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Some Recent Changes in the Course of the Trent: Discussion

Author(s): G. W. Lamplugh, W. Whitaker, P. F. Kendall, Dr. Strahan and B. Smith

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A breakwater was built upon the eastern bank above Kelham bridge about nine years ago to protect the Newark-Kelham road. The river then attacked the road a little further downstream. Repairs were made last year, and the bank was protected by stakes, cement, and sunken barges, with the result that the main flood is thrown into the eastern span of the bridge, and is rapidly clearing away a large stretch of gravel and loam which had accumulated below. The opposite bank has entirely altered; shallows appear where none were before, and deep holes take the place of shoals; the movement is in fact felt a great way downstream.

The following is a list of some of the maps showing the Trent in Nottinghamshire; 1576, Saxton; 1646, chief engineer Scots army, copied and revised by S. Buck, 1725; 1670, Blome; 1676, Thoroton; 1695, Morden; 1727, Moll's English Atlas; 1744, J. Jefferys, Junr.; 1744, J. Chapman (1st Edit.); 1777, Emm. Brown; 1792, J. Harrison; 1794, Cary; between 1792 and 1797, J. Chapman (2nd Edit.); 1795, Gurnill (Burton and Bole rounds); 1801, C. Smith; 1813, Arrowsmith; 1824, Ordnance Survey; 1834, Sanderson; recent Ordnance maps.

Mr. G. W. LAMPLUGH: Mr. Smith has shown very clearly that changes have constantly taken place throughout historical times in the course of the Trent; but to any one who knows the structural conditions and past history of the valley, it is really surprising that the changes of the river have not been even greater. Indeed, that the stream should have maintained so nearly its present course during historic times is good evidence for the interference of man from an early period. The river flows along a wide valley with a flat floor built up from the overburden of material brought down by ancient floods, and the present stream is inadequate to remove this material. Upon this flat floor the Trent, under natural conditions, would be likely to shift its branching channels every season, or even many times in a season, as we know to be the habit of uncultured streams of this type in the unsettled parts of the world; but it is not allowed to do so. We see plenty of evidence that it once had this habit, in examining the old alluvial deposits of the Trent. Man came, and found it inconvenient to have an untamed river, so he set about to tame it; and now it affords a good example of the effect of civilization upon a stream.

The travelling downstream of the meanders is of course what takes place in every river of this type; and it would be very interesting if the rate of travel could be definitely ascertained. But I understand that there is doubt in some cases whether the old flood-banks were erected originally close to the river-brink, and where this doubt exists it may not be quite safe to calculate from the present relative position of the bank. Still, as to the truth of the principle on which the argument is based there can be no doubt.

Mr. W. WHITAKER: I know very little of this particular piece of country, but some of the points that Mr. Smith made might be applied to other rivers, as to the Thames. A parish-boundary sometimes crossed the river, and the county-boundary did not. This gave rise to an important law case between Middlesex and Surrey. There was another point which interested me, the gradual swaying of the river from one side of its valley to the other. We have a very remarkable case of that in one of the notable Thames tributaries, the Lea. That river has gone from west to east, and apparently it has done this far longer than in the case mentioned in the paper, because at present the river has gone so far to the east that it has cut off nearly all signs of presence on that side of the valley at a much earlier time. All the gravel-flats are on the western side, and that looks like a tolerably steady move from one side to the other. Mr. Smith has included among his evidence historical and documentary matters; I think that he will often find that particular class of evidence not worth much; it may sometimes be very misleading. In the legal

case spoken of, the judge said he would not accept a single map or document as evidence, and I think he saved himself and the jury a great deal of trouble. I hope that Mr. Smith will exercise great judgment as to how he deals with this sort of evidence. He may get in places very good historical and documentary evidence, but you must always be ready to put a query after it. It is to be hoped that this inquiry will be extended lower down the river. It is a big thing, and no doubt Mr. Smith has found it convenient to take a piece first. I believe that there is in this country a great deal to be done in this tracing out of the course of even some of our best-known rivers, such as the Thames, that we may get much information from careful work of the sort Mr. Smith has given us.

Prof. P. F. KENDALL: My interests lie rather in the earlier than in the later phases of the history of the Trent valley, but as a student of the Humber drainage I cannot but be interested in Mr. Smith's paper. The evidence adduced of a general swing to the westward and the explanation offered seemed to be very satisfactory. It was an attempt on the part of the river to shorten a part of its course. Taken with the case of the Lea mentioned by Mr. Whitaker, it pointed to the necessity for caution in accepting the assertion frequently made in geological and geographical text-books that north-and-south-flowing rivers, when uncontrolled, tend to swing to the right under the influence of the Earth's rotation. Here are two rivers, one flowing to the north and the other to the south, swinging to the left in spite of attempts to control their courses. Mr. Smith has shown that there are limits to a river's forbearance, and that when endeavours are made to control its course at one place it promptly reasserts its determination to obey its own natural tendency.

There are one or two points in the early part of Mr. Smith's paper that interested me very much, though I am afraid they do not belong to the main subject-matter of his paper—his allusions to the successive stages of the deepening of the Trent valley, indicated by the terraces, and his suggestion that these changes took place before the close of the Pleistocene period. I am inclined to think, by the evidence afforded by the Trent above Nottingham, that these changes must have taken place in the very early part of the Pleistocene period. The remains in one of these terraces included hippopotamus and rhinoceros. Now, the hippopotamus is a distinctly early element in our Pleistocene fauna, and if I remember rightly, the deposits in which they occur are very little above the Trent level, and I should therefore be inclined to place the high-level deposits at a yet earlier stage. Another point is the Lincoln gap. The level of the rock floor in the Lincoln gap is 23 feet below Ordnance datum. I should like to know how that would be explained by Mr. Smith's study. There is a much larger question that I hoped would have come within the scope of the paper—the strange discrepancy between the very early history of the upper and that of the lower Trent. Streams joining the Trent drainage below the furthest point mentioned by Mr. Smith, flow upon a deeply eroded landscape; a landscape that lies, in one case, 170 feet below Ordnance datum (at Barnby Dun near Doncaster). And that is not an isolated observation. In the upper part of the Trent valley no such deep trough has been discovered, and it is a very difficult problem to decide why there should be this striking discrepancy between this upper and lower course. I would suggest that there has been a warping that has brought up the upper course of the Trent, that has raised it, concurrently with the lowering of the lower course.

Dr. STRAHAN: The remarks made by Mr. Whitaker on the Thames forestall an observation I had in my mind at the time. It is a fact that at Goring a bit of Oxfordshire has, so to speak, travelled over into Berkshire; I know of no historical record of how the river changed its channel, but that it has done so

can be seen by comparing the position of the county boundary with that of the present main stream on the 6-inch Ordnance map. Mr. Smith's account of the struggles of the Trent to expand its valley has proved so interesting that I should like to see this line of research followed up in the case of other rivers, and a comparison made between rivers of different character as regards the work they are doing in altering their courses and shaping their valleys.

Mr. B. SMITH: With regard to the remarks of Mr. Whitaker about documentary evidence, I know only too well that there is not too much reliance to be placed upon it, and have therefore only dealt in detail with those parts of the valley with which I am well acquainted. In reply to a question by Prof. Kendal as to the depth of the rock floor in the Lincoln gap; I do not think there is any difficulty about it. Although the surface of the latest valley gravels of the Trent is slightly higher than the surface of the present alluvium, their base is considerably below the base of the alluvium. At the very narrow gap near Clifton these latest gravels are below Ordnance datum. The fall from the Spaldford bank to Lincoln is considerable, so that it is not surprising to find the rock floor of the Lincoln gap 23 feet below Ordnance datum. There is no evidence in this area as to the warping of the lower course of the river; the fall in each set of gravels between Newark and Lincoln seems to be much the same throughout. In conclusion, I must thank the members of the department for the very kind way in which they have received this paper.

MUSIL'S EXPLORATIONS IN NORTHERN ARABIA, 1908-9.*

By his last journey—a toilsome and dangerous one—Alois Musil has removed from our maps the blank space which covered the whole large triangle between Arabia Petræa and Syria on the one hand, and Mesopotamia on the other. Leaving Vienna in the beginning of June, 1903, he arrived at Damascus on the 19th. Thence after long negotiations he succeeded in getting into communication with the powerful Sheikh of Northern Arabia, Nuri ibn Shalân. Then with his companion, Sergeant-Major Thomasberger, of the Military Geographical Institute of Vienna, three servants, and nineteen camels, he made his way in the middle of September to the camp of the sheikh, whose travelling companion he then became. Thenceforth he either marched with the sheikh or made lengthy excursions of his own from the camp. First and foremost, he measured out a base to the south-east of Dmeir, some 75 miles east of Damascus. Next, on October 11, he set off with five camels to the steppe regions in the north-east, and, passing hot springs, remains of Roman military stations, and the ruined town of Isrie, arrived at Resafe, 12 miles from the Euphrates. The ruins of churches and palaces in Resafe, with their inscriptions in Greek, Aramaic, and Arabic, proved of high interest for the history of art. This place marked the most northerly point of Musil's journey. Thence directing his course, first to the south-east and then to the south-west, he returned to the same spot by another way on November 2. During three more excursions of a like kind, but more extensive, the explorer made a plane-table survey of the whole region. The last excursion lasted from the end of March to the middle of April, 1909. In the intervals between these expeditions, he undertook shorter survey trips, or, proceeding further with the sheikh's camp, secured ethnographic records. It sometimes happened that, returning from an excursion of his own, he would be a whole week in tracing his way back to the camp.

* Communicated by Dr. Karl Peucker.