Rupe nigra: Mercator and magnetism

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Full edition of the paper discussed in the International Conference, upon the anniversary of Mercator's 500th birthday "Gerhard Mercator: Wisseschaft und Wissentransfer" University of Duisburg – Essen, Germany, 29th February – 2nd March 2012).*
A synthetized edition, in German, has been published as *Rupes Nigra: Mercator und Magnetismus*, in Ute Schneider, Stefan Brakensiek, eds, *Gerhard Mercator: Wissenschaft und Wissentransfer*, Darmstadt, WBG, Wissenschaftliche Buchgesellschaft, 2015, pp. 116-131 (Isbn 9783534264513).

> Quamobrem satis sit nobis, a rebus aut sensu, aut certa historia notis, rerum verarum scientiam petere, non opinabilium, quorum non est scientia, sic enim non aberrabimus, si in modo iusto ordine progrediamur.
> (Gerhard Mercator, *Atlas*. *Prolegomenon Fabricae Mundi*, Caput I, 1595, p. 3)
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> (Let us to seek the knowledge of the true things, either from our senses or from what is known to us from reliable history; of true things, I say, not conjectural ones, of which there is not knowledge, for in this way we shall not go astray, as long as we proceed in the right order. Translation by D. Sullivan, in CDR *Atlas* edition, Octavo, Oakland, 2000)

Abstract
In the 1574 protrait of Mercator by Frans Hogenberg, Mercator aged, sixty two, is portrayed as "the man of magnetic declination". He underlines in this way his continued, life-long interest in the subject. Magnetism was, in fact, not only a scientific and technical argument useful for navigation; it also symbolized Mercator's cosmological principle of *harmonia mundi.*
This work underlines Franciscus Monachus's probable role in training young Mercator in ermetic studies, then shared with John Dee, which influenced Mercator's cosmology (that he considered "scientifically Christian").
In this cosmology, the device of the pythagoric Y is central. It represents the profound structure of his world, as in the "typus universitatis" sent to Vivianus in 1573, but it is also connected, I propose, to magnetic declination and the correct, new representation of the "rhumb lines" for sailing, featured in Sixteenth-century nautical maps. It was also the model for drawing the other letters of the alphabet in Mercator's 1540 monograph about italic humanist writing.
Pythagoric Y was, in fact, a symbolic and cabalistic device, also employed by Dee in his astrological and alchemic works, which finally represented moral choice; human free will in the providential mechanisms of Creation.

1. A life project

Mercator's portrait in the first pages of his *Atlas* (1595) was engraved in about 1574 by Frans Hogenberg.[1]

Mercator is represented with a globe. In the foreground is the continent of America and the four northern islands of his 1569 North Pole map, with the magnetic mountain at the top, named *Rupes Nigra*.

The compass Mercator has in his hands is pointing to the magnetic pole, not far from the geographic one, where he had suggested drawing the first meridian, i.e. with zero declination.

In 1574, twenty one years before the publication of the *Atlas*, Mercator was already known, and he had himself portrayed as "the man of the magnetic pole".

Notwithstanding, in the posthumous *Atlas* we do not find any reference to magnetism, and we only have his printed maps or private letters as evidence.

Mercator's terrestrial globe of 1541 showed an insula magnetum at the North Pole, and in 1553, in the handwritten *Declaratio insignorum utilitatum quae sunt in globo terrestri, et annulo astronomico* (not published until 1868)[2], addressed to Emperor Charles V (probably concerning his 1551 celestial globe dedicated to Prince-Bishop George of Austria), Mercator had written about his new method for calculating longitude, on the basis of knowing latitude and the magnetic declination of a site.

The magnetic declination had already been noted by sailors, but scholars thought, at that time, that it originated in the heavens. Mercator wrote, on the contrary, that it had to be connected to the earth, but he avoided explaining this argument in detail in the *Declaratio*. He had, in fact, already engraved a magnetic pole on his 1541 terrestrial globe, as written above.

This brief explanation probably allowed him to avoid too complex a scientific argument, but, in 1546, he had already described in a letter to his protector, Cardinal Perrenot de Granvelle, that he had been able to identify the site of the magnetic pole on the earth, thanks to trigonometric calculations, and had discovered that it was not far from the geographic one, i.e. at 168° longitude from the meridian of the Canaries and at 79° of north latitude.

On the 1569 map of the northern regions, the magnetic pole was calculated again, and this time at 180° longitude from the Azores and 73.40° latitude (or 79, according to different data then reported by sailors). This new set of degrees remained the same in Mercator's subsequent map of the northern regions published in the Atlas, in 1595, after his death.[3]

2. Monachus' role in Mercator's esoteric training

Mercator's[4] 1537 map of Palestine represented, for the very first time in history, the magnetic declination of a site. Mercator's 1541 terrestrial globe, as already noted, had showed the magnetic island.

When, in 1577, John Dee asked Mercator to send more information about the polar regions for his search for a possible north-east or north-west passage, Mercator answered that his source was the book by a Belgian traveller, Jakob Cnoyen, who, in turn, had been informed by a northern priest of another book by a 14th century Minorite friar from Oxford, entitled *Inventio Fortunatae*.[5]

Three years later, in 1580, Richard Hakluyt asked Mercator for new information about these sources and Mercator answered that the book, lent to him many years before by a friend from Antwerp and then returned, was now lost.

Modern scholars have for the most part concluded that this friend from Antwerp was Abraham Ortelius, and it is probably for this reason that M. van Durme, editor of

Mercator's correspondence, considers a gap of 4 letters from Ortelio, prior to 1577, to be about this matter.[6]

This source is very important because the next map of the North Pole that Mercator printed in a cartouche of his 1569 world map for sailors, exaclty followed Cnoyen's descriptions and those of the mysterious friar from Oxford. After Mercator, all map-makers producing maps of the northern regions (Dee, Ortelius, Postel) did the same. In fact Olaus Magnus, in his 1539 *Marine map*, indicated a magnetic island called a "mountain of the compass" which is considered to be a glacier.

The detailed nature of Cnoyen's story and the book he quoted, deserves closer attention for other reasons as well.

On the subject of the lost source, Mercator specifies that he had used it many years before, and it is probable – as suggested by Robert Karrow[7] and Nicholas Crane[8] – that it came from Franciscus Monachus's library rather than Ortelius'. Monachus was a Minorite friar, like the unknown author of the *Inventio Fortunatae*, and must have played a crucial part in Mercator's training in the years 1532-33.

Referring to Hakluyt about the mysterious friend from Antwerp, Mercator would not have represented him in such a way had it been Ortelius, who in those years was at the height of his fame.

But since letters exchanged with Monachus, tracked down by the Inquisition in 1544, had caused the arrest and imprisonment of Mercator for suspected heresy (probably due to his 1538 cordiform world map, one can easily understand his motives for being so vague in his writing to Hakluyt.[9]

Antoine De Smet[10] underlined in 1990, that Mercator, after his degree at the University of Louvain, in 1532, despite his collaboration with Gemma Phrysius' group, retired to Antwerp to study arguments he never clearly explained. His aim was to further his studies into the philosophical foundations of the world after the discovery of deep discordances between Aristotle's thinking and the Holy Scriptures. De Smet suggested these interests were the so-called "occult sciences".

During these years Mercator probably approached esoteric studies and white magic (to which he evidently made clumsy reference in the 1544 incriminated letters). His master was probably Franciscus Monachus, who had already expressed the same criticisms of Aristotle's philosophy, placing himself in an unfavourable light with the Inquisition.

As Steven Vanden Broecke[11] recently discovered, Monachus was court astrologer in Mechelen, and along with many astrologers of the time, became involved in the production of maps and globes. He made a map of the *Regiones septentrionales* printed in Antwerp by Sylvester from Paris (a printer active between 1517 and 1579), probably before 1540, because Ortelius quotes it among the sources of his *Theatrum*, printed in that year. Monachus therefore had to gather information about the northern regions and could have possessed the books Mercator referred to.

Monachus had also produced, around 1526, a terrestrial globe, now lost, the first in the Low Countries, used by Phineus (also an astrologer) as a source for his cordiform world map.[12]

But before this first cartographic attempt, it seems that Monachus, due to his court links, had been asked to collaborate on the production of some tapestry world maps, called *The spheres*, commissioned to the painter Bernard van Orley, from Bruxelles, between 1519 and 1524, for the royal wedding of Joao III, king of Portugal, and Catherine of Austria. Van Orley was court painter to Margaret of Austria, Regent of the Low Countries.

Monachus therefore had all the requisites for influencing the young Mercator who was hungry for "causes". As a Franciscan friar he was very close to the Spirituals movement, which had expressed, a century before, the Italian *Fraticelli* movement condemned by the Inquisition.

Mercator had also studied at Hertogenbosch (the town where Cnoyen was born) with the "Brothers of the common life" and he was, in his turn, sensitive to such ideas.
It is probable therefore, that Mercator's speculations on magnetism originated with Monachus.
Magnetism represented, in fact, for esoteric culture (and it would remain so a generation later, in William Gilbert's *De magnete*), the principle of *anima mundi* and the universal attraction of things.
From this point of view, the Franciscans significantly altered in a spiritual sense the direction and development of late Medieval esoteric thinking, and in particular its alchemic component; a style of "occult" thinking that reaches Trithemius and Paracelse, which would be, in its turn, Dee's[13] principal source.
From the 13th and 14th centuries Franciscans had in fact shown great interest in alchemic studies, which they treated as experimental enquiries, but also as proof of the connection between spirituality and physics in nature.
The most important Latin source of alchemy, the ordering and translation of the Arab alchemist tradition, was the so-called Latin-Gerber (Gerber was one of the best known Arab alchemists, living between the 7th and 12th centuries A.D.). It was compiled by an Italian Franciscan friar, Paolo of Taranto.
Ramon Lull and Arnold of Villanova[14], both Catalan, the best European center of occultist studies in the 14th century, had developed many reflections about the "great work" (*Magnum Opus*), as alchemy was called.
Finally, the Franciscan Spirituals movement had mixed certain figures from alchemic tradition, such as Mercury, with Christological symbology. Christ's passion, death and resurrection were shaped in this way by alchemy, proof of the providential and sacred character of the founding principal of alchemy; the *solve et coagula*, which foresaw the putrefaction of matter, its purification, i.e. separation of impurities and subsequent re-materialization at a higher level of perfection until eventually reaching the "golden" one.
These procedures were respectively called *Nigredo, Albedo* and *Rubedo*.

3. *Littera Pythagorae*

In 1540 Mercator was still young: in 1532 he had graduated from the University of Louvain, where he had begun to work with Gemma Phrysius' group, Gogava and van den Heyden in producing globes and astronomic instruments.
He had already engraved his map of Palestine (1537), the double cordiform world map (1538) and the map of Flanders (1540), always employing his new and unmistakable small Italic letters.
In 1540 he also published a handbook of correct Italic humanistic writing, the *Literarum latinarum, quas italicas, cursoriasque vocant scribendarum ratio*. The publisher was Rutgerius Roscius, with whom Mercator had already collaborated.[15]
Up until now we had no information about Mercator's research following his Louvain degree. Gemma had certainly passed on to him his skills in mathematics and astronomy, but Gemma's real influence on Mercator should not be underestimated.
In Louvain's scientific circles Mercator also developed his technical and practical capabilities, such as engraving and producing globes and instruments, already learned, possibly, during his training with the *Brethern* at Hertogenbosch.[16]
Phrysius had also studied medicine however, and astrology was normally an integral part of medical expertise.
When, in 1547-50, John Dee reached Louvain and came into contact with Mercator, their shared interests were geometry, astrology and cartography, disciplines which were considered to be connected. This actually happened many years after Mercator took the decision to develop his studies in private, dedicating himself to cosmology.

As he wrote in 1592 in the dedicatory letter of *Harmonia quatuor evangelarum*, his objective was to get to the roots of knowledge, with many doubts about all traditions. ”Coepi, Mercator wrote, ego de veritate omnium philosophorum addubitare, et, ipsae naturae mysteriis indagare”.
When he published his calligraphic treatise – another “practical” manual – Mercator was in a phase of deep reflection which had brought him to study the books of the ermetic tradition of which there were numerous examples in his library.
This state of mind allows us to consider a more complex meaning of what he writes in chapter 3 of his manual, where he considers the letter Y as a paradigm for writing all the others, and also as a generative model for drawing them (“ab huius figurae proportione omnium relinquarum commensurationes sumendae sunt”, B3v-D1r).
Y is taken as a model and inscribed in a square in which, as on a map, “meridians” are drawn to construct the diagonals which are needed to write the letter Y correctly as well as the other letters of the alphabet.
Mercator thus demonstrated that he was up-to-date with the most recent theories of the humanist Christian cabalists. In 1492 Johann Reuchlin, one of the most important northern Christian cabalists, had sustained, in *De verbo mirifico*, that pythagoric culture was a Greek translation of Hebraic cabala.[17]
Y had, in fact, a very particular meaning in the ermetic tradition. In the *Gematria* (a discipline which studied the numerical equivalents of letters, normally used as numerals, in order to find mysterious connections), and in the *Cabala*, where it was used to represent the first letter of the Hebraic alphabet (*Yod*, written like a simple point, was the first letter and was represented with its phonetic symbol). It was, in turn, considered generative of all the other letters.
This generative capability was not only graphic, but was also connected to the foundation of the world, due to the cosmological function attributed to letters by Hebrew mysticism.
In the pythagoric tradition Y, actually (confused with J; it was the tenth letter of the Greek and the Hebraic alphabet) corresponded to number ten, represented by the *Tetractys* (1+2+3+4=10), the principle founded on the number four, that would afterwards be the central symbolism of Dee’s *Monas hieroglyphica* (1564). The quaternary principle (i.e. built upon the four elements) was a fundamental paradigm of alchemic thought.
Mercator’s interpretation, although in a practical context, of the fundamental role of the letter Y must however be integrated with another, private document of the cosmographer, dated 1573, which makes it easier for us to understand the moral and cosmological meaning Mercator still attributed, twenty three years later, to this symbol.
This document is a letter by Mercator to Johannes Vivian (Vivianus) in which Mercator explains in synthesis his idea of the deep structure of the cosmos, called *Typus universitatis*.[18]
Vivianus was a bookseller in Antwerp, an archaeology enthusiast, friend of Ortelius and very devout.
On August 13th 1573 Mercator wrote a letter accompanied by a drawing (*symbolum aliquod universitatis juxta meas speculationes*), now lost, but known thanks to a reliable copy, which represents his idea of the structure of the universe.
Compared to the concentric celestial spheres of Aristotelian tradition, the drawing shows a second lateral system with the spheres of Mercury and Venus rotating around the sun. This is not particularly remarkable as it is the model of “Martianus Capella”, otherwise called “Egyptian” that Mercator shared with John Dee, as well as Tycho Brahe, later adopted by the Jesuits to preserve the Ptolemaic system, but explaining some inconsistencies already highlighted by Copernic.

What is new, however, is what Mercator wrote along the rays of the celestial spheres: *Transitoria haec sunt omnia,* which corresponds perfectly with what he wrote in the Atlas' Prologue, concerning the creation of the world.
For Mercator, the eternal and incorruptible, the *coelum empyreum*, was only to be found beyond the limits of the fixed stars.
Another important aspect of this thinking is that the planets were not represented solely in their physical condition, but also as correspondents of spiritual and generative forces of terrestrial life, according to astrological-alchemic tradition.
The part of the spheres which moves Saturn, Jupiter and Mercury is called *Mens*, that of the Sun and Venus, *Anima*, while the Moon's sphere corresponds to *Spiritus*.
But even each planet represents different functions and actions: the sun corresponds to strength (*Vindicatio*), Mercury to Activitas, Venus to fertility (*Foecunditas*). Among the upper planets, from the highest and thus more authoritative, is Saturn which reigns over the *Ratio*, Jupiter over Affectus, Mars over Love (written *Sforge*, which is evidently the incorrect writing of the Greek *Storge*).
A totally new itinerary, finally, connects the Earth, in the centre, positioned above the so-called Nothing (*Nihil*), with the *Coelum empyreum*. This itinerary is called *Anima*; it has the shape of a Y (*littera Pythagorae*, precisely as Mercator wrote in his own hand).
Here the narrow line leads to the *Empyreum* and *Vera Beatitudo*, and the other one, wide and twisted, leads to *Nihil*.

4. The magnetic declination

In 1537 the royal cosmographer of Portugal, Pedro Nunes, published in Lisbon his *Tratado da sphaera*. Taking advantage of information from Portuguese mariners, Nunes returned to the problems of the loxodromic routes.
It had been discovered that deformations in the representation of terrestrial curvature on maps, resulted in a spiral-shaped sailing route instead of a straight one. Sailors tried to follow a constant angle of inclination through meridians, but their route ended up being very much longer than they had calculated.
A solution to the problem was to represent the routes on maps as they really were: that is, as curved lines.[19]
Finding the shortest route signified having nautical maps that represented this gap proportionally on paper, and this was the problem that Mercator tried to solve with his famous 1569 world map *ad usum navigantium*.
But, in the meantime, in 1541, in his terrestrial globe, Mercator represented, for the first time, nautical routes as curved lines for sailing (as far as the scale allowed).

This argument had actually been of primary interest to Gemma Phrysius too and his Louvain group. We do not know however, if they might have elaborated Nunes' theses, because Gemma made reference to this matter only in 1545, in an addendum to his edition of Apian's *Cosmography*. It is possibile that Gemma had drawn loxodromic routes in the shape of curved lines in his 1540 world map. This map is now lost and known only in small reproductions printed after 1544; so it is quite likely that Mercator followed Gemma's teaching in his 1541 globe.[20]

Dee too, came into contact with Nunes after his stay at Louvain and developed the technique of representing the loxodromic routes with curved lines, with the result that he produced, discreetly, a so-called *Paradoxall compass* in about 1566 (according to a letter to the English printer John Daye in 1576).
This was a map of the polar region, in which the land was represented in such a way as to correct the deformation. Although the polar region was only a small area, which was strategic for Dee who was searching for a Northern passage, this map, in a certain way,

anticipated Mercator's one, which would be a map of all the continents, modifying the conical projection used by Gemma into a cilindrical one.[21]

The problem underlined by Nunes and many sailors had nothing to do with magnetism. But, in 1538, Mercator had used a heart-shaped projection for his world map, as Phyneus had done in 1534.

For this projection, the North Pole was crucial because, to represent its real relationship to the equator, its meridians were drawn with their centre at the North Pole and the degrees of longitude were calculated in proportion to their real distance from the Equator. The result of this produced a figure similar in shape to a human heart, which motivated Phyneus to observe similarities with the world and the astrological-esoteric figure of the *cor mundi*.[22]

Mercator did not comment in philosophical terms about the 1538 map, which in 1998 I suggested was linked to his 1544 charge of heresy. But three years later (1541) we find the magnetic isle in his terrestrial globe; a sign that the argument had become of increasing interest to him.

The problem of magnetic declination, such as that of the loxodromic routes, became apparent with experience. Colombus had already registered, in 1492, these variations in the compass's needle and this observation had been confirmed and deepened in the following years.

In 1514, the Portugese navigator Joao de Lisboa's *Tratado de agulha de marear* had suggested as a rough solution, to systematically move the compass's needle by 11° and 15°, first sailing from East to West at constant latitude. Other sailors tried to calculate declination in different and complicated ways.

In any case, all attempts were mostly devoted to solving the problem of calculating longitude at sea rather than trying to locate the magnetic pole, which many authors still considered to be in the heavens (as Mercator had written to Charles V), in accordance with Petrus Peregrinus' *Epistula de magnete*, written in the 14th century.

Martin Cortes, a sailor, was of this idea in 1545 when he considered declination as proof that the 9th sphere of the heavens, from Aristotelian-Ptolemaic cosmology, was continually in movement, and this was the reason the magnetic declination existed.[23]

The reason for this interest was practical because, knowing the declination and latitude of a site (calculating latitude being relatively easy), it was possible to calculate its longitude without needing to resort to the complex and imprecise methods employed up until then, such as horizontally pivoted clocks, the observation of rare astronomic events, and so on.

Dealing with such an argument, Mercator, as was his habit, used his practical sense along with his prevalent interest in cosmology. His aim was, in fact, to identify the north magnetic pole and to use its meridian (i.e. that passing through both geographic and magnetic poles) as the prime meridian; i.e. with zero declination.

This signified founding cartographic references upon physics, rather than upon politics or tradition, which had used the Canary Islands as meridian since the times of Ptolemy.

Sailors had suggested that magnetic and geographic poles coincided in some places: at the Green Cape, as reported by a sailor from Dieppe named Franciscus, or at Corbo Isle, in the Azores.[24]

Mercator chose these points of reference for identifying zero meridian on his North Pole map of 1569. Twenty three years before, in the letter addressed to Cardinal Perrenot, he had employed other trigonometric calculations for locating the magnetic pole, proposing then 168° longitude from the Canary Islands and 79° latitude, demonstrating that he already had this argument in mind.

Declination, in fact, increased gradually as the ship moved away from the magnetic pole: it was zero at the prime meridian, at 90°, and at 180°, on the other side, but it was at its maximum going North-East (up to 270°), and then reduced toward zero.[25]

The calculation of a site's longitude through declination was based on the following reasoning: the declination of a site was calculated by comparing the direction of the magnetic needle with geographic North, indicated by the polar star (the North Star). This measurement showed the angle produced by the crossing of the two meridians, the first passing through the geographic pole, the other through the magnetic one.
A spherical triangle was thus formed, from which the measurements of two arcs and an angle were available, and, in this way, the longitude of the site was identifiable, through spherical trigonometry.
For a mind trained by Gemma Phrysius' teaching of triangulation, this reasoning was only a trigonometric calculation, but for a visionary mind, like Mercator's, who saw the cosmological and symbolic connections between the pythagoric Y device and the moral structure of the world, this matter would have seemed much more complex.
The calculation of longitude, founded on a series of lines and circles crossing over, must have seemed like another physical and geographical version of the generative principle of esoteric tradition. Y was an icon of the "right way", not unlike that which secured the route through longitude measurements.[26]
The mechanism of correcting the loxodromic routes did not function differently (an artifice John Dee had called *paradoxall*, like an alchemic marvel, because it was not as it seemed).
Represented together, the loxodoromic and the correct routes seemed like a new Y-shaped line, where the "large way" corresponded to the "long" one (the spiral-shaped) and vice versa. The correct sailing route gradually modified on the plane the gap produced on the map by the curved line of the earth.

5. John Dee: a dynamic follower

Notwithstanding their different characters, John Dee and Mercator cultivated very close interests. The more their scientific studies developed, the clearer and more similar their enquiries became, as was evident by Dee's expressed esteem of Mercator in 1558.
Mercator revealed himself, as documents show, as having the same intellectual influence on Dee as Franciscus Monachus probably did.
Remembering the years spent in Louvain, Dee wrote in the dedication of his *Propaeudeumata aphoristica* (1558), of his friendship with Mercator in the following words. In them the iteration of number 3 is not casual and alludes to their shared interest in numerology.
"Et maxime, cum mutuae nostrae amicitiae, familiaritatisque consuetudo ea erat, toto ut triennio, vix totos tres simul dies, alter alterius lubens careret aspectu: et tea utriusque nostrum discendi, philosophandique aviditas, ut postquam conveniremus, tribus vix horae minutis, ab arduarum et utilissimarum rerum indagatione abstineremus" (*Such was the eagerness of both of us for learning and philosophising that, after we had come together during three years, we scarcely left off the investigation of difficult and useful problems for more of three days and three minutes of an hour*).[27]

In 1558, in fact, Dee published his *Propaeudeumata aphoristica* dedicated to Mercator, reprinted in 1568.
This work could possibly be a personal elaboration by Dee of the studies carried out together at Louvain, regarding the physical foundations of astrological influences modelled on the behaviour of rays of light.
Mercator was not sympathetic towards the astrologians, especially those employed in judicial astrology. In his Prologue of the Atlas, he writes "I consider absurd the opinion

of the astrologians about the malice of Saturn and Mars.[28] Stars have an influence on human things, but life's choices belong to men, who are free".
Mercator was interested in astrology as a science of great universal tendences, of the *harmonia mundi.*
Mercator had planned to write a book on astrology in his great publishing program dedicated to cosmology. In his 1569 *Chronologia quatuor evangelarum*, he wrote that great historical events follow the movements of the stars; these influences were to be considered, however, as mainly physical and imitating the laws of light and of the cosmos.
For instance, the influence of the stars was proportional to their size and proximity to Earth; it was therefore stronger when their rays were perpendicular rather than oblique (in the same way, the magnetic pole influenced the needle of the compass).
In other words, the structure of the world was founded on numbers, and astrology was no exception.
In the *Propaeudeumata*, we find another central principle for Mercator's research in the '40s. Dee perceived the magnet as a providential and divine tool allowing humans to understand how the cosmos functions, i.e. the general attraction of bodies and universal harmony.[29]
Like the stars, the magnet has an influence proportional to its size, but it has a very local power.
Here Dee applied Roger Bacon's physical principle: the so-called "multiplication of the species". This law, according to Bacon, considered the behaviour of magnets as typical of created matter. Dee suggested the action of the magnet wasn't an *emanation*, i.e. of divine origin, but only a particular condition of a medium impressed by an active force. In practice, this was the explanation for the terrestrial origin of magnetic declination, as Mercator had written to Cardinal Perrenot in his letter.[30]

Two documents recently studied by Steven vanden Broecke[31], confirm that Mercator's way of thinking was very close to Dee's.
The first was an astrological disc made in 1551 (the only known one, now at the Historiches Museum of Basel), a year after Dee's definitive return to England.
It had been made to support Mercator's celestial globe printed in the same year.
The disc has the Zodiac circle and ten superimposed circles, used to aid calculation.
This instrument confirms Mercator's interest in producing precise astrological tools, but it is also accompanied by an explanatory text, on the reverse, specifying the value of astrology when supported by mathematical demonstrations.
Like for Dee, astrology, for Mercator, was more a theory, a support for studying cosmology and its laws, i.e. an essential component of "cartographic meditations".
And it is specifically to the cosmographic meditations that the *Breves in sphaeram meditatiunculae* (Koln, 1563), a little work by Mercator'son, Bartholomew, refers even in the title. This work, considered only by a few scholars, is the collection of the lessons taught by Mercator at the Duisburg Gymnasium in about 1560.
It explains clearly that the influence of the stars is proportional to their size and angle of incidence, which is exactly what Dee had sustained in his work.

Dee published, in 1564, another work developing *Propaeudeumata's* thinking; he used for the title-page of his work the same picture already printed in the work dedicated to Mercator. The book was entitled *Monas hieroglyphica*.
For many years this work was considered incomprehensible, but the studies of Nicolas H. Clulee[32] have managed to explain something of the meaning and strategic role in Dee's thinking.

It is still, however, unclear how much Mercator shared Dee's apparently strange speculations.
Having studied these documents, my opinion is that the link with Dee was uninterrupted and is, on the contrary, decisive for understanding Mercator's cosmology and his analysis of terrestrial magnetism.
At the heart of the *Monas* (a title also used by Mercator for his *Evangelicae historiae quadripartita Monas,* 1592) was the discovery (according to Dee's thinking) of a *real cabala*, i.e. of a writing made up of characters which, in their turn, represented the fundamental principles of the cosmos, symbolized by the hieroglyph of the *Monas*.
It was composed of a circle (the universe), a semicircle (the moon), a cross (the four elements) and the double semicircle, representing Aries, the first of the Zodiacal signs, under which creation, according to astrology, began.
This cosmological writing was founded in Hebraic mysticism and in the magic of Trithemius (a book of which Dee had procured from a mysterious dealer in Antwerp).
On the basis of these principles, alchemy was, in short, an *astronomia inferior*, i.e. a guide-science for the connections between the earth and the heavens, following Ermes Trismegistus' *Tabula smaragdina* motto: "what is at the bottom is also at the top, and vice versa".
The study of the causes of the physical world was, finally, analogous to the study of the causes of the stars. Discovering the deep unity of the cosmos, the *Monas*, signified, above all, an interior discovery, a moral elevation. At the same time this acted demiurgically on nature, after having understood its constitutive laws.
To illustrate this principle, Dee made use of the pythaghoric Y as a symbol linked to interior elevation (a figure, in turn, connected to moral choice: the easy way of vice and that narrow and difficult one, to virtue, represented by the two lines of the letter). This elevation was preliminary and essential for understanding the fundaments of the *Opus*, following a scale of 8° (multiple of 4) that moved from childhood till the superior condition of *Adeptius*.
Y was still, in Dee's thinking, a moral symbol, but this dimension, like in Mercator's calligraphic manual and his cosmological setting, was a founding principle of all physical actions upon nature.
One of these principles was indeed the pythagoric *Tetractys*, the quaternarian model at the genesis of the world (1+2+3+4=10).
(1) Number One, the point (i.e. Yod), is the principle and generates (2) the line (representing the imperfect condition of the terrestrial world); (3) the line, rotating upon itself, generates the circle (the cosmos, perfect in its circularity), which is made up of (4) the four elements and their multiples; at the origin of many physical phenomena.
The sum of these universal numbers/characters was 10, represented by Y, which was, again, the point, and the mechanism began again, passing through the letter Y, parent of the other letters of the alphabet, as in Mercator's *Literatum latinarum* book.
In this way the fundaments of astrology and the moral and behavioural significance of the planets became constitutive principles of the chemistry of metals, considered to be all the same substance: sulphur, mercury and salt in different quantities and purities.
Gold was composed, for instance, of sulphur (very little, i.e. the sun) and mercury (a lot, i.e. the moon) at the maximum of their purity.
Salt was, in turn, a mediator connecting together the different components of metals and nature. It was, in fact, a kind of *anima mundi*, an *Eros*, in the spiritualist tradition of alchemy connecting Trithemius to Dee, but also Dee to Mercator, in a long history where Spiritual Franciscans from the 13th century were among the main supporters of this idea.
The Moon in the heavens was, for Dee and Mercator, a mediator between superior influences and terrestrial actions. The Sun, as well as being equivalent to the human heart

in the astronomic system, also purified substances in the alchemical process; i.e. the procedure that presided over the generation of superior substances.
Both were linked to mercury and sulphur.[33]
Some of these principles had been described in Mercator's *Typus universitatis*, but it is significant that in the Prologue of his Atlas, published posthumously, where he reconstructed the steps of creation, following the Christian paradigm of the seven days, according with divine providence, the architecture of his cosmological explanation, the fundement of his *Meditationes de fabrica mundi*, followed, with due respect for orthodox religion, the alchemic model of *solve et coagula*. A principle, like alchemy, regulated by physical and deterministic mechanisms, but under the structure of spiritual harmony and natural unity.

At the beginning, Mercator writes, there was a fluid substance, a mixture of water and earth, Moses had named *thethom*, which means *abyss*.
As this substance solidified, the heaviest parts collected at the bottom and the lightest at the top. Thanks to light which gradually increased through this substance, the separation of water and earth occurred. Air was generated from water, and the air generated the firmament, according to the principle that what is lighter tends to go up and vice versa.
Finally air became aether, which the Scriptures call "overcelestial waters" (*Genesis*. 1, 2),[34] but which is actually, as Mercator underlines, a substance similar to water produced by the distillation and sublimation of air.
Therefore, a providential harmony has given way to a substantially physical process, which still continues because there is nothing incorruptibile under the *empyraeum* (see *typus universitatis*).
The earth generated, therefore, its vital species, such as plants and animals, and, on a lower scale, minerals, thanks to the generative warmth of natural processes.
Thus gold is produced through a *coagulatio*, under the influence of spiritual power, without however increasing in size, and thanks to this, it is contracted and agglomerated by the heat of sulphur, becoming the heaviest metal in nature, which is classic alchemic reasoning.

Dee wasn't involved in alchemy before setting up his laboratory at Mortlake, in about 1570, and certainly Mercator never had interests in transmutating metals. It is probable anyway that the principles of the *astronomia inferior* had a place among his cosmographical meditationes.
Within this architecture, magnetism was proof of the universal harmonic structure, that Mercator may have found in ancient Stoicism, as R. Vermij suggested in 1994,[35] was in existence in humanistic circles in 16th century Low Countries.
The knowledge of metals, for the most part borrowed from alchemy, and occultism had become, finally, in the 16th century, disciplines integrated into Cosmology. Metals and their relations to planets were part of the domain of the cosmographer. This was so well recognized in England, that, besides Dee, alchemists like Robert Recorde and Richard Eden were also cosmographers, authors of mathematical books, maps and scientific translations.[36]
Recorde and Eden were employed by the state as alchemists, for instance, to supervise the extraction of minerals for the royal treasury.
Mercator's library had many books on this matter, classified on his shelf as "Mathematical" or "Medical" books.[37]

Among them some booklets by Charles de Bovelle; the *De diebus decretoriis* (Rome, 1546) by Lucas Gaurico; the *Astrologiae methodus* (Basel, 1576) by Johannes Garcaeus; the *Exempla, quibus astrologiae scientiae certitudo* (Koln, 1585) by Henrich Rantzau, with whom Mercator

corresponded about astrological matters; the *Alchimiae libri* by Geber, the most important Arabic alchemist (Nurberg, 1545) and the *De alchimia dialogi duo* by the same author (Lion, 1548) edited by John Braccesco, an Italian alchemist, author, in turn, of *L'albero della vita* (Rome, 1542).
He owned the *Libelli quinque* (*Aphorismi astronomici*, 1547) by Jerome Cardano; the *De natura magnetis* by the Jesuit Johannes Taisnier (Koln, 1562), which was a plagiarized translation of Petrus Peregrinus' *Epistola de magnete*, conserved and annotated by Dee too; Elias Olai's *Diarium astrologicum et meteorologicum,* a meteorological catalogue of the year 1586, written by Tycho Brahe and published under the name of a Hven student; Marsilio Ficino's *De vita* (Paris, 1592); the *Grosse Wundartznei* (Ulm, 1536) by Paracelse; George Agricola's *De re metallica*; the *Dictionarium quod gemmarum vocant*, in the edition published in Venice in 1568.

6. *Rupes nigra*

Terrestrial magnetism was a central argument for Mercator's cosmology, a mixture of Holy Scriptures and astrological-alchemic physics.
Being naturally reserved, and having been tested by the experience of prison, Mercator lived in a society surveilled by the Spanish Inquisition and wrote unwillingly of such arguments, which were never definitively solved, as in the case of the real location of the magnetic mountain of the North Pole.
In his 1552 *Declaratio* he had clarified that he favoured a terrestrial location. Many histories and mythologies agreed with this solution, but there was also documented evidence.
Ptolemy (VII, 2) had narrated that in the Manioles islands (perhaps in Borneo) ships' nails had been attracted by a mysterious force. The *Thousand and one nights* of Arabic folk-lore had situated such a mountain in the Red Sea, in the Persian Gulf and in the Indian Ocean. Then, in the 12th century, the story had passed into Northern Europe in the narrative of Saint Brandan, the Norwegian sagas, John Mandeville. The Italian poet Guido Guinizzelli, in the 13th century, had located the mountain in the Alps, Peter of Aban at the Arctic Pole.[38]
In 1550-59 Ramusio's collection of *Navigazioni e viaggi*[39] had circulated the story of the Venetian Nicolò Zeno, who had written that some of his forefathers had reached, in about the 14th century, Greenland, where they had found a Christian monastery and three great islands: Frisland, Eastland and Icaria, between Iceland and Scotland, but they made no reference to the magnetic mountain.
Maps of the North Pole began to be populated with islands. Martin Behaim's globe (1492) had four land masses on the Pole not fully separated from each other; channels coming from the Ocean were drawn, as in Mercator's maps; the Pole is not actually perceptible because the iron fixture on the globe is in the way. But there are still, in the Gangetic Gulf, the ancient magnetic islands.
Johannes Ruysch's world map published in Rome in 1517 has four islands around the Pole and its legend mentions, among its sources, the book of the *Inventio Fortunatae*. These islands appeared again in Phrysius' 1534 world map. The Marine map by Olaus Magnus (1539) presented both the four islands and the magnetic mountain.
In the meantime, in the search for the northern passage, there had been reports of a dark mountain. The rock brought back by chance from Martin Frobischer's first voyage to find a NW passage, was dark, and it caused a foolish gold fever as it contained tiny traces of the metal.[40] The land discovered by H. Willoughby and R. Chancellor when searching for the North-East passage was dark, but that was due to the polar nights.
Answering John Dee[41] on April 20th 1577, in a letter then annotated and copied by the English scholar into his manuscript *Volumen of Great and Rich Discoveries*, written to legally justify English colonial ambitions in the north, Mercator told the story of the

Inventio Fortunatae, discovered by reading the book of the Belgian traveller, Jacob Cnoyen of Hertogenbosch.
Mercator's report is written (as he underlines) *ad verbum*. Cnoyen's book was a geographical compilation about the north, a kind of anthology of many authors, among whom probably John Mandeville, who, in fact, is quoted.
Notwithstanding the *Inventio Fortunatae* is quoted, it is clear that Mercator follows Cnoyen's narration. The Belgian voyager remembers that King Arthur had colonized the northern regions, called "provinces of darkness" (evidently due to the polar nights). He describes the closed sea beyond Greenland, surrounded by a chain of mountains for seventeen miles. There the North Pole islands are to be found, at about 70-78° latitude, once called *Ciliae* (probably the ancient *Thule*, Mercator suggests), with many closed channels and strong currents, all running northwards, preventing every ship from turning back, with a frozen sea from October till March.
In 1364, Cnoyen tells of a delegation of people sent by King Arthur to colonize the north, who came back to see the Norwegian king. Among them was a priest (probably the Norwegian Ivar Bardarson)[42] who told that while visiting the northern regions, their forefathers had found short people, 23 feet tall, and magnetic lands.
This priest reported that some years before, in about 1360, a Minorite friar from Oxford (identified as Nicholas of Lynn, 14th century English astronomer who was also a Carmelite, but actually taught at Oxford), a good astronomer, had travelled as far as the Pole and had written, in Latin, in a book entitled *Inventio Fortunatae*, what he had seen from 54° latitude as far as the Pole for the king of England (whom Dee identifies as Edward III).
The Minorite specified that a chain of mountains formed a wall of northern islands, with the exception of some apertures into which 19 channels flowed. The largest one was 12 French miles, the narrowest ¾ mile, and here no ship could have passed due to the strong current. Besides the 19 channels, other five were joined together and flowed into the closed sea.
Here the friar had not found inhabitants, except for 23 short people, 4 feet tall, 16 of whom were women. Elsewhere he had not found traces of human life.
In the middle there was the enclosed sea, 12 French miles wide. On the other side there extended a splendid plain, among the most salubrious of the north. In the centre of the enclosed sea there was a vortex into which flowed the four internal seas of the Pole.
The water moves, he writes, in a circle and goes down into the depths of the earth, as though it were being poured into a funnel, and the aperture is almost eight degrees.
In the middle of the sea there is a mountain 33 French miles wide, completely made of magnet, "black", "glistening" and as high as the clouds.
Reading the cartouche dedicated to the Arctic region in the 1569 map and the commentary on the other map published in the *Atlas* (with a larger representation of the northern area), it is evident that Mercator used this source and considered it reliable.
On both maps, though, we find the unsolved question of the location of the magnetic pole. The geographic pole remains at the centre of the map with its magnetic mountain and the four islands. But another little mountain has been engraved on one of the two magnetic poles. The other magnetic pole is represented with a little dot.
Both locations of the magnetic poles, as we know, derive from the different calculations Mercator had made on discordant information supplied by sailors. He decided not to make a choice between the calculations, which also left space for future clarifications.[43]
At the heart of the "Polus Arcticus" stood out the *Rupes nigra et altissima*.

6.1. Northern Pygmies, the Tenth Lost Tribe of Israel and Terrestrial Paradise

Many Mercator specialists have been surprised by the fabulous nature of these maps and commentaries, which seems inconsistent with Mercator's usual critical and scientific style.

This place described resembles a kind of paradise to Nicholas Crane. And Mercator's other biographer, Andrew Taylor, notes a descent into a "grotesque tale that could have been told by Herodotus more than a millenium earlier".[44]

There are also "infernal" elements, such as the vortex. Plato considered the Tartarus, the infernal river, as the source of terrestrial seas and rivers where the water returned through subterranean channels. Cartesius and Kircher made similar interpretations in the 17th century, and seemed to be developing an argument previously suggested by Agricola. In his treatise about metals, in fact, Agricola sustained that rivers reached the sea through terrestrial cavities.[45]

Mercator's map picks up the idea of Pygmies, called *Skraelinger* (considered people of incomprehensible language and small in height), who were among the inhabitants of the northern isles.

Pygmies were some of the legendary people described in the fantastic ethnography from the time of Alexander the Great, in late antiquity, who then moved away and were discovered gradually in different places. Pygmies had been described by Homer as being only a cubit tall (*pygme* in Greek), who fought with cranes at the edge of the world. Pliny the Elder located them in India and Ethiopia, but in 1120 the *Book of the Icelanders* by Ari Thorgillson, describing Norwegian colonization of Greenland and North America, called them for the first time *Skraelinger*, mentioning their incomprehensible language (Norwegian *skrale* means in fact hoarse voice). They were probably *Eskimos*, evidently not as tall as Norwegians.

As the Norwegians began, after the 12th century, to become familiar with Latin and read books such as Isidor of Seville (who had synthetized the tales of monstrous and fabulous people from late antiquity), the expression became synonymous with Pygmies.[46]

In 1525 the Italian historian Paolo Giovio had located them in Siberia, based on diplomatic information from the Moscow ambassador to Pope Clement VII, Demetrios. Gian Lorenzo of Anania (1576) knew them as the inhabitants of Greenland, called *Greeningen* (an evident mangling of the word *Skraelinger*). Even Gemma Phrysius (1548) had placed Pygmies in the northern seas.

Pliny wrote that Pygmies had also been found in the northern regions, in the Black Sea, beyond the Caspian. Olaus Magnus, archbishop of Sweden, had located them in his 1539 *Marine map* in Greenland, quoting Pliny, but probably also using other local sources (or rather, what he thought were local sources).

But, before Olaus, in 1532, another scholar, Jakob Ziegler, in his description of the *Schondia* (the Scandinavian region)[47], had represented Pygmies in two different places in the north: the undiscovered region of the "Terra Bacalaos" (the land of the stockfishes), near the North Pole, linked to Norway by a strip of land, through which Pygmies had reached Greenland (the other location).

Ziegler had been the main source for Mercator's map of Palestine, and he might have been convinced by the different sources and descriptions concerning the location of Pygmies in the extreme north, which confirmed Cnoyen's statements.

The argument for the Pygmies' passage toward the North Pole through the strip of land of Greenland had also been used by Guillaume Postel in his 1581 world map *Polo aptata nova charta universi.* It confirmed a bridge of ice between Asia and the northern islands, and might have explained the presence of short men at the North Pole. This idea had been taken up again in another world map probably printed by Gerard de Jode of Antwerp in about 1581-87.[48]

From this point of view the arrival of Pygmies in the north was a similar story to the 10 lost tribes of Israel which, according to the Holy Scriptures (*Esdras*, 2, 13, 41-42), had crossed the Euphrates river going north as far as a region called *Arsazeth* (meaning in Hebraic "another country"), from which they would return in the last days of the world.
In 1544 Sebastian Münster had inserted Arsazeth in his map of Asia and in his *Cosmography*. Ortelius had also represented the region in his map of Tartaria of the *Theatrum orbis terrarum* (1570), very close to the Polar Circle.
He linked this place-name to the story of the 10 lost tribes, that – it has been sustained – after reaching Scithya, had changed their name to *Gotes* or *Gothes*. Ortelius had evidently been influenced by Postel, who suggested a mystical interpretation of this biblical story, basing his reasoning on the similarity between the word *Gaou* or *Gaoth* used by Moses crossing the Red Sea, and the refrain of a song *Ga'oh, Ga'oh*, quoted in the *Zohar*, (a reference book for cabalists), which in its 1573 edition, Postel linked to the story of the 10 lost tribes of Israel.[49]
In the chapter dedicated to Tartaria of the *Theatrum*, Ortelius had synthetized Postel's speculations, but all the same, he followed his theory.[50]
The map of the polar region by Postel (1581) featured Mercator's four islands again, without any mystical digression, but in his 1561 *Cosmographicae disciplinae compendium* (which Mercator owned), Postel had already located terrestrial paradise at the North Pole, removing it from a previous location (1553) in the Moluccas.
This new northern location was not of secondary interest for Postel's mystical cosmology because, finally identifying the 10 lost tribes as Goths, allowed him to consider the Gothic language as what remained of the original Adamitic language and to underline that people fortified by the rigours of the northern climate presented the same characteristics of longevity as the ancient people of Paradise.
At the creation of the world, he thought, God had preserved physical characteristics in the high mountain of the North Pole that were very different from any other terrestrial site.[51]

6.2. Mercator's Christian Physics

Mercator knew Postel's works and Ortelius' *Theatrum*, but he made no reference to these stories in his *Atlas* and in the two maps of the North Pole.
There were Pygmies, called *Skraelinger* at the North Pole, as well as particularly salubrious land, but nothing more.[52]
Mercator's mysticism operates at another level compared to the mainly literary and historical mysticism of Postel and Ortelius'. Mercator works at the level of physics and cosmology with a marked alchemical sensitiveness, which he considered a science of foundation, through which it was possibile to restore real *Christian physics*, as in the thinking of the spiritualist alchemists.
Instead of thinking of a terrestrial paradise at the Pole, Mercator tries in fact to understand the providential character of the magnetic mountain and its vortex.
In the Prologue to his *Atlas*, Mercator explains the reason for water disappearing into the hole 8° wide, when he describes the location of seas and rivers on earth in the course of creation.
To solidify the primary fluid matter, Mercator wrote that the sun and moon, helped by the wind, contributed to making terrestrial matter dry and solid. Water was therefore separated from earth, but being lighter in weight, Providence made it penetrate terrestrial cavities to physically balance the earth. It could have ended up on the surface, but, in that case, it would have concentrated in the centre and become stagnant, preventing humankind from benefitting from it as well as contacting other people across it. Or,

again, it might have been absorbed into the earth, or even gradually evaporated, due to lack of balance of the parts.
The "machine of the earth", Mercator says, has therefore been able to regulate itself allowing water to move continually, re-balancing the weight of the emerged land.
The same could be said about the two terrestrial poles.
Then, the horrific cavity of the North Pole was, finally, a positive and providential mechanism.

Mercator insisted that there was fresh water on the east and west sides of the Arctic Polar Circle.
Following Pliny, he remembered the Tabin promontory (today, perhaps Tscheliuskin) at the extreme north of Asia. He wrote to Hakluyt, on July 28th 1580, that he had calculated, thanks to magnetic declination, that this promontory was not far from the Pole and very much advanced over the sea. From there, he suggested, it may be possibile to reach Cathay more easily than from the west. He begged Hakluyt to keep him informed if Arthur Pet, commander of the 1580 English expedition searching for the North-East passage, and collaborator of William Borough, had noted whether the sea between the Nova Zemlia island and the Tabin promontory was of fresh water, possibly confirming his hypotheses.[53]
On the other western side of the Arctic Circle, Mercator's 1595 map registers a sea "dulcium aquarum cuius terminum ignorari Canadienses ex relatu Saguenaiensium aiunt" (as written on the map). In this case Mercator's source was the French Captain Jacques Cartier's account of a voyage exploring northern Canada in 1535-38. He had searched in vain for the "Saguenay Kingdom", which native Iroquois had spoken of, full of gold mines, washed by fresh water and inhabited by white people.
Gold was never found, but the sea was probably Huron Lake, one of the the largest lakes in the world and of fresh water. The Iroquois had not invented everything: the sea was a closed lake, but Mercator could not have known it.[54]

From the alchemic point of view, fresh water was produced by distillation, one of the steps of the *Opus* (but it it is also true that polar glaciers are partially made of fresh water);[55] and this seems coherent with the paradisiacal atmosphere of Mercator's North Pole.
According to alchemic metallurgy, actually, water became enriched with minerals, mainly mercury, while running through the cavities of the earth. In this itinerary it became (following Sendivogius' thinking, a collaborator of John Dee in the alchemic experiments in Prague) the so-called *sal nitrum*, the constitutive principle of life, also called water for its vital power on nature.
For Sendivogius (Michael Sedziwoj, 1566-1636) mercury was like a kind of *sperm*, a life-carrier, linked to *salt*. Alchemists considered that other minerals were also the product of the acqueous vapour existing in the bowels of the earth.[56]
Water therefore, was like the blood of the human circulatory system. Mercator had compared it, in his cosmology, to the structure of the world. This coagulative property of salt would become central in Paracelse's thinking, but it had already been fundamental in medieval alchemic tradition. John of Rochelle, successor to Alexander of Sales in the Franciscan chair of theology in Paris, in the 13th century, had again considered the *Fifth essence,* that Aristotle had renamed *Aether*, considering it the matter of the celestial spheres (the overcelestial waters produced by distillation and sublimation of air, as Mercator wrote in the Prologue of the *Atlas*). They said this substance was able to contain the other four elements and was the very matter of the soul, considered in fact a kind of

salt, a medium able to hold together the soul and the body, coinciding with Universal Love.
This *Fifth essence* became materially visible, La Rochelle had sustained, after the dissolution of the human body, as salt.[57]

Another argument about the location of the magnetic mountain makes clear the meaning Mercator may have given to the two different North Poles.
His 1595 map shows, 26 years after the 1569 one, three different locations for the mountain. Two of these were the result of differing calculations, and were therefore temporary. But was there a connection between the two poles?
On one side the magnetic pole was similar, as in the Pythagoric Y, the wide street, the inert route attracted toward the mistaken pole. This necessitated the use of discernment to find the "true North".
But at the same time, the magnetic pole seemed to be carrying out a providential function, linked to the balancing of the planet.
It is probable that Mercator meditated for a long time about this problem without finding a cosmological solution. So he preserved the two different locations for almost twenty six years, reprinting the two little pictures of the mountain.
A few years after Mercator's death, in 1600, William Gilbert's *De magnete* (Dee's student) apparently solved this problem sustaining that all the earth was a huge magnet.

This uncertainty probably had deeper roots.
One of the problems in representing the Zodiac, which was very much debated in the first half of the 16th century by astrologers, Gemma Phrysius included, was the so-called "domification" of the planets.
The 12 "Houses" in which the Zodiac was divided represented the places where the planets had maximum influence. They were identified dividing the Zodiac into 12 equal parts, each of them measuring 30°.
This kind of division, however, did not correspond to the (apparent) reality of the heavens, because the centre of the sky (called *Medium Coeli*, i.e. the highest position of the sky in respect to the point of observation or to the birth date) divides the ecliptic into two equal parts only twice in its complete rotation. This happens, in fact, when the two Equinoxes are rising.
One solution was to represent the Houses (in a similar way to the method of "increasing latitudes" proposed by Mercator for his world map for sailing) dividing them into unequal parts. There were many proposed solutions.[58]
For this reason the 10th House was retrograded between the 9th and the 10th. Cardan had proposed this practical solution in his horoscopes, substituting the name of *Medium Coeli* with *Cor Coeli*, which varied in his horoscopes, according to necessity and to the calendar.
This principle was analogous to the different locations of the two poles. The *Medium Coeli,* the most northern part of the sky, was not exactly where it seemed to be, and as the 9th House of the astrologers presided over the *Peregrinationes*, the parallel was even stronger with the routes that the calculation of the declination allowed or involved.
As usual, the solution came from the connections between the top and bottom which revealed that north, in the horoscope, i.e. the 10th House, showed a "declination" and some instability.
The dialectic relationship between the magnetic and the geographic poles could be significant: the two poles had, in some way, to cohabit.
The problem which was never solved by Mercator, might have represented one of those paradoxical (*paradoxall*) situations of which John Dee had spoken, where appearances

gave rise to the meditations of the *pneumatikos* philosopher, who, like "Heracles at the crossroads" in the classical tradition, symbolized by the Pythagoric Y, would have been further proof of the dark routes of Divine Providence.

Notes

[1] It seems this portrait was already in circulation in 1572. See in *Imago Mundi*, 17, 1963, the report of the 1962 celebrations dedicated to Mercator.
[2] The *Declaratio* was published by J. van Raedmonck (Saint Nicolas, 1868). A 17th century manuscript copy has been found in the Estense Library of Modena. See P. Radelet-de Grave, "Le magnetisme et la localisation en mer", in M. Watelet, ed., *Gérard Mercator cosmographe, le temps et l'espace,* Antwerp, Fonds Mercator Paribas, 1994, pp. 209-219.
[3] See the letter of 1546, February 26th, in M. van Durme, ed., *Correspondance mercatorienne,* Antwerp, 1959, n. 18. Mercator's astrolab conserved in the History of Science Museum of Florence with the maps of the North and South Poles on the two sides, shows the same latitude of 74°. See G.E. Turner, E. Dekker, "Les astrolabes", in M. Watelet, ed., *Gérard Mercator cosmographe, le temps et l'espace,* Antwerp, Fonds Mercator Paribas, 1994, pp. 179-191.
[4] N. Crane, Mercator, *The man who mapped the planet*, London, Orion Books, 2010, chap. 9.
[5] Richard Hakluyt had proposed the name of Nicholas of Lynn, astronomer, explorer and professor at Oxford in the 14th century, as the author of the *Inventio Fortunatae*. He was Carmelite, but Carmelitans were a mendicant Order and might be confused with Franciscans. E.G.R. Taylor did not agree in her "A letter dated 1577 from Mercator to John Dee," in *Imago Mundi*, 13, 1956, pp. 56-68.
[6] M. van Durme, ed., *Correspondance mercatorienne*, Antwerp, 1959, n. 114, p. 132.
[7] R.W. Karrow Jr, *Mapmakers of the Sixteenth Century and their Maps. Bio-Bibliographies of the Cosmographers of Abraham Ortelius, 1570*, Chicago, Speculum Orbis Press, 1993, ad vocem *Franciscus Monachus***.** On Monachus see B. de Treyer, "Franciscus Monachus", in *Franciscana*, n. 17, pp. 96-105.
[8] N. Crane, quoted, chap. 5.
[9] On Mercator's double cordiform world map of 1538, the dedication was engraved to Johannes Drosius, who was among those arrested and charged with heresy in 1544 along with Mercator. In my *Il "mondo" di Abramo Ortelio. Misticismo, geografia e collezionismo nel Rinascimento dei Paesi Bassi*, Modena, Franco Cosimo Panini, 1998 (2006 rep.), chap. "Cor mundi", I proposed a link between the cordiform projection world map used by Phyneus, Mercator, Postel and Ortelius, with the esoteric interests of the time linked to the religous sect "The Family of Love", which used the heart as symbol and was active in Antwerp (which was only founded in 1540), of which Ortelius and the printer Christopher Plantin were members. See also my "Abraham Ortelius and the Hermetic Meaning of the Cordiform Projection", in *Imago Mundi*, 50, 1998, pp. 59-83.
[10] A. De Smet, "Gérard Mercator (1512-1594) et les sciences occultes", in *Scientiarum Historia*, 1-2, 1990, pp. 5-10. See also A. De Smet, "Mercator à Louvain (1530-1552)", in *Duisburger Forschungen*, n. 6, 1962, pp. 28-90.
[11] S. Vanden Broecke, *The limits of influence: Pico, Louvain and the crisi of Renaissance Astrology,* Leiden, Brill, 2003, pp. 113-121. Vanden Broecke's source is Stadius, *Ephemerides*, 1556, fol. A4r.
[12] See J. Hewitt, *The terrestrial spere of the Spheres' tapestries*, Australian Map Circle, 2010. About Monachus's globe see M. Pellettier, "Die herzogförmigen Weltkarten von Oronce Fine", in *Cartographica Helvetica*, 12, 1995, pp. 27-37.
[13] The role of preliminary "purification" for the philosopher entering the occult mysteries, was central to Trithemius's thinking. Dee was able to buy a copy of the precious *Steganographia* by Trithemius from a merchant in Antwerp in 1563. This book probably influenced Dee's idea of *real cabala*. The spiritualist canon favoured by Franciscans was founded on a profound fusion of Christian thinking and the occult sciences.
[14] In my *Cartografia morale. Geografia, persuasione, identità*, Modena, Franco Cosimo Panini, 2006 (chap. 4, pp. 100-112), I studied Ramon Lull's role and his mnemonic devices at the outset of nautical Catalan cartography. The *toleta* and *marteloyo* (i.e. the map and watch, with a hammer, used constantly while verifying the route), along with the compilation of the on board diary, were perceived (along with financial accounting) as behaviour analogous to meditation and prayer.
[15] Rescius had been among the subscribers to the publication of Mercator's 1541 terrestrial globe. About this argument see J. Denucè, ed*., The treatise of Gerard Mercator. Literarum latinarum, quas Italicas, cursoriasque vocant, scribendarum ratio*, Antwerp-Paris, 1930; T. Croiset van Uchelen, "L'ecriture et la

calligraphie", in M. Watelet, ed., *Gérard Mercator cosmographe, le temps et l'espace*, Antwerp, Fonds Mercator Paribas, 1994, pp. 151-161; P. Huvenne, "L'Italique de Mercator", in *Gerard Mercator et la Geographie dans les Pays-Bas Meridionaux,* Antwerp, Museum Plantin-Moretus, 1994, pp. 57-64.

[16] A characteristic of the teaching of the "Brothers of the common life" was attention to writing and printing books. It is known that they had an important influence on developing humanism in northern European countries.

[17] Mercator studied these arguments probably during his retreat to Antwerp, with Monachus. This kind of interest had already been cultivated at the "Collegium Trilingue" founded in Louvain in 1517, which boosted orientalist studies. Here Rutgerus Rescius (1497-1545) had taught Greek and was the publisher of Mercator's calligraphic manual. The "Collegium's" first professor of Hebraic was Mattheus Adrianus, a converted Spanish Jew, who was accused of cultivating cabalistic studies and abandoned his chair in controversy. Adrianus was in touch with the Basel printer, Johann Amerbach (1443-1513), who had published in 1513 an edition of Saint Jerome's commentaries on the Bible, edited by Johann Reuchlin, one of the most authoritative German cabala scholars. Following Pico of Mirandola, Reuchlin had linked the pythagoric symbology to the cabalistic one. Reuchlin had also taught Beatus Renanus, who had studied, in turn, with Charles de Bovelles in Paris, under the guidance of Jean Lefebre d'Etaples, another French Christian cabalist. Bovelles had published an essay on geometry (which Mercator owned) and in this work he had represented the letters of the alphabet inscribed in a square, in a very similar way to Mercator in his 1540 calligraphic manual (which in any case predates Bovelles'one). In the *Tractatus de psalmo X*, Jerome had used cabalist arguments to connect the Hebraic name for God, *Yaweh* (known as the tetragram), with Christ's name, *Jesus*, employing the letter Y in a mystic-prophetic way. In the same way Jerome described Sarah's (the wife of Abraham) change of name, substituting Y (the aspired h of Sarah, represented by Yod) with another letter of the tetragram (*he*), as a demonstration of her elevation to the superior status of "princess of the world". These themes had been discussed similarly by Reuchlin and Lefebre d'Etaples (as noted by Renanus in a letter to Reuchlin of 1509; see B.P. Copenhaver, "Lefevre d'Etaples, Symphorien Champier, and the secret names of God", in the *Journal of the Warburg and Courtauld Institutes,* 40, 1977, pp. 189-211). These were themes, therefore, that were widely circulated. The prophetic change of Sarah's name had also been discussed in Ortelius' *Parergon*, in the commentary to the map *Abrahami Patriarchae Peregrinatio* (one of the most strategic documents of the book). Abraham was traditionally considered as the author of the *Sefer Yecirah*, a masterpiece of the cabala. Mercator, therefore, well informed as ever, had been able to deepen, in 1540-50, the cabalistic meaning of the Pythagoric Y. Andreas Masius (1514-1574), school-friend of Mercator at Louvain and his correspondent for many years, student of Guillaume Postel and collaborator of the Biblia Regia published by Plantin in 1568-73, dedicated himself to cabalistic studies, collecting the essential texts. In the preface to his commentary to Joshua, *Iosuae Imperatoris Historia*, published by Plantin in 1574 (which Mercator owned) he listed the works he had been able to find (see F. Secret, *I cabbalisti cristiani del Rinascimento*, Italian edition, Rome, 1985, pp. 74-75).

[18] See M. van Durme, ed., *Correspondance mercatorienne*, Antwerp, 1959, n. 92. Vivianus (1520-1598) had travelled with Ortelius and other friends on an archeological tour through the Brabant, then narrated in a booklet, *Itinerarium per nonnullas Galliae Belgicae partes*, printed by Plantin in 1584, dedicated to Mercator. In his *Album amicorum*, now at the Koninklijke Bibliotheek, The Hague, Ortelius had drawn Christ's monogram with the script "Christus vitae scopus", already printed over his portrait in the *Theatrum* from 1574.

[19] See W. Dolz, "Mit compass und Elle – Vermessungs methoden und Feldmessinstrumente zur Zeit Gehrad Mercators", in *Duisburger Forschungen*, n. 3, pp.183-196; W. Krücken, "Der gerade weg – Die Merckator-Weltkarte ad usum navigantiun 1569", in *Duisburger Forschungen*, n. 3, pp. 211-219; E.A. Ash, "Navigation techniques and practice in the Renaissance", in D. Woodward, ed., *The history of cartography,* vol. 3, P. I, *Cartography in the European Renaissance*, Chicago, The University of Chicago Press, 2007, pp. 509-527; R.C. Baldwuin, "Colonial cartography under the Tudor and Early Stuart monarchies, c. 1480 – ca. 1640", in D. Woodward, ed., *The history of cartography*, vol. 3, P. II, *Cartography in the European Renaissance,* Chicago, The University of Chicago Press, 2007, pp. 1734-1780. In 1581 also W. Borough had dedicated a book to magnetic declination (*A discourse on the variation of the compass)*.

[20] See F. Hallyn, *Gemma Frisius, arpenteur de la terre et du ciel,* Paris, Honoré Champion, 2008, pp. 45-53.

[21] See R. Baldwin, "John Dee's interest in the application of Nautical Science, Mathematics and Law to English Naval Affairs", in S. Clucas, ed., *John Dee: Interdisciplinary Studies in Renaissance Thought,* Dordrecht, Sprinter, 2006, pp. 97-158.

[22] See the chap. "Cor Mundi" of my *Il "mondo" di Abramo Ortelio*, quoted.

[23] See A.R.T. Jonkers, *Earth's Magnetism in the Age of Sail,* Baltimore and London, Johns Hopkins University Press, 2003, pp. 43-44.

[24] The calculation of geographical distances through spherical trigonometry had been summarized in K. Peucer's *De dimensione terrae*, published at Wüttemberg in 1550, following Regiomontanus, Copernic and Rheticus. Mercator had made two calculations, as far as we know, to locate the magnetic pole. In 1546 in

his letter to Perrenot (see note 3), he mentioned having used the declination of Walcheren island (now Flushing), in Zeeland, and Danzic. The intersection of the circles passing in the two sites placed the magnetic pole at 168° longitude from the Canaries and 79° latitude. In 1569, the calculation was made again at the declination of Regensburg (Bavaria) with the meridian of the Green Cape islands and also Corbo Island (in the Azores). In both cases information had circulated that the two places registerd zero declination. These calculations had finally permitted two different locations for the magnetic pole (73.30 – 74° from the Green Cape meridian or 77° from Corbo Island) which Mercator printed together in his 1569 map and in the subsequent one of 1595, published in the *Atlas*. See Jonkers, quoted, pp. 44-48 and P. Radelet-de Grave, "Le magnetisme et la localisation en mer", in M. Watelet, ed., *Gérard Mercator cosmographe, le temps et l'espace*, Antwerp, Fonds Mercator Paribas, 1994, pp. 209-219.

[25] Jonkers, quoted, P.II, "In the Age of Sail".

[26] Pythagoric Y was linked to the Biblical theme of the "wide" and "narrow" gate (Matthew, 7; Luke, 13), i.e. the moral choice of the easy way to vice and the difficult way to virtue. This concept had been represented in classical tradition, addressed again in the Renaissance, by the figure of "Heracles at the crossroads" and by that, closer to the ermetic and Neo-Platonic world of the *Tabula Coebetis* (representing the same concept through a difficult journey ascending toward Beatitude, on a high mountain). In the classical tradition it was Hesiod (*Works and days,* 287) who translated the theme of moral choice in terms of landscape, as a choice between two roads. Then it was used by Jerome in his comments on the Bible. (See note 17, where he connected the Y to its cabalistic meaning). The image became known, in the 16th century, to the great northern public thanks to the poet Hans Sachs. In the *Stultifera navis* by Sebastian Brant (1572) this image had taken on a marked religious meaning (see E. Panofsky, *Hercules am Scheidewerge und andere antike Bildstoffe in der neueren Kunst,* 1930). In humanistic circles in the Low Countries, in the 16th century, it was very common and frequently used in popular prints. Plantin published an edition of the *Tabula Coebetis* in 1585. See my *Il "mondo" di Abramo Ortelio*, quoted, pp. 110-125.

[27] J. Dee, *Propaeudeumata aphoristica*, dedication to *Clarissimo viro D. Gerardo Mercatori, Rupelmundano,* London, 1558, in W. Shumaker, ed., *John Dee on Astronomy. 'Propaeudeumata Aphoristica' (1558 and 1568), Latin and English,* Berkeley, Los Angeles, London, University of California Press, 1978, pp. 110-111.

[28] "Quamobrem absurdissima iudico quae Astrologi de Saturni et Martis malitia sibi persuadent", *Atlas*, 1595, Prologue, pp. 9-10.

[29] "Illa Deus in magnete proposuit oculis mortalium spectanda, qualia aliis in rebus subtiliori mentis indagini, et sedulitati experiendi maiori, invenienda reliquit". *In the magnet, God has offered to the eyes of mortals for observation qualities which in other objects he has left for discovery to the subtler research of the mind and greater investigative industry* (*Propaeudeumata Aphoristica*, cap. xxxiv, tr. W. Shumaker, quoted).

[30] See J.L. Heilbron, Introduction to W. Shumaker, ed., *John Dee on Astronomy*, quoted, p. 62; About Roger Bacon's theory of the "multiplication of the species" see G. Federici Vescovini, *Le teorie della luce e della visione ottica dal IX al XIV secolo*, Perugia, Morlacchi, 2003, pp. 76-79.

[31] S. Vanden Broecke, "Dee, Mercator, and Louvain Instrument Making: An Undescribed Astrological Disc by Gerard Mercator (1551)", in *Annals of Science*, 58, 2001, pp. 219-240.

[32] N.H. Clulee, "Astronomia inferior: Legacies of Johannes Trithemius and John Dee", in W.R. Newman, A. Grafton, eds., *Secrets of Nature. Astrology and Alchemy in Early Modern Europe,* Cambridge, London, The Mit Press, 2001, pp. 173-233; N.H. Clulee, *John Dee Natural Philosophy: Between Science and Religion*, London, Routledge, 1989.

[33] Prologue to *Atlas*, 1595, p. 25r.

[34] The substance of the celestial spheres was the *Quinta essentia*, which Aristotle had called *Aether*. Alchemists, Franciscan included, tried to synthesize it chemically, naming it *acqua vitae*.

[35] R. Vermij ("Mercator's Stoic Picture of the World", in *Duisburger Mercator-Studien*, n. 2, 1994, pp. 63-81; Id., "Typus Universitatis", in M. Watelet, ed., *Gérard Mercator cosmographe, le temps et l'espace,* Antwerp, Fonds Mercator Paribas, 1994, pp. 235-239; Id. ed., *Gerhard Mercator un seine Welt,* Duisburg, Mercator Verlag, 1997) has suggested that the origin of Mercator's cosmology is to be found in Stoicism. In fact, he finds many similarities: universal sympathy, the teleological determinism of the cosmos, the theory of Providence, the material character of the soul. The revival of Stoicism, in any case, was developed a generation after Mercator by Justus Lipsius. Analogies between the cosmological model of Mercator and that of Robert Fludd, proposed by Vermij, are possibly linked to Fludd's connections with Dee, to whom he was probably a student (see F. Yates, *Theatre of the World*, London, Routledge, 1969). As sustained by Max Polhenz (*Die Stoa. Geschichte einer Geistigen Bewegung*, Göttingen, 1959, vol. 2), quoted by Vermij as an authoritative source, the last period of Stoic thinking is confused with the origins of ermetic philosophy, with which it shared cosmic natural teleology and the unitarian principle of the world ("All is one and one is all" Hermes teaches in the Asclepius; a work linked to the *Corpus Hermeticum*). In a different way to gnosis and Christianity (to which it offered many arguments), late Stoicism joined with ermetic philosophy had an "optimistic" view of natural teleology, turned to good, which Mercator shared

("Voluntas eius est bonitas omnis. Haec eadem bonitas omnium rerum est ex divina eius nata natura", *Asclepius*, 20).

[36] See A. Statman, *Ordering the World. Cosmography and the Occult Sciences in Renaissance England, 1519-1576,* Doctoral Thesis at Columbia University, New York (published on the web site of the Dep. of History in 2009), pp. 53-59. Eden was involved in the legend linked to the premature and improbable discovery of longitude by John Cabot, the most important English sailor. Cabot revealed his secrets to Eden when he was on his death-bed: the discovery of Saint Graal and the method for determinating longitude at sea. These discoveries came to him, he said, by divine revelation. This was what longitude meant for early transoceanic navigation (Statman, quoted, pp. 122-123). With Reform, Geography had become part of reformed Cosmology, strategic for showing what God had impressed on nature for providential purposes. See M. Büttner, "The significance of the Reformation for the reorientation of Geography in Lutheran Germany", in *History of Science* n. 17, 1979, pp. 151-169; G. Mangani, "Misticismo e geografia", chap. III of my *Il "mondo" di Abramo Ortelio. Misticismo, geografia e collezionismo nel Rinascimento dei Paesi Bassi,* Modena, Franco Cosimo Panini, 1998 (2006 rep.).

[37] See *Catalogus librorum bibliothecae carissimi doctissimique viri, piae memoriae, Gerardi Mercatoris,* Lugduni Batavorum, Thomas Basson, 1604, anastatic edition, Paris, Mercator Fonds Paribas, 1994. It is the catalogue of the sale of Mercator's library, printed by the bookseller Thomas Basson.

[38] Jonkers, quoted, pp. 39-48.

[39] Giovanni Battista Ramusio, *Navigazioni e viaggi*, Venice, 1550-1606.

[40] B. Wolley, *The Queen's conjurer. The Science and Magic of Dr John Dee, Adviser to Queen Elizabeth I,* New York, H. Holt, 2001, chap. XII.

[41] Van Durme, quoted, n. 114b. See E.G.R. Taylor, "A letter dated 1577 from Mercator to John Dee", in *Imago Mundi,* 13, 1956, pp. 56-68.

[42] Cnoyen spoke of a 14th century priest, Ivar Bardarson, who lived for many years in Greenland as administrator to the bishop of Gardar. He made a geographical description of Byorno Island, between Iceland and Greenland (perhaps Gunnjorn Island today). He then returned to Norway and became canon of Bergen church. His description of Greenland is now lost, but a 16th century Danish translation (entitled *Det gamle Groenlands Beskrivelse*) is still available.

[43] "Polus magneticus respectu insularum capitis viridis", "Polus magneticus respectu Corvi insule.

[44] N. Crane, Chap. 24. A. Taylor, *The world of Gerard Mercator, The Mapmaker who revolutionized Geography,* New York, Walker and Company, 2004, p. 207.

[45] A. Kircher, *Mundus subterraneus*, 1664. This argument had already been discussed in George Agricola's *De natura fossilium* (1546), and then in his *De re metallica* (1556), which Mercator owned.

[46] Kirsten A. Seaver ("Pygmies' of the Far North", in *Journal of World History*, 19, 2008, pp. 63-87) tried to demonstrate that, within an abstract and conjectural context, linked to often fantastic traditions, Norwegian relations through their contacts with North American and Greenland natives (among which the *Skraelinger*) were also founded on reliable, empirical information. The Nordic sagas referring to *Skraelinger*, quoted by Seaver have links with the 13th century *Laxdaela saga*, (see *Laxdaela Saga,* London, Penguin, 1969. See also W.R. Mead, "Scandinavian Renaissance Cartography", in D. Woodward, ed., *The history of cartography,* vol. 3, P. II, *Cartography in the European Renaissance,* Chicago, The University of Chicago Press, 2007, pp. 1781-1805).

[47] "A septentrione pertingit ad terram incognitam sub polo, unde etiam veniunt in hanc Pigmei predatores, quod etiam argumentum fuerit subpolares habitari, igitur chresonnesi", in J. Ziegler, *Quae intus continentur Syria, Palestina, Arabia, Aegyptus, Schondia, Holmiae, Regionum Superiorum*, Strasburg, 1536, p. 93. The superb, mid 16th century, handwritten world map by Pierre Descelier (British Library, Add. Ms 24065), made for Henry II of France, showed Pygmies in Canada. Descelier came from Dieppe and produced maps in the style of late medieval *mappae mundi*, and was therefore influenced by legends, but he was also well informed about the French colonies of North America.

[48] See M. Destombes, "An Antwerp 'unicum': an unpublished terrestrial globe of the 16th century in the Bibliothèque Nationale, Paris", in *Imago Mundi*, n. 29, 2008, pp. 85-94.

[49] See Z. Ben-Dor Benite, *The Ten Lost Tribes. A World History*, Oxford, Oxford University Press, 2009.

[50] "Arsazeth, hic 10 tribus secessere et Tatarorum sive Tartarum loco Scÿthice substituerunt. Unde Gautheÿ seu Gauthaÿ a summa Dei gloriae asserenda ibi dicti sunt, et hinc Cathaÿ clarissimum Regnum", A. Ortelius, *Theatrum orbis terrarum*, chap. on Tartaria, Antwerp, 1540.

[51] A. Scafi, *Mapping Paradise. A History of Heaven on Earth*, Chicago, University of Chicago Press, 2006, pp. 284-288. Postel's *Compendium* was contemporary to another unpublished manuscript, dedicated to the theme of a northern paradise (*De paradisi terrestri loco*, Ms Universitätbibliotheck, Basel).

[52] "Haec Insula optima est et saluberrima totius Septentrionis, Mercator, Septentrionalium terrarum descriptio", in *Atlas*, 1595.

[53] "Quand votre Artur sera de retour, je vous prie aussi de savoir de lui, si en quelque endroit de son voiage il n'a point trouvé de mer douce, ou peu salée; car j'ai quelque opinion que la mer qui est entre la Nova Zembla et Tabin, soit de cette qualité" (Van Durme, *Correspondance mercatorienne*, quoted, n. 143).

[54] J.E. King, "The glorious Kindom of Saguenay", in *Canadian Historical Review*, n. 31, 1950, pp. 390-400.
[55] E.G.R. Taylor, "A letter" etc., quoted, translates *filter funnel* as *trechter* in Dutch, the word used by Mercator for representing the great abyss where the polar water flowed. Dutch *Trechter* still means *funnel*, but today it also implies filtering, as in the method for making coffee. It is not clear if Mercator was referring to a kind of desalinization due to the magnetic force or some other natural phenomenon that could have purified the water.
[56] N.H. Clulee, "*Astronomia inferior:* Legacies of Johannes Trithemius and John Dee", in W.R. Newman, A. Grafton, eds., *Secrets of Nature. Astrology and Alchemy in Early Modern Europe,* Cambridge, London, Mit Press, 2001, pp. 173-233.
[57] The profound link between alchemy, Christianity and the birth of the "collective unconscious" has been at the centre of Jung's studies, which are also historical and erudite. In his analysis the salt and the bitterness of the sea were connected to the moon and the white substance appearing in the Albedo. See M. Pereira, "L'alchimia e psicologia di Jung", in A. Carotenuto, ed., *Trattato di psicologia analitica*, Turin, Utet, 1992, vol. 2, pp. 415-445.
[58] The simplest method of "domification" of the Zodiac was to divide it into 12 slices of 30°, each with the *Medium Coeli* at the Zenith. This is the system Mercator seemed to be following in his astrolabs (an example is conserved in the History of Science Museum in Florence). It had the disadvantage however, that the *Medium Coeli* did not generally coincide with the cusp of the 10th House. For this reason this "other centre**"** was called *Cor Coeli* by Jerome Cardan and John Dee (see J. Dee*, Propaeudeumata aphoristica*, pgf. xciii), floating between the 9th and the 10th Houses, depending on the period in question. It was possible to represent the Houses in a way that more closely resembled the sky, using different methods. One was the so-called "Prime Vertical", i.e. they took the 12 points where the ecliptic crossed a prime meridian cutting the horizon vertically, and this was where they considered the cusps of the relative Houses to be. Another method, called "of Alcabytus" (an ancient astrologer), took the celestial Equator as a basis and the meridians of the celestial poles as auxiliary circles for calculating the points of the 12 cusps where they crossed the ecliptic. This method was partially modified in the 16th century by Regiomontanus, who used the circles dividing the celesial Equator from north to south to identify the points where they crossed the ecliptic; these finally indicated the 12 cusps. This method, also called "Equatorial", became the most common during the Renaissance. Cardan used it despite some of his horoscopes having the *Cor Coeli* with the approximate location of the 10th House (see S. Vanden Broecke, *The limits of influence,* quoted, p. 242).

* When I was originally asked to write this paper for this meeting, I answered that I would be unable to write it due to its complexity, but then I was kindly persuaded by Prof. Ute Schneider. I began working from some notes I found in my archive written 20 years ago when I was studying Ortelius' ermetic interests. At any rate, I developed a suggestion about Mercator's "Christian physics", proposed by Jean-Marc Besse at the International 2008 meeting "Les méditations cosmographiques à la Renaissance" (Paris Sorbonne, Centre "V.L. Saulnier") where we had been invited by Franck Lestringant. I thank Andrea Cantile (University of Bologna and Istituto Geografico Militare, Florence) for his help about the the sixteenth-century trigonometry of the sphere. My thanks also go to Isabelle Riviere for her revision of the English edition of this paper.

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