

places deeper, in some shallower; in some places narrower, in some broader; but lies altogether, and is *perfect Lead*, only in the outside, covered with *reddish Earth*.

To the *Quer'es* in the *sixth Title*, I cannot say much; it must be resolved by them, that melt the Lead-Ore, with which I have not been much acquainted, save only, that they beat the *Ore* small; then wash it clean in a running stream; then sift it in Iron-Rudders; then they make of Clay or Fire-stone a Hearth or Furnace, which they set in the ground, and upon it build there Fire, which is lighted with Char-coal, and continued with young Oaken-gadds, blown with Bellows by mens treading on them: And after the Fire is lighted, and the fire place hot they throw their Lead-Ore upon the Wood, which melts down into the Furnace; and then with an Iron-Ladle they take it out, and upon sand cast it into what form they please.

*So far this account*, which is hoped will be made in time more compleat, and succeed with the like *Answers* from other places.

*An Extract*

*Of a Letter sent from Paris, about the Load-stone; where chiefly the suggestion of Gilbert touching the Circumvolution of a Globous Magnet, call'd Terreila; and the Variation of the Variation, is examined.*

*This Letter was written by the Intelligent and Experienced Monsieur Petit, Intendant of the Fortifications of his Most Christian Majesty, to the Publisher, as followes;*

I Have received yours, wherein you desire to know my sentiment about the *present Variation* of the *Needle*, intimating withal, that an Artift in *London* affirms, that whereas heretofore the Declination was *East-ward*, 'tis now about *one degree and a half* to the *west*.

Nothing can be more welcome to me, than to have occasion given me to discourse of this Subject, especially to the Philosophers of *England*, whence the Philosophy of the *Magnet*

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had its rite, and whence also the Principal Observations of the *Change* of its declination are come to us; so that 'tis just that the Observations, made elsewhere concerning the same, should return thither, as to its source.

I shall therefore let you know, that having always been Curious in the Doctrine of the *Load-stone*, after I had made the Experiments that are in *Gilbertus* and others, I made that of the Needles *Declination* on three different Meridian-Lines, which I traced *An. 1630.* in several places of *Paris*, and found, that the Needle declined  $4\frac{1}{2}$  degrees North East: which having publish'd, and made known here to the Curious and to Artists, some of whom counted 9 or 10 degrees according to the Tradition and Writings of *Orontius Fineus*, and *Castelfranc*; others,  $11\frac{1}{2}$  degrees, following *Sennertus* and *Offusius*: all at first rejected my Observation; and as commonly new things meet with obstacles and contradictions, before they are establish'd, those that could not contradict what they saw, pretended, that this Variety did perhaps proceed from the greater or lesser vigour in the Loadstones, employed to touch with; or from thence, that the Needles had been touch'd nearer to or farther from their Poles; which might make them decline more or less from the *Meridian*, so as a Needle, being precisely touch'd by the Pole of a good *Magnet*, might perhaps have no *Declination* at all.

All which conjectures were not without their probability; which was the greater, in regard that all the *Load-stones* I had seen, being rude and like Flints, with irregular surfaces, in bunches and cavities, their Poles were always ill posited, and often within some of the Cavities, so that one could not be sure to strike the Needle thorow the Pole of the Stone. To remove which difficulty, and at the same to find another quality (one of the excellentest of the World, if true;) viz. that which *Gilbert* had assign'd to *Terrella's*; I resolv'd, to make the Experiment of it. And because I have not yet written of it, nor any man, I know, (Men having contented themselves with refuting this Error by Discourse only) you will perhaps not be displeas'd to be inform'd of the success thereof.

You

Yet know, that *Gilbert*, though the first, that has writ rationally of the *Magnet*, and began to say no follies of it, writes about the end of this *Book* (yet *without* being *positive*) that if a *Magnet* altogether round were placed on a *Meridian*, and its *Poles* so posited, as to answer to the *Poles* of the *World*, and consequently its *Axis* to the *Axis* of the *World*, the *Stone* would continually of its self turn round in 24 hours. Whence he infers, that the whole *Earth*, as a great *Magnet*, turns also round about its *Axis* in the same space of time.

To explore the truth of this *Proposition* (which I wish were true; since *then* we should have a perpetual motion without *Wheels*, and a *Watch* yet juster than *Pendulums*) I found the means of causing two *Magnets* to be turn'd with the powder of *Emery*; the one whereof having been made *Spherical* with all possible exactness, became very solid, plain, and without any visible pores, or diversity of matter, being  $1\frac{1}{2}$  inch in *diameter*: the other, bigger, of  $3\frac{1}{2}$  inches *diameter*, but of less vigour, porous also and uneven; which made me lay it aside as useless for this *Experiment*, because, though it had been perfectly *spherical*, as the lesser, I could not be assured, that its *Center of Magnitude* was the same with those of its *Gravity*, and *Strength*; which was requisite to make good *Gilberts Proposition*.

But for the other smaller *Magnet*; that had no defect, and its three *Centers* were the same, with so much justness, that after I had exactly found the two *Poles* of this *Stone*, I caused two small holes to be made therein, to support it by two points of *Needles*, as by two *pivots*: which having put in a *Meridian* of *Brass*, and suspended the *Ball* betwixt them like a little *Globe*, it was so easily moveable that I made it turn every way with a blast only of my mouth, and it stopp'd indifferently, now in one, then in another place, not any side of it prevailing by its *gravity*, nor descending, as it would have done, if any of them had been heavier than another.

This *Stone* thus prepared without any defect in virtue or figure, uniform, homogeneous, equilibrated, being adjusted on its *Meridian* and a *Horizon*, so placed on its *Meridian-line*, that the *Poles* thereof answer'd to the *Poles* of the *Heavens* (as hath been said already;) the success was, that it had not any *Motion*,  
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and a small white mark, I had made upon this *Stone*, remained still in the same place, where I had put it, without turning at all, whence I thought the proposition of *Gilbert* sufficiently refuted.

This *Stone*, having serv'd me for this Experiment, did, together with the greater *Stone*, ( whereof the *Poles* were also well marked) serve me also to find out, whether the *Needles*, touch'd in different places, nearer to, or further from the *Poles*, had *different* Declinations. Which having tryed frequently with these, and with other *Stones*, I found no difference at all in the *Declination* of the *Needles*.

And now to return to the main subject of the Letter, I then observ'd, that all these *Needles* declined *then* from the *Meridian*  $4\frac{1}{2}$  degrees from the *North* Eastward. And, as I did not suspect, that this declination would have changed, having found it to be the same in many places, from *Brest* in *Brittany* to the *Valto-line* amongst the *Alpes*, I believed, the *Antients* had ill observ'd, and that the want of their exactness, in respect either of the *Meridian-line*, or the fabrick of their *Needles*, or the division of their *Circles* was the cause of this defect. But I was soon undeceived of my own Error, when I learned a little while after, by Letters from *England*, that Mr. *Burrows*, Anno 1580. had near *London* observ'd the declination of the Needle to be 11. degr. 11. min. as well as *Offusus* and *Sennertus*: And that Anno 1612. Mr. *Gunther*, Professor of the *Mathematicks*, had in the same place found that *Declination* much diminisht, having then found but 6 degrees: And lastly, that Anno 1633. Mr. *Gellibrand* had found it but 4 degrees *North-east*, conformable to my Observations. Which did assure me, that those *Declinations* were not constant, but had varied.

And that I might be convinced by my self, I made from time to time Experiments in divers places, and found still more and more diminution; so that Anno 1660. in *June*, after I had very exactly traced a *Meridian* by many *Azimuths*, before and after noon, with a *Brass-Quadrant* of 6 foot diameter, and applyed good *Needles* upon it, the one of 7 the other of 10 *Inches* long, I found that they declined but *one* degree, or thereabout: And the

the last year \* I found no more but 10 minutes on the same *Meridian*. Upon which having lately applied, since the receipt of the Letter, the same two *Needles*, me thinks, the *Declination* is yet less, than the last year. But this I can assure you, that the *Declination* is yet some *minutes* towards the *East*, at least at *Paris*. So that you may, upon my word, doubt \* of the Observation of your friend, whom perhaps the *Meridian*, or the *Needle*, or the Construction and Division of his Compass may have deceived to a *degree* and a *half* North-west, which he at the present assigns to the *Declination*, But I doubt not, but in 12 or 15 years it will be found true what he affirms, as I have prognosticated by my *Hypothesis*, which maketh the *Declination* to vary a *degree* every *seven* or *eight* years.

\* This Letter was written this present year.

\* By the favour of the *Author*, is not conclusive, that because the *Declination* is yet somewhat towards the *East* at *Paris*, that therefore it must be so at *London*: Since 'tis known here, that even the *Variation* of *White-Hall* differs from that of *Lime-Houses* which two places are but 4 *English* miles, or thereabouts, distant from one another.

This is, what I had to return to the Letter, which I wish might deserve to be presented to your *Illustrious Society*, and contribute something to the discovery of so many admirable vertues lodged in the Stone, and principally to the finding out of the *Cause* of this *Variation*; for which I have already made some attempt, and proposed my thoughts in a *Dissertation de Latitudine Parisensi & Magnetis Declinatione*, which *M. du Hamel* caused to be printed *Anno 1660*. with his *Astronomia Physica*, I shall be very glad, to learn the sentiment of your Learned Philosophers thereupon, and what cause they suspect there is of so singular an effect. I could discourse to you of other particulars touching the Proprieties of the *Load Stone*, and especially of a remarkable one, I have discover'd, and which, if I am not deceived, subverts that *Theory*, which undertakes to explicate all these effects by the *Particula striata*; but I reserve that for another occasion.