Leafe	Page	Line	Fault	Correct
E 1 b	14		23439	13439
F 3 a	13		24 30	24 39
		26	46 59	26 59
		27	47 9	27 9
F 4 b	14		217	219
		23	77 5	77 57
		28	292	293
		33	139	238
		33	209	208
		34	238	239
G 1 b	32		87 10	87 16
G 2 a	12		87 5	87 54
G 2 b	26		89 4	89 44
G 3 a	12		150	156
H 1 b	17		84 56	83 56
		18	87 55	87 53
		19	87 53	87 55
H 2 b	7		97 17	67 17
		24	43 38	43 55
		25	44 21	44 38
H 3 a	23		89 1	89 14
	b	13	49 17	49 19
		22	43 38	24 38
H 4 b	10		168	158
Aa 4 b	26	5	17 35	5 27 45
Bb 1 a	22	5	28 52	5 27 52
Bb 2 b	21	8	42 29	8 42 9
		27	8 22 57	8 21 57
Cc 3 b	27	16	27 2	16 47 2
Dd 1 a	25	19	1 27	19 1 57
		28	18 32 52	18 32 54
Dd 1 b	11	19	33 4	19 34 4
		31	19 24 34	19 24 38
		32	19 24 48	19 25 2
		33	19 25 2	19 25 17
Ee 2 a	17	22	55 47	22 55 57

Leafe	Page	Line	Colum	Fault	Correct
Gg 2 a	22		Col. 2	61 31	61 35
Hh 1 a	19		Col. 2	13 0	15 0
Hh 2 a	29		Col. 5	17 20	15 20
Ll 1 b	34		Col. 4	16 39	16 37
Mm 1 a	1		Col. 1	1597	1599
Mm 2 a	10			23 48	23 38
Mm 2 a	12			25 59	25 50
Mm 4 a	20		Col 2	19 21	19 27
Nn 2 a	11		Col 3	18 3	18 34
Nn 2 a	13		Col. 4	19 15	19 13
Nn 2 b	32		Col. 4	22 50	22 49
Nn 2 b	33		Col. 4	22 45	22 43
Nn 3 a	10		Col. 3	22 57	21 57
Na 3 b	9		Col. 2	15	15 5
Oo 1 b	11		Col. 4	23 19	23 18
Oo 1 b	36		Col. 3	22 10	22 20
Pp 2 b	18			17	7
Pp 2 b	36		Col. 6		2

Leafe	Page	Line		
F 2 a		30	read, teach degree beginning	
F 2 b		19	in any	or in any
I 3 b		22	leaues	leagues
K 3 b		21	D L from B,	D I, from B
		22	from the	from D the
		28	as the	as in the
K 4 b		17	reade perpendiculars	
		20	P Q	E Q
		22	as the	as in the
N 3 a		3	O N M	O M N
O 3 a		11	our	on
Aa 1 a		31	clarine	claims
Ff 1 b		20	to the	in the
Kk 1 a		16	A B	A D
Kk 1 b		16	the triangle	in the triangle
Kk 2 b		26	the funnes	b the funnes
Kk 3 b		5	A a O.	a A d
Kk 3 b		12	a A b	a A d
Kk 4 b		20	addeth	added
Oo 3 a		19	in the	is the
Oo 3 b		9	5 min.	to 5 min.
Qq 1 b		6	to 6 degr.	to be 6 deg.
Qq 4 b		2	his long	his.

FAVLTS
in the common
Sea Chart,

With Rumbes expreſſed by right lines and degrees of latitude, euery where equall.

AS the Sea Chart is one of the eſpeciall Inſtrumentes that Mariners haue for theyr direction in ſailing, ſo there is not any wherein there are ſo great and daungerous errours.

Errour in the proportion of the length & breadth of places in the common ſea charte.

1 For firſt, what places ſoeuer are deſcribed therein, the length of them (from Eaſt to Weſt) hath a greater proportiõ to the bredth (from North to South) than indeede it ought to haue (except it be at the æquinoctiall:) And ſo much the more this errour increaſeth, by howe much the further diſtant thoſe places are from the æquinoctiall: euen as the proportion of the Meridian to the Paralell, increaſeth the more, the nearer you come to either Pole; ſo that at the paralell of 60 degrees latitude, the proportion of the length to the bredth

ERRORS IN NAVIGATION,

1 Error of two, or three whole points of the Compas, and more ſomtimes, by reaſon of making the ſea-chart after the accuſtomed manor, with right lined rumbes, and equall degrees of latitude.

2 Error of one whole point, and more many times, by neglecting the variation of the Compaſſe.

3 Error of a degree and more ſometimes, in the vſe of the croſſe ſtaffe, eſpecially by not regarding the eccentricitie of the eie.

4 Error of 11. or 12. minures in the declination of the Sunne, as it is ſet foorth in the regiments moſt commonly vſed among Mariners: and conſequently error of halfe a degree in the place of the Sunne.

5 Error of halfe a degree, yea an whole degree and more many times in the declinations of the principall fixed ſtarres, ſet forth to be obſerued by mariners at ſea.

Detected and corrected by often and diligent obſervation.

Whereto is adioyned, the right H. the Earle of Cumberland his voyage to the Azores in the yeere 1589. wherin were taken 19. Spaniſh and Leaguers ſhips, together with the towne and platforme of Fayal.

By Edward Wright.

Printed at London for *Ed. Agas.* 1599

To the right Honourable, George *Earle of Cumberland, Baron Clifford,* Lord Bromflet, Atton, Veſcie, and Vipont, Lord of Weſtmerland, and Knight of the moſt noble Order of the Garter.

RIght Honourable, and my very good Lord, being firſt induced, by occaſion of your Lordſhips imployment of me at ſea, to apply my Mathematicall ſtudies to the vſe of Nauigation: I thought, theſe firſt fruits of thoſe my ſea-labours, could not bee more iuſtly due to any, then to your ſelf: as by whoſe beneficiall hand, they haue been chiefly cheriſhed, to grow thus farre forwardes towardes their ripeneſſe: and to whom the cauſes that moſt moued me thus vnſeaſonably (as it were) to pluck the ſame before the time, that is, the publiſhing of part hereof alreadie by one: and the ſtealing of an other part by a ſecond man, and the daunger of publiſh-

ing the whole by the third, are beſt knowne. For your Lordſhip can witnes (though in a greater matter, meaner witneſſe might ſerue) that not onely a part of this Booke was firſt ſet foorth by one: and that an other part thereof is more lately publiſhed by another in his owne name, in his Mappes of the world, and of Europe: but that the whole alſo was in going to the preſſe, vnder the name of one of the skilfulleſt Nauigators (as he was by many reputed) of our time, and nation, of whome ſomething more then ordinary, out of his many experiments, and obſeruations at ſea, was (at that time eſpecially, when he was to leaue his life) expected to be brought to light, and left to poſteritie, for their common good. But by good happe it was ſtayed, comming by the way into your Lo. hands: who preſently (by comparing it with the originall copy thereof, which I had reſerued to my ſelf) knewe it to be the ſame booke worde for worde, which I had made, and preſented vnto your L. almoſt ſeauen yeares before.

Hauing therefore (as I could for the preſent) made ſupply of ſuch wants, as were in that Booke, I thought it beſt to follow your Lo.

Lo. aduiſe, rather by publiſhing it my ſelf, to acknowledg mine own openly, with all faults, which quieter time, and more leiſure (whereof I haue ſeldome had leſſe ſtore) might haue amended: then either to haue it by peecemeale diſmembred, or vniuſtly chalenged by ſome other man as his owne: and ſo ſett forth to the view of all men, much worſe then I made it.

Deſiring therefor your Lo. to vouchſafe the ſame the ſafegarde of your honorable protection, both againſt theſe, and other iniuries that may be expected of ignorant, or malicious tongues: as not knowing whome better to flie vnto to be protected, both for your honourable fauours towardes me, and for your noble authoritie, ioyned with no leſſe skill, experience, and iudgement in theſe matters belonging vnto Nauigation: I beſeech the Lord of lordes, to increaſe your Lo. with all true honour, and happineſſe in this life: and after this life ended, with endleſſe bliſſe, in the life that laſteth euer.

Your Lo. to command in the Lord.

Edw: Wright.

The Præface

To the Reader.

THe Art of Nauigation (as it is called) though it hath now beene in vſe ſome thouſands of yeeres, yet how far it is at this day, from the perfection which is and were to be deſired, wee would ſcarce beleeue (as a wonder, that a thing of ſo great commoditie, ſhould no more bee ſought into, in ſo many ages:) but that, both the Bookes of the learned are extant, to teſtifie, and reaſon (approoued by often triall) dooth plainely ſhew, that the principall meanes, and inſtruments this Art vſeth, haue beene thus long ſo farre from this perfection, that contrariwiſe they haue beene, and are much ſtained, with many blots and blemiſhes of error, and imperfection.

1 The ſea chart the beſt meane the mariner hath to knowe the courſe from place to place, (as it hath beene hitherto generally made) is ſo faultie in the very foundation and groundworke thereof (that is in the geometricall lineaments of the meridians, paralels, and rumbes deſcribed therein) that hereof there may ariſe ſo groſſe error, as may cauſe the mariner to miſſe one, two, yea three whole points of the compaſſe (and more ſometimes in a farre northerly nauigation) in finding the courſe from place to place. Whereof it may alſo be neceſſarily inferred, that following the direction of his chart in ſuch ſort as hath beene vſed for finding the diſtances of places, he may erre one half, yea three quarters and more ſometimes in thoſe northerne partes: in taking the diſtance to be twice, thrice, yea foure times greater then indeede it is.

2 The Compaſſe (the chiefeſt inſtrument for keeping the courſe ſhewed by the chart) by the variation neglected, as by ſome

to the Reader.

* ſome it hath beene may cauſe you erre an whole point or two in the courſes of diuerſe places: and not rightly vſed hath bred much confuſion in many parts of the chart in laying out many places in falſe courſes: which muſt needs folow when the chart is made according to the direction ſhewed by the pointes of the Compaſſe without abatement or allowance anſwerable to the variation in euery place. This may eſpecially bee ſeene in thoſe places where the variation is greateſt, as vpon the coaſt of Florida, Noua Francia, and New found land; where ſome alſo ſeeking to auoyd this inconuenience, haue fallen into an other as ill or worſe than the former, in making a double ſcale of latitude. And thus one error as a fruitfull mother breeding another, and one abſurdtie admitted drawing many with it: it will manifeſtly appeare by exact diſcourſe out of theſe grounds (what partly through the falſe proiection of the chart, and partly through neglecting, or not rightly vſing the variation of the Compaſſe) that it can not otherwiſe be but that the ordinary charts are in many places much like an inextricable labyrinth of error, out of which it will be very hard for a man eaſily to vnwinde himſelf. M. Peter de Medina, 6. booke, 3. chap.

Hereto accord the often experiments and vſuall practiſe of many wel experienced and iudicial mariners and ſea men of our time, who confeſſe, that in ſailing from the weſt Indues to the Azores, they haue often fallen with thoſe Ilands, when by their account according to the chart they ſhould haue beene 150. or 200. leagues to the Weſtwards of them. The like hath beene found in ſayling from the Azores for Vſhent, as I haue alſo partly ſeene in the little experience I haue had at ſea, where we were comne within ſight of that Iland, when by account of the ordinary chart we ſhould haue beene 50. leagues ſhort of it.

And as concerning the courſes from place to place, I haue obſerued that ſome of our maſters take a wiſe courſe, in not truſting to thoſe courſes which are ſhewed by their charts. But firſt getting themſelues into the height or paralel of the place to which they are going: and withall, knowing aſſuredly whether they be more eaſtwarder weſtward than that place; they then proceed

alwayes heedfully keeping themſelues vnder that parallel till they come to the place deſired. Then which way of ſayling there is none indeed more certaine and infallible for the ſure finding of the place aſsigned: but it hath this inconuenience that it maketh the way longer then otherwiſe it ſhould be, if the ſtreight courſe were kept.

But to returne to that from whence we haue a little digreſſed, by theſe experiments and practiſe of the skilfulleſt mariners it is manifeſt that they themſelues do often find the imperfections of their charts, in ſhewing the courſes and diſtances of manie places each from other Whereto we may adioyne the experience of the beſt Hydrographers of our time: who dayly making their Charts after the accuſtomed manner with ſtreight-lined rumbes and degrees of latitude, euerie where equall, haue found ſuch difficulties in labouring to bring their marine deſcriptions to ſome due correſpondence of trueth in the courſes, heights and diſtances, that tyred herewith in the end, they haue holden it for impoſsible, to make the chart agree in all theſe with the globe. Wherein notwithſtanding they erre, by making too generall a concluſion, in houlding that to bee ſimply impoſsible, which cannot be done by ſuch a way & meanes as they know and vſe.

3 The Croſſe-ſtaffe (the principall inſtrument, that hath at ſea beene moſt generally vſed, for obſerving the altitudes of the Sunne, or ſtarres, thereby to know more aſsuredly the latitude, and ſo to examine and rectifie the account of the courſe, kept by direction of the Compaſſe vpon the chart) if there be not abatement made anſwerable to the eccentricitie of the eye (that is to the diſtaunce wherewith the center or point wherein the ſight beames concurre within the eye is further backward then the end of the ſtaffe) may through neglect of this abatement cauſe error in taking the height obſerued to be greater then indeed it is, by 10, 20, 30, min. yea an whole degree and more ſometimes, if the height be much, the ſtaffe ſmall, and the eccentricitie of the eye great.

4 But both this ſtaffe, and all other inſtruments (though neuer ſo well made and vſed) can doe vs but ſmall pleaſure, for finding the latitude at ſea, if the declination of the Sunne or ſtarres which we obſerue be not alſo knowne. To this end therefore there haue beene made tables of the declinations, both of the Sunne and fixed ſtarres: yet ſuch as euen that which hath beene publikely commended as not differing from trueth in any place aboue one minute (I meane the regiment of the Sunne ſet forth by R.N.) doth notwithſtanding differ from trueth in manie places 10, 11, or 12, minutes. And as for the fixed ſtarres, ſcarce one of them hath his declination truly ſet downe and agreeablie to obſeruation. Yea euen the Pole-ſtarre it ſelf, though it be better knowne, and more obſerued by the moſt part of ſeamen then all the reſt: and indeed as it mought be vſed (being to be obſerued at any time of the night all the yeare long) might ſtand them in as much ſtead for finding the latitude as moſt of the reſt: yet in the bookes of nauigation that are moſt common amongſt Engliſh mariners, the diſtance thereof from the Pole is made to be 38 minutes more then it ſhould be. No maruaile therefore if the mariners complaine (as I haue heard them ſometimes) that they cannot make their obſeruations of the latitude by the Sunne and this ſtarre to agree.

Neither is there more trueth to be looked for in the declinations of many other principall fixed ſtarres, publiſhed in thoſe bookes, diuerſe of them erring from truth one, two yea (ſome of them) three whole degrees and more, as in the treatiſe following ſhall be ſhewed. And theſe errors in the declinations of the Sunne and fixed ſtarres, not onelie I, but alſo the R. W. Sir Chriſtopher Heydon knight, and the noble Lord of Kundſtrupp, Tycho Brahe, founder of Vraniburg, with the gracious Prince William Landtgraue of Haſſia, father of him that now is, haue often found by many and moſt diligent obſeruations with large and exact inſtruments, wherin both minutes and half minutes might be eaſily diſcerned. Notwithſtanding, if anie ſtand in doubt hereof, I wiſh that he himſelf alſo would beſtow no leſſe coſt, time and diligence, to make often heedfull and exact obſeruation then either the Prince of Haſſia, or

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Tycho Brahe, *or at leaſt but as my ſelf haue done, and then let him beleeue that he ſhall ſee to be true with his owne eyes.*

These errors therfore in the Chart, Compaſſe, Croſſe ſtaffe, and declinations of the Sunne and ſtarres, I haue in the treatiſe following laboured to reforme to the vtmoſt (yea rather beyond the vtmoſt) of my poore abilitie, neglecting other ſtudies and courſes that might haue beene more beneficiall to mee: which may argue my good will to haue proceeded further, to the amendment of ſuch other faultes and imperfections as yet remaine beſides thoſe that are alreadie ſpecified, and that eſpecially in two pointes, that is, in the courſes and longitudes of places.

The reforming of the Chart in reducing all places from thoſe varying courſes wherein now they are ſet downe to the true poſitions they haue each from other, by ſeparating the variation (wherewith they are in the ordinarie Charts for the moſt part intermingled) were a buſie peece of worke: yet ſuch as were moſt worthie, and neceſſarie to be laboured in, as without which the Charts mappes, and globes, or any other Hydrographical, or Geographicall deſcriptions, cannot be freed from many intricate abſurdities, wherewith now they muſt needs in many parts be peſtered: becauſe the courſes and poſitions of places are in them ſet downe as they were obſerued by the varying Compaſſe, without ſeparating the variation afterwards, that ſo the true courſes and poſitions of places might be knowne.

The longitude alſo would well deſerue both labour and coſt to be both skilfully and liberally beſtowed, for the finding thereof: whereby it were poſſible to bring it to that paſſe (the motions of the Sunne, and Moone, and places of the fixed ſtarres being verified, whereof that noble Tycho Brahe *affoordeth great hope) that the induſtrious and willing minded mariner mought be capable thereof, in ſuch ſort, that for the moſt part, when the moone and fixed ſtarres appeare, hee might bee able hereby to know what longitude he is in (euen at ſea) more truly then many haue done by their dead reckoning, in ſayling out of the bay of* Mexico *to the* Azores, *or from Newfound land to England, or almoſt from the* Azores *to England. But on land, the longitude might by this meanes be found, as exactly as the latitude hath beene by many obſeruers at ſea. And ſo, opportunities of obſeruation with meete inſtruments on ſhore not being neglected, (eſpecially in long voyages farre Eaſtward or Weſtward) many moſt notorious errors in the longitudes of places would ſoone be corrected, where with the moſt excellent arts of Geographie, & Nauigation are verie much blemiſhed. For who that loueth truth, can patiently endure to heare the Mariners common, and conſtant complaint of 150, or 200. leagues error in the diſtance betweene the bay of* Mexico *and the* Azores: *or (that which is yet moſt intollerable and monſtrous) of 600 leagues difference in the diſtance betweene* Cape Mendoſino *and* Cape California, *ſome making that diſtance to be 12 or 13 hundred leagues, where others will haue it, and that more probable, to be no more then ſixe or ſeuen hundred.*

But forasmuch as the charge, though not great (to ſpeake of) of prouiding meete meanes for ſupplie of theſe wants in the courſes and longitudes, but chiefly in the latter, exceedes the meane abilitie of the moſt part of them that are moſt addicted to theſe vngainfull ſtudies (I muſt not ſay vngratefull, albeit in theſe dayes they prone moſt vnprofitable to their greateſt louers:) Therefore for my part they are like to reſt, as they are vntouched, and onely commended vnto a kinde of hope (whether vaine or no I know not) of ſome Mecœnas *at length of munificent ſpirit to be raiſed vp, though not to do as that magnificall* Tycho *in his* Vraniburg, *as well by his owne high reach of wit and learning, as by a bountifull hand to his aſſiſtants and followers yet at leaſt to haue ſome due conſideration, both of theſe, and of ſuch other wants and imperfections as yet remaine in ſo great and excellent an art as this of Nauigation is, that it may haue ſome increaſe, like as Aſtronomie hath much aduancement by* Tycho Brahe *alone, who for his deſerued renowne cannot be too oft named.*

Doubtles there is no man (cõſidering that the art of Aſtronomy which mounteth vp vnto the heauẽs doth miniſter aid vnto this

this of Nauigation, which courseth vpon the waters) can denie the excellencie thereof, or the profitablenesse either. But if he will my purpose is not to stand vpon it, nor to conuince him by reasons, by records, or by the more wonderfull discoueries in this our age, made to the furthest parts of all the earth, and round about the whole compasse of the same, whereby we haue beene made partakers of the most rare and richest commodities and treasures of the vtmost Indies, and Ilandes of the world, and they likewise haue participated with vs (or els they haue had the more wrong) in the most precious treasures of heauenly trueth. All which and much more then can bee thought of, or now spoken, performed chiefly (next vnder Gods prouidence) by the rules and directions of this art, who seeth not that by how much the more excellent, and vnto mankinde abundantly profitable it is, so much the lesse ought any notorious error to be tolerated therein, and so much the more ought all whome it may concerne (yea but in good will onely, if it may do good) to endeuour themselues that it may be brought to the highest pitch of perfection. I know not then if any one be vnto so excellent an enterprise drawne on, to giue the best furtherance in him lyeth, why he should for his labour fall into any daunger of reprehension at all. Yet it may be, I shall be blamed by some, as being to busie a fault-finder my self. For when they shall see their Charts and other instruments controlled which so long time haue gone for current, some of them perhappes will scarcely with pacience endure it. But they may be pacified, if not by reason of the good that ensueth hereupon, yet towards me at the least because the errors I poynt at in the chart, haue beene heretofore poynted out by others, especially by Petrus Nonius, out of whom most part of the first Chapter of the Treatise following is almost worde for worde translated; I for my part desiring rather that faults should be found by others then by my self, and labouring much more, as for a thing much better, and furre more needfull, and profitable to be a fault mender, then a fault finder.

Or els I may so much the more be misliked, because in seeking to amend, some will think I take vpon me too much: For some will say, and of those perhappes that haue beene employed in sea affayres all their life long, that all this we go about is more then needs. For they without all this ado, haue euer performed their charge with good successe, and are now too olde to giue eare to these innouations. But other seafaring men, who acknowledge the need hereof, are ashamed peraduenture to receyue (as it were) either correction from the schooles, or direction from the land and therefore stick not to condemne Vniuersities and all in comparison of their manifold experiments. Others also as more indifferent for the matter, will haue a fling yet at the person thinking this reformation which is professed, to spring out of other mens fountaines. Which all (because we are now about a worke of amendment) must also (if they will heare reason) amend their opinions. For the first which seeme most vnreasonable, do not consider being addict to these vnreformed instruments, how like they are vnto those auncient maisters of shippes, whom M. Bourne maketh report of, who not many yeares since, wedded likewise to their accustomed vsage, haue mocked them that haue vsed Charts, or Crosse staues, saying they cared not for their sheepes skinnes, they could keepe a better account vpon a bourd: and them that obserued the Sunne or starres for finding the latitude, they would call sunshooters, and starre shooters, and aske if they had hit it. But marke what commeth hereof: for one of these maisters was he as I take it, of whom an ancient seaman (yet liuing as I thinke) once tolde me, who hauing vndertaken the charge of conducting a shippe from England to Saint Michaels (the first of the Azores) and after long seeking, not able to find that Iland, for shame and sorrow cast himselfe ouerbourd. Wherefore these men if they consider it well, haue no cause to boast of successe without skill, but to thanke God for both, that is, for their great and often good happe and safetie, and for their skill also were it smaller then indeed it is. For I will do them no wrong, but do freely graunt and acknowledge, that from any one place to other, the course, height and distaunce may be truly set downe

in the ordinarie Chart, wherein the Rumbes are right lines, and the degrees of latitude euery where equall: and ſo by that Chart they may ſaile truely inough from hence to Ruſſie *or* Iſland, *or any other place. But if by the way they ſhould croſſe ouer from the one to the other, following the direction that their Chart ſheweth them, they cannot but erre a great deale, either in courſe, or diſtance, or both, eſpecially in thoſe Northerly nauigations. Why then ſhould they where there is daunger of wandring, refuſe help of any that is willing to ſhewe a better courſe? But to come vnto thoſe that may obiect I do but* actũ agere, *in doing no more then hath beene done alreadie by* Gerardus Mercator, *in his vniuerſall mappe many yeares ſince: and in publiſhing ſomething already publiſhed by* Iodocus Hondius, *in his greater mappe of the world, and of Europe, now of late: I muſt aunſwere, that indeed by occaſion of that mappe of* Mercator, *I firſt thought of correcting ſo many and groſſe errors and abſurdities, as hereafter are ſhewed in the Sea chart, by increaſing the diſtances of the Parallels, from the equinoctiall towards the Poles, in ſuch ſort, that at euery point of latitude in the Chart, a part of the Meridian might haue the ſame proportion to the like part of the Parallel, that it hath in the globe. But the way how this ſhould be done, I learned neither of* Mercator, *nor any man els. And in that poynt I wiſh I had beene as wiſe as he in keeping it more charily to my ſelf. For ſo perhappes it might haue beene more beneficiall vnto me: neither ſhould any man haue had cauſe to thinke at the firſt ſight of the fourth Chapter of this booke, that all I haue there ſet downe is ſtolne out of one of the foreſaid mappes of* Iodocus Hondius. *But were I brought before a Iudge, I ſhould for my abſolution, and* Iodocus *his condemnation, make the contrarie to appeare, and that by his owne confeſſion in his letters to me, and to a friend of mine, which I haue to ſhewe written in Latine with his owne hand: To me his writing in Engliſh is thus much in effect.*

viz. The booke of the Sea-chart.

I heare that you are ſomewhat offended with me, becauſe I haue taken thoſe fewe things out of your hand-written *booke, whereas I promiſed you that I would not publiſh it:

it: which alſo I would in no wiſe doe without your leaue. For it ſomething grudged my conſcience, euen to publiſh this little, if the diſtance of places would haue ſuffered me conueniently to ſend letters vnto you. I was purpoſed to haue ſet this forth vnder your name: but I feared that you would be diſpleaſed therewith, becauſe I haue but rudely and without elegancie tranſlated it into Latine. Truely I tolde all my friends plainly that you are the Author thereof, and I tell them ſo ſtill, &c.

And in his Letter to maſter Briggs *now profeſſor of Geometrie in* Greſham *College, he writeth thus being turned into Engliſh.* I haue written to *M. Wright* in excuſe of my ſelf, I am verie ſorie that he is angrie with me for that cauſe. I pray you learne of him how he is affected towardes me, and write back vnto me, and excuſe me vnto him as much as you can. I would haue publiſhed his whole booke for the common good, if I might haue done it without breach of my faithfull promiſe. And ſurely my conſcience grudged to publiſh euen this little which I haue taken out: but the profit thereof moued me, &c. At *Amſterdam* from the ſigne of the ſick Pope. *The trueth is that at his owne inſtant requeſt, when he wrought here at London, ſome of my friends alſo procured by his flatterie, perſwading me thereto, I was content to let him haue this booke for a fewe dayes to peruſe: he alſo aſſuring me vpon his faith and credit, that he would not publiſh it, or any part thereof without my knowledge and conſent. But how well and honeſtly he hath performed that proteſtation, grounded vpon faith & credit, the world may now ſee: and how thankefull he hath beene to me for that which hath beene ſo profitable and gainfull vnto himſelf, as may appeare by ſo common ſale of his mappes of the world, and of* Europe, Aſia, Africa, *and* America, (*al which had beene yet vnhatched, had he not learned the right way to lay the groundworke of them out of this booke*) *I my ſelf know too well. But let him go as he is.*

Now if any ſhall think it to be beyond a Land-mans skill, to

¶ ¶ ¶ *find*

find faults in matters belonging to the ſea mans art and profeſſion, they muſt know if they be yet to learne, that one that is but reaſonablie acquainted with Geometrical conceits, may as well, if not better then moſt ſea-men, know the nature and properties of the ſpharical forme of the earth and ſea, with all conſequents and dependaunces thereof. By conſideration of which, the true vnderſtanding and reaſon of the nautical plani-ſphære or Sea-chart, may by him that hath beene but meanely conuerſant in Mathematicall meditations be better apprehended, then otherwiſe it can by the ſea-faring man, though he ſpend his whole life in ſailing ouer all the ſeas in the world. The like may be ſaid of the Croſſe ſtaffe, and Compaſſe, and of the regiments or tables of declination of the Sunne and fixed ſtarres, and of all other principall meanes and inſtruments ſeruing for nauigation. But it is ſtraunge to ſee, the difference of things that in this worlde is made by the difference of hands from which they are to be receyued, howſoeuer the things themſelues be. For let Hannibal a Captaine diſcourſe of warlike affaires, be it neuer ſo diſorderly and out of reaſon or ſeaſon, yet all (for ſooth) muſt needs be of great diſcretion and wiſdome becauſe he hath handled that which he ſpeaketh of. But let Phormio a Philoſopher ſpeake of the ſame, at the leaſt in the hearing of Hannibal be his Oration furniſhed & beautified with neuer ſo much reading, learning, iudgement and eloquence, yet muſt he (there is no remedie) be either a foole or a mad man for his hire. So by all likelihoode, the caſe will ſtand with this poore Treatiſe of mine, which if it had come forth vnto publike view, from out of the boſome (as once it was like) of a maiſter at ſea, of great reputed excellencie, it had no doubt then found the fauour, which, like inough now it ſhall want: all winds then would haue ſweetly blowne it into the pleaſanteſt hauen of euery mans (at leaſtwiſe of euery ſea mans) fauourable entertainment. I ſhall therefore with their patience ſet downe the matter as it was, that none may miſtake a trueth, which is daughter, not onely of time, but of occaſion, as hereby may appeare. It is not vnknowne to ſome of good place and reckoning, that one of the skilfulleſt

naniga-

nauigators (as he was by many accounted) of our time and Nation, who died in Sir Frauncis Drakes laſt voyage, when he came to that extremitie of ſickneſſe, that he ſaw there was no other way but one with him, was reported to haue gathered and bound together into a bundell all his nautical notes and obſeruations, and to haue caſt them into the ſea. But ſoone after notwithſtanding that foreſaid report, there came more comfortable newes by a Captaine that was familiarly acquainted and conuerſant with him in that voyage, and during the whole time of his ſickneſſe, in whoſe armes alſo he died: who mouing ſome ſpeach vnto him touching ſomething of ſir Frauncis Drakes that might then after his death be looked for to be brought to light, concerning Nauigation: Tuſh (ſaith he) for that matter there is not much to be looked for at his hands, hee had little skill in that art. Why? and will your ſelf then do any thing? quoth that Captaine. Whereupon this great nauigator drewe forth a booke out of his boſome, and deliuered it vnto this captaine not long before his death. This booke was ſhewed by the ſame Captaine to the R. Honourable the L. high Admirall of England in the Cales voyage, as being made by that famous Nauigator, which his Lordſhip alſo (as it was reported) thought good ſhould be peruſed and publiſhed. Theſe newes moued ſome expectation of that booke: ſo as the right Honourable, and my verie good Lord the Earle of Cumberland, hearing of it, was deſirous alſo to haue a ſight thereof, and remembred me vnto that Captaine, as one not inſufficient to peruſe and correct the ſame. And hereupon the booke was brought vnto his Lordſhip, at the time and place appointed at Weſtminſter, and was there alſo deliuered vnto me, to be peruſed and corrected. Hauing therefor openedit, & beginning a litle to turne ouer the leaues, to take ſome generall view what matter mought be conteyned therein: I firſt eſpied a Diagramme, the like whereof I knewe verie well I had made in a booke of mine. And herewithall I was the more moued to ſee if there were any more that I could know, as well as the former: turning ouer therefor two or three leaues more, I preſently eſpied another Diagramme alſo, where-

 with

with I was as well acquainted, as with the former: for I found not onely the very same Diagramme, but (that which made me the more to maruaile for the present) folowing also in the same order as I well remembred it did in my booke. Being therefor yet more earnestly stirred vp hereat, and wondering what the reason mought be, that we should thus agree, I betooke my self to the reading of that booke. And looking first vpon the first leafe thereof, and afterwardes in many other places, I found it euery where to agree with mine, and to be a copie of the same booke, worde for worde, which I made and presented vnto his Lordship almost seuen yeares before, as the next morning it plainly appeared both to his Lordship and to the captaine himself that brought it, by comparing it in all poynts with the originall exemplar of the same booke, which I then brought vnto his Lordship.

One crime there remaineth which may seeme more iust then the rest, and yet had I almost forgot it: namely, in that I haue had in this treatise no regard of the parallax of the Sunne, both in making and vsing the table of the Sunnes declination. But the refraction of the Sunne making him to appeare higher then he is, may stand aunswerable for it without error easily obseruable at sea. Notwithstanding, I graunt it to be the exactest way (especially on land) to haue consideration both of paralax and refraction: but first there was found by obseruation, certaine rules of this refraction, (whereto leysure and other needfull meanes haue not hitherto serued me) for as good it is to haue consideration of neyther, as of the paralax onely: and no great matter if both be neglected at sea, where (in mine opinion) he quites himselfe as a verie good obseruer, that shall not in obseruing the height of the Sunne, or starres, erre more then twise so much as can arise by neglect of both refraction and paralax togither. But I feare that whilest I labour to satisfie all, I shall offend some, as making too long a Preface to so small a volume, I will therefor hasten to an end, onely shewing the summe of this treatise: which I thought good to offer vnto your view, as a compendious representation of all that followeth, and rather to set it apart by it self, then to include it as I was purposed within this preface, which is beyond his bounds alreadie: and therefore here I will commit the fauourable reader as my self, vnto the protection of the Almightie.

The summe of the Treatise following.

THe Treatise following containeth foure principall parts, whereof the first may be called Hydrographical, wherein are set downe the errors of the common Sea chart with right-lined rumbes and degrees of latitude euery where equall: then the way to auoyd these errors is geometrically demonstrated, and out of this a Table is calculated, and the vse thereof shewed, for the true and easie diuiding of the Meridians in the Chart into tennes of minutes, or sixth parts of degrees of latitude, proportionally increasing towards the Pole. Whereto is adioyned as arising from thence the Table of Rumbes shewing by what points of longitude and latitude each Rumbe is to be drawne from the equinoctiall, till you come within a minute of the pole: with help of which Table, the Rumbes may in any Chart, Mappe, or Globe, much more truely be described, then by those machanicall wayes long since published by Petrus Nonius, *or lately practised by some Globe-makers in England. After this followeth, a most plaine and sensible demonstration of the disagreement of the common Sea-chart, and of the agreement of the Globe with the chart before described, the vse of which chart is shewed in the Chapter next following: where also (the longitudes and latitudes of any two places being giuen) the way is set downe how to find their distance, measured either in the segment of the rumb, or in the arch of the great circle intercepted betweene them both mechanically with ruler and compasse, and mathematically by the doctrine of triangles, whereby it may without much difficultie be conceyued, how nauigation might by Arithmetical calculation onely, be performed without Chart or Globe, onely*

the longitudes and latitudes of places being knowne.

The ſecond principall part of this Treatiſe may be called Magneticall, becauſe it intreateth of the variation of the Compaſſe, ſhewing how the ſame may be found at ſea (the latitude being giuen) by one obſeruation of the Sunnes height and point of the Compaſſe whereupon he is at the ſame inſtant, before or after noone, with help of the Globe or Aſtrolabe. Which way of finding the variation is alſo exemplified with a Table of ſuch obſeruations as I tooke both at ſea and on ſhore, in the voyage of the right Honourable the Earle of Cumberland, in the yeare 1589. And becauſe the Globe and Aſtrolabe are ſuch inſtruments, as euery one cannot eaſily haue at Sea, I haue alſo ſhewed how (by the Sunnes point of the Compaſſe, or Magnetical Azimuth, and altitude giuen by obſeruation) the variation may be found, either mechanically, with ruler and compaſſe, or mathematically by the doctrine of triangles, and arithmeticall calculation.

The third part may be called Geometricall, intreating of the Croſſe ſtaffe, and ſhewing how ſuch errors may be auoyded, as haue beene commonly committed in the vſe thereof, either by reaſon of the paralax, or eccentricitie of the eie, or by the height of the eye aboue the water, or by the paralax of the Sunne.

The fourth and laſt part may be called aſtronomical, wherein my chief intent was to corect the errors that are in the ordinarie Tables of declination of the Sunne, and fixed ſtarres. To which end there is firſt ſet downe a table of the declination of euery minute of the eclipticke in degrees, minutes & ſeconds, calculated for the greateſt obliquitie of the Zodiacke, as it is found by obſeruation in this age 23. deg. 30. min. Whereto is adioyned the vſe thereof for the readie finding of the place of the ſunne by his declination giuen: or contrariwiſe for finding the ſunnes declination, his place being firſt knowne. After this is ſhewed the way and meanes I vſed for exact obſeruation of the ſunnes Meridian altitudes: with a table of thoſe obſeruations, for foure yeares togither, that ſo the more certaintie might be had of the declinations and places, and of the whole courſe and motion

motion of the ſunne: and that by comparing togither ſo many obſeruations, the ſunnes eccentricitie and apogæum might more aſſuredly be knowne. By knowledge whereof, the way was layd open for making the Ephemerides of the ſunne there ſet downe: without which the regiment of the ſunne next folowing (which I may commend as free from error obſeruable at ſea, and ſeldome differing one minute from obſeruation on land, and for which principally all the former paines was ouertaken) could not ſo eaſily haue beene made. Now if any ſhall thinke that moſt of this fourth part going before this regiment, might haue beene omitted, as being impertinent to the vſe of mariners, and exceeding their capacitie: I anſwere, that it was not my purpoſe, neither could I in all places, applie my ſelf to the moſt part of ſeamens capacity: knowing many that would not be content with this regiment alone, but that deſired more to know the root from whence this fruit grew: whoſe deſire I was alſo willing to ſatisfie as I could for the preſent, hauing ſeldome had a more inconuenient ſeaſon for ſuch a purpoſe. Then followeth a table of 32 principall fixed ſtarres about the aquinoctial, that haue beene moſt commonly knowne, and obſerued by ſeamen, with their declinations corected: and another table of as many more of the notableſt ſtarres about the Pole is thereto annexed, with their diſtances from the pole corected alſo, & verified by diligent obſeruation on land. To theſe is added a table of the ſunnes right aſcenſions (reſolued into houres & minutes) for euery day of the yeare, with the vſe therof, for finding at what houre any of thoſe ſtarres commeth to the Meridian at any time of the yeare: that hereby the mariner might know at all times, when they come to the meridian, & ſo the eaſilier learne to know & obſerue them. Laſtly, I thought it not impertinent to adioyne to this treatiſe, that which gaue the firſt occaſion of writing the ſame, that is the right honorable the Earle of Cumberland his voyage to the Azores performed in the yeare 1589. wherein his Lo. tooke the towne and platforme of Fayall. And ſo for further ſatisfaction in euery one of theſe particulars, I referre the friendly reader to the treatiſe it ſelfe now folowing.

Fare well.

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		33	139	238
		33	209	208
		34	238	239
G 1 b	32		87 10	87 16
G 2 a	12		87 5	87 54
G 2 b	26		89 4	89 44
G 3 a	12		150	156
H 1 b	17		84 56	83 56
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		19	87 53	87 55
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		25	44 21	44 38
H 3 a	23		89 1	89 14
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Mm 2 a	10			23 48	23 38
Mm 2 a	12			25 59	25 50
Mm 4 a	20		Col 2	19 21	19 27
Nn 2 a	11		Col 3	18 3	18 34
Nn 2 a	13		Col. 4	19 15	19 13
Nn 2 b	32		Col. 4	22 50	22 49
Nn 2 b	33		Col. 4	22 45	22 43
Nn 3 a	10		Col. 3	22 57	21 57
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FAVLTS
in the common
Sea Chart,

With Rumbes expreſſed by right lines and degrees of latitude, euery where equall.

AS the Sea Chart is one of the eſpeciall Inſtrumentes that Mariners haue for theyr direction in ſailing, ſo there is not any wherein there are ſo great and daungerous errours.

Errour in the proportion of the length & breadth of places in the common ſea charte.

1 For firſt, what places ſoeuer are deſcribed therein, the length of them (from Eaſt to Weſt) hath a greater proportiõ to the bredth (from North to South) than indeede it ought to haue (except it be at the æquinoctiall:) And ſo much the more this errour increaſeth, by howe much the further diſtant thoſe places are from the æquinoctiall: euen as the proportion of the Meridian to the Paralell, increaſeth the more, the nearer you come to either Pole; ſo that at the paralell of 60 degrees latitude, the proportion of the length to the bredth

is twice greater than indeede it should bee; and that becauſe the meridian is double to that paralell, and ſo in all the reſt, the proportion of the length to the breadth ſhall be greater than the trueth, in the ſame proportion, wherewith the meridian exceedeth the paralell.

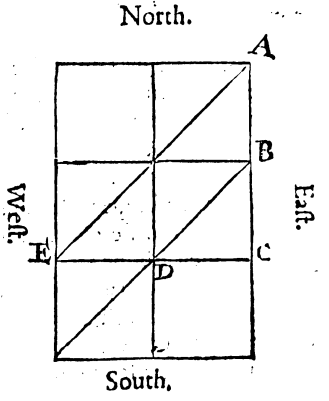
As for example: in the common ſea Chart, the proportion of the length of Frieſland, to the bredth therof, is two-fold greater than in the globe (which ſheweth the true proportion of the length to the breadth) becauſe the meridian is double to the paralell of that Iland. In the Ilands of Groenlant and Groclant, the length to the bredth hath a foure-fold greater proportion in the common Mariners chart, than it hath in the globe; becauſe the meridian is fourefolde greater than the paralell of thoſe places.

Error in finding out the difference of longitude by the common ſea Chart.

2 The way to finde out the difference of longitude, by the common ſea Chart, is true at the æquinoctiall onely, and neare about the ſame may bee vſed without ſenſible errour: becauſe there only the meridian and paralell are equall. But on this ſide or beyond the æquinoctiall there is errour committed proportionally to the difference of the meridian, & paralell, that is, the difference of longitude found out by the Charte hath the ſame proportion to the true difference of longitude, that the paralell hath to the meridian.

As for example: at the paralel of 60 degrees in the common mariners Chart (wherein the degrees of the meridians, and paralels are equall) admit B D be two places bearing each from other ſouthweaſt and northeaſt differing in latitude ſo much as is the arke

arke of the meridian B C, which for example ſake we will ſuppoſe to be one degree, therefore by the ordinarye Chartes the difference of Longitude C D, ſhal be likwiſe one degree: but yet in trueth, becauſe the meridiã is double to that paralel, and conſequently, a degree of the meridian double to a degree of that paralell, therefore B differing a degree in latitude from D



ſhould be placed twice ſo farre from C, that is at A, ſo as A B C may bee all counted but for one degree of the meridian, and ſo bee equall to two degrees of the paralel, whereof ſhoulde followe that E C ſhould be the difference of longitude, that is, two degrees, as the trueth is in the globe, whereas the common Mariners Chart ſheweth the difference of longitude to bee but halfe ſo much. And yet notwithſtanding if you go nearer to the poles, you ſhal erre by their Chart a great deale more, euen as the proportion of the meridian to the paralel increaſeth more and more.

But this errour in ſhewing the difference of longitude, ſhall yet further appeare by this example of *Petrus Nonius*.

In the Mariners Chart, the diſtance betwixt Liſbone and Tercæra, is ſet downe to be 262. Spaniſh leagues (whereof 17 and one halfe make a degree of the Equinoctial or of any of the greateſt Circles) for ſo much the Mariners doe finde that diſtance to be, not onely by eſtimation of the way that the ſhippe maketh, when they ſayle from Eaſt to Weſt to that Iland, but by another account which is much more certaine, and that is this. In ſayling from Liſbone to Madera, they keepe their courſe ſouthweſt, and from this Iland to Tercæra, they ſaile northweſt. Now becauſe Liſbone & Tercæra haue both almoſt the ſame latitude of 39. degrees: and in ſailing frō the northeaſt to ſouthweſt, and likewiſe from ſoutheaſt to northweſt, you alter the longitude as much as the latitude (becauſe that in both thoſe courſes the angle that the way of the ſhip maketh with the meridian, is equall to halfe a right angle: and the Iland of Madera hath almoſt 31. degrees and an halfe of latitude towardes the north, ſo that the difference of the latitudes of Liſbone and Madera, as alſo of Madera and Tercæra is about 7. degrees and ½.) Therefore the difference of the longitudes of Liſbone and Madera, & likewiſe of Madera & Tercera ſhal be 7 & ½ of the ſame degrees of the meridian, both which added together make the whole difference of longitude betwixt Liſbone and Tercæra, to be 15 degrees of the meridian, which are equall to 262, and one halfe Spaniſh leagues. But in the paralel that paſſeth by the 39 degree of latitude, wherein (almoſt) Liſbone and Tercæra are ſituate, there are more degrees in the ſame ſpace, according to that proportion wherewith the meridian is greater than that paralel. Therefore the true difference of longitude betwixt Liſbone and Tercæra, that is, the arke of the paralel or Equinoctiall contained betwixt the meridians of thoſe places ſhall thus be found out.

It is a rule in Geometrie, that the diameters and peripheries, and conſequently the ſemidiameters, and like arkes of circles haue the ſame proportion.

Alſo it is manifeſt that the ſine of the complement of the diſtaunce of any paralell from the Equinoctiall is the ſemidiameter of the ſame paralell.

Now the diſtance of the paralel of Liſbone and Tercæra from the Equinoctiall is about 39 degrees, the complement wherof is 51 degrees: whoſe ſine is 777. which is the ſemidiameter of the foreſaid paralel, in ſuch parts whereof the whole ſine containeth 1000, which is the ſemidiameter of the meridian. Therfore by the rule of proportion inuerſed, if 262. Spaniſh leagues make 15. degrees in the meridian, whoſe ſemidiameter is 1000. parts: then in the paralel whoſe ſemidiameter is 777. of the ſame partes, they ſhal make 19 degrees, & $\frac{333}{777}$ parts of one degree. that is, 18 min. & litle more: which (if it be true that the courſe from Liſbone to Madera is ſouthweſt, & from Madera to Tercæra northweſt: & that the latitude of Madera is 31. deg. 30. min. and the latitude of Liſbone and Tercera 39 deg.) ſhal be the difference of longitude betwixt Liſbone & Tercera. Whereas *Ortelius* & *Mercator* following as it ſeemeth the marine Chartes without correction in their vniuerſall Maps, make them to differ in longitude ſcarce 15. degrees of their paralell, as if it were equall to the Equinoctiall.

Errors in the lying & bearing of places one from another in the common sea Charte.

3 Moreouer, they are deceiued not onely in the ſituation of many places, which the marine Chart ſheweth to be vnder the ſame Meridian: but alſo in the lying, or bearing of other places each from other. For the Meridian is a certaine rule of the poſitions of places. If therefore errour ſhall be committed in the ſituation of the Meridian, there muſt needes be errour in the inclinations of the other rumbes, pointes or lines of the Compaſſe. And therefore not euery inclination, or reſpectiue poſition of place to place, which is ſet down in the marine Chart, is to be taken for true: but that poſition or inclination onely, by which ſome haue ſayled from the one place to the other. This may be ſeene in ſayling to India. For the marine Chart placeth that promontory of Africa, called the promontory of 3. pointes, being in latitude towards the North, 4. degrees and one halfe, and the Ilands of Triſtan acugna (which haue 36. degrees of Southerne latitude, vnder the ſelfe ſame Meridian: Alſo the marine Charte ſheweth the diſtance betweene theſe Ilands and the promontory of Good Hope, to be almoſt 400. leagues: both which notwithſtanding cannot ſtand together. For if all the ſhore frō the promontory of 3. pointes vnto the promontory of Good Hope be rightly deſcribed, and the promontory of 3. pointes alſo lie vnder the ſame Meridian with thoſe Ilands: it muſt needes be that the foreſaid diſtance is much leſſe: But if it be not leſſe, it cannot be that they ſhould haue the ſame Meridian with the promontory of 3. pointes, but muſt needs be more to the Weſtward. Hereof it commeth that

that the Marriners are very oft deceiued, whē they goe from one place to another, following that direction which the ſea Chart ſheweth them. Which place when they find not by that courſe, they think that the cauſe of that errour is either ſome ſwifte current of the Sea, that carrieth them another way: or elſe the declination of the poles of the Loadeſtone, from the true poles of the world: although (perchaunce) they erred onely, for that becauſe they knew not how thoſe places did beare one frō another.

Errour in ſetting of places out of the cōmō ſea Chart into the globe.

4 Neyther are they onely deceiued in that, becauſe they thinke that the ſea Chart can ſhew the ſituations of all places: but alſo becauſe that when they will tranſlate the ſea coaſtes out of the Chart into the Globe, they doe it, hauing reſpecte onely to the numbers of the degrees of longitude and latitude found therein, and no otherwiſe then when they ſet in the fixed ſtarres into a celeſtiall globe. So it commeth to paſſe, that not onely thoſe errours are committed, which doe neceſſarily ariſe out of the common ſea Chatte: but other errours alſo, which might be auoyded, if they firſt turned into degrees, thoſe diſtances of Longitude which they haue truely knowne, and then followed the Longitudes and latitudes of places.

Errour in ſhewing the diſtances of places in the common ſea Charte.

5 In ſhewing the diſtances of places, there is as great errour committed, as in any of the former. For example: If you imagine 2. ſhippes to bee vnder the Equinoctiall 100. leagues aſunder, and that each of them ſhould ſayle from thence due North or South vnder his Meridian, vntill they come to the

the paralell of 60. degrees latitude: they ſhould be there but onely 50. leagues diſtant, becauſe at that paralell the Meridians are diſtant but halfe ſo much one from another, as they were at the Equinoctiall; as it may moſt manifeſtly appeare by the globe: and yet the Charte will ſhewe, that thoſe two ſhippes haue the ſelfe ſame diſtance of 100. leagues, being vnder the 60. paralell, that they had before, beeing vnder the Equinoctiall.

Errour in keeping alwayes the ſame point of the Compaſſe.

6 There is yet another error remaining (though all the former were auoyded) which ariſeth hereof, becauſe that by the direction of the Compaſſe they bend, and turne the ſhippe, in ſuch ſorte, that they conſtraine it alwayes to make the ſame angles with the Meridian. As when they ſayle from Vſhent to to Cape Raſo, both lying vnder the ſame paralel, they guide the ſhippe in ſuch ſorte, that it maketh alwayes right angles with the Meridian, & ſo holding on their courſe due Weſt, they keepe themſelues alwaies vnder the ſame paralell; whereas notwithſtanding, there is a more certaine courſe, whereby they may goe from one place to another, without that loſſe of way, which they muſt needs make that keepe thẽſelues alwaies vnder the ſame paralell.

There is moreouer another commoditie in this kinde of ſailing, that we may finde euery day by a more certaine accompt what way wee haue made, and know in what place we are.

But this way is not to bee defined by any of the leſſer circles, but by a great Circle which is to bee drawne by thoſe two places: and the arke of that great

great Circle conteined betwixte the ſame places is leſſe than the arke of the paralell which lyeth betweene them, as may bee concluded by an euident and neceſſary reaſon out of the principles of Geometrie: much like as a ſtraight line is ſhorter then a crooked, both beeing extended betweene the ſame prickes. Therefore this commoditie is alſo hereunto adioyned, that in ſayling by a great Circle, the way is more ſhort, and compendious. But he that entereth into this courſe of ſayling, muſt knowe, that hee muſt chaunge the pointe of the Compaſſe (whereupon he guideth the ſhippe) not once onely, but very often: and that becauſe of the variable, and inconſtant inequalitie of the angles, which that great Circle maketh with euery new Meridian. Of which angles the inuention indeede (by the Chart eſpecially) is very ſubtile, and conſiſteth herein (to wit) in knowing how much ſuch kinde of angles doe decreaſe, or increaſe as the ſhip goeth forwards. And he that ſo ſhapeth his courſe, goeth the ſtraight & neareſt way. Otherwiſe it cannot be that a man ſhould keepe a ſtraight courſe, if he ſhal continually follow one and the ſame point, or line of the Compaſſe, (except hee ſayle vnder a Meridian, or vnder the Equinoctiall line:) but hee muſt chaunge the poynte of the Compaſſe ſo often as that ſtraight courſe ſhall ſeeme to require.

And therefore it cannot bee by any meanes that the Marriners, when they goe perpetually towards the ſame part of the world, keeping the ſame angle of poſition in reſpect of the Meridian, or the ſame point of the Compaſſe; ſhould goe the ſhorteſt and neareſt way.

This kind of sayling vnder a great Circle, is of especiall vse in our northerne Nauigations, for the discouery of the northeast or northwest passage: which as it may most easily be performed by help of an hydrographicall globe, with the helisphæricall lines drawne thereupon: so for thē, that list not be troubled with the cumbersom carriage & charge of the globe, it may be done (in a manner) with no lesse facilitie by a nauticall planisphære, made after the proiection of *Gemma Frisius* his astrolabe, wherof more hereafter when God shal giue leisure.

The expressing of the rumbes by right lines defended: which some hold for erroneous.

There be some also that hold it for erroneous, that the rumbes in the mariners Chart shoulde bee expressed by right lines, and consequently that the meridians shoulde bee parallelles, or equidistant euery where; which because it is but barely affirmed, and the contrary may bee prooued, as well as that each rumbe except the rumbe of North and South, maketh equall angles with euery meridian: we hold it not onely as true, but also as most meete and commodious for the Mariners common vse, that the meridians in the sea Chart should be euery where equidistant each from other, and consequently that the rumbes should be straight lines for these causes.

First because the rumbes or pointes of the Compasse may so most easily bee drawne in the nauticall Planisphære, onely by a streight ruler. For seeing that any one and the same rumbe (sauing onely the rumbe of North and South, which is all one with the Meridian) maketh alway es equall angles with euery meridian, without either sensible, numerable, or mensurable, though not without intelligible error

rour (for indeede those angles are lesse and lesse as they come nearer to the pole, much like as the angle of a little semicircle is lesse then the angle of a greater semicircle) all the rumbes must needs be streight lines: if the meridians be æquidistant and right lines by the 27 and 28. prop. 1 *Euclid.*

Secondly the respectiue situation of any place to other in the Chart (which they commonly call the lying or bearing of one place from another according to the pointes of the Compasse) may most easily be knowne by the nauticall Planisphære with right lined rumbes and equidistant meridians. For that rumbe from which both places are æquidistant sheweth howe those two places lye or beare one frō another.

And for these two causes of so great facilitie, both in the making, & vsing of the mariners Chart with æquidistant meridians, & streight-lined rumbes, it ought to be preferred before any other instrument heretofore published to that ende for the common vse of the mariner, at sea especially. And though the globe be commended by some as most absolute & perfect for all courses & climates whatsoeuer: yet for the chargeablenes thereof, troublesome cartiage, stowage and tedious vsage for the most part in nauigation, following any other course saue East or West, North or South: it will for the most part be found vnmeete and combersome, and nothing so fit and ready for the mariners common vse at sea as the nauticall planisphære truely made.

How the former errors may be auoyded.

Chap. II.

THeſe errors notwithſtanding they haue beene much complained of by diuerſe, as namely by *Martine Corteſe* in his third booke, and ſecond chapter of the Arte of Nauigation, but ſpecially by *Petrus Nonius* in his ſecond booke of Geometricall obſeruations, rules, and inſtruments : And although *Gerardus Mercator* in his vniuerſall Mappe of the worlde ſeemeth to correct them, by making the diſtances of the paralels greater and greater towardes the poles: yet none of them teacheth any certaine way how to amend ſuch groſſe faults, whereby the poore Mariner may be deceiued many times an whole point of the Compaſſe, yea ſometimes two or three poynts and more, in iudging by his ordinary Chart howe one place beareth from another: eſpecially if he ſaile farre northwards, or ſouthwards, whereby we may eaſily gheſſe, how indirect a courſe he ſhall make to come to the deſired hauen, that ſhall follow ſo falſe and erroneous direction with great danger (at the leaſt) many times to looſe ſhippe, goodes, liues and all.

The fountaine of all the errours aforeſaide (the laſt onely excepted) is in the very foundation and groundworke of the Mariners Charte, that is, in the firſt Geometricall lineaments thereof: namely, becauſe

cauſe the meridians are not rightly diuided, (the diuiſions being euery where equall:) nor the paralells rightly drawne (hauing in al places the ſame diſtances eache from other that the meridians haue at the Equinoctiall:) Whereas the ſpaces betwixt the paralels ſhuld increaſe more and more as you go from the Equinoctiall towards either of the poles, which *Martin Corteſe* alſo noteth in his 3 booke & 2 chapter of the Art of Nauigation. But he omitteth that wherein all the difficultie lieth, that is, how much, or in what proportion thoſe ſpaces ſhould increaſe. Which, that it may the better be perceiued, I thinke it not vnmeete firſt to ſhew by what kinde of proiection (or extenſion rather) the nautical planiſphere may not vnfitly be conceiued to bee geometrically made after this maner.

Suppoſe a ſphericall ſuperficies with meridians, paralels, rumbes, and the whole hydrographicall deſcription drawne thereupon to bee inſcribed into a concaue cylinder, their axes agreeing in one.

Let this ſphericall ſuperficies fwel like a bladder, (whiles it is in blowing) equally alwayes in euerie part thereof (that is as much in longitude as in latitude) till it apply, and ioyne it ſelfe (round about, and all alongſt alſo towardes either pole) vnto the concaue ſuperficies of the cylinder: each paralel vpon this ſphericall ſuperficies increaſing ſucceſsiuely from the equinoctiall towardes eyther pole, vntil it come to bee of equall diameter with the cylinder, and conſequently the meridians ſtil widening themſelues, til they come to be ſo far diſtant euery where eech from other as they are at the Equinoctiall, Thus

it may moſt eaſily be vnderſtoode, how a ſpherical ſuperficies may (by extenſion) be made a cylindrical, and conſequently a plaine paralellelogram ſuperficies; becauſe the ſuperficies of a cylinder is nothing elſe but a plaine parallelogramme wownd about two equall æquidiſtant circles that haue one common axtree perpendicular vpon the centers of them both, and the peripheries of each of them equall to the length of the parallelogramme as the diſtance betwixt thoſe circles, or height of the cylinder is equall to the breadth thereof. So as the nauticall planiſphere may be defined to be nothing elſe but a parallelogramme made of the ſpharicall ſuperficies of an Hydrographicall globe inſcribed into a concaue cylinder, both their axes concurring in one; & the ſphæricall ſuperficies ſwelling in euery part equally in longitude and latitude, til euery one of the paralels therupon be inſcribed into the cylinder (each paralel growing as gret as the equinoctial:) or til the whole ſpherical ſuperficies, touch and apply it ſelfe euery where to the concauitie of the cylinder.

The definition of the nauticall planiſphære.

In this nautical planiſphere thus conceiued to be made, al places muſt needes bee ſituate in the ſame longitudes, latitudes, and directions or courſes, and vpon the ſame meridians, paralels and rumbes that they were in the globe, becauſe that at euery poynt betweene the Equinoctial and the pole, wee vnderſtand the ſphærical ſuperficies whereof this planiſphære is conceiued to be made, to ſwel equally as much in longitude as in latitude (til it ioyne it ſelfe vnto the concauitie of the cylinder, ſo as heereby no part thereof is any way diſtorted or diſplaced out of his

his true and natural ſituation vpon his meridian, paralel, or rumbe, but only dilated & enlarged the meridians, alſo paralels, and rumbs dilating and enlarging themſelues likewiſe, at euery point of latitude in the ſame proportion.

Now then let vs diligently conſider of the Geometricall lineaments, that is, the meridians, rumbs, and paralels of this imaginary nauticall planiſphere, that we may in like maner expreſſe the ſame in the mariners Chart. For ſo vndoubtedly we ſhall haue herein a true hydrographicall deſcription of al places, in their longitudes, latitudes, and directions, or reſpectiue ſituations each from other according to the points of the Compaſſe in all things correſpondent to the globe, without eyther ſenſible, or explicable errour.

Firſt therefore in this planiſphere, becauſe the paralels are euery where equall ech to other (for euery one of them is equal to the Equinoctial or circumferēce of the circumſcribing cylinder) the meridians alſo muſt needs be paralel & ſtraight lines: & conſequently the rumbs (making equal angles with euery meridian) muſt likewiſe be ſtreight lines. 27. Prop 1. Euclid 17.

Secondly, bicauſe the ſpherical ſuperficies whereof this planiſphere is conceiued to be made, ſwelleth in euery part thereof equally, that is, as much in latitude, as in longitude, til it apply it ſelfe round about, to the concauitie of the cylinder: therefore at euerie point of latitude in this planiſphere, a part of the meridian, kepeth the ſame proportion to the like part of the paralel, that the like parts of the meridian, and paralell haue each to other in the globe, without explicable error.

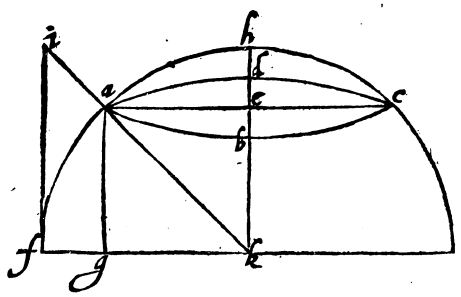
Now

A correction of Errors

Nowe becauſe like partes of wholes keepe the ſame proportion that their wholes haue, therefore the like partes of any paralell, and meridian of the globe haue the ſame proportion that the ſame paralell and meridian haue.

For example ſake, as the meridian is double to the paralell of 60. degrees, ſo a degree of the meridian is double to a degree of that paralell, or a minute to a minute &c. and what proportion the paralell hath to the meridian, the ſame proportion haue their diameters and ſemidiameters each to other. *Papp. l.5.11.& 26.18.c.2.e.15. Rami.*

But the ſine of the complement of the paralels latitude, or diſtance from the equinoctiall, is the ſemidiameter of the paralell.



As here you ſee, *a e* the ſine of *a h* the complement of *a f* the latitude or diſtance of the paralell *a b c d*, from the Equinoctiall, is the ſemidiameter of the ſame paralell *a b c d*.

And as the ſemidiameter of the meridian (or the whole

in the Sea Chart.

whole ſine) is to the ſemidiameter of the parallel, ſo is the Secans, or Hypoteneſa of the parallels latitude (or of the parallels diſtance from the æquinoctiall) to the ſemidiameter of the meridian, or to the whole ſine; as *f k* (that is) *a k*, to *a c* (that is) *g k*; ſo is *i k*, to *k f*.

Therefor in his nauticall planiſphære, the ſemidiameter of each parallel being æquall to the ſemidiameter of the æquinoctiall (that is) to the whole ſine; the parts of the meridian at euery poynt of latitude muſt needs increaſe with the ſame proportion wherewith the Secantes or hypoteniuſæ of the arke, intercepted betweene thoſe pointes of latitude and the æquinoctiall do increaſe.

Now then wee haue an eaſie way layde open for the making of a table (by help of the Canon of Triangles) whereby the meridians of the Mariners Chart may moſt eaſily and truely be diuided into parts, in due proportion from the æquinoctiall towards either pole.

For (ſuppoſing each diſtance of each poynt of latitude, or of each parallel from other, to containe ſo many parts as the Secans of the latitude of each poynt or parallel containeth) by perpetuall addition of the Secantes anſwerable to the latitudes of each point or parellel vnto the ſumme compounded of all the former ſecantes, beginning with the ſecans of the firſt parallels latitude, and thereto adding the ſecans of the ſecond parallels latitude, and to the ſumme of both theſe adioyning the ſecans of the third parallels latitude, & ſo forth in all the reſt, we may make a table which ſhall ſhew the ſections and

points of latitude in the meridians of the nautical planiſphere: by which ſections, the parallels are to be drawne.

As in the table following, we make the diſtance of each parallel from other, to be one minute: and wee ſuppoſe the ſpace betweene any two parellels each next to other in the planiſphære to containe ſo many parts as the ſecans anſwerable to the diſtance of the furtheſt of thoſe parallels frō the æquinoctial: and ſo by perpetuall addition of the ſecans of each minute to the ſumme compounded of all the former ſecantes I make the whole table. As for example, the ſecans of one minute is 10, 000, 000. which alſo ſheweth the ſection of one minute of the miridian from the æquinoctiall in the nauticall planiſphære. Whereunto adde the ſecans of 2. minutes, that is 10,000,002, the ſūme is 20,000,002. which ſheweth the ſection of the ſecond minute of the meridian from the æquinoctial in the planiſphære: to this ſumme adde the ſecans of 3. minutes, which is 10,000,004, the ſumme will be 30, 000, 006. which ſheweth the ſection of the third min. of the meridian from the æquinoctial: and ſo forth in all the reſt: ſauing that in this table wee haue of purpoſe omitted in euery ſecans the 3 firſt ciphers next the right hand: not onely for the eaſier, but alſo for the truer making of the table, becauſe that indeede at euery poynt of latitude, a min. of the meridian in this nauticall planiſphære, hath ſomewhat leſſe proportion to a minute of the parallel adioyning towardes the æquinoctial, then the ſecans of that parallels latitude hath to the whole ſine. But in this

this table it was thought ſufficient to vſe ſuch exactneſſe as that thereby (in drawing the lineaments of the nauticall planiſphere) ſenſible errour might be auoyded. He that liſteth to be more preciſe may make the like table to decades or tennes of ſeconds out of *Ioachimus Rhæticus* his *Canon magnus triangulorum*. Notwithſtanding the Geometrician that deſireth exact trueth, cannot be ſo ſatisfied neither, for whoſe ſake and further ſatisfaction, I thought it not vnmeete to adioyne alſo this Geometricall conceit of diuiding a meridian of the nauticall planiſphere.

Let the æquinoctiall and a meridian be drawne vpon a Globe: Let the meridian (diuided into degrees, minutes, ſeconds, &c.) roule vpon a ſtreight line beginning at the æquinoctial, the Globe ſwelling in ſuch ſort as the ſemidiameter thereof may be alwayes equall to the ſecans of the angle, or arch conteined betweene the equinoctial and ſemidiameter inſiſting at right angles vpon the foreſayde ſtreight line: The degrees min. ſec. &c. of the meridiā noted in the ſtreight line as they come to touch the ſame, are the diuiſions of the meridian in the nauticall planiſphere. And this conceit of diuiding the meridian of the nauticall planiſphere may ſatisfie the curious exactneſſe of the Geometrician: but for mechanicall vſe, the table before mencioned which hereafter followeth may ſuffice.

A correction of Errors.

Till the Printer had thus farre proceeded, I was purposed to haue published the whole Table before mencioned, in such sort as I had made it, (supposing a Meridian of the nauticall Planisphære to be diuided, beginning at the æquinoctial) into such parts whereof a minute of the æquinoctial containeth 10. 000. and setting downe by which of these parts euerie minute of latitude is to be drawne, till you come within a minute of the Pole.

But vpon further aduice it was thought more meet to abridge the same as followeth, to euery tenth minute, & to cut off throughout the Table the three first figures towards the right hand, meaning not at this time to trouble thee with more then mought be of vse, for the true diuiding of the Meridian in the Sea Chart into degrees, and sixt parts of a degree, without sensible error which may be sufficient for the greatest sort of Sea Charts or Maps, that hitherto haue beene commonly vsed.

This Table is diuided into two columnes, whereof the first containeth degrees, and tennes of minutes, of the Meridian of the nauticall planisphare, beginning at the æquinoctial. The second columne containeth æqual parts of the same Meridian, beginning likewise to be numbred from the æquinoctial: (of which parts euery minute of the æquinoctial is vnderstode to containe 10.) and sheweth how many of these parts are answerable to any degree or Decade of minutes of latitude, in the nauticall Planisphære or Sea Chart.

The vse hereof followeth after the Table.

A Table for the true diuiding

1 Col.		2 Col.
De	Mi	
0	10	100
0	20	200
0	30	300
0	40	400
0	50	500
1	0	600
1	10	700
1	20	800
1	30	900
1	40	1000
1	50	1100
2	0	1200
2	10	1300
2	20	1400
2	30	1500
2	40	1601
2	50	1701
3	0	1801
3	10	1901
3	20	2001
3	30	2101
3	40	2201
3	50	2302
4	0	2402
4	10	2502
4	20	2602
4	30	2703
4	40	2803
4	50	2903
5	0	3004

1. Col.		2. Col.
De	Mi	
5	10	3104
5	20	3205
5	30	3305
5	40	3405
5	50	3506
6	0	3606
6	10	3707
6	20	3808
6	30	3908
6	40	4009
6	50	4110
7	0	4210
7	10	4311
7	20	4412
7	30	4513
7	40	4614
7	50	4715
8	0	4815
8	10	4916
8	20	5018
8	30	5119
8	40	5220
8	50	5321
9	0	5422
9	10	5523
9	20	5625
9	30	5726
9	40	5827
9	50	5929
10	0	6030

1 Col.		2 Col.
De	Mi	
10	10	6132
10	20	6234
10	30	6335
10	40	6437
10	50	6539
11	0	6641
11	10	6743
11	20	6845
11	30	6947
11	40	7049
11	50	7151
12	0	7253
12	10	7355
12	20	7458
12	30	7560
12	40	7662
12	50	7765
13	0	7868
13	10	7970
13	20	8073
13	30	8176
13	40	8279
13	50	8382
14	0	8485
14	10	8588
14	20	8691
14	30	8794
14	40	8897
14	50	9001
15	0	9104

of the meridians in the sea Chart.

1. Col. De	Mi	2. Col.
15	10	9208
15	20	9312
15	30	9415
15	40	9519
15	50	9623
16	0	9727
16	10	9831
16	20	9935
16	30	10039
16	40	10144
16	50	10248
17	0	10353
17	10	10457
17	20	10562
17	30	10667
17	40	10772
17	50	10877
18	0	10982
18	10	11087
18	20	11192
18	30	11298
18	40	11403
18	50	11509
19	0	11615
19	10	11720
19	20	11826
19	30	11932
19	40	12038
19	50	12145
20	0	12251

1. Col. De	Mi	2 Col
20	10	12358
20	20	12464
20	30	12571
20	40	12678
20	50	12785
21	0	12892
21	10	12999
21	20	13105
21	30	13213
21	40	13321
21	50	23429
22	0	13537
22	10	13645
22	20	13753
22	30	13861
22	40	13969
22	50	14078
23	0	14186
23	10	14295
23	20	14404
23	30	14513
23	40	14622
23	50	14731
24	0	14840
24	10	14950
24	20	15060
24	30	15170
24	40	15280
24	50	15390
25	0	15500

1 Col De	Mi	2. Col.
25	10	15610
25	20	15721
25	30	15832
25	40	15942
25	50	16053
26	0	16165
26	10	16276
26	20	16388
26	30	16499
26	40	16611
26	50	16723
27	0	16835
27	10	16947
27	20	17060
27	30	17173
27	40	17285
27	50	17398
28	0	17512
28	10	17625
28	20	17738
28	30	17852
28	40	17966
28	50	18080
29	0	18194
29	10	18309
29	20	18423
29	30	18538
29	40	18653
29	50	18768
30	0	18884

A table for the true diuiding

1. Col. De	Mi	2 Col.
30	10	18999
30	20	19115
30	30	19231
30	40	19347
30	50	19464
31	0	19580
31	10	19697
31	20	19814
31	30	19931
31	40	20048
31	50	20166
32	0	20284
32	10	20402
32	20	20520
32	30	20639
32	40	20757
32	50	20876
33	0	20995
33	10	21115
33	20	21234
33	30	21354
33	40	21474
33	50	21594
34	0	21715
34	10	21836
34	20	21957
34	30	22078
34	40	22199
34	50	22321
35	0	22443

1 Coll. De	Mi	2 Col.
35	10	22565
35	20	22688
35	30	22811
35	40	22934
35	50	23057
36	0	23180
36	10	23304
36	20	23428
36	30	23552
36	40	23677
36	50	23802
37	0	23927
37	10	24052
37	20	24178
37	30	24304
37	40	24430
37	50	24556
38	0	24683
38	10	24810
38	20	24938
38	30	25065
38	40	25193
38	50	25321
39	0	25450
39	10	25579
39	20	25708
39	30	25837
39	40	25967
39	50	26097
40	0	26228

1 Col. De	Mi	2 Col.
40	10	26358
40	20	26489
40	30	26621
40	40	26752
40	50	26884
41	0	27017
41	10	27149
41	20	27282
41	30	27416
41	40	27549
41	50	27683
42	0	27818
42	10	27953
42	20	28088
42	30	28223
42	40	28359
42	50	28495
43	0	28632
43	10	28769
43	20	28906
43	30	29044
43	40	29182
43	50	29320
44	0	29459
44	10	29598
44	20	29738
44	30	29878
44	40	30018
44	50	30159
45	0	30300

of the meridians in the sea Chart.

1 Col.		2 Col.
De	Mi	
45	10	30442
45	20	30584
45	30	30726
45	40	30869
45	50	31013
46	0	31156
46	10	31301
46	20	31445
46	30	31590
46	40	31736
46	50	31882
47	0	32028
47	10	32175
47	20	32322
47	30	32470
47	40	32618
47	50	32767
48	0	32916
48	10	33066
48	20	33216
48	30	33367
48	40	33518
48	50	33670
49	0	33822
49	10	33975
49	20	34128
49	30	34282
49	40	34436
49	50	34591
50	0	34746

1 Col.		2 Col.
De	Mi	
50	10	34902
50	20	35058
50	30	35215
50	40	35373
50	50	35531
51	0	35690
51	10	35849
51	20	36009
51	30	36169
51	40	36330
51	50	36491
52	0	36654
52	10	36816
52	20	36980
52	30	37144
52	40	37308
52	50	37473
53	0	37639
53	10	37806
53	20	37973
53	30	38141
53	40	38309
53	50	38478
54	0	38648
54	10	38819
54	20	38990
54	30	39162
54	40	39334
54	50	39506
55	0	39682

1. Col.		2 Col.
De	Mi	
55	10	39857
55	20	40032
55	30	40208
55	40	40385
55	50	40563
56	0	40741
56	10	40921
56	20	41101
56	30	41282
56	40	41463
56	50	41646
57	0	41829
57	10	42013
57	20	42198
57	30	42384
57	40	42570
57	50	42758
58	0	42946
58	10	43135
58	20	43325
58	30	43516
58	40	43708
58	50	43901
59	0	44095
59	10	44289
59	20	44485
59	30	44681
59	40	44879
59	50	45078
60	0	45277

A table for the true diuiding

1 Col.		2 Col.
De	Mi	
60	10	45478
60	20	45679
60	30	45882
60	40	46085
60	50	46290
61	0	46496
61	10	46703
61	20	46911
61	30	47120
61	40	47330
61	50	47541
62	0	47754
62	10	47967
62	20	48182
62	30	48398
62	40	48616
62	50	48834
63	0	49054
63	10	49275
63	20	49497
63	30	49720
63	40	49945
63	50	50171
64	0	50399
64	10	50628
64	20	50858
64	30	51090
64	40	51323
64	50	51557
65	0	51793

1 Coll.		2 Col.
De	Mi	
65	10	52030
65	20	52269
65	30	52510
65	40	52752
65	50	52995
66	0	53241
66	10	53487
66	20	53736
66	30	53986
66	40	54237
66	50	54491
67	0	54746
67	10	55003
67	20	55262
67	30	55522
67	40	55784
67	50	56049
68	0	56315
68	10	56583
68	20	56853
68	30	57124
68	40	57398
68	50	57674
69	0	57953
69	10	58233
69	20	58515
69	30	58800
69	40	59086
69	50	59375
70	0	59667

1 Col.		2 Col.
De	Mi	
70	10	59960
70	20	60257
70	30	60555
70	40	60856
70	50	61159
71	0	61465
71	10	61774
71	20	62085
71	30	62399
71	40	62716
71	50	63035
72	0	63357
72	10	63682
72	20	64011
72	30	64342
72	40	64676
72	50	65014
73	0	65354
73	10	65698
73	20	66045
73	30	66396
73	40	66750
73	50	67107
74	0	67468
74	10	67833
74	20	68202
74	30	68574
74	40	68950
74	50	69331
75	0	69715

of the meridians in the ſea Chart.

1 Col.		2 Col.
De	Mi	
75	10	70104
75	20	70497
75	30	70894
75	40	71296
75	50	71703
76	0	72114
76	10	72530
76	20	72951
76	30	73377
76	40	73808
76	50	74245
77	0	74687
77	10	75134
77	20	75588
77	30	76047
77	40	76512
77	50	76984
78	0	77462
78	10	77947
78	20	78438
78	30	78937
78	40	79442
78	50	79955
79	0	80476
79	10	81004
79	20	81541
79	30	82085
79	40	82639
79	50	83201
80	0	83773

1 Col.		2 Col.
De	Mi	
80	10	84354
80	20	84945
80	30	85546
80	40	86158
80	50	86781
81	0	87415
81	10	88061
81	20	88719
81	30	89389
81	40	90073
81	50	90771
82	0	91483
82	10	92210
82	20	92952
82	30	93711
82	40	94486
82	50	95280
83	0	96091
83	10	96923
83	20	97775
83	30	98648
83	40	99544
83	50	100464
84	0	101409
84	10	102380
84	20	103380
84	30	104409
84	40	105471
84	50	106565
85	0	107696

1. Col.		2 Col.
De	Mi	
85	10	108865
85	20	110075
85	30	111328
85	40	112630
85	50	113982
86	0	115389
86	10	116856
86	20	118389
86	30	119993
86	40	121675
86	50	123444
87	0	125209
87	10	127180
87	20	129272
87	30	131498
87	40	133879
87	50	136437
88	0	139200
88	10	142205
88	20	145497
88	30	149139
88	40	153213
88	50	157834
89	0	163176
89	10	169501
89	20	177259
89	30	187284
89	40	201513
89	50	226223
90	0	*Infinite.*

The vſe of the former Table.

THe vſe of this table for making the ſea Chart, is this: ouerthwart the midſt of the plaine ſuperficies, whereuppon you will draw the lineaments of the Chart, deſcribe a right line, (repreſenting the equinoctiall circle) which you ſhall diuide into 360 parts or degrees, and croſſe the ſame ſquirewiſe with right lines, by euery fift or tenth degree. Then take with your compaſſes the length of half the equinoctiall, (that is, 180 degrees) and ſetting one foote of your compaſſes in the mutuall interſection of the equinoctiall, with the perpendicular or meridian that paſſeth by either end of the equinoctiall, with the other foote make a pricke in the ſame perpendicular or meridian: the ſpace contained betwixt this pricke and the equinoctial, diuide firſt into three equall parts, and euerie one of theſe into other three, ſo haue you nine in all: and again euery one of theſe into three, ſo haue you 27 parts, and euerie one of theſe parts diuide into foure, ſo haue you 108 parts: And againe (if there bee ſpace inough) diuide euerie one of theſe into 10 or 100. ſo ſhall you haue 1080, or 10800 parts. Then note euerie fift and tenth part with blacke lead, and ſet figures at them, beginning at the equinoctiall, and from thence proceeding northwardes and ſouthwardes. Then looke what numbers ſtand ouer againſt each degree in this Table (omitting alwaies one or two of the firſt figures towardes the right hand) and at the ſame numbers of parts in the perpendiculars, make prickes on either ſide the equinoctiall: by which (pricks) draw right lines equidiſtant from the equinoctiall, for they ſhall be the

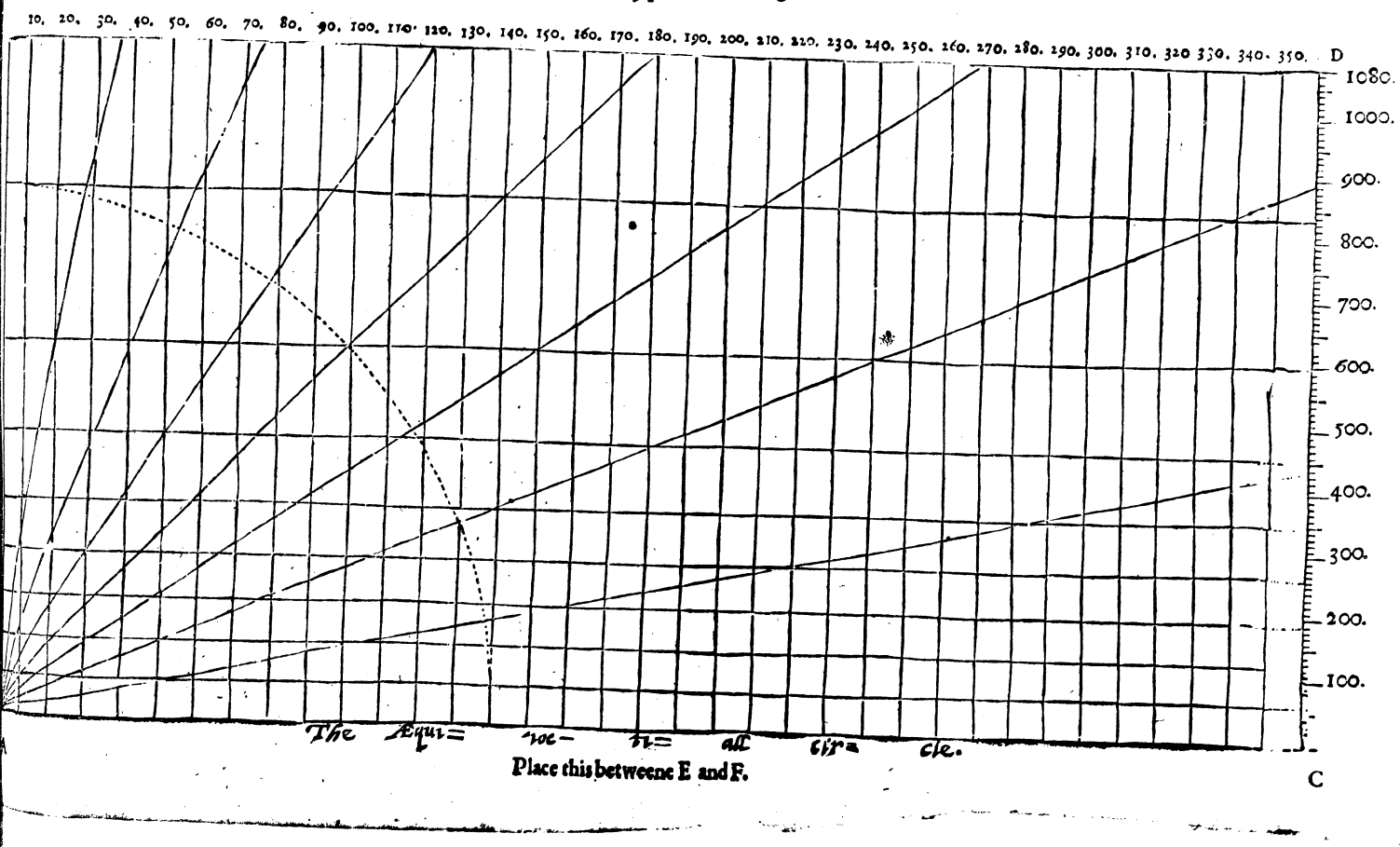
parallels

parallels of the nauticall Planiſphære.

Notwithſtanding theſe parallels are all of them a little further diſtant from the æquinoctiall then in trueth they ſhould be: and ſo much the more the further they are from the equinoctiall. Which error might be ſomething the leſſe, if the former Table had beene firſt made to ſmaller partes then minutes. But that were a matter more curious then neceſſarie, the table here before ſet downe being ſo neare the trueth, that it is not poſsible by any rules or inſtruments of nauigation, to diſcouer any ſenſible error in the ſea Chart, ſo farre foorth as it ſhall be made according thereto.

The figure following containeth onely one part of the nauticall Planiſphære, from the equinoctiall northwardes, becauſe the other part from the equinoctiall ſouthwardes is altogether like to this. Herein firſt drawe the æquinoctiall A C. and diuide it into 360 degrees, drawing perpendiculars from euerie tenth degree thereof, which ſhal be the meridians euerie where equidiſtant each from other. Then take halfe the length of the equinoctiall with your compaſſes, and ſetting one foote in the ende of the equinoctiall at C with the other foote make a pricke at D. in the perpendicular or meridian C D. The ſpace contained betwixt C and D. diuided into 1080 partes, in ſuch ſort as before hath beene ſhewed, and ſet figures to them, as heere you ſee, that you may the more readily number thoſe parts. Then looke in the former table what number anſwereth to euerie tenth degree, and (caſting away

The draught of the Meridians, Parallels, and Rumbes of the nautical Plani-sphære truely made.



away two of the firſt figures next the right hande) finde out the parts anſwerable to the numbers remaining in the line C D. and at thoſe parts make prickes, by which you ſhall drawe the parallels.

As for example: in the table, the number ouer-againſt 10 degrees, is 60 (caſting away the two firſt figures towardes the right hande) therefore I looke 60 in the line C D. and by that part I drawe the parallel of 10 degrees diſtance from the æquinoctiall. And after this manner I draw all the reſt, as you may ſee in the former draught.

Now becauſe the nauticall Planiſphære (as before hath been ſhewed) is nothing elſe but a plaine parallelogramme ſuperficies made by extenſion of a ſphæricall ſuperficies inſcribed into a concaue cylinder, wherein the rumbes, or lines of the Compaſſe make æquall angles with euerie meridian: therefore in this nauticall planiſphære if a circle be drawne and diuided into 32. equall partes, beginning at the meridian paſsing by the centre of that circle: right lines drawne from the centre by thoſe diuiſions ſhall bee the rumbes or lines which the ſhippe deſcribeth in ſayling vpon thoſe poynts, becauſe they make equal angles with euery meridian of the nautical planiſphære, thoſe meridians being euery where æquidiſtant one from an other. Example hereof you haue in the former figure.

By help of this planiſphære with the meridians, rumbes, and parallels thus deſcribed therein, the rumbs may much more eaſily & truly be drawn in the globe then by theſe mæchanical wayes which *Petrus Nonius* teacheth *cap. 26 lib. 2. de obſer. Reg.*

Inſtr. Geom. Heereby alſo they may with no leſſe facility be inſcribed into any other Chart or mappe of what forme or proiection ſo euer, if it be firſt diuided by degrees meridians and parallels into degrees of longitude and latitude: For, by what poynts of longitude and latitude in this planiſphære the rumbes are deſcribed, by the ſame poyntes muſt they be drawen in the globe, or in any other Chart or mappe whatſoeuer. Notwithſtanding this may much more exactly bee performed by the table of rumbes following, which I haue made for that purpoſe, ſhewing for euery degree of longitude, by what degree and minute of latitude euery rumbe is to be drawen til you come within a minute of the pole.

This Table of rumbes is moſt eaſily made by addition only with helpe of the table before mentioned ſhewing (for euery minute from the æquinoctiall to the pole wanting onely but 1. min. next the pole) how the meridians or degrees of latitude in the nauticall planiſphere are to be diuided, after this manner: multiplie the *Tangens* of the angle that the rumb maketh with the æquinoctial by 60 (becauſe euery degree of the æquinoctiall in that table is vnderſtood to containe 60 times 10000 parts, each min. conteining (by ſuppoſition) 10000 partes:) the product ſhall be the firſt number at the beginning of each table of each rumbe, to bee ſet ouer againſt one degree of longitude, and all the reſt are found by perpetuall addition of this number, firſt to it ſelfe (for the ſumme is the number anſwerable to two degrees of longitude) then to

to this ſumme; (the product is the number that anſwereth to 3 degrees of longitude) and ſo forth in all the reſt. Theſe numbers being found out in the table before mentioned, did ſhew at what minute of latitude each rumbe ſhould croſſe the meridian for euery degree of longitude. But theſe numbers were not thought needfull to bee expreſſed in the table folowing, becauſe they ſerue only for the finding out of the degrees and minutes of latitude (by which the rumbes muſt be drawne) which being once found, theſe numbers ſerue to no further vſe.

The ſpeciall vſe of this table is for the true drawing of the rumbes in the globe and the Chart, which ſome call paradoxal: but to ſpeake plaine engliſh, it is nothing elſe but a Chart, whoſe center is the pole, and may beſt be made after the kind of proiection vſed by *Gemma Friſius* in his Aſtrolabe: wherein the meridians will be right lines paſsing by the center, and the parallels peripheries of a circle: ſuppoſing one halfe of the ſphæricall ſuperficies of the terreſtriall globe to be proiected into the plaine of the æquinoctiall. Whoſe principall vſe may be in our northerly nauigatiõs & diſcoueries, wherein the drawing of the rumbes may moſt eaſily and exactly enough be performed by helpe of this table following thus: hauing an Index hanged vpon the center and graduated with degrees of latitude, with figures ſet to euery fifth or tenth beginning at the æquinoctial: hauing alſo diuided the æquinoctiall into degrees of longitude, beginning at the firſt meridian, laye the In-

A correction of Errors

dex to euery degree of longitude in order one after another, looking alwaies withall in this Table the latitudes of the rumbe you desire to describe, and at the same latitudes found in the fiducial line of the index, make pricks in the Chart, for by these prickes the helisphæricall line or rumbe desired must be drawne.

After the same maner altogither must you work with the Globe, hauing first truely hanged it vpon his poles within the meridian diuided into degrees, and subdiuided also into smaller parts (if roume will serue) with numbers set to euery fifth, or tenth degree from the æquinoctiall to the Pole, and then proceeding in all poynts as before, with the Chart, onely vsing the Meridian in steede of the index.

Hereby also the rumbes may most exactly bee described in those distorted hart-formed maps of *Orontius* and *Hopelius*, in any other forme amongst *Ptolome*, and *Ortelius* his Geographical Tables, or any else whatsoeuer; so it be first distinguished by meridians and parallels, shewing the longitude and latitude of any poynt assigned therein: seeing it may easily be knowne out of this Table by what poynts of longitude and latitude each rumbe must passe from the æquinoctiall to the Pole almost. But those two kinds of proiection before mentioned, I meane of the nauticall Planisphere, and *Gemma Frisius* his Astrolabe are such as of al others do best represent in a plaine the true formes of all places that are vpon the Spheericall face of the earth.

The first rumbe from the Equinoctiall.

The rumbe of { *East and by North, East and by South: West and by North, West and by South.*

Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.
Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.
1	0 11	31	6 9	61	12 2	91	17 48	121	23 25	151	29 44
2	0 23	32	6 21	62	12 14	92	17 59	122	23 34	152	29 55
3	0 35	33	6 33	63	12 25	93	18 11	123	23 45	153	29 5
4	0 47	34	6 44	64	12 37	94	18 22	124	23 56	154	29 16
5	1 0	35	6 56	65	12 49	95	18 33	125	24 7	155	29 26
6	1 12	36	7 8	66	13 0	96	18 45	126	24 18	156	29 36
7	1 23	37	7 20	67	13 12	97	18 56	127	24 28	157	29 47
8	1 35	38	7 32	68	13 24	98	19 7	128	24 39	158	29 57
9	1 47	39	7 44	69	13 35	99	19 19	129	24 50	159	30 8
10	1 59	40	7 55	70	13 47	100	19 30	130	25 1	160	30 18
11	2 11	41	8 7	71	13 58	101	19 41	131	25 12	161	30 28
12	2 23	42	8 19	72	14 10	102	19 52	132	25 22	162	30 38
13	2 35	43	8 31	73	14 22	103	20 3	133	25 33	163	30 47
14	2 47	44	8 43	74	14 33	104	20 15	134	25 44	164	30 59
15	2 59	45	8 54	75	14 45	105	20 26	135	25 55	165	31 9
16	3 11	46	9 6	76	14 56	106	20 37	136	26 5	166	31 19
17	3 22	47	9 18	77	15 8	107	20 48	137	26 16	167	31 29
18	3 34	48	9 30	78	15 19	108	20 59	138	26 27	168	31 40
19	3 46	49	9 42	79	15 31	109	21 10	139	26 38	169	31 50
20	3 58	50	9 53	80	15 42	110	21 22	140	26 48	170	32 0
21	4 10	51	10 5	81	15 54	111	21 33	141	26 59	171	32 10
22	4 22	52	10 17	82	16 5	112	21 43	142	27 9	172	32 20
23	4 34	53	10 29	83	16 17	113	21 55	143	27 20	173	32 30
24	4 46	54	10 40	84	16 28	114	22 6	144	27 31	174	32 40
25	4 58	55	10 52	85	16 40	115	22 17	145	27 41	175	32 50
26	5 9	56	11 4	86	16 51	116	22 28	146	27 52	176	33 0
27	5 21	57	11 15	87	17 2	117	22 39	147	28 2	177	33 10
28	5 33	58	11 27	88	17 14	118	22 50	148	28 13	178	33 20
29	5 45	59	11 39	89	17 25	119	23 1	149	28 23	179	33 30
30	5 57	60	11 50	90	17 37	120	23 12	150	28 34	180	33 40

The first rumbe from the Equinoctiall.

The rumbe of { East and by North, East and by South: / West and by North, West and by South.

Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon	Latitu.
Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.
181	33 50	211	38 39	241	43 5	271	47 21	301	51 14	331	54 49
182	34 0	212	38 48	242	43 18	272	47 29	302	51 22	332	54 56
183	34 10	213	38 57	243	43 26	273	47 37	303	51 29	333	55 3
184	34 20	214	39 7	244	43 35	274	47 45	304	51 37	334	55 10
185	34 30	215	39 16	245	43 44	275	47 53	305	51 44	335	55 17
186	34 39	216	39 25	246	43 52	276	48 1	306	51 51	336	55 23
187	34 49	217	39 34	247	44 1	277	48 9	307	51 59	337	55 30
188	34 59	218	39 43	248	44 9	278	48 17	308	52 6	338	55 37
189	35 9	219	39 53	249	44 18	279	48 25	309	52 13	339	55 44
190	35 19	220	40 2	250	44 27	280	48 33	310	52 21	340	55 50
191	35 28	221	40 11	251	44 35	281	48 41	311	52 28	341	55 57
192	35 38	222	40 20	252	44 44	282	48 49	312	52 35	342	56 4
193	35 48	223	40 29	253	44 52	283	48 56	313	52 42	343	56 10
194	35 57	224	40 38	254	45 0	284	49 4	314	52 50	344	56 17
195	36 7	225	40 47	255	45 9	285	49 12	315	52 57	345	56 24
196	36 17	226	40 56	256	45 17	286	49 20	316	53 4	346	56 30
196	36 26	227	41 5	257	45 26	287	49 28	317	53 11	347	56 37
198	36 36	228	41 14	258	45 34	288	49 35	318	53 18	348	56 43
199	36 45	229	41 23	259	45 42	289	49 43	319	53 25	349	56 50
200	36 55	230	41 32	260	45 51	290	49 51	320	53 32	350	56 56
201	37 4	231	41 41	261	45 59	291	49 58	321	53 40	351	57 3
202	37 14	232	41 50	262	46 7	292	50 6	322	53 47	352	57 9
203	37 23	233	41 59	263	46 16	293	50 14	323	53 54	353	57 16
204	37 33	234	42 8	264	46 24	294	50 21	324	54 1	354	57 22
205	37 42	235	42 16	265	46 32	295	50 29	325	54 8	355	57 29
206	37 52	236	42 25	266	46 40	296	50 37	326	54 15	356	57 35
207	38 1	237	42 34	267	46 48	297	50 44	327	54 22	357	57 41
208	38 11	238	42 43	268	46 57	298	50 52	328	54 29	358	57 48
209	38 20	239	42 52	269	47 5	299	50 59	329	54 36	359	57 54
210	38 29	240	43 0	270	47 13	300	51 7	330	54 42	360	58 1

The first rumbe from the Equinoctiall.

The rumbe of { East and by North, East and by South: / West and by North, West and by South.

Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon	Latitu.	Lon.	Latitu.	Lon.	Latitu.
Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.
1	58 7	31	61 8	61	63 53	91	66 25	121	68 40	151	70 [illegible]
2	58 13	32	61 13	62	63 58	92	66 28	122	68 46	152	70 [illegible]
3	58 19	33	61 19	63	64 3	93	66 33	123	68 48	153	70 [illegible]
4	58 26	34	61 25	64	64 8	94	66 37	124	68 53	154	70 [illegible]
5	58 32	35	61 31	65	64 14	95	66 42	125	68 57	155	70 [illegible]
6	58 38	36	61 36	66	64 19	96	66 47	126	69 1	156	71 [illegible]
7	58 44	37	61 42	67	64 24	97	66 52	127	69 6	157	71 [illegible]
8	58 50	38	61 48	68	64 29	98	66 56	128	69 10	158	71 [illegible]
9	58 57	39	61 53	69	64 34	99	67 1	129	69 14	159	71 [illegible]
10	59 3	40	61 59	70	64 39	100	67 5	130	69 18	160	71 [illegible]
11	59 9	41	62 4	71	64 44	101	67 10	131	69 22	161	71 [illegible]
12	59 15	42	62 10	72	64 50	102	67 15	132	69 27	162	71 [illegible]
13	59 21	43	62 16	73	64 55	103	67 19	133	69 31	163	71 30
14	59 27	44	62 21	74	65 0	104	67 24	134	69 35	164	71 34
15	59 33	45	62 27	75	65 5	105	67 29	135	69 39	165	71 38
16	59 39	46	62 32	76	65 10	106	67 33	136	69 43	166	71 41
17	59 45	47	62 38	77	65 15	107	67 38	137	69 47	167	71 45
18	59 51	48	62 43	78	65 20	108	67 42	138	69 52	168	71 49
19	59 57	49	62 49	79	65 25	109	67 47	139	69 56	169	71 53
20	60 3	50	62 54	80	65 30	110	67 51	140	70 0	170	71 57
21	60 9	51	62 59	81	65 35	111	67 56	141	70 4	171	72 0
22	60 15	52	63 5	82	65 39	112	68 0	142	70 8	172	72 4
23	60 21	53	63 10	83	65 44	113	68 5	143	70 12	173	72 7
24	60 27	54	63 16	84	65 49	114	68 9	144	70 16	174	72 11
25	60 33	55	63 21	85	65 54	115	68 13	145	70 20	175	72 15
26	60 39	56	63 26	86	65 59	116	68 18	146	70 24	176	72 18
27	60 44	57	63 32	87	66 4	117	68 22	147	70 28	177	72 22
28	60 50	58	63 37	88	66 9	118	68 27	148	70 32	178	72 25
29	60 56	59	63 42	89	66 14	119	68 31	149	70 36	179	72 29
30	61 2	60	63 47	90	66 18	120	68 35	150	70 40	180	72 33

The first rumbe from the Equinoctiall.

The rumbe of { East and by North, East and by South: / West and by North, West and by South.

Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.
Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.
181	72 36	211	74 18	241	75 50	271	77 13	301	78 29	331	79 36
182	72 40	212	74 21	242	75 53	272	77 16	302	78 31	332	79 39
183	72 43	213	74 24	243	75 56	273	77 19	303	78 33	333	79 41
184	72 47	214	74 28	244	75 59	274	77 21	304	78 36	334	79 43
185	72 50	215	74 31	245	76 2	275	77 24	305	78 38	335	79 45
186	72 54	216	74 34	246	76 5	276	77 26	306	78 40	336	79 47
187	72 57	217	74 37	247	76 7	277	77 29	307	78 43	337	79 49
188	73 1	218	74 40	248	76 10	278	77 32	308	78 45	338	79 51
189	73 4	217	74 44	249	76 13	279	77 34	309	78 47	339	79 53
190	73 8	220	74 47	250	76 16	280	77 37	310	78 50	340	79 55
191	73 11	221	74 50	251	76 19	281	77 39	311	78 52	341	79 58
192	73 15	222	74 53	252	76 22	282	77 42	312	78 54	342	80 0
193	73 18	223	74 56	253	76 24	283	77 44	313	78 57	343	80 2
194	73 22	224	74 59	254	76 27	284	77 47	314	78 59	344	80 4
195	73 25	225	75 2	255	76 30	285	77 49	315	79 1	345	80 6
196	73 28	226	75 5	256	76 33	286	77 52	316	79 3	346	80 8
197	73 32	227	75 8	257	76 36	287	77 54	317	79 6	347	80 10
198	73 35	228	75 11	258	76 38	288	77 57	318	79 8	348	80 12
199	73 39	229	75 14	259	79 41	289	77 59	319	79 10	349	80 14
200	73 42	230	75 17	260	76 44	290	78 2	320	79 12	350	80 16
201	73 45	231	75 20	261	76 47	291	78 4	321	79 15	351	80 18
202	73 49	232	75 23	262	76 49	292	78 7	322	79 17	352	80 20
203	73 52	233	75 26	263	76 52	293	78 9	323	79 19	353	80 22
204	73 55	234	75 29	264	76 55	294	78 12	324	79 21	354	80 24
205	73 58	235	75 32	265	76 57	295	78 14	325	79 23	355	80 26
206	74 2	236	75 35	266	77 0	296	78 17	326	79 26	356	80 28
207	74 5	237	75 38	267	77 3	297	78 19	327	79 28	357	80 30
209	74 8	138	75 41	268	77 5	298	78 21	328	79 30	358	80 32
209	74 12	239	75 44	269	77 8	299	78 24	329	79 32	359	80 34
210	74 15	240	75 47	270	77 11	300	78 26	330	79 34	360	80 36

The first rumbe from the Equinoctiall.

The rumbe of { East and by North, East and by South: / West and by North, West and by South.

Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.
Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.
1	80 38	31	81 33	61	82 23	91	83 8	121	83 49	151	84 25
2	80 40	32	81 35	62	82 25	92	83 9	122	83 50	152	84 26
3	80 42	33	81 37	63	82 26	93	83 11	123	83 51	153	84 27
4	80 44	34	81 38	64	82 28	94	83 12	124	83 52	154	84 29
5	80 45	35	81 40	65	82 29	95	83 14	125	83 54	155	84 30
6	80 47	36	81 42	66	82 31	96	83 15	126	83 55	156	84 31
7	80 49	37	81 43	67	82 32	97	83 16	137	83 56	157	84 32
8	80 51	38	81 45	68	82 34	98	83 18	128	83 57	158	84 33
9	80 53	39	81 47	69	82 35	99	83 19	129	83 59	159	84 34
10	80 55	40	81 49	70	82 37	100	83 21	130	84 0	160	84 35
11	80 57	41	81 50	71	82 38	101	83 22	131	84 1	161	84 36
12	80 59	42	81 52	72	82 40	102	83 23	132	84 2	162	84 38
13	81 1	43	81 54	73	82 41	103	83 25	133	84 4	163	84 39
14	81 2	44	81 55	74	82 43	104	83 26	134	84 5	164	84 40
15	81 4	45	81 57	75	82 45	105	83 27	135	84 6	165	84 41
16	81 6	46	81 59	76	82 46	106	83 29	136	84 7	166	84 42
17	81 8	47	82 0	77	82 48	107	83 30	137	84 8	167	84 43
18	81 10	48	82 2	78	82 49	108	83 31	138	84 10	168	84 44
19	81 12	49	82 4	79	82 50	109	83 33	139	84 11	169	84 45
20	81 13	50	82 5	80	82 52	110	83 34	140	84 12	170	84 46
21	81 15	51	82 7	81	82 53	111	83 35	141	84 13	171	84 47
22	81 17	52	82 8	82	82 55	112	83 37	142	84 15	172	84 49
23	81 19	53	82 10	83	82 56	113	83 38	143	84 16	173	84 50
24	81 21	54	82 12	84	82 58	114	83 39	144	84 17	174	84 51
25	81 22	55	82 13	85	82 59	115	83 41	145	84 18	175	84 52
26	81 24	56	82 15	86	83 1	116	83 42	146	84 19	176	84 53
27	81 26	57	82 17	87	83 2	117	83 43	147	84 20	177	84 54
28	81 28	58	82 18	88	83 4	118	83 45	148	84 22	178	84 55
29	81 30	59	82 20	89	83 5	119	83 46	149	84 23	179	84 56
30	81 31	60	82 21	90	83 6	120	83 47	150	84 24	180	84 57

The first rumbe from the Equinoctiall.

The rumbe of { East and by North, East and by South: West and by North, West and by South.

Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.
Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.	Deg.	De Mi
181	84 58	211	85 28	241	85 55	271	86 19	301	86 41	331	87 1
182	84 59	212	85 29	242	85 55	272	86 20	302	86 41	332	87 1
183	85 0	213	85 30	243	85 56	273	86 20	303	86 42	333	87 2
184	85 1	214	85 31	244	85 57	274	86 21	304	86 43	334	87 3
185	85 2	215	85 32	245	85 58	275	86 22	305	86 43	335	87 3
186	85 3	216	85 32	246	85 59	276	86 23	306	86 44	336	87 4
187	85 4	217	85 33	247	86 0	277	86 24	307	86 45	337	87 4
188	85 5	218	85 34	248	86 0	278	86 24	308	86 45	338	87 5
189	85 6	219	85 35	249	86 1	279	86 25	309	86 46	339	87 6
190	85 7	220	85 36	250	86 2	280	86 26	310	86 47	340	87 6
191	85 8	221	85 37	251	86 3	281	86 26	311	86 47	341	87 7
192	85 9	222	85 38	252	86 4	282	86 27	312	86 48	342	87 7
193	85 10	223	85 39	253	86 5	283	86 28	313	86 49	343	87 8
194	85 11	224	85 40	254	86 5	284	86 28	314	86 49	344	87 9
195	85 12	225	85 41	255	86 6	285	86 29	315	86 50	345	87 9
196	85 13	226	85 42	256	86 7	286	86 30	316	86 51	346	87 10
197	85 14	227	85 42	257	85 8	287	86 31	317	86 51	347	87 10
198	85 15	228	85 43	258	86 9	288	86 31	318	86 52	348	87 11
199	85 16	229	85 44	259	86 9	289	86 32	319	86 53	349	87 11
200	85 17	230	85 45	260	86 10	290	86 33	320	86 54	350	87 12
201	85 18	231	85 46	261	86 11	291	86 34	321	86 54	351	87 13
202	85 19	232	85 47	262	86 12	292	86 34	322	86 55	352	87 13
203	85 20	233	85 48	263	86 13	293	86 35	323	86 56	353	87 14
204	85 21	234	85 49	264	86 13	294	86 36	324	86 56	354	87 14
205	85 22	235	85 49	265	86 14	295	86 36	325	86 57	355	87 15
206	85 23	236	85 50	266	86 15	296	86 37	326	86 58	356	87 15
207	85 24	237	85 51	267	86 16	297	86 38	327	86 58	357	87 16
208	85 25	238	85 52	268	86 16	298	86 38	328	86 59	358	87 17
209	85 26	239	85 53	269	86 17	299	86 39	329	86 59	359	87 17
210	85 27	240	85 54	270	86 18	300	86 40	330	87 0	360	87 18

The first rumbe from the Equinoctiall.

The rumbe of { East and by North, East and by South: West and by North, West and by South.

Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu	Lon.	Latitu.	Lon.	Latitu.
Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.	Deg.	De. Mi.
1	87 18	31	87 34	62	87 49	122	88 13	183	88 34	273	88 56
2	87 19	32	87 35	64	87 50	124	88 14	186	88 34	276	88 57
3	87 19	33	87 35	66	87 51	126	88 15	189	88 35	279	88 58
4	87 20	34	87 36	68	87 52	128	88 16	192	88 36	282	88 58
5	87 21	35	87 36	70	87 53	130	88 16	195	88 37	285	88 59
6	87 21	36	87 37	72	87 53	132	88 17	198	88 38	288	89 0
7	87 22	37	87 37	74	87 54	134	88 18	201	88 39	291	89 0
8	87 22	38	87 38	76	87 55	136	88 18	204	88 40	294	89 1
9	87 23	39	87 38	78	87 56	138	88 19	207	88 40	297	89 1
10	87 23	40	87 39	80	87 57	140	88 20	210	88 41	300	89 2
11	87 24	41	87 39	82	87 58	142	88 20	213	88 42	303	89 3
12	87 24	42	87 40	84	87 59	144	88 21	216	88 43	306	89 3
13	87 25	43	87 40	86	87 59	146	88 22	219	88 44	309	89 4
14	87 25	44	87 41	88	88 0	148	88 23	222	88 44	312	89 4
15	87 26	45	87 41	90	88 1	150	88 23	225	88 45	315	89 5
16	87 26	46	87 42	92	88 2	152	88 24	228	88 46	318	89 6
17	87 27	47	87 42	94	88 3	154	88 25	231	88 47	321	89 6
18	87 28	48	87 42	96	88 3	156	88 25	234	88 47	324	89 7
19	87 28	49	87 43	98	88 4	158	88 26	237	88 48	327	89 7
20	87 29	50	87 43	100	88 5	160	88 26	240	88 49	330	89 8
21	87 29	51	87 44	102	88 6	162	88 27	243	88 50	333	89 8
22	87 30	52	87 44	104	88 7	164	88 28	246	88 50	336	89 9
23	87 30	53	87 45	106	88 7	166	88 28	249	88 51	339	89 9
24	87 31	54	87 45	108	88 8	168	88 29	252	88 52	342	89 10
25	87 31	55	87 46	110	88 9	170	88 30	255	88 52	345	89 10
26	87 32	56	87 46	112	88 10	172	88 30	258	88 53	348	89 11
27	87 32	57	87 47	114	88 10	174	88 31	261	88 54	351	89 12
28	87 33	58	87 47	116	88 11	176	88 31	264	88 55	354	89 12
29	87 33	59	87 48	118	88 12	178	88 32	267	88 55	357	89 12
30	87 34	60	87 48	120	88 13	180	88 33	270	88 56	360	89 13

The first rumbe from the Equinoctiall.

The rumbe of { East and by North, East and by South: / West and by North, West and by South.

Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.
Deg.	De. Mi.	Deg.	De. Mi.	Deg.	De. Mi.	Deg.	De. Mi.	Deg.	De. Mi.	Deg.	De. Mi.
3	89 13	94	89 26	215	89 37	6	89 46	190	89 52	195	89 57
6	89 14	98	89 26	220	89 37	12	89 46	200	89 52	210	89 57
9	89 14	102	89 27	225	89 38	18	89 47	210	89 53	225	89 57
12	89 15	106	89 27	230	89 38	24	89 47	220	89 53	240	89 57
15	89 15	110	89 27	235	89 39	30	89 47	230	89 53	255	89 57
18	89 16	114	89 28	240	89 39	36	89 47	240	89 53	270	89 58
21	89 16	118	89 28	245	89 39	42	89 48	250	89 53	285	89 58
24	89 16	122	89 29	250	89 40	48	89 48	260	89 54	300	89 58
27	89 17	126	89 29	255	89 40	54	89 48	270	89 54	315	89 58
30	89 17	130	89 30	260	89 40	60	89 48	280	89 54	330	89 58
33	89 18	134	89 30	265	89 41	66	89 48	290	89 54	345	89 58
36	89 18	138	89 30	270	89 41	72	89 49	300	89 54	360	89 58
39	89 19	142	89 31	275	89 41	78	89 49	310	89 54	20	89 58
42	89 19	146	89 31	280	85 42	84	89 49	320	89 55	40	89 58
45	89 19	150	89 32	285	89 42	90	89 49	330	89 55	60	89 58
48	89 20	154	89 32	290	89 42	96	89 50	340	89 55	80	89 58
51	89 20	158	89 32	295	89 42	102	89 50	350	89 55	100	89 58
54	89 21	162	89 33	300	89 43	108	89 50	360	89 55	120	89 58
57	89 21	166	89 33	305	89 43	114	89 50	15	89 55	140	89 58
60	89 21	170	89 33	310	89 43	120	89 50	30	89 56	160	89 58
63	89 22	174	89 34	315	89 44	126	89 50	45	89 56	180	89 58
66	89 22	178	89 34	320	89 44	132	89 51	60	89 56	200	89 59
69	89 23	182	89 34	325	89 44	138	89 51	75	89 56	220	89 59
72	89 23	186	89 35	330	89 44	144	89 51	90	89 56	240	89 59
75	89 23	190	89 35	335	89 45	150	89 51	105	89 56	260	89 59
78	89 24	194	89 35	340	89 45	156	89 51	120	89 57	280	89 59
81	89 24	198	89 36	345	89 45	162	89 51	135	89 57	300	89 59
84	89 24	202	89 36	350	89 45	168	89 52	150	89 57	320	89 59
87	89 25	206	89 36	355	89 46	174	89 52	165	89 57	340	89 59
90	89 25	210	89 37	360	89 46	180	89 52	180	89 57	360	89 59

The second rumbe from the Equinoctiall.

The rumbe of { East Northeast, East Southeast: / West Northwest, West Southwest.

Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.
Deg.	De. Mi.	Deg.	De. Mi.	Deg.	De. Mi.	Deg.	De. Mi.	Deg.	De. Mi.	Deg.	De. Mi.
1	0 24	31	12 43	61	24 29	91	35 14	121	44 43	151	52 53
2	0 49	32	13 8	62	24 51	92	35 34	122	45 1	152	53 8
3	1 14	33	13 32	63	25 14	93	35 54	123	45 18	153	53 23
4	1 39	34	13 56	64	25 36	94	36 14	124	45 36	154	53 37
5	2 4	35	14 20	65	25 59	95	36 34	125	45 53	155	53 52
6	2 29	36	14 44	66	26 21	96	36 54	126	46 10	156	54 7
7	2 53	37	15 8	67	26 43	97	37 14	127	46 28	157	54 21
8	3 18	38	15 32	68	27 5	98	37 34	128	46 45	158	54 36
9	3 43	39	15 56	69	27 27	99	37 53	129	47 2	159	54 50
10	4 8	40	16 20	70	27 49	100	38 13	130	47 19	160	55 4
11	4 33	41	16 44	71	28 11	101	38 32	131	47 35	161	55 18
12	4 57	42	17 8	72	28 33	102	38 52	132	47 52	162	55 33
13	5 22	43	17 31	73	28 55	103	39 11	133	48 9	163	55 47
14	5 47	44	17 55	74	29 17	104	39 30	134	48 25	164	56 0
15	6 12	45	18 19	75	29 38	105	39 49	135	48 42	165	56 14
16	6 36	46	18 42	76	30 0	106	40 8	136	48 58	166	56 28
17	7 1	47	19 6	77	30 21	107	40 27	137	49 14	167	56 42
18	7 26	48	19 29	78	30 43	108	40 46	138	49 30	168	56 55
19	7 50	49	19 53	79	31 4	109	41 5	139	49 47	169	57 9
20	8 15	50	20 16	80	31 25	110	41 24	140	50 3	170	57 22
21	8 39	51	20 39	81	31 45	111	41 42	141	50 18	171	57 36
22	9 4	52	21 2	82	32 8	112	42 1	142	50 34	172	57 49
23	9 29	53	21 26	83	32 29	113	42 19	143	50 50	173	58 2
24	9 53	54	21 49	84	32 50	114	42 38	144	51 6	174	58 15
25	10 17	55	22 12	85	33 10	115	42 56	145	51 21	175	58 28
26	10 42	56	22 35	86	33 31	116	43 14	146	51 37	176	58 41
27	11 6	57	22 58	87	33 52	117	43 32	147	51 52	177	58 54
28	11 31	58	23 20	88	34 12	118	43 50	148	52 7	178	59 7
29	11 55	59	23 43	89	34 33	119	44 8	149	52 23	179	59 20
30	12 19	60	24 6	90	34 53	120	44 26	150	52 38	180	59 32

The second rumbe from the Equinoctiall.

The rumbe of { East Northeast, East Southeast: West Northwest, West Southwest.

Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon	Latitu.
Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.
181	59 45	211	65 27	241	70 7	271	73 56	301	77 2	331	79 33
182	59 57	212	65 37	242	70 16	272	74 3	302	77 8	332	79 37
183	60 10	213	65 47	243	70 24	273	74 10	303	77 13	333	79 42
184	60 22	214	65 57	244	70 32	274	74 17	304	77 19	334	79 46
185	60 34	215	66 7	245	70 41	275	74 23	305	77 24	335	79 50
186	60 46	216	66 17	246	70 49	276	74 30	306	77 30	336	79 55
187	60 58	217	66 27	247	70 57	277	74 37	307	77 35	337	79 59
188	61 10	218	66 37	248	71 5	278	74 43	308	77 40	338	80 3
189	61 22	219	66 47	249	71 13	279	74 50	309	77 46	339	80 8
190	61 34	220	66 57	250	71 21	280	74 56	310	77 51	340	80 12
191	61 46	221	67 6	251	71 29	281	75 3	311	77 56	341	80 16
192	61 58	222	67 16	252	71 37	282	75 9	312	78 1	342	80 20
193	62 9	223	67 26	253	71 45	283	75 15	313	78 6	343	80 25
194	62 21	224	67 35	254	71 52	284	75 22	314	78 11	344	80 29
195	62 32	225	67 45	255	72 0	285	75 28	315	78 16	345	80 33
196	62 44	226	67 54	256	72 8	286	75 34	316	78 21	346	80 37
197	62 55	227	68 3	257	72 15	287	75 40	317	78 26	347	80 41
198	63 7	228	68 13	258	72 23	288	75 46	318	78 31	348	80 45
199	63 18	229	68 22	259	72 30	289	75 52	319	78 36	349	80 49
200	63 29	230	68 31	260	72 38	290	75 59	320	78 41	350	80 53
201	63 40	231	68 40	261	72 45	291	76 5	321	78 46	351	80 57
202	63 51	232	68 49	262	72 53	292	76 10	322	78 51	352	81 1
203	64 2	233	68 58	263	73 0	293	76 16	323	78 56	353	81 4
204	64 13	234	69 7	264	73 7	294	76 22	324	79 0	354	81 8
205	64 23	235	69 16	265	73 14	295	76 28	325	79 5	355	81 12
206	64 34	236	69 24	266	73 21	296	76 34	326	79 10	356	81 16
207	64 45	237	69 33	267	73 28	297	76 40	327	79 14	357	81 20
208	64 55	238	69 42	268	73 35	298	76 45	328	79 19	358	81 23
209	65 6	239	69 50	269	73 42	299	76 51	329	79 24	359	81 27
210	65 16	240	69 59	270	73 49	300	76 57	330	79 28	360	81 31

The second rumbe from the Equinoctiall.

The rumbe of { East Northeast, East Southeast: West Northwest, West Southwest.

Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.
Deg.	De. Mi.	Deg.	De. Mi.	Deg.	De. Mi.	Deg.	De. Mi.	Deg	De. Mi.	De.	De. Mi.
1	81 34	31	83 12	61	84 32	91	85 35	121	86 27	151	87 9
2	81 38	32	83 15	62	84 34	92	85 37	122	86 28	152	87 10
3	81 42	33	83 18	63	84 36	93	85 39	123	86 30	153	87 11
4	81 45	34	83 21	64	84 39	94	85 41	124	86 31	154	87 12
5	81 49	35	83 24	65	84 41	95	85 43	125	86 33	155	87 13
6	81 52	36	83 27	66	84 43	96	85 45	126	86 34	156	87 15
7	81 56	37	83 30	67	84 45	97	85 47	127	86 36	157	87 16
8	81 59	38	83 32	68	84 48	98	85 48	128	86 37	158	87 17
9	82 3	39	83 35	69	84 50	99	85 50	129	86 39	159	87 18
10	82 6	40	83 38	70	84 52	100	85 52	130	86 40	160	87 19
11	82 9	41	83 41	71	84 54	101	85 54	131	86 42	161	87 20
12	82 13	42	83 43	72	84 57	102	85 56	132	86 43	162	87 22
13	82 16	43	83 46	73	84 59	103	85 57	133	86 44	163	87 23
14	82 19	44	83 49	74	85 1	104	85 59	134	86 46	164	87 24
15	82 23	45	83 52	75	85 3	105	86 1	135	86 47	165	87 25
16	82 26	46	83 54	76	85 5	106	86 2	136	86 49	166	87 26
17	82 29	47	83 57	77	85 7	107	86 4	137	86 50	167	87 27
18	82 33	48	83 59	78	85 9	108	86 6	138	86 51	168	87 28
19	82 36	49	84 2	79	85 12	109	86 8	139	86 53	169	87 29
20	82 39	50	84 5	80	85 14	110	86 9	140	86 55	170	87 30
21	82 42	51	84 7	81	85 16	111	86 11	141	86 56	171	87 32
22	82 45	52	84 10	82	85 18	112	86 12	142	86 57	172	87 33
23	82 48	53	84 12	83	85 20	113	86 14	143	86 58	173	87 34
24	82 51	54	84 15	84	85 22	114	86 16	144	87 0	174	87 35
25	82 55	55	84 17	85	85 24	115	86 17	145	87 1	175	87 36
26	82 58	56	84 20	86	85 26	116	86 19	146	87 2	176	87 37
27	83 1	57	84 22	87	85 28	117	86 21	147	87 4	177	87 38
28	83 4	58	84 24	88	85 30	118	86 22	148	87 5	178	87 39
29	83 7	59	84 27	89	85 32	119	86 24	149	87 6	179	87 40
30	83 10	60	84 29	90	85 33	120	86 25	150	87 7	180	87 41

The second rumbe from the Equinoctiall.

The rumbe of { East South East, West Southwest: / East Northeast, West Northwest.

Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.
Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.
182	87 43	242	88 31	302	89 2	4	89 22	128	89 44	10	89 56
184	87 45	244	88 32	304	89 3	8	89 23	136	89 45	20	89 57
186	87 47	246	88 33	306	89 3	12	89 25	144	89 46	30	89 57
188	87 49	248	88 34	308	89 4	16	89 26	152	89 46	40	89 57
190	87 50	250	88 36	310	89 5	20	89 26	160	89 47	50	89 57
192	87 52	252	88 37	312	89 6	24	89 27	168	89 48	60	89 57
194	87 54	254	88 38	214	89 7	28	89 28	176	89 48	70	89 57
196	87 56	256	88 39	316	89 7	32	89 29	184	89 49	80	89 57
198	87 58	258	88 40	318	89 8	36	89 30	192	89 50	90	89 58
200	87 59	260	88 41	320	89 9	40	89 31	200	89 50	100	89 58
202	88 1	262	88 43	322	89 9	44	89 32	208	89 51	110	89 58
204	88 3	264	88 44	324	89 10	48	89 32	216	89 51	120	89 58
206	88 4	266	88 45	326	89 11	52	89 33	224	89 52	130	89 58
208	88 6	268	88 46	328	89 12	56	89 34	232	89 52	140	89 58
210	88 8	270	88 47	330	89 12	60	89 35	240	89 52	150	89 58
212	88 9	272	88 48	332	89 13	64	89 35	248	89 53	160	89 58
214	88 11	274	88 49	334	89 14	68	89 36	256	89 53	170	89 58
216	88 12	276	88 50	336	89 14	72	89 37	364	89 53	180	89 58
218	88 14	278	88 51	338	89 15	76	89 37	272	89 54	190	89 58
220	88 16	280	88 52	340	89 16	80	89 38	280	89 54	200	89 58
222	88 17	282	88 53	342	89 16	84	89 39	288	89 54	210	89 58
224	88 18	284	88 54	344	89 17	88	89 39	296	89 55	220	89 58
226	88 20	286	88 55	346	89 17	92	89 40	304	89 55	230	89 59
228	88 21	288	88 56	348	89 18	96	89 40	312	89 55	240	89 59
230	88 23	290	88 57	350	89 19	100	89 41	320	89 55	250	89 59
232	88 24	292	88 58	352	89 19	104	89 41	328	89 56	260	89 59
234	88 25	294	88 58	354	89 20	108	89 42	336	89 56	270	89 59
236	88 27	296	88 59	356	89 20	112	89 42	344	89 56	280	89 59
238	88 28	298	89 0	358	89 21	116	89 43	352	89 56	290	89 59
240	88 29	300	89 1	360	89 21	120	89 43	360	89 56	300	89 59

The third rumbe from the Equinoctiall.

The rumbe of { Northeast and by east, Southeast and by east: / Northwest and by west, Southwest and by west.

Lon.	Latitu.	Lon.	Latitu.	Lon	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon	Latitu.
Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.
1	0 40	31	20 16	61	37 42	91	51 49	121	52 35	151	70 29
2	1 20	32	20 54	62	38 13	92	52 14	122	62 53	152	70 42
3	2 0	33	21 31	63	38 44	93	52 38	123	63 11	153	70 55
4	2 40	34	22 8	64	39 16	94	53 2	124	63 29	154	71 8
5	3 20	35	22 45	65	39 47	95	53 26	125	63 47	155	71 21
6	4 0	36	23 22	66	40 17	96	53 50	126	64 5	156	71 34
7	4 40	37	23 59	67	40 48	97	54 14	127	64 22	157	71 47
8	5 20	38	24 35	68	41 18	98	54 37	128	64 39	158	71 59
9	6 0	39	25 12	69	41 48	99	55 0	129	64 56	159	72 11
10	6 40	40	25 48	70	42 18	100	55 23	130	65 13	160	72 24
11	7 19	41	26 24	71	42 47	101	55 45	131	65 30	161	72 36
12	7 59	42	27 0	72	43 17	102	56 8	132	65 46	162	72 48
13	8 39	43	27 35	73	43 46	103	56 30	133	66 3	163	72 59
14	9 18	44	28 11	74	44 14	104	56 52	134	66 19	164	73 11
15	9 58	45	28 46	75	44 43	105	57 14	135	66 35	165	73 22
16	10 37	46	29 21	76	45 11	106	57 36	136	66 51	166	73 34
17	11 17	47	29 56	77	45 40	107	57 57	137	67 6	167	73 45
18	11 56	48	30 31	78	46 7	108	58 18	138	67 22	168	73 56
19	12 35	49	31 5	79	46 35	109	58 39	139	67 37	169	74 7
20	13 14	50	31 39	80	47 3	110	59 0	140	67 52	170	74 18
21	13 53	51	32 13	81	47 30	111	59 20	141	68 7	171	74 29
22	14 32	52	32 47	82	47 57	112	59 41	142	68 22	172	74 40
23	15 11	53	33 21	83	48 23	113	60 1	143	68 37	173	74 50
24	15 49	54	33 54	84	48 50	114	60 21	144	68 52	174	75 1
25	16 28	55	34 27	85	49 16	115	60 40	145	69 6	175	75 11
26	17 6	56	35 0	86	49 42	116	61 0	146	69 20	176	75 21
27	17 45	57	35 33	87	50 8	117	61 19	147	69 34	177	75 31
28	18 23	58	36 5	88	50 34	118	61 38	148	69 48	178	75 41
29	19 1	59	36 38	89	50 59	119	61 57	149	70 2	179	75 51
30	19 38	60	37 10	90	51 24	120	62 16	150	70 15	180	76 1

The third rumbe from the Equinoctiall.

The rumbe of { Northeast and by east; Northwest and by west; Southeast and by east: Southwest and by west.

Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.
Deg	De. Mi.	Deg.	De. Mi.	Deg	De. Mi.	Deg.	De. Mi.	Deg	De. Mi	Deg	De. Mi.
181	76 10	211	80 14	241	83 6	271	85 8	301	86 34	331	87 35
182	76 20	212	80 20	242	83 11	272	85 11	302	86 36	332	87 36
183	76 29	213	80 27	243	83 15	273	85 14	303	86 38	333	87 38
184	76 39	214	80 34	244	83 20	274	85 18	304	86 41	334	87 40
185	76 48	215	80 40	245	83 25	275	85 21	305	86 43	335	87 41
186	76 57	216	80 47	246	83 29	276	85 24	306	86 45	336	87 43
187	77 6	217	80 53	247	83 34	277	85 27	307	86 47	337	87 44
188	77 15	218	80 59	248	83 38	278	85 30	308	86 50	338	87 46
189	77 24	219	81 5	249	83 43	279	85 34	309	86 52	339	87 47
190	77 32	220	81 12	250	83 47	280	85 37	310	86 55	340	87 49
191	77 41	221	81 18	251	83 52	281	85 40	311	86 57	341	87 51
192	77 49	222	81 24	252	84 56	282	85 43	312	86 59	342	87 52
193	77 58	223	81 30	253	84 0	283	85 46	313	87 1	343	87 55
194	78 6	224	81 36	254	84 4	284	85 49	314	87 3	344	87 53
195	78 14	225	81 41	255	84 8	285	85 51	315	87 5	345	87 56
196	78 22	226	81 47	256	84 12	286	85 54	316	87 7	346	87 58
197	78 30	227	81 53	257	84 16	287	85 57	317	87 9	347	87 59
198	78 38	228	81 58	258	84 20	288	86 0	318	87 11	348	88 1
199	78 46	229	82 4	259	84 24	289	86 3	319	87 13	349	88 2
200	78 54	230	82 9	260	84 28	290	86 6	320	87 15	350	88 3
201	79 2	231	82 15	261	84 32	291	86 8	321	87 17	351	88 5
202	79 9	232	82 20	262	84 35	292	86 11	322	87 19	352	88 6
203	79 17	233	82 26	263	84 39	293	86 14	323	87 21	353	88 7
204	79 24	234	82 31	264	84 43	294	86 16	324	87 22	354	88 9
205	79 31	235	82 36	265	84 47	295	86 19	325	87 24	355	88 10
206	79 39	236	82 41	266	84 50	296	86 21	326	87 26	356	88 11
207	79 46	237	82 46	267	84 54	297	86 24	327	87 28	357	88 12
208	79 53	238	82 51	268	84 57	298	86 26	328	87 29	358	88 14
209	80 0	239	82 56	269	85 1	299	86 29	329	87 31	359	88 15
210	80 7	240	83 1	270	85 4	300	86 31	330	87 33	360	88 16

The third rumbe from the Equinoctiall.

The rumbe of { Northeast and by east, Southeast and by east: Northwest and by west, Southwest and by west.

Lon	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.
Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.	Deg	De. Mi.
1	88 17	31	88 47	61	89 8	92	89 24	155	89 42	310	89 56
2	88 18	32	88 48	62	89 9	94	89 25	160	89 43	320	89 57
3	88 20	33	88 49	63	89 10	96	89 25	165	89 44	330	89 57
4	88 21	34	88 50	64	89 10	98	89 26	170	89 45	340	89 57
5	88 22	35	88 51	65	89 11	100	89 27	175	89 46	350	89 57
6	88 23	36	88 51	66	88 11	102	89 28	180	89 46	360	89 57
7	88 24	37	88 52	67	89 12	104	89 28	185	89 47	10	89 58
8	88 25	38	88 53	68	89 12	106	89 29	190	89 48	20	89 58
9	88 26	39	88 54	69	89 13	108	89 30	195	89 48	30	89 58
10	88 27	40	88 54	70	89 13	110	89 30	200	89 49	40	89 58
11	88 28	41	88 55	71	89 14	112	89 31	205	89 50	50	89 58
12	88 29	42	88 56	72	89 15	114	89 32	210	89 50	60	89 58
13	88 31	43	88 57	73	89 15	116	89 32	215	89 51	70	89 58
14	88 32	44	88 57	74	89 16	118	89 33	220	89 51	80	89 58
15	88 33	45	88 58	75	89 16	120	89 34	225	89 52	90	89 59
16	88 34	46	88 59	76	89 17	122	89 34	230	89 52	100	89 59
17	88 35	47	88 59	77	89 17	124	89 35	235	89 53	110	89 59
18	88 36	48	89 0	78	89 18	126	89 35	240	89 53	120	89 59
19	88 37	49	89 1	79	89 18	128	89 36	245	89 53	130	89 59
20	88 37	50	89 2	80	89 18	130	89 36	250	89 53	140	89 59
21	88 38	51	89 2	81	89 19	132	89 37	255	89 54	150	89 59
22	88 39	52	89 3	82	89 19	134	89 37	260	89 54	160	89 59
23	88 40	53	89 4	83	89 20	136	89 38	265	89 54	170	89 59
24	88 41	54	89 4	84	89 20	138	89 38	270	89 55	180	89 59
25	88 42	55	89 5	85	89 21	140	89 39	275	89 55	190	89 59
26	88 43	56	89 5	86	89 21	142	89 29	280	89 55	200	89 59
27	88 44	57	89 6	87	89 22	144	89 40	285	89 55	210	89 59
28	88 45	58	89 7	88	89 22	146	89 40	290	89 55	220	89 59
29	88 46	59	89 7	89	89 23	148	89 41	295	89 56	230	89 59
30	88 46	60	89 8	90	89 23	150	89 41	300	89 56	240	89 59

The fourth rumbe from the Equinoctiall.

The rumbe of { Northeast, Northwest: Southeast, Southwest.

Lon.	Latitu	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.
Deg.	De Mi	Deg	De.Mi	Deg	De.Mi.	De	De.Mi.	Deg.	De.Mi.	Deg	De.Mi.
1	0 59	31	29 35	61	51 50	91	66 55	121	76 11	151	81 47
2	1 59	32	30 27	62	52 33	92	97 17	122	76 25	152	81 56
3	2 58	33	31 18	63	53 8	93	67 40	123	76 39	153	82 4
4	3 58	34	32 9	64	53 45	94	68 3	124	76 53	154	82 12
5	4 58	35	33 0	65	54 20	95	68 25	125	77 7	155	82 20
6	5 58	36	33 55	66	54 55	96	68 47	126	77 20	156	82 28
7	6 58	37	34 40	67	55 29	97	69 8	127	77 33	157	82 36
8	7 58	38	35 29	68	56 3	98	69 30	128	77 46	158	82 43
9	8 5	39	36 17	69	56 36	99	69 50	129	77 58	159	82 51
10	9 56	40	37 5	70	57 9	100	70 11	130	78 11	160	82 58
11	10 56	41	37 53	71	57 41	101	70 31	131	78 23	161	83 6
12	11 54	42	38 40	72	58 13	102	70 51	132	78 35	162	83 13
13	12 53	43	39 27	73	58 44	103	71 10	133	78 46	163	83 20
14	13 51	44	40 13	74	59 15	104	71 30	134	78 58	164	83 27
15	14 49	45	40 58	75	59 46	105	71 48	135	79 9	165	83 33
16	15 47	46	41 43	76	60 16	106	72 7	136	79 21	166	83 40
17	16 45	47	42 28	77	60 45	107	72 25	137	79 32	167	83 47
18	17 42	48	43 17	78	61 14	108	72 43	138	79 42	168	83 53
19	18 39	49	43 58	79	61 43	109	73 1	139	79 53	169	83 59
20	19 36	50	44 21	80	62 11	110	73 18	140	80 3	170	84 6
21	20 32	51	45 21	81	62 39	111	73 35	141	80 14	171	84 12
22	21 28	52	46 3	82	63 6	112	73 52	142	80 24	172	84 18
23	22 24	53	46 44	83	63 33	113	74 9	143	80 34	173	84 24
24	23 19	54	47 25	84	64 0	114	74 25	144	80 43	174	84 29
25	24 14	55	48 5	85	64 26	115	74 41	145	80 53	175	84 35
26	25 9	56	48 45	86	64 51	116	74 57	146	81 2	176	84 41
27	26 3	57	49 24	87	65 17	117	75 12	147	81 12	177	84 46
28	26 56	58	50 3	88	65 41	118	75 27	148	81 21	178	84 52
29	27 50	59	50 41	89	66 6	119	75 42	149	81 30	179	84 57
30	28 42	60	51 19	90	66 30	120	75 57	150	81 38	180	85 2

The fourth rumbe from the Equinoctiall.

The rumbe of { Northeast, Northwest: Southeast, Southwest.

Lon.	Latitu.	Deg.	De.Mi.	Deg.	De.Mi.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.
Deg	De. Mi	Lon.	Latitu.	Lon.	Latitu.	Deg.	De..Mi.	Deg	De.Mi.	Deg	De Mi.
181	85 7	211	87 7	241	88 17	271	88 58	302	89 24	6	89 47
182	85 12	212	87 10	242	88 19	272	89 0	304	89 25	12	89 49
183	85 17	213	87 13	243	88 20	273	89 1	306	89 26	18	89 50
184	85 22	214	87 15	244	88 22	274	89 2	308	89 27	24	89 51
185	85 27	215	87 18	245	88 24	275	89 3	310	89 28	30	89 51
186	85 32	216	87 21	246	88 25	276	89 4	312	89 29	36	89 52
187	85 36	217	87 24	247	88 27	277	89 5	314	89 30	42	89 53
188	85 41	218	87 26	248	88 29	278	89 5	316	89 31	48	89 53
189	85 45	219	87 29	249	88 30	279	89 6	318	89 32	54	89 54
190	85 50	220	87 32	250	88 32	280	89 7	320	89 33	60	89 55
191	85 54	221	87 34	251	88 33	281	89 8	322	89 34	66	89 55
192	85 58	222	87 37	252	88 35	282	89 9	324	89 35	72	89 55
193	86 2	223	87 39	253	88 36	283	89 10	326	89 36	78	89 56
194	86 6	224	87 42	254	88 38	284	89 11	328	89 37	84	89 56
195	86 10	225	87 44	255	88 39	285	89 12	330	89 37	90	89 56
196	86 14	226	87 46	256	88 40	286	89 12	332	89 38	96	89 57
197	86 18	227	87 49	257	88 42	287	89 13	334	89 39	102	89 57
198	86 22	228	87 51	258	88 43	288	89 14	336	89 40	108	89 57
199	86 26	229	87 53	259	88 44	289	89 15	338	89 40	114	89 57
200	86 30	230	87 55	260	88 46	290	89 16	340	89 41	120	89 57
201	86 33	231	87 57	261	88 47	291	89 16	342	89 41	126	89 58
202	86 37	232	88 0	262	88 48	292	89 17	344	89 42	132	89 58
203	86 40	233	88 2	263	88 49	293	89 18	346	89 43	138	89 58
204	86 44	234	88 4	264	88 51	294	89 19	348	89 43	144	89 58
205	86 47	235	88 6	265	88 52	295	89 19	350	89 44	150	89 58
206	86 50	236	88 8	266	88 53	296	89 20	352	89 44	156	89 58
207	86 54	237	88 9	267	88 54	297	89 21	354	89 44	162	89 58
208	86 57	238	88 11	268	88 55	298	89 21	356	89 45	168	89 59
209	87 0	239	88 13	269	88 56	299	89 22	358	89 46	174	89 58
210	87 4	240	88 15	270	88 57	300	89 22	360	89 46	180	89 59

The fifth rumbe from the Equinoctiall.

The rumbe of { Northeast by north, Northwest by north: / Southeast by south, Southwest by south.

Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.
Deg.	De. Mi.	Deg.	De. Mi.	Deg.	De. Mi.	Deg.	De Mi.	Deg.	De. Mi.	Deg.	De. Mi.
1	1 29	31	42 1	61	67 1	91	79 23	121	85 8	151	87 46
2	2 59	32	43 7	62	67 35	92	79 39	122	85 15	152	87 50
3	4 29	33	44 12	63	68 9	93	79 55	123	85 23	153	87 53
4	5 58	34	45 16	64	68 42	94	80 10	124	85 30	154	87 56
5	7 27	35	46 18	65	69 14	95	80 26	125	85 37	155	87 59
6	8 56	36	47 20	66	69 46	96	80 40	126	85 43	156	88 3
7	10 25	37	48 20	67	70 16	97	80 55	127	85 50	157	88 6
8	11 53	38	49 17	68	70 46	98	81 9	128	85 56	158	88 8
9	13 20	39	50 17	69	71 15	99	81 22	129	86 1	159	88 11
10	14 47	40	51 14	70	71 44	100	81 35	130	85 9	160	88 14
11	16 14	41	52 10	71	72 12	101	81 48	131	86 15	161	88 17
12	17 40	42	53 4	72	72 39	102	82 1	132	85 20	162	83 19
13	19 5	43	53 57	73	73 5	103	82 13	133	86 26	163	88 22
14	20 30	44	54 50	74	73 31	104	82 25	134	86 32	164	88 24
15	21 53	45	55 41	75	73 56	105	82 37	135	85 37	165	88 27
16	23 16	46	56 31	76	74 21	106	82 48	136	86 42	166	88 29
17	43 38	47	57 20	77	74 45	107	82 59	137	85 47	167	88 32
18	25 59	48	58 8	78	75 8	108	83 10	138	86 52	168	88 34
19	27 20	49	58 55	79	75 31	109	83 21	139	86 57	169	88 36
20	28 39	50	59 40	80	75 53	110	83 31	140	87 2	170	88 38
21	29 57	51	60 25	81	76 14	111	83 41	141	87 7	171	88 40
22	31 14	52	61 9	82	76 35	112	83 51	142	87 11	172	88 42
23	32 31	53	61 52	83	76 56	113	84 0	143	87 15	173	88 44
24	33 46	54	62 34	84	77 16	114	84 9	144	87 20	174	88 46
25	35 0	55	63 15	85	77 35	115	84 18	145	87 24	175	88 48
26	36 13	56	63 55	86	77 55	116	84 27	146	87 28	176	88 50
27	37 25	57	64 34	87	78 13	117	84 36	147	87 32	177	88 52
28	38 37	58	65 12	88	78 31	118	84 44	148	87 35	178	88 53
29	39 45	59	65 49	89	78 49	119	84 52	149	87 39	179	88 55
30	40 5	60	66 25	90	79 6	120	85 0	150	87 42	180	88 57

The fift rumbe from the Æquinoctiall.

The sixth rumbe from the Æquinoctiall.

Northeast by north, Nor west by north: || Nor nor east, North northwest.
Southeast by south, Southwest by south: || South southeast, South southwest

Lon.	Latitu.	Lon.	Latitu	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.	Lon.	Latitu.
Deg.	De. Mi.	Deg	De. Mi	Deg	De Mi.	Deg	De. Mi	Deg	De. Mi.	Deg	De. Mi.
181	88 58	212	89 32	273	89 54	1	2 24	31	59 41	61	81 14
182	89 0	214	89 33	276	89 54	2	4 49	32	50 53	62	81 36
183	89 1	216	89 35	279	89 54	3	7 13	33	62 2	63	81 56
184	89 3	218	89 36	282	89 55	4	9 36	34	53 8	64	82 16
185	89 4	220	89 37	285	89 55	5	11 58	35	64 13	65	82 35
186	89 6	222	89 38	288	89 55	6	14 20	36	65 14	66	82 54
187	89 7	224	89 39	291	89 56	7	16 39	37	66 14	67	83 11
188	89 9	226	89 40	294	89 56	8	18 57	38	67 11	68	83 28
189	89 10	228	89 41	297	89 56	9	21 13	39	68 6	69	83 44
190	89 11	230	89 42	300	89 56	10	23 27	40	68 59	70	83 59
191	89 12	232	89 43	303	89 57	11	25 39	41	69 50	71	84 14
192	89 14	234	89 44	306	89 57	12	27 48	42	70 39	72	84 28
193	89 15	236	89 45	309	89 57	13	29 55	43	71 26	73	84 42
194	89 16	238	89 45	312	89 57	14	31 59	44	72 11	74	84 55
195	89 17	240	89 46	315	89 57	15	34 1	45	72 55	75	85 8
196	89 18	242	89 47	318	89 57	16	35 59	46	73 36	76	85 20
197	89 19	244	89 47	321	89 57	17	37 55	47	74 16	77	85 31
198	89 20	246	89 48	324	89 58	18	39 48	48	74 55	78	85 42
199	89 21	248	89 48	327	89 58	19	41 37	49	75 32	79	85 53
200	89 22	250	89 49	330	89 58	20	43 24	50	76 7	80	86 3
201	89 23	252	89 50	333	89 58	21	45 8	51	76 41	81	86 13
202	89 24	254	89 50	336	89 58	22	46 40	52	77 14	82	86 22
203	89 25	256	89 50	339	89 58	23	48 26	53	77 45	83	86 31
204	89 26	258	89 51	342	89 58	24	50 1	54	78 15	84	86 40
205	89 27	260	89 51	345	89 58	25	51 32	55	78 44	85	86 48
206	89 27	262	89 52	348	89 58	26	53 1	56	79 12	86	86 56
207	89 28	264	89 52	351	89 58	27	54 27	57	79 38	87	87 3
208	89 29	266	89 52	354	89 58	28	55 49	58	80 4	88	87 11
209	89 30	268	89 53	357	89 58	29	57 9	59	80 28	89	87 18
210	89 31	270	89 53	360	89 59	30	58 26	60	80 52	90	87 25

The fixt rumbe from the Æquinoctiall.						*The seuenth rumbe from the Æquinoctiall.*					
Nor nor east South southeast			*North northwest South southwest*			*North by east, South by east,*			*North by west. South by west.*		
Lon.	*Latitu.*		*Lon.*	*Latitu*		*Lon.*	*Latitu.*		*Lon.*	*Latitu.*		*Lon.*	*Latitu.*	
Deg	*De.*	*Mi*	*Deg*	*De.*	*Mi*	*Deg*	*De.*	*Mi.*	*Deg*	*De.*	*Mi.*	*Deg.*	*De.*	*Mi.*
91	87	31	121	89	17	152	89	48	1	5	1	31	82	27	61	89	27
92	87	37	122	89	19	154	89	49	2	10	0	32	83	5	62	89	29
93	87	43	123	89	21	156	89	49	3	14	54	33	83	39	63	89	32
94	87	48	124	89	22	158	89	50	4	19	42	34	84	11	64	89	34
95	87	54	125	89	24	160	89	51	5	24	22	35	84	40	65	89	36
96	87	59	126	89	25	162	89	52	6	28	51	36	85	7	66	89	38
97	88	4	127	89	27	164	89	52	7	33	10	37	85	32	67	89	40
98	88	9	128	89	28	166	89	53	8	37	16	38	85	54	68	89	41
99	88	13	129	89	29	168	89	53	9	41	9	39	86	15	69	89	43
100	88	18	130	89	30	170	89	54	10	44	50	40	86	33	70	89	44
101	88	22	131	89	32	172	89	54	11	48	17	41	86	51	71	89	46
102	88	26	132	89	33	174	89	55	12	51	31	42	87	7	72	89	47
103	88	30	133	89	34	176	89	55	13	54	32	43	87	21	73	89	48
104	88	33	134	89	35	178	89	55	14	57	21	44	87	35	74	89	49
105	88	37	135	89	36	180	89	56	15	59	58	45	87	47	75	89	50
106	88	40	136	89	37	183	89	56	16	62	23	46	87	58	77	89	51
107	88	44	137	89	38	186	89	56	17	64	38	47	88	8	79	89	52
108	88	47	138	89	39	189	89	57	18	66	42	48	88	17	81	89	53
109	88	50	139	89	39	192	89	57	19	68	36	49	88	26	83	89	54
110	88	52	140	89	40	195	89	57	20	70	22	50	88	34	85	89	55
111	88	55	141	89	41	198	89	57	21	71	59	51	88	41	87	89	56
112	88	58	142	89	42	201	89	58	22	73	29	52	88	47	90	89	56
113	89	0	143	89	42	204	89	58	23	74	51	53	88	53	93	89	57
114	89	3	144	89	43	207	89	58	24	76	6	54	88	59	96	89	58
115	89	5	145	89	44	210	89	58	25	77	16	55	89	4	99	89	58
116	89	7	146	89	44	213	89	58	26	78	19	56	89	9	102	89	58
117	89	9	147	89	45	216	89	58	27	79	18	57	89	13	105	89	58
118	89	12	148	89	46	219	89	58	28	80	11	58	89	17	108	89	59
119	89	13	149	89	46	222	89	58	29	81	0	59	89	20	111	89	59
120	89	15	150	89	47	225	89	59	30	81	46	60	89	24	114	89	59

A most plain and sensible Demonstration of the agreement of this nautical Planisphære, with the Globe, and of the disagreement of the common sea Chart from them both. Chap. 4.

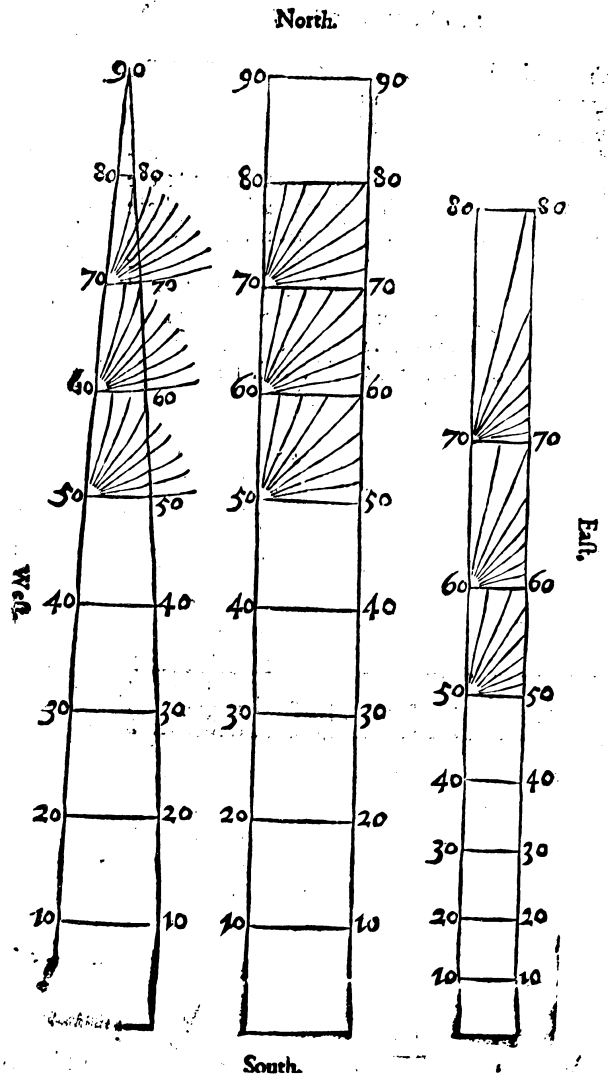
BVt that it may the more plainely appeare howe greatly the common sea Chart (with paralell meridians and degrees of latitude euerie where equall) doth differ from trueth, as also howe well the Chart before described, agreeth with the same: behold these three figures following, whereof the first is in all poynts answerable to a part of a sphæricall superficies, contained betwixt two meridians, differing in longitude 10. degrees, and extended from the equinoctiall to the Pole. The second containeth 10 degrees in longitude, and 90. degrees from the equinoctiall in latitude, of the common sea Chart with equidistant meridians and degrees of latitude euerie equall. The third containeth 10 degrees in longitude, and 80 in latitude of the nauticall Planisphære, truely described with meridians in all places equidistant, and degrees of latitude increasing proportionably towardes the Pole, as before we haue shewed.

Now all the other parts of the Globe or Charts are like vnto these, therefore what agreement or disagreement is found in these parts must needes be also in their wholes. The first figure is a part of

the Globe, and therefore in al things sheweth the verie trueth: therefore wee make it the rule to examine the rest by, for so farre forth as they agree with it, they are true, and as much as they differ from it, they are false. Now therefore let vs bring them to examination.

If there bee two places differing in longitude and latitude 10 degrees (that which hath the greater latitude being more to the eastwards) the second figure as you see maketh them lie each from other northeast and southwest, in what latitude soeuer they be scituate, either nearer or further from the equinoctiall, as in 50 and 60, or in 60 and 70, or in 70 and 80 degrees of latitude. But in the first and third figure, these places shall beare almost northeast and southwest each from other, at the equinoctiall onely. And one place being scituate in 50, and the other in 60 degrees of latitude, they shall lie one from another northeast and by north, and almost halfe a poynt northerly. In 60 and 70 degrees of latitude they lie almost north northeast: in 70 and 80 they beare each from other scarce so much as north and by east. Therefore the common sea Chart, in shewing howe one of those places beareth from another, erreth in the first, one point of the compasse and almost an halfe, in the second, two whole points almost, but in the third, more then three whole points. Neither is it possible to auoyde these so grosse and palpable errors (if the rumbes be right lines, and the degrees of longitude and latitude euerie where equall) but wee must needes fall into other errors as grosse as these, either

ther in the difference of longitudes, or in the difference of latitudes, or in the respectiue scituation, which they commonly cal, the lying or bearing of them one from another, as may most plainely appeare by comparing the common sea Chart & the Globe together. But in this nauticall Planisphere heretofore described, all these errors are auoyded, aswell in the longitudes and latitudes, as also in the directional distances & respectiue scituations of al places, each from other according to the poynts of the compasse, as by like comparison of it with the Globe, will be most manifest.



The vſe of this Planiſphære. Chap. 5.

IF the vſe of this Planiſphere much more mought be written then now I haue leyſure or cauſe to ſette downe, a great parte hereof being in ſuch ſort to be performed, as hath beene heretofore accuſtomed in the common ſea Chart, ſauing that this nauticall Planiſphære generally bringeth you to more certaine trueth in concluſion, then the ordinary Chart hitherto hath done, or poſsibly can do. Somet hing notwithſtanding, (for the better ſatiſfaction of the reader) I thought meete at this time to adde to the former treatiſe (eſpecially in thoſe poynts which may be moſt ſeruiceable for ſea men, and wherein the vſe of this nauticall Planiſphere differeth from the vſe of the common ſea Chart, heretofore ordinarily practiſed.

To knowe vppon what point of the compaſſe one place in this Chart lyeth from another, trye with your compaſſes from what rumbe both places haue equall diſtance, which may be found truly inough, for the martiners vſe for the moſt part by eſtimation onely. But if you would be preciſe, do thus, Draw a ſtraight line by both places, for a line paralell to it from the center of the next roſe or fly (as it is called) is the rumbe of thoſe two places, ſhewing vppon what poynt of the compaſſe you muſt go from the one to the other.

Or thus, (if you liſt not draw any lines vpon your Chart) lay the edge of a long ruler (reaching ouerthwart the Chart) to both places: take with your compaſſes the diſtance of the center of the next flie from the edge of the ruler, then guiding and caryng one foote along by the edge of the ruler, leade the other foote parallel-wiſe (that is, keeping it always equally at that diſtance from the ruler) for ſo it ſheweth you how thoſe places lie one from another.

To finde the diſtaunce of places.

The diſtance of twoo places (as the marriners commonly take it, and meaſure it in their Charts, is the ſegment or part of the rumbe intercepted betweene them, which howe much it is in the ordinary meaſure of leagues ſhall truely be found out by this Planiſphære, thus.

If both places haue one latitude.

If both places haue the ſame latitude, take with your compaſſes the length of a degree of the meridian at that latitude (take halfe the degree aboue, and halfe beneath that latitude) for ſo oft as you ſhall finde that length betweene the two places, ſo many ſcore leaues are there betwixt them. If the diſtance be great, for the more expedition you may take fiue times the length of that degree, and counting it for an hundreth leagues, proceede as before.

If both places haue the ſame longitude.

If both places haue not the ſame latitude, the æquinoctiall alſo not comming betweene them, ſubtract the leſſer latitude out of the greater, but if the æquinoctiall come betwixt them, adde both latitudes together, ſo haue you the difference of latitude betweene both places.

Now

Now if both places haue the ſame longitude, ſo many degrees as there is in the difference of latitude, ſo many ſcore leagues is the diſtaunce.

If both places differ both in longitude and latitude.

But if they differ alſo in longitude as well as in latitude, looke howe many degrees the difference of latitude containeth, ſo many degrees of the æquinoctiall take with your compaſſes, and leading one foote in the æquinoctiall, mooue forwardes the other alſo parallel-wiſe, keeping alwaies that diſtance, till it croſſe the rumbe of thoſe two places, in ſuch ſort, that one foote reſting in that croſſing, the other carried about, may but onely touch the æquinoctiall. Then hauing taken with your compaſſes the ſegment or parte of that rumbe betweene that croſsing and the æquinoctiall, ſet both feete in the æquinoctiall, and ſee howe many degrees are contained betwixt them, for ſo many ſcore leagues is the diſtance of thoſe two places.

Or if that ſegment of the ſayd rumbe be greater then wel can bee taken with the compaſſes, take the length of fiue degrees of the æquinoctiall, betweene the feete of your Compaſſes, and looke how oft you can finde that length in the ſegment aforeſaide of the rumbe, for ſo many hundreth leagues is the diſtance of thoſe two places.

The demonſtration hereof cannot be obſcure to him that well conſidereth the geometricall reaſon of the proiection, and making of this nauticall Planiſphere before ſette downe in the ſecond Chapter, from whence it foloweth, that bicauſe the ſphæricall ſuperficies (whereof this Planiſphære is conceiued to be geometrically made) extendeth it ſelf

euerie

euerie way equally, at euerie poynt of latitude betwixt the æquinoctiall and Pole, till it applie and ioyne it ſelfe round about to the concauitie of the circumſcribed cylinder; therefore the ſegments of the meridian, and of any other rumbe intercepted betwixt any the ſame two parallels, muſt needs increaſe in one and the ſame proportion.

And conſequently, as often as the ſegment of a meridian between any two parallels, is contained in the ſegment of any rumbe intercepted, betwixt theſame parallels in the Globe, ſo often is the like ſegment of a meridian contained in the ſegment of the ſame rumbe intercepted betweene the parallels correſpondent in this Planiſphere. Therfore (ſuppoſing the ſaide ſegment of the meridian in this Planiſphære to be diuided into ſo many equall parts as it containeth degrees) it followeth that ſo often as one of theſe partes is contained in the ſegment of the rumbe aforeſaide in this Planiſphere, ſo many ſcore leagues is the diſtance of the two places ſet at the endes of that ſegment.

Now it is manifeſt that by theſe three ſegments, that is, the ſegment of the rumbe betweene the two places, the ſegment of the meridian betwixt one of the places, and the parallel of the other) that is, the difference of latitude) and the ſegment of the parallel intercepted betwixt one of theſe places, and the meridian of the other, (which is the difference of longitude. I ſay it is manifeſt that by theſe three ſegments a right angled triangle is made, becauſe the ſegments of the meridian and parallel (which are two ſides of this Triangle, include a right angle.

Again

Againe it is plaine, that taking with your compaſſes ſo many degrees of the æquinoctiall as are contained in the difference of latitude: then guiding one foote in the æquinoctiall, and carrying forwardes the other parallel-wiſe, till it croſſe the rumbe of thoſe two places, in ſuch ſort, that one foote of the compaſſes being ſette in that croſsing, the other mooued about, may but onely touch the æquinoctiall: and laſtly, drawing from that croſsing a line perpendicular to the æquinoctiall: It is plaine I ſay, that by this perpendicular and the two ſegments, one of the æquinoctiall, betweene this perpendicular and the rumbe, the other of the rumbe, betweene the perpendicular and the æquinoctiall: by theſe ſegments I ſay, and the ſaide perpendicular, there is comprehended another right angled Triangle: which by the 14. *e* 4, & *c*. 3. *e*. 7 *Ram.* is like to the former right angled Triangle, becauſe two angles of them both are equall, that is, the right angles, and angles of the ſame rumbe. In the laſt of theſe triangles, the ſide perpendicular to the equinoctial, is proportionable to the difference of latitude, and the ſegment of the rumbe betweene the ende of this perpendicular and the æquinoctiall, is proportionable to the ſegment of the ſame rumbe contained betwixt the two places. Therefore by the 2 *p* 6. & 17 *p*. 11 *Eucl.* becauſe the line perpendicular to the æquinoctiall, containeth ſo many equall degrees of the æquinoctiall, as there are equal parts in the difference of latitude (that is) ſo many as there are degrees in the difference of latitude: theſe equall parts alſo of the perpendicu-

lar and difference of latitude are proportionable. Whereof it followeth that ſo oft as one of theſe equall parts of the difference of latitude is contained in the ſegment of the rumbe betwixt the two places (which before wee ſhewed to bee ſo oft as a degree of the meridian in the globe, is contained in the ſegment of the rumb betwixt the ſame places in the globe) ſo oft is one of the ſaid equal parts of the perpendicular aforeſaide (that is a degree of the æquinoctiall) contained in the ſegment of the ſame rumbe betweene the foreſayde croſsing or ende of the perpendicular, and the æquinoctiall. Therefore locke how many degrees of the æquinoctiall there are found in the ſegment of the rumbe of the two places, ſo many ſcore legues is the diſtance of thoſe two places, which was to be demonſtrated.

Thus haue you a way infallible to find out the diſtance betweene any twoo places meaſured in their rumbe: which becauſe it is then onely their true diſtance (that is the ſhorteſt ſpace betwixt thẽ vpon the ſuperficies of the terreſtriall globe) when both places lie north and ſouth each from other, or eaſt and weſt, hauing no latitude: whereas otherwiſe the ſegment of the rumbe betweene the two places is alwaies greater (yea ſometimes greater by halfe and more, in places farre northwardes or ſouthwardes) then the true diſtance: I thought good alſo here to ſette downe the way to finde out the true diſtance of any two places, wherein I haue beene, and yet am publikely charged with my premiſe, and meane at this time to diſcharge my ſelfe thereof.

The

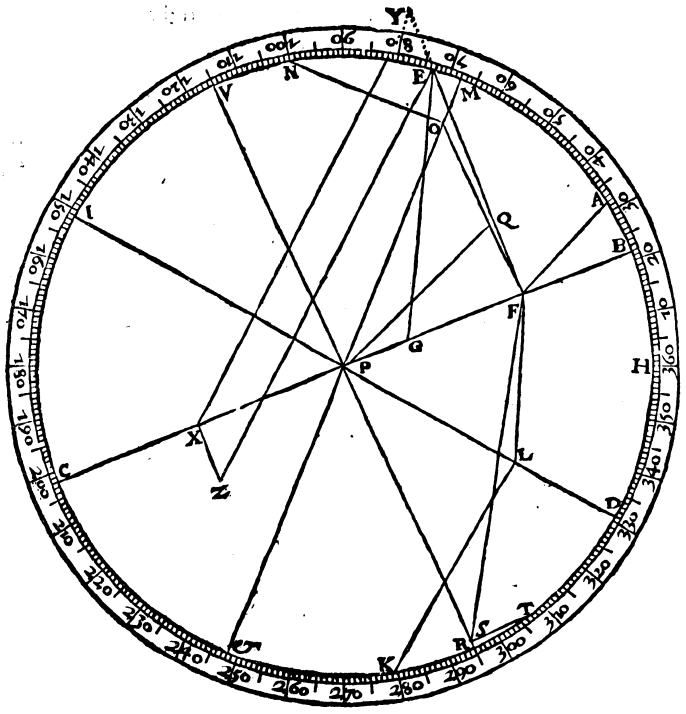
The true diſtance betwixt twoo places is the arch of a great circle intercepted betwixt them, which is thus to be fou nd out.

If both placees haue no latitude (as when they are both vnder the æquinoctiall) and one of them alſo no longitude, the longitude of the other being leſſe, or not more then 180. degrees: the longitude is the diſtance.

But if the longitude be greater then 180 degrees, ſubtract it out of 360. the remainder is the diſtance.

If both places haue either none or the ſame longitude (as when they are in the ſame ſemicircle of the meridian betweene the poles) and one of them onely haue latitude, that latitude is the diſtance But if both places agreeing in longitude haue latitudes alſo of like denomination (as both northerly, or both ſoutherly) ſubtract the leſſer latitude out of the greater, the diſtance remaineth. If one place haue northerly latitude, and the other ſoutherly, adde them together, the ſumme is the diſtance.

If one or both places haue latitude, and differ alſo in longitude: in a great circle diuided exactly into degrees (with figures ſet to euerie fifth or tenth degree) note the longitudes of both places.



Now if one place onely haue latitude, drawe a diameter from the longitude thereof, noted in the circle, and with your compaſſes take ſo many degrees and minutes in the ſame circle, as that latitude containeth: then ſetting one foote of the compaſſes

ſes in the longitude of that place, with the other make a pricke in the circle, which may be called the poynt of latitude. From this poynt draw a line perpendicular, croſsing the diameter drawne from the longitude of that place. Take with your compaſſes the diſtance of this croſsing, from the poynt of the other places longitude, noted in the circle, and leauing one foote in the ſayde croſsing, with the other make a pricke, in the foreſaid diameter: take the diſtance of this pricke from the poynt of latitude noted in the circle. Then ſetting one foote of the compaſſes in that poynt of the circle where the degrees beginne to be numbred, the other foot extended that way, which the nūbers proceed, ſhal ſhewe you in the cirele the diſtance of the places.

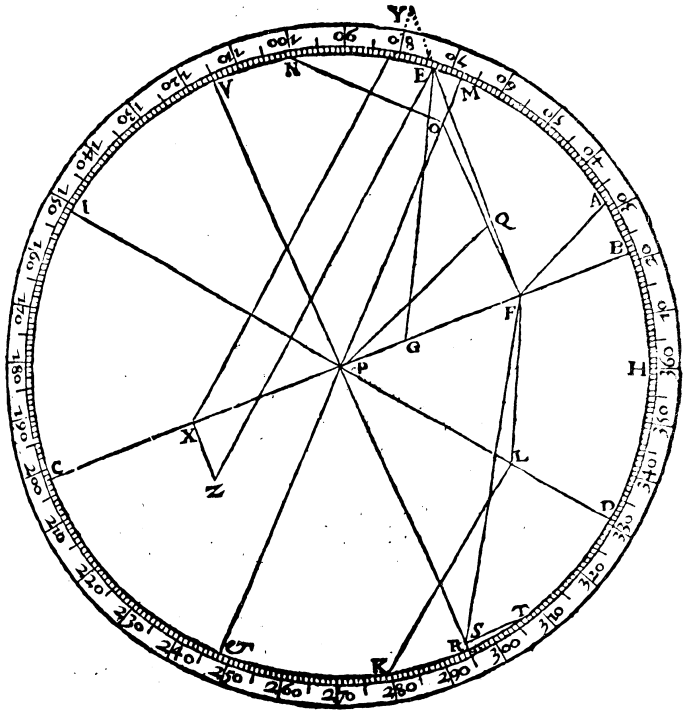
Take for example the cittie of *London*, and Saint *Thomas* Iland, which lieth right vnder the æquinoctiall line, in 32 degrees of longitude. The longitude of *London* admit: to be 22 degrees, the latitude 51 degrees, 32 minutes. Marke the longitudes of Saint *Thomas* Iland and of *London* with A and B. From the longitude of *London*. (becauſe *London* hath alſo latitude) draw the diameter B C. Hauing taken with the compaſſes the latitude of *London* in the circle, ſet one foote in B, and with the other make the pricke E in the circle, and draw the perpendicular E F, croſsing the diameter B C at F. Make F G equall to F A. which is the diſtance of Saint *Thomas* Iland from the ſine of *Londons* latitude. Then G E ſhall bee the line ſubtending the diſtance of thoſe two places. Taking therefore the length of G E with the compaſſes, and ſetting one

foote in H (where the degrees beginne) the other ſtretched forwardes in the circle, will poynte you out the diſtaunce of Saint *Thomas* Ilande and *London*, 52 degrees of a great circle, and about one halfe, that is, 1050 leagues, or 3150 engliſh miles.

If both places haue latitude, do the like for both places as before you did for the one place hauing latitude, till you haue croſſed both diameters with perpendiculars: then take with your compaſſes the diſtance of thoſe croſsings. Now if both their latitudes bee of one denomination (that is, both nottherly or both ſoutherly) and equall, ſette one foote of the compaſſes where the degrees begin to be numbred in the circle, and the other foote extended therein, that way which the numbers ſucceede will ſhew you the diſtance.

As for example, *London* and Cape *Blanco* (neare the coaſt of new found land) haue both northerly and almoſt equal latitude of 51 degrees, 32 minutes. Hauing therefore drawne as well the diameters B C and D I, from B, determining the longitude of *London* (*viz.* 22 degrees) and from the poynt of the longitude of Cape *Blanco* (which admitte to be 332 degrees, as alſo the perpendiculars or ſines of both their latitudes, E F, and K L, (as before was ſhewed) croſsing the diameters in F and L. The diſtance F L taken with the compaſſes, and tranſlated into the circle (as the former example) wil ſhew you the diſtance of cape *Blanco* from *London*, to bee almoſt 31 degrees, of a great circle that is 620 leagues, or 1860 miles.

If the latitudes be not both equall, and alſo of one

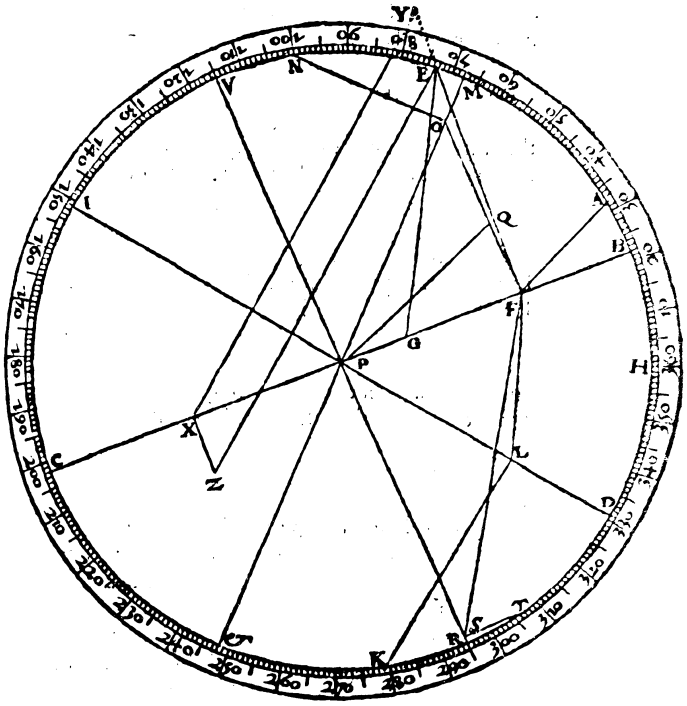


one denomination, leauing one foote of the compaſſes in the croſsing of the ſine or perpendicular diſcending from the poynt of the greater latitude, with thother foot make a prick in the ſame diameter, wherein that croſsing is: Then if the latitudes be

be both of one denomination, take with the compaſſes the length of the perpendicular or ſine drawne from the poynt of the leſſer latitude: and ſetting one foote in the poynt of the greater latitude, with the other make a pricke in the perpendicular deſcending from it, that is, in the ſine thereof: Take the diſtance of this pricke from the former, made in the diameter: This diſtance tranſferred into the circle (as in the firſt example) wil giue you the diſtance of the places giuen.

As *London* and *Hieruſalem* haue both northerly and vnequall latitudes, *Hieruſalems* latitude being onely 32 degrees. Firſt therefore note in the circle both their longitudes: the longitude of *London* (*viz.* 22 degrees) as before with B: The longitude of *Hieruſalem* (68 degrees) note with M. Let the perpendicular or the ſines of the latitudes of *London* and *Hieruſalem*, E F, and N O be drawne as in the former examples. Make F P equall to O F, and P Q equall to N O. The ſpace betwixt P and Q taken with the compaſſes, and then both feete ſet in the circle (in ſuch ſort as the firſt example was ſhewed) ſhall containe betweene them the deſired diſtance of *Hieruſalem* from *London*, 38 degrees, and about ⅓ that is 775 leagues, which are 2325 miles.

But if the latitudes be of diuers denominations, (that is, one northerly and the other ſoutherly) continue forth the perpendicular (that croſſeth the diameter, wherin the foreſayd prick was made) till it be equall to both perpendiculars, that is, to the ſines of both latitudes. The diſtance of the



ende of this continued perpendicular from the pricke aforeſayd in the diameter, taken with the compaſſes, and tranſlated into the graduated periphery of the circle (as before) will ſhewe you how

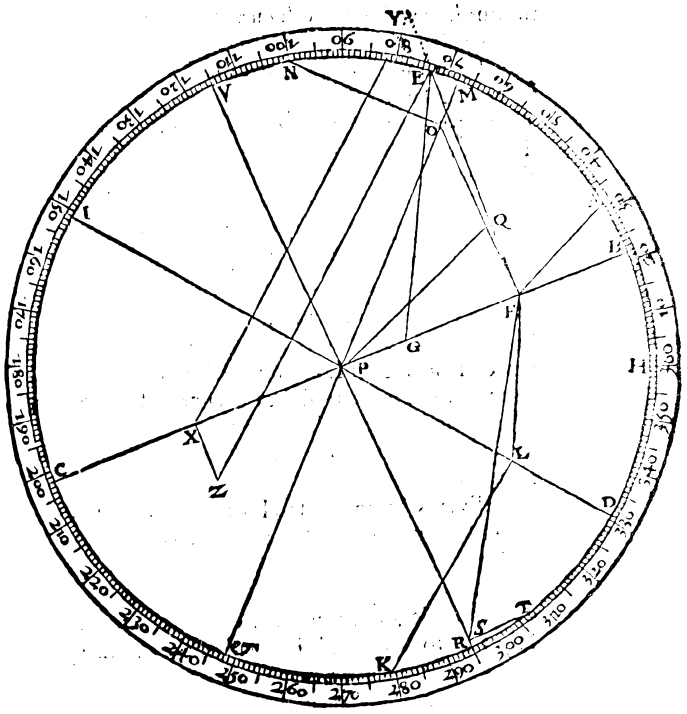
many degrees of a great circle are contained betweene both places.

To shut vp this matter with one example, suppose you would know how farre *Cusco* in *Peru* is from *London*. Let the longitude of *Cusco* be 295 degrees, the latitude 11 degrees southerly: The longitude of *London*, as before, 22 degrees, the latitude 51 degrees, 32 minutes. From both these longitudes noted in the circle with B and R, draw the diameters, as before, B C, and R V: as also the perpendiculars or lines of their latitudes E F, and T S. Make F K equall to F S, the distance of those lines, and H Y equall to S T, the line of *Cuscoes* latitude. Take the distance Y X betweene the feete of the compasses, and let them both in the circumference of the circle, as in the first example, so shall you finde that there are betwixt *London* and *Cusco* almost 97 degrees, of a great circle, that is 1940 leagues or 5820 miles.

If you had rather keepe within the compasse of the circle, make the perpendicular X Z equall to S T, and proceede with E Z, as you did before with X Y.

He that desireth a demonstration of the former rules, must suppose the circle P H D R & C to be the æquinoctiall circle: let him also vnderstand the lines of latitude E F, K L, N O, T S, to stand perpendicularly erect from their diameters of longitude B C, D I, M &, V R, and from the plaine of the æquinoctiall, and consequently by the 3 *e.* 11. Ra, or 4. pr. 11. *Euc.* from the lines F A, F L, F O, F S, which lines are imagined to be in the plaine of the

æquino-



æquinoctiall, and are the distances of the lines of latitude. Therefore if F G be made æquall to F A (which is a line drawne in the plaine of the æquinoctiall from Saint *Thomas* Iland to the line of *Londons* latitude) E G must needes bee æquall to

the

the line ſubtending the diſtance of London and S. Thomas Iland by the 2. e 7. Ra. 4. 26. pr. 1. *Eucl.*

Alſo, becauſe all the ſines of latitude (beeing perpendicular to the ſame plaine of the equinoctiall) are parallels, by the 5. e 21. Ram 6. pr. 11. *Eucl.* Therefore by the 11. e 2. Ram. or 35 d. 1. *Euc.* F L is the line ſubtending the diſtaunce of London and Cape Blanco.

Againe, becauſe FP whereto EF is perpendicular is made equall to FO, (the diſtance of the ſines of London and Hieruſalem, to which (diſtance) EF is alſo perpendicular in the globe) and EQ alſo equall to NO: Therefore FQ being the difference of the ſines of Londons and Hieruſalems latitudes: there muſt needs be the ſame diſtance betwixt P and Q that there is betweene the toppes of the ſines of Hieruſalems and Londons latitudes in the globe.

Laſtly, FX being equal to FS (the diſtance of the ſines of latitude of London and Cuſco in Peru) & XZ perpendicular to FX, and æquall to ST the ſine of Cuſcoes latitude: as EF is the ſine of Londons latitude and perpendicular to the ſame line XF: EZ (to which XY is equall by the 6. e 12. e 5 *Ram.* 33 pr. 1. *Eucl.* YE being equall and parallel to XZ muſt needes be equall to a ſtreight line extended within the globe betweene the points of latitude of Cuſco and London.

Now out of this demonſtration it were an eaſie matter (if any liſt take the paines to be ſo curious) to find out the diſtance of any two places arithmetically by the doctrine of triangles, hauing alwaies two

two ſides giuen which are the ſines of the complements of the latitudes of the twoo places as OP, FP: LP, FP: RP, FP: AP, FP: together with the angle intercepted that is the difference of their longitudes: whereby FA: FO: FL: FS, the diſtances of the ſines of latitude being found by the 2, 3, 4, 5, *Copernic. de Triangulis planis*, the lines alſo ſubtending the diſtances of the places may moſt eaſily be found by the 3. *Copernic. de Triang. plan.* For the ſquares of the diſtance of the ſines, and of the difference of the ſines of their latitudes (if both be northerly or both ſoutherly) or of the ſumme of the ſines of their latitudes (if one be northerly another ſoutherly) are equall to the ſquare of the line ſubtending the diſtance of the places 5. e 12. *Ram.* 47. pr. 1. *Eucl.*

With no leſſe facilitie alſo by helpe of the former Tables, and the Canon of Triangles, any two places being giuen, there may arithmetically and moſt exactly be found out, firſt, by their longitudes and latitudes, the rumbe, and diſtance meaſured in the rumbe: ſecondly, by their diſtance, and latitudes, the rumbe and difference of longitude: thirdly, by their rumbe, and latitudes, the diſtance and difference of longitude: fourthly, by their longitudes, rumbe, and one latitude, the other latitude and diſtance: fifthly, by the rumbe diſtance and one latitude, the other latitude, and the difference of longitude: or any other nauticall or geographical probleme that by the Chart may mœchanically be performed: and the whole Arte of Nauigation arithmeticall (as ſome call it) may as eaſily be pra-

ctifed : So as, hauing onely the longitudes and latitudes of the places (by which, and to which you are to saile) set downe in a Table, you may by arithmeticall calculation onely (if you list take the paines) without any chart, mappe, or globe, shewe the course and distance from anie place to other: and so giue most exact direction for the perfourmaunce of an whole voyage to any knowne place assigned, how oft soeuer you haue trauersed or bin tossed this way and that way by reason of scant, violent, or contrary windes, or any other occasion.

But seeing the first groundes of this Art, that is, the obseruations of the latitudes, but especially of the courses at sea, cannot but be farre from such exquisite trueth as is to be found in those arithmeticall operations: howe exact soeuer you be in the rest of the meanes, you can look for no more truth in conclusion then such as is answerable to the first groundes and principles, out of which the conclusion is gathered. So as the Mariner shall not need to trouble himself any further herewith, but only to cast vp his accounts vpon the chart truly made (as before is shewd) which of al other is most fit & ready for his ordinarie vse. Now therefore it may be sufficient, onely to shewe how the former Problemes may mechanically be performed vpon the nauticall planisphaere before described.

First, By the longitudes and latitudes of both places giuen, the rumbe and distance may thus be found: drawe parallels by both latitudes: take the distance of those parallels: according to which distance drawe a parallel to the æquinoctiall. Then from

from the end of the difference of longitude reckoned from the concurse of the rumbes in the æquinoctiall erect a perpendicular crosing the saide parallel: A line drawn by this crosing from the concurse of the rumbes is the rumbe of the two places. Now to finde out the distance, take so manie degrees of the æquinoctiall as the the difference of latitude containeth: and guiding one foote of the compasses in the equinoctiall, with the other foot carried parallel-wise at equall distance from the æquinoctiall, crosse the rumbe newely found out: take the distaunce of this crosing from the concurse of the rumbes, and set both feete of the Compasses in the equinoctiall, for the degrees intercepted shew you the distance desired.

Secondly, By the distance & latitudes (knowing which place is more eastwardes, or westwardes) the rumb & difference of longitude is thus found: Take with the compasses so many degrees and minutes of the æquinoctiall, as the difference of latitude containeth: According to that distance draw a parallel to the æquinoctiall, take so many degrees of the æquinoctiall with your Compasses, as the distance giuen commeth to: then one foote being set in the concurse of the rumbes in the equinoctiall, with the other crosse the parallel aforesaide: A line drawne by that crosing from the concurse of the rumbes in the æquinoctiall giueth you the rumbe desired. Then both latitudes being noted in the graduated meridian, therein take their difference with the compasses, and guiding one foote in the equinoctiall, with the other carried at that di-

diſtance parallel-wiſe from the æquinoctiall, croſſe the rumbe of the places : the diſtance of that croſſing from the meridian (that commeth from the common meeting of the rumbes in the æquinoctiall) taken with the compaſſes, and brought to the æquinoctiall, ſhal ſhew you the difference of longitude. Or a perpendicular to the æquinoctiall from that croſsing ſhal poynt you out therein, the difference of longitude.

Thirdly, By the rumb and latitudes (being both northerly or both ſoutherly) the diſtance and difference of longitude is thus found : Take the difference of latitudes in the æquinoctiall: according to that diſtance draw a parallel to the æquinoctiall (as before) croſsing the rumb of the two places giuen: take the diſtance of this croſsing from the concurſe of the rumbes : Then both feete of the compaſſes ſet in the æquinoctiall wil ſhew the diſtance of the places. The difference of longitude is found as before.

Fourthly, By the longitudes rumbe and one latitude (knowing whether it bee the leſſer or greater) to finde the other latitude, and the diſtance, do thus : From the concurſe of the rumbes in the æquinoctiall count the difference of longitude: from hence erect a perpendicular croſsing the rumbe: the diſtance of this croſsing from the æquinoctiall tranſlated into the graduated meridian (ſetting one foote in the knowne latitude, and extending the other northwardes or ſouthwardes according as the vnknowne latitude is greater or leſſer) ſhall ſhew you the latitude deſired. Now to finde the diſtance

diſtance worke as before in the firſt Probleme.

Fiftly, by the rumbe, diſtance, and one latitude, you may find the other latitude and the difference of longitude after this manner: Take the diſtance giuen with the Compaſſes in the æquinoctiall: ſet one foote in the concurſe of the rumbes, and with the other croſſe the rumbe giuen : from this croſsing drawe a perpendicular to the æquinoctiall: the length of that perpendicular taken with the Compaſſes and brought into the æquinoctiall ſhal ſhew you the difference of latitude. Thus hauing both latitudes giuen, the difference of longitude may alſo be found as before Prob. 2.

Nowe in euery one of theſe problemes there may be ſome particular caſes wherof ſome diuerſitie of working may follow, yet ſuch as can breed but ſmall trouble to him that well ſhall conceiue the reaſon of that is already ſet down in theſe fiue former Problemes: which are eſpecially to be applied to ſuch places as are both on the ſame ſide of the æquinoctiall, and differ alſo both in longitude & latitude: of which ſort is the greateſt number, and in which the greateſt vſe, and moſt difficultie of working conſiſteth. To proſecute euery particularitie at large (whereof ſome perhaps leſſe acquainted with the reaſon of theſe mathematical practiſes may be deſirous) would be now for mee too long and tedious. For ſome taſte therefore of the vſe of this nauticall planiſphere, let thus much for this time briefly ſuffice.

Of the Variation

Error in the Compaſſe, by the variation neglected, and how to obſerue and auoyde the ſame. Chap. 6

NExt the ſea Chart there is not any inſtrument of Nauigation whereby greater error may enſue then by the Compaſſe, if the variation be neglected. By which neglect alone we may oftē times miſſe an whole poynt and more, in directing the courſe from place to place. Notwithſtanding, M. *Peter* of *Medina* laboureth greatly to prooue that there is no variation of the Compaſſe, and that many inconueniences and abſurdities muſt needs follow out of that opinion, as hee eſteemeth it, thinking it to haue no better grounde then the groſſe and erronious obſeruations of vnskilfull Mariners, as by the third Chapter of his ſixt booke of the art of Nauigation may appeare more at large. But daily experience (by many and diligent obſeruations, with exact inſtruments, heedfully vſed by skilfull obſeruers, not onely at ſea, the vnconſtancie whereof (which cauſeth the ſhippe to be alwaies vnſteadie) might giue ſome colour to *M. Peters* conceit of no variation: but alſo on firme land, where moſt ſteady and certaine obſeruation may eaſily be made:) I ſay daily experience hath ſo often, ſo conſtantly, ſo manifeſtly proued this varying propertie to be in the Compaſſe, that it can be by no meanes with reaſon denied.

The variation of the Compaſſe is the arke of the horizon contained betweene the true meridian and the magneticall meridian.

The true Meridian is an azimuth paſſing by the poles of the world.

The

of the Compaſſe.

The magneticall meridian is an azimuth that paſſeth by the poynts of the wires in the Compaſſe, or of the needle touched with the loadſtone.

An azimuth is a great circle paſsing by the zenith, and conſequently making right angles with the horizon.

A great circle is a circle diuiding the world into two æquall parts.

The zenith is a poynt in the heauens hanging right ouer our heades.

The azimuth of the ſunne is an azimuth paſsing by the center of the ſunne.

The azimuth is ſaid to be giuen, when the arch of the horizon betwixt it & the meridian is knowne.

There are two azimuths of the ſunne, the true azimuth and the magneticall azimuth.

The true azimuth of the ſunne is ſhewed by the arch of the horizon contained betwixt the azimuth of the ſunne, and the true meridian.

The magnetical azimuth of the ſun is ſhewed by the arch of the horizon contained betweene the magnetical meridian & the azimuth of the ſunne.

The difference of theſe two arks of the horizon is alwaies equall to the variation of the Compaſſe.

To find out the magnetical azimuth of the ſun, we muſt firſt know vpon what point of the Compaſſe the ſun is: which although it may be done by aime very neare the truth by him that is experiēced, eſpecially when the ſun is low, or at the horizon riſing or ſetting: yet it may better bee done with helpe of ſuch a ruler and ſights, as land meaſurers vſe with their plaine tables, wherewith you may thus finde vpon what point of the Compaſſe the ſunne is.

Lay the edge of the ruler right ouer the center of the Compaſſe: then holding the ruler ſo fixed, and the compaſſe leuel ſo neare as you can aime, turne it about vntil the midſt of the ſun-beames paſsing throgh one of the ſights, fal alongſt vpon the edge of the ruler, or midſt of the oppoſite ſight. Thē holding your eie in ſuch ſort ouer the Compaſſe, that the rulers edge may ly right vpon the center of the fly, look alſo vpon what point of the compaſſe the edge of the ruler lieth to the ſun-wards, for that is the point wherupon the ſun is at that time: which for breuities ſake may be called the ſunnes point.

This point you ſhal looke in the inſtrument following, & it ſhal ſhew you amongſt the degrees the magneticall azimuth of the Sun. As for example, when the Sunne is due Eaſt by the Compaſſe, I would know in what magneticall azimuth hee is: Therefore I looke the eaſt point in this Inſtrument, which directeth me to 84. degr. ½ which is the magneticall azimuth deſired. And the difference betwixt this & the true azimuth of the Sun is the variation of the compaſſe which we ſeek for. This difference therefore ſhall thus be found out.

At the ſame time when you obſerue the Sunnes poynt, let the height of the Sunne bee alſo obſerued. It is beſt to take both theſe obſeruations when the Sun is neareſt the eaſt or weſt azimuth, for then the height of the Sunne altereth quickeſt, therefore at that time the true azimuth of the Sun ſhall beſt be knowne thus: Firſt finde out the declination of the Sunne, remembring alwayes to giue allowaunce, or take away (according as the declination increaſeth or decreaſeth) for the place and

and time of your obſeruation: Then ſet your Aſtrolabe to the latitude of the place where you obſerue and followe the parallel of the Sunnes declination, vntill you come to the almicantarath or height of the Sunne knowne by obſeruation: for the azimuth that paſſeth by their mutuall interſection, is the true azimuth of the Sunne that was ſought for: which if you folow downe to the horizon, you ſhall haue that azimuth giuen. Now of theſe twoo giuen azimuths (that is the true and magneticall azimuth of the Sunne) ſubtract the leſſer from the greater, for the difference remaining is the variation of the Compaſſe: the denomination whereof (that is whether it be eaſterly or weſterly) ſhall eaſily be diſcerned thus:

If the true azimuth of the Sunne counted from the South poynt in the forenoone, be leſſe then the magneticall azimuth the variation is eaſterly: otherwiſe it is weſterly. Contrariwiſe, in the afternoone: if the true azimuth of the Sunne bee greater then the magnetical azimuth the variation of the Compaſſe from the poynt of true north is eaſtwards, otherwiſe it is weſtwards.

The inſtrument following is then to bee vſed when obſeruation is made as before hath bin ſhewed by a Compaſſe, wherein the north poynts of the wires are ſet halfa point to the eaſtwards from the north poynt of the Compaſſe, which is vſually ſignified by the poynt of the Flowre de luce: (of which ſort are the compaſſes that are and haue been hitherto cōmonly vſed by our Engliſh mariners:) whereas if the poynts of the wires were ſet iuſt vnder the poynts of north and ſouth: and the

 circum-

Lay the edge of the ruler right ouer the center of the Compaſſe: then holding the ruler ſo fixed, and the compaſſe leuel ſo neare as you can aime, turne it about vntil the midſt of the ſun-beames paſsing throgh one of the ſights, fal alongſt vpon the edge of the ruler, or midſt of the oppoſite ſight. Thē holding your eie in ſuch ſort ouer the Compaſſe, that the rulers edge may ly right vpon the center of the fly, look alſo vpon what point of the compaſſe the edge of the ruler lieth to the ſun-wards, for that is the point wherupon the ſun is at that time: which for breuities ſake may be called the ſunnes point.

This point you ſhal looke in the inſtrument following, & it ſhal ſhew you amongſt the degrees the magneticall azimuth of the Sun. As for example, when the Sunne is due Eaſt by the Compaſſe, I would know in what magneticall azimuth hee is: Therefore I looke the eaſt point in this Inſtrument, which directeth me to 84. degr. ½ which is the magneticall azimuth deſired. And the difference betwixt this & the true azimuth of the Sun is the variation of the compaſſe which we ſeek for. This difference therefore ſhall thus be found out.

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and time of your obſeruation: Then ſet your Aſtrolabe to the latitude of the place where you obſerue and followe the parallel of the Sunnes declination, vntill you come to the almicantarath or height of the Sunne knowne by obſeruation: for the azimuth that paſſeth by their mutuall interſection, is the true azimuth of the Sunne that was ſought for: which if you folow downe to the horizon, you ſhall haue that azimuth giuen. Now of theſe twoo giuen azimuths (that is the true and magneticall azimuth of the Sunne) ſubtract the leſſer from the greater, for the difference remaining is the variation of the Compaſſe: the denomination whereof (that is whether it be eaſterly or weſterly) ſhall eaſily be diſcerned thus:

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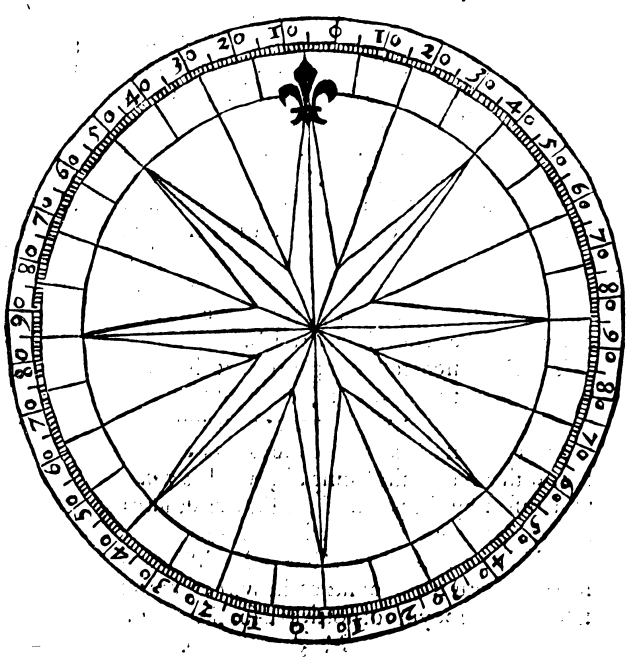
The inſtrument following is then to bee vſed when obſeruation is made as before hath bin ſhewed by a Compaſſe, wherein the north poynts of the wires are ſet half a point to the eaſtwards from the north poynt of the Compaſſe, which is vſually ſignified by the poynt of the Flowre de luce: (of which ſort are the compaſſes that are and haue been hitherto cōmonly vſed by our Engliſh mariners:) whereas if the poynts of the wires were ſet iuſt vnder the poynts of north and ſouth: and the

Of the Variation

circumference of the Compaſſe diuided into degrees both eaſtwards and weſtwards, beginning at the north and ſouth points, and ending with 90. at eaſt & weſt: we might at the firſt haue the magneticall azimuth of the Sunne by obſeruation, and ſo there ſhould be no neede of this inſtrument.

An Inſtrument for the ready finding out of the magneticall azimuth of the Sunne by the ordinary Compaſſe.



of the Compaſſe.

In the Table following you haue the former rules exemplified, out of ſuch obſeruations as I tooke both at ſea and land in the right honourable the Earle of Cumberlands voyage perfourmed in the yeere 1589. the particulars whereof moſt worthy to be remembred and commended to poſteritie, I haue hiſtorically diſcourſed and adioyned to this Treatiſe, as wherby the Reader mought the better be ſatisfied in knowing more ſpecially the places mentioned in this Table: wherein the letters N, W, S, E, b, in the firſt and ſecond columnes ſignifie North, Weſt, South, Eaſt, by. The fractions in the ſecond columne are partes of the poynt annexed. In the columne intituled, The time of obſeruation, the letters A N, and B N, ſignifie, after noone, and before noone.

The

A Table of obſeruations of the Variation of the Compaſſe.

The place of obſeruation	The Sunnes point of the Compaſſe.	The height of the ſunne		The Sunnes magnetical azimuth.	
		Deg.	Mi.	Deg.	Mi.
About twenty leag. from Spaine W	W N W ¼ N	0	0	69	30
30 or 40 leagues from Spaine W	E N E ¼ E	0	0	56	15
About the midway betwixt Lisbon and Saint Michaels.	E N E	0	0	61	40
	W N W	0	0	73	7
Betwixt S. Michaels and Tercera	E by N ¼ N	2	0	70	52
About 3 leag. from Tercæra S S W	E by N ¼ N	2	30	70	53
At Saint Cruz in Flores		29	25	83	30
		18	0	73	0
These obſeruations made in the towne of Fayal, and the former alſo in Flores, were taken by M. William Borowes inſtrument of variation (publiſhed in his booke of the variation of the compaſſe) and by a quadrant, whoſe ſemidiameter was almoſt two cubits.		16	36	74	40
		20	30	62	20
		20	0	62	54
		19	20	63	35
		18	16	64	45
		30	41	57	15
		46	13	17	53
		46	18	16	36
		40.	42	32	45
3 or 4 leagues from Tercæra S E	E S E ¼ E	0	0	75	50
From S. Maries W by S 6 leag.	W S W	13	0	61	50
From S. Maries W by S 6 leagues	W by S ½ S	0	0	67	25
From S. Maries ſouth 5. leagues	E S E ½ S	0	0	69	30
From Saint Maries 16 leagues N W by W northerly.	E S E ¼ E	0	0	75	50
	E S E	2	30	73	7 ½
From S. Georges S E by E 3 leag.	E S E ¼ E	0	0	75	50
From the eaſt part of S. Michaels N E by N about 15 or 20 leag	W S W ¼ S	0	0	59	0
	E S E ¼ E	0	0	70	23
From the rocke W about 66 leag.	S E by S ⅛ S	26		37	30
From C. Finiſterræ N Eaſterly	E S E ½ S	0		67	30
	E S E ¾ S	2		65	37
	S W	11		39	22

The time of obſeruation		The lat. of the place of obſer.		The declination of the ſunne		The true azimuth of the Sunne		The variation of the compaſſe		The middle variation.				The part of variation.
		De	M	De	M	De	M	D.	M	De	M	De	M	
Iul. 9	A N	39	50	20	53	62	0	7	30					Eaſtward
12	B N	39	0	20	25	63	20	6	45					weſtward
23	B N	38	0	17	55	67	0	5	20	5	38			eaſtward
23	A N	38	0	17	46	67	10	5	57					eaſtward
Aug. 8	B N	38	20	13	13	74	10	3	18					eaſtward
9	B N	38	20	12	54	75	0	4	7					eaſtward
14	A N	39	50	11	5	79	30	4	0					Weſtward
Se. 13	A N	38	54	0	8	74	35	1	35					eaſtward
13	A N	38	54	0	9	76	0	1	20					eaſtward
22	A N	38	54	3	39	67	10	4	50					eaſtward
22	A N	38	54	3	39	67	30	4	36					eaſtward
22	A N	38	54	3	39	68	15	4	40	3	5			eaſtward
22	A N	38	54	3	40	69	20	4	35					eaſtward
23	B N	38	54	3	53	54	20	2	55					eaſtward
23	B N	38	54	3	54	14	0	3	53					eaſtward
23	B N	38	54	3	54	13	30	3	6					eaſtward
23	A N	38	54	4	0	35	15	2	30					eaſtward
Oc. 18	B N	38	20	13	5	73	0	2	5					eaſtward
23	A N	37	0	14	50	60	0	1	50					weſtward
23	A N	37	0	14	51	71	5	3	40	0	55			eaſtward
24	B N	37	0	15	2	70	50	3	20					weſtward
26	B N	37	30	15	38	69	50	6	0	5	34			eaſtward
26	B N	37	30	15	39	68	0	5	7					eaſtward
28	B N	38	40	16	16	68	45	7	5					eaſtward
No. 1	A N	38	40	17	30	67	10	8	10					eaſtward
2	B N	38	40	17	41	66	50	3	33					eaſtward
6	B N	38	35	18	43	31	0	6	30					eaſtward
12	B N	44	25	20	5	61	0	6	30					eaſtward
12	B N	44	25	20	5	58	0	7	37½	7	4			eaſtward
12	A N	44	30	20	11	46	15	6	52					eaſtward

Notwithſtanding there be much difference betwixt ſome of theſe variations taken at the ſame place with the ſame inſtruments, yet we vſed with what diligence we could ſuch inſtruments as then we had prepared for that purpoſe: which I ſpeake, that others that ſhall go about hereafter to obſerue the variation (at ſea eſpecially) may bee the more circumſpect to foreſee and preuent all cauſes of error herein. Exact trueth amongſt the vnconſtant waues of the ſea is not to bee looked for, though good inſtruments bee neuer ſo well applyed. Yet with heedfull diligence we may come ſo neare the trueth as the nature of the ſea, our ſight and inſtruments will ſuffer vs. Neither if there be diſagreement betwixt obſeruations, are they all by & by to be reiected? but as when many arrows are ſhot at a marke, and the marke afterwards taken away, hee may bee thought to worke according to reaſon, who to find out the place where the marke ſtood, ſhall ſeeke out the middle place amongſt all the arrowes: ſo amongſt many different obſeruations, the middlemoſt is likeſt to come neareſt the truth.

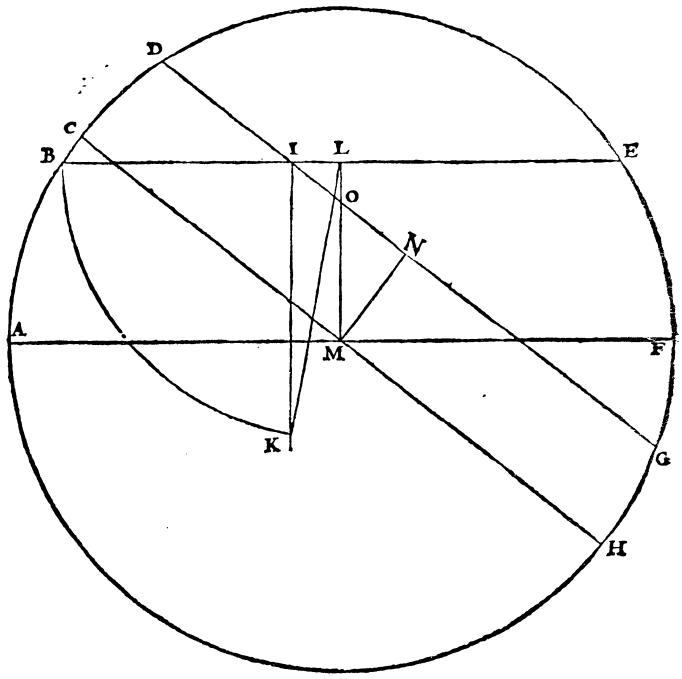
Cauſes of error herein, ſome cannot be auoyded, as the vnſteadineſſe of the ſhip, the imperfection of ſenſe & inſtruments, the weake reſpectiue force of the needle or wires, be they neuer ſo wel touched. Others may be eſchewed, as that there be no iron neare the Compaſſe in time of obſeruation, that the wires bee not kept too long vntouched from the ſtone, that ſuch inſtrumẽts be vſed for obſeruation as need leaſt working afterwards for finding out the variation: wherein the inſtruments heretofore

toſore publiſhed for this purpoſe, are faultie, being ſuch as ſerue for obſeruation onely on land: as alſo requiring many workings afterwards, vnfit for Mariners, before the matter can come to iſſue, wherein are as many lurking holes of error without great diligence. I was therefore purpoſed here to haue adioyned the making and vſe of a certaine inſtrument (which may not vnfitly be called the Mariners rings) wherby the variation of the compaſſe and time of the day is preſently giuen, togither with the obſeruation (the latitude of the place being knowne) and that vniuerſally throughout the world, both at ſea and land. As alſo the variation being giuen, the height of the pole and houre of the day may thereby be knowne without thoſe inconueniences, wherewith *Martine Corteſe* his inſtrument, Chap. 11. part 3. of the art of Nauigation, and *Michael Coignet* his nauticall hemiſphere, are much incumbred: to omit the obſeruation of the height of the ſunne, which (as I haue oft made tryall at ſea) may thereby be more exactly performed, then hath beene hitherto by ſtaffe, ring, or aſtrolabe commonly vſed. But I am at this time inforced to differre it.

In the meane time for them that want the Globe and Aſtrolabe before mentioned, I thought good toſet downe a way whereby (the declination and heigth of the ſun being giuen, togither with the latitude of the place) the ſunnes true azimuth may be founde with ruler and compaſſes onely, after this manner: Drawe the circle A B C D E F G H, repreſenting the Meridian, by the center heereof

drawe the diameter of the horizon AF. From A the end of this diameter, reckon the eleuation of the equinoctiall AC. from whence draw a line by the center, which may be called the diameter of the æquinoctiall C H. From C. the end of this diameter count the declination of the ſunne C D. thereby draw a parallel to the diameter of the æquinoctial, which may bee called the diameter of the Sunnes parallel DG. Likewiſe from the diameter of the horizon number the height of the ſun AB. known by obſeruation, and thereby alſo draw BE a parallel to the diameter of the horizon, which may bee called the diameter of the ſunnes almicantar. From I, the interſection of theſe two parallels, drawe I, K, a line perpendicular to the diameter of the horizon. Then ſetting one foote of the Compaſſes in L the midſt of B E the diameter of the ſunnes almicantar, and ſtretching out the other foote to B the end of this diameter: from thence draw therewith the arch BK till you come to the ſayd perpendicular: This arch reſolued into degtees ſhall giue you the true azimuth of the ſunne.

Now



Nowe (for them that liſt) by the doctrine of Triangles alſo, M N (the ſine of the ſunnes declination) being giuen, with the angle ONM. (equal to the height of the pole) in the right angled Triangle, ONM: the ſide of OM ſhall likewiſe be giuen:

uen: which ſubtracted out of MOL. (the ſine of the ſunnes height) there ſhall remaine LO. wherby LI. in the Triangle LIO, hauing one right angle at L. and conſequently ILK. the angle deſired, are giuen.

Errors in vſing the croſſe ſtaffe, and how they may be auoyded. Chap 7

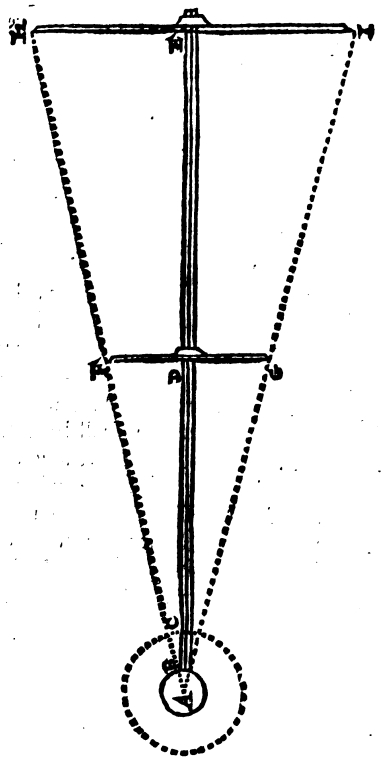
AFter the Chart and Compaſſe, the croſſe Staffe may with good reaſon ſucceede, as in the vſe whereof more error is committed, then in any other inſtrument of Nauigation, the twoo former excepted, and that three ſeuerall waies: Firſt in neglecting the paralax or eccentricitie of the eye: Secondly in not conſidering the height of the eye aboue the water: Thirdly in not regarding the paralax of the ſunne.

For the firſt, they count the height of the ſunne and ſtarres in ſuch ſort as if the center of the eye, or vertex of the viſuall cone in vſing the ſtaffe, were euen with the end therof applied to the eie. Therforehow much the center of the ſight is diſtant frō the ende of the Staffe, ſo much are they deceiued. But howe much the eccentricitie or paralax of the eye is, it may be knowne after this manner: Make two tranſuerſaries, the one twiſe ſo long as the other. The longeſt of theſe twoo ſet faſt at the further end of the index, the other of them moue vp or downe vppon the index, vntill ſuch time that your eye placed at the ende of the index (in ſuch ſort as you vſe to place it when you obſerue) you may

may ſee both ends of both tranſuerſaries lie euen togither. For then looke how much the ſegment of the index betwixt the two tranſuerſaries exceedeth the ſegment from the ſhorter tranſuerſarie vnto the eie, ſo much is the paralax or eccentricitie of your ſight: that is the center of your ſight, or the poynt within your eye, wherein the viſuall beames concurre, is ſo much diſtance from the end of the index.

As for example, in this figure let the tranſuerſarie HEI. placed at E. the end of the index be double to the tranſuerſarie FDG. which is placed in ſuch ſort vpon the index, that the viſuall lines (AFH, AGI) of the eie placed at the end of the index, do paſſe ſtraight on by FH. and GI. the ends of the tranſuerſaries. For in this figure A. is the center of the ſight or eye, wherein the viſuall lines (AFH, AGI) do concurre: B. repreſenteth the ende of the index, placed at the corner of the eye, and then AB. is the eccentricitie: C. ſignifieth the ende of the index ſette againſt the bone vnderneath the eie, for obſeruing of diſtances, and then AC. is the eccentricitie, which is thus demonſtrated.

As



As HE is to FD, ſo is EDA to DA, 13. e 5. Ra. But HE is double to FD by ſuppoſition: therefore EDA is double to DA, and DA the halfe of EDA, equall

æqual to the other halfe DE. Therefore how much BD or CD is ſhorter then DE, ſo much is the paralax or eccentricitie of the eie, and ſo much muſt the tranſuerſary be remooued forwards (from the place where he was ſet in the time of your obſeruation) towardes the faire end of the index, after you haue obſerued any heigth or diſtance of the ſunne or ſtarres, that ſo you may haue the true height or diſtance deſired. Or elſe you may haue a plate of braſſe ſo artificially fitted cloſe within, by the ſide of the ſquare hole in the tranſuerſarie, through which the index is to be put, that you may ſlip it forwardes or backwards like the couer of a boxe, and ſo ſet the fore-edge thereof ſo much before the tranſuerſarie, as the eccentricitie of your eye commeth to (hauing firſt turned the flatte and ſtreight ſide of the tranſuerſarie from you ward, and pared the ends thereof, in ſuch ſort that the viſuall beames may touch the extreames of that ſide) that ſo the edge of the plate may at the firſt ſhewe vpon the index the true heigth or diſtance of the ſunne or ſtarres obſerued without any further correction. Otherwiſe if this paralax of the ſight bee neglected, there may be error of an whole degree and more ſometimes in obſeruing with thoſe ſmall croſſe ſtaues which haue beene commonlie vſed.

Secondly they increaſe the former error by not regarding the heigth of the eye aboue the water. Which although it be not ſo great a fault as the other, yet it may deceiue them by increaſing the former error, fiue or ſixe minutes or more in a tall

ſhip. For the higher the eye is aboue the water, the greater is the angle intercepted betwixt the two viſual lines, whereof one toucheth the conuex ſuperficies of the ſea, the other paſſeth on to the ſun or ſtarres: And the lower the eye is, the leſſer is the foreſayd angle: and then onely it ſheweth the true altitude, when the center of the ſight is in the ſame line of leuell with the ſuperficies of the water. But if the eye be higher then the water, that angle is greater then the true altitude, and therefore ſubtraction muſt bee made accordingly, that you may haue the true altitude. For this purpoſe I haue made this table hereadioyned, the vſe whereof is this: when you obſerue the heigth of the ſunne or ſtarres at ſea with the croſſe ſtaffe, you ſhall alſo find out how many foot high your eye is aboue the water with a plumb-line or otherwiſe: ſeeke that heigth of the eye in the firſt columne of this Table: and in the ſame line in the ſecond column (intituled *Minutes to bee ſubtracted*) you ſhal find what number of minutes are to be ſubtracted from the apparent heigth of the ſunne or ſtarres aboue the ſuperficies of the ſea obſerued with the ſtaffe, that you may haue the apparent

The height of the eie aboue the water.	*Minutes to bee ſubtracted.*
Foote.	*Minutes.*
5	2
10	3
15	4
20	5
25	6
30	6
40	7
50	8
60	9
70	9
80	10
90	11

parent heigth aboue the horizon.

The third error hath place in taking the heigth of the ſunne or moone with the ſtaffe, ring, quadrant, or Aſtrolabe, or any other inſtrument, whether by ſea or land: but in taking the heigth of the fixed ſtarres, this error is not to be regarded, being altogither inſenſible, by reaſon of their exceeding great diſtance from the earth, which is ſo much, that in compariſon thereof the ſemidiameter of the whole earth hath not any ſenſible proportion, and therfore the fixed ſtarres cannot haue any ſenſible paralax. But the ſunne by reaſon of his leſſer diſtance from the earth, hath a ſenſible paralax: in ſo much that in taking his heigth, wee may for this cauſe onely bee deceiued ſometimes neare three minutes, by counting it leſſe then it is indeede, and that eſpecially in winter time, when the ſunne draweth neare the horizon: which although it be no great error, yet it is not altogither to be neglected in the rules and groundes of Art, which ſo much as is poſsible ought to be without all error.

For this cauſe I haue adioined this table following of the ſuns paralax: the vſe whereof is this, in the firſt columne intituled the heigth of the ſunne, looke the ſunnes apparent heigth, and in the ſame line in the ſecond columne, you ſhall haue the paralax of the ſunne, which alwaies is to bee added to the apparent heigth, that ſo you may haue the true heigth of the ſunne aboue the horizon. As for example, admit I finde the apparent heigth of the ſunne to be 25. degrees, therfore I ſeeke that number in the firſt columne, and in the ſecond columne I find the paralax anſwerable thereto to be 2. min. 42. ſec. which added to 25 degr. make the true height of the Sunne to be 25. degr. 2. min. 42. ſec.

The height of the ſunne.	*The paralax of the ſunne.*	
Degr.	*Mi*	*Sec.*
0	2	58
5	2	57
10	2	55
15	2	51
20	2	47
25	2	43
30	2	34
35	2	26
40	2	16
45	2	6
50	1	54
55	1	42
60	1	29
65	1	15
70	1	1
75	0	46
80	0	31
85	0	15

Hereunto ſome do alſo adioine the fourth cauſe of errour by reaſon of refraction of the beames of the ſunne or ſtarres through thicknes of the ayre: which for aught I can finde by obſeruation with large inſtruments is little to bee regarded in anie meridian altitude of the Sunne heere at London: But in the ſtarres I haue many times found it to be ſome

Error in vſing the Croſſe Staffe.

ſome thing, eſpecially when they come neere the horizon, and ſometimes ſcarce any thing being but a few degrees aboue the horizon. So as I think it not greatly needefull at this time to trouble the mariners conceipt herewith any more, for whoſe ſake eſpecially this labour was vndertaken. As alſo I would not wiſh thē to be greatly ſcrupulous for the former error riſing by reaſon of the ſunnes paralax neglected: being ſuch as at ſea can eyther not at al, or at leaſt very hardly be obſerued by any inſtrument. But our land where we may haue ſteady ſtanding to make exact obſeruation, it would not altogether be neglected.

Faults amended in the Table of the Sunnes declination: commonly called the *Regiment of the Sunne.*

NOtwithſtanding the Sunne and Starres are at ſea the moſt certain marks and guides the Nauigator hath, wherby he may direct him ſelfe to rectifie his courſe, and knowe where hee is after many turnings and trauerſings this way & that way, eſpecialy in long voiages wherein he may be forced many times by cõtrary winds and calmes, to ſing with the Poet for many weeks and moneths together,

Cœlum vndique & vndique pontus: and
Nihil eſt niſi pontus & æther:

Yet the Tables of declinations of the Sun & fixed Starres hitherto publiſhed, which I haue compared together and examined by obſeruation, are oft times very faulty: the declination of the Sunne in them ſet down being many times leſſe than truth by 10, 11, or 12 minutes, eſpecially in the moneths of February and March: and ſome of the principall fixed ſtarres that are of moſt vſe in Nauigation, differing in declination from that is ſet downe

in

in the Tables more than one whole degree, as I haue found by many obſeruations.

For the eaſier mending of theſe faults in the tables of the ſunnes declination, I thought it meete firſt to ſet downe the table following, which ſheweth the declination of euery minute of the ecliptike in degrees, minutes, and ſeconds, whereby the place of the ſunne is preſently knowne, his declination being firſt giuen by obſeruation, and conſequently his eccentricitie and apogeum were eaſily found, and the theoricke of the Sunne corrected: out of which the Ephemerides hereafter following were calculated, ſhewing the true place of the Sunne for euerye daye of foure yeeres agreeable, (without notable errour) to the ſeuenth of the heauens: and out of theſe with helpe of this Table of declination, a new regiment (or table of the Suns declination for euery day of foure yeres) was moſt eaſily made: free from ſuch errours as wherewith the tables hitherto publiſhed and commonly vſed haue beene too much peſtered: as by compariſon of this, & thoſe tables with the obſeruations hereafter following may euidently appeare.

¶ *Of the Table of Declination following: wherein is ſet downe, the Declination of euery Minute of the Ecliptick, in Degrees, Minutes, and Seconds. Made according to the greateſt obliquitie of the Zodiacke this preſent age, which by exact obſeruation is found to be 23. Degrees 30. Minutes. Seruing eſpecially for finding out moſt ſpeedily, the true place of the Sunne, his Declination being firſt knowne: Or, contrariwiſe, To find the Declination of the Sunne, his place being firſt giuen.*

BEcauſe the Table of Declination following, dooth differ ſomething from the Tables heretofore publiſhed by others, whereof ſome make the greateſt declination of the Sun to be 23. Degrees, 28. Minutes only, as *Copernicus* and his followers (according to which the Tables of Declination and regiments of the Sunne now generally vſed by our Engliſh Mariners are made:) whereas others of late, as that noble Aſtronomer of *Denmarke Tycho Brahe* in his ſecond book *De recentioribus ætheres mundi phænomenis* ſetteth down the ſame to bee by his obſeruations 23 degr. 27 mi. pag. 38. 23 de. 31 mi. pag. 386. 23 de. 31 mi. 30 ſec. pag. 217. according to which there is a table of declination already publiſhed by *Maginus*: I thought it therfore needfull to ſet downe, what reaſons mooued me to cleaue neither to the one, nor the other, but to keepe, as it were, a middle courſe betweene both: herein not onely agreeing with that excellent arts-man *Germanies Euclide Regiomontanus*, whom *Petrus Nonius* (compared by *Ramus* to *Archimedes*) & *Clarius* (a great Mathematitian though a Ieſuite)

choſe rather to follow, then either of the other: But reſting alſo vppon many and diligent obſeruations (taken by a quadrant of more then ſixe foote *ſemidiameter*, ſo exactly made & diuided into minutes and halfe minutes, as poſsibly we could: and as accurately vſed and rectified by a plumb'line (euerie time we obſerued) as ſight could diſcerne:) All whirh obſeruations do proone with one conſent, that the greateſt declination of the ſunne in this age is 23 degrees and 30 minutes, as thus it may appeare.

In the yeare 1594. the 11 and 12 dayes of Iune, the meridian altitude of the ſunne was obſerued to bee 61 deg. 58 min. whereto the obſeruations of the 8, 9, 10, 13, 14, and 15 dayes of the ſame moneth doo well agree, wherin the meridian altitudes of the ſunne were 61 deg. 55 mi. ½ 61 deg. 56 mi. ½ 61 d. 57 mi. 61 d. 57 mi. ½ 61 d. 57 mi. 61 deg. 56 mi. almoſt, as alſo the obſeruations of the 9, 11, 12, and 13 dayes of Iune, in the yeare 1597: In which daies the meridian altitudes of the ſunne were 61 de. 57 mi. 61 de. 58 ½ mi. almoſt. 61 de. 58 mi. 61 de. 57 ½ mi. By all which obſeruations it may be concluded that the greateſt height of the ſun here at *London* is 61 deg. and 58 minutes. Likewiſe by diligent obſeruation made the 12 of December in the yeare 1595 (which day was very cleare) it is manifeſt that the leaſt meridian altitude of the ſunne at *London* is 14 degrees, 58 minutes, which being taken out of the greateſt height, 61 degrees, 58 minutes, there remaineth 47 degrees, 0 minutes. the diſtance of the *tropiokes*, the halfe whereof is the obliquitie of the *zodiacke*, or greateſt declination of the ſunne at this time, *viz.* 23 degrees 30 minutes.

But yet further to ſatiſſfie them that may perhappes be in doubt hereof, becauſe I bring but one obſeruation onely of the leaſt meridian altitude of the ſunne: who may alſo obiect the refraction of the ſunne beames, being

ſo neare the *horizon*. I haue alſo tried the ſame another way, by many and heedefull obſeruations of the Pole ſtarre, whereby I found the greateſt height thereof here at *London* to be 54 degrees, 24 minutes, and ½: and the leaſt height 48 degrees, 39 minutes ½: the difference of which heigths is 5 degrees 45 minutes: the half whereof 2 degrees 52 min. ¼ (the diſtance of the Pole-ſtar from the Pole) added to the loweſt heigth of the Pole ſtarre, ſheweth the heigth of the Pole at *London* to bee 51 degrees, 32 minutes: the complement whereof (38 degrees, 28 minutes) is the heigth of the equinoctial, which ſubtracted out of the greateſt heygth of the ſunne, 61 degrees, 58 minutes: there remaineth the greateſt declination of the ſunne as before 23 degrees 30 minutes.

De.	0			1			2			3			4			De.
Mi.	Deg	Mi.	Se.	Deg.	Mi.	Se.	Deg.	Mi.	Se.	Deg.	Mi.	Se.	Deg.	Mi.	Se.	Mi.
1	0	0	24	0	24	19	0	48	14	1	12	9	1	36	2	29
2	0	0	48	0	24	43	0	48	38	1	12	33	1	36	26	28
3	0	1	12	0	25	7	0	49	2	1	12	57	1	36	50	27
4	0	1	36	0	25	31	0	49	26	1	13	20	1	37	14	26
5	0	2	0	0	25	55	0	49	50	1	13	44	1	37	37	25
6	0	2	24	0	26	19	0	50	14	1	14	8	1	38	1	24
7	0	2	47	0	26	43	0	50	38	1	14	32	1	38	25	23
8	0	3	11	0	27	7	0	51	2	1	14	56	1	38	49	22
9	0	3	35	0	27	31	0	51	26	1	15	20	1	39	13	21
10	0	3	59	0	27	55	0	51	50	1	15	44	1	39	37	20
11	0	4	23	0	28	19	0	52	14	1	16	8	1	40	1	19
12	0	4	47	0	28	42	0	52	37	1	16	32	1	40	25	18
13	0	5	11	0	29	6	0	53	1	1	16	55	1	40	48	17
14	0	5	35	0	29	30	0	53	25	1	17	19	1	41	12	16
15	0	5	59	0	29	54	0	53	49	1	17	43	1	41	36	15
16	0	6	23	0	30	18	0	54	13	1	18	7	1	42	0	14
17	0	6	47	0	30	42	0	54	37	1	18	31	1	42	24	13
18	0	7	11	0	31	6	0	55	1	1	18	55	1	42	48	12
19	0	7	35	0	31	30	0	55	25	1	19	19	1	43	12	11
20	0	7	58	0	31	54	0	55	49	1	19	43	1	43	36	10
21	0	8	22	0	32	18	0	56	13	1	20	7	1	43	59	9
22	0	8	46	0	32	42	0	56	37	1	20	30	1	44	23	8
23	0	9	10	0	33	6	0	57	0	1	20	54	1	44	47	7
24	0	9	34	0	33	30	0	57	24	1	21	18	1	45	11	6
25	0	9	58	0	33	53	0	57	48	1	21	42	1	45	35	5
26	0	10	22	0	34	17	0	58	12	1	22	6	1	45	59	4
27	0	10	46	0	34	41	0	58	36	1	22	30	1	46	23	3
28	0	11	10	0	35	5	0	59	0	1	22	54	1	46	46	2
29	0	11	34	0	35	29	0	59	24	1	23	18	1	47	10	1
30	0	11	58	0	35	53	0	59	48	1	23	42	1	47	34	0
31	0	12	22	0	36	17	1	0	12	1	24	5	1	47	58	
	29			28			27			26			25			

De.	0			1			2			3			4			De.
Mi.	Deg	Mi.	Se	Deg.	Mi.	Se.	Deg.	Mi.	Se	Deg.	Mi.	Se.	Deg.	Mi.	Se	Mi.
31	0	12	22	0	36	17	1	0	12	1	24	5	1	47	58	29
32	0	12	46	0	36	41	1	0	36	1	24	29	1	48	22	28
33	0	13	9	0	37	5	1	1	0	1	24	53	1	48	46	27
34	0	13	33	0	37	29	1	1	23	1	25	17	1	49	10	26
35	0	13	57	0	37	53	1	1	47	1	25	41	1	49	33	25
36	0	14	21	0	38	17	1	2	11	1	26	5	1	49	57	24
37	0	14	45	0	38	40	1	2	35	1	26	29	1	50	21	23
38	0	15	9	0	39	4	1	2	59	1	26	53	1	50	45	22
39	0	15	33	0	39	28	1	3	23	1	27	17	1	51	9	21
40	0	15	57	0	39	52	1	3	47	1	27	41	1	51	33	20
41	0	16	21	0	40	16	1	4	11	1	28	4	1	51	57	19
42	0	16	45	0	40	40	1	4	35	1	28	28	1	52	21	18
43	0	17	9	0	41	4	1	4	59	1	28	52	1	52	44	17
44	0	17	33	0	41	28	1	5	22	1	29	16	1	53	8	16
45	0	17	57	0	41	52	1	5	46	1	29	40	1	53	32	15
46	0	18	21	0	42	16	1	6	10	1	30	4	1	53	56	14
47	0	18	44	0	42	40	1	6	34	1	30	28	1	54	20	13
48	0	19	8	0	43	4	1	6	58	1	30	52	1	54	44	12
49	0	19	32	0	43	27	1	7	22	1	31	15	1	55	7	11
50	0	19	56	0	43	51	1	7	46	1	31	39	1	55	31	10
51	0	20	20	0	44	15	1	8	10	1	32	3	1	55	55	9
52	0	20	44	0	44	39	1	8	34	1	32	27	1	56	19	8
53	0	21	8	0	45	3	1	8	58	1	32	51	1	56	43	7
54	0	21	32	0	45	27	1	9	21	1	33	15	1	57	7	6
55	0	21	56	0	45	51	1	9	45	1	33	39	1	57	31	5
56	0	22	20	0	46	15	1	10	9	1	34	3	1	57	54	4
57	0	22	44	0	46	39	1	10	33	1	34	26	1	58	18	3
58	0	23	8	0	47	3	1	10	57	1	34	50	1	58	42	2
59	0	23	31	0	47	27	1	11	21	1	35	14	1	59	6	1
60	0	23	55	0	47	50	1	11	45	1	35	38	1	59	30	0
61	0	24	19	0	48	14	1	12	9	1	36	2	1	59	54	
	29			28			27			26			25			

Aries Libra

De.	5			6			7			8			9			De
Mi.	Deg.	Mi.	Se	Deg.	Mi.	Se.	Deg.	Mi.	Se	Deg.	Mi.	Se	Deg.	Mi.	Se.	Mi.
1	1	59	54	2	23	44	2	47	31	3	11	16	3	34	58	59
2	2	0	18	2	24	7	2	47	55	3	11	40	3	35	22	58
3	2	0	41	2	24	31	2	48	19	3	12	4	3	35	46	57
4	2	1	5	2	24	55	2	48	43	3	12	27	3	36	9	56
5	2	1	29	2	25	19	2	49	6	3	12	51	3	36	33	55
6	2	1	53	2	25	43	2	49	30	3	13	15	3	36	57	54
7	2	2	17	2	26	6	2	49	54	3	13	39	3	37	20	53
8	2	2	41	2	26	30	2	50	18	3	14	2	3	37	44	52
9	2	3	4	2	26	54	2	50	41	3	14	26	3	38	8	51
10	2	3	28	2	27	18	2	51	5	3	14	50	3	38	31	50
11	2	3	52	2	27	42	2	51	29	3	15	14	3	38	55	49
12	2	4	16	2	28	5	2	51	53	3	15	37	3	39	19	48
13	2	4	40	2	28	29	2	52	16	3	16	1	3	39	42	47
14	2	5	4	2	28	53	2	52	40	3	16	25	3	40	6	46
15	2	5	28	2	29	17	2	53	4	3	16	48	3	40	30	45
16	2	5	51	2	29	41	2	53	28	3	17	12	3	40	53	44
17	2	6	15	2	30	4	2	53	52	3	17	36	3	41	17	43
18	2	6	39	2	30	28	2	54	15	3	18	0	3	41	41	42
19	2	7	3	2	30	52	2	54	39	3	18	23	3	42	4	41
20	2	7	27	2	31	16	2	55	3	3	18	47	3	42	28	40
21	2	7	51	2	31	40	2	55	27	3	19	11	3	42	52	39
22	2	8	14	2	32	4	2	55	50	3	19	34	3	43	15	38
23	2	8	38	2	32	27	2	56	14	3	19	58	3	43	39	37
24	2	9	2	2	32	51	2	56	38	3	20	22	3	44	3	36
25	2	9	26	2	33	15	2	57	2	3	20	46	3	44	26	35
26	2	9	50	2	33	39	2	57	25	3	21	9	3	44	50	34
27	2	10	14	2	34	3	2	57	49	3	21	33	3	45	14	33
28	2	10	37	2	34	26	2	58	13	3	21	57	3	45	37	32
29	2	11	1	2	34	50	2	58	37	3	22	20	3	46	1	31
30	2	11	25	2	35	14	2	59	0	3	22	44	3	46	25	30
31	2	11	49	2	35	38	2	59	24	3	23	8	3	46	48	
		24			23			22			21			20		

Virgo Pisces

Aries Libra

De.	5			6			7			8			9			De
Mi.	Deg	Mi.	Se	Deg.	Mi.	Se.	Deg	Mi	Se	Deg.	Mi.	Se	Deg.	Mi.	Se	Mi.
31	2	11	49	2	35	38	2	59	24	3	23	8	3	46	48	29
32	2	12	13	2	36	1	2	59	48	3	23	32	3	47	12	28
33	2	12	36	2	36	25	3	0	12	3	23	55	3	47	36	27
34	2	13	0	2	36	49	3	0	35	3	24	19	3	47	59	26
35	2	13	24	2	37	13	3	0	59	3	24	43	3	48	23	25
36	2	13	48	2	37	37	3	1	23	3	25	6	3	48	47	24
37	2	14	12	2	38	0	3	1	47	3	25	30	3	49	10	23
38	2	14	36	2	38	24	3	2	10	3	25	54	3	49	34	22
39	2	14	59	2	38	48	3	2	34	3	26	17	3	49	57	21
40	2	15	23	2	39	12	3	2	58	3	26	41	3	50	21	20
41	2	15	47	2	39	36	3	3	22	3	27	5	3	50	45	19
42	2	16	11	2	39	59	3	3	45	3	27	28	3	51	8	18
43	2	16	35	2	40	23	3	4	9	3	27	52	3	51	32	17
44	2	16	59	2	40	47	3	4	33	3	28	16	3	51	56	16
45	2	17	22	2	41	11	3	4	57	3	28	40	3	52	19	15
46	2	17	46	2	41	35	3	5	20	3	29	3	3	52	43	14
47	2	18	10	2	41	58	3	5	44	3	29	27	3	53	7	13
48	2	18	34	2	42	22	3	6	8	3	29	51	3	53	30	12
49	2	18	58	2	42	46	3	6	32	3	30	14	3	53	54	11
50	2	19	22	2	43	10	3	6	55	3	30	38	3	54	17	10
51	2	19	45	2	43	33	3	7	19	3	31	2	3	54	41	9
52	2	20	9	2	43	57	3	7	43	3	31	25	3	55	5	8
53	2	20	33	2	44	21	3	8	6	3	31	49	3	55	28	7
54	2	20	57	2	44	45	3	8	30	3	32	13	3	55	52	6
55	2	21	21	2	45	9	3	8	54	3	32	36	3	56	16	5
56	2	21	44	2	45	32	3	9	18	3	33	0	3	56	39	4
57	2	22	8	2	45	56	3	9	41	3	33	24	3	57	3	3
58	2	22	32	2	46	20	3	10	5	3	33	47	3	57	26	2
59	2	22	56	2	46	44	3	10	29	3	34	11	3	57	50	1
60	2	23	20	2	47	7	3	10	53	3	34	35	3	58	14	0
61	2	23	44	2	47	31	3	11	16	3	34	58	3	58	37	
		24			23			22			21			20		

Virgo Pisces

Aries Libra

De.	10			11			12			13			14			De
Mi	Deg.	Mi.	Se.	Deg.	Mi	Se.	Deg	Mi.	Se.	Deg.	Mi.	Se.	Deg.	Mi.	Se.	Mi.
1	3	58	37	+	22	12	4	45	43	5	9	10	5	32	32	59
2	3	59	1	4	22	36	4	46	7	5	9	33	5	32	55	58
3	3	59	24	4	22	59	4	46	30	5	9	57	5	38	19	57
4	3	59	48	4	23	23	4	46	54	5	10	20	5	33	42	56
5	4	0	12	4	23	47	4	47	17	5	10	44	5	34	5	55
6	4	0	35	4	24	10	4	47	41	5	11	7	5	34	28	54
7	4	0	59	4	24	34	4	48	4	5	11	30	5	34	52	53
8	4	1	23	4	24	57	4	48	28	5	11	54	5	35	15	52
9	4	1	46	4	25	21	4	48	51	5	12	17	5	35	38	51
10	4	2	10	4	25	44	4	49	15	5	12	41	5	36	2	50
11	4	2	33	4	26	8	4	49	38	5	13	4	5	36	25	49
12	4	2	57	4	26	31	4	50	2	5	13	27	5	36	48	48
13	4	3	21	4	26	55	4	50	25	5	13	51	5	37	12	47
14	4	3	44	+	27	18	4	50	49	5	14	14	5	37	35	46
15	4	4	8	4	27	42	4	51	12	5	14	38	5	37	58	45
16	4	4	31	+	28	6	4	51	36	5	15	1	5	38	22	44
17	4	4	55	+	28	29	4	51	59	5	15	24	5	38	45	43
18	+	5	19	+	28	53	4	52	22	5	15	48	5	39	8	42
19	4	5	42	+	29	16	4	52	46	5	16	11	5	39	31	41
20	4	6	6	4	29	40	4	53	9	5	16	34	5	39	55	40
21	4	6	29	4	30	3	4	53	33	5	16	58	5	40	18	39
22	4	6	53	4	30	27	4	53	56	5	17	21	5	40	41	38
23	4	7	17	4	30	50	4	54	20	5	17	35	5	41	5	37
24	4	7	40	4	31	14	4	54	43	5	18	8	5	41	28	36
25	4	8	4	4	31	37	4	55	7	5	18	31	5	41	51	35
26	4	8	27	4	32	1	4	55	30	5	18	55	5	42	14	34
27	+	8	51	4	32	24	4	55	54	5	19	18	5	42	38	33
28	+	9	15	4	32	48	4	56	17	5	19	41	5	43	1	32
29	+	9	38	4	33	11	4	56	40	5	20	5	5	43	24	31
30	+	10	2	+	33	35	4	57	4	5	20	28	5	43	48	30
31	+	10	25	4	33	58	4	57	27	5	20	52	5	44	11	
		19			18			17			16			15		

Virgo Piſces

Aries Libra

De.	10			11			12			13			14			De
Mi.	Deg.	Mi.	Se.	Deg.	Mi.	Se.	Deg.	Mi.	Se	Deg	Mi.	Se.	Deg.	Mi.	Se	Mi.
31	4	10	25	4	33	58	4	57	27	5	20	52	5	44	11	29
32	4	10	49	+	34	22	+	57	51	5	21	15	5	44	34	28
33	4	11	12	+	34	45	4	58	14	5	21	38	5	44	57	27
34	4	11	36	4	35	9	4	58	38	5	22	2	5	45	21	26
35	4	12	0	4	35	32	4	59	1	5	22	25	5	45	44	25
36	4	12	23	+	35	56	4	59	25	5	22	48	5	46	7	24
37	4	12	47	+	36	19	4	59	48	5	23	12	5	46	30	23
38	4	13	10	+	36	43	5	0	11	5	23	35	5	46	54	22
39	+	13	34	+	37	6	5	0	35	5	23	58	5	47	17	21
40	4	13	57	4	37	30	5	0	58	5	24	22	5	47	40	20
41	4	14	21	+	37	53	5	1	22	5	24	45	5	48	4	19
42	4	14	45	+	38	17	5	1	45	5	25	9	5	48	27	18
43	4	15	8	4	38	41	5	2	9	5	25	32	5	48	50	17
44	4	15	32	+	39	4	5	2	32	5	25	55	5	49	13	16
45	4	15	55	+	39	28	5	2	55	5	26	19	5	49	37	15
46	4	16	19	+	39	51	5	3	19	5	26	42	5	50	0	14
47	4	16	42	+	40	15	5	3	42	5	27	5	5	50	23	13
48	+	17	6	4	40	38	5	4	6	5	27	29	5	50	46	12
49	4	17	30	4	41	2	5	4	29	5	28	52	5	51	10	11
50	+	17	53	+	41	25	5	4	52	5	28	15	5	51	33	10
51	+	18	17	4	41	48	5	5	16	5	28	39	5	51	56	9
52	4	18	40	4	42	12	5	5	39	5	29	2	5	52	19	8
53	+	19	4	+	42	35	5	6	3	5	29	25	5	52	43	7
54	4	19	27	+	42	59	5	6	26	5	29	49	5	53	6	6
55	+	19	51	+	43	22	5	6	50	5	30	12	5	53	29	5
56	+	20	15	4	43	46	5	7	12	5	30	35	5	53	52	4
57	+	20	38	4	44	9	5	7	36	5	30	59	5	54	16	3
58	+	21	2	+	44	33	5	8	0	5	31	22	5	54	39	2
59	+	21	25	+	44	56	5	8	23	5	31	45	5	55	2	1
60	+	21	49	+	45	20	5	8	47	5	32	9	5	55	25	0
61	+	22	12	4	45	43	5	9	10	5	32	32	5	55	49	
		19			18			17			16			15		

Virgo Piſces

De	15			16			17			18			19			De
Mi	Deg.	Mi.	Se.	Deg	Mi.	Se	Deg.	Mi.	Se.	Deg	Mi.	Se.	Deg	Mi.	Se.	Mi
1	5	55	49	6	19	0	6	42	5	7	5	4	7	27	56	59
2	5	56	12	6	19	23	6	42	28	7	5	27	7	28	19	58
3	5	56	35	6	19	46	6	42	51	7	5	50	7	28	42	57
4	5	56	58	6	20	9	6	43	14	7	6	12	7	29	4	56
5	5	57	21	6	20	32	6	43	37	7	6	35	7	29	27	55
6	5	57	45	6	20	55	6	44	0	7	6	58	7	29	50	54
7	5	58	8	6	21	18	6	44	23	7	7	21	7	30	13	53
8	5	58	31	6	21	42	6	44	46	7	7	44	7	30	36	52
9	5	58	54	6	22	5	6	45	9	7	8	7	7	30	48	51
10	5	59	18	6	22	28	6	45	32	7	8	30	7	31	21	50
11	5	59	41	6	22	51	6	45	55	7	8	53	7	31	44	49
12	6	0	4	6	23	14	6	46	18	7	9	16	7	32	7	48
13	6	0	27	6	23	37	6	46	41	7	9	39	7	32	29	47
14	6	0	50	6	24	0	6	47	4	7	10	2	7	32	52	46
15	6	1	14	6	24	23	6	47	27	7	10	24	7	33	15	45
16	6	1	37	6	24	46	6	47	50	7	10	47	7	33	38	44
17	6	2	0	6	25	10	6	48	13	7	11	10	7	34	1	43
18	6	2	23	6	25	33	6	48	36	7	11	33	7	34	23	42
19	6	2	46	6	25	56	6	48	59	7	11	56	7	34	46	41
20	6	3	10	6	26	19	6	49	22	7	12	19	7	35	9	40
21	6	3	33	6	26	42	6	49	45	7	12	42	7	35	32	39
22	5	3	56	6	27	5	6	50	8	7	13	5	7	35	55	38
23	5	4	19	6	27	28	6	50	31	7	13	28	7	36	17	37
24	5	4	42	6	27	51	6	50	54	7	13	50	7	36	40	36
25	6	5	6	6	28	14	6	51	17	7	14	13	7	37	3	35
26	6	5	29	6	28	38	6	51	40	7	14	36	7	37	26	34
27	5	5	52	5	29	1	6	52	3	7	14	59	7	37	48	33
28	6	6	15	5	29	24	6	52	26	7	15	22	7	38	11	32
29	5	6	38	5	29	47	6	52	49	7	15	45	7	38	34	31
30	6	7	2	6	30	10	6	53	12	7	16	8	7	38	57	30
31	9	7	25	5	30	33	6	53	35	7	16	31	7	39	19	
		14			13			12			11			10		

De.	15			16			17			18			19			De
Mi.	Deg.	Mi.	Se.	Deg.	Mi.	Se.	Deg.	Mi.	Se	Deg	Mi.	Se	Deg	Mi.	Se	Mi.
31	6	7	25	6	30	33	6	53	35	7	16	31	7	39	19	
32	6	7	48	6	30	56	6	53	58	7	16	54	7	39	42	
33	6	8	11	6	31	19	6	54	21	7	17	17	7	40	5	
34	6	8	34	6	31	42	6	54	44	7	17	39	7	40	28	
35	6	8	58	6	32	5	6	55	7	7	18	2	7	40	50	
36	6	9	21	6	32	28	6	55	30	7	18	25	7	41	13	
37	6	9	44	6	32	51	6	55	53	7	18	48	7	41	36	
38	6	10	7	6	33	15	6	56	16	7	19	11	7	41	59	
39	6	10	30	6	33	38	6	56	39	7	19	34	7	42	21	
40	6	10	53	6	34	1	6	57	2	7	19	56	7	42	44	
41	6	11	17	6	34	24	6	57	25	7	20	19	7	43	7	
42	6	11	40	6	34	47	6	57	48	7	20	42	7	43	30	
43	6	12	3	6	35	10	6	58	11	7	21	5	7	43	53	
44	6	12	26	6	35	33	6	58	34	7	21	28	7	44	15	
45	6	12	49	6	35	56	6	58	57	7	21	51	7	44	38	
46	6	13	12	6	36	19	6	59	20	7	22	13	7	45	0	
47	6	13	36	6	36	42	6	59	43	7	22	36	7	45	23	
48	6	13	59	6	37	5	7	0	5	7	22	59	7	45	46	
49	6	14	22	6	37	28	7	0	28	7	23	22	7	46	9	
50	6	14	45	6	37	51	7	0	51	7	23	45	7	46	31	
51	6	15	8	6	38	14	7	1	14	7	24	8	7	46	54	
52	6	15	31	6	38	37	7	1	37	7	24	30	7	47	17	
53	6	15	54	6	39	0	7	2	0	7	24	53	7	47	39	
54	6	16	18	6	39	24	7	2	23	7	25	16	7	48	2	
55	6	16	41	6	39	47	7	2	46	7	25	39	7	48	25	
56	6	17	4	6	40	10	7	3	9	7	26	2	7	48	48	
57	6	17	27	6	40	33	7	3	32	7	26	25	7	49	10	
58	6	17	50	6	40	56	7	3	55	7	26	47	7	49	33	
59	6	18	13	6	41	19	7	4	18	7	27	10	7	49	56	
60	6	18	36	6	41	42	7	4	41	7	27	33	7	50	18	
61	6	19	0	6	42	5	7	5	4	7	27	56	7	50	41	
		14			13			12			11			10		

De	20			21			22			23			24			De
Mi.	Deg	Mi.	Se	Deg	Mi.	Se.	Deg	Mi.	Se.	Deg	Mi.	Se.	Deg	Mi.	Se	Mi.
1	7	50	41	8	13	19	8	35	49	8	58	11	9	20	24	59
2	7	51	4	8	13	41	8	36	11	8	58	33	9	20	46	58
3	7	51	26	8	14	4	8	36	34	8	58	55	9	21	8	57
4	7	51	49	8	14	27	8	36	56	8	59	17	9	21	30	56
5	7	52	12	8	14	49	8	37	18	8	59	40	9	21	52	55
6	7	52	34	8	15	2	8	37	41	9	0	2	9	22	14	54
7	7	52	57	8	15	24	8	38	3	9	0	24	9	22	37	53
8	7	53	20	8	15	47	8	38	26	9	0	47	9	22	59	52
9	7	53	43	8	16	9	8	38	48	9	1	9	9	23	21	51
10	7	54	5	8	16	42	8	39	11	9	1	31	9	23	43	50
11	7	54	28	8	17	4	8	39	33	9	1	53	9	24	5	49
12	7	54	50	8	17	27	8	39	55	9	2	16	9	24	27	48
13	7	55	13	8	17	49	8	40	18	9	2	38	9	24	49	47
14	7	55	36	8	18	12	8	40	40	9	3	0	9	25	11	46
15	7	55	58	8	18	35	8	41	3	9	3	22	9	25	34	45
16	7	56	21	8	18	57	8	41	25	9	3	45	9	25	56	44
17	7	56	44	8	19	20	8	41	47	9	4	7	9	26	18	43
18	7	57	6	8	19	42	8	42	29	9	4	29	9	26	40	42
19	7	57	29	8	20	5	8	42	32	9	4	51	9	27	2	41
20	7	57	52	8	20	27	8	42	55	9	5	14	9	27	24	40
21	7	58	14	8	20	50	8	43	17	9	5	36	9	27	46	39
22	7	58	37	8	21	12	8	43	39	9	5	58	9	28	8	38
23	7	59	0	8	21	35	8	44	2	9	6	20	9	28	30	37
24	7	59	22	8	22	57	8	44	24	9	6	43	9	28	52	36
25	7	59	45	8	22	20	8	44	46	9	7	5	9	29	15	35
26	8	0	8	8	22	42	8	45	9	9	7	27	9	29	37	34
27	8	0	30	8	23	5	8	45	31	9	7	49	9	29	59	33
28	8	0	53	8	23	27	8	45	54	9	8	12	9	30	21	32
29	8	1	16	8	23	50	8	46	16	9	8	34	9	30	43	31
30	8	1	38	8	24	12	8	46	38	9	8	56	9	31	5	30
31	8	2	1	8	24	35	8	47	1	9	9	18	9	31	27	
		9			8			7			6			5		

De	20			21			22			23			24			De.
Mi	Deg.	Mi.	Se	Deg.	Mi.	Se	Deg.	Mi.	Se.	Deg.	Mi.	Se	Deg	Mi.	Se.	Mi.
31	8	2	1	8	24	35	8	47	19	9	9	18	9	31	27	29
32	8	2	24	8	24	57	8	47	23	9	9	41	9	31	49	28
33	8	2	46	8	25	20	8	47	45	9	10	3	9	32	11	27
34	8	3	9	8	25	42	8	48	8	9	10	25	9	32	33	26
35	8	3	31	8	26	5	8	48	30	9	10	47	9	32	55	25
36	8	3	54	8	26	27	8	48	52	9	11	9	9	33	17	24
37	8	4	17	8	26	50	8	49	15	9	11	32	9	33	39	23
38	8	4	39	8	27	12	8	49	38	9	11	54	9	34	2	22
39	8	5	2	8	27	35	8	50	0	9	12	16	9	34	24	21
40	8	5	25	8	27	57	8	50	22	9	12	38	9	34	46	20
41	8	5	47	8	28	20	8	50	44	9	13	0	9	35	8	19
42	8	6	10	8	28	42	8	51	7	9	13	23	9	35	30	18
43	8	6	32	8	29	5	8	51	29	9	13	45	9	35	52	17
44	8	6	55	8	29	27	8	51	51	9	14	7	9	36	14	16
45	8	7	18	8	29	50	8	52	14	9	14	29	9	36	36	15
46	8	7	40	8	30	12	8	52	36	9	14	51	9	36	58	14
47	8	8	3	8	30	34	8	52	58	9	15	13	9	37	20	13
48	8	8	25	8	30	57	8	53	21	9	15	36	9	37	42	12
49	8	8	48	8	31	19	8	53	43	9	15	58	9	38	4	11
50	8	9	11	8	31	42	8	54	5	9	16	20	9	38	26	10
51	8	9	33	8	32	4	8	54	28	9	16	42	9	38	48	9
52	8	9	56	8	32	27	8	54	50	9	17	4	9	39	10	8
53	8	10	18	8	32	49	8	55	12	9	17	27	9	39	32	7
54	8	10	41	8	33	12	8	55	34	9	17	49	9	39	54	6
55	8	11	3	8	33	34	8	55	57	9	18	11	9	40	16	5
56	8	11	26	8	33	57	8	56	19	9	18	33	9	40	38	4
57	8	11	49	8	34	19	8	56	41	9	18	55	9	41	0	3
58	8	12	11	8	34	41	8	57	4	9	19	17	9	41	22	2
59	8	12	34	8	35	4	8	57	26	9	19	40	9	41	44	1
60	8	12	56	8	35	26	8	57	48	9	20	2	9	42	6	0
61	8	13	19	8	35	49	8	58	11	9	20	24	9	42	28	
		9			8			7			6			5		

Ariet Libra

De. Mi.	25 Deg. Mi. Se.	26 Deg. Mi. Se.	27 Deg. Mi. Se.	28 Deg. Mi. Se.	29 Deg. Mi. Se.	De. Mi.
1	9 42 28	10 4 23	10 26 8	10 47 44	11 9 9	59
2	9 42 50	10 4 45	10 26 30	10 48 5	11 9 30	58
3	9 43 12	10 5 7	10 26 52	10 48 27	11 9 51	57
4	9 43 34	10 5 29	10 27 15	10 48 48	11 10 12	56
5	9 43 57	10 5 50	10 27 35	10 49 10	11 10 34	55
6	9 44 19	10 6 12	10 27 57	10 49 31	11 10 55	54
7	9 44 41	10 6 34	10 28 18	10 49 53	11 11 16	53
8	9 45 2	10 6 56	10 28 40	10 50 14	11 11 38	52
9	9 45 24	10 7 18	10 29 2	10 50 36	11 11 59	51
10	9 45 46	10 7 40	10 29 23	10 50 57	11 12 20	50
11	9 46 8	10 8 1	10 29 45	10 51 19	11 12 42	49
12	9 46 30	10 8 23	10 30 7	10 51 40	11 12 54	48
13	9 46 52	10 8 45	10 30 28	10 52 1	11 13 15	47
14	9 47 14	10 9 7	10 30 50	10 52 23	11 13 36	46
15	9 47 36	10 9 29	10 31 12	10 52 44	11 13 58	45
16	9 47 58	10 9 50	10 31 33	10 53 6	11 14 19	44
17	9 48 20	10 10 12	10 31 55	10 53 27	11 14 40	43
18	9 48 42	10 10 34	10 32 16	10 53 49	11 15 2	42
19	9 49 3	10 10 56	10 32 38	10 54 10	11 15 24	41
20	9 49 26	10 11 18	10 33 0	10 54 32	11 15 53	40
21	9 49 48	10 11 39	10 33 21	10 54 53	11 16 14	39
22	9 50 9	10 12 1	10 33 43	10 55 15	11 16 36	38
23	9 50 31	10 12 23	10 34 5	10 55 37	11 16 57	37
24	9 50 53	10 12 45	10 34 26	10 55 58	11 17 18	36
25	9 51 15	10 13 6	10 34 48	15 56 20	11 17 39	35
26	9 51 37	10 13 28	10 35 9	10 56 41	11 18 1	34
27	9 51 59	10 13 50	10 35 31	10 57 3	11 18 22	33
28	9 52 21	10 14 12	10 35 53	10 57 24	11 18 43	32
29	9 52 43	10 14 34	10 36 14	10 57 46	11 19 4	31
30	9 53 5	10 14 55	10 36 36	10 58 6	11 19 26	30
31	9 53 27	10 15 17	10 36 57	10 58 27	11 19 47	
	4	3	2	1	0	

Virgo Pisces

Aries Libra

De. Mi.	25 Deg. Mi. Se.	26 Deg. Mi. Se.	27 Deg. Mi. Se.	28 Deg. Mi. Se.	29 Deg. Mi. Se.	De. Mi.
31	9 53 27	10 15 17	10 36 57	10 58 27	11 19 4	29
32	9 53 49	10 15 39	10 37 19	10 58 49	11 20 [illegible]	28
33	9 54 11	10 16 1	10 37 41	10 59 10	11 20 29	27
34	9 54 33	10 16 22	10 38 [illegible]	10 59 32	11 20 51	26
35	9 54 54	10 16 44	10 38 24	10 59 53	11 21 12	25
36	9 55 16	10 17 6	10 38 45	11 0 14	11 21 33	24
37	9 55 38	10 17 27	10 39 [illegible]	11 0 36	11 21 54	23
38	9 56 0	10 17 49	10 39 28	11 0 57	11 22 15	22
39	9 56 22	10 18 11	10 39 50	11 1 19	11 22 37	21
40	9 56 44	10 18 33	10 40 12	11 1 40	11 22 58	20
41	9 57 6	10 18 54	10 40 33	11 2 1	11 23 19	19
42	9 57 28	10 19 16	10 40 55	11 2 23	11 23 40	18
43	9 57 50	10 19 38	10 41 16	11 2 44	11 24 1	17
44	9 58 11	10 20 0	10 41 38	11 3 6	11 24 23	16
45	9 58 33	10 20 21	10 41 59	11 3 27	11 24 44	15
46	9 58 55	10 20 43	10 42 21	11 3 48	11 25 3	14
47	9 59 17	10 21 [illegible]	10 42 42	11 4 10	11 25 26	13
48	9 59 39	10 21 [illegible]	10 43 [illegible]	11 4 31	11 25 47	12
49	10 0 [illegible]	10 21 48	10 43 25	11 4 52	11 26 9	11
50	10 0 23	10 22 [illegible]	10 43 47	11 5 14	11 26 30	10
51	10 0 45	10 22 52	10 44 [illegible]	11 5 35	11 26 51	9
52	10 1 [illegible]	10 22 [illegible]	10 44 [illegible]	11 5 56	11 27 12	8
53	10 1 28	10 23 15	10 44 52	11 6 18	11 27 33	7
54	10 1 50	10 23 37	10 45 12	11 6 39	11 27 54	6
55	10 2 12	10 23 58	10 45 35	11 [illegible] 1	11 28 16	5
56	10 2 34	10 24 20	10 45 56	11 [illegible] 22	11 28 37	4
57	10 2 56	10 24 42	10 46 18	11 7 43	11 28 58	3
58	10 3 18	10 25 [illegible]	10 46 39	11 8 5	11 29 19	2
59	10 3 39	10 25 25	10 47 [illegible]	11 8 26	11 29 40	1
60	10 4 1	10 25 47	10 47 22	11 8 47	11 30 1	0
61	10 4 23	10 26 8	10 47 44	11 9 9	11 30 23	
	4	3	2	1	0	

Virgo Pisces

Taurus Scorpio

De. Mi.	0 Deg. Mi. Se.	1 Deg. Mi. Se.	2 Deg. Mi. Se.	3 Deg. Mi. Se.	4 Deg. Mi. Se.	De. Mi.
1	11 30 23	11 51 25	12 12 17	12 32 56	12 53 23	59
2	11 30 44	11 51 46	12 12 37	12 33 16	12 53 43	58
3	11 31 5	11 52 7	12 12 58	12 33 37	12 54 3	57
4	11 31 26	11 52 28	12 13 19	12 33 57	12 54 24	56
5	11 31 47	11 52 49	12 13 40	12 34 18	12 54 44	55
6	11 32 8	11 53 10	12 14 0	12 34 38	12 55 4	54
7	11 32 29	11 53 31	12 14 21	12 34 59	12 55 25	53
8	11 32 50	11 53 52	12 14 42	12 35 19	12 55 45	52
9	11 33 12	11 54 13	12 15 2	12 35 40	12 56 5	51
10	11 33 33	11 54 34	12 15 23	12 36 0	12 56 26	50
11	11 33 54	11 54 55	12 15 44	12 36 21	12 56 46	49
12	11 34 15	11 55 16	12 16 5	12 36 41	12 57 6	48
13	11 34 36	11 55 36	12 16 25	12 37 2	12 57 27	47
14	11 34 57	11 55 57	12 16 46	12 37 23	12 57 47	46
15	11 35 18	11 56 18	12 17 7	12 37 43	12 58 7	45
16	11 35 39	11 56 39	12 17 27	12 38 4	12 58 27	44
17	11 36 1	11 57 0	12 17 48	12 38 24	12 58 48	43
18	11 36 22	11 57 21	12 18 9	12 38 45	12 59 8	42
19	11 36 43	11 57 42	12 18 30	12 39 5	12 59 28	41
20	11 37 4	11 58 3	12 18 50	12 39 26	12 59 49	40
21	11 37 25	11 58 24	12 19 11	12 39 46	13 0 9	39
22	11 37 46	11 58 45	12 19 32	12 40 7	13 0 29	38
23	11 38 7	11 59 5	12 19 52	12 40 27	13 0 49	37
24	11 38 28	11 59 26	12 20 13	12 40 48	13 1 10	36
25	11 38 49	11 59 47	12 20 34	12 41 8	13 1 30	35
26	11 39 10	12 0 8	12 20 54	12 41 29	13 1 50	34
27	11 39 31	12 0 29	12 21 15	12 41 49	13 2 10	33
28	11 39 52	12 0 50	12 21 36	12 42 9	13 2 31	32
29	11 40 13	12 1 11	12 21 56	12 42 30	13 2 51	31
30	11 40 34	12 1 32	12 22 17	12 42 50	13 3 11	30
31	11 40 55	12 1 52	12 22 38	12 43 11	13 3 31	
	29	28	27	26	25	

Leo Aquarius

Taurus Scorpio

De. Mi.	0 Deg. Mi. Se.	1 Deg. Mi. Se.	2 Deg. Mi. Se.	3 Deg. Mi. Se.	4 Deg. Mi. Se.	De. Mi.
31	11 40 55	12 1 52	12 22 38	12 43 11	13 3 31	29
32	11 41 16	12 2 13	12 22 58	12 43 31	13 3 52	28
33	11 41 37	12 2 34	12 23 19	12 43 52	13 4 12	27
34	11 41 58	12 2 55	12 23 40	12 44 12	13 4 32	26
35	11 42 19	12 3 16	12 24 0	12 44 33	13 4 52	25
36	11 42 40	12 3 37	12 24 21	12 44 53	13 5 13	24
37	11 43 2	12 3 57	12 24 41	12 45 13	13 5 33	23
38	11 43 23	12 4 18	12 25 2	12 45 34	13 5 53	22
39	11 43 44	12 4 39	12 25 23	12 45 54	13 6 13	21
40	11 44 5	12 5 0	12 25 43	12 46 15	13 6 33	20
41	11 44 26	12 5 21	12 26 4	12 46 35	13 6 54	19
42	11 44 47	12 5 42	12 26 25	12 46 56	13 7 14	18
43	11 45 8	12 6 2	12 26 45	12 47 16	13 7 34	17
44	11 45 29	12 6 23	12 27 6	12 47 36	13 7 54	16
45	11 45 50	12 6 44	12 27 26	12 47 57	13 8 14	15
46	11 46 11	12 7 5	12 27 47	12 48 17	13 8 34	14
47	11 46 32	12 7 26	12 28 8	12 48 38	13 8 55	13
48	11 49 53	12 7 46	12 28 28	12 48 58	13 9 15	12
49	11 47 14	12 8 7	12 28 49	12 49 18	13 9 35	11
50	11 57 35	12 8 28	12 29 10	12 49 39	13 9 55	10
51	11 47 56	12 8 49	12 29 30	12 49 59	13 10 15	9
52	11 48 17	12 9 10	12 29 51	12 50 19	13 10 36	8
53	11 48 38	12 9 30	12 30 11	12 50 40	13 10 56	7
54	11 48 59	12 9 51	12 30 32	12 51 0	13 11 16	6
55	11 49 20	12 10 12	12 30 52	12 51 21	13 11 36	5
56	11 49 41	12 10 33	12 31 13	12 51 41	13 11 56	4
57	11 50 1	12 10 53	12 31 34	12 52 1	13 12 16	3
58	11 50 22	12 11 14	12 31 54	12 52 22	13 12 36	2
59	11 50 43	12 11 35	12 32 15	12 52 42	13 12 57	1
60	11 51 4	12 11 56	12 32 35	12 53 2	13 13 17	0
61	11 51 25	12 12 17	12 32 56	12 53 23	13 13 37	
	29	28	27	26	25	

Leo Aquarius

Taurus Scorpio

De. Mi.	5 Deg. Mi. Se.	6 Deg. Mi. Se.	7 Deg. Mi. Se.	8 Deg. Mi. Se.	9 Deg. Mi. Se.	De Mi.
1	13 13 37	13 33 38	13 53 25	14 12 59	14 32 19	59
2	13 13 57	13 33 58	13 53 45	14 13 19	14 32 38	58
3	13 14 17	13 34 18	13 54 5	14 13 38	14 32 57	57
4	13 14 37	13 34 38	13 54 24	14 13 58	14 33 16	56
5	13 14 57	13 34 57	13 54 44	14 14 17	14 33 35	55
6	13 15 17	13 35 17	13 55 4	14 14 36	14 33 54	54
7	13 15 38	13 35 37	13 55 23	14 14 56	14 34 14	53
8	13 15 58	13 35 57	13 55 43	14 15 15	14 34 33	52
9	13 16 18	13 36 17	13 56 3	14 15 35	14 34 52	51
10	13 16 38	13 36 37	13 56 23	14 15 54	14 35 11	50
11	13 16 58	13 36 57	13 56 42	14 16 14	14 35 30	49
12	13 17 18	13 37 17	13 57 2	14 16 33	14 35 50	48
13	13 17 38	13 37 36	13 57 21	14 16 52	14 36 9	47
14	13 17 58	13 37 56	13 57 41	14 17 12	14 36 28	46
15	13 18 18	13 38 16	13 58 1	14 17 31	14 36 47	45
16	13 18 38	13 38 36	13 58 20	14 17 51	14 37 6	44
17	13 18 58	13 38 56	13 58 40	14 18 10	14 37 25	43
18	13 19 18	13 39 16	13 58 59	14 18 29	14 37 44	42
19	13 19 39	13 39 36	13 59 19	14 18 49	14 38 4	41
20	13 19 59	13 39 55	13 59 39	14 19 8	14 38 23	40
21	13 20 19	13 40 15	13 59 58	14 19 27	14 38 42	39
22	13 20 39	13 40 35	14 0 18	14 19 47	14 39 1	38
23	13 20 59	13 40 55	14 0 37	14 20 6	14 39 20	37
24	13 21 19	13 41 15	14 0 57	14 20 25	14 39 39	36
25	13 21 39	13 41 35	14 1 17	14 20 45	14 39 58	35
26	13 21 59	13 41 54	14 1 36	14 21 4	14 40 17	34
27	13 22 19	13 42 14	13 1 56	14 21 23	14 40 37	33
28	13 22 39	13 42 34	14 2 15	14 21 43	14 40 56	32
29	13 22 59	13 42 54	14 2 35	14 22 2	14 41 15	31
30	13 23 19	13 43 14	14 2 55	14 22 22	14 41 34	30
31	13 23 39	13 43 33	14 3 14	14 22 41	14 41 53	
	24	23	22	21	20	

Leo Aquarius

Taurus Scorpio

De. Mi.	5 Deg. Mi. Se.	6 Deg. Mi. Se.	7 Deg. Mi. Se.	8 Deg. Mi. Se.	9 Deg. Mi. Se.	De Mi.
31	13 23 39	13 43 33	14 3 14	14 22 41	14 41 53	29
32	13 23 59	13 43 53	14 3 34	14 23 0	14 42 12	28
33	13 24 19	13 44 13	14 3 53	14 23 19	14 42 31	27
34	13 24 39	13 44 33	14 4 13	14 23 39	14 42 50	26
35	13 24 59	13 44 53	14 4 32	14 23 58	14 43 9	25
36	13 25 19	13 45 12	14 4 52	14 24 17	14 43 28	24
37	13 25 39	13 45 32	14 5 11	14 24 37	14 43 47	23
38	13 25 59	13 45 52	14 5 31	14 24 56	14 44 6	22
39	13 26 19	13 46 12	14 5 50	14 25 15	14 44 25	21
40	13 26 39	13 46 31	14 6 10	14 25 35	14 44 45	20
41	13 26 59	13 46 51	14 6 30	14 25 54	14 45 4	19
42	13 27 19	13 47 11	14 6 49	14 26 13	14 45 23	18
43	13 27 39	13 47 31	14 7 9	14 26 32	14 45 42	17
44	13 27 59	13 47 50	14 7 28	14 26 52	14 46 1	16
45	13 28 19	13 48 10	14 7 48	14 27 11	14 46 20	15
46	13 28 39	13 48 30	14 8 7	14 27 30	14 46 39	14
47	13 28 59	13 48 50	14 8 27	14 27 49	14 46 58	13
48	13 29 19	13 49 9	14 8 46	14 28 9	14 47 17	12
49	13 29 39	13 49 29	14 9 6	14 28 28	14 47 36	11
50	13 29 59	13 49 49	14 9 25	14 28 47	14 47 55	10
51	13 30 19	13 50 9	14 9 45	14 29 6	14 48 14	9
52	13 30 39	13 50 28	14 10 4	14 29 26	14 48 33	8
53	13 30 58	13 50 48	14 10 24	14 29 45	14 48 52	7
54	13 31 18	13 51 8	14 10 43	14 30 4	14 49 11	6
55	13 31 38	13 51 27	14 11 2	14 30 23	14 49 30	5
56	13 31 58	13 51 47	14 11 22	14 30 42	14 49 49	4
57	13 32 18	13 52 7	14 11 41	14 31 2	14 50 8	3
58	13 32 38	13 52 26	14 12 1	14 31 21	14 50 27	2
59	13 32 58	13 52 46	14 12 20	14 31 40	14 50 46	1
60	13 33 18	13 53 6	14 12 40	14 31 59	14 51 5	0
61	13 33 38	13 53 25	14 12 59	14 32 19	14 51 24	
	24	23	22	21	20	

Leo Aquarius

Taurus Scorpio

De	10			11			12			13			14			De
Mi	Deg.	Mi.	Se.	Deg.	Mi.	Se.	Deg.	Mi.	Se.	Deg.	Mi.	Se.	Deg.	Mi.	Se.	Mi.
1	14	51	24	15	10	13	15	28	48	15	47	7	16	5	9	59
2	14	51	42	15	10	32	15	29	6	15	47	25	16	5	27	58
3	14	52	1	15	10	51	15	29	25	15	47	43	16	5	45	57
4	14	52	20	15	11	9	15	29	43	15	48	1	16	6	3	56
5	14	52	39	15	11	28	15	30	2	15	48	19	16	6	21	55
6	14	52	58	15	11	47	15	30	20	15	48	37	16	6	39	54
7	14	53	17	15	12	6	15	30	38	15	48	56	16	6	56	53
8	14	53	36	15	12	24	15	30	57	15	49	14	16	7	14	52
9	14	53	55	15	12	43	15	31	15	15	49	32	16	7	32	51
10	14	54	14	15	13	2	15	31	34	15	49	50	16	7	50	50
11	14	54	33	15	13	20	15	31	52	15	50	8	16	8	8	49
12	14	54	52	15	13	39	15	32	10	15	50	26	16	8	26	48
13	14	55	11	15	13	58	15	32	29	15	50	44	16	8	44	47
14	14	55	30	15	14	16	15	32	47	15	51	2	16	9	1	46
15	14	55	49	15	14	35	15	33	6	15	51	21	16	9	19	45
16	14	56	7	15	14	53	15	33	24	15	51	39	16	9	37	44
17	14	56	26	15	15	12	15	33	42	15	51	57	16	9	55	43
18	14	56	45	15	15	31	15	34	1	15	52	15	16	10	13	42
19	14	57	4	15	15	49	15	34	19	15	52	33	16	10	31	41
20	14	57	23	15	16	8	15	34	38	15	52	51	16	10	49	40
21	14	57	42	15	16	27	15	34	56	15	53	9	16	11	6	39
22	14	58	1	15	16	45	15	35	14	15	53	27	16	11	24	38
23	14	58	20	15	17	4	15	35	33	15	53	45	16	11	42	37
24	14	58	38	15	17	22	15	35	51	15	54	3	16	12	c	36
25	14	58	57	15	17	41	15	36	9	15	54	22	16	12	18	35
26	14	59	16	15	18	0	15	36	28	15	54	40	16	12	35	34
27	14	59	35	15	18	18	15	36	46	15	54	58	16	12	53	33
28	14	59	54	15	18	37	15	37	4	15	55	16	16	13	11	32
29	15	0	13	15	18	55	15	37	23	15	55	34	16	13	29	31
30	15	0	32	15	19	14	15	37	41	15	55	52	16	13	47	30
31	15	0	50	15	19	33	15	37	59	15	56	10	16	14	4	
	19			18			17			16			15			

Leo Aquarius

Taurus Scorpio

De.	10			11			12			13			14			De.
Mi.	Deg.	Mi.	Se.	Deg.	Mi.	Se.	Deg.	Mi.	Se.	Deg.	Mi.	Se	Deg.	Mi.	Se.	Mi.
31	15	0	50	15	19	33	15	37	59	15	56	10	16	14	4	29
32	15	1	9	15	19	51	15	38	18	15	56	28	16	14	22	28
33	15	1	28	15	20	10	15	38	36	15	56	46	16	14	40	27
34	15	1	47	15	20	28	15	38	54	15	57	4	16	14	58	26
35	15	2	6	15	20	47	15	39	12	15	57	22	16	15	15	25
36	15	2	24	15	21	5	15	39	31	15	57	40	16	15	33	24
37	15	2	43	15	21	24	15	39	49	15	57	58	16	15	51	23
38	15	3	2	15	21	42	15	40	7	15	58	16	16	16	9	22
39	15	3	21	15	22	1	15	40	26	15	58	34	16	16	26	21
40	15	3	40	15	22	20	15	40	44	15	58	52	16	16	44	20
41	15	3	58	15	22	38	15	41	2	15	59	10	16	17	2	19
42	15	4	17	15	22	57	15	41	20	15	59	28	16	17	19	18
43	15	4	36	15	23	15	15	41	39	15	59	46	16	17	37	17
44	15	4	55	15	23	34	15	41	57	16	0	4	16	17	55	16
45	15	5	14	15	23	52	15	42	15	16	0	22	16	18	13	15
46	15	5	32	15	24	11	15	42	33	16	0	40	16	18	30	14
47	15	5	51	15	24	29	15	42	52	16	0	58	16	18	48	13
48	15	6	10	15	24	48	15	43	10	16	1	16	16	19	6	12
49	15	6	29	15	25	6	15	43	28	16	1	34	16	19	23	11
50	15	6	47	15	25	25	15	43	46	16	1	52	16	19	41	10
51	15	7	6	15	25	43	15	44	5	16	2	10	16	19	59	9
52	15	7	25	15	26	2	15	44	23	16	2	28	16	20	16	8
53	15	7	44	15	26	20	15	44	41	16	2	46	16	20	34	7
54	15	8	2	15	26	39	15	44	59	16	3	4	16	20	52	6
55	15	8	21	15	26	57	15	45	17	16	3	22	16	21	9	5
56	15	8	40	15	27	16	15	45	36	16	3	39	16	21	27	4
57	15	8	59	15	27	34	15	45	54	16	3	57	16	21	45	3
58	15	9	17	15	27	52	15	46	12	16	4	15	16	22	2	2
59	10	9	36	15	28	11	15	46	30	16	4	33	16	22	20	1
60	15	9	55	15	28	29	15	46	48	16	4	51	16	22	38	0
61	15	10	13	15	28	48	15	46	7	16	5	9	16	22	55	
	19			18			17			16			15			

Leo Aquarius

Taurus Scorpio

De. Mi.	15 Deg. Mi. Se.	16 Deg. Mi. Se.	17 Deg. Mi. Se.	18 Deg. Mi. Se	19 Deg. Mi. Se	De Mi.
1	16 22 55	16 40 24	16 57 36	17 14 31	17 31 7	59
2	16 23 13	16 40 42	16 57 53	17 14 47	17 31 23	58
3	16 23 30	16 40 59	16 58 10	17 15 4	17 31 40	57
4	16 23 48	16 41 16	16 58 27	17 15 21	17 31 56	56
5	16 24 6	16 41 34	16 58 44	17 15 38	17 32 13	55
6	16 24 23	16 41 51	16 59 1	17 15 54	17 32 29	54
7	16 24 41	16 42 8	16 59 19	17 16 11	17 32 46	53
8	16 24 59	16 42 26	16 59 36	17 16 28	17 33 2	52
9	16 25 16	16 42 43	16 59 53	17 16 44	17 33 18	51
10	16 25 34	16 43 0	17 0 10	17 17 1	17 33 35	50
11	16 25 51	16 43 18	17 0 27	17 17 18	17 33 51	49
12	16 26 9	16 43 35	17 0 44	17 17 35	17 34 8	48
13	16 26 26	16 43 52	17 1 1	17 17 51	17 34 24	47
14	16 26 44	16 44 9	17 1 18	17 18 8	17 34 40	46
15	16 27 2	16 44 27	17 1 35	17 18 25	17 34 57	45
16	16 27 19	16 44 44	17 1 52	17 18 41	17 35 13	44
17	16 27 37	16 45 1	17 2 9	17 18 58	17 35 30	43
18	16 27 54	16 45 19	17 2 26	17 19 15	17 35 46	42
19	16 28 12	19 45 36	17 2 43	17 19 31	17 36 2	41
20	16 28 29	16 45 53	17 2 59	17 19 48	17 36 19	40
21	16 28 47	16 46 10	17 3 16	17 20 5	17 36 35	39
22	16 29 4	16 46 28	17 3 33	17 20 21	17 36 51	38
23	16 29 22	16 46 45	17 3 50	17 20 38	17 37 8	37
24	16 29 39	16 27 2	17 4 7	17 20 55	17 37 24	36
25	16 29 57	16 47 19	17 4 24	17 21 11	17 37 40	35
26	16 30 14	16 47 36	17 4 41	17 21 28	17 37 57	34
27	16 30 32	16 47 54	17 4 58	17 21 45	17 38 13	33
28	16 30 49	16 48 11	17 5 15	17 22 1	17 38 29	32
29	16 31 7	16 48 28	17 5 32	17 22 18	17 38 46	31
30	16 31 25	16 48 45	17 5 49	17 22 35	17 39 2	30
31	16 31 42	16 49 3	17 6 6	17 22 51	17 39 18	
	14	13	12	11	10	

Leo Aquarius

Taurus Scorpio

De Mi.	15 Deg. Mi. Se.	16 Deg. Mi. Se	17 Deg. Mi. Se.	18 Deg. Mi. Se	19 Deg. Mi. Se	De. Mi.
31	16 31 42	16 49 3	17 6 6	17 22 51	17 39 18	29
32	16 31 59	16 49 20	17 6 23	17 23 8	17 39 35	28
33	16 32 17	16 49 37	17 6 39	17 23 24	17 39 51	27
34	16 32 34	16 49 54	17 6 56	17 23 41	17 40 7	26
35	16 32 52	16 50 11	17 7 13	17 23 57	17 40 24	25
36	16 33 9	16 50 28	17 7 30	17 24 14	17 40 40	24
37	16 33 27	16 50 46	17 7 47	17 24 31	17 40 56	23
38	16 33 44	16 51 3	17 8 4	17 24 47	17 41 12	22
39	16 34 2	16 51 20	17 8 21	17 25 4	17 41 29	21
40	16 34 19	16 51 37	17 8 38	17 25 20	17 41 45	20
41	16 34 37	16 51 54	17 8 55	17 25 37	17 42 1	19
42	16 34 54	16 52 11	17 9 11	17 25 53	17 42 17	18
43	16 35 11	16 52 29	17 9 28	17 26 10	17 42 34	17
44	16 35 29	16 52 46	17 9 45	17 26 27	17 42 50	16
45	16 35 46	16 53 3	17 10 2	17 26 43	17 43 6	15
46	16 36 4	16 53 20	17 10 19	17 27 0	17 43 22	14
47	16 36 21	16 53 37	17 10 36	17 27 16	17 43 38	13
48	16 36 38	16 53 54	17 10 53	17 27 33	17 43 55	12
49	16 36 56	16 54 11	17 11 9	17 27 49	17 44 11	11
50	16 37 13	16 54 29	17 11 26	17 28 6	17 44 27	10
51	16 37 31	16 54 46	17 11 43	17 28 22	17 44 43	9
52	16 37 48	16 55 3	17 12 0	17 28 39	17 44 59	8
53	16 38 5	16 55 20	17 12 17	17 28 55	17 45 16	7
54	16 38 23	16 55 37	17 12 33	17 29 12	17 45 32	6
55	16 38 40	16 55 54	17 12 50	17 29 28	17 45 48	5
56	16 38 58	16 56 11	17 13 7	17 29 45	17 46 4	4
57	16 39 15	16 56 28	17 13 24	17 30 1	17 46 20	3
58	16 39 32	16 56 45	17 13 40	17 30 18	17 46 37	2
59	16 39 50	16 57 2	17 13 57	17 30 34	17 46 53	1
60	16 40 7	16 57 19	17 14 14	17 30 51	17 47 9	0
61	16 40 24	16 57 36	17 14 31	17 31 7	17 47 25	
	14	13	12	11	10	

Leo Aquarius

De. Mi	20 Deg. Mi. Se.	21 Deg. Mi. Se.	22 Deg. Mi. Se.	23 Deg. Mi. Se.	24 Deg. Mi. Se.	De. Mi.
1	17 47 25	18 3 24	18 19 5	18 34 25	18 49 27	59
2	17 47 41	18 3 40	18 19 20	18 34 41	18 49 41	58
3	17 47 57	18 3 56	18 19 36	18 34 56	18 49 56	57
4	17 48 13	18 4 12	18 19 51	18 35 11	18 50 11	56
5	17 48 30	18 4 28	18 20 7	18 35 26	18 50 26	55
6	17 48 46	18 4 43	18 20 22	18 35 41	18 50 41	54
7	17 49 2	18 4 59	18 20 38	18 35 56	18 50 56	53
8	17 49 18	18 5 15	18 20 53	18 36 12	18 51 10	52
9	17 49 34	18 5 31	18 21 9	18 36 27	18 51 25	51
10	17 49 50	18 5 47	18 21 24	18 36 42	18 51 40	50
11	17 50 6	18 6 2	18 21 39	18 36 57	18 51 55	49
12	17 50 22	18 6 18	18 21 55	18 37 12	18 52 10	48
13	17 50 38	18 6 34	18 22 10	18 37 27	18 52 24	47
14	17 50 54	18 6 50	18 22 26	18 37 42	18 52 39	46
15	17 51 11	18 7 5	18 22 41	18 37 57	18 52 54	45
16	17 51 27	18 7 21	18 22 57	18 38 13	18 53 9	44
17	17 51 43	18 7 37	18 23 12	18 38 28	18 53 23	43
18	17 51 59	18 7 53	18 23 28	18 38 43	18 53 38	42
19	17 52 15	18 8 8	18 23 43	18 38 58	18 53 53	41
20	17 52 31	18 8 24	18 23 59	18 39 13	18 54 8	40
21	17 52 47	18 8 40	18 24 14	18 39 28	18 54 22	39
22	17 53 3	18 8 56	18 24 29	18 39 43	18 54 37	38
23	17 53 19	18 9 11	18 24 45	18 39 58	18 54 52	37
24	17 53 35	18 9 27	18 25 0	18 40 13	18 55 7	36
25	17 53 51	18 9 43	18 25 15	18 40 28	18 55 21	35
26	17 54 7	18 9 58	18 25 31	18 40 43	18 55 36	34
27	17 54 23	18 10 14	18 25 46	18 40 58	18 55 51	33
28	17 54 39	18 10 30	18 26 1	18 41 13	18 56 5	32
29	17 54 55	18 10 46	18 26 17	18 41 28	18 56 20	31
30	17 55 11	18 11 1	18 26 32	18 41 44	18 56 35	30
31	17 55 27	18 11 17	18 26 47	18 41 58	18 56 50	
	9	8	7	6	5	

Leo Aquarius

De. Mi	20 Deg. Mi. Se.	21 Deg. Mi. Se.	22 Deg. Mi. Se.	23 Deg. Mi. Se.	24 Deg. Mi. Se.	De. Mi
31	17 55 27	18 11 17	18 26 47	18 41 58	18 56 50	29
32	17 55 43	18 11 33	18 27 3	18 42 13	18 57 4	28
33	17 55 59	18 11 48	18 27 18	18 42 28	18 57 19	27
34	17 56 15	18 12 4	18 27 33	18 42 43	18 57 34	26
35	17 56 31	18 12 19	18 27 49	18 42 58	18 57 48	25
36	17 56 47	18 12 35	18 28 4	18 43 13	18 58 3	24
37	17 57 3	18 12 51	18 28 19	18 43 28	18 58 18	23
38	17 57 19	18 13 6	18 28 35	18 43 43	18 58 32	22
39	17 57 35	18 13 22	18 28 50	18 43 58	18 58 47	21
40	17 57 51	18 13 38	18 29 5	18 44 13	18 59 2	20
41	17 58 7	18 13 53	18 29 21	18 44 28	18 59 16	19
42	17 58 23	18 14 9	18 29 36	18 44 43	18 59 31	18
43	17 58 39	18 14 25	18 29 51	18 44 58	18 59 45	17
44	17 58 54	18 14 40	18 30 6	18 45 13	19 0 0	16
45	17 59 10	18 14 56	18 30 22	18 45 28	19 0 15	15
46	17 59 26	18 15 11	18 30 37	18 45 43	19 0 29	14
47	17 59 42	18 15 27	18 30 52	18 45 58	19 0 44	13
48	17 59 58	18 15 43	18 31 8	18 46 13	19 0 58	12
49	18 0 14	18 15 58	18 31 23	18 46 28	19 1 13	11
50	18 0 30	18 16 14	18 31 38	18 46 43	19 1 28	10
51	18 0 46	18 16 29	18 31 53	18 46 58	19 1 42	9
52	18 1 2	18 16 45	18 32 9	18 47 13	19 1 27	8
53	18 1 17	18 17 0	18 32 24	18 47 28	19 2 11	7
54	18 1 33	18 17 16	18 32 39	18 47 42	19 2 26	6
55	18 1 49	18 17 31	18 32 52	18 47 57	19 2 40	5
56	18 2 5	18 17 47	18 33 9	18 48 12	19 2 55	4
57	18 2 21	18 18 2	18 33 25	18 48 27	19 3 9	3
58	18 2 37	18 18 18	18 33 40	18 48 42	19 3 24	2
59	18 2 53	18 18 34	18 33 55	18 48 57	19 3 38	1
60	18 3 9	18 18 49	18 34 10	18 49 12	19 3 53	0
61	18 3 24	18 19 5	18 34 25	18 49 27	19 4 7	
	9	8	7	6	5	

Leo Aquarius

De. Mi	25 Deg. Mi. Se.	26 Deg. Mi. Se.	27 Deg. Mi. Se.	28 Deg. Mi. Se.	29 Deg. Mi. Se.	De. Mi.
1	19 4 37	19 18 28	19 32 28	19 46 6	19 59 23	59
2	19 4 22	19 18 42	19 32 42	19 46 20	19 59 37	58
3	19 4 36	19 18 56	19 32 55	19 46 33	19 59 50	57
4	19 4 51	19 19 11	19 33 9	19 46 47	20 0 3	56
5	19 5 5	19 19 25	19 33 23	19 47 0	20 0 16	55
6	19 5 20	19 19 39	19 33 37	19 47 14	20 0 29	54
7	19 5 34	19 19 53	19 33 51	19 47 27	20 0 42	53
8	19 5 49	19 20 7	19 34 4	19 47 41	20 0 55	52
9	19 6 3	19 20 21	19 34 18	19 47 54	20 1 8	51
10	19 6 18	19 20 35	19 34 32	19 48 7	20 1 21	50
11	19 6 32	19 20 49	19 34 46	19 48 21	20 1 34	49
12	19 6 47	19 21 4	19 34 59	19 48 34	20 1 47	48
13	19 7 1	19 21 18	19 35 13	19 48 48	20 2 0	47
14	19 7 16	19 21 32	19 35 27	19 49 1	20 2 13	46
15	19 7 30	19 21 46	19 35 41	19 49 14	20 2 26	45
16	19 7 45	19 22 0	19 35 54	19 49 28	20 2 39	44
17	19 7 59	19 22 14	19 36 8	19 49 41	20 2 52	43
18	19 8 13	19 22 28	19 36 22	19 49 54	20 3 5	42
19	19 8 28	19 22 42	19 36 36	19 50 8	20 3 18	41
20	19 8 42	19 22 56	19 36 49	19 50 21	20 3 32	40
21	19 8 57	19 23 10	19 37 3	19 50 35	20 3 44	39
22	19 9 11	19 23 24	19 37 17	19 50 48	20 3 57	38
23	19 9 25	19 23 38	19 37 30	19 51 1	20 4 10	37
24	19 9 40	19 23 52	19 37 44	19 51 14	20 4 23	36
25	19 9 54	19 24 6	19 37 58	19 51 28	20 4 36	35
26	19 10 9	19 24 20	19 38 11	19 51 41	20 4 49	34
27	19 10 23	19 24 34	19 38 25	19 51 54	20 5 2	33
28	19 10 37	19 24 34	19 38 39	19 52 8	20 5 15	32
29	19 10 52	19 24 48	19 38 52	19 52 21	20 5 28	31
30	19 11 6	19 25 3	19 39 6	19 52 34	20 5 41	30
31	19 11 20	19 25 30	19 39 20	19 52 48	20 5 54	
	4	3	2	1	0	

Leo Aquarius

De. Mi	25 Deg. Mi. Se.	26 Deg. Mi. Se.	27 Deg. Mi. Se.	28 Deg. Mi. Se.	29 Deg. Mi. Se.	De. Mi.
31	19 11 20	19 25 30	19 39 20	19 52 48	20 5 54	29
32	19 11 35	19 25 44	19 39 33	19 53 1	20 6 7	28
33	19 11 49	19 25 58	19 39 47	19 53 14	20 6 20	27
34	19 12 3	19 26 12	19 40 1	19 53 27	20 6 33	26
35	19 12 18	19 26 26	19 40 14	19 53 41	20 6 46	25
36	19 12 32	19 26 40	19 40 28	19 53 54	20 6 59	24
37	19 12 46	19 26 54	19 40 41	19 54 7	20 7 11	23
38	19 13 1	19 27 8	19 40 55	19 54 21	20 7 24	22
39	19 13 15	19 27 22	19 41 9	19 54 34	20 7 37	21
40	19 13 29	19 27 36	19 41 22	19 54 47	20 7 50	20
41	19 13 43	19 27 50	19 41 36	19 55 0	20 8 3	19
42	19 13 58	19 28 4	19 41 49	19 55 14	20 8 16	18
43	19 14 12	19 28 18	19 42 3	19 55 27	20 8 29	17
44	19 14 26	19 28 32	19 42 17	19 55 40	20 8 41	16
45	19 14 41	19 28 46	19 42 30	19 55 53	20 8 54	15
46	19 14 55	19 29 0	19 42 44	19 56 6	20 9 7	14
47	19 15 9	19 29 14	19 42 57	19 56 20	20 9 20	13
48	19 15 23	19 29 28	19 43 11	19 56 33	20 9 53	12
49	19 15 38	19 29 41	19 43 24	19 56 46	20 9 46	11
50	19 15 52	19 29 55	19 43 38	19 56 59	20 9 58	10
51	19 16 6	19 30 9	19 43 52	19 57 12	20 10 11	9
52	19 16 20	19 30 23	19 44 5	19 57 26	20 10 24	8
53	19 16 34	19 30 37	19 44 19	19 57 39	20 10 37	7
54	19 16 49	19 30 51	19 44 32	19 57 52	20 10 50	6
55	19 17 3	19 31 5	19 44 46	19 58 5	20 11 2	5
56	19 17 17	19 31 19	19 44 59	19 58 18	20 11 15	4
57	19 17 31	19 31 32	19 45 13	19 58 31	20 11 28	3
58	19 17 45	19 31 46	19 45 26	19 58 44	20 11 41	2
59	19 18 0	19 32 0	19 45 40	19 58 57	20 11 54	1
60	19 18 14	19 32 [illegible]	19 45 53	19 59 10	20 12 6	0
61	19 18 28	19 32 28	19 46 [illegible]	19 59 23	20 12 19	
	4	3	2	1	0	

Leo Aquarius

Gemini Sagittarius

De. Mi.	0 Deg. Mi. Se	1 Deg. Mi. Se	2 Deg. Mi. Se	3 Deg. Mi. Se	4 Deg. Mi. Se	De. Mi.
1	20 12 19	20 24 52	20 37 3	20 48 52	21 0 17	59
2	20 12 32	20 25 5	20 37 15	20 49 3	21 0 28	58
3	20 12 44	20 25 17	20 37 27	20 49 15	21 0 39	57
4	20 12 57	20 25 29	20 37 39	20 49 26	21 0 50	56
5	20 13 10	20 25 42	20 37 51	20 49 38	21 1 2	55
6	20 13 23	20 25 54	20 38 3	20 49 50	21 1 13	54
7	20 13 35	20 26 6	20 38 15	20 50 1	21 1 24	53
8	20 13 48	20 26 19	20 38 27	20 50 13	21 1 35	52
9	20 14 1	20 26 31	20 38 39	20 50 24	21 1 46	51
10	20 14 13	20 26 43	20 38 51	20 50 36	21 1 58	50
11	20 14 26	20 26 56	20 39 3	20 50 47	21 2 9	49
12	20 14 39	20 27 8	20 39 15	20 50 59	21 2 20	48
13	20 14 51	20 27 20	20 39 27	20 51 10	21 2 31	47
14	20 15 4	20 27 33	20 39 39	20 51 22	21 2 42	46
15	20 15 17	20 27 45	20 39 51	20 51 33	21 2 53	45
16	20 15 29	20 27 57	20 40 2	20 51 45	21 3 4	44
17	20 15 42	20 28 9	20 40 14	20 51 57	21 3 16	43
18	20 15 55	20 28 22	20 40 26	20 52 8	21 3 27	42
19	20 16 7	20 28 34	20 40 38	20 52 20	21 3 38	41
20	20 16 20	20 28 46	20 40 50	20 52 31	21 3 49	40
21	20 16 33	20 28 59	20 41 2	20 52 43	21 4 0	39
22	20 16 45	20 29 11	20 41 14	20 52 54	21 4 11	38
23	20 16 58	20 29 23	20 41 26	20 53 5	21 4 23	37
24	20 17 10	20 29 35	20 41 37	20 53 17	21 4 34	36
25	20 17 23	20 29 47	20 41 49	20 53 28	21 4 45	35
26	20 17 35	20 30 0	20 42 1	20 53 40	21 4 56	34
27	20 17 48	20 30 12	20 42 13	20 53 51	21 5 7	33
28	20 18 1	20 30 24	20 42 25	20 54 3	21 5 18	32
29	20 18 13	20 30 36	20 42 37	20 54 14	21 5 29	31
30	20 18 26	20 30 48	20 42 49	20 54 26	21 5 40	30
31	20 18 38	20 31 1	20 43 0	20 54 37	21 5 51	29
	29	28	27	26	25	

Cancer Capricorne

Gemini Sagittarius

De. Mi.	0 Deg. Mi. Se	1 Deg. Mi. Se.	2 Deg. Mi. Se.	3 Deg. Mi. Se.	4 Deg. Mi. Se	De. Mi.
31	20 18 38	20 31 1	20 43 0	20 54 37	21 5 51	29
32	20 18 51	20 31 13	20 43 12	20 54 48	21 6 2	28
33	20 19 3	20 31 25	20 43 24	20 55 0	21 6 13	27
34	20 19 16	20 31 37	20 43 36	20 55 11	21 6 24	26
35	20 19 29	20 31 49	20 43 47	20 55 23	21 6 35	25
36	20 19 41	20 32 1	20 43 59	20 55 34	21 6 46	24
37	20 19 54	20 32 14	20 44 11	20 55 45	21 6 57	23
38	20 20 6	20 32 26	20 44 23	20 55 57	21 7 8	22
39	20 20 19	20 32 38	20 44 35	20 56 8	21 7 19	21
40	20 20 31	20 32 50	20 44 46	20 56 20	21 7 30	20
41	20 20 44	20 33 2	20 44 58	20 56 31	21 7 41	19
42	20 20 56	20 33 14	20 45 10	20 46 42	21 7 52	18
43	20 21 9	20 33 26	20 45 21	20 56 54	21 8 3	17
44	20 21 21	20 33 38	20 45 33	20 57 5	21 8 14	16
45	20 21 34	20 33 50	20 45 45	20 57 16	21 8 25	15
46	20 21 46	20 34 3	20 45 57	20 57 28	21 8 35	14
47	20 21 58	20 34 15	20 46 8	20 57 39	21 8 46	13
48	20 22 11	20 34 27	20 46 20	20 57 50	21 8 57	12
49	20 22 23	20 34 39	20 46 32	20 58 2	21 9 8	11
50	20 22 36	20 34 51	20 46 43	20 58 13	21 9 19	10
51	20 22 48	20 35 3	20 46 55	20 58 24	21 9 30	9
52	20 23 1	20 35 15	20 47 7	20 58 35	21 9 41	8
53	20 23 13	20 35 27	20 47 18	20 58 47	21 9 52	7
54	20 23 26	20 35 39	20 47 30	20 58 58	21 10 3	6
55	20 23 38	20 35 51	20 47 42	20 59 9	21 10 14	5
56	20 23 50	20 36 3	20 47 53	20 59 21	21 10 24	4
57	20 24 3	20 36 15	20 48 5	20 59 32	21 10 35	3
58	20 24 15	20 36 27	20 48 17	20 59 43	21 10 46	2
59	20 24 28	20 36 39	20 48 28	20 59 54	21 10 57	1
60	20 24 40	20 36 51	20 48 40	21 0 6	21 11 8	0
61	20 24 52	20 37 3	20 48 52	21 0 17	21 11 19	
	29	28	27	26	35	

Cancer Capricorne

Gemini Sagittarius

De. Mi.	5 Deg.	Mi.	Se.	6 Deg.	Mi.	Se.	7 Deg.	Mi.	Se.	8 Deg.	Mi.	Se.	9 Deg.	Mi.	Se.	De. Mi.
1	21	11	15	21	21	57	21	32	12	21	42	2	21	51	28	59
2	21	11	30	21	22	8	21	32	22	21	42	12	21	51	38	58
3	21	11	46	21	22	18	21	32	32	21	42	22	21	51	47	57
4	21	11	51	21	22	28	21	32	42	21	42	31	21	51	56	56
5	21	12	2	21	22	39	21	32	52	21	42	41	21	52	5	55
6	21	12	13	21	22	49	21	33	2	21	42	50	21	52	14	54
7	21	12	24	21	23	0	21	33	12	21	43	0	21	52	24	53
8	21	12	34	21	23	10	21	33	22	21	43	10	21	52	33	52
9	21	12	45	21	23	20	21	33	32	21	43	19	21	52	42	51
10	21	12	56	21	23	31	21	33	42	21	43	29	21	52	51	50
11	21	13	7	21	23	41	21	33	52	21	43	38	21	53	0	49
12	21	13	18	21	23	52	21	34	2	21	43	48	21	53	9	48
13	21	13	28	21	24	2	21	34	12	21	43	57	21	53	19	47
14	21	13	39	21	24	12	21	34	22	21	44	7	21	53	28	46
15	21	13	50	21	24	23	21	34	32	21	44	17	21	53	37	45
16	21	14	1	21	24	33	21	34	42	21	44	26	21	53	46	44
17	21	14	11	21	24	43	21	34	52	21	44	36	21	53	55	43
18	21	14	22	21	24	54	21	35	2	21	44	45	21	54	4	42
19	21	14	33	21	25	4	21	35	11	21	44	55	21	54	13	41
20	21	14	44	21	25	14	21	35	21	21	45	4	21	54	23	40
21	21	14	54	21	25	25	21	35	31	21	45	14	21	54	32	39
22	21	15	5	21	25	35	21	35	41	21	45	23	21	54	41	38
23	21	15	16	21	25	45	21	35	51	21	45	33	21	54	50	37
24	21	15	26	21	25	56	21	36	1	21	45	42	21	54	59	36
25	21	15	37	21	26	6	21	36	11	21	45	52	21	55	8	35
26	21	15	48	21	26	16	21	36	21	21	46	1	21	55	17	34
27	21	15	58	21	26	27	21	36	31	21	46	11	21	55	26	33
28	21	16	9	21	26	37	21	36	40	21	46	20	21	55	35	32
29	21	16	20	21	26	47	21	36	50	21	46	30	21	55	44	31
30	21	16	30	21	26	58	21	37	0	21	46	39	21	55	53	30
31	21	16	41	21	27	8	21	37	10	21	46	48	21	56	2	

24	23	22	21	20

Cancer Capricorne

Gemini Sagittarius

De. Mi.	5 Deg.	Mi.	Se.	6 Deg.	Mi.	Se.	7 Deg.	Mi.	Se.	8 Deg.	Mi.	Se.	9 Deg.	Mi.	Se.	De. Mi.
31	21	16	41	21	27	8	21	37	10	21	46	48	21	56	2	29
32	21	16	52	21	27	18	21	37	20	21	46	58	21	56	11	28
33	21	17	2	21	27	28	21	37	30	21	47	7	21	56	20	27
34	21	17	13	21	27	38	21	37	39	21	47	17	21	56	29	26
35	21	17	23	21	27	48	21	37	49	21	47	26	21	56	38	25
36	21	17	34	21	27	59	21	37	59	21	47	35	21	56	47	24
37	21	17	45	21	28	9	21	38	9	21	47	45	21	56	56	23
38	21	17	55	21	28	19	21	38	19	21	47	54	21	57	5	22
39	21	18	6	21	28	29	21	38	29	21	48	4	21	57	14	21
40	21	18	17	21	28	39	21	38	38	21	48	13	21	57	23	20
41	21	18	27	21	28	50	21	38	48	21	48	22	21	57	32	19
42	21	18	38	21	29	0	21	38	58	21	48	32	21	57	41	18
43	21	18	48	21	29	10	21	39	8	21	48	41	21	57	50	17
44	21	18	59	21	29	20	21	39	17	21	48	50	21	57	59	16
45	21	19	9	21	29	30	21	39	27	21	49	0	21	58	8	15
46	21	19	20	21	29	40	21	39	37	21	49	9	21	58	17	14
47	21	19	30	21	29	50	21	39	47	21	49	18	21	58	26	13
48	21	19	41	21	30	1	21	39	56	21	49	28	21	58	35	12
49	21	19	52	21	30	11	21	40	6	21	49	37	21	58	44	11
50	21	20	2	21	30	21	21	40	16	21	49	47	21	58	53	10
51	21	20	13	21	30	31	21	40	26	21	49	56	21	59	1	9
52	21	20	23	21	30	41	21	40	35	21	50	5	21	59	10	8
53	21	20	34	21	30	51	21	40	45	21	50	14	21	59	19	7
54	21	20	44	21	31	1	21	40	55	21	50	24	21	59	28	6
55	21	20	54	21	31	11	21	41	4	21	50	33	21	59	37	5
56	21	21	5	21	31	21	21	41	14	21	50	42	21	59	46	4
57	21	21	15	21	31	32	21	41	24	21	50	51	21	59	55	3
58	21	21	26	21	31	42	21	41	33	21	51	1	22	0	3	2
59	21	21	36	21	31	52	21	41	43	21	51	10	22	0	12	1
60	21	21	47	21	32	2	21	41	53	21	51	19	22	0	21	0
61	21	21	57	21	32	12	21	42	2	21	51	28	22	0	30	

24	23	22	21	20

Cancer Capricorne

Gemini Sagittarius

De.	10			11			12			13			14			De
Mi.	Deg.	Mi.	Se.	Deg.	Mi.	Se	Deg.	Mi.	Se.	Deg.	Mi.	Se.	Deg.	Mi.	Se	Mi.
1	22	0	3	22	9	7	22	17	18	22	25	5	22	32	25	59
2	22	0	35	22	9	15	22	17	26	22	25	12	22	32	32	58
3	22	0	47	22	9	23	22	17	34	22	25	20	22	32	40	57
4	22	0	56	22	9	32	22	17	42	22	25	27	22	32	47	56
5	22	1	5	22	9	40	22	17	50	22	25	35	22	32	54	55
6	22	1	14	22	9	48	22	17	58	22	25	42	22	33	1	54
7	22	1	23	22	9	57	22	18	6	22	25	50	22	33	8	53
8	22	1	31	22	10	5	22	18	14	22	25	57	22	33	15	52
9	22	1	40	22	10	14	22	18	22	22	26	5	22	33	22	51
10	22	1	49	22	10	22	22	18	30	22	26	12	22	33	29	50
11	22	1	58	22	10	30	22	28	38	22	36	20	22	33	36	49
12	22	2	6	22	10	39	22	18	46	22	26	27	22	33	43	48
13	22	2	15	22	10	47	22	18	53	22	26	35	22	33	50	47
14	22	2	24	22	10	55	22	19	1	22	26	42	22	33	57	46
15	22	2	33	22	11	4	22	19	9	22	26	50	22	34	4	45
16	22	2	41	22	11	12	22	19	17	22	26	57	22	34	11	44
17	22	2	50	22	11	20	22	19	25	22	27	5	22	34	18	43
18	22	2	59	22	11	28	22	19	33	22	27	12	22	34	25	42
19	22	3	8	22	11	37	22	19	41	22	27	19	22	34	32	41
20	22	3	16	22	11	45	22	19	49	22	27	27	22	34	40	40
21	22	3	25	22	11	53	22	19	56	22	27	34	22	34	46	39
22	22	3	34	22	12	1	22	20	4	22	27	42	22	34	53	38
23	22	3	42	22	12	10	22	20	12	22	27	49	22	35	0	37
24	22	3	52	22	12	18	22	20	20	22	27	57	22	35	7	36
25	22	4	1	22	12	26	22	20	28	22	28	4	22	35	14	35
26	22	4	9	22	12	34	22	20	36	22	28	11	22	35	21	34
27	22	4	18	22	12	43	22	20	43	22	28	19	22	35	28	33
28	22	4	27	22	12	51	22	20	51	22	28	26	22	35	35	32
29	22	4	35	22	12	59	22	20	59	22	28	34	22	35	42	31
30	22	4	43	22	13	7	22	21	7	22	28	41	22	35	49	30
31	22	4	51	22	13	15	22	21	15	22	28	48	22	35	56	

19	18	17	16	15

Cancer Capricorne

Gemini Sagittarius

De.	10			11			12			13			14			De
Mi.	Deg.	Mi.	Se	Deg.	Mi.	Se.	Deg.	Mi.	Se	Deg.	Mi.	Se	Deg.	Mi.	Se.	Mi.
31	22	4	51	22	13	15	22	21	15	22	28	48	22	35	56	29
32	22	5	0	22	13	24	22	21	22	22	28	56	22	36	3	28
33	22	5	9	22	13	32	22	21	30	22	29	3	22	36	10	27
34	22	5	17	22	13	40	22	21	38	22	29	10	22	36	17	26
35	22	5	26	22	13	48	22	21	46	22	29	17	22	36	24	25
36	22	5	34	22	13	56	22	21	53	22	29	25	22	36	31	24
37	22	5	43	22	14	4	22	22	1	22	29	32	22	36	37	23
38	22	5	51	22	14	13	22	22	9	22	29	39	22	36	44	22
39	22	6	0	22	14	21	22	22	16	22	29	47	22	36	51	21
40	22	6	9	22	14	29	22	22	24	22	29	54	22	36	58	20
41	22	6	17	22	14	37	22	22	32	22	30	1	22	37	5	19
42	22	6	26	22	14	45	22	22	40	22	30	8	22	37	12	18
43	22	6	34	22	14	53	22	22	47	22	30	16	22	37	19	17
44	22	6	43	22	15	1	22	22	55	22	30	23	22	37	25	16
45	22	6	51	22	15	10	22	23	3	22	30	30	22	37	32	15
46	22	7	0	22	15	18	22	23	10	22	30	37	22	37	39	14
47	22	7	8	22	15	26	22	23	18	22	30	45	22	37	46	13
48	22	7	17	22	15	34	22	23	26	22	30	52	22	37	53	12
49	22	7	25	22	15	42	22	23	33	22	30	59	22	37	59	11
50	22	7	34	22	15	50	22	23	41	22	31	6	22	38	6	10
51	22	7	42	22	15	58	22	23	49	22	31	14	22	38	13	9
52	22	7	51	22	16	6	22	23	56	22	31	21	22	38	20	8
53	22	7	59	22	16	14	22	24	5	22	31	28	22	38	26	7
54	22	8	8	22	16	22	22	24	11	22	31	35	22	38	33	6
55	22	8	16	22	16	30	22	24	19	22	31	42	22	38	39	5
56	22	8	24	22	16	38	22	24	27	22	31	49	22	38	46	4
57	22	8	33	22	16	46	22	24	34	22	31	57	22	38	53	3
58	22	8	41	22	16	54	22	24	42	22	32	4	22	39	0	2
59	22	8	50	22	17	2	22	24	49	22	32	11	22	39	7	1
60	22	8	58	22	17	10	22	24	57	22	32	18	22	39	14	0
61	22	9	7	22	17	18	22	25	5	22	32	25	22	39	20	

19	18	17	16	15	1

Cancer Capricorne

Gemini Sagitearius

De.	15			16			17			18			19			De.
Mi	Deg	Mi.	Se	Deg.	Mi.	Se.	Deg	Mi	Se	Deg.	Mi.	Se	Deg.	Mi.	Se	Mi.
1	22	39	20	22	45	50	22	51	53	22	57	29	23	2	40	59
2	22	39	27	22	45	56	22	51	58	22	57	35	23	2	45	58
3	22	39	34	22	56	2	22	52	4	22	57	41	23	2	50	57
4	22	39	40	22	46	8	22	52	10	22	57	46	23	2	55	56
5	22	39	47	22	46	15	22	52	16	22	57	51	23	3	0	55
6	22	39	54	22	46	21	22	52	22	22	57	56	23	3	5	54
7	22	40	0	22	46	27	22	52	27	22	58	2	23	3	10	53
8	22	40	7	22	46	33	22	52	33	22	58	7	23	3	14	52
9	22	40	14	22	46	39	22	52	39	22	58	12	23	3	19	51
10	22	40	20	22	46	46	22	52	45	22	58	18	23	3	24	50
11	22	40	27	22	46	52	22	52	51	22	58	23	23	3	29	49
12	22	40	34	22	46	58	22	52	56	22	58	28	23	3	34	48
13	22	40	40	22	47	4	22	53	2	22	58	34	23	3	39	47
14	22	40	47	22	47	10	22	53	8	22	58	39	23	3	44	46
15	22	40	53	22	47	17	22	53	14	22	58	44	23	3	49	45
16	22	41	0	22	47	23	22	53	19	22	58	50	23	3	53	44
17	22	41	7	22	47	29	22	53	25	22	58	55	23	3	58	43
18	22	41	13	22	47	35	22	53	31	22	59	0	23	4	3	42
19	22	41	20	22	47	41	22	53	36	22	59	5	23	4	8	41
20	22	41	26	22	47	47	22	53	42	22	59	11	23	4	13	40
21	22	41	33	22	47	53	22	53	48	22	59	16	23	4	18	39
22	22	41	39	22	48	0	22	53	54	22	59	21	23	4	22	38
23	22	41	46	22	48	6	22	53	59	22	59	26	23	4	27	37
24	22	41	53	22	48	12	22	54	5	22	59	32	23	4	32	36
25	22	41	59	22	48	18	22	54	11	22	59	37	23	4	37	35
26	22	42	6	22	48	24	22	54	16	22	59	42	23	4	41	34
27	22	42	12	22	48	30	22	54	22	22	59	47	23	4	46	33
28	22	42	19	22	48	36	22	54	27	22	59	52	23	4	51	32
29	22	42	25	22	48	42	22	54	33	22	59	58	23	4	56	31
30	22	42	32	22	48	48	22	54	39	23	0	3	23	5	1	30
31	22	42	38	22	48	54	22	54	44	23	0	8	23	5	5	
	14			13			12			11			10			

Cancer Capricorne

Gemini Sagittarius

De	15.			16			17			18			19			De
Mi.	Deg.	Mi.	Se.	Deg.	Mi.	Se	Deg.	Mi.	Se.	Deg	Mi.	Se	Deg.	Mi.	Se	Mi.
31	22	42	38	22	48	54	22	54	44	23	0	8	23	5	5	29
32	22	42	45	22	49	0	22	54	50	23	0	13	23	5	10	28
33	22	42	51	22	49	6	22	54	56	23	0	18	23	5	15	27
34	22	42	58	22	49	12	22	55	1	23	0	23	23	5	19	26
35	22	43	4	22	49	18	22	55	7	23	0	29	23	5	24	25
36	22	43	10	22	49	24	22	55	12	23	0	34	23	5	29	24
37	22	43	17	22	49	30	22	55	18	23	0	39	23	5	33	23
38	22	43	23	22	49	36	22	55	23	23	0	44	23	5	38	22
39	22	43	30	22	49	42	22	55	29	23	0	49	23	5	43	21
40	22	43	36	22	49	48	22	55	35	23	0	54	23	5	48	20
41	22	43	43	22	49	54	22	55	40	23	0	59	23	5	52	19
42	22	43	49	22	50	0	22	55	46	23	1	4	23	5	57	18
43	22	43	55	22	50	6	22	55	51	23	1	10	23	6	1	17
44	22	44	2	22	50	12	22	55	47	23	1	15	23	6	6	16
45	22	44	8	22	50	18	22	56	2	23	1	20	23	6	11	15
46	22	44	15	22	50	24	22	56	8	23	1	25	23	6	15	14
47	22	44	21	22	50	30	22	56	13	23	1	30	23	6	20	13
48	22	44	27	22	50	36	22	56	19	23	1	35	23	6	25	12
49	22	44	34	22	50	42	22	56	24	23	1	40	23	6	29	11
50	22	44	40	22	50	48	22	56	30	23	1	45	23	6	34	10
51	22	44	47	22	50	54	22	56	35	23	1	50	23	6	38	9
52	22	44	53	22	51	0	22	56	41	23	1	55	23	6	43	8
53	22	44	59	22	51	6	22	56	45	23	2	0	23	6	48	7
54	22	45	5	22	51	12	22	56	51	23	2	5	23	6	52	6
55	22	45	12	22	51	17	22	56	56	23	2	10	23	6	57	5
56	22	45	18	22	51	23	22	57	1	23	2	15	23	7	1	4
57	22	45	24	22	51	29	22	57	7	23	2	20	23	7	6	3
58	22	45	31	22	51	35	22	57	12	23	2	25	23	7	10	2
59	22	45	37	22	51	41	22	57	18	23	2	30	23	7	15	1
60	22	45	43	22	51	47	22	57	24	23	2	35	23	7	19	0
61	22	45	50	22	51	53	22	57	29	23	2	40	23	7	24	
	14			13			12			11			10			

Cancer Capricorne

Gemini Sagittarius

De. Mi	20 Deg	Mi.	Se.	21 Deg	Mi.	Se.	22 Deg	Mi	Se	23 Deg.	Mi.	Se	24 Deg.	Mi.	Se.	De Mi.
1	23	7	24	23	11	41	23	15	32	23	18	55	23	21	52	59
2	23	7	28	23	11	45	23	15	35	23	18	58	23	21	54	58
3	23	7	33	23	11	49	23	15	39	23	19	1	23	21	57	57
4	23	7	37	23	11	53	23	15	42	23	19	5	23	22	0	56
5	23	7	42	23	11	57	23	15	46	23	19	8	23	22	2	55
6	23	7	46	23	12	1	23	15	49	23	19	11	23	22	5	54
7	23	7	51	23	12	5	23	15	53	23	19	14	23	22	8	53
8	23	7	55	23	12	9	23	15	57	23	19	17	23	22	10	52
9	23	8	0	23	12	13	23	16	0	23	19	20	23	22	13	51
10	23	8	4	23	12	17	23	16	4	23	19	23	23	22	16	50
11	23	8	9	23	12	21	23	16	7	23	19	26	23	22	17	49
12	23	8	13	23	12	25	23	16	11	23	19	29	23	22	20	48
13	23	8	17	23	12	29	23	16	14	23	19	33	23	22	23	47
14	23	8	22	23	12	33	23	16	18	23	19	36	23	22	25	46
15	23	8	26	23	12	37	23	16	21	23	19	39	23	22	28	45
16	23	8	31	23	12	41	23	16	25	23	19	42	23	22	30	44
17	23	8	35	23	12	45	23	16	28	23	19	45	23	22	33	43
18	23	8	39	23	12	49	23	16	32	23	19	48	23	22	36	42
19	23	8	44	23	12	53	23	16	35	23	19	51	23	22	38	41
20	23	8	48	23	12	57	23	16	39	23	19	54	23	22	42	40
21	23	8	53	23	13	1	23	16	42	23	19	57	23	22	44	39
22	23	8	57	23	13	5	23	16	46	23	20	0	23	22	47	38
23	23	9	1	23	13	9	23	16	49	23	20	3	23	22	50	37
24	23	9	6	23	13	13	23	16	53	23	20	6	23	22	52	36
25	23	9	10	23	13	16	23	16	56	23	20	9	23	22	55	35
26	23	9	14	23	13	20	23	17	0	23	20	12	23	22	57	34
27	23	9	19	23	13	24	23	17	3	23	20	15	23	23	0	33
28	23	9	23	23	13	28	23	17	6	23	20	18	23	23	2	32
29	23	9	27	23	13	32	23	17	10	23	20	21	23	23	5	31
30	23	9	32	23	13	36	23	17	13	23	20	24	23	23	7	30
31	23	9	36	23	13	40	23	17	17	23	20	27	23	23	10	
	9			8			7			6			5			

Cancer Capricorne

Gemini Sagittarius

De Mi.	20 Deg	Mi.	Se.	21 Deg.	Mi.	Se.	22 Deg.	Mi.	Se.	23 Deg.	Mi.	Se	24 Deg.	Mi.	Se.	De Mi.
31	23	9	36	23	13	40	23	17	17	23	20	27	23	23	10	29
32	23	9	40	23	13	44	23	17	20	23	20	30	23	23	12	28
33	23	9	44	23	13	47	23	17	23	23	20	33	23	23	15	27
34	23	9	49	23	13	51	23	17	27	23	20	35	23	23	17	26
35	23	9	53	23	13	55	23	17	30	23	20	38	23	23	20	25
36	23	9	57	23	13	59	23	17	34	23	20	41	23	23	22	24
37	23	10	1	23	14	3	23	17	37	23	20	44	23	23	25	23
38	23	10	6	23	14	6	23	17	40	23	20	47	23	23	27	22
39	23	10	10	23	14	10	23	17	44	23	20	50	23	23	29	21
40	23	10	14	23	14	14	23	17	47	23	20	53	23	23	32	20
41	23	10	18	23	14	18	23	17	50	23	20	56	23	23	34	19
42	23	10	23	23	14	21	23	17	54	23	20	59	23	23	37	18
43	23	10	27	23	14	25	23	17	57	23	21	1	23	23	39	17
44	23	10	31	23	14	29	23	18	0	23	21	4	23	23	41	16
45	23	10	35	23	14	33	23	18	3	23	21	7	23	23	44	15
46	23	10	39	23	14	36	23	18	7	23	21	10	23	23	46	14
47	23	10	43	23	14	40	23	18	10	23	21	13	23	23	49	13
48	23	10	48	23	14	44	23	18	13	23	21	16	23	23	51	12
49	23	10	52	23	14	48	23	18	17	23	21	18	23	23	53	11
50	23	10	56	23	14	51	23	28	20	23	21	21	23	23	56	10
51	23	11	0	23	14	55	23	18	23	23	21	24	23	23	58	9
52	23	11	4	23	14	59	23	18	26	23	21	27	23	24	0	8
53	23	11	8	23	15	2	23	18	29	23	21	30	23	24	3	7
54	23	11	12	23	15	6	23	18	33	23	21	32	23	24	5	6
55	23	11	17	23	15	10	23	18	36	23	21	35	23	24	7	5
56	23	11	21	23	15	13	23	18	39	23	21	38	23	24	10	4
57	23	11	25	23	15	17	23	18	42	23	21	41	23	24	12	3
58	23	11	29	23	15	21	23	18	46	23	21	43	23	24	14	2
59	23	11	33	23	15	24	23	18	49	23	21	46	23	24	16	1
60	23	11	37	23	15	28	23	18	52	23	21	49	23	24	19	0
61	23	11	41	23	15	32	23	18	55	23	21	52	23	24	21	
	9			8			7			6			5			

Cancer Capricorne

Gemini Sagitarius

De.	25			26			27			28			29			Mi.	De.
Mi.	Deg.	Mi.	Se.	Deg.	Mi.	Se.	Deg.	Mi.	Se.	Deg.	Mi.	Se.	Deg.	Mi.	Se.		Mi.
1	23	24	21	23	26	23	23	27	58	23	29	6	23	29	46	43	59
2	23	24	23	23	26	25	23	28	0	23	29	7	23	29	47	8	58
3	23	24	26	23	26	27	23	28	1	23	29	8	23	29	47	34	57
4	23	24	28	23	26	29	23	28	2	23	29	9	23	29	47	59	56
5	23	24	30	23	26	31	23	28	4	23	29	10	23	29	48	24	55
6	23	24	32	23	26	32	23	28	5	23	29	11	23	29	48	49	54
7	23	24	34	23	26	34	23	28	6	23	29	11	23	29	49	14	53
8	23	24	37	23	26	36	23	28	8	23	29	12	23	29	49	40	52
9	23	24	39	23	26	38	23	28	9	23	29	13	23	29	50	5	51
10	23	24	41	23	26	39	23	28	10	23	29	14	23	29	50	30	50
11	23	24	43	23	26	41	23	28	12	23	29	15	23	29	50	50	49
12	23	24	46	23	26	43	23	28	13	23	29	16	23	29	51	11	48
13	23	24	48	23	26	45	23	28	14	23	29	17	23	29	51	31	47
14	23	24	50	23	26	46	23	28	15	23	29	17	23	29	51	52	46
15	23	24	52	23	26	48	23	28	17	23	29	18	23	29	52	12	45
16	23	24	54	23	26	50	23	28	18	23	29	19	23	29	52	32	44
17	23	24	56	23	26	51	23	28	19	23	29	20	23	29	52	53	43
18	23	24	58	23	26	53	23	28	20	23	29	21	23	29	53	13	42
19	23	25	1	23	26	55	23	28	22	23	29	21	23	29	53	34	41
20	23	25	3	23	26	56	23	28	23	23	29	22	23	29	53	54	40
21	23	25	5	23	26	58	23	28	24	23	29	23	23	29	54	10	39
22	23	25	7	23	27	0	23	28	25	23	29	24	23	29	54	26	38
23	23	25	9	23	27	1	23	28	26	23	29	24	23	29	54	43	37
24	23	25	11	23	27	3	23	28	28	23	29	25	23	29	54	59	36
25	23	25	13	23	27	5	23	28	29	23	29	26	23	29	55	15	35
26	23	25	15	23	27	6	23	28	30	23	29	26	23	29	55	31	34
27	23	25	17	23	27	8	23	28	31	23	29	27	23	29	55	47	33
28	23	25	19	23	27	9	23	28	32	23	29	28	23	29	56	4	32
29	23	25	22	23	27	11	23	28	33	23	29	29	23	29	56	20	31
30	23	25	24	23	27	12	23	28	35	23	29	29	23	29	56	36	30
31	23	25	26	23	27	14	23	28	36	23	29	30	23	29	56	47	
	4			3			2			1			0				

Cancer Capricorne

Gemini Sagitarius

De.	25			26			27			28			29			Mi.	De.
Mi.	Deg.	Mi.	Se.	Deg.	Mi.	Se.	Deg.	Mi.	Se.	Deg.	Mi.	Se.	Deg.	Mi.	Se.		Mi.
31	23	25	26	23	27	14	23	28	36	23	29	30	23	29	5[illegible]	47	29
32	23	25	28	23	27	16	23	28	37	23	29	31	23	29	56	59	28
33	23	25	30	23	27	17	23	28	38	23	29	31	23	29	57	10	27
34	23	25	32	23	27	19	23	28	39	23	29	32	23	29	57	22	26
35	23	25	34	23	27	21	23	28	40	23	29	33	23	29	57	33	25
36	23	25	36	23	27	22	23	28	41	23	29	33	23	29	57	44	24
37	23	25	38	23	27	24	23	28	42	23	29	34	23	29	57	56	23
38	23	25	40	23	27	25	23	28	43	23	29	34	23	29	58	7	22
39	23	25	42	23	27	27	23	28	45	23	29	35	23	29	58	19	21
40	23	25	44	23	27	28	23	28	46	23	29	36	23	29	58	30	20
41	23	25	46	23	27	30	23	28	47	23	29	36	23	29	58	42	19
42	23	25	48	23	27	31	23	28	48	23	29	37	23	29	58	53	18
43	23	25	49	23	27	33	23	28	49	23	29	37	23	29	58	50	17
44	23	25	51	23	27	34	23	28	50	23	29	38	23	29	58	56	16
45	23	25	53	23	27	36	23	28	51	23	29	39	23	29	59	3	15
46	23	25	55	23	27	37	23	28	52	23	29	39	23	29	59	10	14
47	23	25	57	23	27	39	23	28	53	23	29	40	23	29	59	16	13
48	23	25	59	23	27	40	23	28	54	23	29	40	23	29	59	23	12
49	23	26	1	23	27	42	23	28	55	23	29	41	23	29	59	29	11
50	23	26	3	23	27	43	23	28	56	23	29	41	23	29	59	36	10
51	23	26	5	23	27	45	23	28	57	23	29	42	23	29	59	39	9
52	23	26	7	23	27	46	23	28	58	23	29	42	23	29	59	41	8
53	23	26	9	23	27	47	23	28	59	23	29	43	23	29	59	43	7
54	23	26	10	23	27	49	23	29	0	23	29	43	23	29	59	46	6
55	23	26	12	23	27	50	23	29	1	23	29	44	23	29	59	48	5
56	23	26	14	23	27	52	23	29	2	23	29	44	23	29	59	50	4
57	23	26	16	23	27	53	23	29	3	23	29	45	23	29	59	53	3
58	23	26	18	23	27	54	23	29	3	23	29	45	23	29	59	55	2
59	23	26	20	23	27	56	23	29	4	23	29	46	23	29	5[illegible]	58	1
60	23	26	22	23	27	57	23	29	5	23	29	46	23	30	0	0	
61	23	26	23	23	27	58	23	29	6	23	29	47					
	4			3			2			1			0				

Cancer Capricorne

The vſe of this Table.

This Table of Declination is made ſo particularly to euery minute of the Ecliptike, to auoyde tediouſneſſe in ſeeking the parte proportionall, when you would find out thereby, either the declination of the Sunne, his place being firſt giuen in degrees and minutes: or elſe the place of the Sunne in the Zodiake, his declination being firſt knowne by obſeruation, for which cauſe eſpecially this Labour was vndertaken, that hereby it might preſently appeare how well the Ephemerides and Aſtronomicall Tables hitherto publiſhed, agree with the truth of the heauens. Wherein many times no ſmall difference is found, euen the Prutenike Tables themſelues (which haue beene heretofore commonly accounted the moſt perfect in that kinde) diſagreeing welnigh halfe a degree from trueth, and that in the place of the Sunne, whoſe motion of all others is accounted moſt ſimple and regular, and moſt eaſie to be found out.

To find out the declination of the Sunne by his place firſt giuen, by helpe of this Table, doe thus: If the Sunne be in Aries, Taurus, Gemini, Libra, Scorpio, or Sagitrarie, ſeeke the ſigne and degree of the Sunne in the vpper Margine of the Table, and the odde minutes (if there be any) in the firſt Columne towardes the left hand: Then looke where the line proceeding towardes the right hand from the minute of the Sunne, croſſeth the Collomne comming downewardes from the degree of the Sunne. for there you haue the Declination of the Sunne.

The

But if the Sunne be in Cancer, Leo, Virgo, Capricorne, Aquarie, or Piſces, do contrariwiſe, that is, ſeeke the ſigne and degrees of the ſunne in the nether margine of the table and the minutes (if there bee any) in the laſt columne next the right hand: and following the line of the minute of the ſunne towards the left hand: and the columne of the degree of the ſunne vpwards, in the common meeting of that line and columne you ſhall finde the declination of the ſunne.

Example of the firſt: the firſt of May 1598. the place of the ſun is in 20. degr. 23. mi. 8. according to the Ephemerides of the ſun hereafter following, made agreeable to many exact obſeruations, taken by a quadrant of 6 foot & a quaarter ſemidiameter in the yeares 1594, 1595, 1596, 1597.) Finding therefore Taurus & the 20. degree in the vpper part of this table, and 23 minutes in the firſt columne, I haue in the common meeting (of the columne deſcending from 20, and of the line proceeding from 23 min. towards the right hand) 17 degrees, 53. minutes 19 ſec. the declination of the ſunne the ſame day at noone here at London.

Example of the ſecond. The 15 of Auguſt the ſame yeare by the ſame Ephemerides, the ſunne is in one degree, 50 minutes of Virgo. Therefore I ſeeke Virgo, and 1 in the nether part of this table, and 50 minutes in the laſt columne towardes the right hand aſcending vpwards. Then following the line of 50 minutes leftwards, and the columne of one degree vpwards in the common meeting of the line and columne I finde ten degrees 50 mi-

nutes,57 ſec. the declination of the ſun the ſame day at noone for the meridian of London.

But the declination of the ſunne being firſt knowne (by obſeruation or otherwiſe) the place of the ſunne ſhall moſt eaſily bee founde out by this table after this manner: Seeke the ſuns declination in the area of the table: then if the ſigne wherein the ſunne is (which you may for the moſt part eaſily know by æſtimation) be in the head of the table, aſcend vpwards to the toppe of the ſame columne in which you found the declination giuen, for there you ſhall haue the degree of the ſunne: follow alſo the line wherein you find the giuen declination towardes the left hande, till you come to the firſt columne leftwards, and there you ſhall haue the minute alſo.

But if the name of the ſigne wherein the ſunne is, be in the nether part of the table, you muſt doe all things contrariwiſe, deſcending from the declination found in the area of this table to the ſame columne, till you come to the loweſt part therof, where you ſhall find the degree of the ſunne: and proceeding from the declination towardes the right hand in the ſame line, till you come to the laſt columne, where you ſhall find the minutes to be adioyned, that you may haue the true place of the ſunne.

This way of finding out the place of the ſunne by his declination, firſt knowne by obſeruation, is then of eſpeciall vſe and trueth, when the ſunne is neare the æquinoctiall poynts, for there his declination altereth quickeſt, increaſing or decreaſing

ſing well nigh 24 mi. in 24 houres. But when the ſunne is neare either of the Tropikes, the miſsing of one minute, yea or halfe a minute in obſeruing the declination, may cauſe you erre an whole degree and more ſometimes in the place of the ſunne. He therefore that liſteth trie how well the Ephemerides and aſtronomical tables hitherto publiſhed agree with the trueth of the heauens, had beſt make obſeruation when the ſun is in Piſces, Aries, Virgo, and Libra, where miſsing one minute in obſeruing the declination, will cauſe you miſſe not paſt two or three minutes in the true place of the ſunne.

When the ſunne is neare either of the equinoctiall points, there may ſometimes bee ſome ſmall difficultie in finding out what ſigne the ſunne is in, which may eaſily bee auoyded thus. The meridian altitude of the ſunne increaſing (as in winter and ſpring time) if the heigth of the ſun bee leſſe then the complement of the poles eleuation, the ſunne is in Piſces: otherwiſe in Aries. But if the meridian altitudes of the ſunne be euery day leſſe then other (as in ſummer and Autumne) and the heighth of the ſunne at noone greater then the heigth of the equinoctial or complement of the eleuation of the pole, the ſunne is in Virgo, otherwiſe in Libra.

There may likewiſe bee ſome doubt in what ſigne the ſunne is, being neare either of the Tropikes, which may be reſolued thus: the ſunne hauing ſouth declination increaſing, is in Sagittarie: but if the declination of the ſunne bee ſoutherlie

and decreaſing, he is in Capricorne. Contrariwiſe the declination of the ſunne being northerly and increaſing, he is in Gemini, if decreaſing, he is in Cancer.

Nowe whether the declination of the ſun increaſe or decreaſe, you may know by comparing the declinations of two daies togither. For if the declination anſwerable to the firſt day be greater, the declination increaſeth: otherwiſe it decreaſeth. If both dayes haue æquall declination, the firſt day the ſun is in Gemini, the ſecond in Cancer, if his declination be northerly, if ſoutherlie, the firſt day he is in Sagittary, the ſecond in Capricorne.

An example or two will make all plaine: The eight day of Aprill, 1597 the declination of the ſun was found by obſeruation to be ten degrees, 53 minutes ½, which I ſeeke out in the area of this table, and in the head of the ſame columne wherin I finde this declination, I ſee 28. degrees of Aries (for in Aprill the ſunne cannot be in Libra) and in the ſame line wherein I found this declination, in the furtheſt column towards the left hand I finde 17. minutes. Wherefore by obſeruation I pronounce the place of the ſunne the ſame yeere and day to bee in 28 degrees 17 minutes of Aries. Which *Maginus* following *Copernicus* and the Prutenicall tables (as he proteſteth) maketh to be the 27 degree, 57 minutes of Aries, that is, twentie minutes leſſe then trueth, that æquation alſo beeing abated, which is anſwerable to the difference of longitude betwixt London & Venice.

The

The 11 of March the ſame yeare at London (where by many and diligent obſeruations by large and ſeueral inſtruments, the heigth of the pole is found to be 51 degrees, 32 minutes (the meridian altitude of the ſun was exactly obſerued to be 38 degrees, 49 minutes: whereby it appeareth that his declination the ſame day at noone was 0 degr. 21 minutes, & that northerly, becauſe the heigth of the ſun was greater then the heigth of the æquinoctial. It is plaine therefore that at that time the ſun was entred into Aries. But now to know how farre he was entred: ſeeke out 0 deg. 21 minutes in the area of this table: wherewith you ſhall alſo find in the ſame line in the columne next the left hand 53 minutes, and in the toppe of the columne right ouer this declination you ſhall haue 0 degree. Therefore it is manifeſt that at that time the ſun was in 0 degr. 53 minutes of Aries. Where *Maginus* after the Prutenick account maketh it to be in 0 degr. 25 minutes of Aries: that is, 28 minutes wanting of the trueth found by obſeruation.

The like difference I haue often found by manie and diligent obſeruations, eſpecially for the ſpace of theſe foure yeares paſt: the whole catalogue of which obſeruations I thought good (for thy further ſatiſfaction herein) to ſet downe in a table: (after I haue firſt ſhewed with what inſtrument and in what maner I obſerued the ſame,) that if any error herein hath beene committed, it may the more eaſelie appeare.

The inſtrument therefore wherewith I obſer-

ued was a quadrant of more then ſixe foote ſemi-diameter (for the roome wherein I was to vſe it, could not well admit a greater quantitie) which by reaſon of his largeneſſe was ſo exactly made and diuided, that both minutes and halfe minutes mought therein be eaſily diſcerned. The limbe and ſides of the quadrant were about two ynches and a quarter in thickneſſe: the breadth of the limbe about foure ynches: the breadth of the ſides about two ynches and an halfe.

In the midſt of the endes and of one ſide of this quadrant were two round holes made, in either end one: whereby the quadrant was hanged (like a gate on his hinges, vpon two round pins, fitted to thoſe holes, and fixed in the ends of a couple of ſockets, put cloſe vpon a ſtrong ſquare poſt, perpendicularly erected, and the vpper ende thereof faſtned to the ſide of a principall ſparre in an vpper chamber, where a window (according to the reclination of the roofe of the houſe) was made betweene it and the next ſparre, in ſuch ſort, that carrying your eye along by the circumference of the quadrant, you might by the center therof placed at the window, ſee any part of the heauens neare the meridian, betweene the zenith and horizon. The nether end of this poſt reſting on the flore was put into the midſt of a ſocket nailed to the flore, which was ſo wide, that on euerie ſide the poſt wedges might bee put in to coyne it at pleaſure this way or that way, till the ſide of the quadrant were found to ſtand moſt exactly perpendicular, by the hanging of the plumbeline alongſt

longſt moſt præciſely vpon a line parallel to the zenith line of the quadrant. To the center of the quadrant was faſtned a ſtrong ruler of one ynch in thicknes, two ynches in breadth, & almoſt 6 foot and an halfe in length, carrying two ſights vppon it (viz. at either end one) of æquall breadth and length, the end of the middle line of each ſight falling perpendicularly vpon the middle or fiduciall line and plaine of the ruler. Through the vpper ſight placed at the center was made a ſquare hole as great as well could be. Through the midſt of this ſight and hole was put a ſtraight wire, erected perpendicularly from the fiduciall line and plaine of the ruler, and ſo much of it made flatte and thin, as was betweene the toppe and baſe of that ſquare hole. This wire ſerued for obſeruing the ſtarres, the flat ſide whereof was to be turned towards the eye in obſeruing of great ſtarres, and the narrow ſide or edge of it was turned to the eye ward when ſmal ſtarres came to be obſerued. Through the midſt of the nether ſight, (from the toppe of it to the baſe thereof) was made a narrow ſlit perpendicularly, erected likewiſe from the fiduciall line and plaine of the ruler and quadrant. When I obſerued the ſtarres, I looked through this ſlitte, eleuating and depreſsing the ruler, till the wire (beeing firſt fitted to the bigneſſe of the ſtarre) did euen couer the ſtarre from my ſight: in ſuch ſort, that I might ſee both edges of the ſtarre alike on either ſide of the wire. The ſquare hole in the ſight had a couer fitted to it like the couer of a box wherwith it was wholy couered when the

Sun

Sun was to be obſerued. The nether ende of the ruler carying the ſights, was to be faſtned with a ſcrue pin, at any part of the circumference of the quadrant as neede required.

With this quadrant (alwayes rectified by the plumbe-line in time of obſeruation as before is ſhewed) the height of the Sunne was moſt eaſily & exactly obſerued, by turning the quadrant this way or that way, and eleuating or depreſsing the ruler carrying the ſights, til the toppe and ſides of the ſhadow of the vpper ſight placed at the center, fell vpon the nether ſight placed at the circũference æquidiſtantly from the top and ſides thereof: For then the vpper edge of the ruler ſhewed præciſely the height of the Sunne deſired in degrees and minutes vpon the limb of the quadrant: ſauing that one whole degree was alwayes to be added thereto, becauſe the breadth of that part of the ruler that lay vppon the limb of the quadrant was made to be iuſt equall to two degrees: that is on either ſide one degree from the fiduciall line.

Now for finding out the meridian altitudes of the ſunne and ſtarres, I firſt found out the meridian line thus: with the quadrant rectified and vſed as before is ſhewed, I obſerued the height of the Sunne in the forenoone; and ſo warily letting the quadrant ſtand immooueable, and laying the ſide of a ſtreight ruler (that was about ſeuen foote in length) cloſe along to the perpendicular ſide of the quadrant: cloſe by the end of that ſide of the ruler (touching the floore of the chamber) I made a pricke vpon the floore: Alſo laying the ſide of the ruler to the perpendicular ſide, and limb of the quadrant, I made in like maner another pricke (ſo farre as conueniently I coulde from the former) vpon the floore, cloſe by the corner of that ſide of the ruler.

By theſe two pricks, I drew a right line which repreſented the interſection of the Sunnes azimuth, or of the continued plaine of the quadrant, and of the plaine of the floore in the time of obſeruation. Likewiſe in the afternoone (the ruler of the quadrant carrying the ſights, being fixed in the ſame place where it was in time of obſeruation in the forenoone) I obſerued diligently till the Sunne came to the ſame height that hee had when I obſerued in the forenoone, which I did by following the motion of the Sunnes ſhadowe with the quadrant till the edges of the toppe and ſides of the ſhadow of the vpper ſight, fell vppon the neather ſight æquidiſtantly from the top and ſides thereof.

Then carefully letting the quadrant ſtand immoueable, and drawing the line of interſection of the floore, and ſunnes azimuth, in time of the afternoone obſeruation, in like manner as I did in the forenoone, ſetting one foote of the compaſſes in the interſection of thoſe twoo lines, with the other, drawing an arch, ſo great as I could betweene the ſame lines, and finding out the midſt of this arch, a line from the centre drawne, by this midſt was the meridian line: ouer which, with help of a long ruler layd to the vpright ſide, and limbe of the quadrant, and extended to the floore

(as before) I alwayes placed and faſtned the plain of the quadrant (vnderſtoode to be continued to the floore) ſo oft as I obſerued the meridian altitudes of the Sunne or Starres.

Notwithſtanding there is ſome little error in finding the meridian after this manner, except it be when the Sunne is in, or ſo neere one of the tropicall poynts, that there can be no ſenſible alteration of his declination betweene the times of the forenoone and afternoone obſeruations. But the conſequents of this error, in obſerving meridian altitudes, may for their ſmallneſſe iuſtly bee neglected, and eaſely auoyded, if you attend your obſeruation, but a little before and after the ſunne or ſtarres to be obſerued, come vpon the meridian thus found. And for the more certainty, I took three obſeruations in the forenoone, and as many in the afternoone, and ſo found out three meridian lines, al parallels each to other without notable difference, which if it ſhould haue chaunced to be any, the middlemoſt meridian ſhoulde be like to be the trueſt.

A

¶ A Table of Obſeruations of the Meridian altitudes of the Sunne, taken by a quadrant of ſixe foote ſemidiameter at London, where the eleuation of the pole Arctik is one and fiftie degrees, and two and thirtie minutes.

1594 Maie	The height of the ſunne at noone		The declination of the Sunne.		The place of the Sunne by obſeruation.		The place of Sunne by the prut tables.		The æquat.
Dayes.	Deg.	Min.	Deg.	Min.	Deg.	Min.	Deg.	Min.	Min.
9 Thurſ.	58	14	19	46	28 ♉	1	27 ♉	43	18
11 Satur.	58	41	20	13	0 ♊	4	29	39	24
13 Mund.	59	4	20	36	1	55	1 ♊	34	22
14 Tueſd.	59	15	20	47	2	51	2	32	19
17 Frid.	59	45	21	17	5	33	5	25	8
26 Sund.	61	1½	22	33½	14	19	14	2	17
27 Mund.	61	8	22	40	15	7	15	0	7
28 Tueſd.	61	14	22	46	16	7	15	57	10
29 Wedn.	61	20½	22	52½	17	7	16	55	12
31 Frid.	61	31	23	3	19	5	18	50	15
Iune.									
1 Satur.	61	31	23	7	19	56	19	47	9
2 Sund.	61	40	23	12	21	6	20	44	22
4 Tueſd.	61	46½	23	18½	22	53	22	39	14
6 Thurſ	61	52½	23	24½	25	5	24	34	31
7 Frid.	61	54	23	26	25	49	25	31	18
8 Satur.	61	55½	23	27½	26	41	26	29	12
9 Sund.	61	56	23	28½	27	26	27	26	0
10 Mund.	61	57	23	29	27	54	28	23	29
11 Tueſd.	61	58	23	30	0 ♋	0	29 ♋	21	39
12 Wed.	61	58	23	30	0	0	0	18	18

A Table of Obseruations of the altitudes of the Sunne.

1594 June.	The height of the Sunne at noone.		The declination of the Sunne.		The place of the Sunne by obseruation.		The place of the S. by the prut. tables.		Difference.
Dayes.	Deg.	Min.	Deg.	Min.	Deg.	Min.	Deg.	Min.	Min.
13 Thurſ.	61	57½	23	29½	1 ♋	29	1 ♋	15	14
14 Friday	61	57	23	29	2	6	2	12	6
15 Satur.	61	56	23	28	2	58	3	10	48
22 Satur.	61	35	23	7	10	4	9	51	13
23 Sunday	61	32	23	4	10	43	10	48	5
24 Mond.	61	26½	22	58½	11	48	11	45	3
Iuly.									
6 Satur.	59	56	21	28	23	24	23	13	11
8 Mund.	59	36½	21	8½	25	14	25	8	6
9 Tueſd.	59	26	20	58	26	11	26	5	6
15 Mond.	58	14	19	46	1 ♌	59	1 ♌	50	9
16 Tueſd.	58	1	19	33	2	57	2	47	10
19 Frid.	57	20	18	52	5	49	5	39	10
25 Thurſ.	55	50	17	22	11	32	11	25	7
31 Wedn.	54	9½	15	41½	17	17	17	10	7
Auguſt.									
3 Satur.	53	15½	14	47½	20	11	20	3	8
6 Tueſd.	52	19½	13	51½	23	5	22	57	8
7 VVed.	52	0	13	32	24	4	23	54	10
8 Thurſ.	51	40½	13	12½	25	2	24	52	10
9 Frid.	51	21½	12	53½	25	58	25	50	8
12 Mond.	50	23	11	55	28	49	28	44	5
15 Thurſ.	49	21	10	53	1 ♍	44	1 ♍	38	6
19 Mond.	47	57	9	29	5	35½	5	30	6
23 Frid.	46	30	8	2	9	29	9	22	7
24 Satur.	46	7½	7	39½	10	28½	10	21	8
26 Mond.	45	23½	6	55½	12	24	12	17	7
29 Thurſ.	44	16	5	48	15	19	15	12	7

1594 September	The height of the Sunne at noone		The declination of the Sunne		The place of the Sunne by obſeruation		The place of the S. by the prut. tables		Difference.
Dayes.	Deg.	Min.	Deg.	Min.	Deg.	Min.	Deg.	Min.	Min.
Septem.			South declination						
16 Mond.	37	18	1	10	2 ♎	56½	2 ♎	48	8
17 Tueſ.	36	54	1	34	3	56	3	47	9
19 Thurſ.	36	7	2	21	5	54	5	45	9
20 Frid.	35	44	2	44	6	52	6	44	8
October					♎		♎		
1 Tueſ.	31	28	7	0	17	48	17	35	13
3 Thurſ.	30	43½	7	44½	19	45	19	34	11
4 Frid.	30	21	8	7	20	44	20	33	11
5 Satur.	29	58½	8	29½	21	44	21	33	11
16 Wed.	26	0½	12	27½	2 ♏	46	2 ♏	30	16
18 Frid.	25	20½	13	7½	4	43	4	30	13
19 Satur.	25	0	13	28	5	44	5	30	14
21 Mund.	24	20	14	8	7	46	7	30	16
25 Frid.	23	5	15	23	11	42	11	30	12
29 Tueſ.	21	52	16	36	15	46	15	31	15
Nouemb.					♏		♏		
1 Frid.	21	0	17	28	18	49	18	32	17
3 Sund.	20	27	18	1	20	52	20	33	19
4 Mund.	20	12	18	16	21	49	21	33	16
7 Thurſ.	19	27	19	1	24	48	24	35	13
10 Sund.	18	43	19	45	27	56	27	36	20
19 Tueſ.	16	55	21	33	7 ♐	6	6 ♐	43	23
20 Wed.	16	45	21	43	8	7	7	43	24
22 Frid.	16	27	22	1	10	4	9	45	19
23 Sat.	16	18	22	10	11	7	10	46	21
27 Wed.	15	48	22	40	15	7	14	49	18

A Table of Obſeruations of the altitudes of the Sunne.

1594 Nouember	The height of the Sunne at noone		The declination of the Sunne		The place of the Sunne by the obſeruation		The place of the S. by the prut. tables		The difference
Dayes.	Deg.	Min.	Deg.	Min.	Deg.	Min.	Deg.	Min.	Min.
28 Thurſ.	15	41	22	47	16 ♐	12	15 ♐	50	22
29 Frid.	15	35	22	53	17	13	16	48	25
December									
17 Tueſ.	15	6	23	22	5 ♑	56	5 ♑	10	46
18 Wed.	15	9	23	19	6	57	6	11	46
20 Frid.	15	16	23	12	8	54	8	13	41
22 Sund.	15	25	23	3	10	55	10	16	39
29 Sund.	16	10½	22	17½	17	57½	17	23	34
1595 Ianuary.									
9	18	4½	20	23½	29 ♒	6	28 ♒	35	31
18	20	13	18	15	8	15	7	43	32
23	21	35	16	53	13	15	12	47	28
26	22	28½	15	59½	16	18	15	50	28
31	24	3	14	25	21	22	20	53	29
February									
1 Satur.	24	22	14	6	22	20½	21	53	27½
5 Wed.	25	43	12	45	26	24	25	56	28
8 Satur.	26	46	11	42	29	26	28	57	29
13 Thurſ.	28	33	9	55	4 ♓	25	3 ♓	59	26
15 Satur.	29	19	9	9	6	30	5	59	31
16 Sund.	29	40½	8	47½	7	28	6	59	29
17 Mond.	30	3	8	25	8	28	7	59	29
20 Thurſ.	31	11½	7	16½	11	29	11	0	29
21 Frid.	31	34	6	54	12	28	12	0	28
27 Thurſ.	33	54	4	34	18	29	17	59	30
March									
1 Satur.	34	40	3	48	20	26	19	59	27
3 Mond.	35	27	3	1	22	25	21	58	27

1595 March	The height of the Sunne at noone.		The declination of the Sunne.		The place of the Sunne by the obſeruation.		The place of the S. by the prut. tables.		The difference.
Dayes.	Deg.	Min.	Deg.	Min.	Deg.	Min.	Deg.	Min.	Min.
12 Wed.	39	0	0	32	1 ♈	20	0 ♈	55	25
15 Satur.	40	10	1	42	4	16	3	53	23
17 Mond.	40	58	2	30	6	17	5	51	26
18 Tueſ.	41	22	2	54	7	17	6	50	27
19 Wed.	41	45	3	17	8	15½	7	50	25½
20 Thurſ.	42	9	3	41	9	16	8	49	27
21 Frid.	42	31	4	3	10	12	9	48	24
25 Tueſ.	44	4	5	36	14	10	13	44	26
26 Wed.	44	25½	5	58½	15	8	14	43	25
27 Thurſ.	44	49	6	21	16	6	15	42	24
31 Mond.	46	19	7	51	20	2	19	38	24
April.									
3 Thurſ.	47	25	8	57	22	58	22	34	24
[illegible] Mond.	48	51	10	23	26	52	26	28	24
8 Tueſ.	49	12	10	44	27	51	27	27	24
14 Mond.	51	14	12	46	3 ♉	39	3 ♉	18	21
Maie									
3 Satur.	56	47	18	19	22	1	21	42	19
6 Tueſ.	57	29½	19	1½	24 ♊	50	24 ♊	36	14
14 Wed.	59	10	20	42	2	26	2	17	9
17 Satur.	59	43½	21	25½	6	21½	5	10	11½
21 Wed.	60	21½	21	53½	9	14	9	1	13
23 Frid.	60	38	22	10	11	7	10	56	11
24 Satur.	60	46	22	18	12	6	11	53	13
29 Thurſ.	61	19	22	51	16	52	16	40	12
Iune.									
7 Satur.	61	54	23	26	25	48½	25	17	31½
9 Mond.	61	56½	23	28½	27	26	27	12	14
21 Satur.	61	40½	23	12½	8 ♋	47	8 ♋	39	8
23 Mond.	61	32	23	4	10	43	10	34	9
26 Thurſ.	61	16	22	48	13	38	13	26	12

A Table of Obſeruations

1595 July	The height of the Sunne at noone		The declination of the Sunne		The place of the Sunne by obſeruation		The place of the S. by the prut. tables		Difference
Day	Deg.	Min.	Deg.	Min.	Deg.	Min.	Deg.	Min.	Min.
30 Weds	54	30	16	2	16 ♌	10	15 ♌	58	17
31 Thurſ.	54	14	15	46	17	3	16	56	7
Auguſt.									
1 Frid.	53	56	15	28	18	2	17	54	8
2 Satur.	53	37	15	9	19	3	18	51	12
8 Frid.	51	45	13	17	24	49	24	38	11
9 Satur.	51	26	12	58	25	45	25	36	9
10 Sund.	51	6	12	38	26	44	26	34	10
19 Tueſd.	48	2	9	34	5 ♍	22	5 ♍	15	7
21 Thurſ.	47	20	8	52	7	16	7	12	4
22 Frid.	46	57½	8	29½	8	16	8	10	6
26 Tueſ.	45	30	7	2	12	7	12	3	4
29 Frid.	44	22	5	54	15	4	14	58	6
Septem.									
7 Sund.	40	54	2	26	23	53	23	44	9
8 Mund.	40	30	2	2	24	54	24	43	11
9 Tueſd.	40	7	1	39	25	51½	25	41	10½
10 Wed.	39	44	1	16	26	49½	26	40	9½
11 Thurſ.	39	20	0	52	27 ♎	50	27	39	11
16 Tueſd.	37	23½	1	4½	2	42	2	33	9
17 Wed.	37	0	1	28	3	41	3	32	9
18 Thurſ.	36	36	1	52	4	41	4	31	10
19 Frid.	36	12	2	16	5	41½	5	30	11½
20 Satur.	35	48½	2	39½	6	41	6	29	12
23 Tuei.	34	38	3	50	9	39	9	26	13
26 Frid.	33	29	4	59	12	35	12	24	11
October.									
2 Thurſ.	31	11½	7	16½	18	31	18	20	11
3 Frid.	30	48	7	40	19	33	19	19	14
9 Thurſ.	28	35	9	52	25	30	25	17	13

of the altitudes of the Sunne.

1595 October	The height of the Sunne at noone.		The declination of the Sunne.		The place of the Sunne by obſeruation.		The place of the S. by the prut. tables.		Difference.
Dayes.	Deg.	Min.	Deg.	Min.	Deg.	Min.	Deg.	Min.	Min.
October									
11 Satur.	27	52	10	36	27 ♎	28	27 ♎	16	12
12 Sund.	27	30	10	58	28	30	28	16	14
15 Wed.	26	25½	12	1½	1 ♏	30	1 ♏	15	15
17 Frid.	25	45	12	43	3	30	3	15	15
30 Thurſ.	21	37½	16	50½	16	36	16	16	20
Nouembe:									
18 Tueſ.	17	8	21	20	5 ♐	50	5 ♐	27	23
19 Wed.	16	58	21	30	6	48	6	28	20
20 Thurſ.	16	48	21	40	7	48½	7	28	20½
24 Mond.	16	13½	22	14½	11	40	11	32	8
December.									
2 Tueſ.	15	20½	23	7½	20	2	19	39	23
10 Wed.	13	0	23	28	27 ♑	2	27	47	
12 Frid.	14	58	23	30	0	0	29	50	10
18 Thurſ.	15	8	23	20	6	38	5 ♑	56	42
20 Satur.	15	14	23	14	8	24	7	58	26
21 Sund.	15	18	23	10	9	23	8	59	24
24 Wed.	15	34	22	54	12	37	12	3	34
30 Tueſ.	16	16	22	12	18	38	18	9	29
1596 January									
1 Thurſ.	16	34	21	54	20	42½	20	11	31
3 Satur.	16	53	21	35	22	42	22	14	28
10 Satur.	18	14	20	14	29 ♒	51	29 ♒	21	30
12 Mond.	18	39½	19	48½	1	48	1	23	25
14 Wed.	19	8	19	20	3	52½	3	25	27½
22 Thurſ.	21	14	17	14	12	1	11	32	29
24 Wed.	21	48	16	40	14	0	13	30	30½

A Table of Obſeruations

1596 February	The height of the Sunne at noone		The declination of the Sunne		The place of the Sunne by obſeruation		The place of the S. by the print. tables		The difference
Day	Deg.	Min.	Deg.	Min	Deg.	Min	Deg.	Min	Min.
13 Frid.	28	29	9	59	4 ♓	14	3 ♓	40	34
17 Tueſ.	29	57	8	31	8	12	7	44½	28
18 Wed.	30	10	8	18	8	46½	8	45	
24 Tueſ.	32	37½	5	50½	15	12½	14	45	27½
25 Wed.	33	1	5	27	16	13	15	45	28
26 Thurſ.	33	24	5	4	17	12	16	45	27
29 Sund.	34	34½	3	53½	20	11½	19	44	27½
March									
13 Sat.	39	42	1	14	3 ♈	6	2 ♈	39	27
14 Sund.	40	6	1	38	4	6	3	38	28
16 Tueſ.	40	52	2	24	6	2	5	37	25
April									
20 Tueſ.	53	23	14	55	10 ♉	12	9 ♉	51	21
24 Sat.	54	35	16	7	14	7	13	44	23
25 Sund.	54	51½	16	23½	15	3	14	42	21
26 Mond.	55	8½	16	40½	16	1	15	40	21
28 Wed.	55	41	17	13	17	56	17	36	20
29 Thurſ.	55	57	17	29	18	53	18	34	19
May									
4 Tueſ.	57	13	18	45	23 ♊	43	23 ♊	24	19
11 Tueſ.	58	45½	20	17½	0	26	0	8	18
June									
15 Tueſ.	61	54	23	26	4 ♋	11	3 ♋	39	32
18 Frid.	61	47	23	19	6	57	6	31	26
July					♌				
24 Sat.	55	56	17	28½	11	9	10	56	13
27 Tueſ.	55	8	16	40	14	0	13	49	11
29 Thurſ.	54	34	16	6	15	56	15	44	12
30 Frid.	54	17	15	49	16	53	16	42	11
31 Sat.	54	0	15	32	17	48½	17	39	9½

of the altitudes of the Sunne.

1596 Auguſt	The height of the ſunne at noone		The declination of the Sunne.		The place of the Sunne by obſeruation.		The place of Sunne by the print. tables.		The difference
Dayes.	Deg.	Min.	Deg.	Min.	Deg.	Min.	Deg.	Min.	Min.
10 Tueſ.	50	51	12	23	27 ♍	28	27	17	11
13 Frid.	49	50½	11	22½	0	21	0	11	10
16 Mond.	48	48	10	20	3	16	3	5	11
21 Sat.	47	1½	8	33½	8	5	7	55	10
30 Mond.	43	41	5	13	16	49	16	40	9
31 Tueſ.	43	17½	4	49½	17	49	17	38½	10½
September									
5 Sund.	41	22½	2	54½	22	41	22	31	10
6 Mond.	40	59	2	31	23	41	23	30	11
7 Tueſ.	40	36	2	8	24	39	24	28	11
8 Wed.	40	12½	1	44½	25	38	25	27	11
13 Mond.	38	16	0	12	0	30	0	21	9
14 Tueſd.	37	52	0	36	1	30	1	19½	16½
15 Wed.	37	28	1	0	2	30½	2	18½	12
25 Sat.	33	34½	4	53½	12	21	12	9	12
27 Mond.	32	48	5	40	14	20	14	8	12
October									
4 Mond.	30	9	8	19	21	16	21	3	13
Nouember									
2 Tueſ.	20	35	17	53	20	22	20	3	19
5 Frid.	19	47½	18	40½	23	25	23	4	21
1597 January									
25 Tueſ.	22	19	16	9	15 ♒	46	17 ♒	20	26
29 Sat.	23	34	14	54	19	51	19	22	29
March									
11 Frid.	38	49	0	21	0	53	0	25	28
12 Sat.	39	13	0	45	1	53	1	25	28
13 Sund.	39	36½	1	8½	2	52	2	24	28
14 Mond.	40	0	1	32	3	51	3	23	28

A Table of Obſeruations

1597 March	The height of the Sunne at noone		The declination of the Sunne		The place of the Sunne by obſeruation		The place of the S. by the prut. tables		The diff.
Dayes.	Deg.	Min	Deg.	Min.	Deg.	Min.	Deg.	Min.	Min
15 Tueſd.	40	23	1	55	4 ♈	49	4 ♈	23	26
16 Wed.	40	46½	2	18½	5	48	5	22	26
17 Thurſ.	41	10½	2	42½	6	48	6	21	27
20 Sund.	42	21½	3	53½	9	48	9	19	29
21 Mond.	42	44	4	16	10	45	10	18	27
Aprill									
8 Frid.	49	21½	10	53½	28 ♉	17	27 ♉	57	20
30 Sat.	56	9	17	41	19 ♊	37	19 ♊	18	19
Maie									
2 Mond.	56	40	18	12	21	34	21	14	20
Iune									
9 Thurſ.	61	57	23	29	27 ♊	54	27 ♊	41	13
11 Sat.	61	58	23	30			29 ♋	35	
12 Sund.	61	58	23	30	♋		0 ♋	33	
13 Mond.	61	57½	23	29½	1	29	1	30	1
19 Sund.	61	46	23	18	7	22	7	14	8
Iuly									
4 Mond.	60	12½	21	44½	21	44	21	33	11
5 Tueſ.	60	3½	21	35½	22	39	22	31	8
6 Wed.	59	54	21	26	23	36	23	28	8
8 Frid.	59	34	21	6	25 ♌	28	25 ♌	23	5
24 Sund.	56	1½	17	33½	10 ♍	50	10 ♍	42	8
26 Tueſd.	55	30	17	2	12	44	12	37	7
Auguſt									
3 Wed.	53	11	14	43	20	25½	20	18	7½
9 Tueſd.	51	16	12	48	26	15	26	5	10
September					♎		♎		
22 Thurſ.	34	50	3	38	9	9	8	57	12
30 Frid.	31	44½	6	43½	17	5	16	51	14

1597 October	The height of the ſunne at noone		The declination of the Sunne.		The place of the Sunne by obſeruation.		The place of Sunne by the prut. tables.		The diff.
Dayes.	Deg.	Min.	Deg.	Min.	Deg.	Min.	Deg.	Min.	Min.
October									
6 Thurſ.	29	29	8	59	23 ♏	3	22	48	15
12 Wed.	27	19	11	9	29	1	28	46	15
14 Frid.	26	36½	11	51½	1 ♐	1	0	45	16
24 Mond.	23	16	15	12	11	7	10	46	21
27 Thurſ.	22	22	16	6½	14 ♐	5	13	46	19
29 Sat.	21	46	16	42	16	7	15	47	20
Nouember									
3 Thurſ.	20	24	18	4	21	3	20	48	15
7 Mond.	19	21½	19	6½	25 ♑	11	24	50	21
22 Tueſd.	16	24	22	4	10 ♒	25	10	1	24

Now by the whole courſe of theſe obſeruations, it manifeſtly appeareth, that the declinations ſet down in the regiments of the ſunne, that are, & haue been hitherto ordinarily vſed by our ſea men, doo for the moſt part notably erre from the trueth of the heauens. Which errors as they may moſt truly be corrected by obſeruation only in thoſe dayes wherein certaine obſeruation was made: ſo for finding out the declinations of the middle dayes betweene the obſeruations, I thought it the beſt way, firſt to make the Ephemerides of the ſunne hereafter following, agreeable to the former obſeruations, and then to finde out the declinations aunſwerable to the places of the ſunne for euery day of foure yeares togither, becauſe that after that number of yeares the ſame places of the ſunne, and the ſame declinations returne againe without ſenſible error, which alſo by a certaine equation may be corrected, ſo as theſe tables may thereby be made ſeruiceable for many yeares.

Firſt therefore for making theſe Ephemerides, it is needfull to know the time of the ſunnes entrance into certaine ſpeciall poynts of the Zodiack: as alſo the ſunnes continuance in the arches of the zodiack contained between thoſe poynts, whereby the proportion of the ſunnes motion may geometrically be found out, his eccentricitie and place of his apogæum being hereby knowne.

For knowing the time of the ſunnes entrance into any point of the ecliptick, it is beſt to obſerue exactly the meridian altitude of the ſunne, not onely the ſame day wherein hee is like to enter into the poynt deſired, but euery day alſo, for two or three dayes together, both before and after that day, that both by the teſtimonie of ſo manie obſeruations compared together, you may haue the more aſſured truth: as alſo that if the day you moſt deſire fall not out to bee ſo cleare as you would wiſh, you may notwithſtanding, by the obſeruations of the dayes going before, and following after, or either of them, obtaine your deſire.

Hauing thus obſerued the meridian altitudes of the ſunne, and thereby alſo found his declinations for euery one of thoſe daies wherein you obſerued, you ſhal eaſily know alſo the true place of the ſunne in euery each one of the ſame dayes, with helpe of the former table of the declination of euerie minute of the ecliptick, in ſuch ſort as before was declared, when I ſhewed the vſe of that Table.

Now if it fal out ſo happyly, that both the day be cleare, when the ſunne entreth into the deſired poynt of the ecliptick, & that the place of the ſunne aunſwerable to the declination of that day, be al one with the point deſired, you haue already that you ſought for, without any more adoe, viz. that the ſunne entreth that day at noone into the ponit deſired. Otherwiſe ſubtract the obſerued place of the ſunne, next before the point deſired out of the obſerued place of the ſunne, next following that point, & the remainder ſhal ſhew you the apparēt motion of the ſunne, anſwerable to the time between thoſe obſeruations. Subtract alſo the former place of the ſunne, frō his place in the poynt deſired, and note the difference: for as the former remainder (that is the apparent motion of the ſunne betweene the obſeruations) is to the time betweene thoſe obſeruations: ſo is this difference to the time betweene the firſt obſeruation, and the ſunnes entrance into the poynt deſired.

Example of the firſt: I deſired to knowe the time of the ſunnes entrance into 14. degrees, 0. min. of ♌ in the yeare 1596. I obſerued therefore (at London) the height of the ſunne at noone, the 27. of Iuly the ſame yeare, and found it to be 55 degrees, 8 minutes, whereby his declination was gathered to be 16 degrees, 40 minutes, and conſequently his place in 14 degrees, 0 minutes of ♌ that day at noone.

Example of the ſecond: admitte you woulde know the ſame yeare the time of the ſunnes entrance into the midſt of Taurus. Hauing therefore

fore to this end obſerued, the meridian altitudes of the ſunne, the 24, 25, and 26 dayes of Aprill, in that yeare (within the ſpace of which dayes I am ſure the ſunne muſt needs be in that poynt) to be 54 degrees, 35 minutes, 54 degrees, 51 min. $\frac{1}{2}$ 55 degrees, 8 min. $\frac{1}{2}$, and conſequently, the declinations to be 18 degr. 7 min. 16 degr. 23 $\frac{1}{2}$ min. 16 degr. 40 min. $\frac{1}{2}$, I founde hereby the places of the ſunne the ſame dayes to be 14 degr. 7 min. ♉, 15 degrees 3 min. ♉. 16 degrees, 1 min. ♉. Subtracting therefore 14 degrees, 7 min. ♉. (that is, the place of the ſunne the 24 day) out of 15 deg. 3 mi. ♉. the place of the ſunne the 25 day) the remainder ſhall be 56 min. which is the apparent motion of the ſunne, betweene the 24, and 25 dayes at noone, that is, the diurne motion of the ſunne at that time. Subtracting alſo 14 degr. 7 min. ♉. out of 15 degr. 0 min. ♉. the difference is 53 mi. Now as 56 is to 53: ſo are 24 howres, to 22 houres and $\frac{4}{7}$, that is almoſt 43 minutes. It appeareth therefore by ſubtracting 22 houres, 43 min. out of 24 houres, that the ſunne ſhould enter into the midſt of ♉, the 25 day, about one houre and 17 min. before noone, that is, at ten a clocke, and 43 min.

Now ſuppoſing I had not, or could not haue obſerued the 25 day, I may notwithſtanding find the time of the ſunnes entrance into the midſt of ♉, by the obſeruations of the 24 & 26 daies after this manner: Subtract 14 degr. 7 min. ♉ out of 16 degrees, 1 min. ♉ the remainder will be one degree, 54 min. that is, the motiõ of the ſunne for twoo dayes betweene the 24 and 26 dayes at noone. Therefore as 1. degr. 54. min. is to 48. houres: ſo are 53 min. (that is, the difference of the place of the ſunne the 24 day from the midſt of ♉ found out as before) to 22. houres and almoſt 19 min. ſo as hereby it ſeemeth the ſunne ſhould enter into the midſt of ♉ the 25 day at ten of the clocke and 19 min. before noone.

But if it ſo fall out that you do not or can not obſerue, both before and after the time of the ſunnes comming to the poynt deſired (as ſuppoſe I could not haue obſerued the 24 day, but onely the 25 and 26 dayes, in both which daies the ſunne is gone paſt the poynt deſired) notwithſtanding you may obtein your deſire thus: Subtract 15 deg. 3 min. ♉ (the place of the ſunne the 25 day) out of 16 degr. 1 min. ♉ (the place of the ſunne the 26 day) there will remaine 58 mi. the diurne motion of the ſunne betweene the noonetides of the 25 and 26 dayes. Now becauſe that on the 25 day at noone the ſunne was gone 3 min. paſt the poynt deſired: therefore as 58 min. are to 24 houres, ſo are 3 min. to 1 houre, 14 min. and almoſt a halfe. By this account then the ſunne ſhould enter into the midſt of Taurus the 25 day 1 houre and about 14 min. and $\frac{1}{2}$ before noon: that is, at 10 of the clock and 45. mi. $\frac{1}{2}$ Neither ought that ſmal difference that appeares betweene theſe accounts to be greatly regarded, which amounts not to ſo much as half an houre in which time the motiõ of the Sunne is litle aboue a min. & the declination of the ſun in that

part of the zodiacke cannot alter ſo much as ½ of a minute, which is ſo ſmall, as can by ſenſe verie hardly, or not at all be diſcerned. But this difference may with good reaſon rather ſerue to controll the ouermuch curious ſcrupuloſity of them that will needes bee calculating the place of the ſunne not only to degrees and minutes, but to ſeconds alſo, when as notwithſtanding they miſſe a great many minutes of the trueth, and with all the inſtruments and meanes they can deuiſe, ſhal haue much adooe to finde aſſuredly the true place of the ſunne within one minute, yea euen then, when hee is at, or neare the æquinoctiall poynts, where of all others his place may moſt certainely be knowne.

Neither yet ought that little difference of a minute or two that appeareth betweene the diurne motions of the ſunne, found by obſeruation greatly moue any man (in that by the firſt and ſecond obſeruations the diurne motion ſhould be 56 min. by the firſt and third 57 min. by the ſecond and third 58 min.) the greateſt of which differences may almoſt ariſe by erring but one halfe minute only, in taking the height of the ſunne, which error is in a manner altogither inſenſible and wil be eaſily pardoned by them that haue or ſhall accuſtome themſelues to make the like obſeruations, when beſides their owne experience they ſhall finde that the cheefe artificers in this kinde of skill, *Tycho Brahe de recentiorib. atherei mundi phænom. lib. 2, cap. 10, part 1. Copern. Reuol. libr. 4, cap. 21.* and *Ptolemee* himſelfe in all his Catalogue of the fixed ſtarres *Almageſt. lib. 7. cap. 5.* when they ſhall finde (I ſay) that euen theſe princes of Aſtronomie ſo greatly exerciſed in obſeruations, haue accounted an whole minute or twoo, hardly ſenſible: *Ptolemee* alſo contenting himſelfe, for the moſt part, to haue ſet down the places of the fixed ſtarres to ſixth parts of degrees, and verie ſeldome comming to twelfth parts, thinking it ſufficient (as it may ſeeme by the perpetuall courſe of that Catalogue) to come within 5 or 10 minutes of the truth.

But to returne againe from whence wee haue a little digreſſed: After this manner nowe ſhewed, wee founde the time of the ſunnes entrance into the beginning of ♈ and ♎, & into the midſt of ♉, ♌, ♏, and ♒, as into places ſeruing moſt fitly for the finding out of the ſunnes eccentricitie and apogæum: following alſo herein the example of *Copernicus, Lib. 3 cap. 16 Reuol.* who wel perceiuing how hard, yea rather impoſsible a thing it is, to finde by obſeruation the time of the ſunnes entrance into the ſolſtitiall poynts (where the meridian altitudes, and declinations of the ſunne continue almoſt the ſame, without any ſenſible difference for two or three daies together) choſe rather the parts of the zodiacke alreadie mentioned, where the place of the ſunne may more truly be known by reaſon of the quicker altering of his declination, the difference thereof in the ſpace of 24 howres amounting to more then 17 min. The times therefore of the ſunnes comming to the foreſayd poyntes in the yeares

yeares 1594, 95, 96, 97. wee found to be ſuch as are ſet downe in this table following.

	1594			1595			1596			1597			☉ in
	Da.	Ho.	Mi	Da.	Ho.	Mi	Da.	Ho.	Mi	Da.	Ho	Mi	ig. de
Ian.				24	17	19	24	23	25	24	5	59	♒ 15
Mar.				10	15	27	9	20	58	10	2	37	♈ 0
April				25	17	48	24	22	46	25	5	23	♉ 15
July	28	14	49	28	19	2	28	1	0	28	8	39	♌ 15
Sept.	13	0	24	13	5	25	12	11	48	12	16	41	♎ 0
Octo.	28	5	54	28	9	55	27	15	44	27	21	55	♏ 15

Hereby the times of the ſunnes continuance in the arks of the zodiack betwixt thoſe points, as alſo the arkes of the eccentricke aunſwerable to thoſe times, were more eaſly found then that it ſhould now be needefull for mee to be further tædious, in ſetting downe the manner of finding the ſame, wherein notwithſtanding there may ſome difference of an houre or two ſometimes appeare, by comparing together thoſe times in ſeuerall yeares: yet this error being ſuch as may ariſe by miſsing little more than one minute in one obſeruation: or little more then halfe a minute, in two obſeruations of the meridian altitudes of the ſunne (one obſeruation being made when the ſunne is about the beginning of the arke, the other, when he is about the ending thereof) I make no doubt, but that it ſhal at the leaſt be fauourably cenſured by them that haue acquainted themſelues with often practiſe of obſeruing: wherein he ſhall (in my opinion) quite

quite himſelfe wonderous well, who neyther through imperfection of ſenſe, either in making or diuiding, or in rectifying, or in vſing his inſtrument, and euery part thereof: nor through the difficulty of noting præciſely the edges of the ſhadow of the vpper ſight falling vppon the nether: (the limites or boundes of which ſhadow are but a confuſed mixture (as it were) of light and darkeneſſe together, or a meane æqually compounded of both, the which can no better bee diſcerned than by gheſsing:) nor yet by refraction of the Sunne beames through the thickeneſſe of the ayre, eſpecially when the Sunne is in the ſoutherly ſemicircle of the zodiacke: hee ſhall (I ſay) quite himſelfe very well, that neyther by one, nor ſome, nor all of theſe, ſhall miſſe a minute and more ſometimes in obſeruing the Meridian Altitude of the Sunne: whereby if errour be committed both at the beginning and ending of the foreſayd arkes (eſpecially of thoſe arkes that are conteined between the middeſt of Taurus and Leo, of Leo and Scorpio, of Scorpio and Aquarius, of Aquarius and Taurus) the place of the Sun found by ſuch obſeruation, may be more or leſſe then trueth by 3 or 4 minutes, & both errors together, may amount to 6 or 8 mi. error in the motion of the ſun, wherof may folow 2 or 3 hours error in the time of the ſuns abiding in one of thoſe arkes.

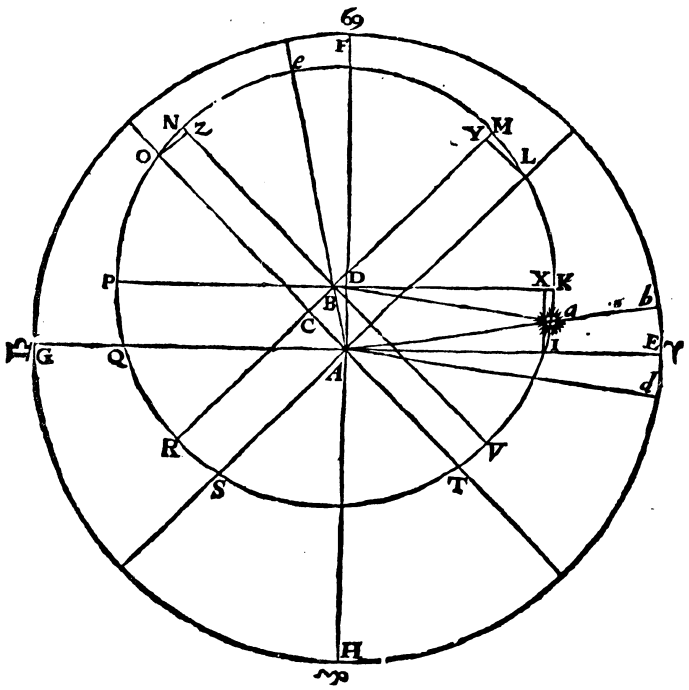
Out of the former table I foũd the time of the ſuns continuance in the northerly ſemicircle of the ecliptick from the beginning of ♈ to the be-

ning of Libra to be 186 dayes, 14 houres, and about one half: and in the ſoutherly ſemicircle frō Libra to Aries, 178 daies, 15 houres, & about one halfe. Whereby the arkes of the ſunnes eccentrick, anſwerable to thoſe ſemicircles, appeared to be 183 degrees, 55 minutes from Aries to Libra, and 176 degrees 5 minutes from Libra to Aries.

Therefor becauſe the place of the ſunne being at, or neare, the equinoctiall poynts, is moſt certainely knowne (his meridian altitude and declination altering there moſt ſwiftly) and conſequently, the arks of the eccentrick conteined betwixt thoſe poynts, are moſt certainly found: it appeareth to be moſt certaine, that the eccentricitie of the ſunne at this time, muſt needs be at the leaſt 341½, ſuch parts whereof the ſemidiameter of the eccentrick containeth 10000, though the ſunnes apogæum were but in the beginning of Cancer. Whereas if it be in 9 degrees, 22 min. of Cancer (as *Copernicus* would haue it) the eccentricitie cannot bee leſſe then 346 of the ſame parts: notwithſtanding hee maketh it to be little more then 322 of thoſe parts in this age.

But finding by the obſeruations of the yeares 1596, & 1597, that the ſunne is in going through the quarter of the zodiack, from the 15 of Aquarius to the 15 of Taurus, 90 dayes, 23 houres, 22 min. and through the next quarter from Taurus to Leo, 94 dayes, 2 houres, 45 min. and conſequently that the arke of the eccentricke anſwerable to the firſt of theſe quarters, is 89 degrees 40 min. 40 minutes, and the ſecond 92 degrees, 46 min. ſo as the whole arke of the eccentrick anſwerable to the ſemicircle of the ecliptick from the 15 of Aquarius, to the 15 of Leo, is 182 degrees, 26 min. It followeth hereof, that the place of the ſunnes apogæū, this preſent age ſhould be about 6 degrees, 50 minutes of Cancer, and the eccentricitie almoſt 344 of the foreſayd parts, as by the demonſtration following it may appeare.

EFGH, the ecliptick.
MNRV, the eccentrick of the sunne.
A, the center of the ecliptick.
B, the center of the eccentrick.



EAG,

EAG, the diameter of the ecliptick, drawn from Aries to Libra.
KBP, the diameter of the eccentricke parallel to EAG.
IKMNPQ, the arke of the eccentrick from the beginning of Aries, to the beginning of Libra 183 degrees, 55 minutes.
KMNP, the semicircle of the eccentrick, 180 degrees. Therefor the arkes of the eccentrick, IK and PQ, ioyned togither, make three degrees 55 minutes.

But IK and PQ are equal, becauſe the diameters of the eccentrick and ecliptick KBP, and EAG are parallels. Therfor IK is the one halfe of 3 degrees, 55 minutes, that is, one degree, 57 minutes ½, the ſine whereof IX æquall to AB, is found by the table of ſines, to bee 341 ½ parts, whereof the ſemidiameter of the eccentrick or whole ſine conteyneth 10000.

TAO, the diameter of the ecliptick drawne from the midſt of Aquarius, to the midſt of Leo.
VBN, the diameter of the eccentrick parallel to TAO.
TVMNO, the arke of the eccentrick from the midſt of Aquarius to the midſt of Leo, 182 deg. 26 min.
VMN, the ſemicircle of the eccentrick 180 degrees.

Therefor TV and NO togither are 2 degrees 26 minutes.

But TV and NO are æquall, becauſe TAO and VBN are parallels. Therefor NO is the

one halfe of 2 deg. 26 min. that is, one deg. 13 mi. the ſine whereof O Z æquall to C B, is 212 parts, whereof the whole ſine conteineth 10000.

L A S, the diameter of the ecliptick drawne from the midſt of Taurus, to the midſt of Scorpio.

M Y B C R, the diameter of the eccentrick parallel to L A S.

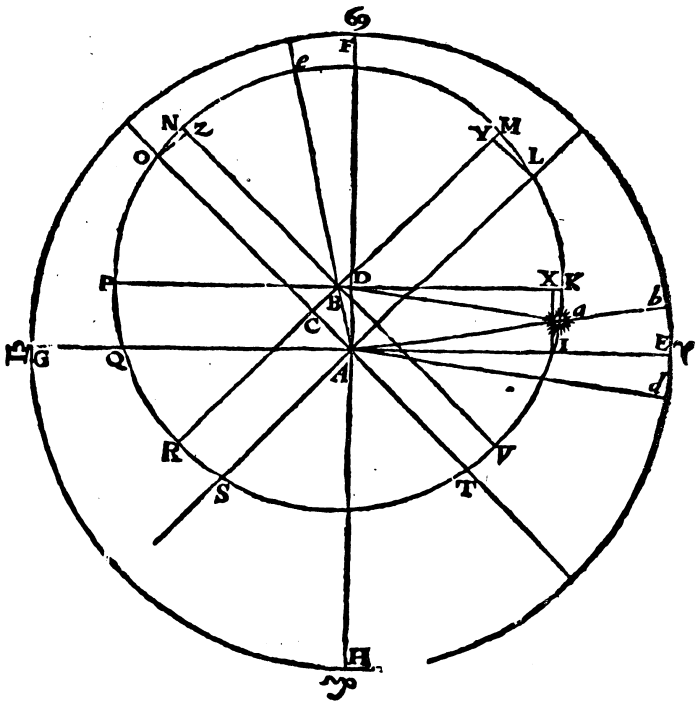
L M N O, the arke of the eccentrick from the midſt of ♉ to the midſt of ♌, 92 degr. 46 min.

The arke of the eccentrick M N O, 91 degr. 13 mi. becauſe it is the one half of the ark T V M N O Therefor M L, the difference of L M N O, and M N O, is 1 deg. 33 mi. whoſe ſine L Y, (that is) A C, (becauſe M Y B C R, & L A S are parallels) is 270 parts, whereof the whole ſine is 1000.

Now then the triangle B C A, two ſides being giuen, C B 212, C A 270, with the right angle B C A, by the doctrine of triangles there ſhall alſo be giuen the angle B A C, 38 degr. 10 mi. which ſubtracted out of the angle C A D, 45 deg. 0 mi. there remaineth the angle B A D, 6 degr. 50 min. which ſheweth the place of the ſuns apogeum in Cancer.

Alſo A D being found before to be 341½ parts, whereof the ſemidiameter of the eccentrick conteineth 10000, and B A the *ſecans* or *hypotenuſa* aunſwerable to 6 deg. 50 min. conteining 1007 parts, whereof D A is ſuppoſed to contein 1000, as out of the canon or table of ſecants it may appeare. Therefor as 1000, is to 1007, ſo is 341½, to 344 (almoſt) which is the eccentricitie of the ſunnes eccentrick, in ſuch parts of which the ſemidiameter of the eccentrick is 1000.

The ſame may otherwiſe be proued after this manner: In the Triangle B C A, the ſides B C and C A were found to bee 212 and 270 of the foreſaid partes. The ſquares of theſe ſides are 44944, and 72900. The ſum of theſe ſquares is



117844, the roote or ſide whereof is little more then 243, which is the quantitie of the third ſide of the ſame Triangle B A, the eccentricitie deſired. But becauſe I might eaſily erre more thē one or two of theſe parts in finding the eccentricitie, and more then half a ſcore minutes in the place of the ſunnes apogæum, (all which error may ariſe by miſsing leſſe then halfe a minute in obſerving the meridian altitudes of the ſunne) I thought it good therefore not to bee too ſcrupulous herein: but for making the Ephemerides following, I tooke the eccentricitie to be 343 parts, wherof the ſemidiameter of the eccentricke is 10000, and the apogæum to be in 7 degrees ♋ minutes of Cancer: Meaning alſo to come ſo neare *Copernicus* as truelh would giue me leaue.

The eccentricitie and apogæum of the ſunne being thus knowne, togither with his true place, which by ſo exact obſeruation as we could, in the yeare 1597, the 11 of March at nooне, we found to be ♓ degrees, 53 minutes of Aries: his middle motion from the beginning of Aries, and his motion of Anomalie, counted from his apogæum, were eaſily alſo found out after this manner:

Let *a* be the place of the ſunne in his eccentrick, the ſunnes true place in the zodiacke.

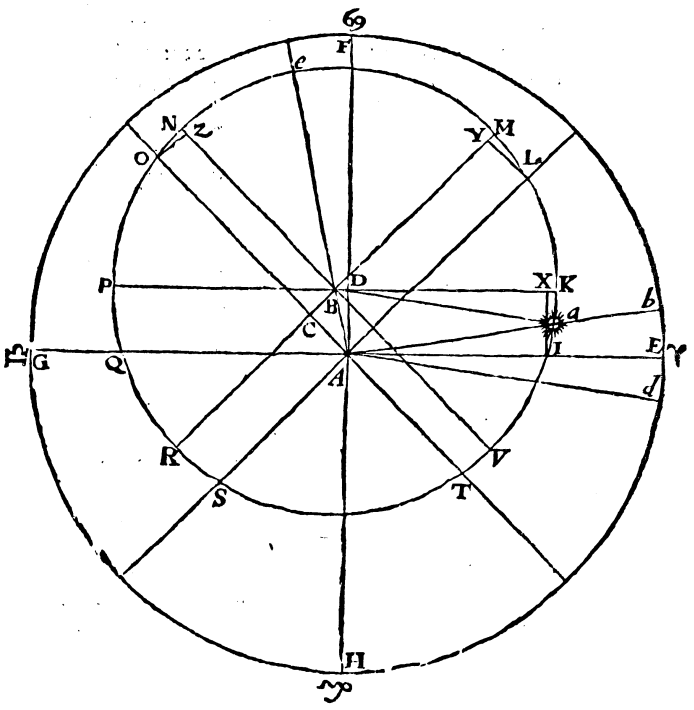
B a, a line drawne from the center of the eccentrick, to the center of the ſunne.

A d, a line drawne from the center of the ecliptick, or of the world, parallel to B a, ſhewing the middle place of the ſunne in the zodiack.

A b, a line drawne from the center of the ecliptick

ecliptick, by the center of the ſunne to the zodiack, ſhewing the true place of the ſunne.

Therefor the angle B A D being 7 degr. and conſequently the Angle B A I 97 degr. becauſe D A I is a right angle: the Angle *a* A I (founde by obſeruation to be 0 deg. 53 mi) being ſubtracted from the angle B A I, there ſhall remaine



the angle B A *a*, in the triangle B A *a* 96 deg. 7 mi. & two ſides of the ſame triangle being giuẽ, *a* B 10000 parts, and B A 343 of the ſame parts, therefor by the doctrine of triangles, the angle B *a* A, equall to A *a* O (becauſe B *a*, and A *d* are parallels) ſhal likewiſe be found to be 1 degr. 57 mi. (the proſthaphæreſis or æquation of the ſunne at that time, which ſubtracted from E b, the true motion of the ſunne, that is, 53 min (adding there to an whole circle, there ſhal remaine the middle motion of the ſunne E F G H *d*, 358 deg. 56 min.

Alſo the angle *a* A *b* (1 deg. 57 min added to the angle *a* A B (found before to be 96 degr. 7 min.) ſhal make the whole angle B A d (that is the angle *e* B *a*, becauſe B *a* and A *d* are parallels) 98 deg. 4 min. which ſubtracted out of 360 degr. ſhall leaue the arke of the eccentrick, *e* R V *a*, 261 deg. 56 min. the motion of the ſunnes Anomalie.

But by the prutenick accoũts made for the meridian of *Mons Regius Boruſſiæ*, which differeth frõ vs in longitude to the eaſtward 27 deg. 30 min.) the 11 of March at noone, 1597, the middle motion of the ſunne from the beginning of Aries, ſhould be 358 degr. 31 min. and the motion of the ſunnes anomalie 258 deg. 16 min. The difference therefor of this middle motiõ of the ſunne, from that we found by obſeruation, neglecting the æquation for the diuerſitie of meridians, is 25 mi. and the difference of the ſunnes motion of anomalie 3 deg. 40 min.

The prutenick tables therefore ſhall be fitted for the making of the Ephemerides following, onely only by adding 25 mi. to the ſunnes middle motion, and 3 degr. 40 min. to his motion of anomalie.

Moreouer, becauſe in the prutenick tables, the greateſt proſthaphæreſis of the ſunne, in time of his leaſt eccentricitie is one deg. 50 mi 40 ſec. & the greateſt exceſſe) to be added when his eccentricity is greateſt) 32 mi. 44 ſec. Alſo the greateſt proſthaphæreſis found agreeable to obſeruation in this age, 1 de. 58 min. exceeding 1 de. 50 mi. 41 ſe. by 7 mi. $\frac{1}{3}$ almoſt, which haue almoſt the ſame proportion to 32 min. 44 ſec. that 13 haue to 60. Therefor adding alwayes to the proſtaphæreſis *orbis*, found in the prutenick tables $\frac{13}{60}$ parts of the exceſſe adioyning, which may eaſily be founde by multiplying the exceſſe by 13, and diuiding the product by 60, we ſhal haue the proſthaphæreſis to be added to, or ſubtracted from the middle motion of the ſunne, that ſo his true motion may be found.

One example will make this more plain: The firſt of Ianuarie at noone, 1599, the middle motion of the ſunne, reckoned from the firſt ſtarre, of the conſtellation of Aries, gathered out of the prutenick tables, is ——

Hereto adde the true preceſsion of the æquinoctium, gathered out of the ſame prutenick tables. ——

and the æquation agreeable to obſeruation at London ——

	Sex.	*Deg.*	*Min.*	*Sec.*
	4	21	56	35
		28	4	25
			25	

	Sex.	Deg.	Min.	Sec.
The ſumme ſhal be the ſunnes middle motion, from the beginning of ♈, agreeable to obſeruation	4	50	26	0
Alſo out of the ſame tables the motion of the ſunnes Anomalie is ——	3	9	44	43
The æquation of this Anomalie agreeable to obſeruation at London ——		3	40	
Therefor the true or coæquate Anomalie is ——	3	13	24	43
The *proſthaphæreſis Orbis* in the prutenick tables agreeable hereto, is ——			26	30
The exceſſe anſwerable to this *proſthaphæreſis* ——			8	10
The part proportional or $\frac{1}{3}\frac{1}{0}$ of this exceſſe is ——			1	46
Which addeth to 26 mi. 30 ſec. maketh the whole or abſolute *proſthaphæreſis* of the ſunne, ——			28	16
Which being added to the ſunnes middle motion, frō the beginning of Aries We ſhal haue the ſuns true motiō from the beginning of Aries. ——	4	50	26	0
And his true place 1 Ianuar. at noon 1599, for the meridian of London ——	4	50	54	16
	♑	20	54	16

1597	January ☌ ♑		February ☌ ♒		March ☌ ♓		April ☌ ♈	
Day	Deg.	Min	Deg.	Min	Deg.	Min.	Deg.	Min.
1	21	25	22	53	20	58	21	32
2	22	26	23	54	21	58	22	31
3	23	27	24	55	22	57	23	29
4	24	28	25	55	23	57	24	28
5	25	29	26	56	24	56	25	26
6	26	30	27	56	25	56	26	25
7	27	31	28	57	26	56	27	23
8	28	32	29	57	27	55	28	22
9	29	♒ 34	☌ ♓	57	28	54	29	♉ 20
10	☌ ♒	35	1	58	29	54	☌ ♈	18
11	1	36	2	58	☌ ♉	53	1	17
12	2	37	3	58	1	52	2	15
13	3	38	4	58	2	52	3	13
14	4	39	5	59	3	51	4	12
15	5	40	6	59	4	50	5	10
16	6	41	7	59	5	49	6	8
17	7	42	8	59	6	48	7	6
18	8	43	9	59	7	48	8	4
19	9	44	10	59	8	47	9	2
20	10	44	11	59	9	46	10	0
21	11	45	12	59	10	45	10	58
22	12	46	13	59	11	44	11	56
23	13	47	14	59	12	43	12	55
24	14	48	15	59	13	42	13	53
25	15	49	16	59	14	41	14	50
26	16	50	17	59	15	40	15	48
27	17	50	18	58	16	38	16	46
28	18	51	19	58	17	37	17	44
29	19	51			18	36	18	42
30	20	52			19	35	19	40
31	21	53			20	33		

1597	May		June				August	
	☉ ♈		☉ ♉		☉ ♋		☉ ♌	
Day	Deg.	Min.	Deg.	Min.	Deg.	Min.	Deg.	Min.
1	20	37	20	19	18	55	18	34
2	21	35	21	16	19	52	19	32
3	22	33	22	14	20	49	20	29
4	23	31	23	11	21	47	21	27
5	24	28	24	8	22	44	22	25
6	25	26	25	5	23	41	23	23
7	26	24	26	2	24	38	24	21
8	27	21	27	0	25	36	25	18
9	28	19	27	57	26	33	26	16
10	29	16	28	54	27	30	27	14
11	0	♉ 14	29	51	28	28	28	12
12	1	11	0	48	29	25	29	10
13	2	9	1	46	♌ 0	22	♍ 0	8
14	3	7	2	43	1	20	1	6
15	4	4	3	40	2	17	2	4
16	5	2	4	37	3	14	3	2
17	5	59	5	34	4	12	4	0
18	6	57	6	32	5	9	4	58
19	7	54	7	29	6	6	5	56
20	8	51	8	26	7	4	6	54
21	9	49	9	23	8	1	7	52
22	10	46	10	20	8	59	8	50
23	11	43	11	17	9	56	9	49
24	12	41	12	15	10	54	10	47
25	13	38	13	12	11	51	11	45
26	14	35	14	9	12	49	12	43
27	15	33	15	6	13	46	13	42
28	16	30	16	3	14	44	14	40
29	17	27	17	1	15	41	15	39
30	18	24	17	58	16	39	16	39
31	19	22			17	37	17	35

1597	September		October		November		December	
	☉ ♍		☉ ♎		☉ ♏		☉ ♐	
Day	Deg.	Min.	Deg.	Min.	Deg.	Min.	Deg.	Min.
1	18	34	18	4	19	6	19	32
2	19	33	19	4	20	6	20	33
3	20	31	20	3	21	7	21	34
4	21	30	21	3	22	7	22	36
5	22	28	22	3	23	8	23	37
6	23	27	23	2	24	9	24	38
7	24	26	24	2	25	9	25	39
8	25	24	25	2	26	10	26	40
9	26	23	26	2	27	11	27	42
10	27	22	27	1	28	11	28	43
11	28	21	28	1	29	12	29	44
12	29	20	29	1	♐ 0	13	♑ 0	45
13	0	♎ 19	♏ 0	1	1	14	1	46
14	1	17	1	1	2	15	2	48
15	2	16	2	1	3	16	3	49
16	3	15	3	1	4	17	4	50
17	4	14	4	1	5	17	5	51
18	5	13	5	1	6	18	6	53
19	6	12	6	1	7	19	7	54
20	7	12	7	2	8	20	8	55
21	8	11	8	2	9	21	9	56
22	9	10	9	2	10	22	10	58
23	10	9	10	2	11	23	11	59
24	11	8	11	2	12	24	13	0
25	12	8	12	3	13	25	14	1
26	13	7	13	3	14	26	15	3
27	14	6	14	3	15	28	16	4
28	15	6	15	4	16	29	17	5
29	16	5	16	4	17	30	18	6
30	17	5	17	5	18	31	19	7
31			18	5			20	9

1598	January		February		March		April	
	☉ ♑		☉ ♒		☉ ♓		☉ ♈	
Day	Deg.	Min.	Deg.	Min.	Deg.	Min.	Deg.	Min.
1	21	10	22	38	20	43	21	17
2	22	11	23	39	21	43	22	16
3	23	12	24	40	22	42	23	14
4	24	13	25	40	23	42	24	13
5	25	14	26	40	24	41	25	11
6	26	15	27	41	25	41	26	10
7	27	16	28	41	26	41	27	8
8	28	17	29	42	27	40	28	7
9	29	♒ 19	☉ ♓	42	28	39	29	♉ 5
10	☉	♒ 20	1	43	29	39	☉	3
11	1	21	2	43	☉	♈ 38	1	2
12	2	22	3	43	1	37	2	0
13	3	23	4	43	2	37	2	58
14	4	24	5	44	3	36	3	57
15	5	25	6	44	4	35	4	55
16	6	26	7	44	5	34	5	53
17	7	27	8	44	6	33	6	51
18	8	28	9	44	7	33	7	49
19	9	29	10	44	8	32	8	47
20	10	29	11	44	9	31	9	45
21	11	30	12	44	10	30	10	43
22	12	31	13	44	11	29	11	41
23	13	32	14	44	12	28	12	40
24	14	33	15	44	13	27	13	38
25	15	34	16	44	14	26	14	35
26	16	35	17	44	15	25	15	33
27	17	35	18	43	16	23	16	31
28	18	36	19	43	17	22	17	29
29	19	36			18	21	18	27
30	20	37			19	20	19	25
31	21	38			20	18		

1598	Maie		Iune		Iuly		August	
	☉ ♉		☉ ♊		☉ ♋		☉ ♌	
Day	Deg.	Min.	Deg.	Min.	Deg.	Min.	Deg.	Min.
1	20	23	20	5	18	41	18	20
2	21	21	21	2	19	38	19	18
3	22	19	22	0	20	35	20	15
4	23	17	22	57	21	33	21	13
5	24	14	23	54	22	30	22	11
6	25	12	24	51	23	27	23	9
7	26	10	25	48	24	34	24	7
8	27	7	26	46	25	22	25	4
9	28	5	27	43	26	19	26	2
10	29	2	28	40	27	16	27	0
11	☉	♊ 0	29	♋ 37	28	14	27	58
12	☉	♊ 57	☉	34	29	11	28	56
13	1	55	1	32	☉	♌ 8	29	♍ 54
14	2	53	2	29	1	6	☉	52
15	3	50	3	26	2	3	1	50
16	4	48	4	23	3	0	2	48
17	5	45	5	20	3	58	3	46
18	6	43	6	18	4	55	4	44
19	7	40	7	15	5	52	5	42
20	8	37	8	12	6	50	6	40
21	9	35	9	9	7	47	7	38
22	10	32	10	6	8	45	8	36
23	11	29	11	3	9	42	9	35
24	12	27	12	1	10	40	10	33
25	13	24	12	58	11	37	11	31
26	14	21	13	55	12	35	12	29
27	15	19	14	52	13	32	13	28
28	16	16	15	49	14	30	14	26
29	17	13	16	47	15	27	15	25
30	18	10	17	44	16	25	16	23
31	19	7			17	23	17	21

1598	September		October		November		December	
	☉ ♍		☉ ♎		☽ ☉ ♐ ♏		☽ ♑	
Day	Deg.	Min.	Deg.	Min.	Deg.	Min.	Deg.	Min.
1	18	19	17	49	18	51	19	17
2	19	18	18	49	19	51	20	18
3	20	16	19	48	20	52	21	19
4	21	15	20	48	21	52	22	21
5	22	13	21	48	22	53	23	22
6	23	12	22	47	23	54	24	23
7	24	11	23	47	24	54	25	24
8	25	9	24	47	25	55	26	25
9	26	8	25	47	26	56	27	27
10	27	7	26	46	27	56	28	28
11	28	6	27	46	28	57	29	29
12	29	5	28	46	29	58	30	30
13	☌ 0	4	29	46	30	59	31	31
14	01	2	30	46	32	0	32	33
15	2	1	31	46	33	1	33	34
16	3	0	32	46	34	2	34	35
17	3	59	33	46	35	2	35	36
18	4	58	34	46	36	3	36	38
19	5	57	35	46	37	4	37	39
20	6	57	36	47	38	5	38	40
21	7	56	37	47	39	6	39	41
22	8	55	38	47	40	7	40	43
23	9	54	39	47	41	8	41	44
24	10	53	40	47	42	9	42	45
25	11	53	41	48	43	10	43	46
26	12	52	42	48	44	11	44	48
27	13	51	43	48	45	13	45	49
28	14	51	44	49	46	14	46	50
29	15	50	45	49	47	15	47	51
30	16	50	46	50	48	16	48	52
31			47	50			49	54

1599	January		February		March		April	
	☉ ♑		☉ ♒		☉ ♓		☉ ♈	
Day	Deg.	Min.	Deg.	Min.	Deg.	Min.	Deg.	Min.
1	20	54	22	23	20	28	21	2
2	21	55	23	24	21	28	22	1
3	22	56	24	25	22	27	22	59
4	23	57	25	25	23	27	23	58
5	24	58	26	25	24	27	24	56
6	25	59	27	25	25	27	25	55
7	27	0	28	26	26	27	26	53
8	28	1	29	26	27	26	27	52
9	29	♒ 3	☌ 0	☽ ♓ 27	28	25	28	50
10	☌ 0	4	1	27	29	25	29	48
11	1	5	2	28	☌ 0	☽ ♈ 24	☌ 0	☽ ♉ 47
12	2	6	3	28	1	23	1	45
13	3	7	4	28	2	22	2	43
14	4	8	5	28	3	21	3	42
15	5	9	6	29	4	20	4	40
16	6	10	7	29	5	19	5	38
17	7	11	8	29	6	18	6	36
18	8	12	9	29	7	18	7	34
19	9	13	10	29	8	17	8	32
20	10	13	11	29	9	16	9	30
21	11	14	12	29	10	15	10	28
22	12	15	13	29	11	14	11	26
23	13	16	14	29	12	13	12	25
24	14	17	15	29	13	12	13	23
25	15	18	16	29	14	11	14	20
26	16	19	17	29	15	10	15	18
27	17	19	18	28	16	8	16	16
28	18	20	19	28	17	7	17	14
29	19	20			18	6	18	12
30	20	21			19	5	19	11
31	21	22			20	3		

1599	Maie		Iune		Iuly		Auguſt	
	☉		☉		☉		☉	
	♉		♊		♋		♌	
Day	Deg.	Min	Deg.	Min	Deg.	Min	Deg.	Min
1	20	8	19	50	18	26	18	5
2	21	6	20	47	19	23	19	3
3	22	4	21	45	20	20	20	0
4	23	2	22	42	21	18	20	58
5	23	59	23	39	22	15	21	56
6	24	57	24	36	23	12	22	54
7	25	55	25	33	24	9	23	52
8	26	52	26	31	25	7	24	49
9	27	50	27	28	26	4	25	47
10	28	47	28	25	27	1	26	45
11	29	45	29	22	27	59	27	43
12	♊ 0	42	♋ 0	19	28	56	28	41
13	1	40	1	17	29	53	29	39
14	2	38	2	14	♌ 0	51	♍ 0	37
15	3	35	3	11	1	48	1	35
16	4	33	4	8	2	45	2	33
17	5	30	5	5	3	43	3	31
18	6	28	6	3	4	40	4	29
19	7	25	7	0	5	37	5	27
20	8	22	7	57	6	35	6	25
21	9	20	8	54	7	32	7	23
22	10	17	9	51	8	30	8	21
23	11	14	10	48	9	27	9	20
24	12	12	11	46	10	25	10	18
25	13	9	12	43	11	22	11	16
26	14	6	13	40	12	20	12	14
27	15	4	14	37	13	17	13	13
28	16	1	15	34	14	15	14	11
29	16	58	16	32	15	12	15	10
30	17	55	17	29	16	10	16	8
31	18	53			17	8	17	6

1599	September		October		Nouember		December	
	☉		☉		☉		☉	
	♍		♎		♏		♐	
Day	Deg.	Min	Deg.	Min.	Deg.	Min	Deg.	Min
1	18	4	17	34	18	36	19	1
2	19	3	18	34	19	36	20	2
3	20	1	19	33	20	37	21	3
4	21	0	20	33	21	37	22	5
5	21	58	21	33	22	38	23	6
6	22	57	22	32	23	39	24	7
7	23	56	23	32	24	39	25	8
8	24	54	24	32	25	40	26	9
9	25	53	25	32	26	41	27	11
10	26	52	26	31	27	41	28	12
11	27	51	27	31	28	42	29	13
12	28	50	28	31	29	43	♑ 0	14
13	29	49	29	31	♐ 0	44	1	15
14	♎ 0	47	♏ 0	31	1	45	2	17
15	1	46	1	31	2	46	3	18
16	2	45	2	31	3	47	4	19
17	3	44	3	31	4	47	5	20
18	4	43	4	31	5	48	6	22
19	5	42	5	31	6	49	7	23
20	6	42	6	32	7	50	8	24
21	7	41	7	32	8	51	9	25
22	8	40	8	32	9	52	10	27
23	9	39	9	32	10	53	11	28
24	10	38	10	32	11	54	12	29
25	11	38	11	33	12	55	13	30
26	12	37	12	33	13	56	14	32
27	13	36	13	33	14	58	15	33
28	14	36	14	34	15	59	16	34
29	15	35	15	34	17	0	17	35
30	16	35	16	35	18	1	18	36
31			17	35			19	38

1600	January. ☉ ♑		February. ☉ ♒		March. ☉ ♓		April. ☉ ♈	
Day	Deg.	Min	Deg.	Min	Deg.	Min	Deg.	Min
1	20	39	22	8	21	13	21	47
2	21	40	23	8	22	13	22	45
3	22	41	24	9	23	12	23	44
4	23	42	25	10	24	12	24	42
5	24	43	26	10	25	12	25	41
6	25	44	27	10	26	11	26	39
7	26	45	28	11	27	11	27	38
8	27	46	29	11	28	10	28	36
9	28	48	☌ ♓	12	29	10	29	34
10	29	49	1	12	☌ ♈	9	☌ ♉	33
11	☌ ♒	50	2	13	1	8	1	31
12	1	51	3	13	2	8	2	29
13	2	52	4	13	3	7	3	28
14	3	53	5	13	4	6	4	26
15	4	54	6	14	5	5	5	24
16	5	55	7	14	6	4	6	22
17	6	56	8	14	7	4	7	20
18	7	57	9	14	8	3	8	18
19	8	58	10	14	9	2	9	16
20	9	58	11	14	10	1	10	14
21	10	59	12	14	11	0	11	12
22	12	0	13	14	11	59	12	11
23	13	1	14	14	12	58	13	9
24	14	2	15	14	13	57	14	6
25	15	3	16	14	14	56	15	4
26	16	4	17	14	15	54	16	2
27	17	4	18	14	16	53	17	0
28	18	5	19	13	17	52	17	58
29	19	5	20	13	18	51	18	56
30	20	6			19	49	19	54
31	21	7			20	48		

1600	May ☉ ♉		June ☉ ♊		July ☉ ♋		August ☉ ♌	
Day	Deg.	Min	Deg.	Min.	Deg.	Min	Deg.	Min
1	20	52	20	33	19	9	18	49
2	21	50	21	31	20	6	19	46
3	22	48	22	28	21	4	20	44
4	23	45	23	25	22	1	21	42
5	24	43	24	22	22	58	22	40
6	25	41	25	19	23	55	23	48
7	26	38	26	17	24	53	24	35
8	27	36	27	14	25	50	25	33
9	28	33	28	11	26	47	26	31
10	29	31	29	8	27	45	27	29
11	☌ ♊	28	☌ ♋	5	28	42	28	27
12	1	26	1	3	29	39	29	25
13	2	24	2	0	☌ ♌	37	☌ ♍	23
14	3	21	2	57	1	34	1	21
15	4	19	3	54	2	31	2	19
16	5	16	4	51	3	29	3	17
17	6	14	5	49	4	26	4	15
18	7	11	6	46	5	23	5	13
19	8	8	7	43	6	21	6	11
20	9	6	8	40	7	18	7	9
21	10	3	9	37	8	16	8	7
22	11	0	☌ ♌	34	9	13	9	6
23	11	58	11	32	10	11	10	4
24	12	55	12	29	11	8	11	2
25	13	52	13	26	12	6	12	0
26	14	50	14	23	13	3	12	59
27	15	47	15	20	14	1	13	57
28	16	44	16	18	14	58	14	56
29	17	41	17	15	15	56	15	54
30	18	38	18	12	16	54	16	52
31	19	36			17	51	17	50

1600	September		October		November		December	
	☉ ♍		☉ ♎		☉ ♏		☉ ♐	
Day	Deg.	Min	Deg.	Min	Deg.	Min	Deg.	Min
1	18	49	18	20	19	21	19	47
2	19	47	19	19	20	22	20	48
3	20	46	20	19	21	22	21	50
4	21	44	21	19	22	23	22	51
5	22	43	22	18	23	24	23	52
6	23	42	23	18	24	24	24	53
7	24	40	24	18	25	25	25	54
8	25	39	25	18	26	26	26	56
9	26	38	26	17	27	26	27	57
10	27	37	27	17	28	27	28	58
11	28	36	28	17	29	28	29♑	59
12	29	34	29	17	0♐	29	1	0
13	0♎	33	0♏	17	1	30	2	2
14	1	32	1	17	2	31	3	3
15	2	31	2	17	3	32	4	4
16	3	30	3	17	4	32	5	5
17	4	29	4	17	5	33	6	7
18	5	28	5	17	6	34	7	8
19	6	28	6	18	7	35	8	9
20	7	27	7	18	8	36	9	10
21	8	26	8	18	9	37	10	12
22	9	25	9	18	10	38	11	13
23	10	24	10	18	11	39	12	14
24	11	24	11	19	12	40	13	15
25	12	23	12	19	13	41	14	17
26	13	22	13	19	14	43	15	18
27	14	22	14	20	15	44	16	19
28	15	21	15	20	16	45	17	20
29	16	21	16	21	17	46	18	21
30	17	20	17	21	18	46	19	23
31			18	21			20	24

The vſe of theſe Ephemerides.

Of the vſe of theſe Ephemerides, becauſe they be altogither of the ſame forme, that others generally are, and haue beene heeretofore: and to be vſed alſo in all points after the ſame manner, for finding out by them the true place of the Sun at any time deſired, during the time of their continuance: I thinke it needeleſſe for mee in this place to make any further mention: it being my purpoſe in this Booke, rather to make ſupply (as I may for the preſent) of that is wanting in others, then to meddle with that which is ſufficiently handled and already publiſhed by others. This notwithſtanding I thought good to admoniſh, that theſe Ephemerides, though they be made for 4 yeeres onely, yet may profitably ſerue for many yeeres to come, after this maner: Subtract 1600 out of the yere of Chriſt giuen: diuide that remaineth by 4: if any thing remaine after diuiſion made, it ſheweth which of the three firſt yeares in this Ephemerides anſwereth to the yeare giuen: if nothing remaine, the fourth yeare is aunſwerable to the yeare giuen. Then marke how much the quotient is, for as many vnities as are conteined therein, ſo many min. muſt be added to the place of the ſunne euery day of the yeere in theſe Ephemerides, anſwerable to the yeare giuen, in the moneths of Maie, Iune, Iuly, Auguſt, September and October: but halfe ſo many minutes onely are to be added in all the reſt of the moneths.

Suppoſe for example the 1 of Ianuary 1614 you would know the place of the Sunne: ſubtracting therefore 1600 out of 1614 there remain 14, which being diuided by 4, the quotient is 3, and the remainder is 2: which remainder ſheweth that the ſecond yeere in theſe Ephemerides (that is the yeare 1598) anſwereth to the yeare giuen. Adding therefor half 3 minutes (that is 1 min. ½) to 21 degr. 10. min. of Capricorne (the place of the ſunne the firſt of Ianuary 1598) I finde the place of the ſunne the firſt of Ianuary 1614 to be in 21 degrees 11 min. ½ of Capricorne.

The place of the ſun being thus eaſly known by theſe Ephemerides for euery day of 4 yeares: the declinatiõs of the ſunne for euery day of the ſame yeres were eaſely found, out of the former table of the declination of euery minute of the eclipticke, in ſuch ſort as was ſhewed in the vſe of that table: And ſo was made with no leſſe facilitie this table following, of the ſunnes declination for euery day of 4 yeeres togither, commonly called by ſea-men, *A Regiment of the Sunne.*

Ianuary

Ianuary.

1			2			3			4			
1597			1598			1599			1600			yeeres of our Lord.
1601			1602			1603			1604			
1605			1606			1607			1608			
1609			1610			1611			1612			
Day	De.	M	Day	De.	M	Day	De.	M	Day	De.	M	
1	21	47	1	21	50	1	21	52	1	21	54	
2	21	38	2	21	40	2	21	43	2	21	45	
3	21	28	3	21	30	3	21	33	3	21	35	
4	21	17	4	21	20	4	21	23	4	21	25	
5	21	6	5	21	9	5	21	12	5	21	14	
6	20	54	6	20	57	6	21	0	6	21	3	
7	20	43	7	20	46	7	20	49	7	20	52	
8	20	30	8	20	33	8	20	36	8	20	40	
9	20	18	9	20	21	9	20	24	9	20	27	
10	20	5	10	20	8	10	20	11	10	20	15	
11	19	51	11	19	54	11	19	58	11	20	1	
12	19	37	12	19	41	12	19	44	12	19	47	
13	19	23	13	19	21	13	19	30	13	19	33	
14	19	9	14	19	12	14	19	16	14	19	19	
15	18	54	15	18	58	15	19	1	15	19	5	
16	18	39	16	18	43	16	18	47	16	18	50	
17	18	23	17	18	27	17	18	31	17	18	35	
18	18	8	18	18	12	18	18	16	18	18	19	
19	17	51	19	17	56	19	18	0	19	18	4	
20	17	35	20	17	39	20	17	43	20	17	47	
21	17	18	21	17	22	21	17	26	21	17	31	
22	17	1	22	17	5	22	17	9	22	17	14	
23	16	44	23	16	48	23	16	52	23	16	57	
24	16	26	24	16	30	24	16	35	24	16	39	
25	16	8	25	16	12	25	16	17	25	16	21	
26	15	50	26	15	54	26	15	59	26	16	3	
27	15	32	27	15	36	27	15	41	27	15	45	
28	15	13	28	15	18	28	15	23	28	15	27	
29	14	54	29	14	59	29	15	3	29	15	8	
30	14	35	30	14	40	30	14	44	30	14	49	
31	14	15	31	14	20	31	14	25	31	14	30	

South declination.

February.

Yeers of our Lord	1	2	3	4
	1597	1598	1599	1600
	1601	1602	1603	1604
	1605	1606	1607	1608
	1609	1610	1611	1612

Day	De. M.	South declination.	Day	De. M.	South declination.	Day	De. M.	South declination.	Day	De. M.	South declination.
1	13 55		1	14 0		1	14 5		1	14 10	
2	13 35		2	13 40		2	13 45		2	13 50	
3	13 15		3	13 20		3	13 25		3	13 30	
4	12 55		4	13 0		4	13 5		4	13 10	
5	12 34		5	12 39		5	12 44		5	12 50	
6	12 13		6	12 18		6	12 23		6	12 29	
7	11 52		7	11 57		7	12 2		7	12 8	
8	11 31		8	11 36		8	11 41		8	11 47	
9	11 10		9	11 15		9	11 20		9	11 26	
10	10 48		10	10 53		10	10 59		10	11 4	
11	10 26		11	10 31		11	10 37		11	10 42	
12	10 5		12	10 10		12	10 15		12	10 21	
13	9 43		13	9 48		13	9 54		13	9 59	
14	9 20		14	9 26		14	9 31		14	9 37	
15	8 58		15	9 3		15	9 9		15	9 14	
16	8 36		16	8 41		16	8 47		16	8 52	
17	8 13		17	8 19		17	8 24		17	8 30	
18	7 51		18	7 56		18	8 2		18	8 7	
19	7 28		19	7 34		19	7 39		19	7 45	
20	7 5		20	7 11		20	7 16		20	7 22	
21	6 42		21	6 48		21	6 53		21	6 59	
22	6 19		22	6 25		22	6 30		22	6 36	
23	5 56		23	6 2		23	6 7		23	6 13	
24	5 33		24	5 39		24	5 44		24	5 50	
25	5 9		25	5 15		25	5 21		25	5 27	
26	4 46		26	4 52		26	4 57		26	5 3	
27	4 22		27	4 28		27	4 34		27	4 40	
28	3 59		28	4 5		28	4 10		28	4 16	
									29	3 53	

March.

Yeers of our Lord	1	2	3	4
	1597	1598	1599	1600
	1601	1602	1603	1604
	1605	1606	1607	1608
	1609	1610	1611	1612

Day	De. M.	South declination.	Day	De. M.	South declination.	Day	De. M.	South declination.	Day	De. M.	South declination.
1	3 35		1	3 41		1	3 47		1	3 25	
2	3 12		2	3 18		2	3 23		2	3 6	
3	2 48		3	2 54		3	3 0		3	2 42	
4	2 25		4	2 31		4	2 36		4	2 19	
5	2 1		5	2 7		5	2 13		5	1 55	
6	1 37		6	1 43		6	1 49		6	1 31	
7	1 13		7	1 19		7	1 25		7	1 7	
8	0 50		8	0 56		8	1 1		8	0 44	
9	0 26		9	0 32		9	0 38		9	0 20	Æqui. noctiall.
10	0 2		10	0 8		10	0 14		10	0 4	
11	0 21		11	0 15		11	0 10		11	0 27	
12	0 45		12	0 39		12	0 33		12	0 51	
13	1 9		13	1 3		13	0 57		13	1 15	
14	1 32		14	1 26		14	1 21		14	1 38	
15	1 56		15	1 50		15	1 44		15	2 2	
16	2 19		16	2 13		16	2 8		16	2 25	
17	2 42		17	2 36		17	2 31		17	2 48	
18	3 6		18	3 0		18	2 54		18	3 12	
19	3 29		19	3 23		19	3 18		19	3 35	
20	3 53		20	3 47		20	3 41		20	3 59	
21	4 16		21	4 10		21	4 5		21	4 22	
22	4 39		22	4 33		22	4 28		22	4 45	
23	5 2		23	4 56		23	4 51		23	5 8	
24	5 25		24	5 19		24	5 14		24	5 31	
25	5 48		25	5 42		25	5 37		25	5 54	
26	6 11		26	6 5		26	6 0		26	6 16	
27	6 33		27	6 28		27	6 22		27	6 39	
28	6 56		28	6 50		28	6 45		28	7 2	
29	7 18		29	7 12		29	7 7		29	7 24	
30	7 41		30	7 35		30	7 30		30	7 46	
31	8 3		31	7 57		31	7 52		31	8 8	

April.

yeares of our Lord.	1		2		3		4	
	1597		1598		1599		1600	
	1601		1602		1603		1604	
	1605		1606		1607		1608	
	1609		1610		1611		1612	
	Day	De.Mi	Day	De.Mi	Day	De.Mi	Day	De.Mi
	1	8 25	1	8 19	1	8 14	1	8 30
	2	8 47	2	8 41	2	8 36	2	8 52
	3	9 9	3	9 3	3	8 58	3	9 14
	4	9 30	4	9 25	4	9 19	4	9 35
	5	9 52	5	9 46	5	9 41	5	9 57
	6	10 13	6	10 8	6	10 2	6	10 18
	7	10 34	7	10 29	7	10 23	7	10 39
	8	10 55	8	10 50	8	10 44	8	11 0
	9	11 16	9	11 11	9	11 5	9	11 21
	10	11 36	10	11 31	10	11 26	10	11 41
	11	11 57	11	11 51	11	11 46	11	12 2
	12	12 17	12	12 12	12	12 7	12	12 22
	13	12 37	13	12 32	13	12 27	13	12 42
	14	12 57	14	12 52	14	12 47	14	13 2
	15	13 17	15	13 12	15	13 7	15	13 22
	16	13 36	16	13 31	16	13 27	16	13 41
	17	13 55	17	13 50	17	13 46	17	14 0
	18	14 14	18	14 9	18	14 5	18	14 19
	19	14 33	19	14 28	19	14 24	19	14 38
	20	14 51	20	14 47	20	14 42	20	14 56
	21	15 9	21	15 5	21	15 0	21	15 14
	22	15 27	22	15 23	22	15 18	22	15 32
	23	15 45	23	15 41	23	15 36	23	15 50
	24	16 3	24	15 59	24	15 54	24	16 8
	25	16 20	25	16 16	25	16 12	25	16 24
	26	16 37	26	16 33	26	16 29	26	16 41
	27	16 53	27	16 49	27	16 45	27	16 57
	28	17 10	28	17 6	28	17 1	28	17 13
	29	17 26	29	17 22	29	17 18	29	17 30
	30	17 42	30	17 38	30	17 34	30	17 46

North declination.

Maie.

	1.		2		3		4	
yeares of our Lord.	1597		1598		1599		1600	
	1601		1602		1603		1604	
	1605		1606		1607		1608	
	1609		1610		1611		1612	
	Day	De.Mi	Day	De.Mi	Day	De.M	Day	De.Mi
	1	17 57	1	17 53	1	17 49	1	18 1
	2	18 12	2	18 8	2	18 4	2	18 16
	3	18 27	3	18 23	3	18 19	3	18 31
	4	18 42	4	18 38	4	18 34	4	18 45
	5	18 56	5	18 52	5	18 49	5	18 59
	6	19 10	6	19 6	6	19 3	6	19 15
	7	19 24	7	19 20	7	19 17	7	19 27
	8	19 37	8	19 34	8	19 30	8	19 40
	9	19 50	9	19 47	9	19 43	9	19 53
	10	20 3	10	20 0	10	19 56	10	20 6
	11	20 15	11	20 12	11	20 9	11	20 18
	12	20 27	12	20 24	12	20 21	12	20 30
	13	20 39	13	20 36	13	20 33	13	20 42
	14	20 50	14	20 47	14	20 44	14	20 53
	15	21 1	15	20 58	15	20 55	15	21 3
	16	21 11	16	21 9	16	21 6	16	21 14
	17	21 22	17	21 19	17	21 16	17	21 24
	18	21 31	18	21 29	18	21 26	18	21 33
	19	21 41	19	21 38	19	21 36	19	21 43
	20	21 50	20	21 48	20	21 45	20	21 52
	21	21 59	21	21 57	21	21 54	21	22 1
	22	22 7	22	22 5	22	22 3	22	22 9
	23	22 15	23	22 13	23	22 11	23	22 17
	24	22 22	24	22 20	24	22 18	24	22 24
	25	22 30	25	22 28	25	22 26	25	22 31
	26	22 36	26	22 34	26	22 33	26	22 38
	27	22 43	27	22 41	27	22 39	27	22 44
	28	22 49	28	22 47	28	22 46	28	22 50
	29	22 54	29	22 53	29	22 51	29	22 55
	30	22 59	30	22 58	30	22 56	30	23 0
	31	23 4	31	23 3	31	23 1	31	23 5

North declination.

June.

yeeres of our Lord.	1	2	3	4
	1597	1598	1599	1600
	1601	1602	1603	1604
	1605	1606	1607	1608
	1609	1610	1611	1612

Day	1 De. Mi.	2 De. Mi.	3 De. Mi.	4 De. Mi.
1	23 9	23 8	23 7	23 10
2	23 13	23 12	23 11	23 14
3	23 16	23 15	23 15	23 17
4	23 19	23 18	23 18	23 20
5	23 22	23 21	23 21	23 22
6	23 24	23 23	23 23	23 24
7	23 26	23 25	23 25	23 26
8	23 28	23 27	23 27	23 28
9	23 29	23 29	23 29	23 29
10	23 30	23 30	23 30	23 30
11	23 30	23 30	23 30	23 30
12	23 30	23 30	23 30	23 30
13	23 29	23 29	23 30	23 29
14	23 28	23 28	23 29	23 28
15	23 27	23 27	23 28	23 26
16	23 25	23 25	23 26	23 24
17	23 23	23 23	23 24	23 22
18	23 20	23 21	23 22	23 19
19	23 17	23 18	23 19	23 16
20	23 14	23 15	23 16	23 13
21	23 10	23 11	23 12	23 9
22	23 6	23 7	23 8	23 5
23	23 1	23 2	23 4	23 0
24	22 56	22 57	22 59	22 55
25	22 51	22 52	22 54	22 50
26	22 45	22 46	22 48	22 45
27	22 39	22 40	22 42	22 37
28	22 32	22 34	22 36	22 30
29	22 25	22 27	22 29	22 23
30	22 17	22 19	22 21	22 15

North declination.

July.

yeeres of our Lord.	1	2	3	4
	1597	1598	1599	1600
	1601	1602	1603	1604
	1605	1606	1607	1608
	1609	1610	1611	1612

Day	1 De. M	2 De. M	3 De. M	4 De. M
1	22 10	22 12	22 14	22 8
2	22 2	22 3	22 6	21 59
3	21 53	21 55	21 57	21 51
4	21 44	21 46	21 49	21 42
5	21 35	21 37	21 40	21 32
6	21 25	21 28	21 30	21 22
7	21 15	21 18	21 20	21 12
8	21 5	21 8	21 10	21 2
9	20 54	20 57	21 0	20 51
10	20 43	20 46	20 49	20 40
11	20 31	20 34	20 37	20 28
12	20 19	20 22	20 25	20 16
13	20 7	20 10	20 13	20 4
14	19 55	19 58	20 1	19 52
15	19 42	19 45	19 49	19 39
16	19 29	19 32	19 36	19 25
17	19 15	19 19	19 22	19 12
18	19 2	19 5	19 9	18 58
19	18 48	18 51	18 55	18 44
20	18 33	18 37	18 41	18 29
21	18 19	18 23	18 26	18 15
22	18 3	18 7	18 11	17 59
23	17 48	17 52	17 56	17 44
24	17 32	17 36	17 40	17 28
25	17 17	17 21	17 25	17 12
26	17 0	17 4	17 8	16 56
27	16 44	16 48	16 52	16 40
28	16 27	16 31	16 36	16 23
29	16 10	16 14	16 19	16 6
30	15 53	15 57	16 2	15 49
31	15 36	15 40	15 45	15 31

North declination.

August.

Years of our Lord.	1		2		3		4	
	1597		1598		1599		1600	
	1601		1602		1603		1604	
	1605		1606		1607		1608	
	1609		1610		1611		1612	
	Day	De. M.	Day	De. M.	Day	De. M.	Day	De. M.
	1	15 18	1	15 23	1	15 27	1	15 13
	2	15 0	2	15	2	15 9	2	14 55
	3	14 42	3	14 47	3	14 51	3	14 37
	4	14 23	4	14 28	4	14 33	4	14 18
	5	14 5	5	14 10	5	14 14	5	14 0
	6	13 46	6	13 51	6	13 56	6	13 41
	7	13 26	7	13 31	7	13 36	7	13 21
	8	13 7	8	13 12	8	13 17	8	13 2
	9	12 48	9	12 53	9	12 58	9	12 43
	10	12 28	10	12 33	10	12 38	10	12 23
	11	12 8	11	12 13	11	12 18	11	12 3
	12	11 48	12	11 53	12	11 58	12	11 43
	13	11 27	13	11 32	13	11 38	13	11 22
	14	11 7	14	11 12	14	11 17	14	11 2
	15	10 46	15	10 51	15	10 57	15	10 41
	16	10 25	16	10 30	16	10 36	16	10 20
	17	10 4	17	10 9	17	10 15	17	9 59
	18	9 43	18	9 48	18	9 54	18	9 37
	19	9 21	19	9 26	19	9 32	19	9 16
	20	9 0	20	9 5	20	9 11	20	8 54
	21	8 38	21	8 44	21	8 49	21	8 33
	22	8 17	22	8 22	22	8 28	22	8 11
	23	7 55	23	8 1	23	8 6	23	7 49
	24	7 33	24	7 39	24	7 44	24	7 27
	25	7 10	25	7 16	25	7 22	25	7 4
	26	6 48	26	6 54	26	6 59	26	6 42
	27	6 26	27	6 32	27	6 37	27	6 20
	28	6 3	28	6 9	28	6 15	28	5 57
	29	5 40	29	5 46	29	5 52	29	5 34
	30	5 18	30	5 24	30	5 29	30	5 12
	31	4 55	31	5 1	31	5 7	31	4 49

North declination.

September.

	1		2		3		4	
	1597		1598		1599		1600	yeares
	1601		1602		1603		1604	00:
	1605		1606		1607		1608	Lord.
	1609		1610		1611		1612	
	Day	De. M.	Day	De. M.	Day	De. M.	Day	De. M.
	1	4 32	1	4 38	1	4 44	1	4 26
	2	4 9	2	4 15	2	4 21	2	4 3
	3	3 46	3	3 52	3	3 58	3	3 40
	4	3 23	4	3 29	4	3 35	4	3 17
	5	3 0	5	3 6	5	3 12	5	2 54
	6	2 36	6	2 42	6	2 48	6	2 30
	7	2 13	7	2 19	7	2 25	7	2 7
	8	1 50	8	1 56	8	2 2	8	1 44
	9	1 26	9	1 32	9	1 38	9	1 20
	10	1 3	10	1 9	10	1 15	10	0 57
	11	0 39	11	0 45	11	0 51	11	0 33
	12	0 16	12	0 22	12	0 28	12	0 10
	13	0 7	13	0 1	13	0 5	13	0 13
	14	0 31	14	0 25	14	0 19	14	0 17
	15	0 54	15	0 48	15	0 43	15	1 0
	16	1 18	16	1 12	16	1 6	16	1 24
	17	1 41	17	1 35	17	1 30	17	1 47
	18	2 5	18	1 59	18	1 53	18	2 11
	19	2 28	19	2 22	19	2 17	19	2 34
	20	2 52	20	2 46	20	2 40	20	2 58
	21	3 15	21	3 9	21	3 4	21	3 21
	22	3 38	22	3 32	22	3 27	22	3 44
	23	4 2	23	3 56	23	3 50	23	4 8
	24	4 25	24	4 19	24	4 14	24	4 31
	25	4 48	25	4 42	25	4 37	25	4 54
	26	5 11	26	5 5	26	5 0	26	5 17
	27	5 35	27	5 29	27	5 23	27	5 41
	28	5 58	28	5 52	28	5 47	28	6 4
	29	6 21	29	6 15	29	6 10	29	6 27
	30	6 44	30	6 38	30	6 33	30	6 49

North declination. South declination. North declination. South declination.

Æquinoctium.

October.

Yeers of our Lord.	1		2		3		4	
	1597		1598		1599		1600	
	1601		1602		1603		1604	
	1605		1606		1607		1608	
	1609		1610		1611		1612	
Day	De.	Mi.	Day	De.	Mi.	Day	De.	Mi.	Day	De.	Mi.
1	7	6	1	7	1	1	6	55	1	7	12
2	7	29	2	7	23	2	7	18	2	7	35
3	7	52	3	7	46	3	7	41	3	7	57
4	8	14	4	8	8	4	8	3	4	8	20
5	8	37	5	8	31	5	8	26	5	8	42
6	8	59	6	8	54	6	8	48	6	9	4
7	9	21	7	9	16	7	9	10	7	9	26
8	9	43	8	9	38	8	9	32	8	9	48
9	10	5	9	10	0	9	9	54	9	10	10
10	10	26	10	10	21	10	10	16	10	10	31
11	10	48	11	10	43	11	10	37	11	10	53
12	11	9	12	11	4	12	10	59	12	11	14
13	11	30	13	11	25	13	11	20	13	11	35
14	11	51	14	11	46	14	11	41	14	11	56
15	12	12	15	12	7	15	12	2	15	12	17
16	12	33	16	12	28	16	12	23	16	12	38
17	12	53	17	12	48	17	12	43	17	12	58
18	13	14	18	13	9	18	13	4	18	13	19
19	13	34	19	13	29	19	13	24	19	13	39
20	13	54	20	13	49	20	13	44	20	13	59
21	14	13	21	14	9	21	14	4	21	14	18
22	14	33	22	14	28	22	14	23	22	14	38
23	14	52	23	14	47	23	14	43	23	14	57
24	15	11	24	15	6	24	15	2	24	15	15
25	15	29	25	15	25	25	15	20	25	15	34
26	15	48	26	15	43	26	15	39	26	15	53
27	16	6	27	16	2	27	15	57	27	16	10
28	16	24	28	16	20	28	16	15	28	16	28
29	16	41	29	16	37	29	16	33	29	16	45
30	16	59	30	16	55	30	16	50	30	17	3
31	17	16	31	17	12	31	17	8	31	17	20

South declination.

Nouember.

	1		2		3		4	
	1597		1598		1599		1600	yeares
	1601		1602		1603		1604	of our
	1605		1606		1607		1608	Lord.
	1609		1610		1611		1612	
Day	De.	Mi.	Day	De.	Mi.	Day	De.	Mi.	Day	De.	Mi.
1	17	32	1	17	28	1	17	24	1	17	36
2	17	49	2	17	45	2	17	40	2	17	53
3	18	5	3	18	1	3	17	57	3	18	9
4	18	21	4	18	17	4	18	13	4	18	25
5	18	36	5	18	32	5	18	28	5	18	40
6	18	51	6	18	47	6	18	43	6	18	55
7	19	6	7	19	2	7	18	58	7	19	10
8	19	21	8	19	17	8	19	13	8	19	24
9	19	35	9	19	31	9	19	28	9	19	38
10	19	48	10	19	45	10	19	41	10	19	51
11	20	2	11	19	59	11	19	55	11	20	5
12	20	15	12	20	12	12	20	8	12	20	18
13	20	28	13	20	25	13	20	21	13	20	31
14	20	40	14	20	37	14	20	34	14	20	43
15	20	52	15	20	49	15	20	46	15	20	55
16	21	3	16	21	0	16	20	57	16	21	6
17	21	14	17	21	11	17	21	8	17	21	17
18	21	25	18	21	22	18	21	19	18	21	27
19	21	35	19	21	33	19	21	30	19	21	37
20	21	45	20	21	43	20	21	40	20	21	47
21	21	55	21	21	53	21	21	50	21	21	57
22	22	4	22	22	2	22	22	0	22	22	6
23	22	12	23	22	10	23	22	8	23	22	14
24	22	20	24	22	18	24	22	16	24	22	22
25	22	28	25	22	26	25	22	24	25	22	30
26	22	35	26	22	33	26	22	31	26	22	37
27	22	42	27	22	40	27	22	38	27	22	44
28	22	49	28	22	47	28	22	45	28	22	50
29	22	55	29	22	54	29	22	52	29	22	56
30	23	0	30	22	59	30	22	57	30	23	1

South declination.

December.

	1		2		3		4	
yeares of our Lord.	1597 1601 1605 1609		1598 1602 1606 1610		1599 1603 1607 1611		1600 1604 1608 1612	
Day	De.	Mi	Day	De. Mi	Day	De. Mi	Day	De. Mi
1	23	5	1	23 4	1	23 2	1	23 6
2	23	10	2	23 9	2	23 7	2	23 11
3	23	14	3	23 13	3	23 12	3	23 15
4	23	18	4	23 17	4	23 16	4	23 19
5	23	21	5	23 20	5	23 19	5	23 21
6	23	23	6	23 22	6	23 22	6	23 24
7	23	26	7	23 25	7	23 24	7	23 26
8	23	27	8	23 27	8	23 26	8	23 27
9	23	29	9	23 28	9	23 28	9	23 29
10	23	30	10	23 30	10	23 29	10	23 30
11	23	30	11	23 30	11	23 30	11	23 30
12	23	30	12	23 30	12	23 30	12	23 30
13	23	29	13	23 29	13	23 29	13	23 29
14	23	28	14	23 28	14	23 28	14	23 28
15	23	27	15	23 27	15	23 27	15	23 26
16	23	25	16	23 25	16	23 26	16	23 24
17	23	22	17	23 23	17	23 23	17	23 21
18	23	19	18	23 20	18	23 20	18	23 18
19	23	16	19	23 17	19	23 17	19	23 15
20	23	12	20	23 13	20	23 14	20	23 11
21	23	8	21	23 9	21	23 10	21	23 7
22	23	3	22	23 4	22	23 5	22	23 1
23	22	57	23	22 58	23	23 0	23	22 56
24	22	52	24	22 53	24	22 54	24	22 50
25	22	46	25	22 47	25	22 49	25	22 44
26	22	39	26	22 41	26	22 42	26	22 37
27	22	32	27	22 34	27	22 35	27	22 30
28	22	24	28	22 26	28	22 28	28	22 22
29	22	16	29	22 18	29	22 10	29	22 14
30	22	8	30	22 10	30	22 12	30	22 6
31	21	59	31	22 1	31	22 3	31	21 57

South declination.

The vſe of the former table, or regiment of the Sunne.

THis table of the ſunnes declinations as it differeth nothing in forme from others that haue beene publiſhed heretofore: ſo likewiſe the manner of vſing it, is altogither the ſame that hath beene accuſtomed in former tables of this kinde, ſauing that I muſt giue warning of one error that hath beene committed herein. Which is as I haue obſerued, that ſome of our ſea-mē do take the ſunnes declinatiō out of their regiments without any æquation, by addition or ſubtraction of the part proportional agreeable to the difference of longitude of the place where they are, as if they were alwayes at the ſame place or vnder the ſame meridian, for which their regiments were made. For which cauſe alone (though they auoyde al other errors) it may ſo fall out that they may be deceiued ſometimes 10 or 12 min. (or more in a long voyage) in taking the ſunnes declination. For there is not any table of the ſunnes declination but that it muſt needs be made for ſome one meridiā (as this former table was made for the meridian of London) and therefor cannot be truely vſed

in any other without æquation aunſwerable to the diſtaunce of the meridians or difference of longitude.

To auoyde this error therefor, firſt learne howe much you differ in longitude from the place for which your table was made, (and though you miſſe halfe a dozen or halfe a ſcore degrees herein it cannot in this caſe breede ſenſible error): Secondly finde out the difference of the ſunnes declination agreeable to the ſpace of 24 houres about the time of your obſeruation: which you ſhal doe by comparing the declination aunſwerable to the day of your obſeruation with the declination of the day next before or after, and ſubtracting the leſſer declination out of the greater, for that remaineth is the difference of declination ſought for. Thirdly as 360 is to this difference of declination, ſo is the difference of longitude to the part proportial or æquation of the declination: which æquation is to be added to the declination of the day of obſeruation if the declination of the ſunne be eyther increaſing & the place of obſeruation weſtwarde: or els decreaſing and the place of obſeruation eaſtwards from the place for which your table of declination was made: otherwiſe this æquation is to be ſubtracted from the declination of your day of obſeruation, that you may haue the true declination of the ſunne for the time and place of your obſeruation.

But if the time of your obſeruation be the nooncetide immediately before or after the ſunnes entraunce into eyther of the æquinoctial points, you muſt follow another rule, and that is this: deuide the difference of longitude by 15. marke howe many vnities the quotient conteyneth, and ſo many minutes adde to the declination found in the former table, if you be eyther eaſtward from the meridian of London, and obſerue the nooncetide before the æquinoctium: or if you be weſtward from that meridian and obſerue the nooncetide after the æquinoctium, for the ſum ſhal be the declination deſired. Otherwiſe if you be eyther weſtward from the meridian of London, and obſerue the nooncetide next before the æquinoctium, or eaſtward from that meridian, and obſerue the day immediately after the æquinoctium: compare the declination found in the table with the foreſaid quotient and ſubtract the leſſer out of the greater for that remaineth in the declination deſired. Which declination hath the ſame denomination of north or ſouth that the table ſheweth if the quotient be leſſe then the declination found in the table: but if the quotient be greater the denomination muſt be altered frō north to ſouth, or from ſouth to north, contrary to that the table ſheweth. If the quotient be æqual to the declination found in the former table the ſunne is in the very æquinoctial point, and hath no declination at all.

A fewe examples will make theſe rules more plaine: ſuppoſe therefor the 30 of March 1599 you were ſayling in the baye of Mexico differing

differing in longitude to the weſtwards from the meridian of London about 90 degrees by æſtimation : The declination of the ſunne for that day found in the former table is 7 deg:30. mi:which ſubtracted out of 7 de: 52 mi:(the declination aunſwerable to the day following) there remaineth 22 min: which is the difference of declination in 24 howres at that time. Nowe as 360 is to 22 min: ſo is 90 deg:5 min: and one half(the part proportional or æquation deſired) which becauſe the declination increaſeth, and the baye of Mexico is alſo weſtward from the meridian of London, muſt be added to the declination before found in the table, and ſo ſhal you haue the true declination of the ſunne that day at noone for that place 7 degr: 35 min. and an half. But admit you had ſayled eaſtwards, and were in the eaſt Indian Ocean ſea, differing likewiſe in longitude from London about 90 degrees: therefor the difference of declination, and the part proportional therof, or æquation of the declination ſhal be the ſame they were before. But becauſe you are gone ſo much eaſtwardes the ſunne commeth 6 howres ſooner to your meridian there then it doth to ours heere at London: and therefor becauſe the declination alſo is increaſing and will be greater when the ſunne commeth to our meridian then it was, the ſunne being vnder the meridian of the eaſt Indies: that æquation of declination muſt there be ſubtracted out of the declination found in the table which before was to be added when wee ſup-

ſuppoſed you to bee in the bay of Mexico, becauſe the ſun cõmeth later by ſix houres to the meridian of that place, then to ours, & therefor the declination of the ſunne increaſing in the meane time, will be greater there then heere.

Now imagine you had ſayled the ſame yeare through the ſtreights of Magellane, and hauing paſſed ouer the ſouth ſea, were the 13 of September come neare the Philippinas, differing in longitude from London weſtwards about 210 deg. In this example, becauſe the ſunne is neare the ęquinoctiall poynt (altering his declination 24 min. in 24 houres, that is, for euerie houre one minute) therefor deuide 210 (the difference of longitude) by 15 (the number of degrees contained in one houre) the quotient will be 14 (the difference of declination anſwerable to that difference of longitude.) The declination found in the table for that day is 4 minutes northerly: which (declination) becauſe it decreaſeth (the ſunne not beeing yet come to the ęquinoctiall) muſt be ſubtracted out of 14, and there ſhall remaine 10 min. the declination of the ſunne that day at noone for that place. But this declination is ſoutherly, becauſe the quotient 14 is greater then 4, the declination found in the table.

It would be at this time too tędious for mee further to exmeplifie euery particulatitie ſpecified in the former rules, which may cauſe ſome ſmall diuerſitie in the vſe of the ſunnes declination, hauing alreadie giuen examples of the hardeſt caſes that may befall herein, which if they be

bee well conſidered, and eſpecially compared with the globe or ſphære, (wherein the whole manner of the ſunnes motion and declination may moſt eaſily not onely be ſeene, but alſo felt as it were with the fingers ends) the reaſon and demonſtration of all thoſe rules, and of all the diuerſities of working therein ſpecified, may moſt plainly appeare to him that is but of meane capacitie.

But becauſe the declination of the ſunne is then only of good vſe for knowing the latitude at ſea, when his meridian altitude may be obſerued: ſo as although all the reſt of the day and night bee faire and cleare, if a cloude couer the ſunne but one quarter of an houre, onely about noone, your Tables of the ſunnes declination will ſtande you in no ſtead: there haue beene therfore other meanes deuiſed for attayning to the knowlege of the height of the pole not only in particular by obſeruation of the pole ſtar and guardes, but alſo in generall by the meridian altitude and declination of any notable fixed ſtar whatſoeuer. So as not in the day time alone, & that onely at noone, but almoſt at any tyme of the night if any ſmall portion of the heauen towards the north or ſouth appeare but a ſmall tyme cleare through the raking clouds, the latitude of the place where you are, may hereby be more eaſily knowne, then by obſeruation of the ſunnes meridian altitude. For (to omitt the changing of the ſunnes declination from North to South, and from South to North twiſe in euery

uery yeare, which notwithſtanding breedeth ſome diuerſitie of working, by neglect whereof, ſome haue groſely erred): the ſunne by reaſon of his ſwifter motion, increaſeth or diminiſheth his declination dayly, yea, hourely, and that very ſenſibly many times, whereof there muſt needes ariſe many ſeuerall conſiderations to be had, of the right vſe and application of the ſunnes declination found in the table, as well in reſpect of the part of declination, (whether it be north or ſouth) as alſo in regarde of the difference of longitude, betweene the place for which the tables of the ſunnes declination were made, and the place of obſeruation, whether it be eaſterly or weſterly from thence, beſides many other particularities lately ſpecified, & needleſſe here to be repeated. But the fixed ſtarres mouing ſo exceeding ſlowly, that in more thē 70 yeares they go not ſo much as one degree in their proper motion, frō the weſt eſtwards, keep not only the ſame part of north or ſouth, but almoſt the ſame point & minute of declinatiō, for many yeares togither, I meane thoſe ſtarres ſpecially that are placed in the ſignes of Gemini, Cancer, Sagittary, or Capricorne, neare the ſolſticial Colure, which in an hundred yeares or two, can alter their declinatiō ſcarce one minute. Whereas thoſe ſtarres that bee ſituate in Piſces, Aries, Virgo, or Libra, eſpecially if they be neare the æquinoctial colure, may differ in their declinations about one minute in 3 yeares, which difference though it be ſomething, yet for a dozen or twenty yeares, will hardly be ſo much as can at ſea be obſerued by any inſtrument hitherto had

in common vſe.

For theſe two cauſes therefor (that is) for the more eaſie and generall vſe of the declinations of the fixed ſtarres, thē of the ſunne, I wiſh they were more generally knowne and obſerued by our ſeamen then they are, as wherby they might not onely moſt eaſily knowe the eleuation of the pole at any time of the night, but alſo in any place of the world, much more commodiouſly then otherwiſe they can, becauſe that into what latitude, and howe farre ſoeuer they ſhould come, either northwards or ſouthwardes, they might alwayes haue their choyſe of diuers fixed ſtarres neare the meridian, both towards the north & ſouth, of a conuenient height to be obſerued. But herewith it were alſo to be wiſhed, that the tables of the fixed ſtars declinations, which are moſt common amongſt Engliſh mariners, had beene more free from error then they are: I meane eſpecially the tables publiſhed in *Bournes* regiment, & *Normans* newe attractiue which (tables agreeing almoſt in euery tittle one with another) ſeem to be take word for word one out of another errors and all, ſo as you cannot finde any error in the one, but you ſhall be ſure alſo to haue the ſame in the other: notwithſtanding, ſome of thoſe errors are more then two or three whole deg. (which becauſe being neglected or vnknowne to the mariner that ſhall vſe thoſe tables) they may bring him in greater daunger, thē many a hidden rocke vnder ſea: I haue therefor by diligent obſeruation with a quadrant of more then ſix foote ſemidiameter, detected & corrected thoſe errors.

errors, ſhewing not only the trueth to be heedfully followed, but thoſe errors alſo, to be as carefully auoyded, in ſuch ſort as is ſet downe in the table following, wherein the firſt columne conteineth the names of the ſtarres, the ſecond, the true declinations (as they were found by obſeruatiō) in degrees and minutes, togither with the part of declination, ſignified by the letters N and S, whereof N ſignifieth the declination to be north, & S ſouth. The third columne conteyneth the declinations publiſhed in *Bournes* and *Normans* tables. The fourth ſheweth the difference of theſe declinations from the trueth. The fift giueth you the right aſcēſions of thoſe ſtarres, reſolued into houres and minutes. In the ſixt and laſt columne are ſette downe the magnitudes or bigneſſe of the ſame ſtarres.

Of the vſe of the table following.

The declinations of the fixed ſtars conteined in this table, being to be vſed altogither after the ſame maner as the declinatiōs of the ſun, for finding out the heyght of the pole: it were ſuperfluous for me in this place, to write any more of the vſe thereof, being a thing ſo eaſie and ſo commonly knowne amongſt Mariners, and alreadie ſufficiently deliuered by others.

A table of fixed Starres about the Equinoctiall.

The names of the ſtarres.	*Declination by obſeruation.*			*Bournes and Normans declination.*		*The deffe-rence*	*Right aſcenſion*		*Big-neſſe.*
	Deg.	*Min.*		*Deg.*	*Min.*	*De.M*	*Ho.*	*Min.*	
Whales backe	12	20	*S*	12	11	9	0	50	3
Whales belly	12	22	*S*	12	20	2	1	32	3
Rammes horne	17	17	*N*	17	19	2	1	32	3
Rammes head	21	33	*N*	21	16	17	1	46	3
Bulles eye	15	38	*N*	15	42	4	4	13	1
Orions left foote	8	43	*S*	9	14	29	4	55	1
Orions left ſhoulder	5	56	*N*	4	37	1 19	5	4	2
Firſt in Orions girdle	0	38	*S*	1	19	41	5	12	2
Orions right ſhoulder	6	17	*N*	6	18	1	5	34	1
Great dogge	16	12	*S*	15	30	42	6	27	1
Leſſer dogge	6	13	*N*	6	4	9	7	18	1
Brighteſt in Hydra	6	53	*S*	4	47	2 6	9	8	2
Lions hart	13	55	*N*	21	59	17	9	57	1
Lions necke	21	52	*N*	14	3	8	9	46	2
Lions backe	22	43	*N*	22	30	13	10	52	2
Lions taile	16	50	*N*	16	46	4	11	29	1
Rauens head	20	45	*S*	19	53	52	11	50	3
Rauens wing	15	16	*S*	17	8	1 52	11	56	3
Virgins ſpike	9	0	*S*	8	53	7	13	5	1
Betwixt Boores thighs	21	20	*N*	22	9	49	13	56	1
South ballance	14	14	*S*	13	44	30	14	30	2
North ballance	7	46	*S*	7	33	13	14	55	2
Scorpions haut	25	25	*S*	24	47	38	16	6	1
Hercules head	14	57	*N*	15	20	23	16	56	3
Serpentarius head	12	57	*N*	14	7	1 10	17	16	3
Eagles hart	7	54	*N*	7	28	26	19	32	2
Dolphins taile	10	0	*N*	10	1	1	20	16	3
Goares taile	17	51	*S*	14	13	3 38	21	27	3
Water powrers legge	18	10	*S*	15	52	2 18	22	35	3
Pegaſus ſhoulder	12	58	*N*	13	1	3	22	46	2
Pegaſus legge	25	58	*N*	26	30	32	22	44	
Whales taile.	20	12	*S*	21	47	1 35	0	24	3

But ſeeing this former table conteyneth almoſt no other ſtars, but ſuch as are betwixt the tropiks, and neere about the æquinoctiall circle, which are not ſo fitte to be obſerued by them that ſayle farre ſouthwards, or vnder the burnt zone (for there they wil be too high aboue the horizon) I thoght good hereto to adioyne another table of as manie more principall fixed ſtarres (heedefully obſerued alſo with the ſame quadrant) that are placed neare about the pole, which may ſtand your in as much ſtead, as twiſe ſo many taken out of other parts of the heauens, becauſe they come twiſe to the Meridian aboue the horizon, in euery 24 houres: ſo as in winter time many of them may bee obſerued both at euening and morning, twiſe in one night, both aboue and beneath the pole. Notwithſtanding, for them that ſayle northwards, it ſhal be beſt to obſerue theſe ſtarres when they come to the meridian vnder the pole. Contrarywiſe they that trauell far ſouthwards may beſt obſerue their meridian altitudes aboue the Pole. Herein alſo this table differeth from the former, that whereas in the former were ſet down the declinations of the ſtarres, or their diſtances from the equinoctiall, in this contrariwiſe are ſette downe the complements of their declinations, or their diſtances from the pole, whereby the heigth of the pole may more eaſily be found, then by their declinations, onely by adding the heigth of the ſtarre obſerued beneath the pole, to the diſtance thereof from the pole: or by ſubtracting onely the diſtance of the ſtarre, from the pole out of the northerly meridian altitude, obſer-

ded aboue the pole. But if the meridian altitude of the ſtarre be ſoutherly (the ſtarre obſerued being ſouthward from the zenith) ſubtract the heigth of the ſtarre from 180, and out of the remainder ſubtract the diſtance of the ſtarre from the pole: ſo ſhall you haue the heigth of the pole. Thus alſo there would be a more eaſie way, then that is commōly vſed for knowing the latitude by the ſunne or ſtarres, hauing ſoutherly declination. For if in ſtead hereof the complement of declination were ſet downe in the table: the heigth of the ſunne or ſtarres alwaies ſubtracted out of this complement, ſhould leaue you the height of the pole, or latitude deſired.

But to returne to the table of fixed ſtarres following, the firſt columne therein conteineth (as before) the names of the ſtarres, the ſecond their complements of declination, or diſtances frō the pole. The third columne giueth you their right aſcenſions reduced into houres, and minutes of an houre, the fourth ſheweth their bigneſſe or magnitudes.

A

A table of fixed Starres about the North Pole.

The names of the ſtarres.	Diſtance from the Pole		Right Aſcenſion.		Bigneſſe
	Deg.	Min.	Ho.	Min.	
In the breaſt of Caſsiopeia	35	35	0	19	3
In her hippe	31	26	0	32	3
The pole ſtarre	2	52	0	50	3
At the knees of Caſsiopeia	31	50	1	0	3
In her legge	28	18	1	25	3
Perſeus right ſhoulder	38	5	2	35	3
Perſeus right ſide	41	38	2	56	2
The goate or wagoners left ſhoulder	44	30	4	49	1
The wagoners right ſhoulder	45	11	5	30	2
The firſt in the great beares fore foote	40	30	8	24	3
The ſecond in the ſame foote	41	28	8	32	3
In her former left knee	36	37	8	58	3
The great beares ſide	31	26	10	38	2
The great beares backe	26	5	10	40	2
The end of the dragons taile	18	26	11	8	3
The great beares thigh or buckle bone	34	3	11	32	2
The great beares rump	30	41	11	54	2
The next to the end of the dragons taile	17	57	12	14	3
The firſt in the great bears taile next hir	31	49	12	32	2
The middlemoſt in hir taile (rump	32	55	13	6	2
In the end of hir taile	38	37	13	32	2
The next before the turning of the dra-	23	40	13	53	3
The foremoſt guard (gons taile	14	11	14	54	2
In the turning of the dragons taile	29	37	15	14	3
The hindmoſt guarde	16	42	15	26	2
Next after the turning of the dragons	30	20	15	54	3
The dragons eie (taile	37	18	17	22	3
The dragons head	38	22	17	44	3
In the ſwans right wing	45	44	19	34	3
In hir taile	46	6	20	30	2
Cepheus his right ſhoulder	29	0	21	10	3
The backe of Caſsiopeiaes chaire.	33	2	23	48	3

Nowe becauſe the fixed ſtarres are then onely meete to bee obſerued for finding the latitude when they are in the meridian: it is therefor good for him that meaneth to obſerue them, to knowe at what time they come to the meridian. To this end there are tables publiſhed, and almoſt in euery Mariners hands, pretending to ſhewe at what houre and minute euerie ſtarre in the firſt of theſe two former tables, commeth to the meridian, for the beginning and midſt of euery moneth in the yeare, agreeing likewiſe in euery error one with another, but becauſe theſe errors breede not (at any time) greater danger or dammage to the mariner, that is aware of them, then to make him watch for their comming to the meridian, a quarter, or halfe an houre longer then otherwiſe hee needed (this ſmal inconuenience only prouided for) thoſe tables may ſerue the turne well inough, for them that liſt not trouble themſelues to learne a better way. But for them that are deſirous of a more true and generall way, I haue alſo made the table following of the ſunnes right aſcenſions (reduced into houres and minutes (for euery day of this preſent yeare 1599. according to the Ephemerides of the ſunne, before ſette downe: with help of which table it may eaſily bee knowne for any day of anie yeare in our age, at what time not onely any of the forelayd fixed ſtarres about the æquinoctiall, but thoſe alſo about the pole, or any other (whoſe right aſcenſions are known in houres & minutes) come to the meridian, and that after this manner: Finde out in the table folowing the month & day wherein you obſerue the moneth in the vpper margine of the Table, the day in the firſt columne therof next the left hand, the common meeting of the columne deſcending from that month, and of the line proceeding from that day towards the right hand, ſhall giue you the ſunnes right aſcenſion in houres and minutes, for the ſame day. This right aſcenſion of the ſunne, ſubtract alwaies out of the right aſcenſion of the ſtarre, adding 24 houres to the ſtarres right aſcenſion, if it bee leſſe then the right aſcenſion of the ſunne: the remainder ſheweth how many houres and minutes after noone, the ſtar commeth to the vpper part of the meridian, which if they be more then 12. houres, ſubtract twelue from them, and the remainder ſhal ſhewe you how many houres and minutes after midnight, the ſtarre commeth to the vpper part of the meridian. The vpper part of the meridian I call that, which paſſeth from the pole by the zenith to the horizō ſouthwards. But it ſhall be needfull alſo many times, when you would obſerue the ſtarres about the pole, (which neuer ſet) to knowe the time of their comming to the nether part of the meridian, which may verie eaſily be done, only by adding twelue houres to the time of theyr comming to the vpper part of the meridian, if it bee leſſe then twelue houres, or by ſubtracting as much, if it be more.

Suppoſe for example, the 25 of February, 1599 I would know the time of the great dogs comming to the meridian: Firſt therefor (in the next table) following the columne deſcending frō Februarie

downewardes, and the line proceeding from the 25 daye towards the right hand, in the common meeting of them both, I finde 23 howres, 10 min. the sunnes right ascension that day at noone. Then in the first table of fixed starres, I finde the great dogges right ascension, to 6 degrees, 27 min. to which (because it is lesse then the sunnes right ascension) I adde 24 houres, and the summe of both commeth to 30 houres, 27 minutes. Out of this I subtract the sunnes right ascension 23 houres, 10 min and there remaine 7 houres, 17 min. the time of the great dogges comming to the vpper part of the meridian after noone.

Take one example also of a starre that never setteth: and admit the 20 of December next, you would know what time the foremost guarde cōmeth to the meridian beneath the pole. First therefor you shal find as before, the suns right ascension that day to be 18 houres, 36 min. And the right ascension of that starre (in the second table of fixed starres) 14 houres, 54 min. to which (beeing lesse then the sunnes right ascension) adde 24 houres, and from the summe 38 houres, 54 minutes: subtract the sunnes right ascension 18 houres, 36 min. there shal remaine 20 houres, 18 minutes, the time of the foreguards comming to the vpper parte of the meridian: from which subtract 12, so haue you the time when it commeth to the nether part of the meridian, 8 houres 38 minutes after noone.

A

A table of the sunnes right ascension for

	January		February		March		April		May		June
Dayes	Ho.	Min.	Ho.	Min.	Ho.	Min	Ho.	Min.	Ho.	Min	H.M.
1	19	30	21	39	23	25	1	18	3	11	5 15
2	19	34	21	43	23	28	1	22	3	15	5 19
3	19	39	21	47	23	32	1	26	3	19	5 23
4	19	43	21	50	23	36	1	29	3	23	5 27
5	19	47	21	54	23	40	1	33	3	27	5 31
6	19	52	21	58	23	44	1	36	3	30	5 36
7	19	56	22	2	23	47	1	40	3	34	5 40
8	20	0	22	6	23	51	1	43	3	38	5 43
9	20	4	22	9	23	55	1	47	3	42	5 49
10	20	8	22	14	23	58	1	51	3	46	5 53
11	20	13	22	18	0	2	1	55	3	50	5 57
12	20	17	22	21	0	6	1	58	3	54	6 1
13	20	22	22	25	0	9	2	2	3	58	6 5
14	20	26	22	29	0	12	2	6	4	3	6 9
15	20	30	22	32	0	16	2	10	4	7	6 13
16	20	34	22	36	0	20	2	14	4	11	6 18
17	20	38	22	40	0	23	2	18	4	15	6 22
18	20	42	22	44	0	27	2	22	4	19	6 26
19	20	46	22	48	0	31	2	26	4	23	6 30
20	20	50	22	52	0	35	2	30	4	27	6 34
21	20	54	22	56	0	38	2	33	4	31	6 38
22	20	58	22	59	0	42	2	37	4	35	6 42
23	21	3	23	3	0	46	2	41	4	39	6 46
24	21	7	23	7	0	49	2	44	4	43	6 51
25	21	11	23	10	0	53	2	48	4	47	6 55
26	21	15	23	14	0	57	2	52	4	51	6 59
27	21	19	23	18	1	0	2	56	4	56	7 3
28	21	23	23	22	1	3	3	0	5	0	7 7
29	21	27			1	7	3	4	5	3	7 11
30	21	31			1	11	3	7	5	7	7 15
31	21	35			1	15			5	11	

euery day of the yeare in houres and minutes.

	July		*Auguſt*		*September*		*October*		*Nouember*		*December*	
Dayes	*H.*	*M.*	*Ho.*	*Min.*	*Ho.*	*Min.*	*Ho.*	*Min*	*Ho.*	*Min.*	*Ho.*	*Min*
1	7	19	9	22	11	16	13	5	15	5	17	12
2	7	23	9	26	11	20	13	8	15	9	17	17
3	7	27	9	30	11	23	13	12	15	13	17	21
4	7	31	9	33	11	27	13	16	15	17	17	25
5	7	35	9	36	11	30	13	19	15	21	17	30
6	7	40	9	40	11	33	13	23	15	25	17	34
7	7	44	9	44	11	37	13	27	15	29	17	39
8	7	48	9	48	11	41	13	31	15	33	17	43
9	7	52	9	52	11	44	13	34	15	37	17	47
10	7	56	9	56	11	48	13	38	15	42	17	52
11	8	0	9	59	11	52	13	42	15	46	17	56
12	8	4	10	3	11	55	13	45	15	50	18	0
13	8	8	10	7	11	59	13	49	15	54	18	5
14	8	12	10	11	12	3	13	53	15	58	18	10
15	8	16	10	15	12	7	13	57	16	3	18	14
16	8	20	10	18	12	11	14	1	16	7	18	18
17	8	24	10	22	12	14	14	5	16	11	18	23
18	8	28	10	26	12	18	14	9	16	16	18	27
19	8	31	10	29	12	22	14	13	16	20	18	32
20	8	35	10	33	12	25	14	17	16	24	18	36
21	8	39	10	36	12	29	14	20	16	28	18	41
22	8	43	10	40	12	32	14	24	16	33	18	45
23	8	47	10	44	12	36	14	28	16	37	18	50
24	8	52	10	47	12	40	14	32	16	41	18	55
25	8	55	10	51	12	43	14	36	16	46	18	59
26	8	59	10	54	12	47	14	40	16	50	19	3
27	9	3	10	58	12	51	14	44	16	55	19	7
28	9	7	11	2	12	54	14	48	16	59	19	12
29	9	11	11	6	12	58	14	53	17	3	19	16
30	9	15	11	9	13	2	14	57	17	8	19	21
31	9	19	11	13			15	1			19	25

By

By theſe tables of fixed ſtarres and right aſcenſions of the ſunne, you may eaſily knowe alſo the houre of the night at any time of the yeare, after this manner. Looke which of thoſe ſtarres is at the meridian, which may eaſily be knowne by a needle diall or compaſſe: or if you will obſerue the north ſtars that neuer ſet (which indeed are fitteſt for this purpoſe, eſpecially when they come to the meridiã vnder the pole) you ſhall firſt finde the place of the pole in the heauens, ſo neare as you can by æſtimation (for a little error therein breakes no ſquare) which may be done thus. From the Pole-ſtarre directly towardes the firſt ſtarre next the rumpe in the great beares tayle, imagine almoſt ſo much ſpace as the guardes are diſtant a funder, for neare thereabouts is the place of the pole. Nowe betwixt your eye and this place of the pole, hold a plumbline, hanging as perpẽdicularly & ſteadfaſtly as you may, & marke withal if that plumbline come betwixt your ſight, & any of the ſtars noted in the table of fixed ſtarres about the pole: for that ſtarre is at the meridian. Then learne (as before was ſhewed) at what time that ſtar cõmeth to the meridian, and ſo you ſhal haue the houre of the night.

Suppoſe for example the 10 of Februarye, you finde after this manner the ſwans taile at the meridian vnder the pole, deſiring hereby to know the houre of the night at that time: The right aſcenſion of the ſunne for that day, you ſhall find as before, to be 22 houres, 14 min. whereto you may adde a minute or two more (becauſe that ſtarre wil come to the meridian very late in the euening) ſo ma-

making the ſunnes right aſcenſion 22 houres, 16 min. The right aſcenſion of that ſtarre in the ſecond table of fixed ſtarres, you ſhall finde to be 26 houres, 30 min. From which (becauſe now you deſire to know the time of that ſtarres comming to the nether part of the meridian) you may ſubtract 12 houres, and there ſhall remaine 8 houres, 30 mi. To this remainder, becauſe it is leſſer then the ſunnes right aſcenſion adde 24 houres) and from the ſumme (32 houres, 30 min.) ſubtract the right aſcenſion of the ſunne 22 houres, 16 min. ſo there ſhall remaine 10 houres, 14 min. the time of the night deſired.

Of finding the elevation of the Pole by obſervation of the pole ſtarre and guarde.

Beſides the wayes alreadie ſpoken of, to finde the elevation of the pole by the meridian altitudes and declinations of the ſunne and fixed ſtarres in generall: there hath beene alſo vſed another way more ſpeciall, by the height of the pole ſtarre, whē the fore-guard is ſcituate from it, either towardes the eaſt, weſt, north, or ſouth, or elſe vpon the middle poynts betwixt theſe principall, as vppon the northeaſt, northweſt, ſoutheaſt, and ſouthweſt poynts. Of which way as it hath beene hitherto publiſhed and vſed, I muſt for the preſent onelie giue the mariner warning that hee truſt not to it, being verie erroneous, and grounded vpon twoo falſe poſitions. The one is, that the diſtance of the pole

poleſtarre from the pole, is three degrees, 30 min. which often and exact obſeruation, is found to be at this time not aboue 2 deg. 52 min. The other is, that the equations or allowances (to bee added to, or ſubtracted from the height of the pole-ſtarre, to finde thereby the height of the pole) are made the ſame for all latitudes.

But hauing alreadie ſhewed ſufficiently howe to knowe the latitude almoſt at any time of the night by the fixed ſtarres in the former tables, I hope to be the eaſelier excuſed for finding a fault herein, and not amending it at this time, meaning ſo ſoone as the giuer of all good ſhall lend me leyſure, to ſhew a way by obſeruation of the pole ſtarre and guards, to finde preſently the height of the pole, not onely when they ſhal be in ſome of thoſe eight principal poſitions afore mentioned, as hath beene vſed, but in any other poſition alſo, and at any time of the night, when the guardes and pole-ſtarre may be ſeene, and that without any allowance giuing or taking, by addition or ſubtraction of any equation, in regard of the pole-ſtarres, being higher or lower then the pole.

In the meane time I wiſh the friendly readers profiting by that is alreadie deliuered, may be aunſwerable to my paines herein, and good will towards him, which if he ſhall finde, let him thankfully remember with me, the Right Honourable the Earle of Cumberland, by whom I was firſt moued, and receiued maintenance to diuert my mathematicall ſtudies, from a theoricall ſpeculation in the Vniuerſitie, to the practicall demonſtration

ſtration of the vſe thereof in Nauigation, by experience at ſea, and that eſpecially in his [redacted] voyage to the Azores, happily performed in the yeare 1589. The whole diſcourſe of which voyage, being the firſt occaſion to mee of writing the former treatiſe, I thought good alſo as an appendix to adioyne hereunto.

The

The Voyage of the right Ho. GEORGE EARLE OF CVMBERL. to the Azores, &c.

THE Right Ho. the Earle of *Cumberland* hauing at his own charges prepared his ſmal Fleete of foure Sayle onely, *viz.* The *Victorie*, one of the Queenes Ships royall, the *Megg*, and *Margaret*, ſmall Ships, (one of which alſo he was forced ſoone after to ſend home againe, finding her not able to endure the ſea) and a ſmall Caruell, and hauing aſſembled together about foure hundred men, (or fewer) of Gentlemen, Souldiers, and Saylers, embarqued himſelfe and them, and ſet ſayle from the ſound of *Plimmouth* in *Deuonſhire*, the eighteenth day of Iune, 1589. being accompanied with theſe Captaynes and Gentlemen which heereafter follow.

Captaine *Chriſtopher Liſter*, a man of great diligence, courage, and reſolution, Captaine *Edwarde Careleſſe, alias, Wright*, who in S. Frauncis Drakes *Weſt-Indian* voiage was Captaine of the *Hope*. Captaine *Boſwell*, Captaine *Mervin*, M. *Henry Longe*, M. *Partridge*, Maiſter *Norton*, Maiſter *William Mounſon* Captaine of the *Megge*. now S. *William Mounſon*, Maiſter *Pigeon* Captaine of the Caruell.

About three dayes after our departure from *Plimmouth*, we met with three French ſhippes, whereof one was of *Newhauen*, another of S. *Maloes*, and ſo finding them to be Leaguers and lawful Prize, we tooke them, and ſent two of them for England with all their loding, which was fiſh for the moſt parte from *New-found-land*, ſauing that there was parte therof diſtributed amongſt our ſmall Fleete, as we could finde ſtowage for the ſame, and in the third, all their men were ſent home into Fraunce.

The ſame day and the day following, we met with ſome other ſhippes, whom (when after ſome conference had with them, we perceiued plainely to be of *Roterodame* and *Embden*, bounde for *Rochell*) we diſmiſſed.

The

The 28. and 29. dayes, we met diuers of our English shippes, returning from the Portugall Voyage. The thirteenth day of Iuly, being Sonday in the morning, we espied eleuen ships, without sight of the Coast of *Spaine*, in the height of 39. degrees, whom we presently prepared for, and prouided to meete them, hauing first set foorth the *Meg* before vs to descrie whence they were. The *Megge* approching neere, there passed some shot betwixt them, whereby, as also by their Admirall, and Vice-admirall putting foorth their Flagges, wee perceiued that some fight was likelye to follow. Hauing therefore fitted our selues for them, we made what haste we could towards them with regard alwayes to get the winde of them, & about 10. or 11. of the clocke, we came vp to the with the *Victory*. But after some few shot, and some little fight passed betwixt vs, they yeelded themselues, & the Maisters of the all came aboorde vs, shewing their seuerall Pasportes, from the cities of *Hambourg* & *Lubecke* from *Breeme*, *Pomerania*, and *Calice*.

They had in them certaine bagges of Pepper and Sinamome, which they confessed to be the goodes of a Ievve in *Lisbone*, which should haue beene carried by them into their countrie, to his Factor there, and so finding it by their owne confession to be lawfull Prize, the same was soone after taken and deuided amongst our whole companie, the vallewe whereof was esteemed to be about 4500. pounds at two shillings the pound.

The 17. day, the foresaid ships were dismissed, but 7. of their men, that were willing to goe along with vs for Saylours, wee tooke to helpe vs, and so held on our course for the *Azores*.

Two dayes after some of their Saylours remaining with vs, reported that the saide *Easterlinges* shippes, had also in them twentie thousand pounds worth of Spanyards goodes: but then it was too late to search them.

The first of August being Fryday in the morning, we had sight of the Iland of S. *Michaell*, being one of the Eastermost of the *Azores*, toward which we sayled all that day, and at night hauing put foorth a Spanish Flagge in our maine toppe, that so they might

might the lesse suspect vs, we approched neere to the chiefe towne, and roade of that Iland, where we espied three ships riding at anchor, and some other small Vessells: all which we determined to take in the darke of the night, & accordingly attempted about 10. or eleuen of the clocke, sending our boates well manned to cutte their cables, and hausers, and let them drine into the sea. Our men comming to them, found that one of those greatest ships, was the *Falcon* of *London* being there vnder a Scottish Pilot, who bare the name of her as his owne. But three other smaller ships, that lay neere vnder the Castle there, our men let loose, and towed them away vnto vs, most of the Spaniardes that were in them, leaping ouerboard, and swimming to shoare, with lowde and lamentable outcries, which they of the towne hearing, were in an vproare, and answered with the like crying. The Castle discharged some great shot at our boates, but shooting without marke, by reason of the darkenes, thei did vs no hurt. The Scots likewise discharged three great geeces into the Ayre, to make the Spaniards thinke they were their friendes, and our enimies; and shortly after the Scottish Maister and some others with him, came aboard to my L. doing their duetie, and offering their seruice, &c. These three shippes were fraught with wine and Sallet-oyle, from *Seuill*.

The same day our Carvell chased a Spanish Caruell to shoare, at S. *Michaells*, which carryed letters thither, by which we learned, that the *Carrickes* were departed from *Tercera* eight dayes before.

The seuenth of August we had sight of a little ship, which wee chased towards *Tercera* without Pinnesse (the weather being calme) and towards euening, we ouertooke her, there was in her 30. Tunnes of good *Madera* Wine, certaine wollen cloath, silke, Taffata, &c. The 14. of August we came to the Iland of *Flores* wher we determined to take in some fresh water, & fresh victualls, such as the Iland did afoorde. So we maned our boats with some 120. men, & rowed towards the shoare. Whertoo when we approched, the Inhabitants that were assembled at the landing place, put foorth a flag of truce, wherupon we also did the like.

When we came to them, my Lord gaue them to vnderſtand by his Portugall Interpreter, that he was a friend to their King *Don Antonio*, and came not any way to iniure them, but that he ment onely to haue ſome freſh water, and freſh victualles of them, by way of exchange for ſome prouiſion that he had, as Oyle, Wine, or pepper, to which they preſently agreed willingly, and ſent ſome of their companie for Beefes and ſheepe, and we in the meane ſeaſon marched Southward about a myle, to *Villa Sancto Cruz*, from whence all the Inhabitants young and ould were departed, and not any thing of vallewe left. Wee demaunding of them, what was the cauſe heereof, they anſwered, feare; as their vſuall manner was, when any ſhips came neere their coaſt.

Wee found that parte of the Iland to bee full of great Rockye barren hilles and mountaines, little inhabited, by reaſon that it is molleſted with ſhippes of warre: which might partly appeare by this towne of *Sancto Cruz* (being one of their chiefe townes) which was all ruinous, and (as it were) but the reliques of the ancient Towne, which had beene burnt about two yeares before, by certayne Engliſh ſhips of warre, as the Inhabitants there reported.

At euening as we were in rowing towards the *Victorie*, an huge fiſh purſued vs for the ſpace wel nigh of two myles together, diſtant for the moſt part from the boats ſterne not a ſpeares length, and ſometimes ſo neere, that the boate ſtrooke vpon him, the typs of whoſe fynnes about the ghilles (appearing oft times aboue the water) were by eſtimation foure or fiue yardes a ſunder, and his Iawes gaping a yarde and an halfe wide, which put vs in feare of ouerturning the Pinneſſe, but God be thãked (rowing as hard as we could) we eſcaped.

When wee were about *Flores*, a little ſhip called the *Drake*, brought vs word that the *Caricks* were at *Tercera*; of which news we were very glad, and ſped vs thitherward with all the ſpeede we could: and by the way we came to *Fayall* road, the ſeuen and twenteth day of Auguſt, after ſunne ſet, where we eſpyed certaine ſhips ryding at anker, to whom we ſent the *Sawſie Iacke*, a ſmall ſhippe,

lately

lately conſorted with vs, and our ſkiffe well manned, with which ſhips our men had fight about an houre in the night, the towne alſo diſcharging their great ordinance from the Platforme there, in defence of thoſe ſhippes, wherwith the Maiſter onely of our Caruell was hurt, but in the end our men brought them all out of the harbour, beeing ſix in number, whereof one was of 250. Tunnes, lodẽ with Sugar, Ginger, Hides, &c. lately come from the *Weſt-Indies*. Two of the worſt we let floate on the Sea, hauing firſt taken out of them ſuch thinges as we liked. The other foure were ſent for England, the 30. day of Auguſt.

At the taking of theſe prizes, were conſorted with vs ſome other ſmall men of warre, as *Maiſter John Dauis*, with his ſhip, Pinneſſe, & Boate, Captaine *Markſburie*, with his ſhip, whoſe owner was S. *Walter Raleigh*, the Barke of *Lime*, which was alſo conſorted with vs before.

The laſt of Auguſt in the morning we came in ſight of *Tercera*, beeing about ſome 9. or 10. leagues from ſhoare, where we eſpied comming towards vs, a ſmall boate vnder ſaile, which ſeemed ſomewhat ſtrange vnto vs, beeing ſo farre from land, and no ſhip in ſight, to which they mought belong: But comming neere, they put vs out of doubt, ſhewing they were Engliſh men (eyght in number) that had lately beene priſoners in *Tercera*, and finding opportunitie to eſcape at that time, with that ſmall boate, committed thẽſelues to the ſea, vnder Gods prouidence, hauing no other yard for their maine ſayle, but two pipe ſtaues tyed together by the ends, and no more prouiſion of victualles, then they could bring in their pockets and boſomes. Hauing taken them all into the *Victorie*, they gaue vs certaine intelligence, that the *Carricks* were departed from thence about a weeke before.

Thus beeing without any further hope of thoſe *Carickes*, wee reſolued to returne for *Fayall*, with intent to ſurprize the Towne, But vntill the 9. of September, we had either the winde ſo contrarie, or the weather ſo calme, that in all that time, we made ſcarce 9. or 10. leagues way, lingring vp and downe not far from *Pico*.

The tenth of September, being Wednesday in the afternoone, wee came againe to *Fayall* roade: Whereupon immediately my L: sent Captaine *Lister*, with one of *Graciosa* (whome C. *Mounson* had before taken) and some others, towards *Fayall*, whom certaine of the Inhabitants met in a boate, and came with Captaine *Lister* to my L: to whom he gaue this choyce: eyther to suffer him quietly to enter into the platforme there without resistance, where hee and his companie would remaine a space without offering any iniurie to them, that they (the Inhabitants) might come vnto him and compound for the Ransome of the Towne: or else to stand to the hazard of warre.

With these wordes they returned to the towne: But the Keepers of the platforme answered, that it was against their oath, and allegeance to King *Phillip*, to giue ouer without fight. Whereupon my L: commanded the boates of euerie ship, to be presently manned, and soone after landed his men on the sandye shoare, vnder the side of an hill, about halfe a league to the Northwardes from the platforme: vpon the toppe of which hill, certaine Horsemen and Footemen shewed themselues, & other two companies also appeared, with Ancients displayed, the one before the towne, vpon the shoare by the sea side, which marched towardes our landing place, as though they would encounter vs; the other in a valley to the Southwards of the platforme, as if they would haue come to helpe the Townesmen: during which time, they in the platforme also played vpon vs with great Ordinance. Notwithstanding my Lo: (hauing set his men in order) marched alongst the sea shoare, vpon the sandes, betwixt the sea and the Towne, towardes the platforme, for the space of a myle or more, and then the shoare growing rockie, and permitting no further progresse, without much difficultie, hee entred into the towne and passed through the street without resistance, vnto the platforme, for those Companies before mencyoned, at my Lo: approching, were soone dispersed, and soddenly vanished.

Like-

Likewise they of the platforme, (being all fled at my Lordes comming thither) left him, and his Company to scale the Walles, to enter and take possession without resistance.

In the meane time our shippes ceased not to batter the foresaid Towne and Platforme with great shotte, till such time as wee sawe the Red-Crosse of England florishing vpon the Forefront thereof.

This Fayàil is the principall Towne in all that Land, and is scituate directly ouer against the high & mightie mountaine *Pico*, lying towardes the West North-west from that mountaine, beeing deuided therefrom by a narrow Sea, which at that place is by estimation about some two or three leagues in breadth, betweene the Ilandes of *Fayall and Pico*.

The Towne conteyned some three hundred Housholdes, their houses were faire, and strongly buylded of Lime and Stone, & double couered with hollow tyles, much like our Roose-tyles, but that they are lesse at the one end then at the other, in manner of a Concaue semiconicall figure.

The first course lyeth with the hollow sides, and greater endes vpward, the lesser end of one tyle, lying alwayes within the greater end of the other, in such sorte, as (all alongst the house, from the Roofe to the Eues) they make so many gutters, as there are courses of Tyles layed.

The second courses are layed with the round sides, and lesser ends vpwardes, couering vnder their hollownes, the edges of the former courses, in such sorte, that all the raine that falleth, slideth of from the backes of the Tyles that are layed in the second courses, and runneth downe the foresayde gutters without taint or infection of Morter, or myre, and so beeing receiued into Cisternes, supplyeth very well their necessarie vses of fresh water: Whereof otherwise there is great want in that place.

Euerie house almost had for this purpose, [redacted] a Cisterne, or Well in a Garden, on the Backeside: In which gardens grewe

grewe Vines (with ripe cluſters of Grapes) making pleaſant ſhadowes: *Tabacco* now commonlye knowne and vſed in England, wherewith their women ther, dye their faces reddiſh, to make thē ſeeme freſh and young: Pepper, Indian, and Common: Figg-tree, bearing both white and red Figges: Peach-trees, not growing verie tall: Orenges, Limons, Quinces, *Potato* rootes, &c. Sweet wood, (Cæder I thinke) is there very common, euen for building and firing.

My Lo: hauing poſſeſſed himſelfe of the towne and platforme, and beeing carefull of the preſeruation of the Towne, gaue commandement, that no Marriner or Souldiour, ſhould enter into any houſe, to make any ſpoyle thereof. But eſpecially hee was carefull that the Churches and houſes of Religion there, ſhould be kept inviolate, which was accordingly performed, through his appoyntment, of Guarders and Keepers for thoſe places: But the reſt of the Towne, eyther for want of knowledge of the former Inhibition, or for deſire of ſpoyle and pray, was rifled, and ranſacked by the Souldiers and Marriners, who ſcarcely left any houſe vnſearched, out of which they tooke not ſuch things as liked them, as Cheſts of ſweete wood, Chaires, Cloath, Couerlets, Hangings, Bedding, Apparell: And further ranged into the Country, where ſome of them alſo were hurt by the Inhabitants. The Fryerie there, conteyning and maintaining 30. *Franciſcane* Fryers (amongſt whome wee could not finde any one able to ſpeake true Latine) was builded by a Fryer of *Angra* in *Tercera*, of the ſame order, about the yeare of our Lord, 1506. The Tables in the Hall had ſeates for the oue ſide onely, and were alwayes couered, as ready at all times for dinner or ſupper.

From Wedneſday in the afternoone, at which time, we entred the Towne, vntill Saterday night we continued there, vntill the Inhabitants had agreed, and payed for the Ranſome of the Tovvne, two thouſand Ducats, moſt parte vvherof vvas Church-Plate.

Wee fonnd in the Caſtle eyght and fiftie yron peeces of Ordinance

denance, whereof three and twentie (as I remember) or more were ready mounted vpon their cariages, betweene *Barricadors* vpon a platforme towards the ſea ſide, all which Ordenaunce we tooke, and ſet the Platforme on fire, and ſo departed: My Lord hauing inuited to dinner in the *Victory* on the Sonday following, ſo many of the Inhabitants as would willingly come (ſaue onely *Diego Gomes* the Gouernour, who came but once onely to parlee about the Ranſome) onelye foure came and were well entertained, and ſolemnely diſmiſſed with ſound of Drumme and Trumpets, and a peale of Ordenance: to whom my L: deliuered his letter ſubſcribed with his owne hand, importing a requeſt to al other Engliſhmē to abſtaine from any further molleſting thē, ſaue onely for freſh water, and victualls neceſſarie for their intended voyage. During our aboade heere (*viz.* 11. Septembris) two men came out of *Pico* which hath beene priſoners there: Alſo at *Fayall* we ſet at libertie a priſoner tranſlated from S. *Iago*, who was Coſen to a ſeruant of *Don Antonio* K. of *Portugall* in England: Theſe priſoners wee deteyned with vs.

On Monday wee ſent our boates a ſhoare for freſh water, which (by reaſon of the raine that fell the former night) came plentifully running downe the hills, and would otherwiſe haue beene hard to be gotten there. On Tueſday likewiſe hauing not yet ſufficiently ſerued our turnes, wee ſent againe for freſh water, which was then not ſo eaſie to be gotten as the day before, by reaſon of a great winde: which in the afternoone increaſed alſo in ſuch ſort, that we thought it not ſafe to ride ſo neere the land; whereuppon wee weyed anker and ſo departed north-weſt & by-weſt, alongſt the coaſt of *Fayall* Iland. Some of the Inhabitants comming aboord to vs this day, told vs that alwayes about that time of the yeare ſuch windes Weſt South-weſt blew on that coaſt.

This day as we ſayled neere S. *Georges* Iland, a huge fiſh lying ſtill a little vnder water, or rather euen therewith, appeared hard by a head vs, the ſea breaking vpon his backe, which was blacke coloured, in ſuch ſort, as deeming at the firſt it had beene a rocke,

and the ſhippe ſtemming directly with him, we were put in a ſodaine feare for the time: till ſoone after wee ſawe him moue out of the way.

September. 16. in the night it lightened much, whereupon there followed great windes and rayne, which continued Sep. 17 18. 19. 20. 21. The 22. of September wee came againe into *Fayall* roade to weigh an anker which (for haſte & feare of foule weather) wee had left there before: whereto wee went a ſhoare to ſee the towne, the people (as wee thought) hauing now ſetled themſelues thereagaine: But notwithſtanding many of them, through too much diſtruſtfulnes, departed and prepared to depart with their packets at the firſt ſight of vs: vntill ſuch time as they were aſſured by my Lo: that our comming was not any way to iniure them, but eſpecially to haue freſh water, and ſome other thinges needefull for vs, contenting them for the ſame.

So then wee viewed the Towne quietly, and bought ſuch thinges as wee deſired for our mony, as if we had been in England. And they helped to fill vs in freſh water, receiuing for their paines ſuch ſatisfaction as contented them.

The 25. day wee were forced againe to depart from thence, before wee had ſufficiently watered, by reaſon of a great tempeſt that ſoddenly aroſe in the night, in ſo much, that my Lo: himſelfe ſoone after midnight rayſed our men out of their Cabines to weye anker, himſelfe alſo together with them haling at the Capſten, and after cheering them vp with wine.

The next day wee ſent out Caruell and the *Sawſie Iacke* to the roade of S. *Michaels*, to ſee what they could eſpye: We following after, came vpon the 27. day, plying to and fro, came within ſight of S. *Michaels*, but by contrarie vvindes the 28. 29. and 30. dayes vvee vvere driuen to ſeevvard, and could not get neere the Iland.

The 31. day vve ſayled alongſt *Tercera*, and euen againſt *Brasil* (a promontorie neere to *Angra* the ſtrongeſt Tovvne in that Iland) vvee eſpied ſome boates comming to the Tovvne, and made out

towardes them: but beeing neere to land they ranne to ſhoare & eſcaped vs.

In the afternoone wee came neere to *Gratioſa*, whereuppon my Lo: foorthwith ſent Captaine *Liſter* to the Ilanders, to let them vnderſtand, that his deſire was only to haue water and Wine of them, and ſome freſh victualls, and not any further to trouble them. They anſwered they could giue no reſolute anſwer to this demaund, vntil the Gouernours of the Iland had conſulted thereuppon, & therefore deſired him to ſend againe to them the next daye.

Vppon the 1. of October early in the morning, wee ſent foorth our long boate and Pinneſſe, with emptie Caſke, and about ſome 50. or 60 men together with the *Margaret*, and Captaine *Dauis* his ſhippe: For wee now wanted all the reſt of our conſorts. But when our men would haue landed, the Ilanders ſhot at them, and would not ſuffer them. And Troupes of men appeared vpō land, with ancient diſplayed to reſiſt vs: So our boates rowed alongſt the ſhoare, to finde ſome place where they might land, not with too much diſaduantage: our ſhippes and they ſtill ſhooting at the Ilāders: But no place could be found where they might land without great perill of looſing many of their liues, and ſo were conſtrained to retire without receiuing any anſwere, as was promiſed the day before. We had three men hurt in this conflict, whilſt our boats were together in conſulting what was beſt to be doone: two of thē were ſtrooken with a greate ſhot (which the Ilanders drewe from place to place with Oxen) wherwith the one loſt his hand, & the other his life within 2. or 3. dayes after: the third was ſhot into his necke with a ſmal ſhot, without any great hurt. Vvhen theſe newes our compaine returned backe againe at night, whereuppon preparation was made to goe to thē againe the next day: But the day was all ſpent before we could come neere them with our ſhip: Neither could we finde any good grownde to anchor in, where we might lye to batter the Towne, and further wee could finde no landing place without great danger to looſe many men: which might turne not only to the ouerthrow of our Voiage, but alſo put the Q. ſhip in

perill for want of men to bring her home. Therefore, my Lor thought it best to write to them to this effect: That he could not a little maruell at their inhumanity, and crueltie which they had shewed towardes his men, seeing they were sent by him vnto them in peaceable manner, to receiue their answere which they had promised to giue the day before: and that were it not for *Don Antonio* their lawfull King his sake, hee could not put vp so great iniury at their handes, without iust reuengement vpon them: Notwithstanding for *Don Antonio* his sake, whose friend he was, hee was yet content to send to them once againe for their answere: At night Captaine *Lister* returned with this answere from them. That their Gunner shot of one of their peeces, which was charged with powder onely, and was stopped: which our men, thinking it had beene shot at them, shot againe, and so began the fight: and that the next morning they would send my Lo: a resolute aunswere to his demaunde, for as yet they could not know their Gouernours minde heerein. The next morning there came vnto vs a boate from the shoare with a Flag of truce, wherin were three of the chiefe men of the Iland, who agreed with my Lo: that hee should haue of th 60. Buttes of wine, and fresh victualls to refresh himselfe and h companie withall: But as for fresh water, they could not satisfie our need therein, hauing themselues little or none, sauing such as they saued in vessells or Cisternes when it rayned, and that they had rather giue vs two Tunnes of wine, then one of water: But they requested that our Souldiers might not come on shoare, for they themselues would bring all they had promised to the waterside, which request was graunted, we keeping one of them aboord with vs, vntill their promise was performed, and the other we sent to shoare with our emptie Caske, and some of our men to helpe to fill, and bring them away with such other prouision as was promised: So the *Margaret*, Captaine *Dauis* his ship, and another of *Waymouth* stayed ryding at anker before the Towne, to take in our prouision. This shippe of *Waymouth* came to vs the day before, & had taken a rich Prize (as it was reported) woorth sixteene thousand pound, which brought newes that the *West-Indian* Fleete was not yet come, but would come verie shortly. But wee with the *Victory* put of to sea: And vpon Saturday the fourth of October, wee tooke a French ship of *S. Maloes* (a Citye of the vnholy league) loden with fish from *New-found-land*: which had beene in so great a tempest, that shee was constrayned to cut her maine mast ouerboord for her safetie, and was now comming to *Graciosa*, to repaire her selfe. But so hardly it befell her, that she did not onely not repaire her former losses, but lost al that remained vnto vs. The chiefe of her men wee tooke into our shippe, and sent some of our men Mariners, and Souldiers into her to bring her into England.

Vppon the Sonday following at night, all our promised prouision was brought vnto vs from *Gratiosa*: And we friendly dismissed the Ilanders with a [redacted] peale of Ordenance.

Vpon Monday, Tuesday, and Wednesday, wee plyed to and fro [redacted] about those Ilandes, beeing verie rough weather. And vpon Thursday at night, beeing driuē some three or foure leagues from *Tercera*, wee sawe 15. sayle of the *West-Indian* Fleete comming into the Hauen at *Angra* in *Tercera*. But the winde was such, that for the space of foure dayes after, though wee lay as close by the winde as was possible, yet wee could not come neere them. In this time we lost our late French prize, not beeing able to lye so neere the winde, as wee, and heard no more of her, till wee came to England, where shee safely arriued. Vpon Monday wee came very neere the Hauen mouth, beeing minded to haue runne in amongst them, and to haue fetched out some of them, if it had been possible: But in the end this enterprize was deemed too daungerous: considering the strength of the place where they rode, beeing haled and towed in neerer the towne, at the first sight of our approching, and lying vnder the protection of the Castle of *Brasill*, on the one side (hauing in it fiue and twentie peeces of Ordenance) and a Fort on the other side, wherein were 13. or 14. great Brasse peeces. Besides, when wee came neere land, the winde proued too scant for vs, to attempt any such enterprise.

Vpon

Vpon Tuesday (14. Octob.) we sent our boate to the roade, to sound the depth, to see if there were any anchoring place for vs, where wee might lye without shot of the Castle and Fort, & within shot of some of those shippes, that wee might either make them come out to vs, or sinke them where they lay. Our boate returned hauing found out such a place as wee desired, but the winde would not suffer vs to come neere it, and againe if we could haue anchored there, it was thought likely that they would rather run themselues a grownd, to saue their liues and liberties, and some of their goodes, then come foorth to loose their liberties and goodes to vs their enemies. So wee shot at them to see if wee could reach them, but it fell farre short. And thus wee departed, thinking it not probable, that they would come foorth so long as wee watched for them before the hauen mouth, or with in sight of them. For the space of 5. daies after wee put of to sea, & lay without sight of them, & set a Pinnesse to lye out of sight, close by the shore, to bring vs word if they should come foorth. After a while the Pinnesse returned, and told vs that those ships in the hauen, had taken downe their sayles, and let downe their toppe maste: so that wee supposed they would neuer come forth, till they perceiued vs to be quite gone.

Wherefore vpon the 20. of October, hearing that there were certaine Scottish shippes at S. *Michael's*, wee sayled thither, and found there one scottish roader, and two or three more at *Villa Franca*, the next road, a league or two from the towne of S. *Michaels*, to the East wardes: of whome wee had for our reliefe some small quantitie of Wine (*viz.* some fiue or six buttes of them all) and some fresh water, but nothing sufficient to serue our turne.

Vppon Tuesday the one and twentieth of October, wee sent our long boate to shoare for fresh water at a brooke a little to the Westwardes from *Villa Franca*.

But the Inhabitants espying vs, came downe with two Ancients displayed, and about some hundred and fiftie men armed to withstand our landing. So they hauing spent all their powder vpon

pon them in attempting to land, and not beeing able to preuaile at so great oddes, returned frustrate.

From hence wee departed towardes S. *Marres* Iland, minding to water there, and then to goe for the coaste of Spaine. For wee had intelligence that it was a place of no great force, and that wee might water there very well; Therefore vpon Fryday following my Lord sent Captaine *Lister*, and Captaine *Amias Preston*, now Sir *Amias Preston* (who not long before came to vs out of his owne shippe, and shee loosing vs in the night, hee was forced to tarry still with vs) with our long boate and Pinnesse, and some sixtie or seuentie shot in them, both with a friendly letter to the Ilanders, that they would graunt vs leaue to water, and wee would no further trouble them.

So wee departed from the *Victory* for the Iland, about nine a clocke in the forenoone, and rowed freshly vntill about 3 a clocke afternoone. At which time our men beeing something wearye with rowing, and beeing within a league or two of the shoare, and 4. or 5. leagues from the *Victory*, they espyed (to their refreshing) two shippes ryding at Ankor hard vnder the Towne, whereupon hauing shifted some 6. or 7. of our men into Captaine *Dauis* his boate, beeing too much pestered in our owne, and retayning with vs some twentie shot in the Pinnesse, wee made way towardes them with all the speede wee could.

By the way as we rowed we sawe boates passing betwixt the roaders and the shoare, and men in their shirtes swimming & wading to shoare (who as wee perceiued afterwardes) were labouring to set those shippes fast on grownd, and the Inhabitants as busiely preparing themselues for the defence of those roaders, their Iland, and themselues. When vvee came neere them, Cap. *Lister* commanded the Trumpets to bee sounded, but prohibited any shot to be discharged at them, vntill they had direction from him: But some of the company, either not vvell perceiuing, or regarding vvhat hee sayd, immediately vppon the founde of the Trumpettes discharged their Peeces at the Ilanders,

vvhich

which for the moſt parte lay in trenches, and fortified places vnſeene to their owne beſt aduantage: who immediately ſhot likewiſe at vs, both with ſmall and great ſhot, without danger to theſelues: Notwithſtading Captaine *Lifter* earneſtly haſtened forward the Saylers that rowed, who began to ſhrinke at the ſhot, flying ſo faſt about their eares, and himſelfe firſt entring one of the ſhippes that lay a little further from ſhoare, then the other, wee ſpeedely followed after him into her, ſtill plying them with our ſhotte. And hauing cut in ſunder their Cables, and Haucers, towed her away with our Pinneſſe. In the meane time Captayne *Danis* his boate ouertooke vs, and entred into the other ſhippe, which alſo (as the former) was forſaken by all her men: But they were conſtrained to leaue her & to come againe into their boate (whilſt ſhot & ſtones from ſhoare flewe faſt amongſt them) finding her to ſticke ſo faſte a grownde, that they could not ſtirre her: which the Townesmen alſo perceiuing, and ſeeing that they were but fewe in number: & vs (buſied about the other ſhip) not comming to ayde them, were preparing to haue come and taken them. But they returned vnto vs, and ſo together wee came away towards the *Villoy*, towing after vs the prize we had now taken, which was lately come from *Braſile*, loden with Sugar.

In this fight we had two men ſlaine, and 16. wounded: And as for them, it is like they had little hurt, lying for the moſt parte behinde ſtone walles, which were builded one aboue another hard by the ſea ſide, vpon the end of the hill whereuppon the Towne ſtoode, betwixt two valleyes. Vpon the toppe of the hill lay their great Ordenance (ſuch as they had) wherewith they ſhotte leaden bullets, whereof one pearced through our Prizes ſide, and lay ſtill in the ſhippe without doing any more harme.

The next day we went againe for water to the ſame Iland, but not knowing before the inconuenience and diſaduantage of the place where wee attempted to land, we returned fruſtrate.

The ſame night Octob. 24. wee departed for S. *Georges* Iland for freſh water, whither we came on Monday following Octob. 27. and

and hauing eſpyed where a ſpout of water came running downe the pinneſſe and long boate were preſently manned, & ſent vnder the conduct of Captaine *Preſton*, and Captaine *Mounſon*, by whom my Lo: ſent a letter to the Ilanders as before, to graunt vs leaue to water onely, and wee would no further trouble the, notwithſtanding our men comming on ſhoare, found ſome of the poore Ilanders which for feare of vs hid themſelues amongſt the rockes.

And on Wedneſday following our boates returned with freſh water, whereof they brought onely 6. Tunnes for the *Victory*, alledging they could get no more, thinking (as it was ſuppoſed) that my Lo: hauing no more prouiſion of water and wine, but only 12. Tunnes, would not goe for the coaſt of Spaine, but ſtraight for the coaſt of England, as many of our men greatly deſired: notwithſtanding my Lo: was vnwilling ſo to do, and was minded the next day to haue taken in more water: but through roughnes of the ſeas and winde, and vnwillingnes of his men it was not done. Yet my Lo: purpoſed not to returne with ſo much prouiſion vnſpent: and his voyage (as hee thought) not yet performed in ſuch ſort as mought giue ſome reaſonable contentment or ſatiſfaction to himſelfe and others.

Therefore becauſe no more water could now conueniently bee gotten, and beeing vncertaine when it could bee gotten, and the time of our ſtaying abroad alſo vncertaine, the matter beeing referred to the choyce of the whole companie, whither they would tarrie longer, till wee might be more ſufficiently prouided of freſh water, or goe by the coaſt of Spaine for England, with halfe ſo much allowance of drinke as before, they willingly agreed, that euery meaſe ſhould bee allowed at one meale but halfe ſo much drinke as they were accuſtomed (except them that were ſicke or wounded) and ſo to goe for England, taking the coaſt of Spaine in our way, to ſee if wee could that way make vp our voyage.

Vpon Saturday Octob. 31. wee ſent the *Margaret* (becauſe ſhe leaked much) directly for England: togither with the Prize of *Braſile*, which wee toke at S. *Marks*, and in them ſome of our hurt &

 woun-

wounded men or otherwiſe ſicke, were ſent home, as they deſired, for England.

But we held on our courſe for the coaſt of *Spaine*, with a faire winde and a large (which before we ſeldome had). And vpō Tueſday following (Nouemb. 4. wee eſpied a Sayle right before vs, which wee chaſed till about three a clocke in the afternoone: at which time, we ouertaking her, ſhee ſtrooke ſayle, and being demanded who was her Owner, and from whence ſhee was, they anſwered a *Portugall*, and from *Farnanbucke* in *Braſile*. She was a ſhip of ſome 110. Tunnes burden fraughted with 410. cheſtes of Sugar, and 50. Kintalles of Braſill-wood, euerie Kintall conteyning 100. pound weight: wee tooke her in Lat. 29. degr. about 200. leagues frō *Liſbone* weſtwardes. Captaine *Preſton* was preſently ſent vnto her, who brought the principalleſt of her men aboord the *Victory*, and certaine of our men Mariners and Souldiers were ſent aboord her. The *Portugalls* of this prize tould vs that they ſawe another ſhippe before them that day about noone: Hauing therefore diſpatched all things about the prize aforeſaid, and left our long boate with Captaine *Dauis*, taking his leſſer boate with vs, wee made way after this other ſhip with all the ſayles wee could beare, holding on our courſe due Eaſt, and giuing order to Captaine *Dauis* his ſhippe, and the prize that they ſhould follow vs due Eaſt, and that if they had ſight of vs the morning following they ſhould follow vs ſtill: if not, they ſhould goe for England.

The next morning wee eſpied not the ſayle which wee chaſed, and Captaine *Dauis* his ſhip & the Prize were behinde vs out of ſight. But the next Thurſday Nouemb. 6. (being in Latitude 38. degrees 30. and about ſome 60. leagues from *Liſbone* weſtwardes early in the morning Captaine *Preſton* deſcried a ſayle ſome two or three leagues a head vs, after which wee preſently haſtened our chaſe, and ouertooke her about 8. or 9. of the clocke before noone. She came lately from S. *Michaels* roade, hauing beene before at *Braſill* loden with Sugar and *Braſill*. Hauing ſent our boate to them to bring ſome of the chiefe of their men aboord the *Victory* in the meane

meane time whileſt they were in coming to vs, one out of the mayne top eſpied another ſayle a head, ſome three or foure leagues from vs. So immediately vpon the returne of our boate, hauing ſent her backe againe with ſome of our men aboord the prize, wee purſued ſpeedily this new chaſe, with all the ſayles wee could packe on, & about two a clocke afternoone ouertooke her: Shee had made prouiſion to fight with vs, hauing hanged the ſides of the ſhip ſo thicke with hides (wherewith eſpecially ſhe was loden) that Mulket ſhot could not haue pearced them: but care wee had diſcharged two great peaces of our Ordanance at her, ſhee ſtrooke ſayle, and approching neerer, we asking whence they were, they anſwered from the *Weſt-Indies*, from *Mexico*, and S. *Iohn de* ■ *Leone* (truely called *Vthna*). This ſhippe was of ſome three or foure hundred Tunnes, and had in her ſeuen hundred hides, woorth 10 ſhillings a peece: ſix Cheſtes of Cutchinell, euery Cheſt houlding one hundred pound weight, and euery pound woorth ſix and twentie ſhillings 8. pence, and certaine Cheſtes of Sugar & *China* diſhes, with ſome plate and ſiluer.

The Captaine of her was an *Italian*, and by his behauiour ſeemed to bee a graue, wiſe, and ciuile man: he had put in aduenture in this ſhip fiue and twentie thouſand Ducats. Wee tooke him with certaine other of her chiefeſt men (which were Spaniardes) into the *Victory*: And Captaine *Liſter* with ſo many other of the chiefeſt of our Mariners, Souldiers, & Saylours, as were thought ſufficient, to the number of twentie or there abouts, were ſent into her. In the meanetime (wee ſtaying) our other Prizes which followed after, came vp to vs. And now wee had our hands full: and with ioy ſhaped our courſe for England, for ſo it was thought meeteſt, hauing now ſo many Portugalls, Spaniards, & Frenchmē amongſt vs, that if we ſhould haue taken any more prizes afterwards, we had not been wel able to haue mānēd them without endangering our ſelues. So about ſix of the clocke in the afternoone. (when our other Prizes had ouertaken vs) wee ſet ſayle for England. But oure prizes not beeing able to beare vs companie without ſparing them many of our ſayles which cauſed our ſhip to rowle &

wallow in ſuch ſort that it was not onely very troubleſome to vs, but, as it was thought, would alſo haue put the maine maſt in danger of falling ouerboord: hauing acquainted them with theſe inconueniences, wee gaue them direction to keepe their courſes togither following vs, and ſo to come to *Portſmouth*. Wee tooke this laſt Prize in the Latitude of 39 degrees, & about 46. leagues to the Weſtwardes from the rocke.

She was one of thoſe ſixteene ſhippes which we ſawe going into the Hauen at *Angra* in *Tercera*, Octo 8. Some of the men that we tooke out of her tould vs that whileſt wee were plying vp and downe before that hauen, as before was ſhewed, expecting the comming foorth of thoſe ſhippes: Thre of the greateſt and beſt of them, at the appointment of the Gouernour of *Tercera*, were vnloden of their treaſure & marchandiſe. And in euery of them were put three hundred Souldiers, which were appointed to haue come to lay the *Victory* aboorde in the night, and take her: But when this ſhould haue beene done the *Victory* was gone out of their ſight.

Now wee went merrely before the winde with all the ſayles wee could beare, in ſo much that in the ſpace of 24. houres, wee ſayled neere ſeuen and fortie leagues, that is ſeuenteene Engliſh myles, betwixt Fryday at noone & Saturday at noone (notwithſtanding the ſhippe was verie foule, and much growne with long being at ſea) which cauſed ſome of our companie to make accompt they would ſee what running at tilt there ſhould bee at Whitehall vpon the Qu. day. Others were imagining what a Chriſtmas they would keepe in England with their ſhares of the Prizes wee had taken. But ſo it befell, that wee kept a could Chriſtmas with the Biſhop and his clarkes (rockes that lye to the Weſtwards from *Silly*, and the weſterne parres of England) For ſoone after the wind ſcanting, came about to the Eaſtwardes (the worſt parte of the heauens for vs, from which the winde could blow) in ſuch ſort, that wee could not ſetch any part of England. And heereuppon alſo our allowance of drinke (which was ſcant inough before) was yet more

more ſcantened, becauſe of the ſcarcitie thereof in the ſhip. So that now a man was allowed but halfe a pinte at a meale, and that many times cold water, and ſcarce ſweete. Notwithſtanding this was an happie eſtate in compariſon of that which followed. For from halfe a pinte wee came to a quarter, & that laſted not long neither, ſo that by reaſon of this great ſcarcitie of drinke, and contrarietie of winde, wee thought to put into *Ireland*, there to relieue our wants. But when wee came neere thither, lying at *Hull* all night (tarrying for the daylight of the next morning, whereby we might the ſafelyer bring our ſhippe into ſome conuenient Harbour there) wee were driuen ſo farre to leewardes, that wee could fetch no part of Ireland, ſo as with heauie hearts and ſad cheare, wee were conſtreined to returne backe againe, and expect till it ſhould pleaſe God to ſend vs a faire winde either for England or Ireland. In the meane time wee were allowed euery man three or foure ſpoones full of Vineger to drinke at a meale, for other drinke we had none ſauing onely at two or three meales, when wee had inſteede heerof as much wine, which was wringed out of the Wine-lees that remained. With this hard fare (for by reaſon of our great want of drinke, wee durſt eate but very little) wee continued for the ſpace of a fourtnight or thereaboutes: Sauing that now and then we feaſted for it in the meane time: And that was when there fell any hayle or raine: The Haile-ſtones wee gathered vp & did eate thē more pleaſantly then if they had beene the ſweeteſt Comfits in the vvorld; The Raine-drops vvere ſo carefully ſaued, that ſo neere as vve could, not one vvas loſt in all our ſhippe. Some hanged vp ſheetes tyed vvith cordes by the foure corners, and a vveight in the midſt, that the vvater might runne dovvne thither, and ſo bee receiued into ſome veſſell ſet or hanged vnderneth: Some that vvanted ſheetes, hanged vp napkens, and clouts, and vvatched thē till they vvere thorow vvet then vvringing and ſucking out the vvater. And that vvater vvhich fell dovvne and waſhed away the filthe and ſoyling of the Ship, trod vnder foote, as bad as runneth dovvn: the kennell many times vvhen it rayneth, vvas not

loſt I warrant you, but watched and attended carefully (yea ſometimes with ſtriſe and contention) at euery ſcup-hole & other place where it ranne downe, with diſhes, pots, cannes, & Iarres, whereof ſome drunke harty drawghtes euen as it was, mud and all, without tarrying to cleanſe or ſettle it. Others cleſed it firſt, but not ofte, for it was ſo thicke & went ſo ſlowly thorow, that they mought ill endure to tarry ſo long, and were loath to looſe too much of ſuch pretious ſtuffe: ſome licked with their tongues (like dogges) the boardes vnder feete, the ſides, rayles, and Maſts of the ſhippe: others that were more ingenious, faſtened girdles or ropes about the Maſts, dawbing tallow betwixt them and the maſt (that the raine might not runne downe betweene) in ſuch ſort, that thoſe ropes or girdles hanging lower on the one ſide then on the other, a ſpout of leather was faſtened to the loweſt part of them, that all the rayne drops that came running downe the maſt, might meete togither at that place, and there bee receiued.

He that got a canne of water by theſe meanes, was ſpoken of, ſued to, and enuyed as a rich man. *Quam pulchrum digito monſtrari & dicier hic eſt.* Some of the poore Spaniards that wee had taken (who notwithſtanding had the ſame allowance that our owne men had) would come and craue of vs for the loue of God, but ſo much water as they could hould in the hollow of their hand: and they had it, notwithſtanding our great extremite, to teach them ſome humanity in ſteade of their accuſtomed barbarity, both to vs and other nations heeretofore. They put alſo bullets of leade into their mouthes to ſlake their thirſt.

Now in euery corner of the ſhippe were heard the lamentable cries of ſicke & wounded men ſounding woefully in our eares, crying out and pittifully complaining for want of drinke; beeing ready to dye, yea many dying for lacke thereof, ſo as by reaſon of this great extremity wee loſt many more men, then wee had done all the voyage before: hauing before this time beene ſo well and ſufficiently prouided for, that wee liued in manner as well and healthfully,

healthfully, and dyed as ſewe as if wee had beene in England, whereas now lightly euery day ſome were caſt ouerboord.

But the ſecond daye of Decemb. 1589 was a feaſtiuall day with vs, for then it rayned a good pace, and wee ſaued ſome pretty ſtore of rayne water (though wee were well wet for it, and that at midnight) and filled our ſkinnes full beſides: notwithſtanding it were muddy and bitter with waſhing the ſhippe, but (with ſome ſugar which we had to ſweeten it withall) it went merrily downe, yet remembred wee and wiſhed for with all our hearts, many a Conduit, Pumpe, Spring, and ſtreame of cleare ſweete running water in England: For how ſoeuer miſerable we had accounpted ſome poore ſoules whome wee had ſeene driuen for thirſt to drinke therof, yet now happie we would haue thought our ſelues if we might haue had our fills of the ſame: yet ſhould wee haue fared the better with this our poore feaſting, if wee might haue had our meate and drinke (ſuch and ſo much as it was) ſtand quietlye before vs, but beſide all the former extremities, wee were ſo toſſed & turmoyled with ſuch horrible ſtormy & tempeſteous weather, that euery man had beſt hould faſt his Canne, Cup, & Diſh in his handes, yea & himſelfe too many times, by the ropes, railes, or ſides of the ſhippe, or elſe hee ſhould ſoone finde all vnder feete.

Heerewith our maine ſayle was torne from the yarde and blowne ouerboorde quite away into the ſea without recouerye, and our other ſayles to rent and torne (from ſide to ſide of them) that hardly any of them eſcaped hole. The raging waues and ſoming ſurges of the ſea came rowling like mountaines one after another, and ouerraked the waſt of the ſhippe like a mighty riuer running ouer it, wheras in faire weather it was neere 20. foote aboue the water, that now we might well crie out with the Poet.

Heu miſero quanti montes voluntur aquarum,
Iam iam taſturos lydera ſumma putes.
Heu miſero quanti ſubſidunt æquore valles,
Iam iam tacturas tartara nigra putes.

Yea

Yea rather with the Princely Prophet *Pſalm.* 107. Vers. 26 *They mount vp to heauen, and deſcend to the deepe, ſo that their ſoule melteth away for trouble: they reele to and fro, and ſtagger like a drunken man, and all their cunning is gone.* With this extremitie of foule weather the ſhippe was ſo toſſed and ſhaken, that by the craking noyſe it made, and by the leaking which was now much more then ordinary, wee were in great feare it would haue ſhaken in ſunder, ſo that now alſo we had iuſt cauſe to pray a little otherwiſe then the Poet, though marring the Verſe, yet mending the meaning.

Deus maris & Cæli, quid enim niſi vota ſuperſunt,
Soluere quaſſatæ parcite membra ratis.

Notwithſtanding it pleaſed God of his greate goodnes to deliuer vs out of this danger. Then forthwith a new maine ſayle was made and faſtened to the yard, & the reſt repayred as time & place would ſuffer, which wee had no ſooner done, but yet againe wee were troubled with as greate extreamitie as before, ſo that againe wee were like to haue loſt our newe maine ſayle, had not Maiſter *William Antony* the Maiſter of the Shippe himſelfe (when none els would or durſt) ventured with danger of drowning by creeping along vppon the maine yarde (which was let downe cloſe by the rayles) to gather it vp out of the ſea, and to faſten it thereto, being in the meane while oft times ducked ouer head and eares into the ſea.

Theſe ſtormes were ſo terrible, that there were ſome in our companie, which confeſſed they had gone to ſeas for the ſpace of twentie yeares, and had neuer ſeene the like, and vowed that if euer they returned ſafe home, they would neuer come to Sea againe.

The laſt of Nouember at night wee met with an Engliſh ſhip, out of which (becauſe it was too late that night) it was agreed that we ſhould haue had the next morning twoo or three Tunnes of wine, which, as they ſaid, was al the prouiſion of drinke they had, haue

haue onely a butte or two, which they muſt needes reſerue for their owne vſe: but after that, wee heard of them no more, till they were ſet on grownd vpon the coaſt of Ireland, where it appeared that they might haue ſpared vs much more then they pretended they could, ſo as they might well haue relieued our great neceſſities, and haue had ſufficient for themſelues beſides, to bring them into England.

The firſt of December at night wee ſpoke with an other Engliſh ſhippe, and had ſome beere out of her, but not ſufficient to carry vs into England, ſo that wee were conſtrained to put into Ireland, the winde ſo ſeruing.

The next day wee came to an anker, not farre from the S*helmes* vnder the land and winde, where we were ſomewhat more quiet, but (that beeing no ſafe harbour to ride in) the next morning we went about to weigh anker, but hauing ſome of our men hurte at the Capſten, wee were faine to giue ouer and leaue it behinde, holding on our courſe to *Ventre* hauen, where wee ſafely arryued the ſame day; that place beeing a very ſafe & conuenient harbour for vs, that now wee might ſing as wee had iuſt cauſe, *They that goe downe to the ſea, &c.*

So ſoone as wee had anchored heere my Lord went forthwith to ſhoare, and brought in preſently freſh water and freſh victualls, as Muttons, Pigges, Hennes, &c. to refreſh his company withall. Notwithſtanding himſelfe had lately beene very weake, and taſted of the ſame extremitye that his company did: For in the time of our former want, hauing a little freſh water left him remaining in a pot, in the night it was broken, and the water drunke and dryed vppe. Soone after the ſicke and wounded men were carryed to the next principall Towne, called *Dingleacuſh*, beeing about three myles diſtant from the foreſaid hauen, wher our ſhippe roade, to the Eaſtwardes, that there they might bee the better refreſhed, and had the Chirurgians daylye to attend vpon them. Heere wee well refreſhed our ſelues whileſt the Iriſh Harpe ſounded ſweetelye in our eare, and heere we who for the former extremities, were in mar-

nere halfe deade, had our liues (as it were) reſtored vnto vs againe.

This *Dingleacuſh* is the chiefe Towne in all that part of Ireland, it conſiſteth but of one mayne ſtreete, from whence ſome ſmaller doe proceede. On eyther ſide it hath had Gates (as it ſeemeth) in times paſt at eyther end to open and ſhut as a Towne of warre, & a Caſtle alſo. The houſes are very ſtrongly built with thicke ſtone walles, and narrow windowes like vnto Caſtells, for as they confeſſed, in time of trouble, by reaſon of the wild Iriſh or otherwiſe, they vſed their houſes for their defence as Caſtells. The Caſtle & all the houſes in the Towne, ſaue foure, were woone, burnt, and ruinated by the Earle of *Deſmond*. Theſe foure houſes fortifyed themſelues againſt him, and withſtoode him and all his power perforce, ſo as he could not winne them.

There remayneth yet a thicke ſtone wall that paſſeth ouerthwart the midſt of the ſtreete which was a parte of their fortification. Notwithſtanding whileſt they thus defended themſelues, as ſome of them yet aliue, confeſſed, they were driuen to as greate extremities as the Iewes, beſieged by *Tytus* the Romaine Emperour, in ſo much that they were conſtrained to eate deade mens carcaſes for hunger. The towne is againe ſomewhat repayred, but in effect there remaine but the ruines of the former towne. Commonlye they haue no Chimnies in their houſes, excepting them of the better ſorte, ſo that the ſmoke was very troubleſome to vs, whilſt wee continued there. Their Fewell is Turfes, which they haue very good, and whinnes or furres. There groweth little Wood thereaboutes, which maketh building chargeable there: as alſo want of lime (as they reported) which they are faine to fetch from farre, when they haue neede thereof. But of ſtones there is ſtore ynough, ſo that with them they commonly make their hedges to part each mans grownd from other, and the grownde ſeemeth to bee nothing elſe within but rockes and ſtones: Yet it is very fruitfull and plentifull of graſſe, and graine, as maye appeare by the aboundance of Kine and Cattell there: in ſo much that we had good muttons (though ſomewhat leſſe then ours in England) for two ſhil-

lings or fiue groates a peece, good pigges and hennes for three pence a peece.

The greateſt want is induſtrious, painefull, and huſbandlye Inhabitants to till and trimme the grownde: for the common ſort, if they can prouide ſufficient to ſerue from hand to mouth, take no further care.

Of money (as it ſeemeth) there is very ſmall ſtore amongſt them, which perhaps was the cauſe that made them double and tryple the prizes of many things wee bought of them, more then they were before our comming thither.

Good land was heere to bee had for foure pence the *Acre* yearlye rent. There are Mines of Allome, Tinne, Braſſe, and Iron. Stones we ſawe there as cleare as Chriſtall, naturally ſquared like Diamonds.

That parte of the country is all full of greate *Mountaines* and Hills, from whence came running downe the pleaſant ſtreames of ſweete freſh running water. The naturall hardnes of that nation appeareth in this, that their ſmall children runne vſually in the midſt of winter vp & downe the ſtreetes barefoote & bare egged, with no other apparell (many times) ſaue onely a mantell to couer their nakednes.

The chiefe Officer of their Towne they call their Soueraigne, who hath the ſame office and authority among them that our Maiors haue with vs in England, and hath his Sergeants to attend vpon him, and beare the Mace before him as our Maiors.

We were firſt entertained at the Soueraignes houſe, which was one of thoſe foure that withſtood the Earle of *Deſmond* in his rebellion. They haue the ſame forme of common prayer word for word in Latin, that we haue here in England. Vpon the Sonday the Soueraigne cometh into the church with his Sergeant before him, & the Sheriffe and others of the Towne accompany him, and there they kneele downe euery man by himſelfe priuately to make his prayers. After this they riſe and goe out of the Church againe to drinke, which being done, they returne againe into the Church, and then the Miniſter beginneth prayers.

Their manner of baptising differeth something from ours: part of the seruice belonging thereto is repeated in Latin, and part in Irish. The Minister taketh the childe in his hãds, and first dippeth it backewardes, and then forwardes, ouer head and eares into the could water in the midst of winter, whereby also may appeare their naturall hardnes, (as before was specifyed.) They had neither Bell, Drumme, nor Trumpet, to call the Parishioners together, but they expect till their Soueraigne come, and then they that haue any deuotion follow him.

They make their bread all in cakes, and, for the tenth part, the Bakers baketh for all the Towne.

Wee had of them some 10. or 11. Tunnes of beere for the *Victory*, but it proued like a present Purgation to them that tooke it, so that wee chose rather to drinke water then it.

The 20. of Decemb. we loosed from hence, hauing wel prouided our selues of fresh water, and other thinges necessary, being accompanyed with Sir *Edward Denny*, his Lady, and two young Sonnes.

This day in the morning, my Lord going a shoare to dispatch away speedily some fresh water that remayned for the *Victory*, the winde beeing very faire for vs, brought vs newes that there were 60. Spanish prizes taken and brought to England. For two or three dayes wee had a faire winde, but afterwards it scanted so, that (as I said before) wee were faine to keepe a cold Christmas with the Bishop and his Clarkes.

After this wee met with an English ship, that brought vs ioyfull newes of 91. Spanish prizes that were come to England: and sorrowfull newes withall, that the last and best Prize wee tooke, had suffred shipwrack at a place vpon the coast of *Cornwale* which the Cornish men call *Als Efarra*, that is Hell-Cliffe, and that Captaine *Lister* and all the men in the ship were drowned, saue fiue or sixe, the one halfe English, the other Spanish that saued themselues with swimming: But notwithstanding much of the goods were saued, & reserued for vs, by Sir *Francis Godolphin*, & the W... Gentlemen of the country there.

My

B.2.

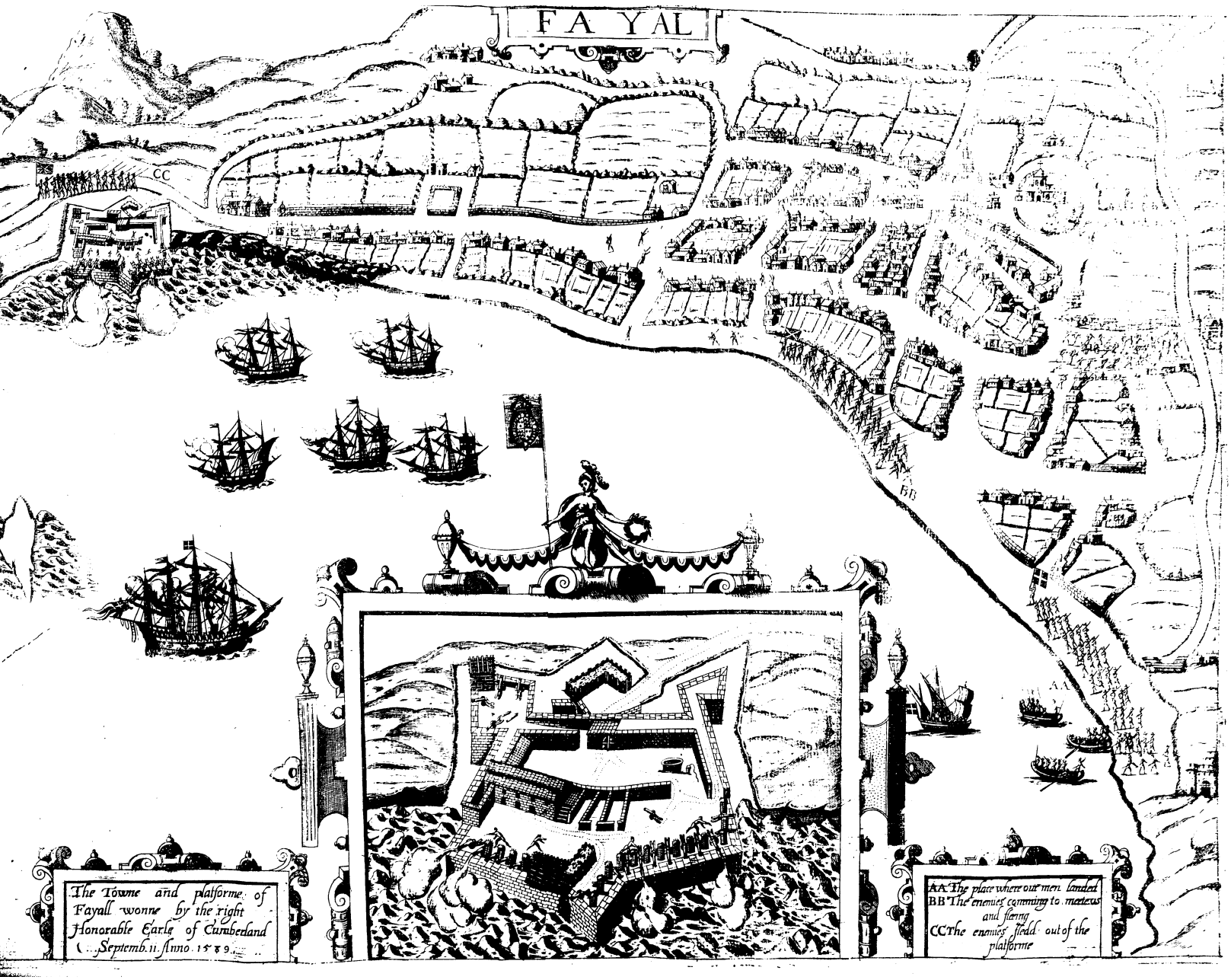
My Lord was very sorry for Captaine *Listers* death, wishing that hee had lost his voyage to haue saued his life.

The 29. of Decemb. we met with another shippe, that tould vs the same newes, and that Sir *Martyn Frobisher*, and Captaine *Reymond* had take the Admirall and Vice-Admirall of the Fleete that wee espyed going to *Tercera* hauen. But the Admiral was sunke with much leaking, neere to the *Iddy Stone*, a rocke that lyeth ouer against *Plimmouth* sound, and the men were saued.

This ship also certifyed vs that Captaine *Prestons* ship had taken a Price laden with siluer. My Lo: entred presently into this ship, and went to *Falmouth*, and we held on our course for *Plimmouth*. At night wee came neere to the *Ram Head* (the next Cape Westwards from *Plimmouth* sound) but we were afraide to double it in the night, misdoubting the scantnes of the winde. So wee stoode of to sea halfe the night, and towardes morning had the winde more large, and made too little spare thereof, that partlye for this cause, and partly through mistaking of the land, wee were driuen so much to leewards, that we could not double that Cape: Therfore we returned backe againe, and came into *Falmouth* hauen, where we struck on grownd in seuenteene foote water: But it was a low ebbe, and ready againe to flow, and the grownde softe, so as no hurt was done. Heere with gladnes we tooke once againe vpon the English grownd (long desired) and refreshed our selues with keeping part of Christmas vpon our natiue soyle.

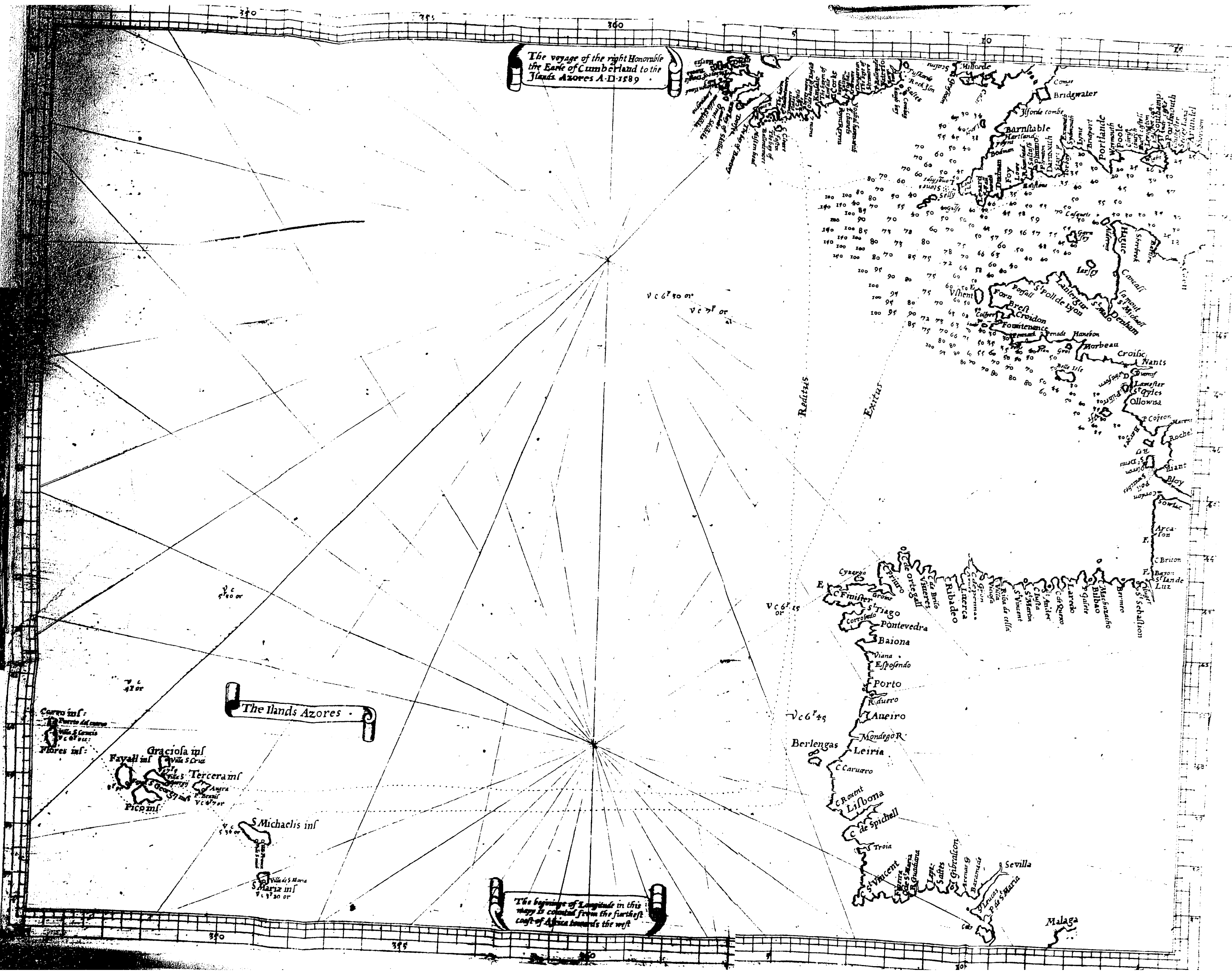
Faultes escaped in the E. of Cumb. voiage.

Page.	*Line.*	*Fault.*	*Correction.*
8.	34.	the Castle,	the platforme.
16.	9.	their,	hir.
19.	13.	vthna,	vlhua.
22.	2.	scup-hole,	scupper hole.
23.	11.	for howsoeuer,	and how.
	13.	yet now happy we would,	& how happy we would now.
	25.	side of,	side some of,
24.	20.	close by,	close to.
26.	4.	proceed. On either side it,	proceed on either side. It
28.	30.	Als, Eferra,	Als Efferne.
¶ 2.	28.	Kundstrop,	Knudstrop.
¶¶ 2.	24.	was,	would be.
¶¶¶ 4.	8.	ouertaken,	vndertaken.



The Towne and platforme of Fayall wonne by the right Honorable Earle of Cumberland (...) Septemb. 11. Anno. 1589.

AA The place where our men landed
BB The enemies comming to meete us and flieing
CC The enemies fledd out of the platforme


The voyage of the right Honorable the Earle of Cumberland to the Ilands Azores A·D·1589
The Ilands Azores
The beginnige of Longitude in this mapp is counted from the furthest coast of Africa towards the west
Corvo insl
Flores insl
Graciosa insl
Fayall insl
Tercera insl
Angra
Pico insl
S Michaelis insl
S Maria insl
Reditus
Exitus
Berlengas
C Finister
S Tiago
Pontevedra
Baiona
Viana
Esposendo
Porto
R duero
Aueiro
Mondego R
Leiria
C Carvaero
C Rocent
Lisbona
C de Spichell
Troia
S Vincent
S Gibraltar
Sevilla
Malaga
Ribadeo
Bilbao
Laredo
S Sebastion
S Iande Luz
Bayon
C Briton
Arcason
Bloy
Rochel
Olowna
Hants
Croisic
Morbeau
Brest
Croidon
Fountenance
Vshent
Lanlergar
S Poll de Lyon
Cancall
Hague
Iarsey
Barnstable
Hartland
Bridgwater
Milforde
Portlande
Poole
Weymouth
Portsmouth
Arundel
Bridport
Lyme
Dartmouth
Plimmouth
Foy
Silly
Corke

The meridians in this Chart are many where equidistant: yet in all places, we kept the same proportion of Longitude, and latitude, that is in the globe: the degrees of latitude, increasing in the same proportion, wherewith the parallels, and consequently the degrees of longitude decrease in the globe: so as in the longitudes, latitudes, courses, and distances of all places, this Chart agreeth with the globe. It was thought more reasonable, to begin the longitude from the westermost part of the mane continent of Africa, Asia, and Europe, then from any small Ilands, as the Canaries, or the Azores, especially seeing those reasons faile, which moued Ptolomee, and Mercator to begin their account from hence: whereof the one knew no land more westerly then the Canaries: the other thought that the true and magneticall meridian agreed in one at the Azores only.

The difference of longitude betweene the Rocke and S Michaels, we make to be about XV degr. agreeable to the often experience of English Nauigators, who (for the most part) haue made the distance betwixt those places, to be about two hundred and thirty. English leagues, though some would haue that distance to be lesse. But they may easily erre half a score leagues in a hundred, because the way of finding distances from east to west at sea is for the most part coniecturall, in estimating how much way the ship maketh in a day. The latitudes and courses of the Ilands Azores each from other, we obserued as followeth: The latitude of S Cruze in Flores 39 degr. 52 mm. The latitude of Fayall towne, 38 degr. 54 min The latitude of Grahosa 39 degr. 35 min. The latitude of Tercera, 38 degr. 45 mm The latitude of S Maries Iland 37 degr. 15 mm The latitude of S Michaels, 38 degr. The latitude of Dmalracush in Ireland, 52 degr. 12 mm The course from the easternmost part of Grahosa to Pico, is Southwest and by South. Tercera beareth from the same place southeast and by east. Riding at anker in Fayall rode, we sawe the Ile of Grahosa by the west end of S Georges Iland. S Georges Iland lieth westwards from Tercera. The mountaine Pico lieth east southeast southerly, from the towne of Fayall. The letters v c signifie the variation of the compasse: which how much it is the numbers adioyned do declare, whereof the first sheweth the degrees, the second the minutes. The syllables or, or occ, shew whether the variation be orientall, or occidentall. About the longitude of 346 degrees and a halfe, betwixt the Ilands of Fayal and Flores, it seemeth there should be no variation of the compasse.

The voyage of the right Honorable the Earle of Cumberland to the Ilands Azores A.D. 1589

PARTE OF ENGLAND

PARTE OF FRANCE

PARTE OF SPAYNE

The Ilands Azores

Corvo ins
Flores ins
Graciosa ins
Fayall ins
Tercera ins
Pico ins
S Michaels ins
S Maria ins

In the Iland Pico there is an exceeding high mountaine of the same name: the height whereof is almost three Italian miles upright. The top of it is for the most part seene about the clouds.

The beginning of Longitude is taken from the westermost part of Africa.

Certaine
ERRORS IN
NAVIGATION,
Arising either of the ordinarie erroneous making or vsing of the sea Chart, Compasse, Crosse staffe, and Tables of declination of the Sunne, and fixed Starres detected and corrected.

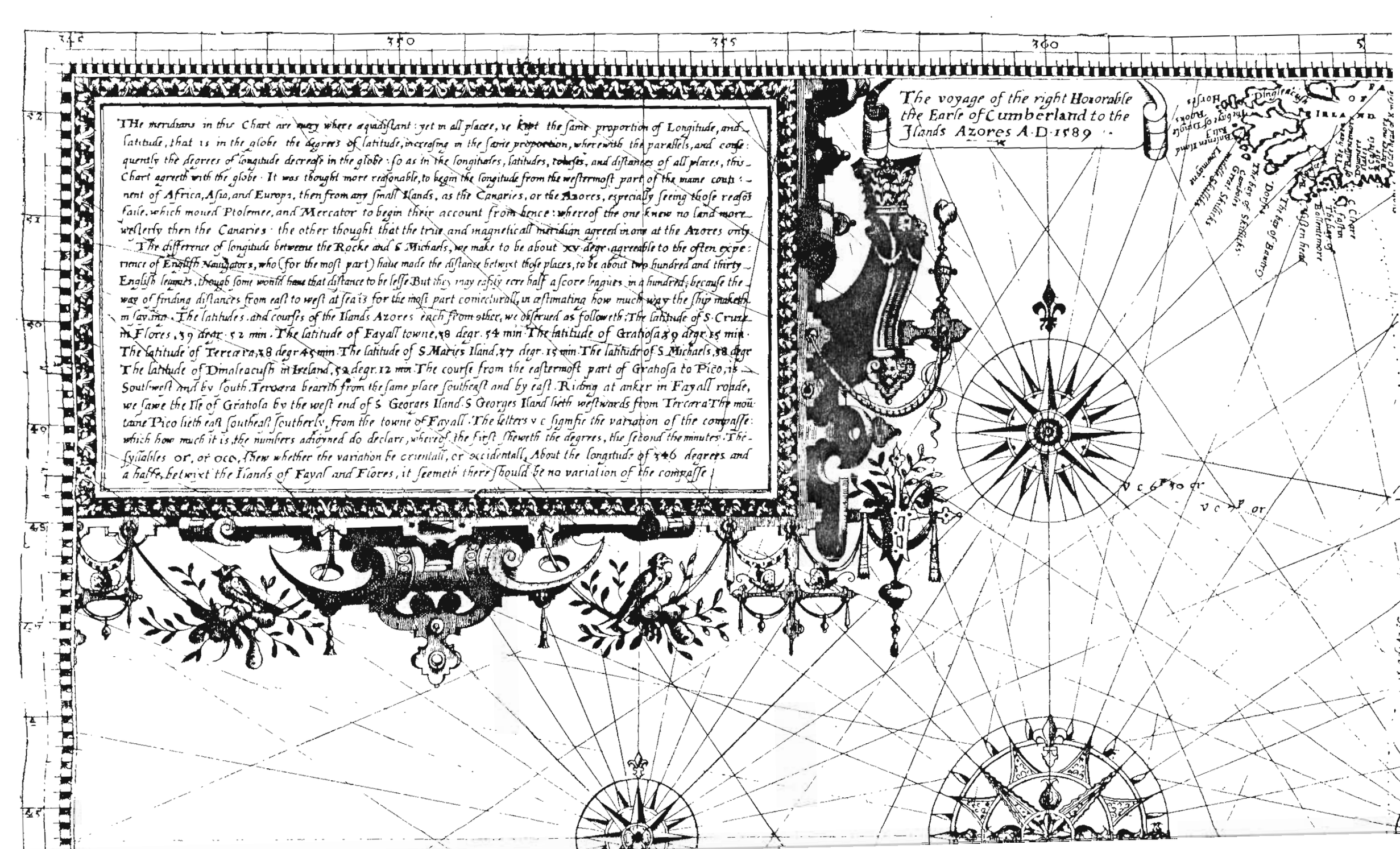
By E. Wright.

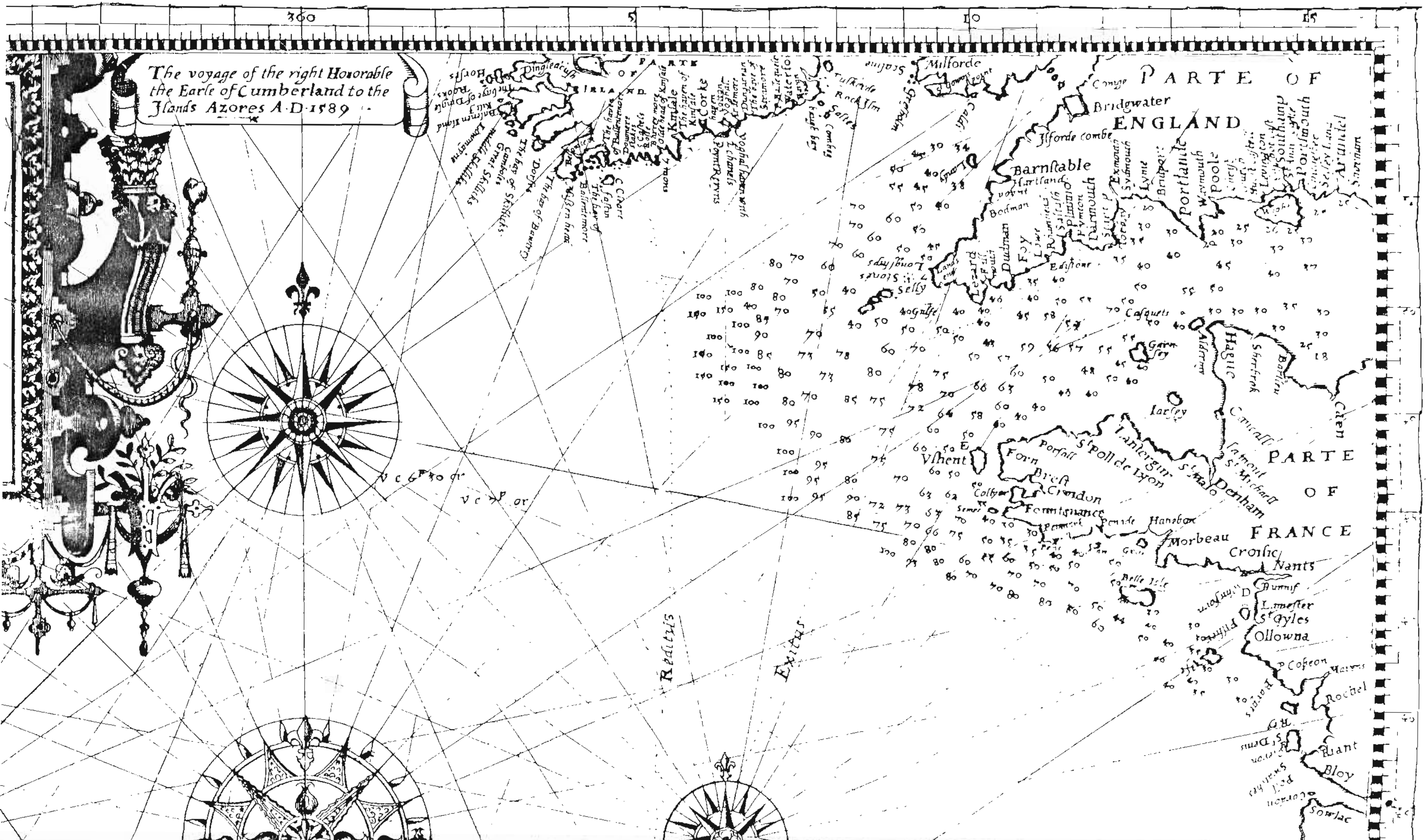
Printed at London by Valentine Sims, 1599.

The voyage of the right Honorable the Earle of Cumberland to the Ilands Azores A·D·1589

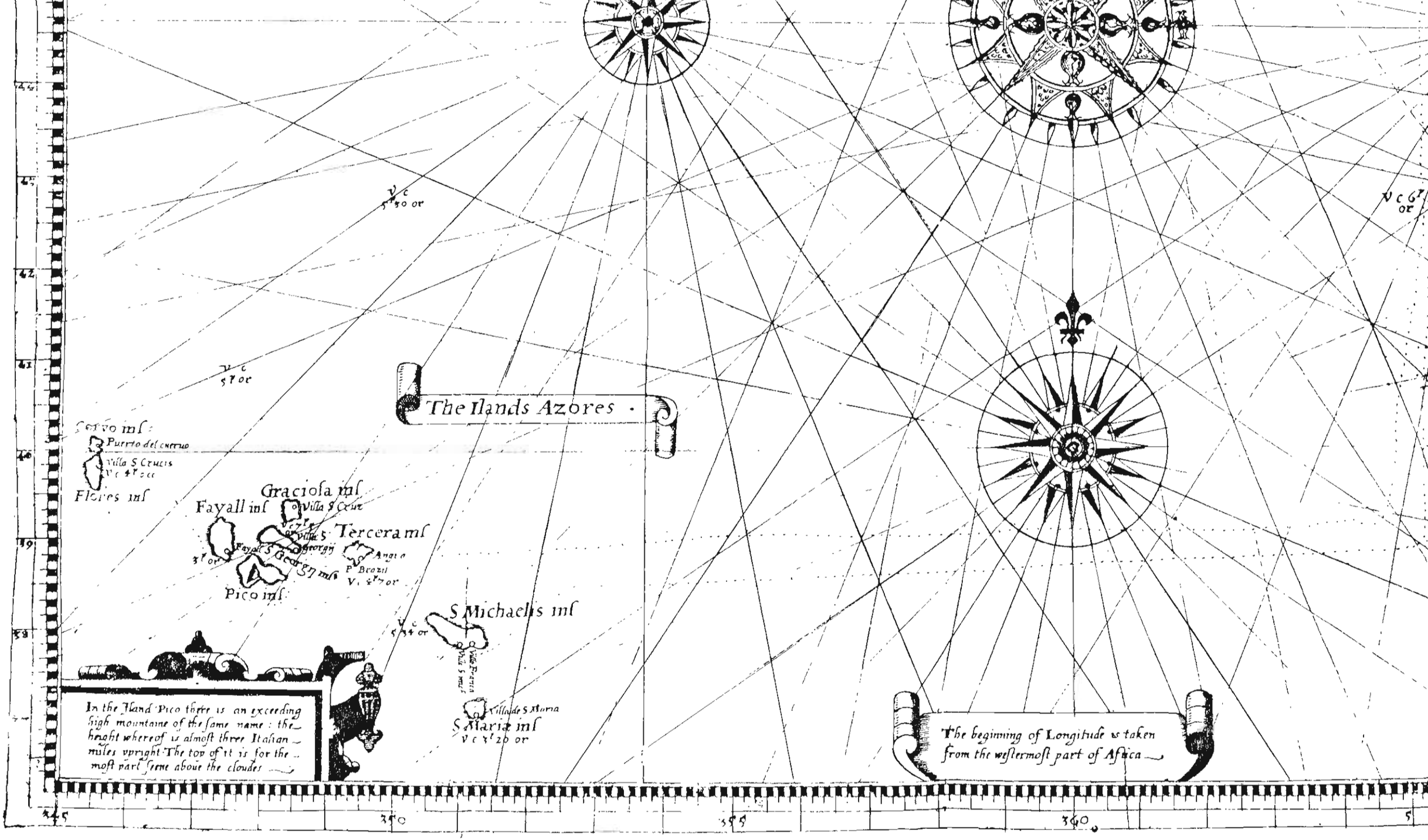
THe meridians in this Chart are many where equidistant: yet in all places, we kept the same proportion of Longitude, and latitude, that is in the globe the degrees of latitude, increasing in the same proportion, wherewith the parallels, and consequently the degrees of longitude decrease in the globe: so as in the longitudes, latitudes, courses, and distances of all places, this Chart agreeth with the globe. It was thought more reasonable, to begin the longitude from the westermost part of the mane continent of Africa, Asia, and Europa, then from any small Ilands, as the Canaries, or the Azores, especially seeing those reasons faile, which moued Ptolemee, and Mercator to begin their account from hence: whereof the one knew no land more westerly then the Canaries: the other thought that the true and magneticall meridian agreed in one at the Azores only.

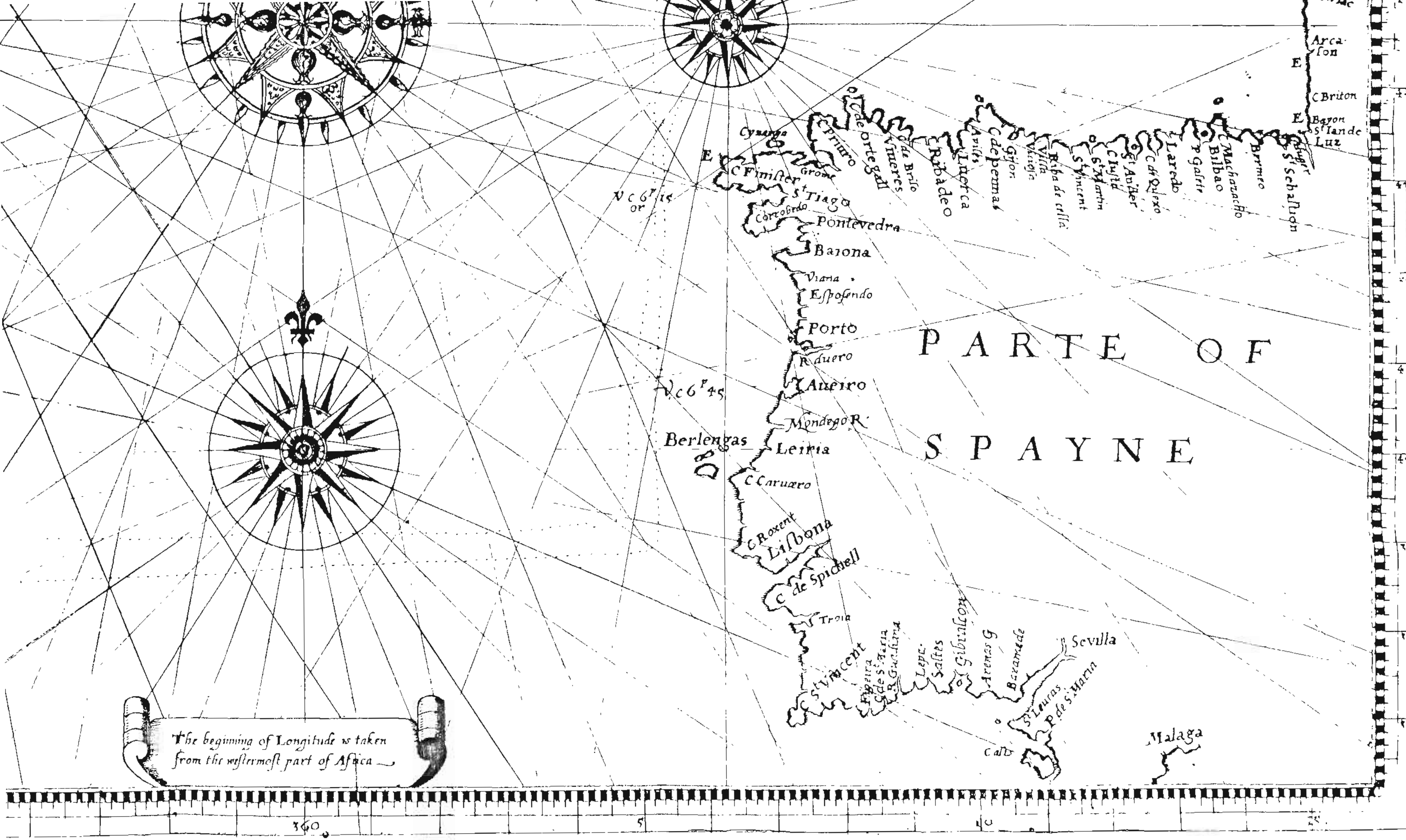
The difference of longitude betweene the Rocke and S Michaels, we make to be about xv degr. agreeable to the often experience of English Nauigators, who (for the most part) haue made the distance betwixt those places, to be about two hundred and thirty English leagues, though some would haue that distance to be lesse. But they may easily erre half a score leagues in a hundred; because the way of finding distances from east to west at sea is for the most part coniecturall, in estimating how much way the ship maketh in sayling. The latitudes and courses of the Ilands Azores each from other, we obserued as followeth: The latitude of S. Cruze in Flores, 39 degr. 52 min. The latitude of Fayall towne, 38 degr. 54 min. The latitude of Gratiosa 39 degr. 15 min. The latitude of Tercera, 38 degr. 45 min. The latitude of S Maries Iland, 37 degr. 15 min. The latitude of S Michaels, 38 degr. The latitude of Dinaleacush in Ireland, 52 degr. 12 min. The course from the easternost part of Gratiosa to Pico, is South west and by South. Tercera beareth from the same place southeast and by east. Riding at anker in Fayall roade, we sawe the Ile of Gratiosa by the west end of S Georges Iland. S Georges Iland lieth westwards from Tercera. The mountaine Pico lieth east southeast southerly, from the towne of Fayall. The letters v c signifie the variation of the compasse: which how much it is, the numbers adioyned do declare, whereof the first sheweth the degrees, the second the minutes. The syllables or, or occ, shew whether the variation be orientall, or occidentall. About the longitude of 346 degrees and a halfe, betwixt the Ilands of Fayal and Flores, it seemeth there should be no variation of the compasse.





The voyage of the right Honorable the Earle of Cumberland to the Ilands Azores A·D·1589
PARTE OF IRELAND
Kinsale
Corke
Waterfo
Milforde
PARTE OF ENGLAND
Bridgwater
Barnstable
Hartland
Lezard
Dudman
Foy
Plimmo
Dartmouth
Exmouth
Lyme
Bridport
Portlande
Weymouth
Poole
Southamp
Portsmouth
Arundel
Selly
Vshent
Garnsey
Iarsey
Aldernay
Hague
Caen
PARTE OF FRANCE
S. Poll de Lyon
S. Malo
Brest
Morbeau
Croisic
Nants
Belle Isle
Ollowna
Rochel
Bloy
Reditus
Exitus


The Ilands Azores
Corvo ins
Flores ins
Graciosa ins
Fayall ins
Villa S Cruce
Villa S Terceira ins
Pico ins
S Michaelis ins
S Maria ins
Villa de S Maria
The beginning of Longitude is taken from the westermost part of Africa
In the Iland Pico there is an exceeding high mountaine of the same name: the height whereof is almost three Italian miles upright. The top of it is for the most part seene aboue the clouds.


PARTE OF SPAYNE
The beginning of Longitude is taken from the westermost part of Africa
Berlengas
C Finister
S^t Tiago
Pontevedra
Baiona
Viana
Espofendo
Porto
R duero
Aueiro
Mondego R
Leiria
C Caruæro
C Roxent
Lisbona
C de Spichell
Troia
C S^t Vincent
Figeira
C de S^t Maria
R Guadiana
Lepe
Saltes
Gibraltar
Arenas G
Baramede
Sevilla
S^t Lucas
P de S^t Maria
Calis
Malaga
C Priuro
C de ortegall
Viueres
Ribadeo
Luerca
C de penas
Gijon
Ribadesella
S^t Vincent
Laredo
Bilbao
Bermeo
S^t Sebastian
C Briton
Arcason
S^t Iande Luz

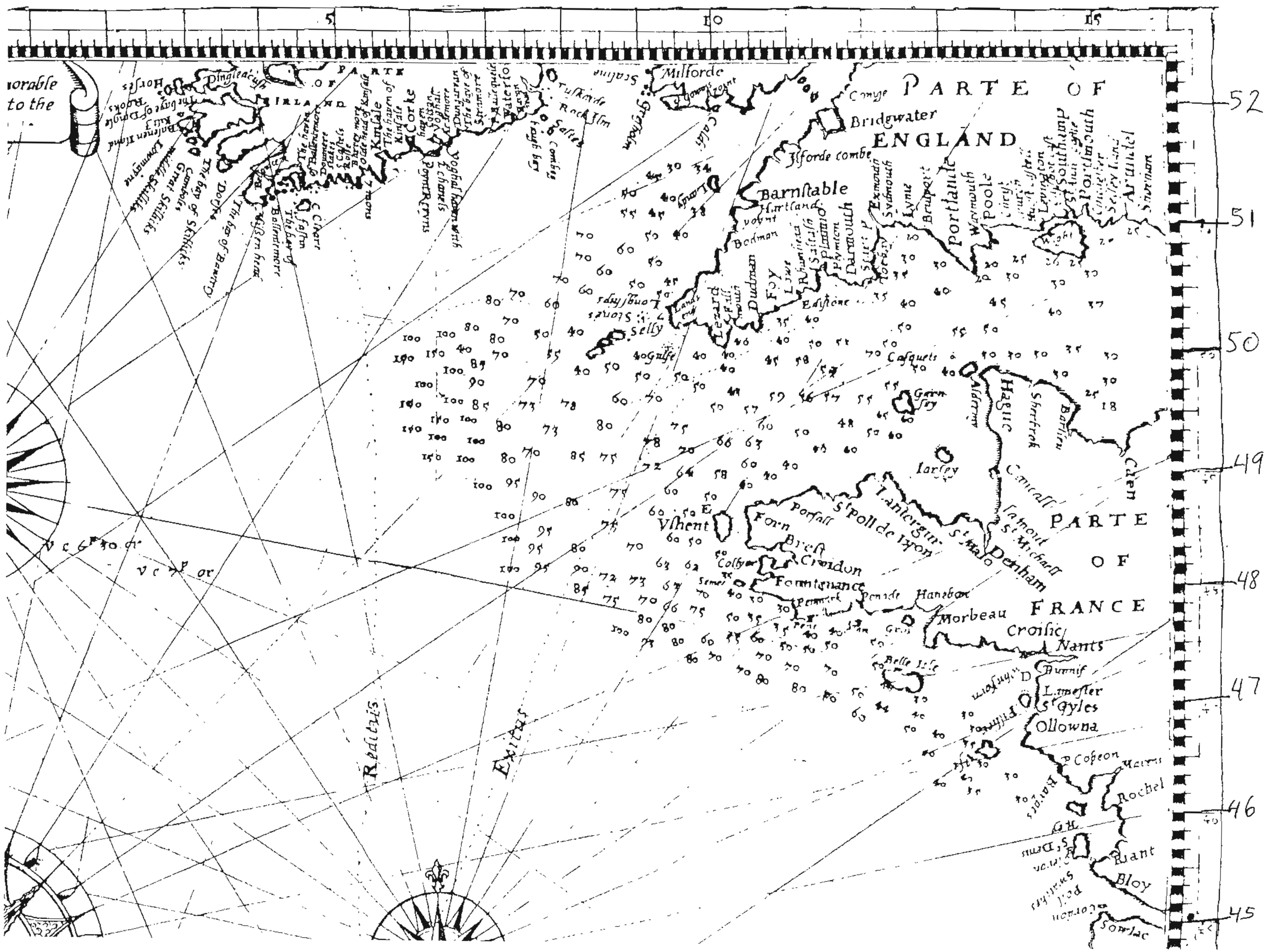
Certaine

ERRORS IN NAVIGATION,

Ariſing either of the or-*dinarie erroneous making* or vſing of the ſea Chart, Compaſſe, Croſſe ſtaffe, and Tables of declination of the Sunne, and *fixed Starres detected and corrected.*

By E. Wright

Printed at London by Valentine Sims, 1599.


PARTE OF ENGLAND
Bridgwater
Barnstable
Milforde
Lezard
Dudman
Foy
Darmouth
Portlande
Poole
Southhampton
Portsmouth
Arundel
Selly
Kinsale
Corke
Waterford
Vshent
Brest
S. Poll de Lyon
S. Malo
Denham
Garnsey
Iarsey
Caen
PARTE OF FRANCE
Morbeau
Croisic
Nants
Belle Isle
S. Gyles
Ollowna
Rochel
Bloy
Reditus
Exitus
5
10
15
45
46
47
48
49
50
51
52