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VESPUCCI, FLORENCE AND THE DISCOVERY OF THE «NEW HEAVENS AND THE NEW EARTH»

In his letter written from Lisbon to Lorenzo di Pier Francesco dei Medici in June 1502, where Amerigo Vespucci suggests for the first time that he has reached a "new land", he also speaks of the "new heavens" of the Southern continent.

There – he writes – «the sight was revealed to me of countless very bright and beautiful stars, which always remain hidden in the North». His undeniable sense of awe before these wonderful constellations does not prevent him from also looking at the stars dispassionately, since he goes on to say:

> «There I observed the wondrous workings of their movements and their magnitudes, measuring the diameter of their orbits and notating them with geometrical figures; and many other movements of the heavens I noted down, which it would be prolix to describe» (VESPUCCI, 1992, p. 30).

Vespucci speaks of the movements and magnitude of the stars, of having observed their orbits and recorded them in graphic form. It could be argued that the stars Amerigo is referring to had been seen before, as was the case with the Southern Cross, first observed by Alvise Cadamosto in June 1455 and with other Southern constellations described by Marco Polo in a conversation which took place between 1293 and 1310 and was recorded by Pietro d'Abano (OLSCHKI, 1957, pp. 45-65). Equally the magnitude or brightness of the most important stars had been calculated from ancient times. But the problem with European and Middle Eastern astronomy was that the observations concentrated heavily on the zodiacal zone and therefore these stars were not usually depicted in the star-maps. What Amerigo seems to have done is to draw a chart of the stars which were not included in

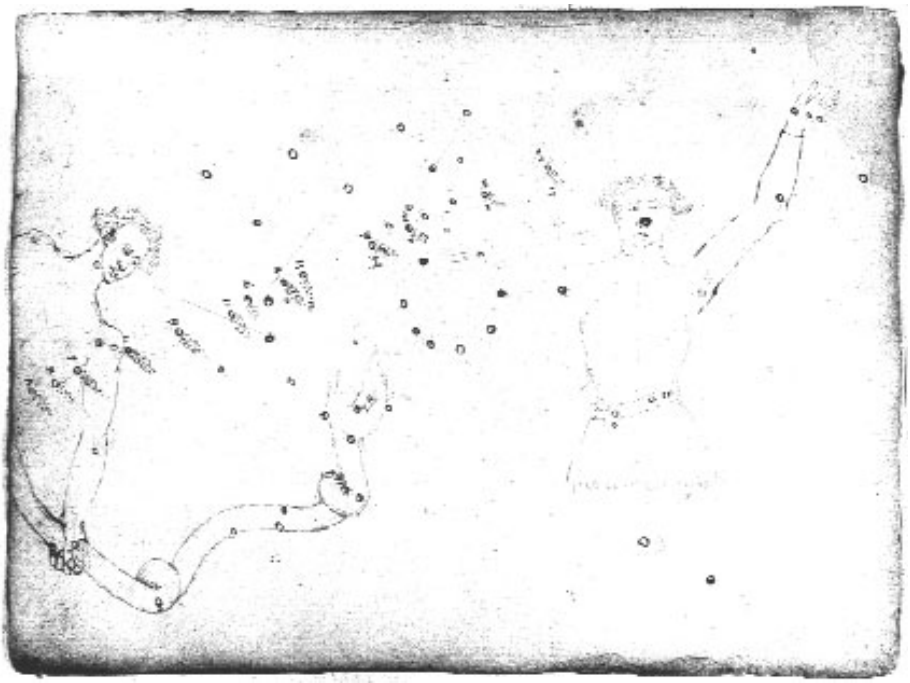
the star-maps of his time. This demonstrates that he was engaged in a wide-ranging study of the stellar positions and that – with an experimental frame of mind – he was comparing and correcting the existing data.

With these words therefore the prophetically inspired vision of the "New Heavens and New Earth" mentioned by Columbus in his letter to Doña Juana de la Torre, former nurse of Prínce don Juan, written about the end 1500 (VARELA, 1982, pp. 263-271) is given a new meaning [1]. As a deeply religious man, Columbus viewed the lands he had discovered in the light of the authority of the Bible and its prophecies. For him these were the utopian regions promised by Isaiah and later in the Apocalypse, while for Vespucci the "New Heavens and New Earth" were a physical reality which could be mapped and measured. Both perceptions were valid, and in fact they were not contradictory but complementary. They demonstrate a normal mental and historical trajectory, which is that of the passage from prophecy to science. A comparison between the attitudes of both discoverers will illustrate this transition.

Vespucci, born and bred within the most influential circles of High Renaissance Florence, having lived among scholars, artists, politicians, merchants and prelates, could understand and transmit the importance of his mathematical observations [2]. He possessed the necessary verbal and

[1] This letter was written about the time of Columbus's return from his third voyage. It is possible that his prophetic rapture was to a degree motivated by his sense of the injustice of his treatment, since he had been humiliated and sent back to Spain in chains. His declaring himself in this letter to be God's messenger and the chosen one with the mission of revealing the "New Heavens" and the "New Earth" announced in the prophecies has therefore been often interpreted as a reaction to his disgrace. Examination of his writings, however, demonstrates that he had already resorted to Scripture to explain the significance of his discovery much earlier. The account of the third voyage abounds with references to the prophets and the authority of the Fathers of the Church.

[2] It is this mathematical perception of nature which characterizes the emerging new science. Koyré (KOYRÉ, 1943, p. 419) quotes Galileo on the subject who writes: «La filosofia è scritta in questo grandissimo libro, che continuamente ci sta aperto innanzi agli occhi (io dico l'universo), ma non si può intendere se prima non s'impara a intender la lingua, e conoscer i caratteri, ne' quali è scritto. Egli è scritto in lingua matematica, e i caratteri son triangoli, cerchi, ed altre figure geometriche, senza i quali mezi è impossibile a intenderne umanamente parola» (GALILEI, 2005, VI, p. 232). G. Caraci has remarked on the link created between Vespucci and Galileo by their common search for an astronomical method for the determination of longitude at sea, although the latter never knew about Amerigo's experiments (CARACI, 1979).



*Toscanelli's drawing of the trajectory of the comet of 1449-50 (*Codice Magliabechiano*, classe XI, n.121. Carta 250 A.* Firenze, Biblioteca Nazionale Centrale, banco Rari).

technical skills to do so. But, more important still, once he had after many preliminary steps reached the conclusion that the lands he had encountered were a separate continent, he had the empirical frame of mind to sustain his views in the face of authority, even when they contradicted it. My aim in this paper is to relate Amerigo's behaviour to the cultural atmosphere of the Florence of his time. There, from mythical notions about stellar influences was emerging a new science, which relied on a measured and objective depiction of the sky (FORMISANO, 2004, p. 35).

The Florence of the Medici was not only the cultural capital of Europe, and the site of its most glorious artistic splendour, but also a city shaken like no other by intimations of an approaching end and hopes for a new beginning. A new era was then expected, a new age which would bring as a reward the hope of a different life for those who had endured and survived the present trials. Within the prevailing apocalyptic mindset, however, the start of this new era had to be preceded by the end of the

existing order, considered to be beyond redemption. Intimations of such an end were not lacking in a Florence torn by power struggles, collective fear and religious fanaticism (VASOLI, 1962). The common denominator which brought together the perception of the fears and the hopes of the time in terms of ends and new beginnings was a shared belief in astrology (GARIN, 1976, pp. 15-19). By the middle of the Fifteenth century the spread of astrology, encouraged by the humanist revival of Pagan philosophy and literature touched all levels of society. It is difficult to find any eminent personality of the time who escaped the appeal of astrological speculation. Cosimo and Lorenzo dei Medici, the Guicciardini family (CASTAGNOLA, 1990), Ficino (FICINO, 1969) and even the Popes could not avoid its attraction (TRONCARELLI, 1985).

This phenomenon was not confined to Florence, of course. After the fall of Constantinople – which had been experienced by many as an apocalyptic event – the best minds of the time had endeavored to understand the fate of the *respublica christiana* in the face of the advance of Islam and the disintegration of the most revered institutions. Given the images in the book of Saint John of a «dragon who draws the stars of heaven and cast them to the earth» (*Apo.*, 12, 3-4) and of «lightning and thunder» and a «great earthquake» which will cause «every island to flow away and the mountains to disappear» (*Apo.*, 18-21), the Apocalypse was conceived in cosmic terms. Scrutiny of the heavens in search for astrological clues about the proximity of the events prophesied in it became therefore the normal course of action.

Columbus, who had an apocalyptic frame of mind, alludes to astrology in many of his writings, particularly in his famous letter of 1501, which introduces his *Book of Prophecies*[3]. There, the name of Pierre d'Ailly – not as a geographer but as a defender of astrology – is mentioned several times and the letter concludes with the following remark:

> «Cardinal Peter d'Ailly writes much concerning the end of the Mohammedan sect, and of the coming of the Antichrist in a treatise, which he wrote "About the Concordance of Astronomical Truth and Historical Narration", in which he relates the sayings of many astronomers about the ten revolutions of Saturn, and especially at the end of the said book in the last nine chapters» (*Raccolta Colombiana*, 1894, I, II, p. 81).

[3] In Columbus's own description this is a collection of the sayings of the Fathers of the Church and the Prophets concerning the recovery of Jerusalem and the discovery and conversion of the islands of the Indies and all other peoples and nations to the Spanish Monarchs (*RC*, 1894, I, III, tav. CI).

What Columbus is referring to here is the theory of the great conjunctions formulated by the Arab astrologer Abu Ma'sar[4] which had entered the Christian world in the Twelfth century by means of the translations of John of Seville (1133) and Hermann of Carinthia (1140). This theory established a correspondence between different historical periods and the cycles of the conjunctions of the two major planets, Jupiter and Saturn. As these conjunctions recurred at regular intervals and were presumed to have momentous influence on human affairs, particularly in the fields of politics and religion, they could serve to foretell the rise and fall of kingdoms and nations. Rabbi Abraham bar Hiyya, from Barcelona (1065-1136), set a precedent for most of the Jewish and Christian messianic literature in the Middle Ages when, in spite of Rabbinical opposition, adapted this theory to the Biblical narrative in his *Meguillat-ha-Megalleh* (*Scroll of the Redeemer*)[5]. Pierre d'Ailly followed his example and applied the cycle of the great conjunctions to the prophecies of the Apocalypse. His aim was to harmonize theological and astrological truth, but what he did in fact was to introduce the science of astronomical cycles into revealed prophecy, something which did not appear impossible to him, since both predicted the future. As Columbus remarked, Pierre d'Ailly also used the Arabic theory of the cycle of the ten revolutions of the planet Saturn in his calculations (D'AILLY, 1930, ch. 57) and with its help he correctly foretold great changes in the fate of the world for the year 1789, date of the French Revolution. The influence of the astrological theories of Pierre d'Ailly on Columbus is significant (PHILLIMORE, 1992). The Discoverer even annotated Pierre d'Ailly's remarks on the cycle of the ten revolutions of Saturn which would take place in the year 1489 in the Postilla C783 of his own copy of the *Imago Mundi* (*Raccolta Colombiana*, 1894, I, II, p. 434).

Although this demonstrates the great popularity of this theory, and even the fact that it had become sufficiently acceptable as to be mentioned in a letter to the Catholic Monarchs, in Fifteenth century Florence

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[4] For a modern translation and edition of the text, see ABŪ MA'SHAR, 1994 and 2000.

[5] In the fifth book of this work, known in Latin translation as *Liber de redemptione Israel*, Rabbi Abraham sets out to inquire into the date of the coming of the Messiah with the help of astrology. Since this is the object of all the hopes of Israel, he considers that obtaining correct knowledge of this date with the help of astronomical science could strengthen the faith and motivation of his people. The version I have used is the modern Catalan translation (MILLÀS VALLICROSA, 1929).

matters were different. Describing the character of the city Eugenio Garin speaks of the co-existence in Florence of the rarified and exquisite culture of the Neoplatonists with the more down to earth and practical knowledge of the merchants, artists and artisans (GARIN, 1957, pp. 245-247). Both groups believed in and practiced astrology, but with different purposes and sometimes with different methods. At this point a distinction must be made between the astronomic-astrological methods of prediction, which were regarded as rational and not contradictory to science and the purely superstitious beliefs in stellar influences, often contaminated by magical or necromantic practices, which had entered the Christian West in astrology's wake. The reaction against these beliefs, which would culminate with Giovanni Pico della Mirandola and Girolamo Savonarola's attack on astrology started to gather momentum (PICO DELLA MIRANDOLA, 1946-1952, voll. II; SAVONAROLA, 2000). These men were particularly critical of the beliefs of the "conjunctionists" which they considered as dangerous since they appeared to submit Christianity to the influence of the stars.

Those who considered astrology as science, on the other hand, knew that astrology dealt with the laws of the propagation of light, and that it entailed the advanced study of mathematics, geometry and perspective. As Graziella Federici Vescovini has demonstrated in her important body of work, during the Fourteenth century a mathematical conception of perspective had began to emerge from the belief of the previous centuries in metaphysics of light better adapted to spiritual contemplation than to practical purposes.

This connection between perspective and astrology was of particular interest to men like Leonardo da Vinci [6], Gian Battista Alberti [7], and Paolo dal Pozzo Toscanelli [8] who were engaged not in discarding, but in extrac-

[6] On Leonardo's belief that astrology could not be understood without knowledge of perspective see FEDERICI-VESCOVINI, 2005.

[7] Alberti was a close friend of Toscanelli and shared with him an interest in mathematical astrology. The dome in the Old Sacristy of San Lorenzo in Florence, painted in 1442, which represented the night sky, would not have been achieved without an advanced knowledge of perspective and astronomy. It has been attributed to Alberti working with the advice of Toscanelli. See OLSON, PASACHOFF, 2001, pp. 313-316.

[8] In Toscanelli's time the study of medicine required knowledge of astrology. At Padua, where Toscanelli studied medicine, the chair of astrology had been held for many

ting from this ancient tradition practical conclusions and useful instructions on how to look at the world and nature, on how to apply the knowledge about atmospheric perspective or the rules of refraction contained in old astrological tracts to the world of art, commerce and navigation. All three were cartographers, and all three had engaged – at some time – on astrological speculation.

This was not surprising, since the political and social difficulties of the times, had been punctuated by exceptional cosmological events. The year 1425 had seen three great and threatening conjunctions of the three superior planets, which were related by some to the growth of heresy. There were important conjunctions in 1445, 1450 and 1464, the latter written about by Antonio de Camera in his judgment dedicated to Piero dei Medici and an important conjunction of Saturn and Jupiter in the sign of Scorpio was announced by Johann Lichtenberger for the year 1484. In the meantime, other signs of impending disaster had appeared in the sky. These were the comets of 1456, 1468 and 1472 which provoked a plethora of predictive tracts linking their appearance to the advance of the Turks or to the end of the ruling monarchies (THORNDIKE, 1934, vol. IV, pp. 413 and ff.). In his *Tetrabiblos* Ptolemy recommended that for the purpose of prediction the comets should be closely observed, since the parts of the sky in which their heads appear and the directions in which the shape of their tails point indicate the regions upon which the misfortunes impend. The colour and the shape of the head were also important, as was the time their passage lasted and their position relative to the sun (*Tetrabiblos*, II, 9). Yet, all this necessitated accurate observations.

So, while many of his contemporaries lost their sleep fretting over the possible consequences of the comets' arrival, Paolo dal Pozzo Toscanelli, Florence's greatest astronomer, spent many sleepless nights in the laborious observation of the comets of 1433, 1449-50, 1456 and 1472. Not that this exercise was completely devoid of astrological content. In the manuscript of the National Library of Florence which contains these observations (Ms. *Magl.*, XI, 121) there are also notes concerning the astrological significance of the comet of 1456 written by Pietro Bono Avogario, astrologer practicing and teaching at Ferrara un-

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years by Biagio Pelacani da Parma, the author of a seminal work on perspective, whose influence was still felt. See EDGERTON, 1975, pp. 61-62.

til 1506 [9]. In spite of his personal astrological interests, Toscanelli looked at the comets in a scientific manner, trying to understand what these celestial phenomena really were and tracing their trajectories with extreme precision. His observations defied the authority of Ptolemy, whose astrological views had dominated the thought on the subject throughout the Middle Ages and prepared the ground for Tycho Bra-

[9] «Stelle cum caudis secundum Ptolemeum in libro Centum verborum novem sunt, quarum nomina sunt ista. Prima Veru dicitur, secunda Tenaculum, 3 a. Pertica, 4 a. Miles, 5 a. Dominus Ascone, 6 a. Mattutina, sive Aurora, 7a. Argentum, 8a. Rosa, 9 a. Nigra. Quarum quatuor prime assimilantur stellis, et omnes significant bella et terrores et magnos eventos in mundo, et ex colore earum cognoscetur malum in mundo futurum, et ex natura signi in quo primo apparent et cum quo oriuntur scitur quando malum accidens erit, ex predictis nature cometis in presente unus ascendit cum signo Tauri sub polo Artico, et parum declinat versus orientem, et caudam erigit inter austrum et orientem, et celum mediat cum signo Geminorum, cuius [vires] cum Ptolemeo a Saturni et Martis et parum Mercurii viribus non recedunt, cui etiam tria sunt nomina in diversis temporis spatiis, videlicet in principio, in medio, et in fine sui ortus. In principio ortus Rosa est, in medio vero Dominus Ascone, et in fine Nigra. oritur autem sphera Saturno exeunte in domo Martis et Marte in domo tenebrarum cum cauda Draconis. Significat enim Stella ista comata secundum Ptolemeum mortem regum et divitum magnatum et nobilium et eorum qui regno sunt subiecti, et eventus magnarum rerum, et ipsarum apparitionem et aliarum rerum antiquarum que mutabuntur ad melius, et mutabuntur res mundane et venient melior.es, et in parte in qua apparet cauda, videlicet in oriente et meridie, inducit mortem regum et guerras et mortem multam et decollationem et mortalitatem et mortem naturalem et mortem per gladium. Et quia, in adventu solis ad primum minutum Cancri, cometa oritur cum Cancro et equidistat signo Geminorum, ut scribit Albumasar tractatu 5°. differentia 7 a significat casum guerrarum et rumorum terribilium in terris Romanorun et Babillonie, et significat quod advenient civibus Babillonie egritudines vehementes, et erit cum eis annona pauca, et incurrent cives Italie infortunium, et consequentur oppressionem et mortalitatem. Significat etiam quod ex terrernotu quedam pars terre desolabitur, et quod erit frigus vehemens in hieme et corruptio rnessium in anno sequente, et quia apparet ex parte orientis, significat quod rex Turcorum timebit de inimicis, et quod cadent bubones in homines illius regionis vel mortalitates et durabunt annis sequentibus. Et quia etiam apparet in equidistantia Geminorum, significat quod rex Romanorum habebit angustias multas et infortunia, et quod rex Egypti morietur, et regnabit post ipsum fur qui non erit de Egyptiis, et erunt egritudines et mortalitates et fames et mors puerorum et abortus pregnantium et mors avium et tonitrua magna et corruscationes, et comburentur fructus. Et quia apparet in oriente, multi magnates cadent de ordinibus suis et, secundum Haly, libro 8. capitulo 41, morietur rex Christianorum, et erunt interfectiones et guerre in terra Babillonie, et multe civitates in terris Christianorum depopulabuntur. Morientur Taurini et civitates Taurine ab epidemia non evadent ex cometa cum Tauro ascendente. Civitates autem et provincie Taurine sunt: Campania magna, Bononia, Sene, Verona, Ancona, Tarvisium; secundum aliquos Mantua, Asti, Senegalia, Pensaurum &c. Die,17. iunii 1456. Petrus Bonus Avogarius» (Ms. *Magl.*, XI, 121, carta 237 A).

he's assertion a century later that comets were not sublunary phenomena (CALDER, 1980, pp. 30-32).

Although little evidence is left of Toscanelli's work, it is known that he installed a gnomon in the Dome of Santa Maria del Fiore in Florence, which permitted him to assess the date of the solstice with exactitude. With this information it was possible to calculate the dates of the equinoxes, one of the most important issues for an astronomer of the time, because without an exact knowledge of the precession motion the Ptolemaic coordinates of the stars could not be checked or corrected. Toscanelli arrived at quite a precise value for the annual shift caused by the precession of the equinoxes, which permitted him to correct the coordinates given in Ptolemy's stars catalogue. Giovanni Celoria whose work was published in 1894 by Gustavo Uzielli in the *Raccolta Colombiana* studied the manuscript of Toscanelli's observation of the comets and praised the exactness of the drawing of the constellations which serve as a background for his tracing of the trajectory of the comet (CELORIA, 1894, V, I, p. 370 and ff.). Although made on free-hand, these are really scientific drawings. Giorgio Abetti in his *History of Astronomy* remarks that from the seventy-six stars the comet traverses on its successive positions, five are not in the *Almagest*, and that Toscanelli must have determined their co-ordinates on the basis of his own observations (ABETTI, 1954, p. 58).

It is most likely that Amerigo would have been acquainted with Toscanelli's work, or at least that he had read some of the books on astronomy, mathematics and perspective which were at the basis of the latter's knowledge, since his uncle Giorgio Antonio Vespucci, who had been his mentor, was also a co-trustee with Toscanelli of the Library of the Convent of San Marco in Florence, where many of these books were gathered (ULMAN, STADTER, 1972). Amerigo not only described and mapped for the first time the "New Heavens" of the Southern continent, but he also looked at the heavens in a new way. In his *Centiloquium* Ptolemy speaks about the influence of the planet Mars as dangerous for navigation and cause of shipwrecks. Similarly, the conjunctions of the Moon and Mars were traditionally considered as harbingers of storms. This is how Columbus looked at them. In his *Journal of the First Voyage* (13 January 1493), he refers to several approaching conjunctions which he interprets in their predictive or their astrological-meteorological sense (VARELA, 1982, p. 114). Vespucci, on the other hand, observed the conjunctions of the Moon and Mars to establish his position by longitude. Even if the results he ob-

tained were erroneous, the establishment of this method demonstrates that Amerigo had moved away from the astrological perception of these celestial phenomena as announcers of storms in order to consider them as hands in the celestial clock useful in the establishment of longitude on a scientific base.

The method used by Vespucci to find his longitude on the 24 August 1499 has preoccupied scholars for a long time and has been the theme of much controversy. Recently Ilaria Luzzana Caraci in her commentary in the *Nuova Raccolta Colombiana* to Amerigo's letter to Lorenzo di Pier Francesco dei Medici of the 10 July 1500 has given a conclusive answer to the question by surveying the opinions of those who criticized Amerigo's assertions and by exposing the flaws in their reasoning. She particularly refutes the allegations made by J.W. Stein, who maintained that Vespucci's claim to have established his longitude by direct observation of the conjunctions of the Moon and Mars was to a great extent a fiction (STEIN, 1950, pp. 345-353). Luzzana Caraci argues that Amerigo made these observations, but using simple and empirical procedures to which the advanced calculations of modern mathematicians do not apply (LUZZANA CARACI, 1996-1999, II, pp. 455-461).

The conclusion at which he arrived, that his longitude was 82 degrees 30' from the meridian of Cadiz, although wrong, was the best which could be reached given the conditions in which the observations were made and the instruments used. Surprisingly, it coincided with Columbus's reading of his longitude taken at the island of Saona by the observation of the lunar eclipse of 14 September 1494 (*NRC*, III, 1993, I, p. 192).

It could be said that Amerigo's method was more practical and easy to apply, since the conjunctions of Mars and the Moon happen with much greater frequency than total lunar eclipses and can be seen from everywhere on earth, but what matters here is that his method was experimental: he speaks about having spent many nights observing the sky and comparing what he saw with the data provided in the astrological tables available to him, proceeding by trial and error, and above all, he candidly confesses that "it was difficult". It had also been very difficult for Columbus to arrive at his result with the tools at his disposal.

The fact that both discoverers arrived at the same result is highly suggestive. Both men were innovators. As Luzzana Caraci has remarked, Columbus was the first to attempt to establish the position of the new lands within the cosmological ideas of his time by a calculation of longi-

tude (LUZZANA CARACI, 1980, p. 519). The procedure he followed in both his observations was scientific and the deductions at which he arrived, logical. But disconcertingly, he separated these pieces of scientific evidence from their context and attached them to the vast religious structure of his *Book of Prophecies*, placing them under the authority of Scripture.

Amerigo also was the first to use the conjunctions of the Moon and Mars for the assessment of longitude. However, he joined together this piece of evidence with many disparate others, such as his observation of the Southern sky, the strangeness of the vegetation, the width of the rivers and the customs of the inhabitants to arrive at the conclusion that the land he had discovered was a vast continent. Then, in anticipation of the new scientific spirit, which wanted that if a result obtained by experience and properly verified contradicted authority, authority should bow down to experience, he broke away from all preexisting cosmological notions and announced that what he had discovered was a New World. From where had he obtained this frame of mind? We have to look no further than to Florence and Giorgio Antonio Vespucci.

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