

CELTIC SEAFARING AND TRANSPORT

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In this chapter I plan to review the evidence for Celtic boats and ships, the landing places these vessels were operated from, and the way goods were moved inland from beach, river foreshore and lakeside. I shall also describe some of the seafaring and navigational techniques the Celts needed to use on overseas voyages.

The precise bounds of the Celts in time and space are difficult to define. In certain parts of Europe, for example, there is a degree of cultural continuity archaeologically visible from the second millennium BC, through to Roman times (Audouze and Büchsenschütz 1991). Furthermore, in Ireland and in other western regions of the archipelago of islands off the north-west coast of continental Europe, Celtic cultural traits, including boatbuilding techniques, continued into the medieval period and beyond. The core period of this book is, however, 600 BC to AD 600, and this chapter will therefore generally be restricted to that date range. It will also concentrate on the heartlands of the Celtic peoples (Figure 15.1) and not follow them to the eastern Mediterranean.

Environmental conditions such as sea-levels, the shape and character of coastlines, river courses and the general climate, all of which have an effect on maritime affairs, have not always been as they are today (McGrail 1987: 258–60). However, off north-west Europe in the period from the mid-first millennium BC to the mid-first millennium AD, the mean sea-level was well within today's tidal range, at c.1.5 to 0.7m below the AD 1950 tidal datum; the tidal regime was probably comparable with that we experience today; and the climate, including the predominant wind, must have been not unlike that of the twentieth century, apart from the 300 years or so from AD 100 to 400, when it was somewhat warmer and drier (Heyworth and Kidson 1982; Lamb 1977: 372–4, 384–5). The main environmental differences are that, in the period under discussion, there would have been less silting of estuaries, and spits and bars across river mouths would not have been as prominent as they are today. Furthermore, rivers, especially in their lower reaches, would not have been restricted to the one well-defined channel to which they are nowadays generally constrained.

WATER TRANSPORT

By the Bronze Age the technological 'environment' in Europe was such that, in theory, almost any type of raft and boat ever known could have been built (McGrail

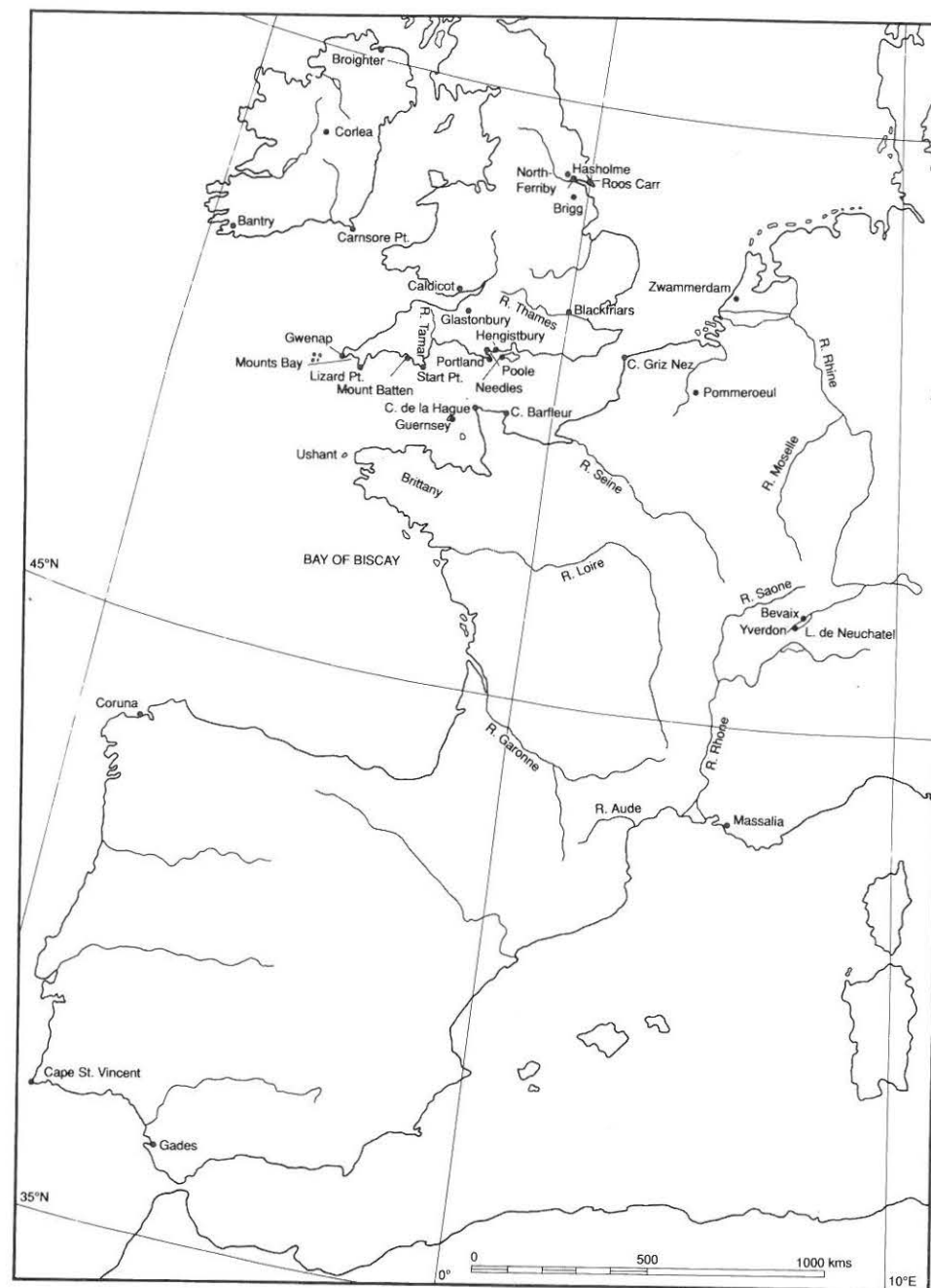


Figure 15.1 Map of Atlantic Europe showing sites named in the text. (Institute of Archaeology, Oxford.)

1990b: table 4.1). Those most likely to have been built are: bundle rafts, log rafts, hide boats, logboats and plank boats. All these could have been used on inland waters for hunting, fishing and the gathering of reeds, for the movement of animals and goods, and for social intercourse.

Rafts, however, cannot generally be used at sea north of latitude 40° to 45°N, even in the summer months. People cannot endure for long the chilling and wetness effects of low sea temperatures, combined with wind and spray, which soon produce numbness and indeed hypothermia. Thus boats, in which there is some protection from the elements, had to be used for seafishing, and for coastal and cross-Channel voyages in European waters outside the Mediterranean.

Propulsion

Paddles capable of propelling rafts and boats are known from the fourth millennium BC in Europe, whilst the earliest evidence for oars is a fifth-century BC gold model boat (Figure 15.2) from Dürrenberg (Ellmers 1978). There is both documentary and iconographic evidence for indigenous sail in north-west Europe from the first century BC (Caesar, *De Bello Gallico* III.13; Farrell and Penney 1975). However, embedded within the fourth-century AD poem *Ora Maritima* by Avienus (Murphy 1977) are extracts from a *periplus* (a coastal pilot's 'handbook') which Hawkes (1977: 19) has dated to the late-sixth century BC. This *periplus* mentions two-day voyages by hide boats from the region of Ushant in western Brittany to Ireland, which almost certainly must have been made under sail.

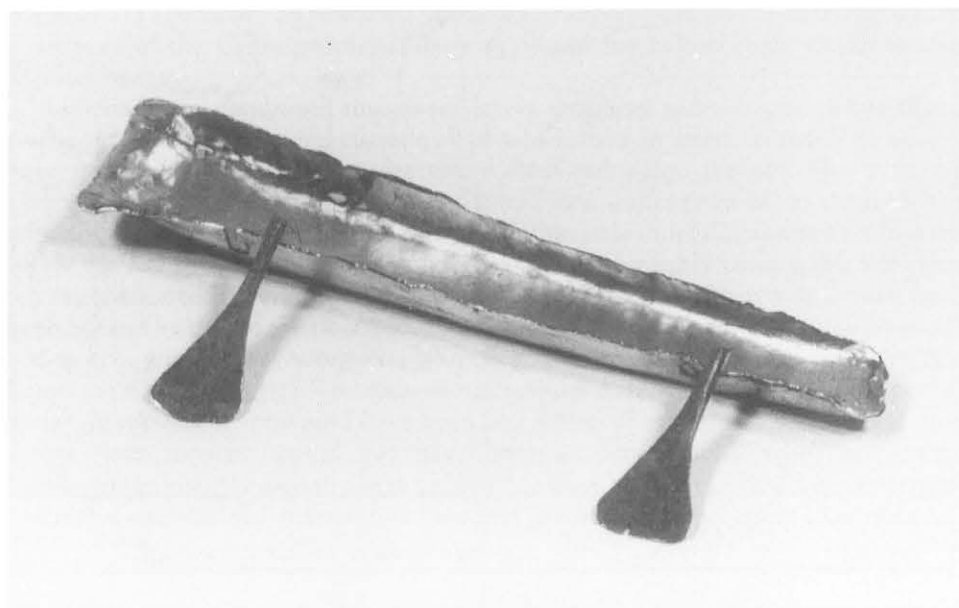


Figure 15.2 A fifth-century BC gold model boat with two oars from Dürrenberg (Germany). (Photo: Keltenmuseum, Hallein.)

Steering

A first-century BC gold model boat from Broughter in the north of Ireland (Figure 15.3) has a steering oar pivoted near the stern as have the boats depicted on the first-century AD monument to Blussus (a Celt) now in Mainz Museum (Ellmers 1975) (Figure 15.4), and on a third-century AD altar to the Celtic deity Nehalennia from Colijnsplaat (Ellmers 1978: fig. 5). A steering oar, some 10 m in length, and dated to the second/third century AD, has been recovered from Lake Neuchâtel, Switzerland (Egloff 1974); a 5.15 m steering oar from the first/second century AD boat site at Zwammerdam, Netherlands (de Weerd 1988); and one of 4.10 m in length with the second/third century AD Bruges boat (Marsden 1976: fig. 6). As the boat depicted on the eighth-century AD Kilnaruane Pillar near Bantry, Co. Cork, also has a steering oar (Hourihane and Hourihane 1979), the total evidence seems to suggest that steering oars were widely used on Celtic boats. There is no mention of the steering arrangements of the Veneti seagoing plank ships described by Caesar (*De Bello Gallico* III.13) and by Strabo (IV.4.1) and perhaps we may conclude that they had side rudders as in Roman ships, possibly only one rather than a pair. Side rudders are, indeed, shown on the starboard side of seagoing plank vessels depicted on two

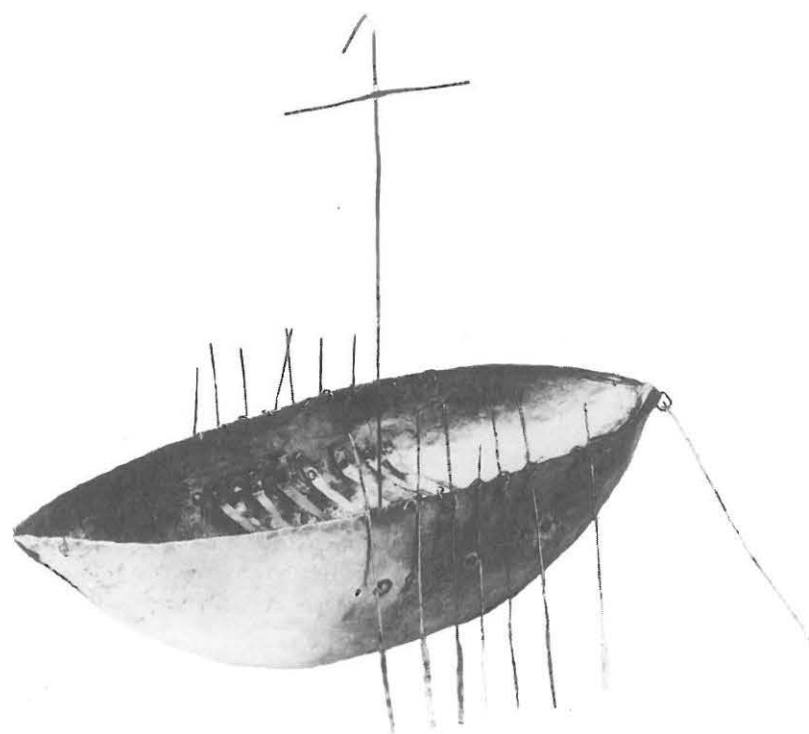


Figure 15.3 A first-century BC gold model boat from Broughter (Ireland). (Photo: National Museum of Ireland.)

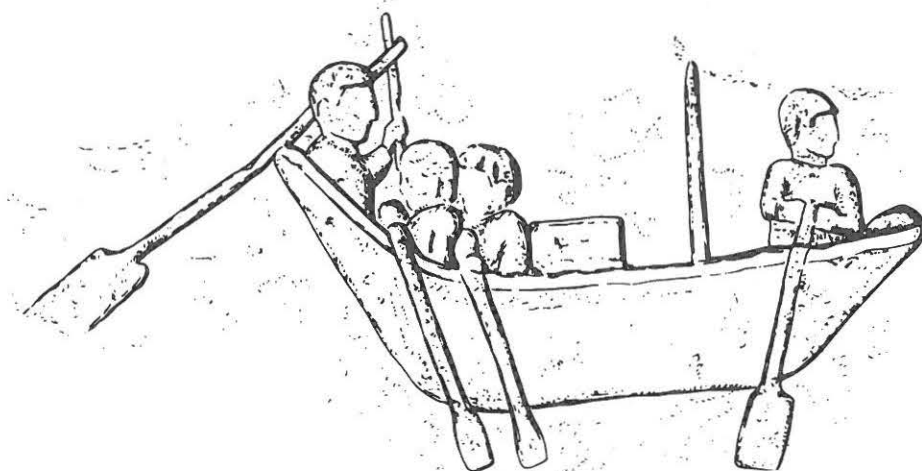


Figure 15.4 Relief on first-century AD Blussus monument (Mainz).
(Drawing: Landesmuseum, Mainz.)

first-century AD coins (Figure 15.5) of the Celtic ruler Cunobelin found at Canterbury and at Sheepen near Colchester (McGrail 1990b). This is some 500 years before the first evidence for side rudders on vessels of the pre-Viking/Nordic tradition of northern Europe (McGrail 1987: 244–6).

Rafts

In the first century BC Caesar (*De Bello Gallico* 1.12) noted that the Celtic Helvetii used log rafts to cross the river Saône, a tributary of the river Rhône, whilst the Sugambri used them to cross the river Rhine (*De Bello Gallico* vi.35). Parts of two log rafts dated to the second century AD were found at Strasbourg near the river Rhine in 1938 (Ellmers 1972: 106, figs 83, 84).

Bundle rafts have not been excavated and as they are generally made of ephemeral materials which can readily be reused, perhaps early examples will never be found. However, simple rafts of reed bundles have been used in recent times on inland waters in Ireland and elsewhere in Europe (McGrail 1987: 163) and it seems likely that they were widely used in earlier times wherever reeds were readily available.

Logboats

Logboats – that is boats made by hollowing out a log and sometimes known as ‘dugout canoes’ – have been found throughout north-west Europe (McGrail 1978: 4–13). The circumstances of their discovery usually mean that dating by association or by stratigraphy is not possible. Furthermore, research is insufficiently advanced at present to permit accurate dating by technological criteria. It is necessary therefore to



Figure 15.5 A first-century AD coin of Cunobelin from Canterbury. (Photo: Canterbury Archaeological Trust.)

use other methods, such as radiocarbon assay, to obtain reliable dates. Apart from a few Swiss logboats (Arnold 1992), however, there is at present only one European region, southern Britain, where a sizeable group of logboats has been dated and technologically recorded. The Godwin Laboratory in the University of Cambridge has recently published 81 radiocarbon dates for 57 British logboats; of these, ten boats are dated between 600 cal. BC and cal. AD 600 and also come from sites which can clearly be identified as having been occupied by Celtic peoples at the time of deposition (Table 15.1). Four logboats dated from before 600 BC (Peterborough, Short Ferry, Brigg and Appleby), which appear to have technological similarities with those of the core Celtic period, are also included in Table 15.1.

Raw Material

All the logboats in Table 15.1 were of oak (*Quercus* sp.), as are the great majority of those reported elsewhere in Europe. In general terms the tabled data show that the length of parent tree of these logboats becomes less with time, either because smaller logboats were able to carry out the functions required of them, or because larger oaks were no longer available. From the Appleby logboat of 1525 to 1205 BC to Holme Pierrepont 3 of 410 to 135 BC twelve parent logs averaged 9.3 ± 2.9 m in length, whilst the five parent logs from Shapwick (795 to 80 BC) to Wisley (110 BC to AD 345) averaged 5.6 ± 1.5 m.

Table 15.1 Logboats from Southern Britain dated AD 600 or earlier

Logboat	Date range BC cal.	Region	Size ^d (m)	Deadweight ^e coefficient	Volumetric ^f coefficient ($\times 10^{-3}$)
Appleby Short Ferry	1525-1205	Humber/Ancholme	>7.5 × 1.35		
Brigg 1	1255-805	Wash/Witham	>7.3 × 0.85		
Peterborough	1245-800	Humber/Ancholme	14.78 × 1.37 × 1	0.67	1.54
Hasholme ^a	875-530	Wash/Nene	>9.8 × 0.78		
Ellesmere	750-390	Humber/Foulness	12.78 × 1.4 × 1.25	0.57	3.00
Clifton 1	465-200	Severn/Parry	3.35 × 0.73 × 0.44	0.67	11.3
Clifton 2	450-195	Humber/Trent	8.55 × 0.76 × 0.36	0.43	1.9
Poole	415-95	Humber/Trent	9.25 × 0.76 × 0.38	0.47	1.7
Holme Pierrepont 1	410-190	Poole Harbour	10.01 × 1.52 × 0.5	0.57	1.94
Holme Pierrepont 2 ^b	410-135	Humber/Trent	>6.5 × 0.86		
Holme Pierrepont 3 ^b	—	Humber/Trent	>5.3 × 0.82		
Shapwick ^c	—	Humber/Trent	>10.0 × 1.28		
Glastonbury 1	795-80	Brue	>6 × 0.75		
Woolwich	340-30	Brue	5.4 × 0.69 × 0.42	0.60	4.6
Baddiley Mere	205-105 AD	Thames	>4.75 × 0.55		
Wisley	100-110 AD	Mersey/Weaver	5.49 × 0.92 × 0.61	0.66	14.8
	110-345 AD	Thames/Wey	>3.66 × 0.7		

Notes

^a Dated by dendrochronology (Sheffield) to 322-277 BC (Millett and McGrail 1987: 79-84).

^b Undated but considered contemporary with HPR.

^c The one date for this boat (Q-357) has a high uncertainty (± 120), hence the large date range. It is possible that this boat has a similar date to Glastonbury 1.

^d Sizes are given as length $\times$ max. breadth $\times$ max. height of hull, for those boats which have been theoretically reconstructed. For the others, with less remains, a minimum length and breadth are given.

^e Deadweight coefficient = weight of crew and cargo/displacement at standard draft (60% height of sides). The greater this coefficient, the better the boat is for carrying high density loads (McGrail 1978: 137).

^f Volumetric coefficient = displacement/cube of waterline length (when carrying maximum crew and no cargo). A value $\leq 2 \times 10^{-3}$ indicates a hull of potentially high speed.

Sources

Dates: Switsur, R.V. (1990) *Results of Boat Dating Programme*, Cambridge (unpublished). The dates have been calibrated using the curves published by Pearson and Stuiver (1986). The felling dates of the parent logs of these boats (close to the building date) could be an estimated 25 to 70 years later than the calibrated dates given above.

Other data: McGrail, S. (1978) *Logboats of England and Wales*, Oxford: British Archaeological Reports 51.

Woodworking Techniques

The techniques used to fasten fittings or to make repairs to logboats may be listed in chronological order:

- sewing from c.1525 to 800 BC
- wooden treenails from c.1525 BC to AD 345 (and onwards)
- dovetailed joints from c.1255 to 135 BC (and onwards)
- cleat and transverse timbers from c.1245 to 277 BC.
- iron nails from c.410 to 135 BC (and onwards)

Large, mature oaks tend to develop heart rot which spreads up the centre of the tree from the butt end. Every logboat over 7 m long in Table 15.1 had been fitted with a transom board set into a groove near the stern – this was probably necessary because of heart rot at that end. In the case of the Brigg parent log this rot extended almost to the bow end (Atkinson 1887: 367); in the Hasholme tree, rot probably extended along the whole of the usable length, for a composite bow of two large timbers had to be fastened to the main log (Figure 15.6). Extending the bow of a logboat as in Hasholme is almost unique: the only comparable cases are Pommeroeul 2 (de Boe and Hubert 1977) and Zwammerdam 3 (de Weerd 1988), both dated to the first/second centuries AD.

Estimates of the age of the Hasholme tree when it was felled range from 600 to 820 (Hillam 1987: 84) to 810 to 880 years (Millett and McGrail 1987: 107). This log, without branches, would have weighed more than 20 tonnes, whilst the Brigg parent log would have weighed over 30 tonnes, both sizeable objects to move from the forest to the river: that the Celts could do this testifies to their competence in this field.

Performance

Details of the loads eight logboats could carry are given in Table 15.2 where it can be seen that, in a state of adequate transverse stability, the smallest one could carry a useful load of 337 kg whilst the logboats from Brigg and Hasholme could carry nearly 6 tonnes.

The volumetric coefficients in Table 15.1 were calculated at the 'maximum men' condition given in Table 15.2, that is, when maximum paddling power was available. Four logboats, Brigg, Clifton 1 and 2 and Poole, have coefficients $\leq 2 \times 10^{-3}$: in theory these boats have high speed potential. For reasons of stability, however, the Clifton boats were probably only able to embark around half the crew there was room for and thus they are unlikely to have developed sufficient power to achieve more than, say, 3 kts. On the other hand, both Brigg and Poole were able to carry a full complement of paddlers, who, in reasonable conditions, may have been able to make the boat semi-plane and thus achieve extraordinary speeds, say up to 7 kts for a short while.

The Use of Logboats at Sea

A simple logboat, generally speaking, has insufficient freeboard (height of sides above waterline) and transverse stability to be safely used at sea except in the calmest

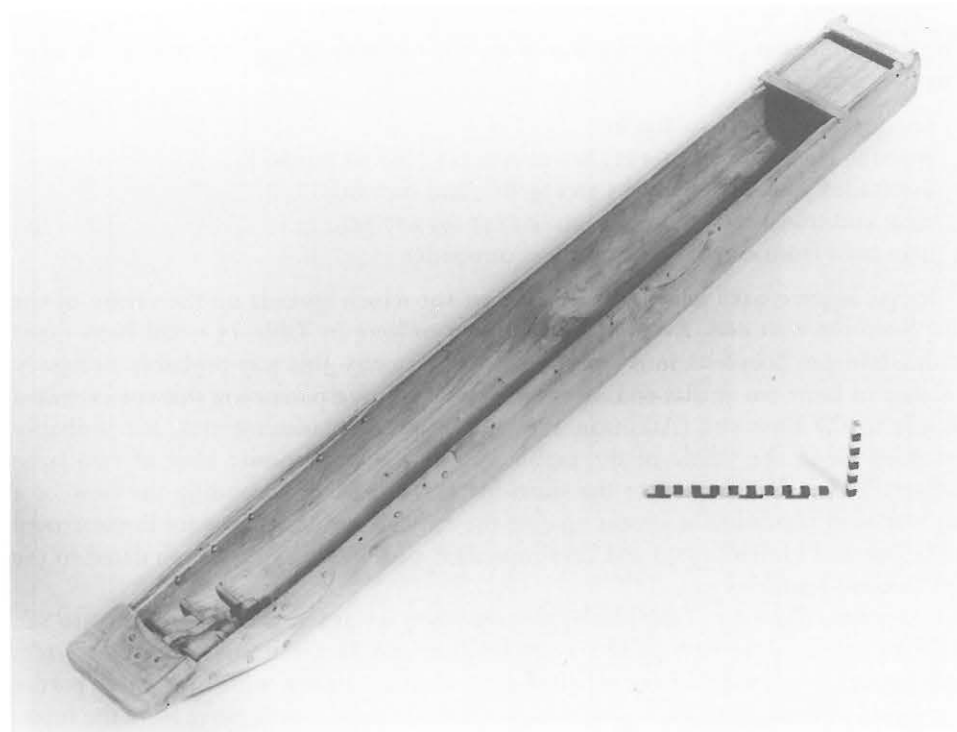


Figure 15.6 Model of the Hasholme logboat of c.300 BC (1:10 scale). (Photo: Institute of Archaeology, Oxford.)

of conditions. It is possible, however, to gain extra stability by increasing the waterline breadth (beam measurement) of a boat; and to increase freeboard by adding extra planks to the sides. Washstrakes were, in fact, added to the Hasholme logboat but only over a limited length towards the bow and no effective extra freeboard was gained overall.

One way of increasing the waterline breadth of a logboat is to force the sides apart after heat treatment. There is, however, no sign that any of the boats in Table 15.1 had been so expanded. Indeed, it is only certain species of tree that can be expanded safely, and oak seems unlikely to be one of these (McGrail 1978: 38–41).

A second method of increasing the waterline breadth measurement and hence improving stability is to pair two boats side by side. Clifton 1 and 2 are very similar to one another and could have readily been paired; however, there is no sign on the surviving remains of any appropriate fittings or fastenings. On the other hand, the three logboats from Holme Pierrepont, also from the river Trent, do have a number of holes along their sides which *might* be where each one was fastened to another boat of similar form. Nevertheless, these boats were incomplete when found, the accounts of their recording do not always agree with the published drawings, and they have never since been made available for re-recording and so the evidence remains ambiguous (McGrail 1978: 205–18, figs 20–2).

Table 15.2 Load-carrying estimates for eight logboats from southern Britain

Boat	Description	Draft (m)	Freeboard (m)	%age ^a	Dwt ^b (tonnes)
Brigg	maximum men (2 + 26)	0.35	0.65	35	1.44
	5 men + 5491 kg cargo	0.60	0.40	60	5.79
Hasholme	Maximum men (2 + 18)	0.46	0.79	37	1.20
	5 men + 5502 kg cargo	0.75	0.50	60	5.80
Ellesmere	maximum men (1)	0.13	0.31	28	0.06
	1 man + 277 kg cargo	0.26	0.18	60	0.38
Clifton 1	maximum men (1 + 5)	0.17	0.19	46	0.36
	2 men + 361 kg cargo	0.21	0.15	60	0.48
Clifton 2	maximum men (1 + 6)	0.19	0.19	50	0.42
	2 men + 533 kg cargo	0.23	0.25	60	0.65
Poole	maximum men (2 + 16)	0.29	0.21	59	1.08
	4 men + 898 kg cargo	0.30	0.20	60	1.14
Glastonbury 1	maximum men (1 + 2)	0.18	0.24	42	0.18
	1 man + 345 kg cargo	0.25	0.17	60	0.41
Baddiley Mere	maximum men (1 + 6)	0.25	0.36	41	0.42
	1 man + 832 kg cargo	0.37	0.24	60	0.89

Notes

^a Ratio of draft to height of sides expressed as a percentage. 60% is used for international comparison of seagoing vessels.

^b Deadweight = weight of crew and cargo.

Source McGrail 1978.

Glastonbury 1 has notches worked in the top edges of both sides, near one end (McGrail 1978: fig. 62) which may have been where a transverse fitting was fastened to pair this boat to a similar one. However, at least one more fastening point would be needed and there is no clear sign of this.

Thus there is no unambiguous evidence that Celtic logboats from Britain were paired and the continental evidence is also insubstantial. On the other hand, we know from Caesar (*De Bello Gallico* 1.12) that the Celtic Helvetii used paired boats as river ferries. Detailed recording of future finds from this period may provide more convincing artefactual evidence for this practice than is available from the logboats known to date.

Another stability-enhancing method is to fasten longitudinal timbers to both sides of individual boats at the waterline. The only early British logboats with holes through their sides are those from Holme Pierrepont, Hasholme and Brigg, but these holes appear to be either too high or too low for stabilizers.

In sum then, there is no unchallengeable evidence from this group of logboats from southern Britain that any were modified to increase stability or freeboard. Nor is there any good evidence for these practices in any other of the north-west

European logboats from this period. Nevertheless, paired boats were clearly used by the Celts on rivers and thus, providing that these boats had increased freeboard, they may also have been used at sea.

Hide Boats

Hide boats, sometimes known as skin boats, are essentially a hide or leather waterproof covering fastened to a framework of light timbers. These are insubstantial materials, not surviving well over the years, and there is little excavated evidence of them to date. Reappraisal of the evidence from an early bronze age grave at Barns Farm, Dalgety, Fife, has suggested to Watkins (1980) that the body had been buried in a coracle; Sheppard (1926) noted a 'coracle like vessel' containing a 'skeleton' found in Lincolnshire near the confluence of the river Ancholme with the river Humber and possibly of Roman date; whilst a bronze or iron age 'coracle burial' was said to have been excavated in 1961 at Corbridge near the Roman Wall (Bishop and Dore 1988: 7); and from a tenth-century crannog site at Ballinderry, Co. Westmeath, a short length of timber has been interpreted as part of a currach's framework (Ellmers 1972).

The literary evidence from the late first millennium BC onwards is more promising. The sixth-century BC *periplus* extract incorporated within Avienus's fourth-century AD poem *Ora Maritima* (Hawkes 1977; Murphy 1977) tells us that the 'hardy and industrious peoples' of western Brittany used hide boats (*netisque cumbis*) to obtain tin and lead from Ireland and Britain, whilst Pliny (IV.104) quoting the early third-century BC historian Timaeus, describes how Britons used seagoing boats of 'osiers covered with stitched hides'. Other references to British hide boats, used both at sea and on inland waters, are made by Roman authors of the first century BC to the third century AD including Caesar (*De Bello Gallico* I.54), Pliny (VII.206), Lucan (*Pharsalia* IV.130–8) and Solinus (*Polyhistor* II.3).

The Brouighter Model

A small gold model from Brouighter on the margins of Lough Foyle, Co. Derry, Ireland, probably represents such a seagoing hide boat of the first century BC (Figure 15.3). This vessel could be propelled by a square sail on a mast stepped near amidships, or by oars – nine oarsmen each side – or in the shallows by poles ('punted'). She was steered by a steering oar which could be pivoted through a grommet (of rope?) on the port or starboard quarters. Other equipment with this model includes a grapnel anchor and a spar which may have been used to bear out the sail thus improving windward performance. If we assume that the thwart (cross-beams) are spaced at 3 ft (0.914 m) intervals, the minimum distance for sea-rowing (McKee 1983: 139) then this model represents a hide boat which was c.20 m in overall length: that is, about twice the size of T. Severin's hide boat *Brendan* (1978). The largest Inuit seagoing hide boat (umiak) ever recorded is said to have been c.18 m in length (Adney and Chapelle 1964: 175–6), so 20 m would not be an unreasonable estimate for the length of the Brouighter prototype.

Hide Boat Structure

Recent umiaks and currachs have not had keels, and their wooden framework has been made of laths fastened together by lashings, wooden pegs or iron nails. However, a late seventeenth-century drawing, now in the Pepys Library of Magdalene College, Cambridge, shows a large Irish sailing currach with prominent keel and stem outside the hide, and with a woven wickerwork hull underneath the hide. From medieval authors such as Adamnan, in his sixth/seventh-century *Vita St Columba* (Anderson and Anderson 1961; Marcus 1953–4: 315) and from classical authors such as Caesar (*De Bello Gallico* I.54), Lucan (*Pharsalia* IV.136–8), Pliny (*Naturalis Historia* VII.205–6) and Dio Cassius (*Epitome* XLVIII.18–19) we get a similar picture of early British and Irish hide boats built on an osier or woven wicker framework and having prominent keels.

With such a keel an ancient currach would have been able to sail somewhat closer to the wind than its keel-less twentieth-century equivalent; and the woven basketry framework would have been stronger and more resilient than the frameworks of twentieth-century hide boats.

Performance

The lightweight structure of a hide boat, only half the weight of a planked boat of similar capacity, gives it good freeboard even when loaded: however, the consequent light draft means less resistance to leeway, and modern currachs and umiaks have a strong tendency to drift downwind. On the other hand, the prominent keel on the ancient currach and the use of a steering oar rather than a rudder mean that Celtic seagoing hide boats probably experienced less leeway than their keel-less twentieth-century equivalents. The other main drawback of the hide boat is that, although hide on a woven framework results in a resilient and energy-absorbing hull, the hide cover contributes little to structural strength: thus hide boats are limited in length and could never have been developed into ships. They would, however, have fitted well into the environment and economy of the western Celts in France, Britain and Ireland for fishing and for transport both at sea and on rivers and lakes. It is much to be regretted that, as yet, we have no excavated example of this 'workhorse' of the maritime Celts.

Plank Boats

Sewn Boats

The oldest known plank boats in Europe, and indeed in the world outside Egypt and the eastern Mediterranean, are from Britain: the so-called Brigg 'raft', actually a flat-bottomed boat, from the river Ancholme, a tributary of the river Humber, dated c.800 cal. BC (McGrail 1981b, 1985; Switsur and Wright 1989); the remains of three, possibly four, boats from North Ferriby on the northern foreshore of the Humber, dated c.1300 cal. BC (Wright 1990; Switsur and Wright 1989); and a plank fragment from a former bed of the river Niddern, a tributary of the river Severn at Caldicot Castle, Gwent, dated 1594–1454 cal. BC (Parry and McGrail 1991). These boats were

built in the shell sequence from oak (*Quercus* sp.) planks which were fastened together by yew (*Taxus* sp.) lashings (Caldicot and Ferriby) or by continuous willow (*Salix* sp.) stitching (Brigg), with moss caulking between the planking held in position by longitudinal laths. Another common feature is that the planks in these boats were linked together by transverse timbers wedged within mortises in cleats that were proud of, but integral with, the planking. This technique was also used in a repair to the Brigg logboat and to fasten the lower bow to the hull of the Hasholme logboat – a tradition lasting from c.1500 to c.300 BC.

After the time of the Brigg 'raft', sewn plank boats are known only from the Baltic region: the plank boat from Hjortspring, Als, Denmark of c.350 BC (Rosenberg 1937); and medieval and later sewn plank boats of Finland, Sweden, Norway, Estonia and Russia (McGrail and Kentley 1985: 195–268). A similar survival at the margins may be seen in the Mediterranean: sewn planking is known from the third millennium BC through to the mid-first millennium BC in the eastern and central Mediterranean region, but from then on appears to be restricted to the Adriatic, in the Po estuary and on the Dalmatian coast, where it survived until at least the eleventh century AD (Pomey 1985; McGrail 1981a: 21).

The Caldicot, Ferriby and Brigg boats were all narrow, relatively long and full-bodied (Caldicot and Ferriby) or flat-bottomed (Brigg), without stems or significant keels. They were probably propelled and steered by paddles or, in shallow water, by poles. The Brigg boat would have been used within the river Ancholme, whereas the Caldicot and Ferriby boats could have been used along and across tidal estuaries and their associated rivers. Examples of loads that could be carried are given in Table 15.3. With a length:breadth ratio at the waterline of c.6:1, the Ferriby estuary boats were designed for speed, possibly up to 6 kts, which would be necessary when crossing the tidal Humber at times other than slack water.

In autumn 1992 there were further finds of early sewn plank boats in Britain: two fragments of planking, dated to c.1000 BC, at Goldcliff, Gwent, on the foreshore of the Severn estuary; and the substantial remains of a boat at Dover, Kent, in a former freshwater stream. The Goldcliff fragments have features also found in the Brigg 'raft', whilst the Dover boat has some similarities with the boats from North Ferriby.

Another Tradition?

One of the bronze age logboat-shaped coffins from Loose Howe, North Yorkshire, has a pseudo-keel and stem worked in the solid (Elgee and Elgee 1949; McGrail 1978). Furthermore, the Poole, and possibly Holme Pierrepont 3, logboats of the period 410–135 BC have similar 'stems'. Such fittings are non-functional in a logboat: the idea may well have been copied from a plank boat; this suggests that there may have been an early tradition of plank boats with keels and stems for which there is, as yet, no direct archaeological evidence.

Romano-Celtic Boats and Ships

Towards the end of the Iron Age and during late Roman times, between the first century BC and the third century AD, there is evidence for Celtic plank boats and ships, both riverine and seagoing. Caesar (*De Bello Gallico* III.13) and Strabo

Table 15.3 Load-carrying estimates for the Ferriby and Brigg plank boats

Boat	Load ^a	Draft (m)	Freeboard (m)	%age ^b	Dwt ^c (tonnes)	Dwt coeff. ^d
Ferriby 1	20 crew + 30 passengers + 2.9 tonnes of cargo ^c	0.58	0.40	60	6.70	0.60
Brigg 2	4 crew + 26 sheep 6 crew + 17 cattle	0.25 0.46	0.09 0.09	74 84	1.54 7.16	0.23 0.57

Notes

^a Assumes each man weighs 60kg; sheep 50kg; cattle 400 kg.

^b Ratio of draft to height of sides expressed as a percentage.

^c Weight of crew + cargo.

^d Deadweight/displacement.

^e If this was not high-density cargo, then the weight carried would be less.

Sources

Coates 1981, 1990: 113–16.

(*Geography* IV.4.1) describe the seagoing sailing ships of the Veneti Celts of south-west Brittany, which were more seaworthy and better suited to the difficult seas off north-west France than were Caesar's own vessels, for they could sail closer inshore and take the ground readily in those tidal waters. They had flush-laid oak planking which was caulked with 'seaweed' – possibly moss (Wright 1990), or even reeds (*harundines*), which Pliny (*Naturalis Historia* XVI.158) tells us were used for caulking by the Belgae in the first century AD. The Veneti planking was fastened to 1 ft (30 cm) thick framing timbers by iron nails 1 inch (2.5 cm) in diameter. These Veneti ships were propelled by sails of leather and were used for cross-Channel voyages to Britain. A Gallic merchant ship known as a *ponto* is mentioned elsewhere by Caesar (*Bellum Civile* III.29), but it is not clear whether this is a reference to the Veneti ships or to another Celtic seagoing type (McGrail 1990b: 41–3).

A Celtic sailing ship is featured on a gold coin of the first century BC Atrebatas (McGrail 1990b: fig. 4.9), but this representation is stylistic and difficult to interpret. Vessels with more readily recognizable features are depicted on two bronze coins of the first century AD issued by Cunobelin of the Catuvellauni of south-eastern Britain (Figure 15.5). These two vessels have the relatively deep hull of a merchant ship, were propelled by a square sail set on a mast stepped near amidships, and steered by side rudder. Braces to the yard suggest a weatherly performance, as do the protruding forefoot and the spar at the stem head which may have taken a bowline. If these Cunobelin ships were broad in the beam to match the depicted depth of hull, they would have been stable, seaworthy ships with good cargo capacity, albeit only moderate speed potential.

A dozen or more boats from the second and third centuries AD, some seagoing, some for inland waters, from the Thames estuary, the lower reaches of the Rhine (Figure 15.7) and nearby rivers, from Guernsey, and from the Swiss lakes, have several boatbuilding features in common which differentiate them as a group from both the contemporary Mediterranean tradition and from the late Roman/early



Figure 15.7 A Zwammerdam barge during excavation.
(Photo: I.P.P. University of Amsterdam.)

medieval proto-Viking tradition of northern Europe (McGrail 1981a: 23–4). Some of the boats in this group do have anomalous features: for example Zwammerdam 2 and 6 have some overlapping planking fastened by nails, comparable with proto-Viking techniques; whilst Zwammerdam 6 also has flush-laid planking fastened by loose-tongue joints similar to those in the Mediterranean tradition; and Zwammerdam 6 and Pommeroeul 5 have flush-laid planking fastened by obliquely driven spikes (de Weerd 1988; de Boe and Hubert 1977). Nevertheless, in all the boats of this group, the greater part of the planking is flush-laid and is not edge-joined, but fastened to the heavy framing timbers by large iron nails clenched by turning the point back through 180° so that it re-enters the frame.

This strongly suggests that these boats and ships were built in the skeleton sequence, possibly the earliest known use of this technique in the building of plank boats. Arnold (1992) has, however, argued that boats of this tradition designed for use on inland waters (in particular those from Yverdon and Bevaix, Switzerland) were neither skeleton nor shell construction, but ‘bottom-based construction’. It is true that shell and skeleton concepts are more difficult to apply to barge-like boats with flat-bottomed transverse sections and hard chines, than to round-hulled vessels; and it is also true, as Arnold says, that ‘the flat bottom constitutes a base for the entire construction’. However, the shape of the sides of such a boat is determined either by the shape of the first side strakes (the side timbers subsequently conforming to that shape), in which case the shell sequence has been used; or initially by the shape of the floor-timber ends and subsequently by the side timbers (the planking conforming to this shape), in which case the skeleton sequence has been used. Which of these two sequences was used is not clear from the publications of the great majority of boats in this tradition, but it is clear for the ship Blackfriars 1 (Figure 15.8) (Marsden 1991): floor timbers were fastened to the two longitudinal planks forming the keel of this ship, and the shape of the hull (full form with rounded bilges) was determined by these floors and by the subsequently erected side framing – thus Blackfriars 1 was built in the skeleton sequence, as also probably was the Romano-Celtic ship from St Peter Port, Guernsey (Rule 1990).

The idea of using a framework or skeleton to give the form of a boat had been familiar to north-west European hide-boat builders from prehistoric times (McGrail 1987: 173–86). To transfer this technique to the building of plank boats and ships may well have been a major contribution by the Celts to nautical technology. There are, however, those who would not give the name ‘Celtic’ to this distinctive type of boatbuilding: see, for example, Parker (1991); and Haywood (1991: 17–21) has argued that, by the second and third centuries AD, the land near the Rhine mouth, where several of these boats were excavated, was occupied by Germanic tribes. Nevertheless, most of these boats were excavated from regions which were undoubtedly occupied by Celts at the date attributed to the boats. Furthermore, the general similarity between Caesar’s description of the Veneti vessels and features of the Blackfriars 1 and St Peter Port ships is undeniable. It does not therefore seem unreasonable to call this tradition ‘Celtic’ although perhaps ‘Romano-Celtic’ (or ‘Gallo-Roman’ to Francophones) is to be preferred, as the nucleus of the boats and ships of this tradition are of Roman date; moreover, this term draws attention to the possibility of some Roman technological influence on this Celtic tradition.

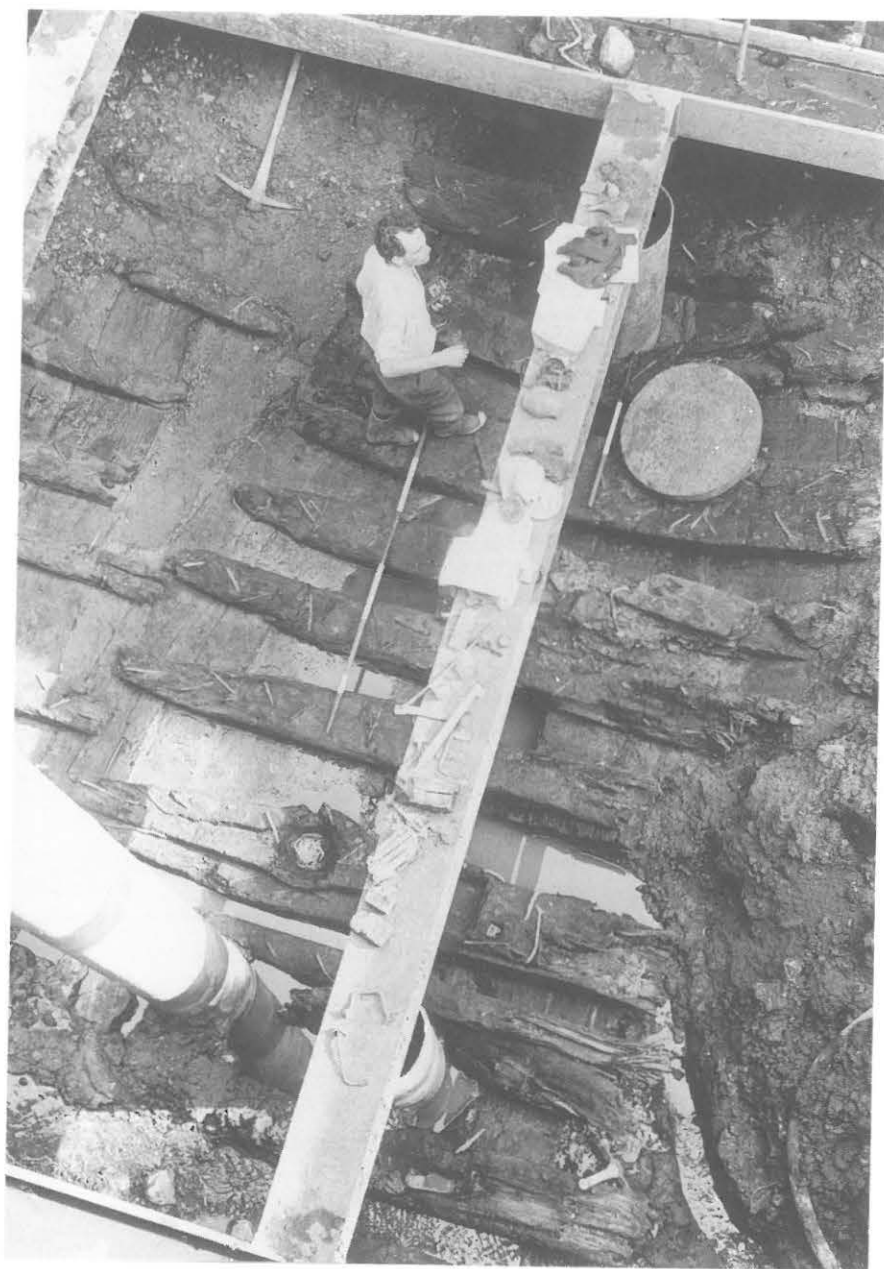


Figure 15.8 Blackfriars boat 1 during excavation. (Photo: P. Marsden.)

De Weerd (1988, 1990) has taken an extreme view on this question and argues that the Zwammerdam boats and related ones were built under strong Roman influence. He has sought to demonstrate that their planks were of standard lengths and that their frames were spaced out in multiples of the standard Roman unit the *pes*

monetalis. As Arnold (1991) has pointed out, de Weerd's sample is small, there are inconsistencies in his choice of data for analysis, and his use of 1:20 scale drawings rather than direct measurement cannot give the necessary accuracy of measurement. Moreover, such data, even when precisely measured, must be investigated statistically to determine the numerical value of the unit most likely to have been used, rather than assuming, as de Weerd has done, that the *pes monetalis* was the unit and then showing that it more or less fits the data.

Another distinctive feature of these Romano-Celtic boats and ships is that, where a mast step has survived to be excavated, it is found to be positioned at c.one-quarter to one-third the waterline length from the bow (McGrail 1987: 217–18, table 12.5; Rule 1990). For barge-like boats used on rivers this is the ideal position for a towing mast, but for the two seagoing ships (Blackfriars 1 and St Peter Port) such a mast must have carried a sail. A square sail so far forward would induce steering problems if the wind was other than from the stern sector (McGrail 1987: 225–7). This suggests that these two ships may therefore have had a fore-and-aft sail such as a sprit or lugsail, rather than a square sail (McGrail 1990b: 45). Support for this hypothesis comes from Rhineland representations of Romano-Celtic river boats of the second/third century AD, which Ellmers (1969, 1975, 1978) believes have leather lugsails with battens.

Here again is another strong suggestion of a Celtic innovation, as lugsails are otherwise not known in European waters until post-medieval times. Such fore-and-aft sails would have enhanced the windward performance of Celtic boats and ships, and as the mast was well forward, the cargo hold would have been free of obstructions. Both river barges and seagoing ships of this Romano-Celtic tradition were capable of carrying sizeable quantities of cargo: the barges 18 to 20 tonnes; the Blackfriars ship up to 60 tonnes (Table 15.4).

In autumn 1993 a third-century AD boat of the Romano-Celtic tradition was excavated at Barland's Farm, Magor, Gwent, from the bed of a stream which formerly flowed southwards into the Severn estuary. This boat has a mast-step well forward and other features characteristic of this tradition. In general terms she may be thought of as a boat one-fifth the size in volume of Blackfriars 1.

CELTIC BOATBUILDING AND SEAFARING

Similarities between the logboats and plank boats of the period 600 BC to AD 600 and those of earlier times suggest that the roots of Celtic boatbuilding lie in the second millennium BC or earlier. From this time onwards increasing competence is shown in boatbuilding and woodworking techniques, for example, the movement of large logs from felling site to river and their transformation into cargo-carrying logboats; the ingenious system of interlocking planking seen in the Ferriby boats, particularly towards the bow and stern; and the range of techniques used in the Hasholme logboat of c. 300 BC. Iron began to be used in boats in the period 410–135 BC or even earlier, culminating in the great iron nails used to fasten planking to framework in Romano-Celtic seagoing ships: these nails were up to 0.79 m (2 ft 7 in) in length and weighed up to 1.5 kg (3.3 lbs), a very clear indication of the Celtic smith's abilities (see Chapter 17).

Table 15.4 Load-carrying estimates for three Romano-Celtic vessels

Vessel	Load	Draft (m)	Freeboard (m)	%age ^a	Dwt ^b (tonnes)	Dwt coeff. ^c
Blackfriars 1	12 barrels of wine	1.02	1.83	36	15.33	0.30
	grain	1.07	1.78	37	18.36	0.35
	stone	1.18	1.67	41	26.00	0.45
	mixed load	1.71	1.14	60	63.30	0.66
Bevaix	mixed load	0.50	0.40	55	10.00	0.61
	mixed load	0.70	0.20	77	18.00	0.74
Yverdon 1	mixed load	0.80	0.20	80	20.00	0.71

Notes

^a Ratio of draft to height of sides, expressed as a percentage. Bevaix and Yverdon 1 are boats from inland waters and therefore they have been assessed at drafts deeper than the seagoing standard of 60%.

^b Weight of cargo.

^c Deadweight/displacement.

Sources

Marsden 1991; Arnold 1992.

On rivers and lakes the Celts used log rafts (and possibly bundle rafts), plank boats (barges) of (near) rectangular cross-section and logboats. In estuaries they had plank-built ferry boats designed for speedy crossings. At sea, from early times, they seem to have used hide boats and possibly paired logboats. There are signs in the Bronze Age that plank boats may also have been used at sea, and in the first century BC there is clear evidence for Celtic seagoing planked ships specifically designed for operations in the difficult waters of the Channel and the south-western approaches.

The evidence at present available strongly suggests that the Celts were innovative boatbuilders and seamen. From 500 BC or earlier they were undertaking open sea voyages of two days' duration on which they had to use specialized navigational techniques: these voyages are the earliest known, indigenous, ocean-going voyages in northern Europe. By this date too, they were using sail – again the earliest known European use outside the areas of Mediterranean influence. Furthermore, by the first century AD the Celts had developed both hull and rigging to improve weatherly performance: and their probable use of fore-and-aft sails from the second century AD is also the earliest known use outside the Mediterranean. By this time too, if not earlier, they were using side rudders rather than steering paddle or oar, the earliest indigenous use in northern Europe.

Perhaps the most striking Celtic innovation is their use of the skeleton sequence of building ships, from the early years of the first millennium AD. For it was only by using this technique, rather than the shell sequence, that the large ocean-going ships of the fifteenth century could be built. Although there is a hint in Herodotus (1.194) that plank boats were built by a form of skeleton building in the eastern Mediterranean in the fifth century BC (Morrison 1976: 165–6), the first clear steps towards a skeleton-built seagoing ship do not seem to have been taken in that region

until the seventh century AD, some 500 years after its use in Celtic Europe. This Celtic innovation seems to disappear from archaeological sight by the fourth century AD, apparently swamped by the widespread use of the shell sequence in the Viking/Norse tradition. It is not noted again until the eleventh century when it reappears in the lower hull of the Cog tradition (Ellmers 1979): future finds of the fourth to eleventh century may clarify what happened during this hiatus.

CELTIC NAVIGATIONAL TECHNIQUES

Today, navigation is regarded primarily as a science, and seafarers have many aids to help them find their way and keep a reckoning of their position in the seas off north-west Europe. Before the twelfth century AD this was not so: the only instrument in use was the sounding lead, and navigation was more of an art in that personal skills were used. Being essentially non-instrumental, there is no artefactual evidence for the methods used by the Celts. There is, however, indirect archaeological evidence and some documentary evidence, and we can also draw on comparative evidence from other times and places with a generally similar technological background (Olsen 1885; Lewis 1972; Waters 1978: 3–38; Binns 1980: 79–80; McGrail 1989).

The alignment of neolithic and bronze age megalithic structures in Britain, Ireland and France indicates a knowledge of the sun's movements and possibly those of the moon (Wood 1978: 184–8; Heggie 1981: 222–3). The Celtic world inherited this learning and extended it: Caesar (*De Bello Gallico* vi.14) describes the Celts' knowledge of astronomy, 'the stars and their movements', and there was particular emphasis on the moon (Piggott 1974: 104–5): being the chief arbiter of tides, the moon would be of particular importance to maritime Celts. Recent analysis of the fragments of a second century AD calendar, found in 1897 in a vineyard at Coligny, north of Lyons, has shown that it was primarily a lunar calendar adapted to the solar cycle, with an error of only 1 day in 455 years (Olmsted 1992). This further emphasizes the Celts' ability to study the heavens systematically, an ability which would have been especially needed by Celtic navigators.

Precisely how directions and distances at sea were measured and described by the Celts is not clear, but contemporary Roman usage and comparative evidence from such diverse sources as the Vikings (McGrail 1987) and Homer in his account of Odysseus's voyages (McGrail forthcoming), suggests that distances would have been in units of a standard day's sail. Directions, when land was out of sight, would probably have been estimated relative to the wind, the swell, sunset and sunrise, and at night from the Great Bear (Ursa Major) or even the Little Bear (Ursa Minor) or other constellations (McGrail 1983) for in those times there was no star actually at the North Pole (the null point about which the heavens appear to revolve).

Celtic navigators would have 'plotted' these estimates of distances and directions travelled on their 'mental sea charts' and so determined their position relative to their home base or to their overseas destination (McGrail 1983).

The Celts paid great attention to memory training and oral instruction for the transmission of learning (Caesar, *De Bello Gallico* vi.14; Chadwick 1970: 45–7; Ross 1970: 125–6). The motions of the heavenly bodies, the phases of the moon and the

ebb and flow of the tides, the weather sequences, descriptions of coastal landscapes, safe channels and sailing marks leading to the main landing places, the direction and distance between point of departure, and landfalls for each overseas route used – all these would have had to be memorized by Celtic seamen, encapsulated in easily remembered phrases and rules of thumb, possibly in verse form, which medieval Arabs are known to have used (Tibbetts 1981).

We can theorize that the following oral sailing directions might have been learned and used by a fifth-century BC seaman crossing from Mounts Bay, Cornwall, to Ushant off Brittany:

Leave Mounts Bay in the afternoon on an ebb tide and with a westerly wind (as is often the case in the sailing season). Keep this wind as far forward of the starboard beam as is practicable and steer away from land, noting your track by reference to memorized landmarks and seamarks; use the sounding lead if necessary.

Take departure from land before sunset by noting your position relative to Lizard Head or Gwenap Head, and maintain or turn to that heading which puts the wind just forward of the starboard beam. Note the relative direction of the sea swell. Confirm the boat's heading at sunset when the sun should be on or near the starboard beam. When dark, keep the Great Bear constellation fine on the starboard quarter. Check wind and swell direction against this bearing. At dawn check them against the bearing of sunrise which should be on the port quarter.

Certain types of cloud or the flight line of birds may give early warning of the French coast. If the standard speed [4 kts in twentieth-century terms] has been maintained, and visibility is good, high ground beyond the French coast should be seen on the port bow at around the time of day when the sun is at its highest. The island of Ushant will be sighted fine on the port bow during the afternoon, well before sunset.

Use landmarks and seamarks to identify your position, and plan your approach to the land so that you have a flood tide for entering your destination haven; use the sounding lead.

Celtic seamen had solved the problems of deep-sea voyages in some of Europe's most dangerous waters by the fifth century BC or even earlier. As the evidence stands at present, in their use of these skills they were well ahead of their contemporaries in northern Europe.

OVERSEAS ROUTES AND HARBOURS

From the first century BC there is confirmation in the writings of Caesar, Pliny, Strabo and Diodorus of cross-Channel routes between the Continent and Britain and Ireland suggested by contemporary and earlier distribution patterns of artefacts (Cunliffe 1982; McGrail 1983). These are (Figure 15.9):

- The Rhine to the Thames
- In the region of the Strait

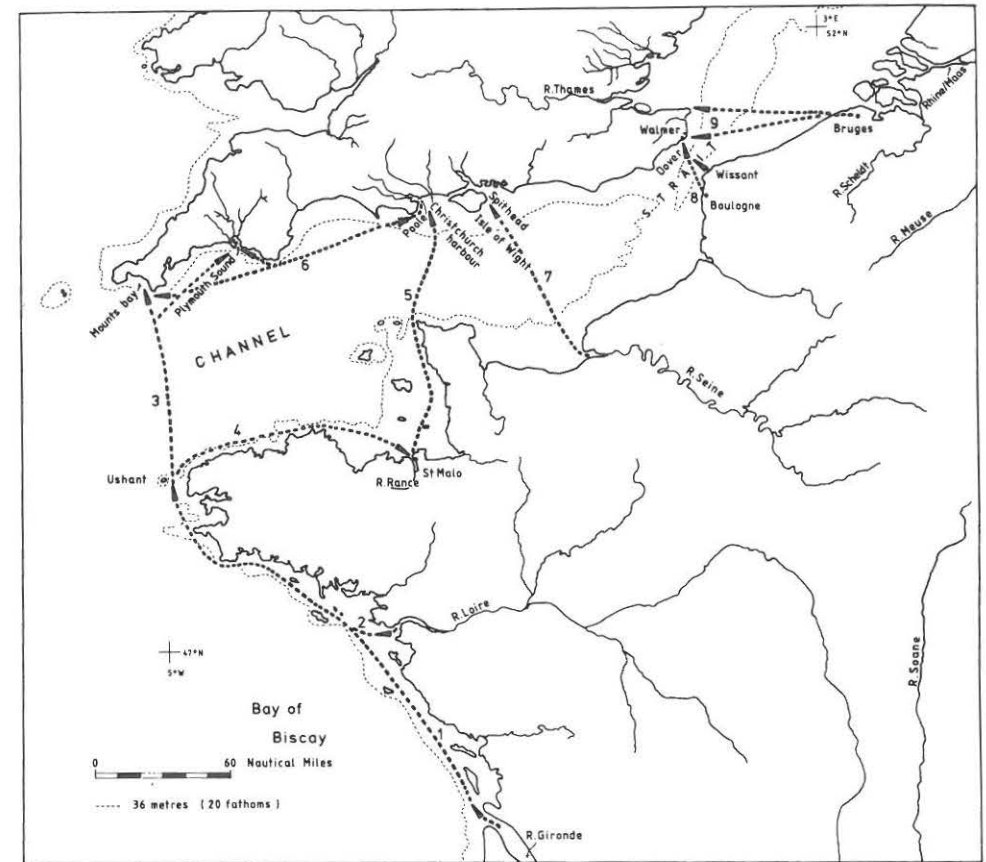


Figure 15.9 Map of cross-Channel trade routes. (Institute of Archaeology, Oxford.)

- Mid-Channel routes
- Western Brittany to south-west Britain and south-east Ireland

Mediterranean maritime trade routes were linked to these Channel crossings and their associated coastal routes in one of three ways:

- Up the river Rhône, then portages to the upper reaches of the rivers Loire, Seine and Rhine.
- Up the river Aude, then a portage across the Carcassonne gap to the river Garonne and Gironde; thence via the coastal route to western Brittany.
- Through the strait at Gibraltar and then the Iberian coastal route to western Brittany. This Atlantic route seems to have been used by Mediterranean merchants in the late sixth century BC and also by Pytheas on his late fourth-century BC exploration of northern waters (Hawkes 1977, 1984; Murphy 1977; McGrail 1990b: 36). This would have been an arduous passage, especially outbound from the Mediterranean, with a strong eastward setting current in the Strait and generally foul winds and currents along the Iberian Atlantic seaboard.

Furthermore, there were prominent headlands to be rounded which could have caused considerable delays during the wait for favourable winds and tidal streams. That this difficult route was indeed used in Roman times seems to be confirmed by the lighthouse built at Corunna in north-west Spain (Hague 1973).

Landing Places

Vessels on cross-Channel voyages would have taken departure from, and made a landfall off, a prominent landmark such as the island of Ushant, Cap de la Hague, Pointe de Barfleur, Cap Gris Nez or the Needles, Portland Bill, Start Point and the Lizard. The beginning and end of these voyages would, however, have been natural havens such as the Gironde, the Loire estuary, the Baie de St Malo, the Seine, Rhine and Thames estuaries, the Solent, Christchurch and Poole harbours and Plymouth Sound. Landing places within these havens were informal ones with little, if any, man-made protection or facilities. Only on soft muddy strands, where a beached boat might stick despite a rising tide, were artificial structures (hards) needed, as at Hengistbury with its gravelled area on the foreshore (Cunliffe 1990) or at North Ferriby where Wright (1990) found light timbers and hurdles pegged to the beach in the intertidal zone.

Carts and Wagons

Boats were beached on a falling (ebb) tide or they were anchored in the shallows below low-water mark off these beaches, and goods unloaded into smaller boats (logboats?). Horse or oxen-drawn wagons or carts were also probably used to load and discharge beached and anchored boats (Ellmers 1985). Logboat 1 from Holme Pierrepont on the river Trent, Nottinghamshire, was found lying on a 12-spoked wheel (Musty and McCormick 1973). Fragments of wheels have also been excavated from Glastonbury (Bulleid and Gray 1911) in the vicinity of the find-spot of Glastonbury logboat 1 (Bulleid 1893, 1894). Timbers from the village at Glastonbury have been dated by radiocarbon to the period 80 BC to AD 150 (J.M. Coles 1989: 64) whilst the date range of Glastonbury 1 logboat is 340 to 30 BC. Cart or wagon wheels have also been found at similar sites in the Netherlands and in Lower Saxony (Piggott 1983; Coles and Coles 1989: 162; see also Chapter 18).

In the first century BC Diodorus (v.22.1-4) described how the inhabitants of Belerion (the Devon/Cornwall peninsula) used wagons to take tin to an island Ictis; Pliny (*Naturalis Historia* iv.16.104), quoting Timaeus of the third century BC, gives a similar account about an island Mictis which may be in the Solent region. The two places considered most likely to be Ictis are the island of St Michael's Mount, Cornwall, and the peninsula of Mount Batten in Plymouth Sound (Cunliffe 1983; Hawkes 1984). Tin and copper could have been brought by wagon from north and central Cornwall to Mount's Bay and thence to the island at low water. On the other hand, Mount Batten seems archaeologically more likely as there are a number of finds from there which indicate it was prominent in international trade from the fourth century BC until the first century AD (Cunliffe 1988). Tin and copper from the Dartmoor and Callington deposits would, however, more easily have been

brought to Mount Batten by boats down the rivers Tavy and Tamar, whereas wagons could have been used to take ingots from a 'warehouse' at Mount Batten to beached or anchored ships.

INLAND TRAVEL

Rivers

Celtic lands are well endowed with rivers and streams which become natural routes for travel, trade and social intercourse: by raft or boat in favourable circumstances, or by riverside tracks when the water level was too low, the river bed encumbered with obstacles, or the river flow too fast. Thus the preferred inland routes to and from international landing places would have been the rivers. From Hengistbury Head within Christchurch harbour, for example, the rivers Stour and Avon give access to a large tract of Wessex including Cranbourne Chase and Blackmore Vale in the west and much of Wiltshire as far north as the Vale of Pewsey. The Thames, Humber, Rhine, Seine, Loire and Gironde have even greater catchment areas.

Roads

In the wet seasons rivers could still be used, though with more difficulty, but riverside and valley bottom tracks would often have been impassable, and travellers by foot, cart or wagon would have used alternative routes along higher ground. The lowlands were sometimes connected to these ridgeways by sunken roads created in part as banks were built to define fields, and in part by the repeated passage of cattle (Audouze and Büchenschütz 1991: 145-7). These were natural roads with, generally speaking, no man-made structures. However, where wetlands had to be traversed, as in marshy areas, or on the approaches to a river or the coast, causeways – roads raised above their general surroundings – had to be built (Coles and Coles 1989: 151-69).

Evidence from the Somerset levels, the Irish midlands, the Netherlands and Lower Saxony suggests that there were two main types of built roads: simple, relatively narrow footpaths for foot travellers, built of brushwood, or hurdles or planking laid longitudinally – examples are the Garvins, Eclipse and Sweet causeways of Somerset (Coles and Coles 1986); and broader, heavy-duty roads built of large timbers (often oak) laid transversely in corduroy fashion, which could be used by carts and wagons – examples are the bronze age causeway on the approaches to the river Ancholme near Brigg, Lincolnshire (McGrail 1981b); the 148 BC causeway at Derraghan and Corlea, Co. Longford, Ireland (Raftery 1986); and the Bohlensweg xcii of 129 BC which crossed the Wittemoor in Lower Saxony and was probably used by wheeled vehicles transporting bog iron to boats in a tributary of the river Weser (Coles and Coles 1989: 167-8).

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