireland), the preferred material is widely thought to have been calf-skin, thus *vellum* (from Latin *vitellus*) is a term often used interchangeably in discussions about manuscripts. In practice, distinguishing calf from sheep in the folios of a codex is said to be unattainable, at least by observation (Ivy 1958, 34; Brown, J 1993a, 126), although occasionally diagnostic traces of hair or wool survive (Brown, J 1993a, 135). We are thus encouraged to use the term 'membrane' which does not beg the question – although old habits die hard. 'Every time I mean to say *Insular membrane*' remarked the great palaeographer Julian Brown, 'I say *vellum*' (1993a, 126). In this paper, we use the word parchment to mean an animal skin made into a folio for writing on. Since this specific function carries fundamental political and religious implications, the first archaeological task is to ensure that we have successfully distinguished it from the general production and employment of leather.

By the end of the medieval period over twenty different types of craftsmen who worked hides were named, *tannator*, *curreur*, *peltario*, *parmenter*, *whyttawere* being just a few listed in a guild roll from Leicester (Carlisle 1996, 23–8; Cherry 1991, 307). Separate leather-working crafts were vigorously demarcated by the guild system – the squabbling between cordwainers (a name deriving from the working of fine Cordovan leather) and cobblers for rights

to make and repair shoes being a well-known example. The diverse nomenclature not only demonstrates the utility and versatility of leather but, more significantly, indicates multiple specialisms among those involved. The basic process of preparing leather barely altered from the Graeco-Roman world to the late 18th century (Cherry 1991, 295) and is well documented, both in written and archaeological records. The skin of the beast was a secondary product from its slaughter, which produced a carcass. Since the bones of the lower leg, hoof, horn and tail were of limited meat value, they were often left attached to the skin, at the same time providing convenient handles for the skinning process. Thus an archaeological concentration of lower leg and hoof bones could be equated with leather-working waste (for example, O'Connor 1984; Keene 1985, 287). The skin would be washed in fresh water to remove blood and gore, and then the preservation of the hide would begin, eventually comprising at least three stages. First, the hide was washed or leached in a solution of bird droppings, dog dung, stale beer or urine, which would putrefy the hair follicles and break down the fatty acids contained in the epidermis. Both hair and flesh could then be scraped off more easily using a knife over a curved beam. The leather was then immersed daily in a new weak solution of tanning agent, such as oak bark, until the colour was even; and finally it was layered with the solid tanning agent in 'layaways' where it might remain for up to 12 months (Cherry 1991, 296–7). Medieval pits identified as appropriate for tanning are commonly excavated and are usually round or rectangular and lined with clay or wooden staves. The different depths of pits encountered probably reflect their role in the process: shallow for washing and frequent handling, and deep for long term layaways (ibid). Tools, such as currier's knives, awls and needles, represent the final conversion of leather into finished products such as saddles, footwear and sheaths.

If leather was to be light coloured, it was tawed, that is treated with alum, rather

than tanned with oak bark. The distinction between tanning and tawing was preserved in the medieval name *whittawyers*, who alone claimed the right to handle the skins of sheep, goat, horses, deer and dog. Their products were gloves, purses, belts and straps (Cherry 1991, 299; Campling 1997, 231; Thomson 1998, 5). The pelt was immersed in a tawing agent, alum or lime, a caustic or astringent solution that contracts organic tissues and loosens the hair. Longer term deposition in a layaway was not necessarily part of the process, so the deeper kind of pit might not be required. John Cherry describes a later medieval procedure whereby the hide was trampled in a paste of alum, egg-yolks, oil and flour (1991, 299). Excess alum or lime was finally removed by washing in fresh water. This produced the desired white-tawed end-product. Hides might also be dried and smoked. The seventh-century *Hesperica Famina* describes how to make a book satchel: 'Not long ago it protected the fattened flesh of a sheep; a butcher flayed the hairy hide with a sharp knife. It was stretched on the wall between thick stakes and dried with fiery smoke. A proud craftsman cut out the [shape of] the container [satchel] and drew taut the skin covering with tight laces, fashioned the four angles and finished the leather container with a choice strap' (Herren 1974, 104–7). The smartest book satchels were white ones, as affected by the students who feature in the same poem:

Hang your white booksacks on the wall,
Set your lovely satchels in a straight line,
So that they will be deemed a grand sight by the
rustics

(lines 262–4; with thanks to Mark Clark
for this reference).

MAKING PARCHMENT

The preparation of parchment was a specialist and high status branch of the industry (Ivy 1958; Bischoff 1990, 8–10; de Hamel 1992; O'Neill 1997; Haines 1999). Timothy O'Neill remarks

that vellum (ie calf-skin) was ‘far too valuable for anything other than book production’ (1997, 71). Some early documentary sources suggest details of the processes involved, for example the 10th-century riddle from the Exeter book provides a poetic account of the manufacture of a book:

An enemy ended my life, deprived me of my physical strength: then he dipped me in water and drew me out again, and put me in the sun, where I soon shed all my hair. After that, the knife’s sharp edge bit into me and all my blemishes were scraped away ... (Quoted in Backhouse 1981, 27)

The riddle goes on to describe the binding, scribing and elaborate covering of a book. Knowledge of the manufacturing processes can also be extracted from the books themselves, the chemistry involved (Meehan 1997; Alcock 2003, 404; Thomson 1998, 1–3) and from modern craftsmen still engaged in the production of handmade parchment (de Hamel 1992, 11; Mark Clark, pers comm). In a gentler version of the preservation process, calf, sheep or goat skins were immersed in a solution of lime and water from three to ten days, stirred regularly with a wooden pole, then brought out and de-haired and de-fleshed carefully on a beam. The wet skin was then stretched in a frame, where it was dried, thinned and scraped with a crescent-shaped blade, named a *lunellum* or *lunellarium* (Ivy 1958, 36), polished with smoothing stones and pumice, and finally dressed with chalk and oil. A 15th-century source (Trinity Coll. Cam. MS. R.14.45, part v, f.30) distinguishes between the treatment of sheep and calf. Both are immersed in lime and water for nine days, after which the hair or wool is easily shed, but then a sheep skin is trimmed and thinned on the flesh side only, whereas a calf skin is trimmed on both the flesh and hair sides (Ivy 1958, 35).

In order to stretch the hide taut in a wooden frame, pegs and thongs were required (de Hamel 1992, 11; Leahy 2003, 89). The pegs functioned like tuning pegs in a stringed instrument: they were tapered at one end to allow insertion into

holes along the edge of the frame, and were slotted at the other end to allow secure fastening of a thong. The pegs were tightened as the hide was stretched. The thongs were not directly threaded into perforations in the hide, since these would widen and tear the hide as it became thinner. Thus, small pebbles were folded into the outermost edge thereby forming little knobs around which a thong could be lashed. As the parchment is stretched, it reveals patches that reflect the colour of the hair of the beast – brown, black or white (so a white calf is ideal). Any holes accidentally made during de-fleshing begin to gape and must be sewn (de Hamel 1992, 11). The hide might be dried using heat or smoke and the hardened surface smoothed with pumice or abrasive powder (*pounce*) which served to even the surface and lighten its colour. A 13th-century German source (Copenhagen, Königliche Bibl. MS. 4) implies that parchment was whitened on the frame while still damp, eg with chalk (Brown, M 1998, 66). Chalk appears to have been the principal whitening agent used in the west, although it is not documented before the 12th century; in the east, however, parchment was prepared by soaking in salt water and whitened with flour and this practice extended to Sicily (Sirat, quoted in Brown, J 1993a, 135). The parchment was then cut into quires, divided into leaves, pricked with an awl, ruled with a stylus and was then ready to take writing in ink (from oak gall and gum; Ivy 1958, 45) and painting in colour (illumination) on both sides. The materials used for illumination were also precious: gold or silver leaf, and the dyes, particularly red and purple, used for fine robes, as well as ground-up lapis lazuli, a gem originating in Afghanistan. Such redeployment of the materials of power can be seen as an integral part of the Christian conversion process.

Insular membranes, as found in the Lindisfarne Gospels or the Book of Kells, are distinctive, so much so that they are said by palaeographers ‘to have little in common with either Continental or with Oriental membranes’ (Brown, J 1993b, 239). The idea that Insular

manuscripts employed calf skin (vellum) while Continental manuscripts employed sheep skin was advanced by E A Lowe in 1934 and has stuck in the literature, even though Julian Brown pointed out that Lowe retracted his theory a year later, replacing it with a proposal that it was the method of preparation that differed. This involved, for Insular parchment, the trimming and roughening of both sides to produce surfaces that were particularly good for painting (Brown, J 1993a, 133). The distinctive character of Insular parchment means that it can be tracked in the libraries of Europe, and Julian Brown located it in use at Echternach, Fulda, St Gall and elsewhere (Brown, J 1993a, 128). However the extensive use of 'Insular' membrane in the output of the Carolingian Palace School (*ibid*) does give rise to the suspicion that this was a functional rather than a cultural difference. It must be assumed therefore that centres of production in Britain and Ireland made use of other skins besides calf, depending on the size of book that was required and whether it was to be painted. But there are of course other reasons that Insular centres may have chosen vellum. Cattle represented a major index of wealth and status in the early medieval north and dominate the faunal remains at hillforts (Alcock 2003, 114). As with precious metal and stone, the use of calves to make gospel books would therefore have carried additional symbolic and devotional value. The investment was considerable. The number of calves required to make a gospel book can be estimated from the number of its gatherings and their size: 130 animals for the Lindisfarne Gospels (Brown, M 2003, 30), 185 for the Book of Kells (Meehan 1994, 86) and 515 for each of the three pandects made by Ceolfrid of Jarrow around AD 700, one of which has survived as the Codex Amiatinus (Bruce-Mitford 1969, 2). This is a measure of the political commitment that was involved.

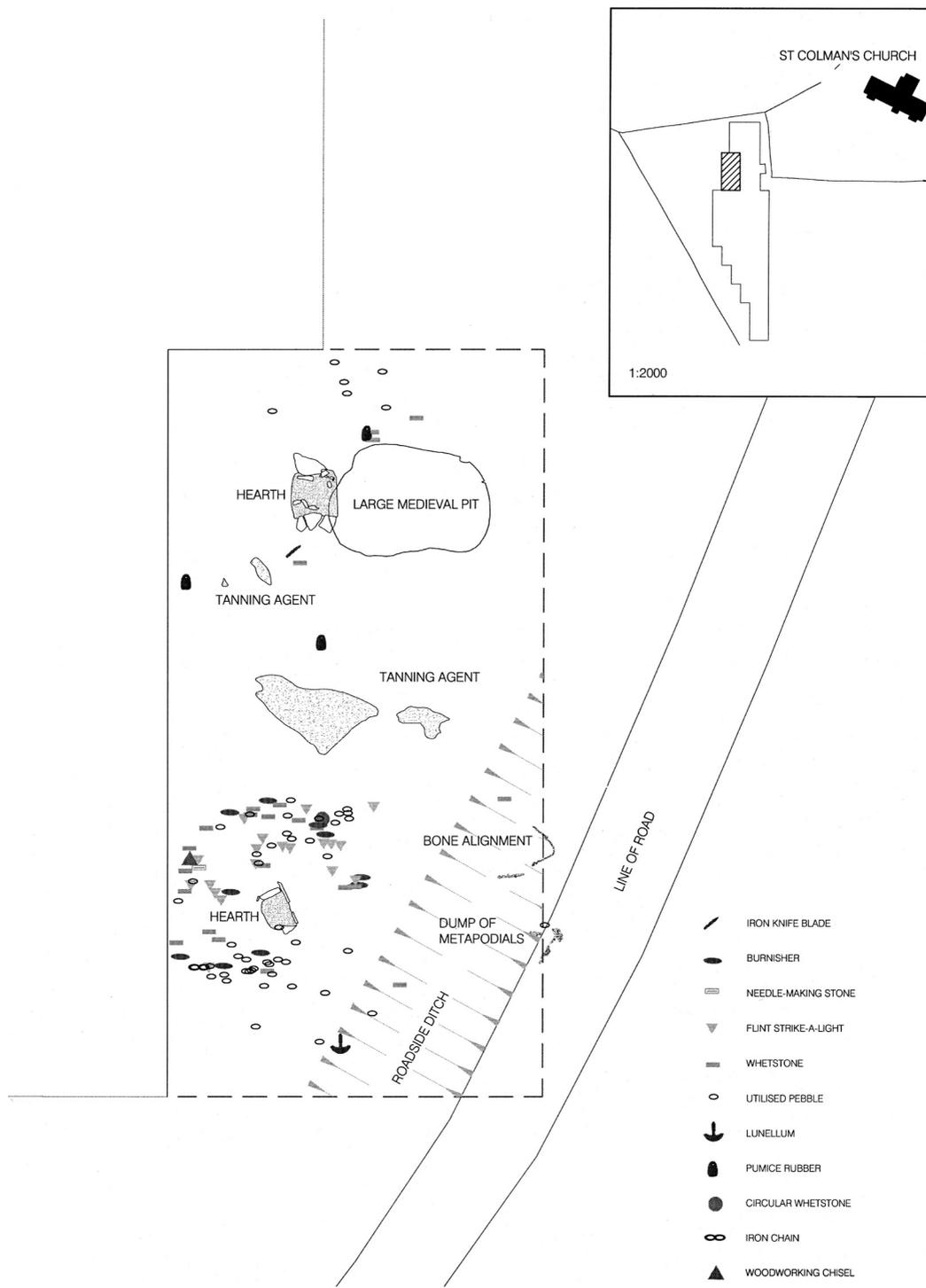
In the Book of Kells, size suggests that the skins of 2–3 month old calves were used, each cut into bifolia with the spine of the calf running horizontally or vertically across the page

(Meehan 1994, 85–6). Each bifolium (folded page) was aligned to the next to form gatherings, and the gatherings were stitched together using needle and thread and tied with leather thongs to wooden boards top and bottom. The wooden boards were then covered. Although only one example (the Stonyhurst Gospels) has survived, it is clear that in the case of insular production these covers could be extremely ornate with leather knotwork and inlaid plates of precious metal set with gems. The colophon of the Lindisfarne Gospels remarks that Ethiluald, Bishop of the Lindisfarne islanders, impressed the book on the outside and covered it 'as he well knew how to do'. From the same source we learn that Billfrith, the anchorite 'forged the ornaments which are on it on the outside and adorned it with gold and with gems and also with gilded-over silver – pure metal' (Brown, M 2003, 104). It is likely that the elaborate 'carpet pages' which precede the gospels in Insular manuscripts such as the Lindisfarne Gospels or the Book of Durrow, are skeuomorphic echoes of real elaborate metal covers.

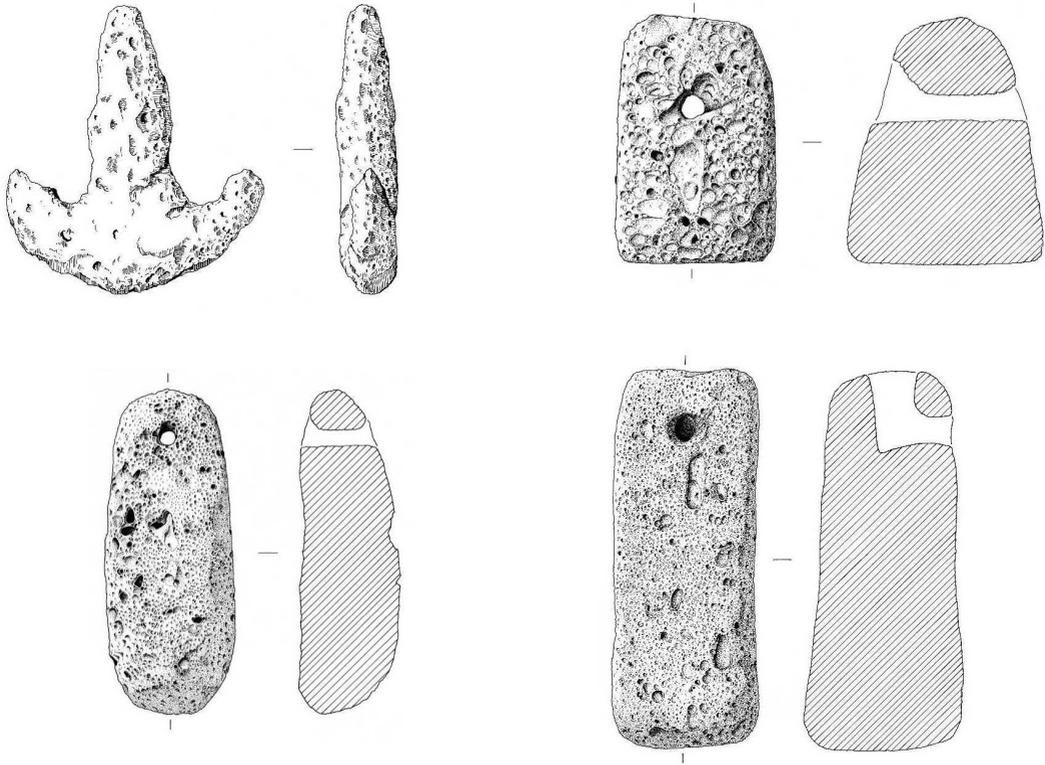
The making of an early medieval codex was thus a major investment of materials and skills, in which precious metals and vellum and wood might be worked in close proximity. A centre that practised the art in the period sixth to ninth centuries was, *de facto*, a centre of major economic and political importance. Although it is not easy to establish where a surviving illuminated codex was made, the monastic sites recorded by Bede and Adomnán, such as Iona, Lindisfarne and Jarrow are prime candidates. Into this illustrious company, the otherwise unremembered site of Portmahomack in the far north of Scotland now bids for entry.

RECOGNIZING PARCHMENT-MAKING ON THE GROUND

As we learn from documented practice (above), the basic process of making parchment required the soaking of skins in a solution of lime and



ILLUS 3 Plan of western workshop area, showing the vellum-making zones and distribution of finds (1:100)



ILLUS 4 Objects from Portmahomack associated with vellum-preparation. Top left: iron *lunellum* (79×70×16mm); top right, bottom left and bottom right: pumice rubbers with suspension loops (68×44×54mm, 90×35×27mm, 104×40×43mm)

water, scraping on a beam, drying, stretching on a frame and smoothing to take ink. The treated skins were measured, cut, folded, ruled for the formal writing of texts and sewn into gatherings, which were in turn sewn onto thongs laced into wooden boards (O'Neill 1997, 71–2, 78). The basic elements of preparation would therefore include a pit or water-holding container for soaking and curing the skins in an astringent solution of lime or salt, a beam and knife for de-hairing and de-fleshing, a hearth for heating, a frame with pegs and pebbles for stretching, a curved knife for trimming the parchment on the frame, needles for sewing up holes, a whitening agent such as chalk or flour and abrasive rubbers for evening, roughening, smoothing and polishing the surface. Although some of the tools and by-products that might be associated

with these stages have been encountered in archaeological excavations, each in isolation can have alternative explanations, and thus a secure parchment-making assemblage has been hard to find (Hall & Kenward 2003, 121–4).

At some sites in early medieval north Britain, the production of vellum has been suggested on the basis of a high proportion of calves (eg at Dundurn and Dunollie, Alcock 2003, 113, 404; Flixborough, Loveluck 2001, 114; Lindisfarne, O'Sullivan 2001, 42). However, O'Connor cautions against the interpretation of such assemblages in isolation, even as proof of leather-working, since a concentration of skeletal elements can derive from the butchering process alone and does not necessarily indicate or prove the use of secondary products (O'Connor 2003). A site practising a dairy economy produces an



ILLUS 5 A crescent-shaped knife as depicted in a medieval manuscript (extract from Staatsbibliothek, Bamberg MS. Patr.4, fl v; reproduced in de Hamel 1992, Fig. 7)

assemblage rich in neonate bones, so these alone cannot prove the culling of calves for vellum. More diagnostic should be a high proportion of those bones relating to hides (ie the feet) or bone objects that are actually used in the leather-working process.

The Portmahomack workshop thought to be dedicated to the making of parchment consists of a roughly square area on the west side of the paved road (above). It is bordered by a road-side ditch and contains a sequence of floor layers that, in the final phases, fill up the ditch and run over it. In this area, virtually all the evidence for parchment-making was concentrated (illus 3). An iron *lunellarium*, the first leather-working tool to be recovered at Portmahomack, has direct links with the production of vellum (illus 4, 5). The curved blade was particularly needed for scraping a hide in tension on a frame (illus 5).

However, the tool on its own is not sufficient proof of a specialism, as it can also go by the name 'head' knife, used in leather-working to cut or pare leather, and is also associated with light leather-working craft (Cherry 1991, 299). Indeed, many semi-lunate knives, such as draw knives normally associated with wood-working, could find good employment either in a tannery or vellum workshop. An iron *lunellarium* dated to the late eighth century from the site at Flixborough is cited as evidence for leather-working (Loveluck 2001, 97–8).

Pumice is another material associated with fine leather and was known as an effective abrasive. More specifically to parchment, it was used to erase the mistakes of a scribe and could be used with crushed chalk to dress a folio prior to writing (above). The ninth-century leather-worker's toolkit from Evie, Orkney,

currently on display in the Museum of Scotland in Edinburgh, included a small lump of natural pumice (Kirkness 1953; Stevenson 1952, 190). Excavation at the Brough of Birsay has produced several fragments of pumice, some shaped, perforated and worn, which have been identified either as floats for fishing or as pieces used for skin processing (Curle 1982, 70, Ill 45:601a; Hunter 1986, 187, Ill 82). Three pumice rubbers have been recovered at Portmahomack, two from rubbish pits and one from the workshop floor levels (illus 4). These are all deliberately-shaped pieces, with perforations at one end, presumably for suspension from the waist or neck. A white substance has been trapped inside the natural cavities at the worn end of the rubbers, and this might represent residue from pouncing with chalk or another agent (see below). MacGregor (1974, 92–3) notes the occurrence of pumice on the northern and western coasts of Britain and a recent visit by one of us (CAS) to the shore of Whithorn Bay produced one amorphous lump of lightweight pumice. The Birsay pumice is thought to have floated in from the north Atlantic (Hunter, *op cit*), but since the Moray Firth is not directly exposed to north Atlantic flotsam, the Portmahomack pumice could have been imported rather than casually collected on the beach. It is relatively dense, the finished object being clearly smaller than the piece from which it was fashioned. If so, it is tempting to see the pumice travelling via exchange routes from the Continent, or perhaps direct from the Mediterranean. Willibald's travels to the Mediterranean included a visit (in about AD 728: Jenkins 1968, 69) to the volcano in the Lipari Islands, where he described the eruption and mentioned the pumice that was thrown up and floated to the beach, 'which the transcribers of manuscripts used for polishing vellum' (Levison 1946, 44).

Among the earliest features to attract attention in our workshop was a cluster of complete cattle metapodials revealed after the removal of one of the metallised surfaces of the road that runs between the workshops (illus 6a).

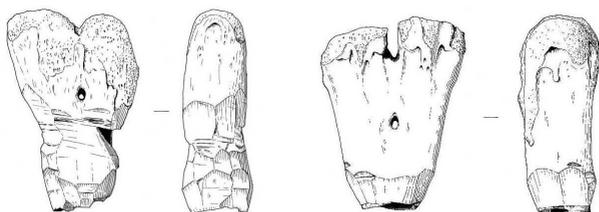
Near this dump of metapodials were two rows of the same bones at right angles each apparently pushed deliberately into the ground. These bones had been modified, some having been hacked at mid-shaft to form a point, and a few deliberately shaped (illus 6b). All were found inserted into the ground with the distal end upwards. The shape of a cattle metapodial, such as the two knuckle-like protuberances at the distal end forming a slot, and the foramen often penetrating through the bone, make it a good candidate for a practical use of some kind. The re-fashioning of metapodials for use as tools is known from prehistoric to recent times, and some have been found in rows, leading to their interpretation as borders for hearths or, in the later periods, for flower beds (Malcolm & Bowsher 2003, 23–4; Armitage 1989, 147–60; Murphy 1998, 16–17; Niall Sharples, *pers comm*; Divers, Killock & Armitage 2002). At Tarbat, the modified metapodials suggest pegs, and their arrangement in rows might suggest that they were being lined up for use in a stretcher-frame such as required by a parchmenter (illus 4d). It could be that the rows represent pegs *in situ*, where the wood of the frame has entirely vanished, but these examples are rather closely spaced.

The Portmahomack metapodials form a conspicuous concentration, distinct from animal bone assemblages found elsewhere on the site (which, however, still await detailed analysis). Their apparent reuse as pegs and in alignments suggests that they were also treated differently in the workshop and were not disposed of like the missing phalanges. The possibility that the hooves were retained for boiling to manufacture glue, or 'neatsfoot' oil to dress vellum should not be discounted. The animals that produced these metapodials were mature when killed, since the intact distal epiphyses were fused with no sign of the epiphyseal line (Rowland, *pers comm*). Silver (1969) gives ages of 24–30 months for the fusion on the distal metacarpal and 27–36 months for the distal metatarsal, making the Portmahomack cattle at least three years old. Animals of this age would be appropriate for

a



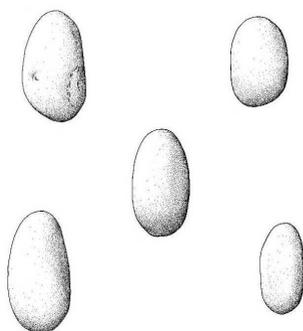
b



d



c



ILLUS 6 (a) Bone row: cattle metapodials set in a V-shape in the ground (b) Examples of the sharpened metapodial pegs (c) Examples of small pebbles found near the bone-row (d) Modern craftsman with a parchment on a stretcher-frame. The hide is attached to the adjustable pegs with thongs. The border of the hide is folded over small smooth pebbles that form knobs around which the other end of the thongs are wound (Source de Hamel 1993, Fig. 5)

making leather rather than vellum. To adapt the hide of a mature beast for vellum-making would require that an already laborious process is made more intensive; the hide would be thicker, requiring more thinning and probably had many more flaws. However there is no necessity for the animal which supplied the pegs to have simultaneously supplied the parchment, and there are other indications that the latter was still the main purpose of the workshop.

A central feature of the workshop floor was a broad spread of greasy, greyish-white ash with soap-like qualities. This should have played a role in the workshop process: but which role? Inspection of the finely-sieved components of the deposit resulted in the identification of small calcareous casings belonging to *spirorbis borealis*, an annelid worm or tubeworm (Stephen Carter, pers comm). These casings are normally found attached to serrated wrack seaweed (*ficus serratus*), which can still be harvested from the beach at Portmahomack today. In fact, the weed and casings are so common as to be found along most of the coast of Britain and Ireland. *Spirorbis* is caustic and can burn to the touch, and thus could act as an astringent, either for tawing or for treating hides destined for parchment. The classic tawing agent, slaked lime, would be hard to source in the Tarbat vicinity, which is geologically based on Old Red Sandstone, but an ash of these casings may have provided a substitute, being both white and alkaline. If analogies with later practice are valid, this evidence points towards either the making of white leather artefacts, such as book-satchels, or of parchment.

Chalk is similarly rare in the Highland zone, and an alternative or additional application of *spirorbis* is in the preparation of *pounce*, as suggested and demonstrated experimentally by Gifford Charles-Edwards (pers comm). When seaweed and *spirorbis* were burnt together in her experiments, they produced an abrasive ash, which was however black, and thus unsuitable for treating parchment (although it could have been used as an abrasive polish in metal-working).

However, *spirorbis* on its own gave better results. Drying the seaweed in a canister over a fire effected separation of the tubeworm casings from the seaweed, by shaking out the casings once the seaweed had become brittle. When ground up, the casings produced a caustic pink powder. The modern agents for pouncing are ground-up volcanic lava (pumice) and gum sandarac, which smoothes the surface of the skin and degreases it so it will take a water-based ink. Charles-Edwards achieved comparable surfaces using a paste of the *spirorbis* casings ground with an agate burnisher. It seems likely that the Portmahomack craftsmen, aware of the materials they needed, but deprived of a reliable supply, were obliged to experiment vigorously to discover substitutes for those not available in the north.

The *lunellarium*, the metapodials, the ash and hearth offered a focus for the small area that we felt emboldened to designate provisionally as the 'vellum workshop'. The floor (or floors) of this area contained a large number of other objects, nearly all of which can be recruited to the craft concerned. The bone needles may have been used to repair the tears, or prepare the gatherings in which the end product was no doubt delivered to a scriptorium higher up the hill. On the floor of the workshop, a chisel had been dropped and lay corroding on the floor surface, incidentally preserving the make-up of the floor. The corrosion layers of the iron object had fossilized a thick layer of wood-shavings and sawdust (the species and exact nature of the detritus awaits specialist identification), thus demonstrating that the floor of the workshop had been covered in wood shavings, either imported deliberately to refresh a workshop engaged in relatively noisome work, or, more likely, left behind by those working wood in the workshop. The shavings may have been produced by a pole lathe, which implies turned legs or bowls. But the manufacture and upkeep of the wooden frames needed for vellum-working and the making of wooden book covers also provide possible explanations for the marriage of the

two crafts in one space. The carved wooden box containing the Evie toolkit is thought to have been executed by one more familiar with leather than wood (Kirkness 1952, 195–6) and the mingled wood and leather-working debris dumped in the seventh-century vallum ditch at Iona (Barber 1981, 320, 357) suggest that the alliance was perhaps commonplace.

The best-preserved and actually the most complex component of the assemblage was that made of stone. The natural subsoil in the workshop area is mostly clean sand and we could be confident that virtually all the stones had been brought in from somewhere else. Every example of a stone has therefore been noted and recorded and we are in a position to report on them in a preliminary manner. They fall, so far, into at least five distinct types. Plough-pebbles about 10–20mm long with one end flattened by abrasion are now familiar from Peter Hill's excavations at Whithorn (Hill 1997, 28, 464). At Portmahomack they generally belong to the earlier phases of the monastic settlement, that is, from a period earlier than the vellum workshop. Fragments of sandstone, often with carving, belong to the early medieval monuments that were broken up at the time the monastery was burnt and subsequently abandoned. In general, these are easy to distinguish and have been found in the layers that were deposited later than the workshops. This leaves three varieties of shaped or selected stones that are associated with the workshop phases and with the vellum area in particular. A small red sandstone disc is likely to be a carborundum stone, of a type used in modern toolkits to sharpen axes and knives. A group of elongated pebbles about 100mm long show signs of use in smoothing and burnishing. On the basis of similar stones, Campbell and Lane (2000, 179) inferred that leather-working may have occurred at Dunadd. The last and most populous group consists of unworked white quartzite and small round red jasper pebbles (illus 6c). These pebbles are conspicuous at the site since the local high-grade agricultural soil is almost completely stone-free, and inspection

of the small erratic pebbles washed out of the old red sandstone on the surrounding beaches does not present similar examples. A reason for their selection and collection may be found in the small stones used to secure the parchment in its frame, where it was stretched and whitened (above).

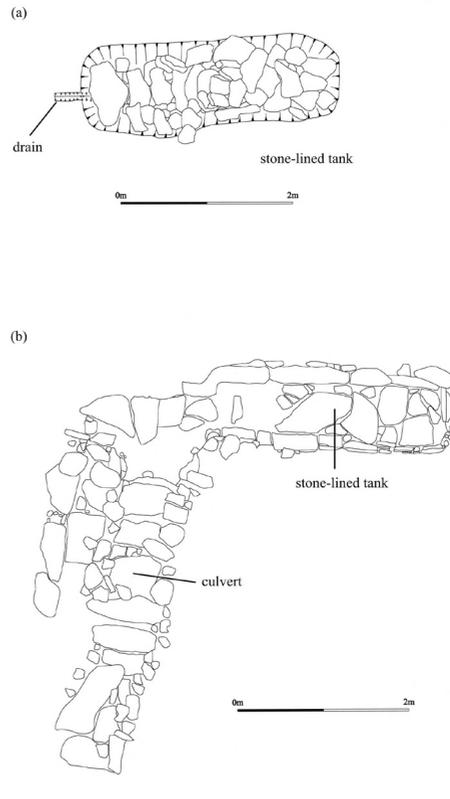
As with the other components of these monastic workshops, the small stones also have a symbolic aspect. The 19th-century beaches of Iona were famed for their pebbles, which included 'gray pebbles, beautifully marked; fine *lapis nephriticus*; jaspers, green mixed with red; serpentine stone, gray and other porphyries; pure white marble and many other rare stones' and in 1806 it was noted that 'It is a sort of trade among the children here to collect pebbles and sell them to strangers' (Ritchie 1997, 17). Our suggestion that these pebbles performed an essential part in the process of parchment manufacture intersects with their shadowy but potent role in the realms of religion. Adomnán relates how, after a visit to King Bridei, Saint Columba picked up a white pebble from the River Ness and said to his companions 'Mark this white stone, through which the Lord will bring about the healing of many sick people among this heathen race' (*Life of Columba*, I, 1; II, 33; Sharpe 1995). Painted pebbles, of which the Portmahomack workshop has also produced a fine example, are also thought to have performed some magical role among the Picts. Their distribution is confined to the north-east part of Britain in the early medieval period (Ritchie 1972).

The accumulating evidence for vellum-working has directed attention to other less specific features nearby. The narrow road-side ditch was no doubt primarily intended to drain the road, but it would also have been a useful carrier of water into the workshop zone. The hearths excavated in the workshop area were not, in this case, dedicated to metal-working, and might rather have provided a source of heat for drying and hardening the parchment folios. Five metres to the north, a rectangular pit (illus 7) may have functioned for soaking hides. It

was lined with stone slabs and surrounded by a sill of rammed pebbles. It was equipped with an outlet culvert, also stone lined, which took liquid away down hill towards the millstream. It contained a very sparse residue with a green tinge that seemed to suggest it had once held some organic liquid. Although now leaky, the gaps between the slabs could have been readily waterproofed with the ubiquitous red boulder clay that is found at a depth of about 1.5m. At first thought to be a latrine or wash-place, this pit was revisited with an eye to its possible deployment in leather or vellum manufacture. It seemed to provide a good match for the shallower type of pit in which the hides were washed and handled in caustic solution.

More work is needed to firmly identify the correlates of such features, which can remain exasperatingly unspecific at the macro-level. Elizabeth Rennie has drawn our attention to the 'fire-pit' (F8) excavated at Ardnadam in Argyll, which was lined with stone slabs and equipped with a drain. The pit was located within in a structure or fence with a pebbled floor and there were two substantial post-holes on each side. The pit's contents of ash and heat-cracked stones naturally suggested a furnace, but Rennie noted the force of liquid outflow from the drain and concluded that the pit was originally built for tanning, with posts for suspension on either side. It stood adjacent to an early medieval chapel. Three rubbing stones were also found, and a heap (two bucketfuls) of smooth round white pebbles (Rennie 1984, 30–1; 1991, 31). It seems probable, given the importance of leather as a resource and measure of wealth in the early medieval period, that the various apparatus of tanning and tawing and vellum-making will one day come to be more widely recognized (cf Alcock 2003, 101).

The intact floor horizon of a workshop so littered with tools, waste products and the remains of raw materials granted a rare opportunity to examine a specialized craft area (illus 3). The cluster of whetstones, burnishers, strike-a-lights and small pebbles around the



ILLUS 7 (a) Stone-lined trench excavated at Ardnadam Glen, Argyll (after Rennie 1984, 30)
(b) Stone-lined trench at Portmahomack with effluent culvert. A possible tawing-tank

hearth gave a picture of craftsmen gathered around the main source of heat and light. However, not only does the distribution of these objects provide evidence for behavioural detail, it also implies a building deserted in a hurry. The layers of burning overlying the workshop buildings of the Portmahomack monastery may explain why such a wealth of evidence has been found in situ.

What remain deeper in the province of speculation are the texts that may have been produced in the Portmahomack scriptorium. The insular inscription, dedicating one of early medieval Europe's most accomplished sculptural monuments to an individual, indicates

that literate craftsmen worked at Portmahomack (Higgitt 1982). The art of their sculpture shows that the members of the Tarbat community as a whole would have been familiar with, and capable of producing, the finest Insular manuscripts that have survived, such as the Lindisfarne Gospels, at one end of the eighth century, and the Book of Kells at the other (Henderson & Henderson 2004). Now the *parchmenerie* that has been excavated endorses the notion that they had the blank folios on which to write and illuminate insular texts in the heart of northern Pictland, then almost at the known limits of the Christian world. Would that one such text could one day come to light!

CONCLUSION

These observations of materials and activities associated in one of the Portmahomack workshops have led, through mutually supporting inference, to the conclusion that parchment, probably vellum, was being prepared there. The context of Portmahomack is monastic, which makes vellum-production there easier to believe, just as vellum-production would reinforce the identification of that context. From this first body of evidence, more secure and more direct correlates for vellum production may eventually emerge. The distinction between workshops preparing vellum and more robust kinds of leather is a fine one, and we should seek more specific tests to distinguish them, particularly chemical tests to identify the preservative solutions (tannins or astringents) that currently form the principal diagnostic. Correct identification is matter of great interest, since the question of whether vellum was produced on hillfort sites such as Dunadd, Dundurn or Dunollie is crucial to models of social control. Such production would imply either that early medieval monasteries had no monopoly of the written word, or that they were dependent on the secular power for the creation of their most influential instrument.

Recognising more secure correlates may not be just a matter of chemistry. It is likely that the production of illuminated books in Insular contexts required a degree of ingenuity in order to adapt this Mediterranean craft to local conditions. Alkaline seaweed and tubeworm-ash, cattle hides and metapodials, selected pebbles, local abrasive stones and pumice that floated to the shore are examples of materials possibly recruited in the far north to the service of the great manufacturing project of the age. The colours are also likely to have been extracted from local resources, such as the use of *Nucella lapillus*, proposed as a substitute for murex to produce purple dye (Henry 1952; Murray 2000). Thus the residues, if and when recognized, may not be precisely those anticipated, and it will be necessary to extend the inquiry to the properties of what materials were being exploited and how they might serve as substitutes.

Craftsmen at Portmahomack may well have been making brown tanned leather for boots and jerkins, and white tawed leather for book satchels. But the balance in favour of vellum being an additional, or principal, product is perhaps tipped by the subtlest components: the pebbles and pegs of a stretcher-frame found together, the pumice, the abrasive agent implied by *spirorbis*, and the proximity of the wood-workers and metal-smiths. The case for book production at Portmahomack is not yet unequivocal, but deposits and features from the workshops await excavation in the closing seasons of the project and extensive further analyses are planned for the assemblage. It is for this reason that we have decided to publish, now, our findings to date. Although preliminary, we hope they will provoke colleagues into expressing suggestions and reservations that may still be tested while the site lies open in the ground.

ACKNOWLEDGEMENTS

We are especially grateful to John Higgitt for allowing us to profit from his extensive knowledge.

Special thanks to Gifford Charles-Edwards whose experiments with *spirorbis* demonstrated its potential use as pounce, and to Mark Clark who generously shared with us insights and information won from his experiences with the parchment-makers of Ethiopia. The illustrations were prepared by Toby Simpson and Richard Jackson. The Tarbat project is co-directed by Justin Garner-Lahire of FAS Ltd and supported by Tarbat Historic Trust, Historic Scotland, the National Museums of Scotland, Highland Council and Ross and Cromarty Enterprise.

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