ASPECTS OF THE VOCABULARY AND HISTORY OF HYDRAULICS IN THE SOUTH-WEST: The Roman clyse of the Somerset Levels and the possibility of a Roman tidal lock at Abona, Sea Mills, Bristol

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Three recent contributions to the archaeology and early history of Somerset and the Bristol region, two of which have already appeared in Archaeology South-West, raise the interesting but vexed problem of Roman hydraulic technology. In his article in Archaeology South-West (No. 20, December 2007, p.38), Tony Setterington, our Education Officer, reminded us that the intriguing dialect word ‘clyse’ (y as in ‘dye’) is recorded in the Oxford English Dictionary (O.E.D. 2nd edition, 1989) as having been in use in ca 1880 in Reports of the Somerset Drainage Commissioners, with the sense of ‘sluice’ or ‘lock’. Making enquiry in selected localities in Somerset, Tony found that the word indicated a simple gravity-operated cast-iron flap or valve contrivance usually installed at the outfall of a rhyne or small river, which opens on the ebb-tide, under the pressure of the fresh water behind it, allowing this to drain, until the weight of the flap is sufficient to cause it to close. Conversely, on the flood, the valve closes under its own weight as the water levels start to equalise, preventing salt or brackish water from flowing in (Figure 5-1).

In my short study for the Bristol Branch of the Historical Association The History of the Bristol Region in the Roman Period (Bristol Branch of the Historical Association, No. 115, 2005, available at the Record Office in Bristol), I suggested that such a device as a lock might possibly have been employed at Abona in order to create a wet-dock facility for the shipping of the II Augusta Legion during the period of the Roman Conquest. Hydraulic installations of this type (for which technical terminology in the ancient classical languages of the Mediterranean existed, as will be shown) would have been very appropriate in order to defeat the conspicuous disadvantages, to docking, of the huge tidal range in the Severn estuary – a world-class tidal phenomenon which must have dismayed the Roman navigators and their military leadership when they first encountered it, since it adumbrated problematic consequences for the management of their shipping in the south-west region of Britannia. Finally, in his close study of the archaeology and history of Sea Mills Dock (Archaeology South-West No. 21, June 2008, pp. 36-46), James Russell later considered my suggestion of a possible Roman hydraulic solution to the perennial tidal problems along the Avon at Sea Mills and pondered whether Abona was ever large or important enough in Roman times to have warranted such engineering sophistication as a tidal-lock in the first place – a structure for which no material precedents, in any case, survived in Roman Britain.

For my part, I think that the evidence of aerial photography, recently come to light, raises the possibility that the military establishment at Abona, rather than presenting a mediocrity of Roman architectural achievement, may have been planned, in the first instance, as a fortress of legionary
size. The air photography of 1946 reveals crop-marks of what appear to be two bastions and lengths of bulwark in the Deer Park of old Sneyd Park [House], southerly fortifications that effectively double the size of the assumed military area of Abona. Too little is known with any certainty about the stages of the development of Abona, from the, probably timber, fort of the earliest Conquest period to the small Roman town it finally became in the second century. What exactly the military base at Sea Mills was intended to become in the very early years (perhaps in the mind of Vespasian himself) is a question that the air photography of 1946 perhaps (subject to archaeological investigation) answers. There was certainly room for another legionary fortress between Exeter and Gloucester, related to the strategic horizontal grid of Roman roads running westwards from the Fosse Way. Bath was not suited for this military role, but its Brittonic religious and cultural significance merited a close legionary presence. The mouth of the river Avon (Bath’s river), open to incursions from Irish and Welsh waters, needed a vigilant armed watch with legionary shipping on the alert. When the overpowering military necessities of the Silurian campaigns in the 70s AD induced the Governor and general, Sextus Julius Frontinus, to displace the active presence of the Second Augusta from the mainland to Welsh ground, the legion’s building work (on perhaps a legionary scale) at Abona would have ceased, since there was a more urgent military need to be answered in the dangerous and unruly territory of the Silures across the Bristol Channel. Work must have stopped at once, perhaps leaving the bastions and bulwarks of the Deer Park even uncompleted above the foundations. The ghost features on our photographs may

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therefore indicate the once officially planned extent of *Abona* for occupation by the Second Augusta Legion, before it moved to its new legionary fortress at Caerleon in 75 AD. This was when Frontinus, having opened his Silurian campaigns, was confronted for the first time by the imperatives of the long-term military needs of the Welsh peninsula in south-western Britannia. In these circumstances, an investment of Imperial funds in the dock-facilities at Sea Mills, with some form of tidal lock, would not have been inappropriate.

Frontinus, with his major supply-base arguably at *Abona*, fought the Silures of South Wales between 74 and 78 AD, and would have been the ideal candidate as hydraulic engineer for such a project as a tidal-lock at Sea Mills.¹ His treatise on the water engineering of ancient Rome *De Aquaeductu Urbis Romae* (*On the Water Supply of the City of Rome*), public works for which he was later responsible as *Curator Aquarum* (*Prefect for Water Supply*) under the emperors Nerva and Trajan, still survives as the standard primary source, after Vitruvius, for information on the public provision, control and costing of water in antiquity. However, in his treatise on Rome’s hydraulics, Frontinus is concerned in sophisticated detail with aqueducts and piped water supply from countryside to town, rather than with ports and canals. Fortunately, other literary and circumstantial evidence survives for the realities of locks in Roman times. My surmise that the known 18th-century tidal lock-gate at Sea Mills *might* have been built ‘perhaps with Roman masonry on Roman foundations’ (Figures 5-2 and 5-3, above) was, indeed, surmise, and James is correct to point out that I did not quote any palpable archaeological precedent for such locks in Roman Britain. The fact is that there are no such unquestioned traces of locks from the past on our shores or elsewhere (the more humble land-drainage sluice is a different matter – see below). The dearth of material evidence for locks is actually Roman Empire-wide, such has been the destructive power of tides, waves and rain on ancient coastal and riverine sites. Locks or sluices, installed in primitive soil or turf dams in early historical times, were especially prone to erosion and thus short-lived. Especially vulnerable would have been the simple staunch or flash-lock with its manually removable horizontal boards or vertical paddles, frequently set in a perishable timber frame within a turf-sided dam (*agger*). The typological descendants of the ancient flash-lock (which released an unruly surge or ‘flash’ of dammed or impounded water) can be seen in surviving mill-leats that utilise horizontal flash-boards; the vulnerable earth dam can still be observed in the two rare turf-sided locks, numbers 90 and 102 of the Kennet and Avon canal at Thatcham and Theale; while an illustration of a typical, archaic Thames flash-lock employing paddles survives from the late 19th century (Figure 5-4).

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¹ Sheppard Frere, 1987, p 69, suspected a major role for *Abona* in the Conquest period, suggesting this port, together with Topsham, as possible major store-centres equal to that at Richborough during the Conquest period. Peter Ellis, 1987, p.100, noted that the ‘plentiful pottery’ dating from 60 AD, excavated at *Abona*, indicated an ‘expansion’ of the military presence ‘leading to the campaigns of Julius Frontinus, governor in 74 AD, against the Silures’.
But from before the period of the Roman Empire, what appear to be the vertical grooves, cut into rock, of four 2nd-century BC flash-locks have been found in the Phoenician harbour of Sidon. Further, Ammianus Marcellinus (325/330-after 391 AD), in his history of the later Roman Empire speaks of the destruction of what he calls stone sluices during a tornado on the major watercourse of the Euphrates, whilst the Romans were besieging Anatha in Assyria in 263 AD. Here, incidentally, Ammianus uses the Latin technical term cataracta (generally given as ‘waterfall, floodgate, sluice, portcullis’). This Latin word derives from the Greek verb ‘to fall/drop down precipitously’; hence Ammianus implies that something of (probably) wooden construction ‘dropped down’ into place, precisely like a ‘portcullis’, presumably along vertical grooves cut into a stone matrix, in order to control water-flow (modern terminology for this installation prefers ‘guillotine’ sluice).

However, while a developed vocabulary of hydraulics certainly existed in the ancient Latin and Greek languages, no identifiable remains of locks (if not primitive sluices) from that early period actually survive with identification or dating unchallenged in the archaeological record of the Roman Empire. A claimed Roman pont-barrage exists in the northern Roman Empire: the 13-arch sluice over the river Hantes at Montignies-Saint-Christophe in Hainaut, Belgium (Figure 5-5). Each arch appears to have been engineered to accommodate something like a winch-controlled cataracta (vertical-drop shutter). But the dating of the construction is open to question. Some archaeologists deem it roman (Roman) or gallo-romain (Gallo-Roman) in origin; others prefer roman (Romanesque) or even later. But whatever the true date, the hydraulic technology of this impressive weir must surely be considered Roman in inspiration.

Yet the argument may be raised that, since the Mediterranean was (as it still is) virtually free of significant tidal rise and fall, there would have been little incentive for Romans to invent sophisticated hydraulic controls in the first place. For example, neither the imperial Claudian outer port of Rome at the mouth of the Tiber nor the octagonal inner Trajanic port with which it is connected by canal appear, from the archaeology so far investigated, to have had lock-gates. On the other hand, classical Mediterranean harbours with sluggish water flow needed regular flushing of riverine or coastal siltation by some hydraulic device or other. Traces of flash-locks, like those possibly at Phoenician Sidon, might yet be found at Portus of Ostia Antica.

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4 Ammianus Marcellinus, Historia, chapter 24.1.11.  
6 Keay, et al, 2008, indicate no hydraulic structures. But in a personal comment, Kristian Strutt pointed out to
Other modern historians have assumed that hydraulic engineering associated particularly with efficient locks only began in earnest in the Middle Ages or early Italian Renaissance, culminating in the technological contributions of such architects and inventors as Alberti and Leonardo da Vinci. But it has to be borne in mind that the Italian geniuses of the Renaissance quoted above made no explicit claim whatsoever for their own authorship of the hydraulic devices they illustrated. The literary efforts of both Italians were as much encyclopaedic as creative. Identifying Leonardo’s genuine innovations amongst his modifications to, and improvements of, earlier technological achievements is one of the common-places of the problematics of Da Vincian scholarship; as Ludwig Heydenreich has said:

“For as we have practically no literary sources [from antiquity] dealing with the technical sciences, it is not always possible today to decide with any certainty what Leonardo really invented himself. [In] hydraulic engineering … [as] in the fields of military and mechanical engineering, Leonardo found the practice highly developed.”

Take, for example (Figure 5-6), his drawings of the guillotine lock (It. cataratta) and its associated pound or basin (It. piscina, conca, bascino). Here Leonardo may well have incorporated only improvements in the engineering of a device with which he and his contemporaries were already acquainted. Since the words which Leonardo and his colleagues used are all technical Latin in origin, there can be no prima facie linguistic case for assuming that the technology was not Roman in origin (or available to Romans), even if the archaeology is lacking. And we must not overlook the material fact of substantial Roman achievements in hydraulics in general, in our own and other landscapes. We have to bear in mind the many relatively humble irrigation and land-drainage...
schemes, where less developed types of sluices than those on the Euphrates were employed to keep out salt-water and manage flow. The Po Valley – but one region amongst several in Italy - has much Roman technology of this sort together with the centuriation of land allotment with which reclamation was frequently associated. At home we have Roman reclamation works of very probably the II Augusta Legion on the Gwent Level of Wentlooge with its systematic, quasi-centuriated long, narrow fields, and nearby the ditched enclosures of Caldicot, on the opposite shore to that of Somerset. On the latter shore we have Roman-inspired reclamation with sea-walls on the north Somerset Level and managed watercourses (Parrett, Brue, Pilrow, Axe) connecting settlements (Combwich, Crandon Bridge, Uphill, Rooksbridge, Cheddar) on the Central Somerset Level.

It is arguable, in fact, that the Romans were masters of the control of water in all its manifestations, the knowledge of which skills, as applied to important and expensive achievements such as canals, had theoretically been available in the ancient Mediterranean world since the Pharaoh Ptolemy I restored his dynasty’s artificial waterway, which ran from the Red Sea to an arm of the Nile, in the 280’s BC. This he completed with a ‘cleverly contrived gate’ (Gk. diaphragma) that could be opened and ‘closed quickly again’: in other words, it is likely to have been a form of swinging, probably single-leaf lock gate that the historian Diodorus Siculus implied in his account. The last renovation of the canal, which was wide enough to allow two ships to pass each other in a journey of four days, was effected by Trajan. The Greek lexicographers H.G. Liddell and R. Scott, drawing from different sources, also allow diaphragma (lit. ‘gate, fence’) the meaning of ‘lock [-gate]’ in their standard Greek dictionary.

As to the Somerset word ‘clyse’, disappointingly, it features in neither the newly published Oxford Handbook of Engineering and Technology in the Classical World (OUP, 2008) nor in the recent Waterways and Canal-Building in Medieval England (OUP, 2007). The word’s etymology is treated, as has been said, in the Oxford English Dictionary, which specifies that it is from the Latin that it ultimately derives.

Indeed, the words ‘clyse’ and ‘sluice’ both derive from Latin clūsa (‘sluice’ more precisely from exclūsa), but both originate in the common or vulgar Latin clōdere (originally claudere) ‘to close, close off’. Thus clūsa and its derivative exclūsa must allow for a wide range of types of water-control contrivances, including ‘lock’ as well as ‘sluice’ and, of course, ‘clyse’. But importantly, the question poses itself as to whether the Somerset dialect word ‘clyse’ might even be a genuine, native Latin remnant, surviving together perhaps with the object it denotes, unchanged in its essential features, from the Roman period. The O.E.D. surmises that the term ‘sluice’ may have come originally from a Latin source in Gaul (later Francia), thence into Modern English usage via the Old (i.e. effectively Norman) French [e]clus. On the other hand, the editors of the dictionary surmise that the word ‘clyse’ may have come into circulation later, via early Middle English clus or cluse of ca 12th century. But exactly what the Anglo-Saxons may have called a simple flap-valve sluice in their Old English language, before the Norman Conquest, seems not to have been recorded or addressed.

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12 Liddell & Scott, 1996.
We cannot simply deduce from all this that Englishmen, before King William I’s accession in 1066, did not always have the use of different types of sluice for land-drainage, together with the words that denoted them. For example, the ‘hackle weir’, where a wattle hurdle (O.E. haec[ec] ‘hatch, gate’) is employed as the paddle of a flash-lock, is certainly of Anglo-Saxon origin. But is this all of the historic picture – what of our Roman inheritance? It is important to bear in mind that because some – probably most – reclaimed land from the Roman period was later re-flooded, from a variety of causes, both human and climatic, this does not mean that all such ancient reclaimed land, together with the appropriate hydraulic devices and vocabulary of the expertise, was overwhelmed. As far as historical water-management is concerned on the Somerset Levels, Stephen Rippon argues for a complete hiatus between the late/post-Roman landscape and the medieval landscape; there appears to him to have been no technological continuity across the periods. On the other hand, as has been said, Stephen finds strong evidence for managed marshland continuity on the Wentlooge Levels on the opposite (Brittonic) shore in the territorium of Roman Caerleon (Gwent). But philology argues against Stephen’s categorical assertion regarding the negative Somerset picture for Roman hydraulic survival, for it is possible to propose, on linguistic evidence, that the Old English language of pre-Norman times employed a word for lock or sluice directly descended from the Latin of Roman Britain, arguably mediated through Brittonic, viz. Latin clūsa. This would not be unexpected,

14 Rippon, 2007, p. 211.
15 The ū of clūsa (‘lock, sluice’), in Latin loan-words in the native Brittonic language of Roman Britain, is known to have survived scarcely changed by the early to middle 6th century. By this time linguistic contact and exchange between the surviving Romano-British and the early Anglo-Saxons had begun and the Somerset (West Saxon) dialect ‘clyse’ was arguably born (for the development of Latin -ū- in Brittonic see K. Jackson, 1953, p. 321). Evolved Brittonic (i.e. the Welsh language), on the other hand, dispensed with forms from Latin clūsa in favour of other solutions: e.g. argae (perhaps from Lat. obl. arginem ‘embankment, dyke’) ‘dam, lock, weir’; lliddfdr ‘floodgate, sluice’; and (from English) loc. This lexical loss, of uncertain date, arguably implies the disappearance also of the technology (the flap-valved clyse) in routine land-drainage practice in Gwent and elsewhere in Wales. Further investigation, linguistic and archaeological, is
given the vocalic development of other words of similar phonological formation in the lexicon of early Latin loan-words in Old English. Here, as nearly always in the ‘archaeology’ of words, the vowel of the stressed syllable is diagnostic. Here it is the stressed ō of clūsa. Certain Latin words of similar structure with stressed u have a similar history in their journey into English: for example, Lat. cūcūla gave O.E. cugele (Mod.E. ‘cowl’); Lat. cūlter ‘knife, ploughshare’ gave O.E. culter (Mod.E. ‘coulter’ i.e. ‘ploughshare’); and Lat. mustum (‘grape-juice during fermentation’) gave O.E. and Mod.E. ‘must’.

Similarly Lat. clūsa (bearing the sense of ‘sluice, lock’) arguably gave rise to O.E. [be]clysen ‘to close, close off’, with its distinctive West Saxon vowel form in –y-. Therefore, in contradiction of Stephen Rippon’s hypothesis of an historical hiatus in the management of the north Somerset marshland, both the Somerset dialect word ‘clyse’ and the hydraulic device it denoted, may well, from the philological perspective, have had genuinely native Romano-British origin, both technology and word passing smoothly into early Anglo-Saxon usage centuries before the Norman Conquest. On the other hand, as Stephen Rippon shows, Roman water-management in coastal wetlands of the western Netherlands certainly included use of the ‘duiker’ – a sluice made from a hollowed tree trunk with a hinged flap-valve at the end: dendrochronology dates these ancestors of the Somerset clyse to the Late Pre-Roman Iron Age and (extensively) the Roman periods (Figure 5-7). Both the Roman technology and the terminology of the clyse may therefore have lived on in the Somerset landscape and language, in seamless continuity, into succeeding periods.

But what of a notional Roman tidal-lock at Abona (Sea Mills), a much larger hydraulic enterprise than the Somerset ‘clyse’? Despite the lack of ‘hard’ archaeological evidence (so far) of this sort of hydraulic device in the arena of the Roman Empire (including Britannia) and the wider Mediterranean of antiquity, there is no reasonable doubt, from the literature, that the existence of something that functioned precisely as a swinging or dropping lock-gate was virtually taken for granted in the ancient world. In addition to Diodorus Siculus’ written evidence of Ptolemy II’s achievement, several other equally grand hydraulic enterprises, demanding substantial water-control by means of efficient ‘locking’ devices of whatever size and shape, were completed or planned by Roman and Byzantine authorities. Ptolemy’s ‘gate’ (diaphragma) already referred to, was devised large and manage able enough to prevent Red Sea brine, in uncontrolled quantities, from entering the potable waters of the Nile (the difference in elevation between the two bodies of water was reckoned at the time to be some 4 cubits/6 feet). As has been said, this ancient Egyptian canal was restored for the last time by the emperor Trajan in 98 AD when, fresh from his governorship of Britannia, Frontinus was his ‘Curator Britannia’ at Rome, a grand imperial achievement upon which the respected engineer and former governor of Britannia might have been consulted. Similarly the rapids of the ‘Iron Gate’ on the Danube were circumvented by means of a canal – and necessarily by some locking contrivance - by Trajan during Frontinus’ career at the forefront of Roman hydraulic endeavour. And as Gardner Moore (cit.) reminds us, a plan conceived by Pliny the Younger, drawn up for Trajan, was envisaged as linking a lake, situated at some altitude in the territory of Nicomedia in Bithynia, with the Propontis. This canal, Pliny assured the emperor, despite entailing a drop of 40 cubits/60 feet, would not mean lowering the water-level of the lake since ‘it would be practicable to restrain the flow of water by means of sluice-gates (sing. cataracta)”.

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16 Campbell, 1983, paras. 498 and 508.
17 Campbell, 1983, paras. 529 and 199 respectively.
18 Rippon, 2000, pp. 86-89
19 Gardner Moore, 1950, pp. 97-111
20 Sasel, 1973, p. 81
21 ‘cataractis aquae cursum temperare’: Pliny’s Letter 61 to Trajan, written between 28th January and 18th September, 111 AD, in Williams, 1990, pp. 50-51
Pliny's estimate was later revised upwards by the emperor's own team of military *libratores* (lit. 'levellers' i.e. canal surveyor-engineers) to 118 feet and the canal, perhaps for reasons of cost or strategic obsolescence, was not built. However, Pliny's revised plan was only shelved in the imperial archives as, no less than 400 years later, the emperor Justinian I in Constantinople (527-565 AD), recognising the worth and hydraulic practicality of Pliny's plan, revived the enterprise, and progressed as far as the construction of a substantial and expensive bridge of eight arches which the overall scheme also demanded (the bridge still survives). This Byzantine project was then abandoned, but clearly not for reasons of hydraulic feasibility. The third extant plan for a canal in antiquity takes us back again to Imperial Rome of the 1st century AD. It was conceived on a truly grand scale, and would have demanded a suite of locks of substantial formation, most probably of *diaphagma* or *cataracta* typology. These devices would have served a canal which, rising approximately 140 metres/460 feet over a distance of 40 kilometres/25 miles, had its watershed high in the Vosges mountains at 360 metres/1180 feet. Such an impressive enterprise, indeed, would have demanded a flight of locks (perhaps paired flash-locks) reminiscent of a 'stretched' version of the present 19th-century Caen Hill flight on our Kennet and Avon canal (altogether 29 locks rising 237 feet over a distance of 2.5 miles). The object of the Roman plan was to link the Rhine (via the Moselle) with the Rhône (via the Saône) – in other words, no less a conception than to link the North Sea with the Mediterranean (the modern Canal de l'Est probably takes, more or less, the line of the planned Roman waterway)

22 Grewe, 2008, pp. 334-5
kilometres in length but with a maximum watershed at only 190 metres/624 feet). The Roman Imperial plan was cancelled by Nero in one of his frequent less rational moods. Therefore both modern aerial photography and early written historical evidence encourage the view that a tidal lock of Roman typology – ranging from the simple stepped sill-lock (Figure 5-8) to the developed flash-lock employing the single-leaf diaphragma or cataracta – would not have been a financial improbability nor a technical impossibility in the basin of the Trym at Abona. Such hydraulic features (certainly and not least the tidal sill-lock) would have been in the vocabulary and professional repertoire of a distinguished water-engineer such as Sextus Julius Frontinus at Abona. But still, admittedly, the lock might not have been built, although the 18th-century entrance lock at Sea Mills, some of its upper works and foundations still visible in the waters of the Trym, is only a very modest engineering achievement compared to the great aqueducts of Imperial Rome. And from all the evidence of several ambitious Roman canal schemes in the written record, the libratores, masons and carpenters of the Roman army of the Occupation period would certainly have been technically capable of constructing some reliable form of clūsa at Abona in the 1st century AD, in order to regulate and accelerate the transportation of essential military equipment and supplies by water to the II Augusta Legion which Frontinus commanded, in Rome’s crucial struggle against the Silures. Only the Roman military possessed the knowledge and practice of hydraulics – it was not a civilian achievement.

In conclusion, although the possible Roman solution of the stepped sill-lock at Sea Mills seems the most attractive as to cost and practicality in the fast-moving events of the first century of the Conquest, I remain intrigued by the Bristol historian Barrett’s report of a ‘fine arched [Roman]

Figure 5-9: Leonardo da Vinci, 'A set of lock-gates along a river' (Codice Laurenziano, Florence, late 15th to early 16th century). Arguably, Leonardo was often less the genuine inventor than the rediscoverer, improver and publiciser of earlier water-control devices, probably having access to Roman technical literary sources and material remains from the classical world, now unavailable to modern scholarship and archaeology. The Roman ‘arched gateway’ excavated from the Trym basin in 1712 may have resembled in form and function the arched, tower-like lock-gates in Leonardo’s illustration, with their ‘portcullis’ or ‘guillotine’ mechanism possibly based on a classical Roman model (see text).

23 It is fair to point out that in the latest contribution to the study of the planned Roman canal between the Moselle and the Saône, Klaus Grewe, 2008, pp. 334-5, assumes that it was conceived ‘as a diversion canal without locks…. a project that proved not to be feasible with the technology available’. But it is not clear from the surviving literature that the canal was conceived ‘without locks’ nor that the venture was technologically unfeasible: Grewe’s assumption is based perhaps uncritically on the generally-held view that pound-locks were never conceived or built by Roman engineers. But there is no actual proof, material or literary, for this negative understanding of the matter. Indeed, paired single-leaf flash-locks – whether of cataracta or diaphragma type - would have created the necessary conditions for the impounding of the water of the canal and answered what is, after all, a simple hydraulic problem.
gateway’ recovered in 1712 from the ‘upper part of the dock’ at Sea Mills by workmen who were excavating the new facility24. This report appears to indicate that the Roman masonry of the gateway – still recognisably intact - was found in soft water-logged conditions between the dock and the inner basin, along the river Trym, rather than on the adjacent, higher site of the Roman town proper25. If so, the gateway belonged not perhaps to the walled circuit of the town itself, but may have been raised by Roman engineers over the stream of the Trym, in order to allow access to an inner wet-dock facility of the harbour. Such a structure may conceivably have housed a ‘shutter’ (cataracta) of the ‘portcullis’ or ‘guillotine’ type, raised or lowered by winch, precisely as Leonardo da Vinci later depicted the arched gateway-like locks along a river in Italy, based perhaps on a now unknown Roman model (Figure 5-9).

But of equal importance, whatever the possible concrete reality of the hydraulic measures taken by the Romans at Abona in the glory days of its 1st-century military phase, any debate and exchange of opinion on this fascinating subject between historians and archaeologists can only strengthen the case for the prompt establishment of SMART (Sea Mills Archaeological Research Team) in memory of the life and work of Keith Gardner. Names of volunteers to our Acting Secretary Andrew Smith at once please!

Bibliography


24 Barrett, 1789, p. 12
25 For the 18th-century plans of the facility at Sea Mills, with its outer dock and inner basin, see Russell, 2008, p. 42

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