PTOLEMY'S GEOGRAPHY OF ALBION. By Professor FLINDERS PETRIE, F.R.S., F.B.A., Hon. F.S.A. Scot.

Many studies have been made of Ptolemy's *Geography* on the ground of taking it as whole statement, more or less erroneous and incomprehensible. In 1886 I tried to show a different treatment of it, by systematic analysis into its original elements, in the case of Egypt (*Naukratis I.*, pp. 90–94). As Britain is remarkable in Ptolemy's work for the amount of distortion, this treatment by analysis is much needed, in order to understand how his errors arose, and from what material he was building. This study does not touch on the original authors from whom Ptolemy drew his material, but only on the original facts which were utilised, whether combined by Ptolemy or any of his predecessors. When, therefore, the name of Ptolemy is used here, it is without any prejudice to the question of whether he borrowed his basic facts or adopted the work already done by others.

The first step in studying Ptolemy is to take account of the various readings of the MSS. For this purpose the edition of C. Müller (Paris, 1883), with all the MS. variations, is indispensable. But the utility of this apparatus must not necessarily give authority to the form of the text adopted by Müller. His industry may have exceeded his judgment in forming a standard text. He gives great weight to the three Florentine MSS.; but, by the test of harmonious positions, these are by no means of ruling authority. In an appendix are stated seven test cases where the geographical position checks the readings; in these the older text of Nobbe is always preferable to that of Müller.

For purposes of study the most convenient map is Kiepert's *Insulæ Britannicæ*, 1893. On a net of the same size of degrees Ptolemy's positions were all plotted; and on strips of paper the *Antonine Itineraries* were laid off to the same scale. Thus (*a*) the true positions in Kiepert, (*b*)

Ptolemy's positions, and (c) the Antonine distances, can all be compared graphically and immediately. No reliance has been placed on the Kiepert identifications of places, unless well known otherwise. Roman miles only are used in this paper. The Latin forms of the names have been preferred, as probably they were reported by Roman sources in this shape and translated into Greek by Ptolemy. The variations of the forms of names are not dealt with here.

ABSOLUTE POSITIONS.

The first question is the astronomical basis for the principal points. Longitudes there were none, except by dead reckoning and mapping. Latitudes were fixed—at least in Britain—solely by the hours in the longest day. For converting the number of hours into the corresponding latitude Ptolemy gives a table (lib. i. cap. xxiii.). To compare this with the truth, we have here a diagram, showing the relation of hours to the latitudes between 48° and 66°; the curves are from calculations of six points, for the theoretical number of hours of the sun's centre above the horizon regardless of atmosphere, and also for the extreme appearance of the sun's edge as raised by refraction. For this the obliquity of the ecliptic has been taken at 23° 41' for the first century, refraction at 30', and semidiameter at 15'. The points tabulated by Ptolemy are connected by a broken line. His form of curve is very accurate, but gives about 10' too low a latitude for the theory of centres. When refraction and the sun's diameter are taken into account, the actual visible sunshine will be much longer at any place than Ptolemy allowed, and his latitudes of places are correspondingly too high.

In lib. viii. cap. ii. Ptolemy gives the hours of the longest day for six positions in our region.

	Ptolemy.	Actually.	Error.
	h m °	h m ° · '	m °
Uectis	16 40 = 52	16 33 = 50 40	+ 7 1⅓
London	17 54	16 42 51 30	+18 2½
York	17 50 57½	17 10 54	+40 3½
Caturactonium	18 58	17 18 54 24	+42 3½
Alata	18 30 59½	18 4 57 25	+26 2
Dumna	19 10 61⅓	18 22 58½	+48 2⅚

The actual length of day shows that the observations were very bad for this purpose, only Uectis being tolerable, and the others evidently including a good deal of twilight. Thus the latitudes were all in excess, first by the length of day being overstated, second by the refraction raising
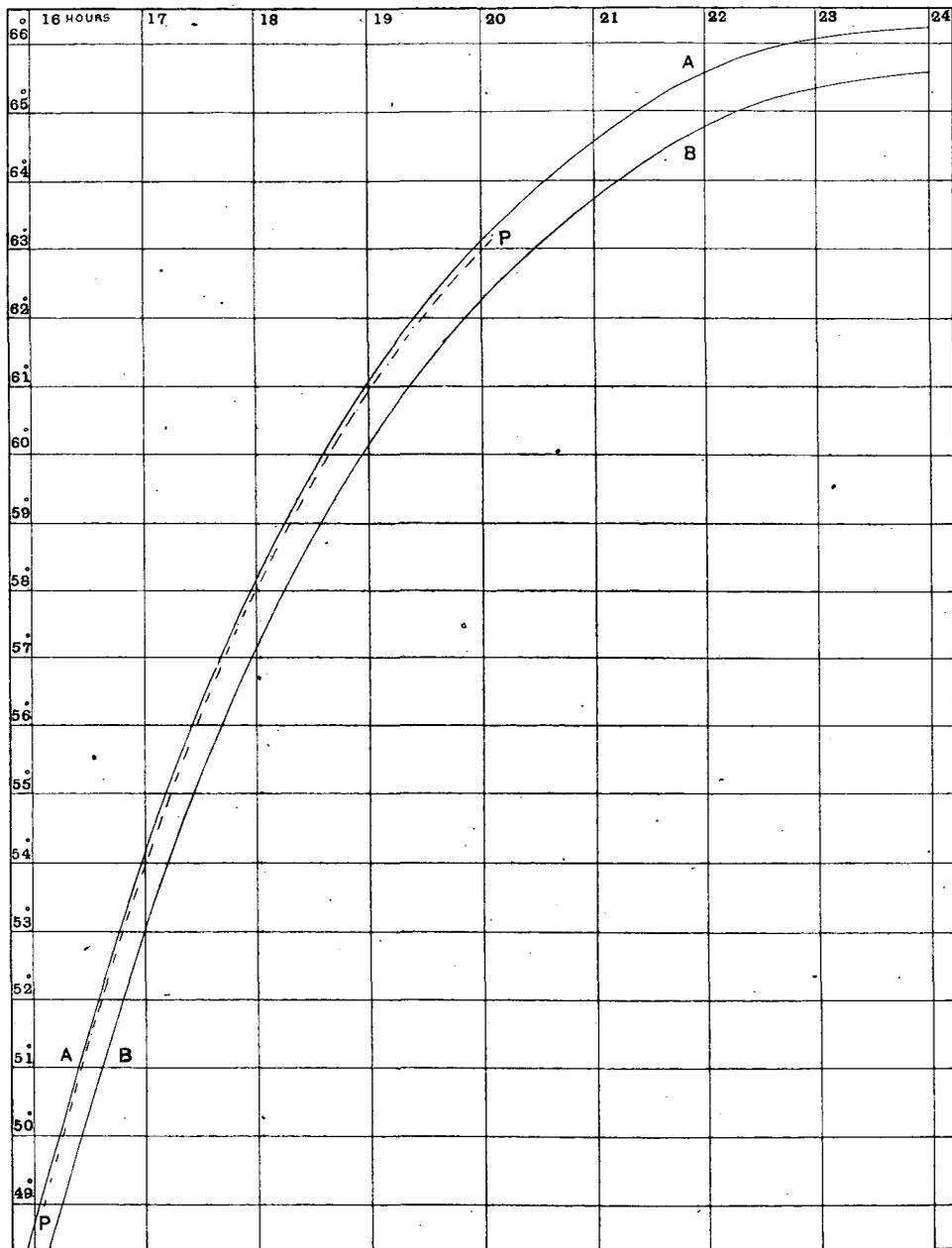
Fig. 1. Curves of Length of Longest Day at different latitudes.
A–A, By Sun's centre without refraction; B–B, actual visibility of Sun's edge;
P–P, stated by Ptolemy (broken line).

the apparent sun, third by reckoning the centre and not the edge of the sun.

We can now begin to see the source of the main distortion of the map of Albion. The direct distance as plotted from London to Caturactonium is equal to that from C. to Alata Castra (Nairn), and it is very likely therefore that Ptolemy had a statement that Caturactonium was half way between the distant points, such being near the truth (distances as 8:9). Having by unfortunate errors in the length of the day placed Caturactonium 1° too far north of London, and Alata Castra 1½° too little north of Caturactonium, he had to fit one length into 4° in England, and an equal length into only 1½° in Scotland. The only possible way to reconcile this was to turn the northern length either to east or west to fit it into the 1½° of latitude. Thus the great distortion can be definitely run down to the mistake of reckoning the day in Yorkshire to include twenty minutes more twilight than was reckoned in London or Nairn.

Coasting Distances.

The best materials that were available for relative positions were the coasting distances. We might think that such were far inferior in value to road distances; but the road material was so scanty that the coasting was superior in value. It is certain that Ptolemy had none of the Antonine Itineraries, for if he had had those he could not possibly have made the internal errors that we see. A small number of road lengths were used, but not any one whole iter. He also ignores Hadrian's Wall.

The first point in the coasting is that the places along a given piece of coast are at equal distances. Remembering that Ptolemy usually only states the nearest 10', and never less than 5', any distances agreeing within such limits are to be considered equal. This equal spacing probably results from statements of day's sailing between ports. The distances stated in this paper are all in Roman miles, in order to be comparable with the itineraries.

PTOLEMY.	ACTUAL.
Cantium Promontorium.	*South Foreland.*
59 to Novus Portus.	33 to Rye or 58 to Pevensey.
49 ,, Trisantonis fl.	55 ,, Shoreham ,, 68 ,, Portsmouth.
62 ,, Magnus Portus.	48 ,, Clausentum ,, 43 ,, Poole.
66 ,, Alaunus fl.	68 ,, Weymouth ,, 67 ,, Axe.
(37) ,, Isaca.	50 or 57 to Exe ,, 17 ,, Exe.
65 ,, Tamarus.	60 to Tamar.
178 (3 × 59) to Ocrinum.	69 ,, Lizard.
(80) to Bolerium.	29 ,, Land's End.
122 (2 × 61) to Herculis pr.	98 ,, Hartland.
193 (3 × 64) to Sabriana ost.	138 ,, Gloucester.

Here, of ten distances round the South Coast, only two are not close to 60 miles or a multiple of that. As the sailing was during summer, in long days, that might well be 18 hours' sail at 3 statute miles an hour. The actual distances, on either of the alternatives, are much less regular. As the eight distances stand in Ptolemy the average is 60, mean difference 4; or if Ptolemy knew of Beachy Head and allowed for rounding it, the seven other distances average 62, mean difference 2. The actual distances of the best part, east of the Exe, have a mean difference of 14 or 12 miles. Hence Ptolemy was here following a scale of equal distances, probably the fullest day's sailing, with two known exceptions.

As to the modern equivalents, the Cantium Pr. must be the South Foreland, as Rutupiæ (Richborough) was 10 miles nearer London. Of the alternative names the difficulties of distances are equal; but in favour of the first column there was a station of the Second Legion 10 miles from Alaunus, and the station of Dorchester is 7 miles from Weymouth, which would thus be Alaunus. Then Dunium would be on the height of Purbeck. The relation of Isca to the Isaca is dealt with among the inland places. The position of Cenion indicates the Fowey, at the headland of which is the Cannis rock.

On the East Coast it was reckoned an equal distance (40 to 44 miles) from the Thames estuary to London, to Idumanius, and to Camulodunum. Taking the estuary as at Southend, this would agree to about 38 miles to London, Maldon, and Colchester. There was no coasting known from Colchester to the Wash, and that distance was taken at only a third of the true length. Nor are there equal distances up the rest of the East Coast.

Round the Welsh coast there is a shorter spacing.

PTOLEMY.	ACTUAL.
Sabrina.	*Gloucester.*
36 to Rhatostathubius.	58 to Cardiff.
40 ,, Tubius.	77 ,, Towy.
50 ,, Octapitarum.	59 ,, St David's Head.
50 ,, Tuerobis.	38 ,, Teify.
40 ,, Stuccia.	38 ,, Ystwyth.
42 ,, Ganganorum.	63 ,, Brach-y-pwll.
38 ,, Toesobis.	36 ,, Caernarvon.
76 (2 × 38) to Seteia.	51 ,, the Dee.

Thus Ptolemy's distances average 42 miles, with mean difference 4; while the actual average of 49, mean difference 15, shows that Ptolemy followed an arbitrary unit of 42 miles for his spacing, as it is much more regular.

Belisama, the Mersey, may be represented by Wallasey on the

corner of the Mersey estuary. Toesobis must be the river Sebint or Seiont at Caernarvon, and may perhaps be Ty-sebint, the "dwelling on the Sebint."

Another region of equal distances is around Scotland, from Longus fl. to Tuaesis estuary.

PTOLEMY.	ACTUAL.
Longus fl.	*Loch Linnhe.*
112 (2 × 56) to Itis fl.	80 to Loch Alsh.
112 (2 × 56) ,, Navaius fl.	82 ,, Loch Inver.
54 to Taruidum.	42 ,, Cape Wrath.
54 ,, Ueruuium.	80 ,, Duncansby Head.
58 ,, High bank.	65 ,, Lothbeg Point.
62 ,, Uara or Loxa.	40 ,, Cromarty Firth (mouth).
52 ,, Tuaesis.	43 ,, the Spey.

These distances in Ptolemy average 56 miles with a mean difference of 2. Allowing that he erred in reckoning Cape Wrath to Duncansby Head as one day's sail instead of two, the actual average is 43, mean difference 5 miles. It seems, then, that the day's sailing was reckoned by Ptolemy as—

PTOLEMY.	ACTUAL.
South Coast, 62.	52 to Tamar.
Wales, 42.	49
Scotland, 56.	43

There is also a possibility, but not so well defined, of a spacing in equal distances.

PTOLEMY.	ACTUAL.
Metaris.	*The Wash.*
81 to Ocellum pr.	70 (?) to Spurn Head.
76 ,, Dunium sin.	125 (2 × 62) { about Whitby.
78 ,, Uedra fl.	{ Wear.

But the uncertainty as to where the Wash was reckoned, and the lack of a clear point for Dunium, prevent this giving a fixed value.

INLAND DISTANCES, ENGLAND.

The many impossible relations of places shown by Ptolemy indicate that we must look for traces of his method of reaching his results, if we are to understand them. There are two modes of attack: one by seeking three or more points in a straight line, which suggests a single line of measurement; the other by taking the distances from a place to every other place around, and seeing which distance agrees with the actual ground. Of course, in this as in the coast distances,

no distance in miles is named by Ptolemy, but from his latitudes and longitudes plotted down we can measure off the distances one or more of which he must have utilised for his positions.

For Daruernum he gives 53 miles from London, and it is lii in the iter, actually 58 miles. The reason for placing it so far south seems to have been that he knew there was a port near it on the south (actually 14 miles), so he placed it 11 miles from Nouus Portus.

London to Rutupiae is 77 miles, and to Richborough is actually 71.

Uenta Belgarum is placed at 69 from London, and is lxvi in the iter, actually 72 miles.

Uenta to Aquae Calidae is placed at 62 miles, actually 60 or 65 by different lines.

Aquae Calidae to Ischalis (Ilchester) is 30 by Ptolemy, and actually so.

Ischalis to the Uexalla (Axe) is 30 by Ptolemy, 29 actually.

The position of Uxella must have been on the Taw near Chulmleigh, where an ancient road line crosses between Dulverton and Hallwall. From this the distances are :—

PTOLEMY.		ACTUAL.
To Uexalla,	73	69 to Axe.
and ,, Tamare,	36	35 ,, Launceston.
,, ,, Tamaris fl.,	53	49 ,, Plymouth.

This close agreement to three points in different directions seems to fix this place well, and to show that these were known road lines.

Tamare is 30 from the Tamaris estuary, and Launceston is 28 to 30 by different roads from Plymouth.

Uoliba is placed at 14 from Tamare, further inland; and at 12 from Launceston is Holla-combe, which may retain the name. The place of Isca is uncertain. Most MSS. say long. 17°, which would agree to its being on the Isaca river running north. The latitude varies from 52° 30' to 50', and 52° 35' seems to have most weight. This would give 81 miles from Aquae Calidae, against 76 actual distance to Exeter. The fusion of Isca and Legio II. in many MSS. is probably due to identity in latitude in the successive entries. That Isca was at Exeter is proved by the distance from Durnovaria in iter xv.

There is much variation in the latitude stated for Noeomagus. But in the text (lib. i, cap. xv.) it is given as 59 miles from Londinium, and it was the city of the Regni. This agrees with Chichester, which is 61 miles from London. The latitude required for this is 53° 15', and MSS. vary as 53° 0', 10', 20', and 25'.

In the south midlands, London to Caleua is 47 in Ptolemy, xliv in the iter, 48 actually to Silchester.

Caleua to Corinium is 44 in Ptolemy, and 50 actually to Cirencester.

Uenta to Corinium is 60 in Ptolemy, and 60 actually; this was then probably the main fixing distance.

Deuana is placed by most MSS. on the position of Uennonae, High Cross, and that was so very important a centre of main roads that it is likely to be named. We must accept that position for Uennonae, although it has been confused with Deva-Chester. This is discussed further at the end.

Corinium to Deuana-Uennonae is 67 (Pt.) and 66 actually. London to Uennonae is 100 (Pt.), xci in the iter, 93 actually. Sabriana = Gleuum to Uennonae is 64 (Pt.) and 67 actually. All these distances are so close to the truth that evidently Ptolemy used them in fixing the positions.

A tempting emendation, followed by Müller, is to emend Urolanium as 1° to the south at 54° 30′ on the London-Uennonae road, where it might be identified with Uerolanium, St Albans. But as Urolanium with Salinae is in the Catyeuchlani, and both in nearly the same latitude, 55° 30′ and 40′, it seems impossible to bring it far southward; it should be about Bourn, by the distances from Lindum and Uennonae, and thus be independent of Verulam.

In Wales there are three straight lines of places, and the distances on these are—

PTOLEMY.		ACTUAL.
Sabriana to Bullaeum,	54.	55 Gloucester to Glasbury.
Bullaeum ,, Stuccia,	52.	57 Glasbury ,, Ystwith.
Stuccia ,, Uiroconium,	63.	71 Ystwith ,, Wroxeter.

Maridunum is obviously on the Tubius, at 12 miles from the mouth, and Caer-marthen is at 11 miles up the river, and evidently retains the name.

The Midlands are in a confused state, as, owing to having placed York a degree too far north of London, there is a dearth of material to occupy such a space. First, as to Metaris, which is some part of the Wash. Norfolk was formerly much more insulated, and the Wash extended up to the isle of Ely. The distance from Idumanius, or Sidumanius, the Blackwater river, to Metaris is 53 miles in Ptolemy, and from Lindum to Metaris is 78 miles. From the Blackwater at Maldon to Thetford, south of Ely, is 58 miles, and from Lincoln to Thetford is 85 miles. These are so near to Ptolemy's distances that they were probably the lines on which Ptolemy's positions were based. Another line of connection is, Lindum to Mediolanum 108 miles, and actually 109 to Whitchurch. Lincoln may also possibly be cross-fixed by the distance from Deuana-Uennonae, which is 52 miles in Ptolemy, against 65 miles actually. What,

then, is to be made of Petuaria? There is no proof of connection with the Humber, and the distances from Metaris 76 miles, and Eboracum 59 miles, agree closely with the direct distance from Thetford 77 miles to Lincoln, and thence 61 miles to York. The distances, therefore, suggest that Petuaria is a synonym of Lindum, or close to it. In favour of this duplication by Ptolemy, Petuaria is the city of the Parisi, and Paris was a district round Horncastle east of Lincoln, from which came Matthew of Paris. Possibly Potter Hanworth, 6 miles S.E. of Lincoln, may be an echo of the name Petuaria. Beyond York, Ptolemy gives—

Eboracum.	*York* via *Leeds.*
41 to Olicana.	40 to Ilkley *via* Ripley.
70 ,, Uinnouion.	65 ,, Binchester.

He evidently had this route before him, though he did not know that it doubled back at a sharp angle, but supposed it straight, and so ran Uinnouion out to the west coast instead of being near the east.

From this misplacement of Uinnouion and the wrong distance of York from London, it is clear that Ptolemy had not the Antonine iters before him. The distances north of York are—

BY PTOLEMY.	ITER.	ACTUAL.
Eboracum.		*York.*
24 to Isurium.	xvii	17 to Boroughbridge.
26 ,, Caturactonium.	xxiv	25 ,, Catterick.
38 ,, Uedra.		35 ,, Chester-le-Street on Wear.

These distances show that the excess of latitude between the observed points at York and Catterick was thrown on to the York-Boroughbridge distance by Ptolemy.

The further distance from Uedra to Bremenium is only 40 in Ptolemy, but 52 miles actually.

Along the coast—

BY PTOLEMY.	ACTUALLY.
Uedra.	*Wear* (39 to *Alne*).
60 to Alaunus.	71 to Tweed.
38 ,, Boderia.	40 ,, North Berwick.

These are quite near enough for approximations by coasting distances, but seem to put Alaunus at the Tweed, and not at the Alne. This complicates the Bremenium distance of 35 miles to Alaunus; from Rochester to Alnmouth is 31 and to the Tweed 41 miles. Probably the latter was intended, and was the mode of fixing Bremenium.

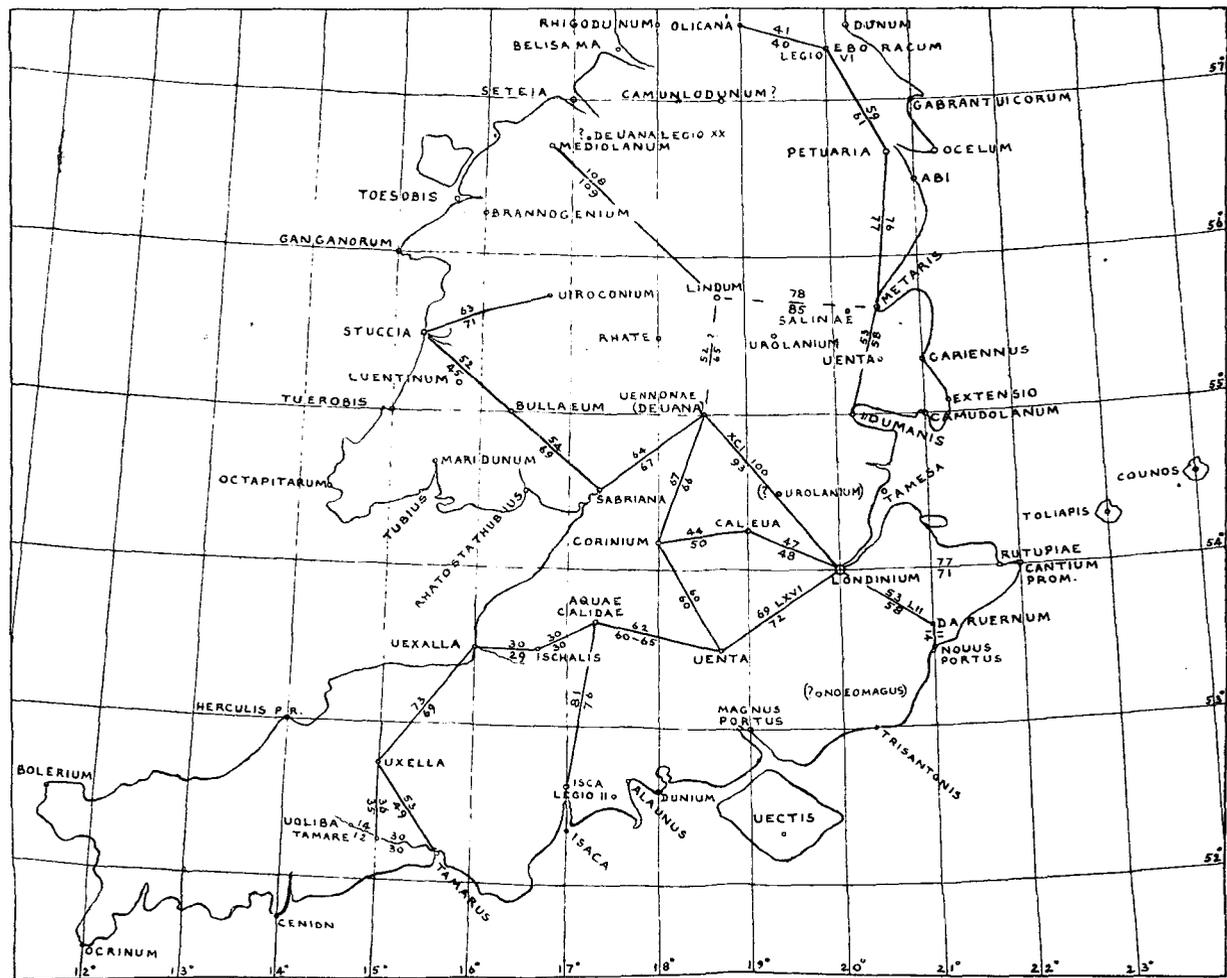The width across Northumberland was well known, as from the Uedra

Fig. 2. Towns and Coast Names in England fixed by Ptolemy. The natural coast is here adjusted to these points.

to the Ituna is 69 miles, and actually from the Wear to Carlisle is 73 miles.

THE LOWLANDS.

The most distorted and difficult part of the geography is that of the Lowlands. We need first to pick out the distances which are fairly correct, as they are probably the basis on which the map was built. After that it is time to seek for the cause of error in the other parts.

First there is an obvious straight line running through Abrauannus fl., Retigonium, Uanduara, Clota, Alauna, Uictoria, Horrea, and probably on to Taua. The former part is exaggerated, but from Clota onward it is fairly correct.

Clota.	*Cumbrae, Clydemouth.*
32 to Alauna.	32 to Glasgow (lowest bridge).
38 ,, Uictoria.	38 ,, Stirling (N. and E. by Forth).
25 ,, Horrea.	20 ,, Auchterarder.
41 ,, Taua.	41 ,, Taymouth.

As there is no question as to the termini, the two intermediate places may be accepted thus. As Alauna and Clota might be known to be opposite Boderia—the Clyde opposite to the Forth—this would suffice to lay out the line from Taua. Glasgow must have been an important point, as it is the lowest place that could be bridged on the Clyde, or the first narrow ferry. Hence it is likely to be a station, and it exactly agrees with the distances of Alauna.

Now, on looking at the Lowlands, Alauna is seen to be the centre of road lines, straight through (1) Bremenium to Uedra, (2) Curia to Ituna, (3) Coria to Uxellum, (4) a branch from Coria by Lindum to Nouius, (5) from Coria through Corda and Carbantorigum to Deua, (6) from Alauna to Clota, Uanduara, Retigonium, and Abrauannus. This net of branching roads is evidently the basis of the plan.

Taking the distances along these lines—

BY PTOLEMY.	ACTUALLY.	Ratio.
Alauna is	*Glasgow is*	1 to
170 to Ituna.	94 to Eden.	1·82
also 170 ,, Nouius.	also 79 ,, to Nith.	2·15
186 ,, Deua.	94 ,, Dee.	1·98
169 ,, Iena.	89 ,, Wigtown.	1·90
180 ,, Abrauannus.	92 ,, Glenluce.	1·92
190 ,, Nouantum.	93 ,, Port Patrick.	2·05

It seems that all these distances have been doubled, the mean of the ratios being 1·97, and the variations what might be expected in a rough

country with devious tracks. The actual distances are those measured along river lines and present roads, in the most likely course.

Why all these distances are doubled we can hardly guess. It might be due to having exaggerated coasting distances, but if so there cannot have been any road lengths known. It might more likely be due to a local habit of counting in the mile a thousand single paces, instead of double paces, and so recording in half miles instead of whole miles.

The strange projection of Nouantum from between the two bays shows that different materials were here used. The bays and estuaries are what almost entirely attract the coasting record, and were probably fixed thus between Abrauannus and Clota. The position of Nouantum is due to one of the doubled distances from Alauna, and hence far beyond the bays.

It is along the possible lines of road from Glasgow to the coast that search should be made, at the right distances, for the various inland towns. At a first view we may expect Curia at Courance, south of Moffat, which is the exact distance; Trimontium, west of the Annan, possibly the coast hills at Cummertrees; Uxellum at Caerlaverock; Coria between Strathavon and Muirkirk; Lindum about Dalpedder, below Leadhills; Corda 4 miles north or north-east of Carsphairn; Carbantorigum near New Galloway; Lucopibia about Dromore east of Newton Stewart; Uanduara would be 17 miles from Alauna, and Doura is 20 miles from Glasgow, near Kilwinning. These positions are all on the obvious lines of road, and should be searched before looking elsewhere.

THE HIGHLANDS.

The only internal places in the Highlands are on one straight line from Clota to Tuaesis estuary (the Spey). This line can be fairly traced by its holding to the valley of the Spey as far as possible, and at the south end holding to Loch Lomond, to avoid the bending further to the west. Thus we can follow it clearly as—

Tuaesis est.	*Spey.*
	By Glen Truim—
82 to Tameia.	83 to Little Dalwhinnie.
	By Loch Lydoch—
39 ,, Banatia.	39 to Orchy Bridge.
	By Loch Lomond, Cardross, Shaw's Water—
70 ,, Clota.	68 to Polteath at mouth of Firth of Clyde.

Of course, there is nothing fixed of these but the termini; the intermediate points are only stated to show whereabout they must fall on

such a line. The alternative road by Fort William and Inveraray would be too long, and would not use the excellent road of Loch Lomond. From the close agreement of the total distance above, it seems certain that Ptolemy had a good statement to go by along this road.

Regarding the places along the East Coast there is a general agreement of scale, but much minor variation.

Boderia.	*Forth.*
51 to Tina fl.	35 to 65 to Eden.
40 ,, Taua est.	10 ,, Tay.
40 ,, Deua fl.	60 ,, Dee.
60 ,, Taezalorum pr.	47 ,, Kinnaird Head.
29 ,, Celnius fl.	34 ,, Cullen.
20 ,, Tuaesis est.	12 ,, Spey.
30 ,, Alata Castra.	35 ,, Nairn.
26 ,, Uara est.	30 ,, Dingwall.
44 ,, Loxa fl.	54 ,, Evlex Water.
19 ,, High Bank.	24 ,, Lothbeg Point.
38 ,, Ila fl.	40 ,, Wick Bay.
20 ,, Ueruvium pr.	19 ,, Duncansby Head.

Of these distances we may note the following:—From the Forth at North Berwick across to the Eden may vary between 35 and 65 miles according to extent of open sea crossed. The Eden of Carlisle is the Ituna, and so the Eden of Cupar would compare with the Tina. The distance of 40 miles from the Eden to the Tay may be due to being reported up to Perth; between the estuary mouths it is only 10 miles. The Dee is placed about 15 miles too near the Tay, perhaps due to their being stated at a whole degree apart. Deuana by its position is evidently on the Don. Alata Castra, if in this series of positions, must fall at Nairn, though as a strategic point it would be expected to be at Inverness. Uara (some MSS. have Uarar) may be connected with Glen Gowrie and Loch Gorran, which run into the head of Cromarty Firth near Dingwall; this name might have extended down to the Firth. Loxa seems connected with Evlex Water, which runs into Dornoch Firth. The ὄχθη ὑψηλή does not imply a headland or mountain, but a high bank of earth, such as a ridge or high sea-wall which cut off the view inland from a ship. By the distance this would come about Lothbeg Point.

The Cantire coast is a great difficulty, as there seems to be no room for it in Ptolemy. Certainly he had no material to construct any approximation to the complex of promontories and firths between the Clyde mouth and Loch Linnhe. Lemannonius by its name would belong to the River Leven and Loch Lomond; but no connection by distances seems possible, as it should be between Banatia and Clota. The reading

varies as Lelaannonius; as this might be a MS. corruption of Leggan-
nonius, it would connect with Laggon at the mouth of Loch Fyne, which
is evidently the inlet in question.

The two islands of Toliapis and Counus between Kent and the
Continent appear to have been reckoned as at a normal day's sail from
Cantium pr. to Toliapis, and another to Counus. To understand these
we should refer to Clement Reid's *Submerged Forests*, where the map on
page 40 shows that these islands would have been on the ridge between
the old Thames Valley and Channel Valley. As the submergence prob-
ably took place about as long before Ptolemy as we are after him, it
is quite likely that this ridge, which would be about the last part to be
attacked by the sea, might have remained still as a couple of islands in
the time of Ptolemy. We must remember that the evidence of the forest
beds shows that there was no Channel sea during the Neolithic period,
but from England across to Denmark was continuous land.

Several uncertainties of the MSS., which do not much affect the
general view, have not been noticed so far. The more serious of these
are the following:—In Scotland, Loxa and Uara are both uncertain in
position. Beside the places of the usual text here plotted, there is con-
siderable authority for placing Loxa in Cromarty Firth in the place of
Uara, and Uara into Inverness Firth. For Boderia there is much
authority for 58° 45′ and less for 59°; neither place would make a differ-
ence in the identification—it would only be a matter of how far along
the Firth of Forth the site was fixed. Alaunus is by a few MSS. put at
21° 20′, which would agree better with the distance from the Wear to
the Alne, but it would throw out the distance from Bremenium.
Carbantorigum has much authority for 59° 30′ lat.; if it were so it
would be on the Alauna-Lindum-Nouius road.

In England, Camunlodunum is uncertain in position—usually put at
18° 15′, also at 18° and 18° 45′. The latitude in the usual text is 57°,
but all the MSS. appear to give 57° 45′. This would put it just half
way on the road from Olicana to Uinnouium, at about Middleham in
Wensleydale.

Deuana is an intricate case. In the older versions down to Nobbe the
place is 18° 30′, 55° 0′, with the Twentieth Legion. Such exactly accords
with Uennonae, High Cross. The MSS. are three with 17° 10′, one altered
to 17° 30′, and twelve with 18° 30′; latitudes, four MSS. of 53°, four of 55°,
four of 55° 30′, one 56° 45′. Hence there is only a single reading that will
agree with Deva-Chester, and the Twentieth Legion that was stationed
there, according to the iter; but the Uennonae position is given by nearly
all the longitudes, and by as many MSS. for its latitude as there are for
any other. How all this came about it is impossible to say without

NOUANTUM

RHERIGONIUS S

ABRAUANNUS

DUMNA

RETI-GONIUM

UIDOGARAS

EPIDIUM

LONGUS F.

TIS

UOLSAS

NAVAIUS

IENA

LUCOPIBIA

LELLANNONIUS

TARUIDUM

QUERUUIUM

DEUA

UANDUARA

CLOTA

LOXA

HIGH BANK

ILA

CARBANTORIGUM

CORDA

NOUIUS

LINDUM

UARA

UXELLUM

CORIA

ALAUNA

70 68 BANATIA

39 TAMEIA

ALATA KASTRA

TRI MONTIUM

COLANIA

CURIA

38 38

UIKTORIA

TUAESISO 82 83

TUAESIS

ITUNA

BREMENIUM

35 41

25 20

HORREA 41 41

DEUANA

CELNIUS

TAEZALORUM

EPIACUM 69 73

UEDRA

ALAUNUS

BODERIA

TINA

TAUA

DEUA

MORICAMBE

UINNOUIUM

CATURACTONIUM

CAMUN LODUNUM CALATUM

SETANTIOR

RHIGO DUNUM

OLICANA

ISURIUM

BELISAMA

DUNUM

EBORACUM LEGIO VI

Fig. 3. Towns and Coast Names in Scotland fixed by Ptolemy. The natural coast is here adjusted to these points.

an exhaustive study of the relationships of the MSS. throughout the whole *Geographia.* As an hypothesis we may expect that the original reading was—

Uennona	.	.	18° 30′	55° 0′
Deuana	.	.	17 10	56 45
Legio XX. Victrix—				
Uiroconium	.	.	16 45	55 45

Then by confusion in a very early MS. the -ona ending was confused with the -ana, and Deuana put to 18° 30′, and Uennona and 17° 10′ dropped out. This must have been before dividing the towns by the tribal sections, as we cannot suppose Uennonae to be in the Cornavii like Deua-Chester, as Ratae and Lindum were in the Coritani.

Another difficulty is about Salinae. The reading of Nobbe, 16°, cannot be right, as it is with Urolanium in the Catyeuchlani. The MSS. have 20° 10′ in sixteen cases, and 20° 45′ in twelve cases. For the latitude, three are of 55° 20′, six of 55° 40′, nine of 55° 50′. From all these it must have been near Norfolk; and, by its link to Urolanium, probably at 20° 10′, which in the MS. goes with 55° 40′, so rather west of Metaris.

In this paper I have not attempted to take into account the other sources outside of Ptolemy. Here we only try to ascertain what Ptolemy used, and how he worked. The full study of the geography must take in many other sources of information.

APPENDIX.

The following cases serve to test the relative values of the texts adopted by Nobbe (N) and by Müller (M):—

Clota is in the coasting list, and 59° 40′ for it (N) agrees with the breadth across to the Forth, while 59° 20′ (M) would be only about half the breadth.

Bullaeum, 16° 20′ (N), lies in a straight line between Sabriana and Stuccia; but if it is 16° 50′ (M), it would not be in line. Darouernum is put at 54° by M, on the strength of a single MS. at Constantinople. If so, it would be only 44 miles from Londinium. But if 53° 40′ (N), it comes to 52 miles from London, exactly as the Antonine itinerary; the actual distance is 58 miles.

Noeomagus, M puts at 53° 5′ without any MS., solely because it is said to be 59 miles from Londinium. That distance, however, would bring it to 53° 15′ on the map. The various readings are 53°, 53° 10′, 53° 20′, and 53° 25′.

Ischalis is taken at 16° by M (with the Florentine MS.), which would put it on the coast, yet it is not in the coast list. 16° 40′ (N), as in most

MSS., puts it between Aquae Calidae and Uexalla, and it agrees thus exactly with the distances to Ilchester, which was a Roman station by its name.

Uenta, on the Florentine authority, is put at 53° (M), close to Magnus Portus, while Winchester is far from a port. Most MSS. give 53° 30′ (as N), which is 69 miles from London, and Winchester is actually 72. Uoliba is put at 52° by M, trusting the Florentines, which would put it on the coast, but it is not in the coast list. The 52° 20′ (N) of all other MSS. places it rightly on the Tamar, inland. These test cases, where collateral facts help to decide between MSS., all show that the other readings, such as those of Nobbe, are mostly to be preferred to the version drawn up by Müller.