Discussion document for comment: Navigation of the Derwent in Roman and medieval times.

Historic references and arguments

Some have considered (Lane, 1986) that it might have been possible that the Derwent was navigable as far north as Cromford in Roman times. On the other hand it has also been said that the Derwent was not navigable (Priestley, 1831; Langdon, 1993) but this appears, as so often the case, to be a position in which the *totality of available evidence* has not been considered. It is therefore necessary to summarise the range of evidence as it is currently understood.

In the case of the medieval Derwent, Jones (2000) in presenting a critique of the work of previous authors Edwards and Hindle says:

> *"A charter of 1204, a grant of 1229 and a reference to the use of the river in King John's reign suggest that the river was navigable to Derby (*from the Trent*) until the early thirteenth century. On the other hand, after the building of nine mills at Borrowash between 1268 and 1270, the case for continued navigation is much less satisfactory. For his part Edwards notes the existence of two fourteenth century references to barge loads of lead being sent from the King's Derbyshire lead mines to Nottingham. This provides the basis for his conclusion that the Derwent must have been navigable for some distance beyond Derby. Yet these references to barge loads of lead do not prove that water transport was being used, since the 'barge-loads' and 'cart-loads' referred to in the accounts are simply units of measurement. That it is not possible to infer from the use of either term how lead was actually transported becomes clear when the 1325 reference that Edwards cites is examined in full. It reads: Allowance to the Sheriff of Nottingham of the price of 24 great cartloads and 1/2 foot of lead, if it appears this amount has been delivered to him by Robert de le Forde and Nicholas his brother, farmers of the King's lead mine of the Wapentake of Wirksworth (and Hartington) in accordance with the King's order to deliver as much as might be needed for covering certain houses in Nottingham Castle at the price contained in their commission, viz. 44s. the barge-load."*

Jones critique is problematical: on the one hand the source does not say as such that the lead was transported by barge, on the other hand it does give a price for it to be transported by barge - if it could only be transported by cart why quote a barge price at all? However, the wording of King John's 1204 charter itself is well known: *"The Derwent, navigable from ancient times"… "And the Derwent shall be open to navigation by the length of a perch on each side of mid-stream"*. Jones goes on to say:

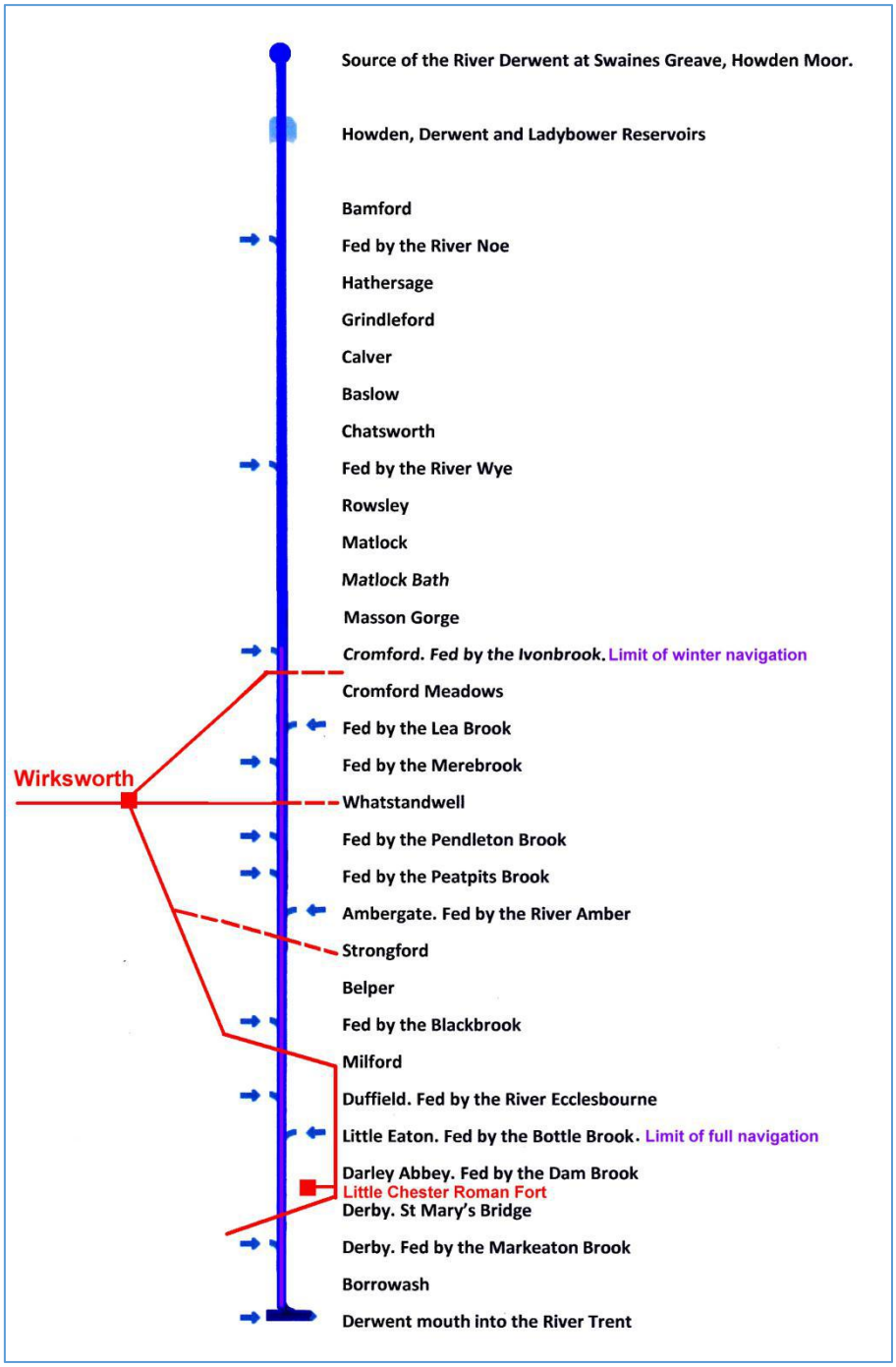
> "*Edwards's other fourteenth-century evidence for Derwent navigation is based on a quotation taken from the Calendar of Patent Rolls that in 1378 Derby was "charged with making a balinger". Edwards suggests that after construction this ship "would no doubt be floated the 9 miles down-river to the Trent, for delivery to the King's officers". Unfortunately, Edwards misquotes the Calendar—which in fact states that Derby was "charged along with the men of Nottingham with making a balinger". This is important since it means that even if the 25 balingers that the Crown ordered to be built this year were all built at the place so charged this particular vessel could have been constructed at Nottingham rather than at Derby.*"

This critique is equally problematical: there is no way of knowing where the boat was built, even if both Nottingham and Derby paid for it.

What does seem to emerge is that that the Derwent was certainly navigable south of Derby in medieval times, but after 1268 several "mills at Borrowash" were built which might have presented an obstruction to the Derwent's continued use for river traffic. Although there is an absence of genuine evidence that the mills blocked the whole of the navigation at that time. It was certainly the case that milldams could be

provided with a “flash”, that is a removable sluice, which would permit the passage of boats. However, not only did the gradual encroachment of medieval mills impact the navigation, so did the construction of fishing weirs, both below and above Derby. In short, the navigability of the Derwent appears to have declined to the point of no return by about 1350. Even if we take a view that the transport of lead from Wirksworth (Wapentake) was indeed along the Derwent and the Trent to Nottingham in 1325 we cannot be sure from this evidence alone what the true upper limit of navigation was north of Derby.

The Derwent wasn’t made navigable again until after an Act of Parliament in 1720 and then only between the Trent and Derby. This is not to say that the Derwent was unused by boats for fishing, ferrying and other activities, even if it was not wholly navigable: there are two “Boat Meadow” place-names noted by Cameron: One for Belper (from 1842) and an earlier one (from 1636) for Little Eaton. Eaton itself means “River Settlement”. Oksanen (2017) observed that some of the Eaton place-names in other parts of the country were often adjacent to Roman roads: this would also be the case at Little Eaton. “Eatons” might, Oksanen felt, therefore represent trans-shipment points between river and road transport in Saxon times.



The River Derwent and its main tributaries (in blue). Not to scale.
Navigation limits in purple. Roman roads or possible Roman roads in red

More recent findings

In researching their invaluable book about the Duffield Frith (Crisp, Rich, Wiltshire and Woore, 2005) it was discovered in the translations of the Cartulary of Darley Abbey that the monks of Darley Abbey were licensed by William de Ferrers the 3rd Earl of Derby to carry wood by water through the Forest of Duffield, meaning along the Derwent, implying navigability north of Derby. The charter is undated but another charter exists whose same form of words, about William and his wife Sybil de Braose, is considered to date from 1181. Their marriage was 1173 and William died in 1190 long before Sybil. Therefore the conceptual date range of the Frith charter could be considered as being 1173 to 1190. In addition, the licence was confirmed in 1191 by William de Ferrers the 4th Earl of Derby (Darlington, 1945) and this at least tells us that the earlier charter is not a fluke. The northern boundary of the forest came down to the west bank of the Derwent at Whatstandwell and extended to both banks of the Derwent from Ambergate south almost as far as Burley Hill opposite Little Eaton.

Physical capability and flow of the Derwent in determining the limit of navigation

So much then for documentation implying navigation. Let us turn to some science: Is the Derwent physically capable of providing navigation and if so, to where and when?

The accepted rule for the navigability of a river is a flow of 20 cubic metres of water per second or more (Eckholdt, 1984). The flow of the Derwent has been measured for many years and the recording points are listed in the National River Flow Archive (www.nrfa.ceh.ac.uk). The data here is averaged because each year's rainfall differs, some years are drier and some years are wetter. What is clear from the data is that the middle Derwent is only truly navigable in the winter months (and then obviously not in stormy or freezing weather). Recording points on the Derwent provide the following information:

Matlock Bath Recording Point:
Average annual flow: 12.97 cubic metres per second.
Flow of above 20 cubic metres per second from mid October to the end of March.
Exceeding 30 cubic metres per second from late October to mid March.

Whatstandwell Recording point:
Average annual flow: 14.58 cubic metres per second.
Flow of above 20 cubic metres per second from mid October to the end of April.
Exceeding 30 cubic metres per second from mid October to mid March.

Derby St Mary's Recording Point:
Average annual flow: 17.41 cubic metres per second.
Flow of above 20 cubic metres per second from mid October to the end of April.
Exceeding 30 cubic metres per second from mid October to mid April.

There is a view that water flow in rivers was greater in Roman times or medieval times than now due to changes in weather patterns, but Eckholdt takes the view that there is no evidence for this. What we do know about the River Derwent is that water is abstracted at the upper Derwent reservoirs for use in the East Midlands cities at the rate of 200,000 cubic metres a day or 2.32 cubic metres a second (Douglas, 2013). In addition water is also abstracted from some of the smaller tributaries of the Derwent such as the Ivonbrook (Bonsall Brook) to feed the Cromford Canal: there appear to be no figures for this abstraction. There may be other local abstractions and pumping also takes place at high water levels to fill Carsington Reservoir. We can at least add the upper Derwent reservoirs' abstraction rate to the modern flow rates. In doing so we find that at Derby St Marys this would result in an increase giving an average annual flow of very nearly 20 cubic metres per second, although this does not significantly change the times of year when

the middle Derwent was high enough to be easily navigated, that is to say October to April. Bearing in mind that the four main tributaries of the Derwent below Whatstandwell are the Amber, the Blackbrook, the Ecclesbourne and the Bottle Brook, in that order, when we are quoting the flow rate at the recording point at St Mary's Bridge, this would also effectively be the flow rate of the Derwent where the Bottle Brook joins it at Little Eaton (making Little Eaton the limit of year round navigability, because there are no further major tributaries between the Bottle Brook and St Mary's Bridge). Whilst there are some variants within this (for example the Merebrook Sough has taken water from the flow of the Ecclesbourne to the flow of the Derwent at a higher point than it naturally flowed in the past) there is no reason why the general figures should not be correct and reflect the long term historic flow.

The fall of the Derwent, over its 106 kilometre length, is some 560 metres. Its rises at Swains Greave at Howden Moor, some 590 metres above sea level and outfalls into the Trent at Derwent Mouth near Great Wilne, a little over 30 metres above sea level (ASL). Between Little Eaton (about 50 metres ASL) and Derwent Mouth (about 30 metres ASL) is some 20 kilometres, the fall is of the order of 1:1,000. Between Whatstandwell (about 70 metres ASL) and Little Eaton is some 17.5 kilometres, the fall is of the order of 1:875. Between Cromford (about 80 metres ASL) and Whatstandwell is some 6 kilometres, the fall is of the order of 1:600. Between Matlock (about 90 metres ASL) and Cromford is some 4 kilometres, thus the fall steepens to 1:400. From Swains Greave to Matlock is the remaining distance (all figures are approximate) in consequence an average fall to Matlock of 1:123.

Geographic limits of navigability

Finally, what is the geographic limit upstream of navigability? The answer to this lies both in understanding the geography of the Derwent and bearing in mind that river craft travel downstream with the flow and upstream by being punted, rowed or towed. Geographically the Derwent was a relatively sylvan river upstream from the Trent as far as Cromford, but north of Cromford the river enters a limestone gorge at Masson Mill and parts of this gorge, lying between Cromford and Matlock, mean that the river runs in some difficult rapids through a narrow, treacherous, steep-sided valley. Cromford is also the location where the Derwent is joined by the busy Ivonbrook (into which flows the Bonsall Brook at the Pig of lead), both historically contributing to the flow of the Derwent at Cromford Meadows. In short, it would not appear possible to get a laden flat-bottomed boat upstream beyond Cromford because of the nature of the Masson gorge and the reduced flow above the point at which, prior to Arkwright's Mill, the Ivonbrook flowed into the Derwent: this also shows in the fall figures, above Cromford the fall becomes progressively more acute.

Replica Roman rowing and sail flat-bottomed barge constructed in the Netherlands

Cost and types of river traffic

As a generality, there are only limited studies of the relative cost of road transport versus river transport in medieval times but Oksanen (2017) noted that the cost of river transport was about half the cost of road transport for wheat. Where the type of goods being transported were heavier or bulkier than this, it might be that river transport costs were relatively still less. Coastal transport (shipping) was even cheaper.

Timber
We have noted that wood was transported by water through the Forest of Duffield by the monks of Darley Abbey, their licence to do so was, however, only for three days a year, but there may of course have both been other licensees and, indeed, the deFerrers are hardly going to licence themselves to move their own wood by water through their own Forest if they needed timber at their local or more distant manors.

Lead
Lead production is seasonal, the peak mining season in medieval times (and perhaps no less so in Roman times) was April to July. From July to August the lead was washed and dressed, for example at Wash Green, Wirksworth. The King's lead was smelted at Ladycliffe, Wirksworth (Blanchard, 2005) and was ready for despatch at the end of September. This timing essentially co-incides with the seasonal rise in river levels, thus enabling river transport by punt or flat bottom boat when the flow of the Derwent increases from mid October at the most accessible loading points from Wirksworth, that is Cromford and Whatstandwell.

Other goods and people
In Roman times there were industrial sites producing pottery at Hazelwood connected to the Derwent by North Lane, a road which runs down the Chevin to the river at Milford, from that point it could be sent onwards by river. An assessment of the finds of Roman Derbyshireware in places further afield than Derby might shed light on this, as the finds of lead ingots do for the lead industry. Additionally, Roman quern making was a major industry at Alderwasley and this location appears to be connected to the Derwent at Strongford. However, the quern industry and its distribution pattern is much less well understood than pottery or lead. It is known that boat "passengers" were carried but records of this are quite rare nationally (Oksanen, 2017) and there are none currently known for the Derwent.

The archaeology

Archaeologically, there is a cluster of Roman age finds, such as coins and lead pigs, at Cromford, noted in the Sites and Monuments Record and by Dennis (1971) which suggests a possible concentration of Roman activity there. Such activity may, taken with the navigability issue, possibly suggests a viable landing place at Cromford meadows might be considered. This may offer a sidelight in terms of the movement of lead pigs to the port of Peturia (Brough on Humber) by river, for trans-shipment there in Roman times. In later times the transport of goods was by road, as was the case when the lead trade was eventually documented in the Stuart period (Slack, 2000).

Whatstandwell may represent a slightly better location for navigability and a landing place or possible Roman wharves than Cromford, because the flow of the Derwent is improved by tributaries south of Cromford including the Lea Brook at Lea Wood and the Merebrook which flows into the Derwent a little north of Whatstandwell itself. If smelting was indeed at Ladycliffe the Whatsandwell road would be nearly adjacent and the distances by road to either location is about 3 miles. In short, either or both appear worthy of consideration and assessment.

The Roman fort at Little Chester is next to the Derwent, whilst the fort was originally constructed of a clay rampart and defensive ditches (Sparey-Green, 2002) it was later enclosed with a stone wall. The source of the stone has not been investigated apart form the general comments of it being gritstone (sandstone).

However, for this to be robust, it would have to be Ashover Grit. The nearest outcroppings of this type of stone to the fort are at Breadsall Priory along Ryknield Street from which road transport would have had to be used or, interestingly, at Eaton Bank (Thomas, 2019) from where river transport could have been used.

It may be felt that modern archaeological techniques such as the use of Lidar might reveal the remains of ancient wharves, if they existed. However, river-banks and water meadows often silt up over time and this could hide remains, for example the Roman road recently found at Duffield Bank (Cobbold, 2017) was almost a metre below current ground level. Secondly, the course of the river as it now is, may not be as it was in olden days: rivers move often in their paths and such changes may hide things we are looking for.

Conclusions

This study was begun in response to a question about the purpose of two possible Roman roads emanating from Wirksworth, one which crossed the Derwent at Cromford and one which crossed the Derwent at Whatstandwell - did these roads not only serve locations further distant than the river crossings, but was there a possible link between these roads and river transport from them in Roman times? Without the discovery (to date) of any Roman wharves on the Derwent, we cannot yet say either way.

However, on flow rate data, it is at least likely that the Derwent was navigable historically as far north as Cromford in winter months. Given the river flow rates and the contributions made by the tributaries of the Derwent south of Cromford, the same can be said of Whatstandwell and it is within the evidence that Little Eaton represents the actual location to where full year-round navigability of the Derwent was achievable in Roman times: as the flow rate and fall of the river does not appear to be much different at Little Eaton than at St Mary's Bridge in Derby, and then all the way to Derwent Mouth at Great Wilne.

The Derwent only became seriously obstructed by mills and weirs in medieval times (perhaps after 1350) and navigation was not then restored, even on the lower reaches of the river, until 1721.

Appendix 1: Bridges and fords in the record of the lower Derwent

Notes on Bridges and Fords	Location	Recorded date of first bridge	Comment	Source
Derby St Mary's Bridge	Current bridge	1229 Speculative? 1326 actual record	"Replaced previous ford"	Derbyshire Archaelogical Journal 1931 p 76. 19 Edward II charter.
Darley Abbey Bridge	Current toll bridge	1783	Darley Abbey Ford ?	Anecdotal, reference via listing of weir.
Ford Lane Bridge	Current bridge	"Modern"	Breadsall - Allestree	Ford Lane: Place-name of street
Horseford	354 414	Ford	Burley - Little Eaton Ford	Anecdotal
Duffield Bridge	Current bridge	1372	Le Pont de Duffield	Cameron K. Place-names of Derbyshire. p553
Duffield Castle Ford	Ford Mouth Lane	Ford	Before 1787	DAJ 1913 p 134
Moscow Farm Ford	Uncertain	Ford	Alleged	DAJ 1887 p141
Milford Bridge	Current bridge	1790	Replaced a chain ferry which replaced a ford	"Muleford" Domesday book 1086 Heritage Assessment of Milford
Derneford	Unknown but in Belper parish	Ford in 1415	Derne means "hidden"	Cameron p529
Belper Bridge	Current bridge	1387	Pontem de Beaurepair	Cameron p 526
Strongford	Nr Dairyhouse Farm	Ford in 1415	Suspected continuation of Street's Rough Road.	Cameron p530. May be replicated as Stamford (Stoneford) or Swaleford (Swaler - Merchant's ford), but these may be different.
Half Penny Bridge Ambergate	Current bridge	1792	Replaced a ferry ("Ferry House") presumably replaced a ford.	May be represented by one of the above ford names.
Whatstandwell Bridge	Current bridge	1390 Actual date	Agreement between Abbot of Darley and John de Stepul to build a bridge	Cameron p438. Replaced Walter Standwell's ford.
Homesford	North of Whatstand well	None	Very late reference	Crich parish: "abode" in a burial of Samuel T Gregory in 1722
Pennyford	Cromford parish	Ford	Single field name, location unknown.	Cameron p359
Cromford Bridge	Current Bridge	"14th or 15th century"	Replaced a ford	"Crunforde" Domesday book 1086
Matlock Green Bridge or Matlock Bank Bridge	Which one and where? Current Bridge	1250	Pontem de Matelock - not clear whether this was over the Derwent (Matlock Bank / Sainsburys) or the Bentley Brook (Matlock Green / Church).	Cameron p389
Darley Bridge	Current Bridge	1312	Mentions the town as Bridgetown not the bridge itself	Cameron p411

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