and would therefore ufe the fame meafure with that employed in buildings. It appears then that this foot was ufed in fuperficial meafurement; and Vitruvius, who derives his meafures from the proportions of the human body, which he affumes as a ftandard, makes no difference between the foot ufed in the conftruction of buildings, and that employed in the menfuration of diftances on the road. The author of the Treatife de Menfuris' fays farther, that the meafures taken from the proportions of the human body are thofe " quæ ad viatores feu ad curfores pertinent."

Romans ufed one kind of foot meafure only. We may then, I think, fairly conclude, that the Romans ufed one foot meafure only, and that the Coffutian foot was the Roman foot for all purpofes.

Dr. Murdoch fpeaks twice of the pes monetalis of Athens, for which he feems to cite Greaves, who is fo far from regarding it as an Attic meafure, that he calls it the *pes monetalis*[*], or *Romanus*.

Dr. Murdoch again fays, that the proportion of the pes monetalis to the Englifh foot is as 19 to 20; and adds, that the term *monetalis* is to be found in Hyginus. It is certainly mentioned twice by that author; but it refers in both places to the *Roman*, and not to the *Attic* foot.

Pes monetalis whence derived. The word *monetalis* is of Roman[*], not of Greek extraction, and

y Rei Agrariæ Scriptores, Goefii, p. 320.

* On the Roman foot.

* Μόνητα ἡ Ἥρα παρὰ Ῥωμαίοις. Phav. Lexic. Vocem ab æde Junonis ex arce extitiffe, quocirca Junonem illam appellatam *Monetam*,

Cicero de Divinatione.

The Romans, being in want of money at the time of the war with Pyrrhus, invoked the affiftance of Juno; who replied, in anfwer to their applications, that if the war which they carried

derived from an epithet of Juno, in whose temple the money was coined. The pes monetalis, or rather its subdivisions, seem to have been the standard for measuring the diameter of the silver coin; and it appears from Vitruvius [b], and others, that there was much connection between the Greek and Roman measures and the Greek and Roman money. The pes monetæ is mentioned frequently by the writers of the middle ages, and is defined from one of these by Du Cange, to be " meta monetariis præscripta in " cudendis nummis, quam omnino observare tenentur." From this hint, I examined several very fair Roman coins [c], both aurei and

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carried on was just, money should not be wanting. The Romans then, after gaining what they wished, paid divine honours to *Juno Moneta*, or the Adviser; and decreed, that the money should be coined in her temple. Suid. Lexic. Vox Μόνητα.

[b] Ex eo etiam videntur civitates Græcorum fecisse, uti quemadmodum cubitus est sex palmorum, ita in drachmis quoque, eo numero uterentur. Illæ enim æreos signatos, uti asses ex æquo sex, quos obolos appellant; quadrantesque obolorum, quæ alii dichalca, nonnulli trichalca dicunt, pro digitis viginti quatuor constituere.

Palmus autem habet quatuor digitos, ita efficitur, uti habeat pes sexdecim digitos, et totidem asses æreos denarius. Vitruv. lib. iii. cap. 1.

As the denarius contained sixteen asses, so the foot contained sixteen digitos. And as the assis was divided into twelve uncias, so likewise the foot was divided into twelve uncias; and therefore the dodrans is used by Frontinus, and the semiuncia and Sicilicus by Pliny, for proportional parts of the Roman foot, as the same are used by other classical authors for proportional parts of the Roman assis or uncia. Greaves of the Roman foot.

[c] The length of the digitus, or sixteenth part of the Roman foot, is, according to Mr Greaves, ·72525 decimal parts of an inch; but as so many figures denote fractional parts too minute to be ascertained by actual measurement, I have used the three first figures only; and the reader will remark, in the table annexed, how nearly the diameter of the beaded circle stamped upon the Roman coin accords with Mr. Greaves's calculation of the extent of the digitus. Some irregularity takes place; but this may be imputed, either to the inaccuracy of the workmen, or perhaps, in some degree, to the inequality of force in the blows of the hammer, with which the ancient money was struck: but the coincidence of this part of the impression with the digitus in the consular coins, and those of the higher empire, renders it more than probable that this measure was intended to be the standard of the dimensions of the die. The coins referred to were selected from a considerable number, for the fairness of the impression, and the clearness with which the beaded circle was marked out. The measurements were taken with a pair of fine hair-compasses, and a brass scale of inches and decimal parts, made for this purpose by Mr. Troughton.

Table

denarii, and found the beaded circle impreffed on them to coincide
very nearly with Mr. Greaves's proportion of the digitus.

Dr. Murdoch himfelf cannot difcover the length of the Roman
itinerary foot, as he calls it, from any of his calculations.   In
the eftimation of the diftance between Bologna and Modena, he
computes the Roman foot at one-fixty-fourth, or a quarter of a
digit, lefs than the Englifh : in reckoning the diftance between
London and Verulam, he makes it to be one-thirty-fecond, or half
a digit, lefs ; which differs very little[d] from the proportion affigned
by Mr. Greaves.

Again, he computes the Roman itinerary foot to be to the
Englifh as forty-five to forty-four, or one-forty-fourth part greater.
Such confufion arifes from unauthorifed fuppofitions. The Roman
itinerary foot as diftinguifhed from the common Roman foot, is
to me as vifionary as the pes monetalis of Athens.

Table of the dimenfions of the beaded circle on the circumference of feveral Roman Coins.

Gold Coins.	Diameter of the beaded circle in decimals of an inch.	Silver Coins.	Diameter of the beaded circle in decimals of an inch
Vefpafian	.71	Claudius	.695
Trajan	74	Domitian	.725
Trajan	.725	Domitian	.70
Hadrian	.74	Domitian	.69
Reverfe	.725	Domitian	.71
		Trajan	.71
Silver Coins.		Trajan	.71
		Hadrian	.71
Confular	.695	Hadrian	.705
Confular	.725	Marc. Aurelius	.725
Confular	.725	Alex. Severus	.71 bad filver
Divi filius	.725	Gordian	.775 bad filver
Divus Auguftus	.725	Philippus	.82 bad filver

[d] 967 : 1000 :: 31 : 32.005.

Having

Having thus, I hope, settled the length of the Roman. it remains to speak of the Greek foot, and the proportion which these bear to one another.

This is computed by Greaves to be in the ratio of 25 to 24, the Greek foot exceeding the Roman in that proportion, which is the same within a very minute fractional part with that of 1007.29[e] to 967; and this proportion has been adopted by Arbuthnot, and indeed, with an almost imperceptible difference, by Dr. Reinhold Forster.

Our knowledge of this proportion is deduced from

1. The difference of number between the Greek and the Roman feet, said to be contained in the stadium, there being 600 Greek feet, as we have already seen, and 625 Roman feet, which, if we suppose the stadium to be of an equal length in both computations, makes the Greek foot to be longer than the Roman, in the ratio of 25 to 24.

2. The passage of Polybius cited by Strabo, and mentioned above, which seems to give the same proportion.

3. The proportion of the Philæterian foot, which is described to be $\frac{1}{600}$ part of a stadium, and appears to have been the Greek foot, and was, as Salmasius[f] lays it down, $\frac{1}{24}$ part longer than the Roman foot, or pes monetalis.

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[e] 25 : 24 :: 1007.29 : 966.9984.
[f] Sic vigesima quarta parte major erat pes

Græcus et Philæterius, Romano, sive monetali. Salmaf. Plin. Exercitat.

4. From

4. From the defcription of the Ptolemaic foot, given by Hyginus[g], which appears to be the fame with the Greek, and was half an inch longer than the pes monetalis, or as 25 to 24.

5. From the meafures of ancient buildings, now remaining. " Mr. Stuart," as we are told by the editor of the two laft volumes of the Antiquities of Athens, " appears to have taken very great " pains to difcover the true length of the Greek foot, from dif- " ferent meafures of the temple of Minerva Parthenon; which, from " its name Hecatompedon, was fuppofed to contain a meafure of " an hundred feet, in fome confpicuous part of the building."

The difference of the foot, and the proportion it bears to Englifh meafure, taken from various parts of the building, are as follows.

TABLE I.

	ENGLISH MEASURE.	
	Inches.	Dec. parts.
I. Length of the upper ftep in front of the temple gives for one Greek foot	12.	139
II. From outfide to outfide of the angular columns . . .	12.	095
III. From center to center of the front columns	12.	0928
IV. From the Roman foot, by meafure of the obelifk of Sefoftris	12.	11551
V. Length of the architrave	12.	0625
VI. From length of the third ftep in vol. ii. pag. 8. . .	12.	137
Average of the whole	12.	10697
Average of Nos. I. II. III. V. VI.	12.	0808

g Præterea pes eorum qui Ptolemaicus ap-   ciam. Hyginus de Limitibus conftituendis. pellatur habet monetalem pedem et femun-

TABLE II.

	Eng. feet.	Dec parts.
Suppofe the Englifh foot to be as	1000.	
The Greek foot, according to Greaves, is . . .	1007.29	
According to No. I. in the other table	1011.591	
According to No. II. . . . ϑ	1008.	
According to No. III.	1007.68	
According to No. IV.	1009.6	
According to No. V.	1005.21	
According to No. VI.	1011.41	
Average of Mr. Stuart's calculations	1008.915	
Proportion of Greek foot to Roman	25 : 23.9614	
Length of Greek Olympic ftadium, according to Mr. Stuart's calculation of the foot . .	605.	341

The near coincidence of thefe calculations with thofe of Mr. Greaves is a ftrong prefumption of the correctnefs of both, and proves how much thofe have been deceived who have attempted to reduce the Greek foot to lefs than two-thirds of the Englifh. But of this more hereafter.

Mr. Rennel, in his work entitled " The Geographical Syftem of
" Herodotus," mentions the Olympic ftadium of 600 feet, but
alledges, that, " there is no teftimony of the application of this
" ftadium to itinerary purpofes. On the contrary, every portion
" of diftance, as well throughout Herodotus's hiftory, as the
" writings of other Greeks, appears, on a reference to the ground
" itfelf, to be meafured by a ftade of a much fhorter ftandard,
" moft of them rifing above that of Xenophon, which is of 750
" to a degree, but falling below that of Strabo, which is of 700."

To

To Mr. Rennel's affertion, that there is no teftimony of the application of the Olympic ftadium to itinerary purpofes by Herodotus, it may be replied, that there is as much teftimony as could be expected. It is defcribed as a fuperficial meafure by that writer, and its parts or fubdivifions particularifed, and this but a few lines after he had fpecified the extent of the lake Mœris, which he eftimates at 3600 ftadia, or 450 miles, in circumference, a fpace which Mr. Rennel will furely allow to be fufficient to be accounted an itinerary computation. Now Herodotus never defcribes any other ftadium, or gives any reafon to think, that the one ufed in computing the extent of the lake Mœris was of a different length from the one defcribed juft after. It is worth remarking, that Herodotus, at the beginning of the fame book, tells us, " that thofe who have but a fmall portion of land, meafure it " by the ὀργυιὰ, or fathom; thofe who have more, meafure it by the " ftadium ; thofe who have much, by the parafanga; and thofe who " poffefs countries of great extent, by the fchœnus ; the former of " the two laft-mentioned meafures confifting of 30, and the latter " of 60, ftadia." Now the ὀργυιὰ is mentioned as the next divifion to the ftadium in both thefe places, and of courfe we have reafon to think that the fame ftadium was meant in both.

From the dimenfions of the lake Mœris

From the diftance between Pifa and Athens. In order to prove that Herodotus meant to exprefs a ftadium fmaller than the Olympic, Mr. Rennel takes the diftance between Pifa and Athens, which, he fays, " ought, if the numbers be not " corrupted, to be accounted decifive." This diftance was, according to Herodotus, fifteen ftadia fhort of 1500, or 1485 ftadia ; and this, he fays, agreed nearly with the one between Heliopolis in Egypt, and the fea. " The direct diftance," Mr. Rennel fays, is, " in D'Anville's map of Greece, 105 Greek miles." I have

that

that map now before me, and this diſtance meaſures upon it 990 Olympic ſtadia, or 123 Greek miles and ¾. If we add to this ⅛, or 15 miles and ½, for the winding of the road, it will make up 139 miles and ¼, equal to 1114 ſtadia of 600 to a degree. Say then, [b] 1114 : 600 : : 1485 : 799.8, or almoſt 800 to a degree.

Let us now ſee what the number of ſtadia to a degree would be by Mr. Rennel's own numbers: [i] 118. × 8. = 944 : 600 : : 1485 : 943.856, both calculations very different from that of Mr. Rennel.

But the road which we may preſume was uſually travelled is as follows :

From Piſa to Corinth	570	
From Corinth to Megara	250	Olympic ſtadia, according to D'Anville's map.
From Megara to Athens	229	

Direct diſtance from Piſa to Athens 1049

Add ⅛, or 131 ſtadia, for winding of the road, and the numbers will be 1180 ſtadia. Say then 1180 : 600 : : 1485 : 755.08, a number not very different from the one aſſigned by Mr. Rennel, but not deducible from thoſe calculations which he has ſpecified.

[h] 600 Olympic ſtadia are reckoned equal to a degree, on Mr. D'Anville's map of Greece.

[i] This is the number aſſigned by Mr. Rennel, with the addition of ⅛ for winding of the road.

The

The diftance, according to Mr. Rochette's map of Greece, ftands thus:

From Pifa to Corinth 63
From Corinth to Megara .... 27 } Englifh miles
From Megara to Athens 26

Diftance from Pifa to Athens 116
Add ⅛ or 14½ miles, for winding of the road   14.5

————

130.5

Say then, 130.5 : 1485 : : 69.5 : 790.86 for the number of ftadia in a degree.

But whatever dependence Mr. Rennel may place on this calcu- lation, he owns that the account given by Paufanias, of the dif- tance from Olympia to Sparta, leads to a different conclufion, and gives a ftadium of no more than 707 to a degree. Paufanias efti- mates this diftance at 660[k] ftadia ; and Mr. Rennel fays, " that on " the map this diftance is 50 Greek miles, or 56 by the road, " giving a rate of 707 to a degree. The Theodofian Table has 61 " mille paffus only, equal to about 49 Greek miles by the road."

The diftance between Olympia and Sparta is, according to Mr. D'Anville's map, 500 ftadia, or 62½ Greek miles, equal to 57.23 Englifh miles, which laft is nearly the diftance laid down in Mr. Rochette's[l] map. If we add to this ⅛ for winding, it will make

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[k] Ὁδοῦ δὲ τῆς ἐς Λακιδαίμονα ἐξ Ὀλυμπίας ἐπὶ ἑτέραν ῥύμην τὴν ἐν Λακιδαίμονι μέτρα εἶναι ςαδίες ἐξήκοντά τε κὴ ἑξακοσίως. Paufan. lib. vi. p. 492.

Edit. Kühn.

[l] This is the fame with the one in Stuart's Antiquities of Athens.

up

up 562½ ftadia, or 70 Greek miles, or nearly 64¼ Englifh miles. Say then, 64.326 : 660 :: 69.5 : 713.09, which is not far from Mr. Rennel's conclufion, though not founded on his calculations.

Let us now fee how the account will ftand, according to his own computation. 51.28 Engl. m. = 56 Greek m. : 660 :: 69.5 : 817.22; very different from Mr. Rennel's calculation of 707 to a degree.

As to what Mr. Rennel fays refpecting the diftance being by the Theodofian or Peutingerian Tables 61 M. P. I anfwer, that I have thefe now before me, in Bertius's edition of Ptolemy's Geography, and find that there are two roads put down from Olympia to Lacedæmon, one the more direct by Melæna, the other following for a confiderable part of it the fea-coaft. The more direct road has the diftances marked on it no farther than from Olympia to Melæna, which laft place is fet down as 12 miles from Olympia, which, by Mr. D'Anville's map, appears to be nearly the true diftance; but no farther fpecifications are to be found for the remainder of the way.

The road by the coaft is as follows; with the diftances as marked in the tables, and thofe meafured in a ftraight line in Mr. D'Anville's map of Greece.

From

	Peutingerian Table.	D'Anville's map.
From Olympia to Samaco	15 M. P.	17 M. P.
From Samaco to Cypariffa	24	18 ·
From Cypariffa to Pylus	15	14
From Pylus to Methone	30	19
From Methone to Afine	12	11
From Afine to Meffene	30	28
From Meffene to Lacedæmon . . .	30	30
	156 Total.	137
Add ⅛, or 17 M. P. to Mr. D'Anville		17
		154 Total.

The agreement between modern and ancient computation is here very remarkable; but I fufpect that the road, to which Paufanias alludes, was more circuitous than the common allowance of will account for.

Let us now examine fome of the diftances of which we may be fuppofed to have more accurate accounts, and which Herodotus himfelf is faid to have meafured. He fays, that the length of the Bofporus is 120 ftadia. According to the large map of the Propontis, it meafures 16^m Englifh miles; and, according to Mr. Arrowfmith's chart, 13° = 15 Englifh miles. If we take the medium of thefe two computations, we may fay, 15.5 : 120 : : 69.5 : 538 nearly.

We know not indeed the points between which Herodotus formed his menfurations; but they could not be far from thofe

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^m Rochette's map makes it to be 15½ Englifh miles.

here

here fixed on ; and this inftance would argue, that Herodotus ufed a ftadium confiderably greater than even the Olympic. Again, Herodotus fays, that the Propontis is 1400 ftadia in length ; but by the large map it meafures, including the Bofporus, which Herodotus fays belongs to it, 142.5 Englifh miles. Say then, 142.5 : 1400 : : 69.5 : 683 nearly, a ftrange difproportion between two diftances fo nearly connected.

The fame writer eftimates the length of the Hellefpont at 400 ftadia ; but it meafures, from Gallipoli to the opening into the Ægean fea, no more than 38 Englifh miles, or about 331 Olympic ftadia ; though it winds fo much, that Herodotus's calculation of the courfe of the Strait may be nearly juft, and indicates, that he meafured on this occafion by the Olympic ftadium. But the truth is, that the meafurements of Herodotus are in general fo inaccurate, or fo corrupted, as not to be depended on, and cannot be regarded as a foundation on which any ftandard meafure can be eftablifhed, and fully juftify the obfervation of Dr. Blair[n], that " nothing is more common than to find a confufion of numbers in " the diftances given us by ancient authors."

Mr. Rennel obferves truly on the diftance between Pifa and Athens, as laid down by Herodotus, that the diftance from Heliopolis[o] to the fea, which Herodotus defcribes as equal to the other, is not in reality more than 80 Greek miles.

Let us then apply to Xenophon, who, as he travelled himfelf,

[n] Hift. of Geography. Strabo acknowledges the fame inaccuracy, οὐ γὰρ ὁμολογεῖται περὶ τ̃ διαςημάτων. Strab lib. iv. pag. 178.

[o] From Heliopolis to Tanis is 80 Greek miles by D'Anville's map, or 73¼ miles by Faden's map. 1802.

the

the diftances, which he deferibes in Afia Minor, may afford more
fatisfactory information. Mr. Rennel tells us, that " Xenophon's
" ordinary march was 150 ftadia daily, which both he and Hero-
" dotus accounts to be equal to five parafangas." The proper
way, I apprehend, of computing the march of Xenophon's army,
is to take that part of it where they marched over ground with
which they were acquainted; not where they were haraffed and
purfued by the enemy. I would therefore felect the account of
their march from Sardis to Babylon, a fpace where the diftances
were meafured, and more to be depended on than thofe which
occurred when they were traverfing backwards and forwards
deferts, and other difficult and dangerous paths, with which they
were totally unacquainted.

March of Xenophon, with the Greek Auxiliaries.

	Parafan-gas.	Days journey.	Stadia, according to D'Anville.
From Sardis to the Mæander	22	3	475
From the Mæander to Colofea	8	1	200
From Colofea to Celænæ	20	3	475
From Celænæ to Peltæ	10	2	250
From Peltæ to the Market of the Cramians	12	2	
From the Market of the Cramians to Cayftrus	30	3	600
From Cayftrus to Thymbrium	10	2	250
From Thymbrium to Iconium	20	3	675
From Iconium to Tyana	25	4	1275
From Tyana to Tarfus	254		535
From Tarfus to Pharus	10	2	
From Pharus to Pyramus	5	1	350
From Pyramus to Iffus	15	2	300
From Iffus to the Gates of Cilicia	5	1	125
From the Gates of Cilicia to Myriandrus	5	1	150
From Myriandrus to Calus	20	4	600

From

	Parafan-gas.	Days journey.	Stadia, according to D'Anville
From Calus to Daradax	30	5	475
From Daradax to Thapfacus	15	3	930
From Thapfacus to Araxes	50	9	
From Araxes through Arabia	35	5	
From Corfotæ to Pylæ	90	13	
Through Babylonia	12	3	
	474	76	7065

Now 474 divided by 76 gives 6.2368, or almoſt *fix* parafangas and a quarter, for a day's journey, not *five*, as Mr. Rennel ſays. Again, 6.2368 multiplied by 30 gives 187.104 ſtadia for a day's march, which, if we count by Olympic ſtadia, is equal to 21.34 Engliſh miles. This meaſure of a day's march differs much from the computation of Mr. Rennel, who affigns 15 miles only; but it is more agreeable to the accounts we have from antiquity of ſuch military movements. But more of this preſently.

The fourth column in the foregoing table marks the diſtances between the ſtages mentioned in Xenophon, meaſured from the ſcale of Olympic ſtadia annexed to Mr. D'Anville's map of Aſia Minor. It is continued only from Sardis to Thapfacus, as the limits of the map did not afford an opportunity of purſuing it farther. The diſtance between every ſtage mentioned by Xenophon is not ſet down, as the ſeveral ſtages are not all marked in the map; but this makes little or no difference in the whole diſtance; and the coincidence of the numbers ſpecified by Xenophon with thoſe in D'Anville's map, is very remarkable. The diſtance between Sardis and Thapfacus was, according to Xenophon, 287 parafangas; which, reckoning 30 ſtadia to a parafanga, amounts to 8610 ſtadia. According to Mr. D'Anville's map, the ſum of the direct

direct diftances between each ftage amounts to 7665 Olympic
ftadia. If we add to this ⅛, or 958 ftadia, for winding of the road,
the comparative account will ftand thus.

Diflance from Sardis to Thapfacus.

According to Xenophon, 8610 ftadia.	According to D'Anville's map . . . . 7665 ⎫ Add ⅛ . . . . . . 958 ⎬ Olympic ftadia. ─────── 8623 ⎭ Difference from Xenophon 13 ftadia, or a 663d part of the whole diftance.

Surely this coincidence, in a fpace of fuch an extent, is a fuffi-
cient proof that Xenophon ufed the Olympic ftadium.

The above calculation for a day's march implies, no doubt, that
it was accelerated beyond the ufual rate; and that it was actually
fo, we are exprefsly told by Xenophon himfelf. After having faid,
that fome of the marches were very long, he adds, that " upon the
" whole, Cyrus appeared throughout to haften their march, ftop-
" ping no where, unlefs to get provifions, or for fomething elfe
" that was neceffary; for he judged, that the quicker he marched,
" the more unprepared the king would be to encounter him, and
" the flower, the more numerous would be the king's army; for
" it was obvious to any perfon of attention, that the Perfian em-
" pire, though ftrong with regard to the extent of the country,
" and the numbers of men, was however weak by reafon of the
" great diftances of the places, and the divifion of its forces, when
" furprifed by a fudden invafion [p]."

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[p] Spelman's Tranflation of Xenophon's
Anabafis, p. 31　It muft however, I think,
be admitted, that the acceleration of the march
of Cyrus could not have been very great, other-
wife

Arrian tells us, that Alexander marched from the lake Afcania [q] Of Alexander. to Celæne in five days. This is, according to D'Anville's ancient map of Afia Minor, 1250 Olympic ftadia, and 143' Englifh miles by Rochette's map, and the fame by D'Anville's modern map of Afia Minor. This makes 250 ftadia, or 28½ Englifh miles, for each day's march, allowing nothing for the winding of the road. If it be allowed on that account. each day's march will be 280 ftadia, equal to 32 Englifh miles [r].

Herodotus tells us, that 200 ftadia, or 25 Greek miles, equal to 22.893 Englifh miles, was a day's journey for a foot traveller; and that 150 ftadia, or 18¼ Greek miles, was a day's march for an army. [Accounts from Herodotus.]

Strabo affigns 250, or even 300, ftadia for a day's journey for a foot traveller; and Procopius [t] mentions 210 as the ufual computation. [From Strabo. From Procopius.]

Vegetius [u], at a time when the Roman difcipline began to decline, fays, that the ufual daily march of the army was 20 miles, which was performed in five hours [x]; and that if they accelerated [From Vegetius.]

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wife it could fcarcely have been continued for fo many days fucceffively.

[q] Καὶ ἀφικνεῖται ἰς Κελαίνας πεμπταῖος. Arriani Vit Alexandri, lib. i.

[r] 143 Englifh miles are equal to 1249.248 Olympic ftadia.

[s] Alexander, when more at leifure, marched from Gaza to Pelufium in feven days, which is, according to Mr. D'Anville's map, with the allowance of ⅟₇ for winding of the road, 1237.5 Olympic ftadia; or, according to a later map,

1252 ftadia, which is about 178 ftadia each day, or more than 20 Englifh miles.

[t] Bello Vandalico, lib. i. c. 1. Procopius fays, a little after, that it was 40 days journey for a foot traveller from Chalcedon to the Phafis. The diftance is, according to Arrian, 8505 ftadia, or 212.6 ftadia nearly for each day.

[u] He lived about A. D. 387.

[x] Lib. i. cap. 9.

their

their pace, they could march 24 miles in the same time. If this appears to be a greater effort than soldiers in the present age are equal to, we should consider the effects [y] of habit and exercise. The armour of our own forefathers, which was easily carried by them, and under the weight of which they even performed feats of activity, could scarcely be supported by a man of moderate strength in the present age. Vegetius tells us, that in his time the weight of the armour and provisions, which was carried by the Roman soldiers on these long marches, amounted to 60 pounds. Yet we have reason to believe that this was done without any extraordinary difficulty. Their military exercise was a constant habituation to fatigue, whereas that of modern times is more adapted to the practice of quick motions, and rapid evolutions, than to the endurance of hardship and labour. This circumstance gave the soldiers of antiquity a capacity of performing what we can scarcely conceive. Yet we must not deny what is so incontestably proved, from writers [z] of the best authority, and indeed from the general tenor of history.

From Cicero

Cicero gives nearly the same account with Vegetius of the

[y] Livy reckons 25 Roman miles (equal to 200 stadia, as appears from the corresponding passage in Polybius) to be a day's journey or march for a body of men, on a military expedition. Twenty-five Roman miles were equal to 22.893 Eng. miles. Liv. lib. xxi. sect. 28.

[z] Pondus bajulare, usque ad sexaginta libras, et iter facere gradu militari frequentissime cogendi sunt juniores, quibus, in arduis expeditionibus necessitas imminet annonam pariter et arma portandi. Nec hoc credatur esse difficile, si usus accesserit, nihil enim est quod non assidua meditatio facillimum reddat. Quam rem antiquos milites factitavisse Virgilio ipso teste cognoscitur. Veget. lib. i. cap. 19.

Silvam cædere, portare onera, transilire fossas, natare in mari seu fluminibus, gradu pleno ambulare, vel currere, etiam armatos, cum sarcinis suis frequentissime convenit ; ut quotidiani laboris usus in pace, difficilis non videatur in bello. Veget. lib. ii. cap. 23.

Roman

Roman diſcipline[a] in his time, and of its effects, which Marius had before experienced in the Cimbric war. Men who could undergo ſuch fatigues might well perform longer marches than thoſe to which Mr. Rennel objects. But, ſays Mr. R. the ſpace of 14½ miles was the mean diſtance travelled by an Indian army. But that of Cyrus was not a tumultuary multitude of that kind. Xeno-phon himſelf relates a remarkable[b] inſtance how forward the prin-cipal perſons among them were to expedite the march of the army by their perſonal exertions. Cyrus himſelf was the moſt conſummate general of the age in which he lived; he commanded forces raiſed in Greece, or in countries connected with it; he himſelf admired and practiſed the Grecian diſcipline; he promiſed himſelf the empire of Perſia, by the aid of the Greeks; and al-though a tragical accident put an end at once to his life and to his hopes, his allies, in the midſt of an enemy's country, and ſubject to every diſadvantage, returned ſword in hand, in deſpite of all the efforts of their enemies, by a different road, and reached Greece in ſafety. Surely ſuch forces were as capable of a long

[a] Noſtri exercitus unde nomen habent vides: deinde qui labor, quantuſque agminis, ferre plus dimidiati menſis cibaria; ferre, ſi quid ad uſum velint: ferre vallum? Nam ſcutum, gladium, galeam, in onere noſtri milites non plus numerant, quam humeros, lacertos, ma-nus: arma enim membra milites eſſe ducunt. Ciceron. Tuſc. Diſp. lib. ii. ſect. 15.

[b] Once, where the road was narrow, and ſo deep that the carriages could not paſs with-out difficulty, Cyrus ſtopped, with thoſe about him of the greateſt authority and fortune, and ordered Glus and Pigres to take ſome of the barbarians belonging to his army, and help the carriages through: but thinking they went ſlowly about it, he ordered, as in anger, the moſt conſiderable Perſians who were with him to aſſiſt in haſtening on the carriages. This afforded an inſtance of their ready obe-dience; for, throwing off their purple robes, where each of them happened to ſtand, they ran, as if it had been for a prize, down a very ſteep hill, in their coſtly veſts and embroidered drawers, ſome even with chains about their necks, and bracelets round their wriſts; and leaping into the dirt with theſe, they lifted up the carriages, and brought them out ſooner than can be imagined. Spelman's Expedition of Cyrus, p. 30, 31.

march

march as the Roman armies were in the middle of the fourth century.

Mr. Rennel again allows that Strabo reckoned eight ftadia to a mile, and that feemingly on his own judgment; and afterwards fays, that if the opinion of Polybius is to be followed, one-third of a ftadium is to be added, as he has allotted 8⅓ ftadia to a mile. But I have before produced a paffage from the works of Polybius, now extant, in which he allows eight ftadia only to a mile; and it is probable that the paffage cited by Strabo might be only to accommodate the Greek to the Roman meafure, if it be not, as I have before hinted, a miftake of Strabo himfelf.

It is rather incorrect in Mr. Rennel to fay that 8⅓ Olympic ftadia, of 600 feet each, were equal to 5000 feet. If he meafures the Olympic ftadium by Roman feet, and allows only 600 of thefe to a ftadium, contrary to the account given by all the Roman writers, who affign 625 Roman feet to a ftadium, his calculation will hold good; but it is more natural to fuppofe that a Greek meafure fhould be computed by Greek feet. If thefe were meant, eight Olympic ftadia, without any addition, though containing only 4800 Greek feet, would be equal to 5000 Roman feet, as has been obferved before.

Miftake of
Mr. Rennel.
It is unfortunate that a perfon of Mr. Rennel's fagacity and abilities fhould fall into fuch a miftake, as to fuppofe that a figure of eight could be fubftituted in place of a figure of nine, in the MSS. of Strabo, when the ufe of the Arabic numerals was not introduced until a later date than that of any good MSS. of that writer, and when the number is not expreffed by any numeral

figures

figures at all, but by the Greek word ὀκτασάδιον [c], which requires more than the change of a fingle letter to metamorphofe it into ἐννεασάδιον.

The meafures of fome of the ancient buildings may be applied towards afcertaining the length of the ftadium, as well as that of the foot.

Paufanias tells us, that the Peribolus, or wall [d] furrounding the court which inclofed the temple of Jupiter Olympius at Athens, was at moft [e] four ftadia in circumference. The dimenfions, according to Mr. Stuart, are as follows :

	Feet.	Inches.	Dec. of an Inch.
Length	688	6	5
Breadth	463	5	37
	1151	11	87
			2
	2303	11	74

equal to 2286 Greek feet nearly, which are one-nineteenth part and a half fhort of four Olympic ftadia ; but neverthelefs fufficiently coinciding with the expreffion of Paufanias, fuppofing he meant Olympic ftadia ; but not if he meant ftadia of the dimenfions affigned by Mr. Rennel.

[c] Ptolemy affigns only 500 ftadia to a degree, or eight ftadia and one-third to a minute, or 60 Roman miles, at 625 feet to the ftadium. Geogr. cap. vii. A Greek or Roman mile is about 75 to a degree on the equator; of courfe 600 ftadia would be the proper number.

[d] Paufanias, lib. i.

[e] The words of Paufanias are, ςαδίων μάλιςα τισσάρων ἐςιν· which means, at moft or near four ftadia. Conft. Lexic. et Steph. Thefaur. Vox μάλιςα.

The

The length of the area of the Panathenæan ftadium is yet dif-tinguifhable. It was accurately meafured by Mr. Vernon, who accompanied Sir George Wheeler to that place, A. D. 1676, and was determined by him to be 630 Englifh feet; and with this account both Dr. Chandler and Mr. Stuart agree. If we confider that the racers in the ftadium, in the courfe called Δίαυλος, returned in the fame direction in which they fet out, we may allow 25 feet for the turn at the end round the meta; and if fo, the length of the courfe will be 600 Greek feet, or 605 Englifh feet; which, from this meafurement, I think more than probable.

Opinion of Mr Barré confidered

In the nineteenth volume of the French Memoirs of Literature, including from the year 1714 to 1746, there are fome differtations on the length of the ftadium, by Mr. De la Barré[f]. That gentle-man had conceived a notion, that the ftadium of Herodotus was only ⅗ of the length of the one employed by Pliny; and this pofition, which abridges the length of the ftadium more than any which I have feen, is fupported by him with much learning and ingenuity, though not altogether with candour and impartial reprefentation.

He founds his argument on the length of the Pythic ftadium, which, Cenforinus tells us, confifted of 1000 feet; whilft the Italic contained only 625, and the Olympic but 600 feet.

Mr. Barré thinks, that the Romans adopted the Pythic ftadium from the intercourfe which they had with Greece, when they fent, as they often did in early times, to confult the Pythian or Delphic

[f] Sur les Mefures Géographiques des Anciens.

oracle. But this is all a conjecture of his own. The Pythic stadium never could have been in general use among the Romans, as it is never, as far as I can find, noticed, or even named, by any other writer than Censorinus, even by those who treat professedly of the mensuration of distances. It seems probable that it was a local measure only, perhaps of the Gymnasium[g] belonging to the place, and not in use elsewhere. But let us examine his arguments.

He begins with saying, that Pliny, translating a passage from Theophrastus, renders the words τρεῖς καὶ δέκα ὀργυιῶν, by *centum triginta pedum*; and as the words so applied signify that each ὀργυιὰ, or fathom, contains ten feet, which is four feet above the length assigned by Herodotus, it follows, that the fathom in the time of Pliny was as five to three to that used in the time of Herodotus; and from thence infers, that the stadium of Pliny exceeded that of Herodotus in the same proportion. But, supposing the reading to be genuine, all that I can infer from it is, that thirteen fathoms in the time of Theophrastus were equal to 130 feet in the time of Pliny; and of course, that the fathom was increased in the proportion of five to three from the time of Herodotus to that of Theophrastus, a thing difficult to conceive, as the interval was no more than 137 years. But this no ways concerns Pliny's calculation of the length of the stadium, which he never reckons by fathoms, but by paces and feet; and says positively, that a stadium

(margin: Argument from the words of Theophrastus, as translated by Pliny.)

[g] The Pythian games were celebrated at or near Cirrha, in the neighbourhood of Delphi, where, as it appears from Pausanias and Pindar, there was a horse-course (Ἱππόδρομος) and a stadium.

Πυθοῖ τι γυμνοῖ ἐπὶ
Στάδιον καταβάντις ἤλεγξαι
Ἑλλανίδα ςρατιὰν ὠκύτα-
τι. Pindar. Pyth. Od. xi. verf. 73.
See also Paufan. Phocic. p. 893. Edit. Kühn.

contain

contains 125 of the former, and 625 of the latter. To suppose on such a random conjecture that Pliny ascribed 1000 feet to a stadium, when his own words so directly contradict it, would be the height of absurdity.

But let us now examine, from the testimony of various writers of authority, Greek as well as Roman, if the measure of ten Roman feet would not be utterly inconsistent with the description of the ὀργυιὰ, or fathom, itself.

Xenophon [h], who flourished only 54 years after Herodotus, describes the ὀργυιὰ to be the measure of the distance which reaches from the extremity of one arm to that of the other, when both are extended at right angles to the body. Phavorinus[i], Suidas[k], Hesychius[l], and Julius Pollux[m], explain it in the same way.

The same measure, though without a name assigned to it, is described by Vitruvius, who makes it equal[n] to the length of the body. It is also evident that Vitruvius meant hereby a measure of six feet, as he reckons the measure[o] of the foot as one-sixth part of the height.

Of the authors above cited, Vitruvius lived about 126 years be-

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[h] Κτῆρες μὶν γὰρ, ἱι δίοι αὐτὰς τὰ πλέω ὀργυιᾶς δίχοντα ἅμα ποιῆσαι, ἐκ ἀν δύναιτο. Memorab. lib. ii. cap. 3. sect. 19.

[i] Ὀργυιὰ τὸ ἐξηπλωμένον μέτρον τῶν χειρῶν, ἢ τὴν ἴκτασιν τῶν χειρῶν. Phavorin.

[k] Ὀργυιαὶ τὰ μὶν ἰδίων χειρῶν μέτρα. Suidas.

[l] Ὀργυιαὶ ἡ τῶν ἀμφοτέρων χειρῶν ἴκτασις. Hesychii Lexic.

[m] Εἰ δ' ἄμφω τὰς χεῖρας ἐκτείνοιας, ὡς καὶ τὸ στέρνον αὐταῖς συμμιτρεῖν, ὀργυιὰ τὸ μέτρον. Jul. Polluc. lib. ii. sect. 158.

[n] Nam si a pedibus imis ad summum caput altum erit, eaque mensura relata fuerit ad manus pansas, invenitur eadem latitudo uti altitudo. Vitruv. lib. iii. cap. 1.

[o] Pes vero altitudinis corporis sexta. Ibid.

fore

fore Pliny ; Julius Pollux lived about eighty years later, and Hefychius about 300 years after Pliny. Is it reafonable then to fuppofe that Pliny fhould affign ten Roman feet to a meafure, univerfally allowed in his own time to be equal to the height of a man, as a ftandard ? Six Roman feet are, in Englifh meafure, equal to 69.624 inches, or rather more than five feet nine inches and a half, which is nearly the medium fize of well-proportioned men. But if Pliny eftimated the height of a man at ten Roman feet, equal to nine feet eight inches Englifh meafure, we muft fuppofe he borrowed his ftandard from the heroic ages, and was himfelf infected with the " Græciæ fabulofitas [p]," of which he more than once complains. But I fufpect the paffage cited from Pliny to be corrupt. It is certainly incorrect, as it defcribes the cedar, whofe extraordinary fize he records, as growing in Cyprus, when Theophraftus exprefsly fays [q], that it grew in Syria.

Mr. Barré next remarks, that the circumference of the earth, as reckoned by Pofidonius, who lived in the time of Pompey, was 240,000 ftadia ; which number, he obferves, is to 400,000 (the number affigned by Ariftotle) as 6 is to 10; and concludes from thence, that there was a difference of $\frac{2}{5}$ in the length of the ftadia, by which they refpectively calculated. But Pofidonius no where fays that his computation was derived from Ariftotle ; on the contrary, we know from Cleomedes [r], that it was deduced from an

[p] Lib. iv. Argum. Lib. xii. cap. i. lib. v. cap. i.

[q] Theophraft. lib. v. cap. 9.

[r] Lib. i. cap. 26.

observation

obfervation of the ftar Canopus ¹, made by himfelf. He remarked,

¹ Height of the North Pole at Rhodes 36 27
Diftance from the Pole to the Equator 90
Declination of Canopus South   52 31

       Subftract this fum   178 58
       From   180

       Remainder . . .   1 2
  • Add for refraction   24
Apparent altitude of Canopus at Rhodes 1 26

Height of North Pole at Alexandria 31 11
Diftance from the Pole to the Equator 90
Declination of Canopus South   52 31

       Subftract this fum   173 42
       From   180

       Remainder . .   6 18
       Add for refraction .   8
Apparent altitude of Canopus at
  Alexandria 6 26
Subftract for its apparent height
  at Rhodes 1 26

       Remainder . . .   5
which is the difference between its apparent
height at the two places. Five degrees of la-
titude, at 69.25 Englifh miles each, = 346
Englifh miles, = 3023 Olympic ftadia; which
fhould be, according to this calculation, the
diftance between Alexandria and Rhodes, fup-
pofing them to lie under the fame meridian.
But Alexandria is 1° 51′ to the eaft of Rhodes,
a fpace in the latitude of Alexandria equal to
110 Englifh miles.

    Square of 346   119716
    Square of 110   12100

      Sum   131816

  Square root 363.65 E. miles.

for the diftance from Alexandria to Rhodes, =
3177 Olympic ftadia. But this diftance is
too fmall, owing to the proportionally greater
refraction at the altitude of 1° 2′, than at 6°
18′, which amounts to 16′ in altitude, and to
about 17′ in diftance.

True altitude of Canopus at Rhodes 1 2
             at Alexandria 6 18

       Difference   5 16
  Equal to 364.71 Englifh miles.
  Square of 364.71   133013 37
  Square of 110   12100

      Sum   145113.37

  Square root   380.97 E. miles.
Equal to 3328 Olympic ftadia, for the diftance
from Alexandria to Rhodes.

Let us now fee how the calculation of Po-
fidonius, refpecting the circumference of the
earth, would ftand, had his obfervations of the
refpective altitudes of Canopus at Alexandria
and Rhodes been correct, though without al-
lowing for refraction. The apparent diffe-
rence of altitude at the two places was, as I
before obferved, 5°. Say then 5° : 360 : :
5000 ftadia to 360,000 = 41207.4 Englifh
miles, juft double to his later calculations,
being 1000 ftadia to a degree. By his other
computations, derived from the gnomonic
meafurements of Eratofthenes, and which efti-
mate the diftance only at 3750 ftadia, it would
ftand thus—5 : 360 : : 3750 : 270,000, or
750 ftadia to a degree.

Pofidonius, it is evident, made two mif-
takes, befides that of fuppofing Rhodes and
Alexandria to lie under the fame meridian;
the firft in fuppofing Canopus to have no alti-
tude at Rhodes, whereas it has a real one of
                1° 2′,

that this ftar was but juft vifible in the horizon of Rhodes, and that at Alexandria its meridian height was a forty-eighth part of a great circle in the heavens, or 7° 30'; and inferred from thence, what part of a great circle on the earth this difference would amount to. The diftance between Rhodes and Alexandria he took for granted to be 5000 ftadia; and of courfe the circumference of the earth would be 240,000 ftadia. Cleomedes was however doubtful of this meafurement; as he obferves, that a lefs fum is to be taken, if the diftance between Rhodes and Alexandria fhould be found to be lefs than 5000 ftadia; which diftance, Mr. Coftard[t] very properly obferves, from Strabo, was not obtained by any attempt at menfuration, but only from the eftimation of navigators[u]. But when Pofidonius heard that Eratofthenes had, by gnomonic obfervations, afcertained the diftance between Alexan-

1° 2', and an apparent one of 1° 26 , and the fecond in over-rating the altitude of the ftar at Alexandria, which he took to be 7° 30'; whereas it is no more, including the effects of refraction, than 6° 26 . Thefe errors caufed him to under-rate the extent contained in 7° 30', although he over-rated the real diftance.

The following comes nearer the truth:

Diftance between Rhodes and
    Alexandria 380 97
Subftract for difference of lon-
    gitude 16,26
               Remains 364.71 E. miles.

Say then, 316 : 364.71 : : 21600 : 24935 27 Englifh miles, only five Englifh miles different from modern calculation, and equal nearly to 217840 Olympic ftadia, for the circumference of the earth, or 605.11 Olympic ftadia to a degree on the equator, very near to what it is

computed to be in Table IV.

Caffini obferved, that the medium number between the calculations of Eratofthenes and Pofidonius, refpecting the circumference of the earth, which the former fuppofed to be 252,000, and the latter to be 180,000 ftadia, is 216,000; which number, divided by 360, gives 600 ftadia to a degree, and 10 ftadia to a minute.

The refpective latitudes and longitudes of Alexandria and of Rhodes are as below ftated

	Latitude.	Longit.
	° '	° '
Alexandria, Robertf. Navig.	31 11	30 17
———— from Denon's Trav.	31 12	29 55
———— from Walfh	31 13	29 45
Rhodes, Robertfon's Navig.	36 27	28 26

[t] Coftard's Aftronomy, p. 207.
[u] Strabo, lib. ii. p. 125, 126. Ed. Cafaub. Paris.

dria

dria and Rhodes to be no more than 3750 ftadia, and taking this interval to be (what it is not) a forty-eighth part of the earth's circumference, he reduced his computation to 180,000 ftadia[x]; and this meafure, in which the number of degrees affigned by Pofidonius, and the number of ftadia meafured by Eratofthenes, are made ufe of, was received by Marinus[y] of Tyre, and others, and is generally afcribed to Ptolemy, becaufe he makes ufe of it in his geography.

Befides, Eratofthenes, who lived during the interval between Ariftotle and Pofidonius, and 123 years later than Ariftotle, had concluded the circumference of the earth to be 250,000 ftadia; or, as moft account it, 252,000 ftadia, from an obfervation of the diftance between Syene and Alexandria[z], and the refpective meridian altitude[a] of the fun at each place.

[x] Strabo, lib. ii. p. 95.

[y] Long's Aftronomy, vol. i. p. 128.

[z] Eratofthenis Geograph. Fragmenta, p. 53.

[a] Arat. Phænom. Edit. Oxon. 1672. p. 37.
κατατιρίσμων.

De ftadiis Eratofthenis nihil pro certo affirmare audeo, quale ftadium in animo habuerit. Hoc tamen expectandum effet, aliud Eratofthenis fi habuerit ftadium, a Strabone effet indicatum. Nunc autem Strabo octo ftadia mille paffibus Romanis adnumerat, cui convenit Plinius, centum viginti quinque paffus Romanos ftadio tribuens femperque, ubi Eratofthenis ftadia paffuum numero exhibet, hac dimenfione utens. Secundum hæc itaque terræ maximus circulus effet 31500 milliaria Romana, feu 6300 milliaria noftra (Germanica) geographica. Nam unum milliare geographicum eft æquale quinque milliariis Romanis. Error itaque effet 900 mill.

geograph. Nam fecundum noftrorum dimenfiones geographicas ambitus circuli maximi eft 5400 mill. geograph. Ex hoc ipfo apparere videtur, eo ftadio, quod Olympicum vocant, ufum fuiffe Eratofthenem. Etenim fecundum ejus dimetiendi rationem, magnitudinem circuli maximi nimiam æftimare fane debebat. Secundum accuratiorem dimenfionem autem non nifi 600 ftadia Olympica uni gradui conveniunt. Stadium Ægyptiacum, quorum quindecim funt æqualia uni milliario Romano, nullo modo dimenfioni Eratofthenis poteft accommodari adverfus ftadium Græcum minus teftatur locus Strabonis. Eratofthenis Fragm. Edit. a G. C. F. Seidel, Goettingæ, 1789. p. 58.

Univerfum autem hunc circuitum Eratofthenes in omnium quidem literarum fubtilitate et in hac utique præter cæteros folers, quam cunctis probare video ducentorum quin-
quaginta,

Archimedes[b], who was contemporary with Eratofthenes, mentions that 300,000 ftadia was the number affigned by fome for the circumference of the earth in his time

The proportion therefore, which Mr. Barré remarks between the numbers of Aristotle and thofe of Pofidonius, was in all probability cafual, and ferves only to confirm the remark of Dr. Blair, above cited, " that nothing is more common than to find a " confufion of numbers in the meafurements given us by ancient " authors."

In order to prove the ancient Greek ftadium to be only ⅓ of the length of the one ufed in later times, by which Mr. Barré means thofe fubfequent to the age of Alexander, he obferves, that it had been before remarked, that a Roman mile did not always contain eight ftadia, but fometimes only feven and a half. This might prove that there was a difference in the length of the mile, but proves nothing refpecting that of the ftadium. Strabo fays, that in his time the ufual computation was eight ftadia, but that fome reckoned only feven and a half. This difference feems however to have been provincial only.

Polybius, as I have before remarked, reckons in general eight ftadia to a mile; which, he fays, was according to the Roman meafurement. Livy appears to have ufed the fame computation with Polybius. Thus, what Polybius calls διακόσια ςάδια, lib. iii. fect. 47. 7. Livy calls viginti quinque millia, lib. xxi. fect. 28.

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quaginta, duorum millium ftadiorum prodidit. Quæ menfura, Romana computatione, efficit trecenties quindecies centena millia paf-

fuum. Plin. lib ii. cap. 1.8. $31\,500 \times 8$ $= 252.000.$

[b] In Arenario.

What

What Polybius calls ἀπὸ τῆς πόλεως ἑκκαίδεκα ϛαδίους, lib. iii. ſect. 101. Livy renders by *duo ferme a Geronio millia*, lib. xxii. ſect. 21. What Polybius calls ἑκατὸν εἴκοσι ϛαδίες, lib. viii. ſect. 28. Livy calls *quindecim millia*, lib. xxv. ſect. 9. The words of Polybius, lib. xiv. ſect. 4. περὶ γὰρ ἑξήκοντα ϛαδίες, are rendered by Livy, *ſeptem enim millia itineris erant*, lib. xxx. ſect. 4. where, as Sigonius obſerves, the whole paſſage is cited by Livy from Polybius. Again, περὶ τριάκοντα ϛαδίες, Polyb. lib. xiv. ſect. 8. is rendered by Livy, *quatuor ferme millia*, lib. xxx. ſect. 8.

Mr. Barré next attempts to prove that the Roman foot was equal to the πῆχυς, or cubit, of the Greeks. Let us ſee how he ſupports this extraordinary poſition.

His firſt argument is drawn from the deſcription of the plant called dracunculus ; or, by Dioſcorides, δρακόντιον[c], which the laſt-mentioned writer ſays is two cubits high, and which Pliny deſcribes as " bipedali fere altitudine." Taking it then for granted that Pliny copied Dioſcorides, he would infer, from the laſt-mentioned paſſage, that the foot of Pliny was equal to the cubit of Dioſcorides. But Pliny[d] himſelf is doubtful if the plant he calls dracunculus be in reality the δρακόντιον of the Greeks. The height of the plant (as Mr. Barré would reconcile the accounts) is the only circumſtance in which they agree. Dioſcorides mentions only two kinds, Pliny ſpecifies three ; and the deſcription of their qualities in the reſpective authors by no means coincides.

Bodæus a Stapel, the learned editor of Theophraſtus, thinks the

[c] Lib. ii. cap. 160.   [d] Lib. xxxiv. cap. 16.

account

account given by Pliny to be very erroneous ; and adds, that the plant fuppofed to be the δρακόντιον is three feet high [e]; which agrees with the defcription given by Diofcorides, fuppofing the cubit to be a foot and a half, but not with Pliny's account.

Again, Mr. Barré fays, that the Greeks employed two different meafures, or palms, in eftimating the foot and the cubit; the fmaller called παλαιςὴ, and the larger σπιθαμή. The former of thefe he defines to be the breadth [f] of the four fingers, laid clofe to one another; and the latter to be the breadth of the four fingers, with the addition of that of the thumb, in what he calls its natural ftate; which he explains to be when it appears a little feparated from the fingers, as it always is when the hand is opened.

His definition of the former of thefe meafures is juft [g], but not fo of the latter. The σπιθαμή is the fpan [h], not meafured from the fingers lying clofe together, but from the thumb to the little finger, when both are extended. Indeed this is what the word itfelf denotes, being derived from σπίζω, which both Euftathius [i] and the Scholiaft on Ariftophanes interpret to be of the fame meaning with ἐκτείνω.

[e] Caulem erigit tripedalem. Theophraft. p. 836.

[f] La palefte eft compofée de quatre doigts de la main joints les uns contre les autres, auquels en ajoutant le pouce dans fon état naturel, c'eft-à-dire un peu écarté d'eux, comme il eft toujours quand la main eft ouverte, on a la fpithame. Vol. xix. p. 522.

[g] Τῶν δὲ μέτρων ἐςὶ μέντοι κỳ δάκτυλος, δοχμὴ δὲ συγκλεισθέντες οἱ τέσσαρες δάκτυλοι. Jul. Poll.

lib. ii. fect. 157.

Παρὰ τὸ πίλας συνάγειν τὰ ὁςὰ, id eft, πλησίον ποιῆ τὸς δακτύλες. Etymolog.

[h] Εἰ δὲ τὰς δακτύλες ἀποτείνας, ἀπὸ τε μεγάλε πρὸς τ̃ μικρότατον μετρεῖς, σπιθαμὴ τὸ μέτρον. Jul. Polluc. lib. ii. fect. 157.

Τὸ μέτρον τὸ ἀπὸ τοῦ μεγάλε δακτύλε ἐπὶ τὸν μικρὸν διάςημα. Hefych. vox σπιθαμή.

[i] Steph. Thefaur. Græc. Vox σπίζω.

Mr.

Mr. Barré again aſſumes firſt, that there was the ſame difference between the σπιθαμὴ and the παλαιςὴ, as there was between the cubit and the foot; namely, that they were each to the other as three to two; and again, that the σπιθαμὴ was equal to four Roman digits only, or a quarter of a foot. Now as he ſuppoſes the σπιθαμὴ to have been equal to the palmus, which was four Roman digits alſo, it follows that four ſpithames, which, according to his computation, are equal to ſix paleſtes, would be equal to the Greek cubit: and as each ſpithame was equal to the palmus, it followed that the Greek cubit would be equal to the Roman foot. But the length he aſſigns to the ſpithame can by no means be admitted. The δῶρον and the παλαιςη were only different names[k] for the ſame thing. The word didoron, we are told by Vitruvius[l], implied half a foot; and we learn from Hero[m], that the δῶρον was the third part of the σπιθαμή.

This is agreeable to what might be expected from the derivation of the terms. The breadth of the four fingers of a man's hand of moderate ſize is about three inches, or four Roman digits; and the extent of the fingers when ſtretched out, as above deſcribed, is nearly nine inches, or twelve Roman digits, agreeable to the proportion above laid down.

It appears alſo, that, where accuracy of length is to be ſpecified, the Romans tranſlated the Greek word πῆχυς by the Latin word cubitus. Thus Herodotus[n], deſcribing the cell wherein the body of Oreſtes was depoſited, ſays, that both that and the body were

[k] Julii Polluc. lib. ii. ſect. 157.   [m] Hero de Menſuris.
[l] Lib. ii. cap. 3.   [n] Lib. i.

ſeven

ieven cubits in length; and Pliny °, copying profeſſedly from him, tranſlates the word επλαπήχει by *ſeptem cubitorum*: and Aulus Gellius [p] does the ſame, and adds, that theſe ſeven cubits were equal to 12¼ Roman feet, which would make the Greek cubit longer than it has hitherto been ſuppoſed in any computation.

Again, the authors of the Septuagint, in deſcribing the height of Goliah, who is repreſented to have been a man of gigantic ſtature [q], tranſlate the correſponding Hebrew words into, ύψος αύτᾶ τεσσάρων πήχεων καὶ σπιθαμῆς. This, if underſtood to be of the Greek cubit, according to common interpretation, will amount to ſix feet nine inches and ſix tenths of an inch; and, if we reckon according to Aulus Gellius's computation, will be ſeven feet ſeven inches and a quarter; both of them extraordinary heights, though neither of them exceeding credibility; as I have ſeen a man much taller than either.

But if we diminiſh this, according to Mr. Barré's calculation, to four Roman feet three inches, (equal to four Engliſh feet one inch and a quarter,) we ſhall ſink this boaſting giant into a dwarf, and probably make him much inferior in ſtature to his antagoniſt, David, whom he ſo much deſpiſed.

We ſhould conſider that the authors of the Septuagint were perſons of great learning, and knowledge both in the Greek and in the Hebrew tongues; and were alſo prior in date to Dioſcorides by 336 years, and who muſt have known the real length of the

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° Lib. viii. cap. 16.
[p] Lib. iii. c. 10.

[q] All of gigantic fize, Goliah chief.
MILTON.

Greek

Greek meafures in their own time, too well to reprefent a man as a giant, who was only four feet and a quarter in height.

It muft indeed be owned that the later Greek writers (incorrectly, I think) are apt to confound the fpithame[r] and the palette. Thus Aetius, fpeaking of the viper, defcribes it as being in general of a cubit's length ; and the longeft παλαιςῶν τριῶν. This laft meafure would amount but to 12 digits, or only three-quarters of a cubit, fuppofing the cubit to be of a foot length only. But if we underftand that he meant three fpithames, or thrice three-fourths of a Greek foot, fuch a meafure exceeds a cubit in a proper proportion, or as three to two, or as 27 to 18. And this appears to be the real fize of thefe animals.

Mr. Pennant fays[s], that " they are feldom of a greater length " than two feet ; though once he faw a female viper almoft " three feet long." This proves Aetius meant a foot and a half, and not a foot only, by the cubit. Many more inftances of the confounding the two meafures may be found in Conftantine's Lexicon[t].

Mr. Barré next produces an argument from the fize of the

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[r] Illud vero etiam dignum quod admiretur, Græcos alterum pro altero ufurpare. Conft. Lexic. Vox παλαιςή.

Sometimes the true or larger fpithame was diftinguifhed by the name of σπιθαμὴ βασιλική. Thus Here fays, " the ὀργυιά, or fathom, con- " tained eight royal fpithames, (of 12 digits " each,) or fix feet and one common fpitha- " me." By the latter he undoubtedly meant

a meafure of four digits, or the palefte; which fhews that the orguia, which the Greek writers reckon as fix feet, was by the Romans counted as fix and ¼ of their feet, which makes the proportion of the Roman foot to the Greek to be as 24 to 25.

[s] Britifh Zoology.

[t] Vox παλαιςή.

pygmies,

pygmies, which Pliny, Aulus Gellius, and Strabo say, were three spithames in height; or, as Pliny expresses it, " ternos dodrantes " non excedentes;" and Aulus Gellius, " non longiores esse quam " pedes duos et quadrantem."

Euftathius, as Mr. Barré alledges, says of these people, that they were οὐδὲ πηχυαῖος τὸ μέγεθος, not of a cubit's size; and then reckoning the cubit as a foot only, he still farther reduces the size of these little folks. But I think Euftathius meant no more than to represent in strong terms the diminutive size of the pygmies, and not to assign to them any determinate proportion. Euftathius had before observed, that the δῶρον, or four fingers breadth, was one-third of the spithame; and of course, that two spithames made a πῆχυς, or foot and a half.

Again, Mr. Barré, taking it for granted that the Greek cubit was equal to the Roman foot, adds, that of course 600 Greek feet were equal to 400 Roman feet; and that there muft be 12½ Olympic ftadia to make up the mile: and as the Pythic ftadium was greater by ⅓, it muft follow, that seven and a half of the latter would be required to make up the mile; and that 7500 Greek feet, equal to 5000 Greek cubits, or 5000 Roman feet, would be equal to a Pythic ftadium.

But Herodotus [u] and Diodorus [x], neither of whom reckoned by the Pythic ftadium, assign 3600 ftadia for the circumference of the

[u] Τῆς τὸ περίμετρον τῆς περιόδυ εἰσὶ ςάδιοι ἑξακόσιοι κ̦ τρισχίλιοι. Lib. ii. p. 177. Ed. Wessel.

[x] Τὴν μὲν γὰρ περίμετρον αὐτῆς φασιν ὑπάρχειν ςαδίων τρισχιλίων καὶ ἑξακοσίων. Diodor. lib. i. p. 61. Ed. Wessel.

A a

lake

lake Mœris; and Mucianus[y], a perſon of great authority, and frequently cited by Pliny, ſays, that it is 450 mille paſſus. Now 450 × 8 = 3600.

I wiſh to repeat here in ſome degree what I before mentioned curſorily reſpecting the Olympic foot and the Olympic ſtadium. We are told by Aulus Gellius, that theſe meaſures exceeded the others in the ſame proportion as the foot of Hercules did that of ordinary men. The foot, we ſhould recollect, was ſuppoſed to be one ſixth of the height of the perſon. But what muſt we think of the ſtature of Hercules, ſhould the length of his foot be reduced to eight Roman inches[z]? What muſt we think of the common race of mortals at that time, when he who is deſcribed, " corpore excelſiorem quam alios[a]," was only of the diminutive ſize above deſcribed?

I agree with Mr. Barré, that it is probable that Pliny copied Herodotus in his account of the thickneſs and height of the walls of Babylon: but his account is very incorrect, and inconſiſtent with the original, as Mr. Barré, and before him Salmaſius, had obſerved. If the royal cubit was three digits longer than the

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[y] Plin. lib v. cap. 9.

[z] 8 × 6 = 48 inches, = 4 feet.
Ricciolus obſerves, that if the foot of Hercules, according to the common computation, was ⅙ of his height, he muſt have been ſix Roman feet three inches high, or rather more than ſix feet one inch and a half, Engliſh meaſure. Apollodorus makes Hercules to be four cubits high, which, according to Mr. Barré, is four feet only.

Τετραπηχυαῖον μὲν γὰρ εἶχε τὸ σῶμα.
Apollod. lib. ii. cap. 4. ſect 9.
If we even add eight inches, (or one foot more, as calculated by Mr. Barré,) to make up his height ſeven feet, which is ſaid by an ancient writer, cited by Tzetzes, to be his height, it will not bring him to the pitch of what is now accounted an inferior ſtature. See Notes on Apollodorus, ed. Heyne, vol. ii. p. 330.

[a] Aulus Gellius.

common

common cubit, the royal foot could be only two digits longer than the common foot.

It fhould however be remarked, that Pliny, when defcribing the extent of the circuit of the walls of Babylon, lays it down as being fixty miles, which correfponds with the 480 ftadia of Hero-dotus, reckoning thefe at eight to a mile, which is very different from Mr. Barré's calculation.

In like manner the city of Nineveh is defcribed in the book of Jonah as being very great, and about three days journey in circuit, (ὡσεὶ πορείας τριῶν ἡμερῶν.) It is agreed that 20 M. P. are the allotted meafure[b] for a day's journey, fo that the whole amounts to 60 M. P. equal to the 480 ftadia affigned by Diodorus for the circum-ference of that city.

The promontory of Sunium is, according to Strabo, 330 ftadia from Piræus; and, according to Pliny, 42 Roman miles. Now $330 \div 8 = 41.25$, very near Pliny's calculation, at eight ftadia to a mile.

Arrian, in the Periplus of the Euxine fea, fays, that the diftance from the Temple of Jupiter Urius to the river Rhebas is 90 ftadia. This meafures on the large map of the Propontis about nine Englifh miles; to which if we add $\frac{1}{7}$, for the winding of the road, we fhall have about 89.87 Olympic ftadia, almoft exact to Arrian's

[b] Hæc menfura legitima putabatur ad iter unius diei, ut ex jurefconfulto clarum eft. Sic tam apud Græcos, quam apud veteres Latinos diurnum iter viginti millibus paffuum definie-batur. Salmaf. Plin. Exercitat. p. 351, 352, where this fubjeςt is largely difcuffed.

calcu-

calculation. The diſtance from the Rhebas to Acra Melænæ is counted by Arrian 150 ſtadia; but it meaſures by the large map 18½ Engliſh miles nearly. If to theſe we add ⅛ for winding, we ſhall have upwards of 20½ miles, equal to about 179 ſtadia, or nearly a fifth part more than Arrian's computation. But, on the other hand, from Heraclea to Amaſtris is, according to Arrian, 690 ſtadia; but by Arrowſmith's chart it meaſures, in a ſtraight line, 542 ſtadia; to which if we add ⅛, it comes nearly to 609 ſtadia, or 81 ſhort of Arrian's computation.

Again, from Amaſtris to Carambis is, according to Arrian, no more than 480 ſtadia; but by Arrowſmith's chart[c] it meaſures, in a direct line, 550, and with the addition of ⅛, 619 ſtadia. It is obvious that no juſt concluſion reſpecting the length of the ſtadium can be drawn from the two laſt inſtances.

From Sinope to Amiſus is, according to Arrian, 1020 ſtadia; but by Arrowſmith's chart it is, in a right line, 786 ſtadia only; and 884, with the addition of ⅛. The difference in the diſtance between Amiſus and Ceraſuntum is ſtill greater. Arrian makes it 1570 ſtadia; Arrowſmith's chart no more than 926, in a direct line; and, with the addition of ⅛, only 1041.

Faden's map however makes it to be 1226 ſtadia, or 1379, with the addition of ⅛. D'Anville makes it 1110 ſtadia in a direct line, or 1248.7 with the addition of ⅛. Modern geographers in this inſtance vary nearly as much from one another, as modern do from ancient.

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[c] The meaſurements on the chart were made with a due allowance for the difference of the   degrees of longitude in different latitudes.

The

The laft inftance I fhall produce from Arrian fhews a nearer coincidence. From Cerafus to Trapezus is, according to Arrian, 745 ftadia. It meafures on D'Anville's map 660; and, with the addition of $\frac{1}{8}$, = 85 ftadia, makes up 745, agreeing exactly with Arrian. Arrowfmith's chart agrees nearly herewith. It meafures by that 649 ftadia; and, with the addition of $\frac{1}{8}$, equal to 81 ftadia, makes up 730 ftadia; not differing fo much as two Greek miles from the calculation of Arrian.

There is in the 28th volume of the Mémoires de Littérature, page 362, a paper written by Mr. De la Nauze, on this fubject. He is of opinion that Herodotus, Xenophon, Ariftotle, and other writers of antiquity, employed a ftadium of ten to a mile. He begins his proof of this with faying, that Herodotus afcribes fifty fathoms, or ὀργυιαὶ, to the depth of the lake Mœris in Egypt, which is rendered by Pliny fifty paces; and as the former of thefe mea-fures was to the latter in the proportion of 6 to 5, he inferred that the ftadia of Herodotus were ten to a mile. But firft, the propor-tion of 6 to 5 is not correctly the fame with that of ten to eight. $6 : 5 :: 10 : 8.333$. Again, there is reafon to think that the paf-fus, when applied to explain the ὀργυιὰ, means fix feet, and refers to the expanfion of the arms, not of the legs. Pitifcus's Lexicon derives it " a paffis vel expanfis brachiis, et dicitur Græcis ὀργυιὰ, " quæ eft menfura fex pedum, quæ inter ambas manus, menfurato " fimul pectore, continetur expanfas."

Another inftance adduced by Mr. La Nauze is taken from the fuppofed diftance between Ephefus and Sardis. But this has been fo differently computed by geographers, modern as well as an-cient, that it is difficult to draw any conclufion.

Diftance from Ephefus to Sardis.

According to Herodotus 540 Olympic ftadia.

According to Mr. La Nauze, from De Lifle's map of Ancient Greece, $37° = 42.704$ Englifh miles, $= 373.075$ Olympic ftadia.

According to Mr. D'Anville, 480 Olympic ftadia.

According to Mr. Rochette, 66 Englifh miles, $= 576$ ftadia.

According to Mr. Arrowfmith, 59' 30", $= 68.623$ Englifh miles, $= 602.5$ Olympic ftadia.

It muft be obferved, that thefe calculations of the modern geographers refer to the direct diftance. If $\frac{1}{8}$ be added, it will ftand thus :

DE LISLE.

$37 + \frac{1}{8}\ (=4.625) = 41.625 = 48.48$ Englifh miles, $= 423$ Olympic ftadia ;

which laft number is to that affigned by Herodotus, (540) as 8 to 10.2126 ; and of courfe fhould give the laft-mentioned number for that of the ftadia contained in a mile.

D'ANVILLE, *Map of Afia Minor.*

$$480 + \frac{1}{8}\ (= 60) = 540 ;$$

the fame with Herodotus, and eight to a mile.

ROCHETTE, *Map of Greece.*

66 Eng. miles, $+ \frac{1}{8}\ (=8.25) = 74.25 = 648.7$ Olympic ftadia, or 6.6595 to a mile.

ARROWSMITH, *Map of Turkey in Europe.*

$68.623 + \frac{1}{8}\ (=8.57) = 77.201 = 675$ Olympic ftadia, or 6.4 to a mile ;

which makes the ftadium of Herodotus longer than the ufual computation of the Olympic in the proportion of 5 to 4. For 5 : 675 : : 4 : 540.

This

This inftance then, if it proves any thing. proves the direct contrary to the opinion of Mr. La Nauze.

The fame gentleman again alledges, that Herodotus has eftimated a fhip's failing for a day and a night at 1300 ftadia; whereas Ptolemy allows 1000 ftadia only; which difference he fuppofes to be owing to their employing ftadia of different lengths. But the voyage of Scylax, whofe date, though not afcertained, is confeffedly much prior to the age of Ptolemy, allows no more than 1000 ftadia; and Herodotus fpeaks of 700 ftadia as a long day's fail; μακρημερίη: and the words, which affign 600 ftadia as a night's fail, are in many copies wanting altogether.

The ancient writers made a great difference between a long day's fail and one of a common day. Xenophon fays, that a trireme galley could row, in a very long day, (Ἡμέρας μάλα μακρὰς πλοῦς,) from Byzantium to Heraclea; which diftance is, by Arrowfmith's chart of the Black fea, 131 Englifh miles, or 1144 Olympic ftadia. The longeft day in that latitude is lefs than 15 hours, and the complement of this number to 24 would allow time fufficient to complete a voyage of more than 1300 ftadia (fuppofing them to be Olympic) in a day and night.

The laft inftance I mean to cite from Mr. La Nauze does, I think, no credit to his candour. He fays, that Herodotus lays down 200 ftadia as the extent of a day's journey of a foot traveller; and that Vegetius had mentioned 20 miles as the day's march of the Roman foldiers; which, he obferves, is juft ten ftadia to a mile. But Herodotus exprefsly refers to the diftance travelled by a foot meffenger, not to the march of armies. When the

latter

latter is underſtood, he aſſigns 150 ſtadia only, or 18¼ Roman miles, a diſtance ſufficiently near to Vegetius's calculation.

The above facts and arguments will, I truſt, prove that, where the ſtadium is mentioned, and no ſpecification of a different meaſure appears, the Olympic ſtadium of eight to a mile is underſtood ; eſpecially in the earlier writers, as Herodotus, Xenophon, Diodorus, Strabo, Arrian, and even Pauſanias.

APPENDIX.

APPENDIX.

APPENDIX.

THE learned Bishop of St. Asaph, Dr. Horsley, in a note annexed to Dr. Vincent's Account of the Voyage of Nearchus, has expressed himself to be of a different opinion, respecting the length of the stadium, from the one above specified. I shall take the liberty of examining briefly his Lordship's arguments; and must request the reader's patience, if I repeat some part of what has been urged in the foregoing Dissertation.

He begins with observing, that the circumference of the earth amounted, according to Eratosthenes's calculation, to 252,000 stadia; and, according to Aristotle, to 400,000 stadia; and infers from thence that the stadium of Aristotle was to the stadium of Eratosthenes as 252 is to 400, or very nearly as five to eight.

But this proposition takes it for granted that Aristotle and Eratosthenes agreed in opinion respecting the dimensions of the earth, and differed only in respect to their estimations of the measure which each of them respectively employed; a position which can by no means be admitted.

It

It does not appear on what grounds Ariſtotle [a], or rather the mathematicians of his age, eſtimated the circumference of the earth to be 400,000 ſtadia : but this is certain, that Eratoſthenes did not borrow his calculations from them, but formed his opinion from obſervations of his own, which are yet preſerved. He at-tempted this arduous taſk by an actual meaſurement of a ſegment of a great circle on the globe, making his computation upon the whole by uniting obſervations made in the heavens with a cor-reſponding diſtance, meaſured (as it was ſuppoſed to be) on a me-ridian of the earth.

The ſegment of the meridian, which he fixed on for this pur-poſe, was that between Alexandria and Syene, the diſtance be-tween which places he is ſaid to have meaſured, and found to be 5000 ſtadia. He alſo found that the angle of the meridian ſhadow upon the ſcaphia or ſun-dial at Alexandria was equal, at the ſum-mer ſolſtice, to $\frac{1}{50}$ part of the circle; and that there was no ſhadow from the gnomon at Syene at the ſame period of time, and at the ſame inſtant of the day.

Suppoſing then Alexandria and Syene to lie under the ſame meridian, he concluded that the diſtance between them was $\frac{1}{50}$ part of a great circle of the earth; and this diſtance being (as was ſuppoſed) by meaſure, 5000 ſtadia, the whole circumference of the earth muſt be of courſe 250,000 ſtadia. But in the account of this proceſs, which is accurately detailed by Cleomedes, not a

[a] Dr. Blair ſuggeſts, that this may be an ob-jection to that work being written by Ariſto-tle, as Eratoſthenes was generally allowed to be the firſt who attempted that menſuration. Blair's Hiſt. of Geography.

word

word occurs refpecting the calculation of Ariftotle, who, I believe, however great in other inftances, had not much fkill in aftronomy.

Dr. Long laments " that the Babylonic Obfervations, a treafure " almoft ineftimable, and which he neither knew how to make " ufe of himfelf, nor fo much of their value as to induce him to " ufe the neceffary means for their prefervation, for the ufe of " thofe who did, had not fallen into the hands of Eudoxus, ra- " ther than into thofe of Ariftotle."

There is then neither proof nor prefumption that Eratofthenes accommodated his calculation to that of Ariftotle; or that the itinerary ftadium was lefs in the time of Ariftotle than it was in that of Eratofthenes [b]. But I fear we can place no great confidence either in the obfervations or in the meafurements of Eratofthenes. He thought that Alexandria and Syene lay under the fame meridian; whereas they are found to differ by a fpace equal to 100 minutes of latitude, equal nearly to 115½ Englifh miles, Alexandria being fo much to the weft of Syene. The difference of latitude is about 7° 20'; fo that the real diftance between the two places is about 521 Englifh miles, equal nearly to 4552 Olympic ftadia.

This falls fhort of Eratofthenes's calculation by 448 ftadia, equal to 51 Englifh miles: but we muft confider that the diftance laid down by Eratofthenes is the one found by meafurement, which muft exceed the difference of latitude, fince the meafurers

[b] Eratofthenes lived about 123 years after Ariftotle.

did

did not difcover that the two places lay under different meridians. The numbers of Eratofthenes above fpecified were not however acquiefced in by fucceeding aftronomers, fince Marinus and Pto-lemy allotted, as Dr. Blair obferves, no more than 3600 ftadia ᶜ to that diftance; as the feven degrees twelve minutes (a calculation of the latitude not very different from that of Mr. D'Anville be-fore-mentioned) amounted exactly to that number on the propor-tion of 500 ftadia to a degree; which, Ptolemy tells us, was agree-able to menfurations allowed and acknowledged.

The learned Prelate's calculations in the next paragraph are rather incorrect. He ftates the proportion of the Roman foot to the Englifh to be as 97 : 100; whereas it appears from Greaves, whofe meafurement the Bifhop feems to have adopted, to be only 967 : 1000; which makes a difference of nearly $\frac{1}{33}$ part, and amounts nearly to 16 feet in the fpace of an Englifh mile; which, although an inconfiderable difference in fmall diftances, is neceffary to be taken into account in the eftimation of large extents; and this error, by over-rating the length of the Roman foot, vitiates in fome meafure his fubfequent calculations.

This appears in the next fentence of his Lordfhip's obfervations; where he urges, " that if eight Olympic ftadia were equal to a " Roman mile, and that Polybius's addition of ⅛ of a ftadium was " an error of his own, arifing from the difference between the " Roman and the Olympic foot, then one Olympic ftadium would " be 606.25 feet, London meafure;" which computation over-rates

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ᶜ 3600 × 50 gives only 180,000 ftadia,   ference of the earth.
or 20603.4 Englifh miles for the circum-

the

the length of the ftadium by one foot and 875 decimal parts, equal to 22.5 inches, amounting to more than 15 feet in the extent of an Englifh mile.

The Bifhop next lays it down, that the opinion of the Greek foot being to the Roman in the proportion of 25 to 24 was erroneous, though current among the Romans themfelves. But it is difficult to fuppofe that perfons of rank, fcience, and education among the Romans were ignorant of the difference between the Greek and the Roman foot, when we confider the intimate connection which fubfifted between the two countries; or that Pliny, perhaps the moft learned and philofophical man of the age in which he lived, and who, as appears from works of his, publifhed by himfelf, and ftill extant, beftowed much labour on geographical refearches, would affign 625 feet to a ftadium, when he muft know that 600 only was the proper quantity, and that too in a paffage, wherein he was fpeaking of the ftadium only, without any reference to the mile.

Nor can I admit with the learned Prelate, that the Romans, even in their popular valuation of the Greek meafures, would be apt to reckon eight Olympic ftadia to be exactly equal to their own mile, taking no account of the fraction mentioned by Polybius, fuppofing that fuch an addition was neceffary to complete the true extent of the mile.

Can we fuppofe this to have been the cafe with thofe perfons to whom the care of the menfuration of thefe diftances was committed, when we are told by Polybius, not at fecond-hand, as in the quotation from Strabo, but in a paffage now extant in his
                                                                    original

original works, " that the diftances between places were diftinctly " and accurately marked and divided by the Romans into portions " of eight ftadia each ?"

Would it have been confiftent with the character of thefe men-fores terrarum [d], perfons of rank entrufted with this charge by public authority, to have neglected one part in twenty-five of the diftance which they were directed to meafure, which, in large extents, would have amounted to a confiderable fpace?

Thus Herodotus tells us, that the circumference of the lake Mœris amounted to 3600 ftadia; which extent is eftimated by Mucianus, a perfon of the greateft authority, and frequently appealed to by Pliny, to be 450 M. P. which is eight ftadia, and no more, to a mile. Had the third part of a ftadium been added, it would have amounted only to 432 M. P. or about 18 miles fhort of Mucianus's calculation; a fpace too large to be properly overlooked in any furvey that pretends to accuracy.

Again, Pliny tells us, that the 252,000 ftadia, which Eratofthenes computed to be the circumference of the earth, amounted in Roman meafure to 31,500 M. P. This, it is obvious, is no more than eight ftadia to a mile; and it is furely very improbable, if Pliny had known (as he muft have done, had it really been the cafe) that ⅓ of a ftadium was neceffary to be added to make up the

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[d] In judicando, menfor bonum virum et juftum agere debet, nulla admonitione aut fordibus moveri, fervare opinionem, et arte et moribus omnis illi artificii veritas cuftodienda eft. Totum autem hoc judicandi officium homi-nem bonum, juftum, fobrium, caftum, modeftum, et artificem egregium exigit. Aggen. Urbicus de Officio Menforis.

Via eft illi fua lectio, oftendit quod dicit, probat quod didicit. Caffiodor. Var. iii. 53.

mile,

mile, that he did not take fuch an additional quantity into the account, where it would make fo great a difference.

Two hundred and fifty-two thoufand ftadia, at eight ftadia and one-third to the mile, amount only to 30,240 M. P. which is 1260 M. P. fhort of Pliny's calculation. Can we then fuppofe that Pliny, on whofe fcientific character it is needlefs to enlarge, would knowingly have paffed over, as not worthy notice, a fpace, which, at 75 M. P. to a degree, amounts nearly to 17 degrees of latitude, or about 1153 Englifh miles?

But the learned Prelate would do well to confider, that Pliny is not the only Roman writer who has affigned 625 feet to the ftadium. Columella, in a part of his work above cited, which was written profeffedly to explain the præcepta menfurarum, allots the fame number with Pliny, both of paces and of feet; and Cenforinus, Frontinus, together with the authors of the treatife de Limitibus, and that de Menfuris, preferved among the Rei Agrariæ Auctores, all concur in giving the fame defcription of this meafure. Is it poffible to fuppofe writers of fuch rank and accuracy all uniting in the fame miftake, refpecting a circumftance of fuch common occurrence? Is it not more reafonable and more natural to fuppofe the meaning of Polybius to be, that the ftadium, meafured by 600 Roman feet, would be defective one part in 24, compared with its length, if meafured by the fame number of Greek feet; and that therefore it would be neceffary to add $\frac{1}{24}$ part, or 25 additional Roman feet, to make up the deficiency? and that thefe 25 feet were really added, the teftimonies above produced demonftrate.

The

The Olympic foot, we are exprefsly told by Aulus Gellius, exceeded the common foot in the fame proportion as the foot of Hercules exceeded in length the foot of an ordinary man ; and this difference appears to be in the proportion of 25 to 24.

It is proper to remark, that all the Greek writers, who defcribe the Olympic or itinerary ftadium, and who might be fuppofed to reckon by Greek feet, as Herodotus, Hero, and Suidas, concur in affigning to this meafure 600 feet. On the other hand, all the Latin or Roman writers, to whom the Roman foot was more familiar, who defcribe the ftadium in ufe among the Romans, uniformly afcribe to it the meafure of 625 feet. Yet we have no reafon to think that the Greek and the Roman ftadium were of different dimenfions.

The Greek foot, as deduced by Mr. Stuart, from meafurements of different parts of the Hecatompedon at Athens, exhibits, as I have before fhewn, as nearly as poffible, allowing for fmall inaccuracies in the menfuration, and perhaps for fome in the conftruction of the building itfelf, the proportion of 25 to 24, as compared with the Roman foot defcribed by Mr. Greaves to be fculptured on the marble monument of Coffutius at Rome ; which proportion coincides with the difference of the number of feet affigned to the ftadium by the Greek, and that affigned to the fame meafure by the Latin or Roman writers. If Hercules was taller than other men, " aliorum procerius," as it is exprefſed by Aulus Gellius, the meafure taken from his foot, fuppofing that to be in proportion with the reft of his body, muft exceed the ufual meafure of length ; and of courfe fewer Herculean feet than feet of the ufual fize would be required to make up a given length. To this

we

we may add, that the proportion of 25 to 24 is no extravagant or improbable excefs of ftature above that of ordinary men, for one fo celebrated for ftrength, activity, and other athletic exercifes, as Hercules is reported to have been.

Suppofing the height of an ordinary man to be five feet ten inches, Englifh meafure, the addition of a 24th part will make that of Hercules to have been rather under fix feet and one inch, which is no extraordinary height, though fuperior to the common ftandard of mankind.

TABLES

OF

THE PROPORTION

WHICH

ANCIENT MEASURES OF LENGTH

BEAR TO

ENGLISH MEASURE.

TO WHICH IS ADDED,

A TABLE

OF THE

EXTENT OF THE DEGREES OF LONGITUDE,

AT EVERY TEN MINUTES OF LATITUDE,

RECKONED FROM

THE EQUATOR TO THE POLE.

TABLE I.

Table of the proportion which Greek Stadia bear to Greek Miles,
to English Miles, and to English Feet.

Greek Stadia.	Greek Miles and decimal parts.	English Miles and decimal parts.	English Feet and decimal parts.	Greek Stadia.	Greek Miles and decimal parts.	English Miles and decimal parts.	English Feet and decimal parts
1 equal to	.125	.114465	604.374 [a]	17 equal to	2.125	1.945875	10274.358
2	.25	.228930	1208.748	18	2.25	2.06034	10878.732
3	.375	.343395	1813.122	19	2.375	2.174805	11483.106
4.	.5	.457860	2417.496	20	2.5	2.289300	12087.48
5	.625	.572325	3021.87	21	2.625	2.403765	12691.854
6	.75	.686790	3626.244	22	2.75	2.518230	13296.228
7	.875	.801255	4230.618	23	2.875	2.632695	13900.602
8	1.	.915720	4834.992	24	3.	2.747150	14504.976
9	1.125	1.030185	5439.366	25	3.125	2.861615	15109.25
10	1.25	1.144650	6043.74	26	3.25	2.976070	15713.724
11	1.375	1.259115	6648.114	27	3.375	3.090535	16318.098
12	1.5	1.373570	7252.488	28	3.5	3.205000	16922.472
13	1.625	1.488025	7856.862	29	3.625	3.319465	17526.846
14	1.75	1.602490	8461.36	30	3.75	3.43395	18131.22
15	1.875	1.716955	9065.61	31	3.875	3.548415	18735.594
16	2.	1.831410	9669.984	32	4.	3.66288	19339.968

[a] The length of the Greek stadium, expressed as here laid down in English feet, is correct according to the numbers given by Mr. Greaves, who has employed only two places of decimal figures. If we extend these to fix figures, (and it may be done indefinitely,) the proportion will be as below stated.

$$24 : 25 : : 967 : 1007.291666$$

Again, $1007.291666 \times 12 \div 1000 = 12.087509992$

Again, $12.087509992 \times 600 = 7252.5059952$

Again, $7252.5059952 \div 12 = 604.3754933$

which differs from the calculation used in the Tables less than .018 decimals of an inch, or considerably less than $\frac{1}{50}$ part of an inch in the extent of a stadium.

Greek Stadia.	Greek Miles and decimal parts.	English Miles and decimal parts.	English Feet and decimal parts.	Greek Stadia.	Greek Miles and decimal parts.	English Miles and decimal parts.	English Feet and decimal parts.
33 equal to	4.125	3.777345	19944.342	55 equal to	6.875	6.295575	33240.570
34	4.25	3.891810	20548.716	56	7.	6.410040	33844.944
35	4.375	4.006275	21153.090	57	7.125	6.524505	34449.318
36	4.5	4.120740	21757.464	58	7.25	6.638970	35053.692
37	4.625	4.235205	22361.838	59	7.375	6.753435	35658.066
38	4.75	4.34967	22966.212	60	7.5	6.8679	36262.44
39	4.875	4.464135	23571.586	100	12.5	11.4465	60437.4
40	5.	4.57860	24174.96	200	25.	22.893	120874.8
41	5.125	4.693065	24779.334	300	37.5	34.3395	181312.2
42	5.25	4.807535	25383.708	400	50.	45.786	241749.6
43	5.375	4.921995	25988.082	500	62.5	57.2325	302187
44	5.5	5.036460	26592.456	600	75.	68.6789	362624.4
45	5.625	5.150925	27196.830	700	87.5	80.1255	423061.8
46	5.75	5.265390	27801.1204	800	100.	91.572	483499.2
47	5.875	5.379855	28405.578	900	112.5	103.0185	543936.6
48	6.	5.494320	29009.952	1000	125.	114.465	604374
49	6.125	5.608785	29614.326	2000	250.	228.930	1,208748
50	6.25	5.723250	30218.7	3000	375.	343.395	1,813122
51	6.375	5.837715	30823.074	4000	500.	457.86	2,417496
52	6.5	5.952180	31427.448	5000	625.	572.325	3,021870
53	6.625	6.056645	32031.822	10,000	1250.	1144.65	6,043740
54	6.75	6.171110	32636.196	20,000	2500.	2289.3	12,087480

TABLE II.

Of the proportion which English Miles bear to Greek Stadia.

English Miles and decimal parts.	Greek Stadia and decimal parts.	English Miles and decimal parts.	Greek Stadia and decimal parts.	English Miles and decimal parts.	Greek Stadia and decimal parts.
⅛ or .125 equal to	1.09203925	17 equal to	148.517338	40 equal to	349.45256
¼ or .25	2.18407850	18	157.253652	41	358.188874
⅜ or .375	3.27611775	19	165.989966	42	366.925188
½ or .5	4.36815700	20	174.726280	43	375.661502
⅝ or .625	5.46019625	21	183.462591	44	384.497816
¾ or .75	6.55223550	22	192.198908	45	393.134130
⅞ or .875	7.64427475	23	200.935222	46	401.870444
1	8.736314	24	209.671536	47	410.606758
2	17.472628	25	218.407850	48	419.343072
3	26.208942	26	227.144164	49	428.079386
4	34.945256	27	235.880478	50	436.81570
5	43.681570	28	244.616792	51	445.552014
6	52.417884	29	253.352106	52	454.288328
7	61.154198	30	262.08942	53	463.024642
8	69.890512	31	270.825734	54	471.760956
9	78.626826	32	279.562048	55	480.497270
10	87.36314	33	288.298362	56	489.233584
11	96.099454	34	297.034676	57	497.969898
12	104.835768	35	305.770990	58	506.706212
13	113.572082	36	314.507304	59	515.442526
14	122.308396	37	323.243618	60	524.17884
15	131.044710	38	331.979932	100	873.6314
16	139.781024	39	340.716246	200	1747.2628

TABLE II. CONTINUED.

English Miles.	Greek Stadia and decimal parts.	English Miles	Greek Stadia and decimal parts.	English Miles.	Greek Stadia and decimal parts
300 equal to	2620.8942	800 equal to	6989.0152	4000 equal to	34945.256
400	3494.5256	900	7862.6826	5000	43681.570
500	4368.1570	1000	8736.314	10,000	87363.14
600	5241.7884	2000	17472.628	20,000	174726.28
700	6115.4198	3000	26208.942		

TABLE III.

Greek Feet reduced to English Measure.

Greek Feet.	English Feet, Inches, &c.			Greek Feet.	English Feet, Inches, &c.		
	Feet.	Inches.	Decimals of an Inch.		Feet.	Inches.	Decimals of an Inch
I equal to	I		08748	26 equal to	26	2	27448
2	2		17496	27	27	2	36196
3	3		26244	28	28	2	44944
4	4		34992	29	29	2	53692
5	5		43740	30	30	2	62440
6	6		52488	31	31	2	71188
7	7		61236	32	32	2	79936
8	8		69984	33	33	2	88684
9	9		78732	34	34	2	97432
10	10		87480	35	35	3	06180
11	11		96228	36	36	3	14928
12	12	I	04976	37	37	3	23678
13	13	I	13724	38	38	3	32424
14	14	I	22472	39	39	3	41172
15	15	I	31220	40	40	3	49920
16	16	I	39968	41	41	3	58668
17	17	I	48716	42	42	3	67416
18	18	I	57464	43	43	3	76164
19	19	I	66212	44	44	3	84912
20	20	I	74960	45	45	3	93660
21	21	I	83708	46	46	4	02408
22	22	I	92456	47	47	4	11156
23	23	2	01204	48	48	4	19904
24	24	2	09952	49	49	4	28652
25	25	2	18700	50	50	4	37400

Greek Feet.	English Feet, Inches, &c.			Greek Feet.	English Feet, Inches, &c.		
	Feet.	Inches.	Decimals of an Inch		Feet.	Inches.	Decimals of an Inch.
51 equal to	51	4	46148	400 eq. to	402	10	99200
52	52	4	54896	500	503	7	74000
53	53	4	63634	600 equal to a ftadium.	604	4	48800
54	54	4	72392				
55	55	4	81140	700	705	1	23600
56	56	4	89888	800	805	9	98400
57	57	4	98636	900	906	6	73200
58	58	5	07384	1000	1007	3	48000
59	59	5	16132	2000	2014	6	96000
60	60	5	24880	3000	3021	10	44000
100	100	8	74800	4000	4029	1	80000
200	201	5	49600	5000	5036	5	40000
300	302	2	24400	6000	6043	8	88000

TABLE IV.

Of the proportion which the Minutes upon the Equator, reckoned from one to sixty, bear to English Miles and decimal Parts, to English Feet, and to Greek Stadia and decimal Parts.

N. B. A Degree is reckoned to contain 365640 English Feet, according to Mr. Picart's calculation.

Minutes	English Miles.	English Feet	Greek Stadia	Minutes	English Miles.	English Feet	Greek Stadia.
1 eq. to	1.154166	6094	10.083127	22 eq to	25.391652	134068	221.828794
2	2.308332	12188	20.166254	23	26.545818	140162	231.911921
3	3.462498	18282	30.249381	24	27.699984	146256	241.995048
4	4.616664	24376	40.332508	25	28.854150	152350	252.078175
5	5.770830	30470	50.415633	26	30.008316	158444	262.161302
6	6.924996	36564	60.498762	27	31.162482	164538	272.244429
7	8.079162	42658	70.581889	28	32.316648	170632	282.327556
8	9.233328	48752	80.665116	29	33.470814	176726	292.410683
9	10.387494	54846	90.748143	30	34.624980	182820	302.494900
10	11.54166	60940	100.831270	31	35.779146	188914	312.576937
11	12.695826	67034	110.914397	32	36.933312	195008	323.660064
12	13.849992	73128	120.997524	33	38.087478	201102	332.743191
13	15.004158	79222	131.080651	34	39.241644	207196	342.826318
14	16.158324	85316	141.163778	35	40.395810	213290	352.909445
15	17.312490	91410	151.246905	36	41.549976	219384	362.992572
16	18.466656	97504	161.330032	37	42.704142	225478	373.075699
17	19.620822	103598	171.413159	38	43.858308	231572	383.158826
18	20.774988	109692	181.496286	39	45.012474	237666	393.241953
19	21.929154	115786	191.579413	40	46.166640	243760	403.325080
20	23.083320	121880	201.66254	41	47.320806	249854	413.408207
21	24.237486	127974	211.745667	42	48.474972	255948	423.491334

Minutes.	Englifh Miles.	Englifh Feet.	Greek Stadia.	Minutes.	Englifh Miles.	Englifh Feet.	Greek Stadia.
43 eq. to	49.629	262042	433.574461	52 eq. to	60.016632	316888	524.322604
44	50.783304	268136	443.657588	53	61.170798	322982	534.405731
45	51.937470	274230	453.740715	54	62.324964	329076	544.488858
46	53.091636	280324	463.823842	55	63.479130	335170	554.571985
47	54.245802	286418	473.906969	56	64.633296	341264	564.655112
48	55.399968	292512	483.990096	57	65.787462	347358	574.738239
49	56.554134	298606	494.073223	58	66.941628	353452	584.821366
50	57.70830	304700	504.156350	59	68.095794	359546	594.904493
51	58.862466	310794	514.239477	60	69.25	365640	604.9898

TABLE V.

Of the extent of the Degrees of Longitude in English Miles and decimal Parts, at every ten Minutes of Latitude, reckoned from the Equator to the Pole.

Degrees.	Minutes.	Length of Degrees of Longitude in English Miles.	Degrees.	Minutes.	Length of Degrees of Longitude in English Miles.	Degrees.	Minutes.	Length of Degrees of Longitude in English Miles.
Equator.		69.25	4		69.08130	8		68.57680
	10	69.24973	4	10	69.06700	8	10	68.54773
	20	69.24885	4	20	69.05203	8	20	68.51883
	30	69.24736	4	30	69.03650	8	30	68.48936
	40	69.24531	4	40	69.02043	8	40	68.45930
	50	69.24271	4	50	69.00375	8	50	68.42865
1		69.23945	5		68.98648	9		68.39740
1	10	69.23565	5	10	68.96863	9	10	68.36563
1	20	69.23125	5	20	68.95020	9	20	68.33323
1	30	69.22646	5	30	68.93120	9	30	68.30360
1	40	69.22086	5	40	68.91160	9	40	68.26675
1	50	69.21454	5	50	68.89142	9	50	68.23263
2		69.20783	6		68.87600	10		68.19800
2	10	69.20500	6	10	68.84915	10	10	68.16268
2	20	69.19260	6	20	68.82740	10	20	68.12683
2	30	69.18410	6	30	68.80486	10	30	68.09400
2	40	69.17500	6	40	68.78173	10	40	68.05340
2	50	69.16535	6	50	68.76600	10	50	68.01583
3		69.15510	7		68.73366	11		67.97770
3	10	69.14426	7	10	68.70900	11	10	67.93880
3	20	69.13285	7	20	68.68354	11	20	67.89966
3	30	69.12085	7	30	68.65756	11	30	67.85980
3	40	69.10825	7	40	68.63100	11	40	67.81935
3	50	69.09510	7	50	68.60380	11	50	67.77837

De-grees.	Mi-nutes.	Length of Degrees of Longitude in English Miles.	De-grees.	Mi-nutes.	Length of Degrees of Longitude in English Miles.	De-grees.	Mi-nutes.	Length of Degrees of Longitude in English Miles.
12		67.73671	17	50	65.92263	23	40	63.42583
12	10	67.69455	18		65.86066	23	50	63.34470
12	20	67.65181	18	10	65.79813	24		63.26330
12	30	67.60850	18	20	65.73504	24	10	63.18083
12	40	67.56460	18	30	65.67150	24	20	63.09100
12	50	67.52020	18	40	65.60721	24	30	63.01483
13		67.47510	18	50	65.54246	24	40	62.93130
13	10	67.42951	19		65.47716	24	50	62.84670
13	20	67.38340	19	10	65.41130	25		62.76181
13	30	67.33663	19	20	65.34490	25	10	62.67641
13	40	67.28930	19	30	65.27793	25	20	62.59050
13	50	67.24141	19	40	65.21040	25	30	62.50430
14		67.19300	19	50	65.14233	25	40	62.41743
14	10	67.14400	20		65.07371	25	50	62.33953
14	20	67.09436	20	10	65.00453	26		62.24150
14	30	67.04423	20	20	64.93480	26	10	62.15293
14	40	66.99350	20	30	64.86454	26	20	62.06383
14	50	66.94220	20	40	64.79373	26	30	61.97420
15		66.89036	20	50	64.7237	26	40	61.88460
15	10	66.83800	21		64.65044	26	50	61.79340
15	20	66.78500	21	10	64.57800	27		61.70220
15	30	66.73141	21	20	64.50500	27	10	61.61050
15	40	66.67730	21	30	64.43141	27	20	61.51825
15	50	66.61260	21	40	64.35731	27	30	61.42550
16		66.56736	21	50	64.28266	27	40	61.33223
16	10	66.51156	22		64.20750	27	50	61.23844
16	20	66.45520	22	10	64.13160	28		61.14413
16	30	66.39827	22	20	64.05550	28	10	61.04930
16	40	66.34078	22	30	63.97864	28	20	60.95400
16	50	66.28271	22	40	63.90130	28	30	60.85809
17		66.22410	22	50	63.82341	28	40	60.76171
17	10	66.16493	23		63.74494	28	50	60.66481
17	20	66.10520	23	10	63.66600	29		60.56741
17	30	66.04500	23	20	63.58646	29	10	60.46950
17	40	65.98460	23	30	63.50640	29	20	60.37107

TABLE V. CONTINUED.   209

Degrees	Minutes.	Length of Degrees of Longitude in English Miles.	Degrees.	Minutes	Length of Degrees of Longitude in English Miles.	Degrees.	Minutes	Length of Degrees of Longitude in English Miles.
29	30	60.27214	35	20	56.49425	41	10	52.13126
29	40	60.17270	35	30	56.37750	41	20	51.99845
29	50	60.07274	35	40	56.26027	41	30	51.86518
30		59.97501	35	50	56.14260	41	40	51.73150
30	10	59.88507	36		56.02442	41	50	51.59735
30	20	59.76980	36	10	55.90580	42		51.46280
30	30	59.66783	36	20	55.78667	42	10	51.32777
30	40	59.56534	36	30	55.66710	42	20	51 19232
30	50	59.46234	36	40	55.54739	42	30	51.05646
31		59.35884	36	50	55.42651	42	40	50.91008
31	10	59.25483	37		55.30651	42	50	50 78341
31	20	59.15034	37	10	55.17135	43		50.64624
31	30	59.04534	37	20	55.06211	43	10	50.50864
31	40	58.93983	37	30	54.93963	43	20	50.37062
31	50	58.83383	37	40	54.80423	43	30	50.23220
32		58.72732	37	50	54.69353	43	40	50.09330
32	10	58.62032	38		54.56972	43	50	49.95400
32	20	58.51270	38	10	54.44550	44		49.81430
32	30	58.40487	38	20	54.32080	44	10	49.67414
32	40	58.29538	38	30	54.19562	44	20	49.53358
32	50	58.18740	38	40	54.0982	44	30	49.39261
33		58.08792	38	50	53.94390	44	40	49.25115
33	10	57.96814	39		53.81736	44	50	49.10938
33	20	57.85752	39	10	53.69035	45		48.96714
33	30	57.74660	39	20	53.56290	45	10	48.83878
33	40	57.63520	39	30	53.43510	45	20	48.68143
33	50	57.52326	39	40	53.30665	45	30	48.53796
34		57.41094	39	50	53.17783	45	40	48.39410
34	10	57.29796	40		53.04860	45	50	48.24980
34	20	57.18460	40	10	52.91887	46		48.10510
34	30	57.07074	40	20	52.78872	46	10	47.96000
34	40	56.95641	40	30	52.65811	46	20	47.81448
34	50	56.84160	40	40	52.52710	46	30	47.66855
35		56.72628	40	50	52.39560	46	40	47.52224
35	10	56.61050	41		52.26366	46	50	47.37551

Degrees	Minutes	Length of Degrees of Longitude in English Miles	Degrees	Minutes	Length of Degrees of Longitude in English Miles	Degrees	Minutes	Length of Degrees of Longitude in English Miles
47		47.22840	52	50	41.83640	58	40	36.01112
47	10	47.08085	53		41.67571	58	50	35.83890
47	20	46.93294	53	10	41.51464	59		35.66639
47	30	46.78462	53	20	41.35324	59	10	35.49357
47	40	46.63590	53	30	41.19149	59	20	35.32045
47	50	46.48680	53	40	41.02940	59	30	35.14732
48		46.33730	53	50	40.86693	59	40	34.97331
48	10	46.18740	54		40.70412	59	50	34.79930
48	20	46.03712	54	10	40.54100	60		34.62500
48	30	45.88644	54	20	40.37750	60	10	34.52981
48	40	45.73531	54	30	40.21367	60	20	34.27551
48	50	45.58391	54	40	40.04952	60	30	34.10033
49		45.43209	54	50	39.88501	60	40	33.92486
49	10	45.27992	55		39.72008	60	50	33.74911
49	20	45.12726	55	10	39.56410	61		33.57306
49	30	44.97428	55	20	39.38947	61	10	33.39674
49	40	44.82092	55	30	39.22362	61	20	33.22014
49	50	44.66716	55	40	39.05746	61	30	33.04324
50		44.51304	55	50	38.89094	61	40	32.86608
50	10	44.35854	56		38.72411	61	50	32.68863
50	20	44.20367	56	10	38.55694	62		32.51090
50	30	44.04842	56	20	38.38945	62	10	32.33290
50	40	43.89280	56	30	38.22164	62	20	32.15463
50	50	43.73671	56	40	38.05350	62	30	31.97610
51		43.58044	56	50	37.88534	62	40	31.79724
51	10	43.42371	57		37.71629	62	50	31.61820
51	20	43.26661	57	10	37.54715	63		31.43812
51	30	43.10915	57	20	37.36913	63	10	31.25922
51	40	42.95131	57	30	37.20800	63	20	31.07934
51	50	42.79312	57	40	37.03795	63	30	30.89920
52		42.63456	57	50	36.86759	63	40	30.71880
52	10	42.47565	58		36.69692	63	50	30.53813
52	20	42.31540	58	10	36.52593	64		30.35720
52	30	42.15673	58	20	36.35463	64	10	30.17602
52	40	41.99676	58	30	36.18325	64	20	29.99458

TABLE V. CONTINUED. 211

De-grees	Mi-nutes	Length of Degrees of Longi-tude in English Miles.	De-grees	Mi-nutes	Length of Degrees of Longi-tude in English Miles	De-grees	Mi-nutes	Length of Degrees of Longi-tude in English Miles
64	30	29.81290	70	20	23.30591	76	10	16.55751
64	40	29.63095	70	30	23.11613	76	20	16.36190
64	50	29.44874	70	40	22.92614	76	30	16.16610
65		29.26631	70	50	22.73591	76	40	15.97015
65	10	29.08362	71		22.54551	76	50	15.77407
65	20	28.90071	71	10	22.35504	77		15.57785
65	30	28.71751	71	20	22.16521	77	10	15.38152
65	40	28.53410	71	30	21.97335	77	20	15.18505
65	50	28.35041	71	40	21.78222	77	30	14.98840
66		28.10172	71	50	21.59092	77	40	14.79170
66	10	27.98231	72		21.39941	77	50	14.59490
66	20	27.79800	72	10	21.20771	78		14.39760
66	30	27.61331	72	20	21.01590	78	10	14.22050
66	40	27.42852	72	30	20.82340	78	20	14.00360
66	50	27.24344	72	40	20.63162	78	30	13.80623
67		27.05813	72	50	20.43930	78	40	13.60878
67	10	26.87251	73		20.24674	78	50	13.40120
67	20	26.68682	73	10	20.05402	79		13.21323
67	30	26.50084	73	20	19.86112	79	10	13.03540
67	40	26.31461	73	30	19.66806	79	20	12.81782
67	50	26.13820	73	40	19.47428	79	30	12.61981
68		25.94150	73	50	19.28144	79	40	12.42170
68	10	25.75463	74		19.08790	79	50	12.22343
68	20	25.56752	74	10	18.89417	80		12.02510
68	30	25.38021	74	20	18.70030	80	10	11.82670
68	40	25.19261	74	30	18.50621	80	20	11.62820
68	50	25.00431	74	40	18.31207	80	30	11.43951
69		24.81700	74	50	18.11772	80	40	11.23081
69	10	24.62881	75		17.92322	80	50	11.03200
69	20	24.44044	75	10	17.72858	81		10.83308
69	30	24.25181	75	20	17.53380	81	10	10.63408
69	40	24.06308	75	30	17.33882	81	20	10.43500
69	50	23.87409	75	40	17.14372	81	30	10.23580
70		23.68490	75	50	16.94847	81	40	10.03650
70	10	23.49550	76		16.75310	81	50	9.81455

De-grees.	Mi-nutes.	Length of Degrees of Longi-tude in English Miles.	De-grees.	Mi-nutes.	Length of Degrees of Longi-tude in English Miles.	De-grees.	Mi-nutes.	Length of Degrees of Longi-tude in English Miles.
82		9.63774	84	50	6.23618	87	40	2.81938
82	10	9.43822	85		6.03554	87	50	2.61809
82	20	9.23862	85	10	5.83484	88		2.41673
82	30	9.03894	85	20	5.63409	88	10	2.21546
82	40	8.83919	85	30	5.43329	88	20	2.01412
82	50	8.63935	85	40	5.23245	88	30	1.81275
83		8.43945	85	50	5.03156	88	40	1.61138
83	10	8.23942	86		4.83064	88	50	1.40998
83	20	8.03943	86	10	4.62967	89		1.20858
83	30	7.83932	86	20	4.42866	89	10	1.00716
83	40	7.63915	86	30	4.22761	89	20	.80574
83	50	7.43890	86	40	4.02653	89	30	.60431
84		7.23860	86	50	3.82541	89	40	.40288
84	10	7.03823	87		3.62427	89	50	.20144
84	20	6.83780	87	10	3.42301	90		.00000
84	30	6.63732	87	20	3.22188			
84	40	6.43678	87	30	3.02064			

TABLE VI.

Of the Greek Numerals, and of the Characters ufed by PTOLEMY
to exprefs Minutes of Longitude and Latitude.

GREEK NUMERALS.

α	β	γ	δ	ε	ϛ	ζ	η	θ
1	2	3	4	5	6	7	8	9
ι	κ	λ	μ	ν	ξ	ο	ϖ	ϟ
10	20	30	40	50	60	70	80	90
ρ	σ	τ	υ	φ	χ	ψ	ω	ϡ
100	200	300	400	500	600	700	800	900
α	β	γ	ι	κ	ρ			
1000	2000	3000	10,000	20,000	100,000			

Characters ufed by Ptolemy to exprefs Minutes.

ιβ	ϛ	δ	γ	γιβ	L'	L'ιβ	γο	L'δ	L'γ	L'γιβ	α
5	10	15	20	25	30	35	40	45	50	55	60

THE END.