JOURNAL OF
INTERDISCIPLINARY
HISTORY OF IDEAS

2014
Volume 3 Issue 6
Item 7a

– Section 2: Articles –

Erasmian Philology and Mathematical Astronomy

Jakob Ziegler and the Humanist Recovery of Pliny's *Natural History*

by
Pietro Daniel Omodeo

JIHI 2014

Volume 3 Issue 6

Erasmian Philology and Mathematical Astronomy

Jakob Ziegler and the Humanist Recovery of Pliny's Natural History

Pietro Daniel Omodeo *

In the first half of the 16th century, humanists associated with Erasmus of Rotterdam gave new impulse to the reception, reading and interpretation of the astronomical sections of Pliny's Natural History. *This novel interest is documented by the Basle publication, in 1531, of* In C. Plinii de naturali historia librum secundum commentarius *(*Commentary on Pliny's Natural History Book Two*) authored by Erasmus's collaborator Jacob Ziegler (1470-1549), shortly followed by another commentary composed by Erasmus' pupil Jacob Milich (1501-1559), professor of mathematics in Melanchthon's Wittenberg. These commentaries showed not only philological competences but also and foremost astronomical and mathematical expertise.*

These sources reveal the philological and mathematical skills underlying the editorial and scholarly culture of the humanists working in Erasmus's environment. In particular, this article focuses on Ziegler's commentary on Pliny's planetary theory as presented in Natural History *II, 12-16. This is the basis for an assessment of Ziegler's approach, supplemented by some historical prospects about the further circulation of this Plinian work among German humanists—pointing to Milich's commentary, issued and received in a Melanchthonian context.*

* Max-Planck-Institut für Wissenschaftsgeschichte, Berlin (*pdomodeo @ mpiwg-berlin.mpg.de*).

Journal of Interdisciplinary History of Ideas 3(2014), 6, p. 7a:1–7a:23. Peer-reviewed.

In the first half of the 16th century, humanists associated with Erasmus of Rotterdam gave new impulse to the reception, reading and interpretation of the astronomical sections of Pliny's *Natural History*. This novel interest is clearly documented by the Basle publication, in 1531, of *In C. Plinii de naturali historia librum secundum commentarius* (*Commentary on Pliny's Natural History Book Two*) authored by Erasmus' collaborator Jacob Ziegler (1470-1549). This was shortly followed by another commentary composed by Erasmus' pupil Jacob Milich (1501-1559), professor of mathematics in Melanchthon's Wittenberg. His *Commentarii in librum secundum historiae mundi C. Plinii* (*Commentaries on the Second Book of Pliny's World History*), first printed in Hannover, in 1535, was followed by a series of revised editions. These commentaries showed not only philological competences but also and foremost astronomical and mathematical expertise. Indeed, in the subtitle of his volume, Ziegler promised: "all difficulties present in Pliny, especially those in the astronomy, will hereby be solved" (*quo difficultates Plinianae, praesertim astronomicae, omnes tolluntur*).

In the following, I shall deal with what this source reveals of the philological and mathematical skills underlying the editorial and scholarly culture of the humanists working in Erasmus's environment. In particular, I shall focus on Ziegler's commentary on Pliny's planetary theory as presented in *Natural History* II, 12-16[1]. This will be the basis for an assessment of Ziegler's approach. Finally, I shall provide some historical prospects about the further circulation of this Plinian work among German humanists, pointing to Milich's commentary, issued and received in a Melanchthonian context.

1. Ziegler's Environment

The humanist scholar Jacob Ziegler was a close associate of Erasmus, whom he first met around 1500 during one of his countless peregrinations. He is mostly known for his theological positions, especially for his defense of Erasmus against Diego López Zúñiga (†1531). In 1520, this Spanish ultra-orthodox critic had entered a public controversy with Erasmus, affirming the superiority of the Latin

[1] Here and onwards I will use the modern standard numbering.

Vulgate over the Erasmian translation of the New Testament, and openly accused him of heresy in his *Erasmi Roterodami blasphemiae et impietates* (Rome, 1522). Ziegler, who was at that time in Rome, penned the apology *Libellus (...) adversus Stunicae maledicentiam.* It was quickly printed by Johann Froben (1491-1527) in Basel, in 1523, along with Erasmus's *Catalogus lucubrationum.* Ziegler, who had a bias toward the Reformation, eventually embraced an open and tolerant perspective inspired by Erasmian irenicism[1]. His writings on cosmography and astronomy are less known than his theological and exegetical works. Yet he was quite prolific in these fields. In 1532, he had a geographical work printed in Strasbourg, based on classical sources such as Ptolemy, Strabo, and also Pliny. Moreover, he composed an introduction to spherical astronomy, *Sphaerae atque astrorum coelestium ratio* (Basel, 1536), which appeared some years after his commentary on *Natural History*, Book II (Basel, 1531)[2].

The publisher of this Pliny commentary was Heinrich Petri (1527-1479), one of Basel's leading printers. Petri was in fact at the hart of the guild in which Erasmus had so intensively worked. In 1564, for instance, Petri married the widow of Hieronymus Froben (1528-1563). The latter, who had been a *famulus* of Erasmus in Leuven in 1518, continued his father's Johann activity as a publisher. Thanks to his efforts, the collected works of Erasmus came out of his press between 1538 and 1540. Erasmus, on his part, had lived in Johann's house in Basel. Evidently, the *sodalitas* of the Basel printers was established on personal connections and exchanges, as well as on familiar and intellectual bonds. Petri, who belonged to this "Family", chose an editorial line which included scientific and philosophical works, among them, landmarks such as the *Cosmographia universalis* (1550) of his stepfather, the Hebraist and cosmographer Sebastian Münster (1448-1552), the Ptolemaic *Typus Orbis a Ptolemaeus descriptus* (1540), Nicholas Cusanus's *Opera* (1565), and the second edition of Nicholas Copernicus's *De revolutionibus orbium coelestium* together with the third edition of Georg Joachim Rheticus's *Narratio prima* (1566)[3].

[1] Cf. CoE, vol. 3, s.v.

[2] See Karl Schottenloher, *Jakob Ziegler aus Landau an der Isar. Ein Gelehrtenleben aus der Zeit des Humanismus und der Reformation* (Münster: Aschendorffschen Buchandlung, 1910), especially chap. 13, 324-79, "Zieglers wissenschafltiche Leistung".

[3] On Froben, father and son, cf. CoE, vol. 2, *sub vocibus*, and on them, as well as Heinrich Petri, cf. Josef Benzing, *Die Buchdrucker des 16. und 17. Jahrhunderts im Deutschen Sprachgebiet* (Wiesbaden:

One of the great cultural achievements of Erasmus and his generation was the constitution of a pan-European *res publica* of *literati* sharing the commitment to the direct study of classical and patristic sources, their philological edition, the revival of an elegant Latin style, and an ethos marked by moderate humanistic skepticism. The clearest document of this wide network is Erasmus's large epistolary, and the impressive list of his correspondents. Ziegler was part of this humanistic connection. The frontispiece of his commentary on Pliny points to his ties with other learned scholars, in particular with the Viennese *sodalitas Danubiana*.

As one reads, the volume comprises some comments (*scholia*) by Georg Tannstetter (*Georgius Collimitius*) (1482-1535) and by Joachim Vadianus (1484-1551). The former was a mathematician, astronomer and physician, appointed as a professor at Vienna beginning in 1503, and imperial physician to Maximilian I and Ferdinand I. His astrological calendars were very appreciated and widespread[1]. Vadianus was affiliated to Vienna, as well. He taught Latin authors, particularly on geographical issues. He especially commented on Pliny's *Natural History* VII and Pomponius Mela. In his editions of Mela (1518 and 1522), one can find appraisals of Erasmus[2]. The esteem was reciprocated. In an epistle, Erasmus wrote to Ulrich Zwingli (1484-1531) about the pleasure he had had to meet Vadianus in person: "Vadianus non minus placet conspectus quam ante lectus. Nihil eo candidius"[3] Additionally, in the *Adagia*, Erasmus referred to him, "Ioachimus Vadianus meus", as an example of virtuosity[4]. After the establishment of the Reformation in St. Gallen, in eastern Switzerland, Vadianus wrote a religious history of that locality, where he lived as a town physician from 1518 onwards. In this *Chronik der Aebte des Klosters St Gallen*, he established a connection between Erasmus, Luther and Zwingli as the three champions of the Church renovation of his time[5].

Harrassowitz, 1963), 30 and 33-34.

1 Cf. ADB 37 (1894): 388-389, and NDB 3 (1957): 322-323.

2 Cf. CoE, vol. 3, *s.v.*

3 *Allen* 1314, vol. 5, 130: "I did not have less pleasure in meeting Vadianus than I had earlier in reading him. No one is more candid than him".

4 *Adagia* II, IV 53; ASD II-3, 366.

5 Cf. Bruce Mansfield, *Phoenix of His Age: Interpretations of Erasmus (c. 1550–1750)* (Toronto: University of Toronto Press, 1979), 70-73.

Apart from the Viennese connection, Ziegler pointed to his connections with Italian humanistic circles. His commentary on Pliny began with a dedicatory poem (to a certain Alphonsus Trottus) authored by the Ferrara professor of Greek and rhetoric, Celio Calcagnini (1479-1541), who was one of the most visible Italian appreciators of Erasmus. Famously, he sided with him in the heated quarrel against Martin Luther on free will and predestination. In fact, Calcagnini's *Libellus elegans de libero arbitrio ex philosophiae penetralibus* (*Elegant Booklet on Free Will Based on the Inner Doctrines of Philosophy*) was approved by Erasmus and appeared in Basel in 1525. The printer of this booklet was Johann Froben;[1]. Calcagnini's *Nachlass* was printed by the successor, Hieronymus Froben, together with his associate Nicolaus Episcopius (1529-1564), under the generic title of *Opera aliquot* (*Some works*, Basel, 1544).

Calcagnini first met Ziegler in Hungary in 1517, while traveling across Europe in the retinue of the Cardinal Ippolito d'Este (1479-1520), and later gave him hospitality in Ferrara (1525-1528). Calcagnini shared Ziegler's interest in cosmology. Around 1518, he composed an eccentric essay in defense of terrestrial motion on the basis of epistemological and natural arguments, *Quod Coelum stet, Terra autem moveatur* (*That the Heaven Stands Still whereas the Earth Moves*), which was later included in the Basel edition of the *Opera aliquot*. It is likely that by that time he was already informed about Copernicus's geokinetic and heliostatic hypotheses, since he was in Cracow in 1518 to attend to the wedding of the King of Poland, Sigismund Jagiellon (1467-1548), with the Italian aristocrat Bona Sforza († 1557). In the Polish capital, Copernicus's planetary theories circulated in manuscript form in learned circles since at least 1514[2].

For Ziegler, Calcagnini composed the poem printed right at the beginning of the commentary on Pliny. It was a celebration of the humanistic revival of the classics after their knowledge was obscured during barbaric ages, as witnessed by the following lines:

[1] Silvana Seidel Menchi, *Erasmo in Italia 1520-1580* (Torino: Bollati Boringhieri, 1987), 95-96.

[2] Ludwik Antoni Birkenmajer, "Solpha i Calcagnini", in idem, *Mikołaj Kopernik: Studya nad pracami Kopernika oraz matyriały biograficzne* (W Krakowie: Ksiegarni Spólki Wydawniczej Polskiej, 1900), 480–91 Pietro Daniel Omodeo, *Copernicus in the Cultural Debates of the Renaissance: Reception, Legacy, Transformation* (Leiden: Brill, 2014), 18 and 209-13.

Plinius haec paucis, sed mira expresserat arte,
Quae tamen audaci presserat ore situs
Horrida posteritas, ignavaque secula postquam
Schemate Romano dedicere loqui.
Restituit Ziglerus opes, gentemque Latinam
Deiectam coelo rursus in astra vocat.

Pliny expressed these [astronomical notions] in few words but with admirable art,
And these a horrible posterity, and indolent centuries,
Suppressed with their bold language, after they lost
The habit to speak with an elegant Latin.
Ziegler brings back those riches, and guides the Latin people,
Fallen from the heavens, up to the stars again.

2. Ziegler's Approach to Pliny's Planetary Theory

Ziegler's commentary is not easy to read. Entire sections from the *Natural History* are condensed in few pages and followed by very extensive commentaries. Therefore, it is difficult to consult these comments and rapidly find the particular passages they are referring to. Chapters II 12-15 on planetary motions are compressed in the brief space of six pages (from p. 146 to p. 151), whereas the corresponding commentary extends over more than sixty pages (pp. 152-215). Moreover, textual references are indicated by catchwords. For instance, Ziegler makes reference to section II 14 of the *Natural History*, dealing with inferior planets, by only mentioning the first two words of the paragraph, in capital letters: "PRIMUM IGITUR". Apart from the capitalized *incipit* of the passages to be commented on, there are no references to sections' numbering, nor subtitles that might help the reader orientate in the densely written textual continuum.

Ziegler illustrates the aims of his commentary and his approach to Pliny in the dedicatory letter, which has the function of a preface to the entire work. In his eyes, Pliny's astronomical notions can be seen as the remains (*vestigium*) of a *prisca quadam Astronomia*, that is, an ancient knowledge about the heavens, whose memory would be lost if this work was not transmitted[1]. Its textual recovery is assuredly the task of trained philologists, as it ought to be based on the collation of different "lectiones"[2]. Still, philological work is not sufficient if the interpretation is left to grammarians, poets, historians and philosophers. In fact, as Ziegler claims, expertise in spherical astronomy as well as in planetary theory is essential:

"Sed fuit postrema gravissima causa difficultatis, ea, quod quos illa cura tenuit Plinii intelligendi, iidem reliquo studiorum genere fuerunt humanioribus litteris grammaticis, Poetis, Oratoribus, Historicis, denique Philosophis cognoscendis et interpretandis occupati. Astronomica autem attigerunt in transitu ex vulgatis auctoribus, qui sphaeralem rationem exiliter, catholica vero septem vagarum stellarum etiam impedite tractarunt"[3].

Ziegler does not deny that there are some obscurities in the *Natural History*. These descend, among other reasons, from Pliny's *historical* rather than *theoretical* perspective. It consists in presenting the celestial phenomena as they occur: "historica narratione complexus coelitus evenientes res, eum [lectorem] haec legere voluit"[4]. Moreover, such phenomena are very much in agreement with the astronomical discipline, as it developed later: "tamen adeo remotus [Plinius] non est vulgata postea disciplina, ut peti ad hac ratio non possit eius explicande, obscuritatis etiam, qualem subesse negare nemo queat"[5].

[1] *Iacobi Zigleri (...) in C. Plinii de naturali historia librum secundum commentarius* (Basileae: Excudebat Henricus Petrus, 1531), "Epistola nuncupatoria", f. a3r.
[2] Ibid., f. a3v.
[3] Ibid., f. a4r: "But the most serious reason for the difficulty [in Pliny's recovery] is the following. Those who engaged in understanding Pliny were busy with another kind of studies, that is, in the knowledge and interpretation of literature—grammarians, poets, orators, historians, as well as philosophers. Regrettably, they derived astronomical notions *en passant* from common authors who treated spherical astronomy superficially and the theory of the seven wandering stars confusedly".
[4] Ibid., f. a3v: "he restricted himself to the factual presentation of the phenomena in the entire heavens".
[5] Ibid., ff. a3*r-v*: "however, [Pliny] is not so remote from the later developments of the discipline

In line with this anachronistic approach, interpreting Pliny's astronomical notions in the light of later theories, Ziegler opens his commentary with a forty-pages theoretical-practical section providing the reader with some general astronomical information and, in particular, explaining to him how to build a celestial sphere and epicyclical models for the wandering stars. Similarly, the section dedicated to planetary motions, commenting on *Natural History* II 12-15, begins with a preliminary overview of Ptolemaic geometrical models. As one reads, some diagrams (*schemata*) are seen as necessary in order to make sense of Pliny's considerations on issues such as solar conjunctions and oppositions, retrograde motions and stations: "before we tackle these issues, it is expedient to consider a diagram and, on the basis of this visualization, to explain the particular [passages]"[1].

Introducing the epicycles, Ziegler explains that Pliny calls them "absides"[2]. He clearly refers to *Natural History* II 13, 63: "Pluribus de causis haec omnia accidunt. Prima circulorum quos Graeci ἀπσίδας in stellis vocant (etenim Graecis utendum erit vocabulis)"[3]. Ziegler printed an epicyclical diagram (*fig. 1*) to help decipher Pliny's passages on planetary motions.

Deferents and epicycles, as those represented in the diagram (KOQS and EGFH, respectively), account for heavenly appearances. Ziegler admits that Pliny might have not known such theory; he might not have been able of distinguishing the specific functions of the different circles; or perhaps even confused them. Nonetheless, Ziegler claims that knowledge of these geometrical models is necessary for the explanation of the Plinian source:

"Eo (...) constat (...) ratio unde stellae aliis et aliis partibus orbis, nunc tardare videntur naturales motus, nunc maturare. Eum utrum Plinius agnoverit, aut alterum ab altero

that it cannot be explained in its light, including those obscurities the existence of which no one can deny".

[1] Ibid., 152: "sub earum rerum ingressu videtur opportunum nobis proponere schema, atque ab huius representatione facere singulorum expositionem".

[2] Ibid.: "Motus corporis stellae vagae est per breves circuitus (...). Eum disciplina astrorum vocat epicyclum, Plinius absides".

[3] See Pliny, *Natural History, Books 1-2* (Cambridge, MA-London: Harvard UP, 1938, repr. 1991), transl. by H. Rackham, 211: "All these occurrences are due to a plurality of causes. The first is the factor of the circles which in the case of the stars the Greeks designate *apsides* or arcs (it will be necessary to employ Greek terms)".

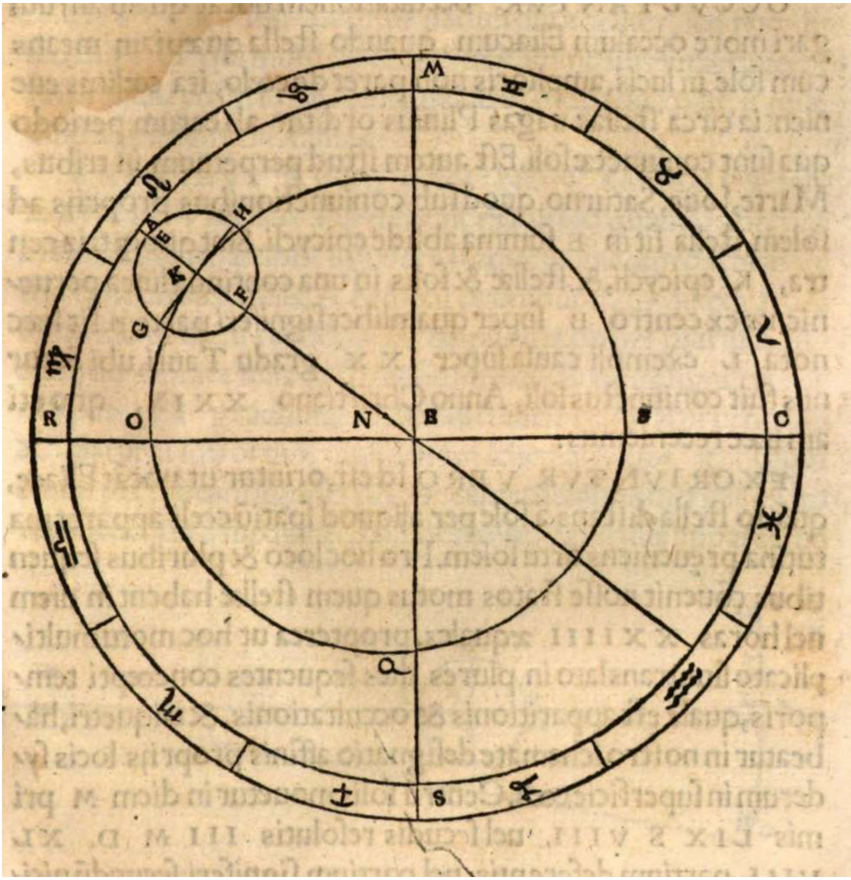


Figure 1: Ziegler's diagram, in his commentary on Pliny (1531), 513, introducing Ptolemaic devices that shall serve his explanations of planetary motions, as presented in *Natural History* II 12-15 (Provenance: Bayerische Staatsbibliothek).

propriis officiis discreverit, nequeas deprehendere, ita miscet utriusque potestatem, et facit ad hunc a priore oscuram transitionem, tamen ab hoc duplici genere orbium petitur expositio Pliniana”[1].

3. A Test Case: The Inferior Planets

As a test case to observe Ziegler’s application of his interpretative principles, I would like to focus on his extensive treatment of *Natural History* II 14, dealing with the theory of the inferior planets and the differences between their motions and those of the superior planets, especially relative to their solar elongations, velocities and heliacal raisings and settings (see the technical note). Ziegler first comments the following lines (*Nat. Hist.*. II 14, 72):

“Primum igitur dicatur, cur Veneris stella numquam longius XLVI partibus, Mercurii XXIII ab sole abscedant, saepe citra eas ad solem reciprocent. Conversas habent utraque apsidas ut infra solem sitae, tantumque circuli earum sub terra est quantum superne praedictarum; et ideo non possunt abesse amplius quoniam curvatura apsidum ibi non habet longitudinem maiorem: ergo utrique simili ratione modum statuunt apsidum suarum margines, ac spatia longitudinis latitudinum evagatione pensant”[2].

The question about the astronomical models underlying Pliny’s second book is controversial. The historian of ancient astronomy Otto Neugebauer assumes

[1] *Zigleri (...) commentarius*, 153-54: “This [diagram] shows the reasons wherefore the stars seem to slow down their natural motions or to accelerate them in different places of their orb. It is impossible to establish whether Pliny knew this, or distinguished the function of the one [circle] from that of the other. In fact, he mixes their respective functions and confusedly takes the ones for the others. Nevertheless, these two kinds of circles [i.e., deferents and epicycles] are essential in order to explain Pliny”.

[2] Pliny, *Natural History* (transl. revised), 218-19: “First therefore let us state the reason why Venus never departs more than 46 degrees and Mercury never more than 23 degrees from the Sun, and why they often retire and return towards the Sun within those limits. As situated below the Sun both have apses that are the oppositeof those of the other planets, and as much of their circle is below the Earth as that of the planets mentioned before is above it; and they cannot be further from it than they are because the curve of their arcs does not allow greater elongation there; consequently the edges of their arcs put a limit on a similar principle for each, and compensate for the dimensions of their longitude by the enlargement of their latitude”.

that the classical author employed epicyclical models[1]. Yet, this is not indisputably evident from the Plinian text. It is significant in this respect that, insofar as the medieval reception of the *Natural History* is concerned, the medieval diagrams accompanying Pliny's work did not resort to epicyclical devices to account for planetary retrograde motions. As Bruce Eastwood showed in his studies on Carolingian astronomy, diagrams designated in that age to illustrate planet's circles and their apses (i.e., their nearest and farthest points relative to the Earth) only display their eccentricity and indicate the location of the apses with notches[2]. Ziegler's approach is very different, anticipating that of Neugebauer. On the one hand, he did not refrain from looking at Pliny through Ptolemaic lenses; on the other, he was so cautious as to explain that this was just his "adaptation" (*ad hanc designationem aptemus verba Plinii*). To illustrate the Plinian passage I am concerned with, he produced a diagram (*fig. 2*) displaying the eccentric circles of the inferior planets.

Ziegler's explanation goes as follows:

"Conversas, id est, differentes positione apsidas habent, ut quae infra Solem sitae sunt tantis spaciis, quantis apsides trium superiorum sunt superne sive supra Solem sitae, proptereaque quanto sunt breviore ambitu orbium, tanto reperiuntur distancia a sole minore. Concipit enim Plinius (...) orbes stellarum alios intra alios in eade[m] superficie ratis spaciis distare, eccentros ad se mundi centrum sicut subiecta formula: Sit A Solis, B Veneris, C Mercurii, et Apsidum B et C curvaturae sint. Hic BD, BE, illic CF et CG, signum medium orbium sit H et diameter AH, quae secet inferiores apsides communiter in K. Ad hanc designationem aptemus verba Plinii. Non possunt, inquit, abesse a Sole amplius, ideo quoniam curvatura DE et FG apsidum B et C non habet longitudinem a Sole per spacia zodiaci et coeli maiorem quam sit ex H medio signo ad margines apsidum"[3].

[1] Otto Neugebauer, *A History of Ancient Mathematical Astronomy* (Berlin-Heidelberg-New York: Springer, 1975), vol. 2, 802-05.

[2] Bruce S. Eastwood, *Ordering the Heavens: Roman Astronomy and Cosmology in the Carolingian Renaissance* (Leiden-Boston: Brill, 2007), 109-26.

[3] *Iacobi Zigleri... commentarius*, 193-94: "They [the inferior planets] have opposite apses—that is, they are different as to their position—so that they are just as distant from the Sun from below, as the apses of the three superior [planets] from above. Hence, their solar elongations are smaller insofar as the dimensions of their spheres] are smaller. In fact, Pliny holds that celestial spheres included in the same surface have well determined distances between each other. Their eccentrics are accorded to the following rule. The [sphere] of the Sun is A, that of Venus B, that of Mercury C,

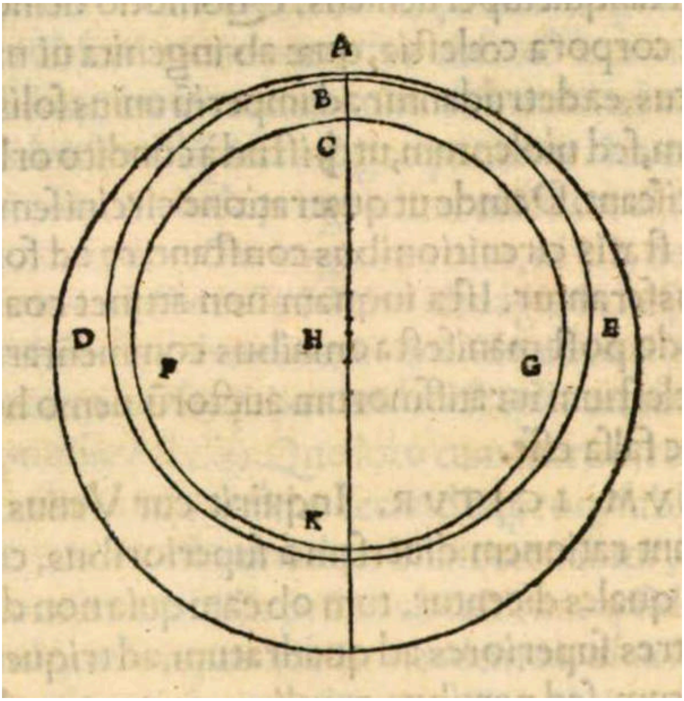


Figure 2: Ziegler's diagram displaying the eccentricity of the circles and the apses of the inferior planets, as well as the orb of the Sun, in his Commentary on Pliny (1531), p. 194 (Provenance: Bayerische Staatsbibliothek).

The apses move—no matter whether "apsides" refers here to the points of maximal proximity or distance from the center, to some arcs or to epicycles. As the humanistic commentator explains, referring to the figure at p. 194 (*fig. 2*),

"Est vero is habitus, quod earum stellarum apsides, id est, orbes eccentri moventur ad signorum successionem. Hoc argumento, quia nunquam transeunt Solem, sed media eorum ubi exit KHCB, semper sunt in loco Solis quacunque is zodiaci parte fuerit"[1].

Eccentric circles are not the only addition aimed to make sense of Pliny's astronomical considerations. In his assessment of *Natural History* II 14, 73, which is the passage directly following the aforementioned, Ziegler resorts to epicycles and equants. The relevant passage from Pliny is the following:

"At enim cur non semper ad quadraginta sex et partes viginti tres perveniunt? Immo vero; sed ratio canonicos fallit. Namque apparet apsidas quoque earum moveri, quod numquam transeant Solem; itaque cum in partem ipsam eius incidere margines alerutro latere, tum et stellae ad longissima sua intervalla pervenisse intelleguntur: cum citra fuere margines totidem partibus et ipsae ocius redire coguntur, cum sit illa semper utrique extremitas summa"[2].

A first problem Ziegler faces in his interpretative effort is epistemological, namely the problem of respecting the astronomical principle of uniform circular

and the apses are the curves B and C—on the one side BD [and] BE and, on the other side, CF and CG—the center of the spheres is H and AH the diameter intersecting the inferior apses together in K. This is the meaning that we attach to Pliny's words. He says that they cannot be more distant from the Sun, because the curvatures DE and FG of the apses B and C do not have a distance from the Sun in the spaces of the Zodiac and the heavens that is bigger than that between H and the margins of the apses".

[1] Ibid., 195: "This is in fact the rule, that the apses of these celestial bodies move along the succession of the [zodiacal] signs, that is, their eccentric spheres [rotate in that direction]. The argument is that they never go far from the Sun, but their centers, traversed by the line KHCB, are always in the place of the Sun wherever it is along the Zodiac".

[2] Pliny, *Natural History,* 218-219: "But it will be objected why do they [the inferior planets] not reach 46 and 23 degrees always? As a matter of fact they do, but the explanation escapes the theorists. For it is manifest that even their apses move, because they never go far from the Sun; accordingly when the edges have fallen on one side or the other into the actual degree of the Sun, then the stars also are understood to have reached their longest distances, but when the edges are short of that, they themselves too are compelled to return with greater velocity, since with each of them that is always the extreme limit" (transl. revised).

motion. On this point, he is uncomfortable with Pliny's words "*ipsae ocius redire coguntur*" (they are compelled to return with greater velocity). According to theory—that is, according to Ptolemaic planetary theory—variations of speed are only apparent and have to be reduced to the combination of circular motions around different centers.

"Hactenus nihil est verborum Plinii quod non assequatur proposita designatio, praeter id quod ab altera stationum stellae redire ocius dicuntur: quia enim stella in orbe suo non accelerat naturales motus suos, ita quod hoc patet ocius, illa tardius ferretur: sunt autem in designatione quadrantes orbium B et C aequis partibus assumpti. Non potest stella sub pari motu, pares arcus inaequaliter transire, id est, ab extremitate summa stationum nunc ocius redire, quam digressa fuerit. Hic ergo postulatur ratio legitimae theoricae"[1].

Ziegler's next step, in order to offer an appropriate planetary theory, is to introduce epicyclical models. In this case, he discusses Mercury's motions as visualized in a diagram (*fig. 3*) which is not just an abstract geometrization of celestial motions but also represents a material model. As is evidenced from Ziegler's expressions, the readers shall construct this model following the illustration:

"The deferent [of Mercury] AQBR is a separate round slice accorded to the measure of its circumference. Please, nail it in the point H corresponding to the point H of the inferior surface, in which the Zodiac and the equans are [represented], in such a way that it can revolve. Please, nail the epicycle on the deferent in correspondence of point A"[2].

The diagram (*fig. 3*) shows the zodiacal circle, centered in D, and its equant point H. On it, Mercury's deferent AQBR is nested. The center of the epicycle is A. The points L and 'L *bis*' on the epicycle (one on the right and one on the left)

[1] Ibid. 195-196: "Up to this point nothing in Pliny's words is at odds with the proposed description, apart from the assertion that celestial bodies come back quicker from the second station. In fact, a celestial body does not accelerate its natural motions in its orb, so that it is transported quicker in this part and slower in the other one. Note that in this description the quadrants of the orbs B and C are assumed to have the same measure. A star cannot cover equal arcs in different times if it has the same speed, that is to say, it cannot come back from the extreme point of the stations quicker than it went there. Hence, the explanation shall be obtained from an adequate theory".

[2] Ibid., 196: "Deferens AQBR sit separata tabula rotunda ad mensuram circumferentiae ipsius, et in puncto H figatur in parisigno H superficiei inferioris, in qua est zodiacus et aequans, ita ut revolvi possit. Epicyclus figatur super deferente in parisigno C [sic! corrige: A].

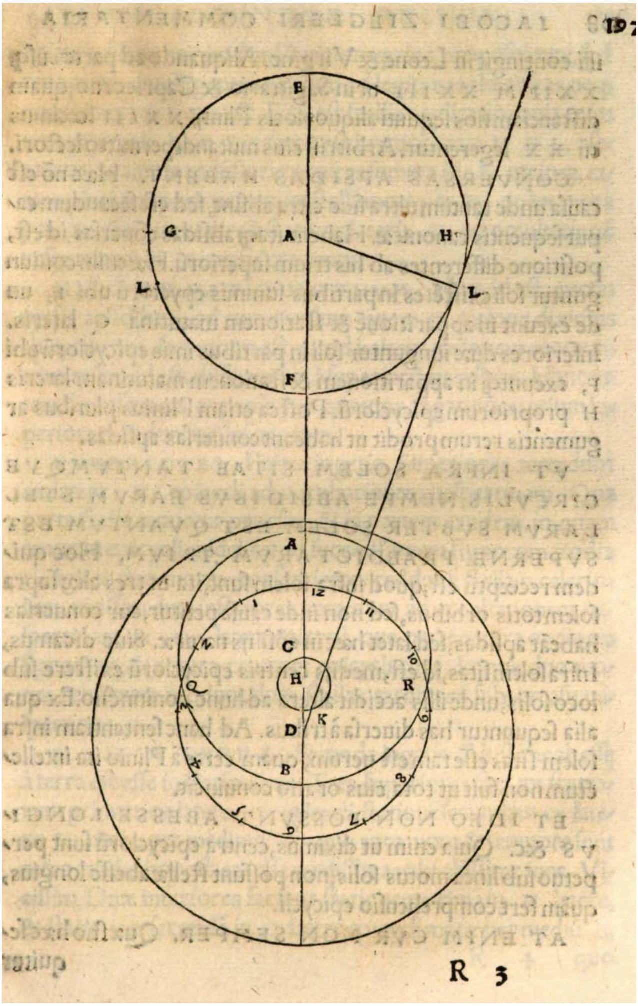


Figure 3: Ziegler's epicyclical model for the inferior planets in his commentary, p. 197 (Provenance: Bayerische Staatsbibliothek).

are determined by the perpendicular lines connecting A and the tangent lines drown from the cosmological center D. These points indicate the maximal elongations for Mercury. As Ziegler summarizes: " AND THEY CANNOT BE FURTHER etc. Since, as we explained, the centers of the epicycles are always under the line of the Sun, celestial bodies [*stellae*] cannot move further then the extent of the epicycle"[1] Hence, the maximal elongations depend on two constraints: first, on the fact that the centers of the epicycles are always in a line with the mean solar position and, second, on the dimensions of these circles (see the technical note).

The same *theorica* also helps explain the *apparent* variation of speed in planetary motions:

"Eius est facilis explicatio: quia enim arcus epicycli LFL tanto est brevior arcu LEL sequitur: quamvis eadem sit extremitas summa in L utrinque, tamen pluri tempore perveniat stella mota per E quam mota per F. Atque ita redire a statione lateris G ad occultationem vespertinam in F ocius creduntur"[2].

I am not going to discuss Ziegler's analyses and interpretations in more detail since these examples are sufficient to grasp his approach to Pliny. His aim is to adhere as closely as possible to his source but, as soon as the words seem to contrast with epistemological and natural assumptions of the mathematical astronomy of his age, Ziegler translates them into the language of present-day astronomical knowledge. In order to understand complex passages, such as those on the inferior planets in Pliny II 14, he refers to the *theorica planetarum* of the day. Assuming that Pliny could not depart from accepted astronomical principles, such as that of uniform circular motion, Ziegler believed that epicyclical and eccentric devices could cast light onto Plinian obscurities. He also introduces equants, if planetary theory requires so. In this respect, he did not even

[1] Ibid., 198: "ET IDEO NON POSSUNT ABESSE LONGIUS etc. Quia enim ut diximus, centra epicyclorum sunt perpetuo sub linea motus solis, non possunt stellae abesse longius, quam fert comprehensio epicycli".

[2] "The reason is simple. In fact, from the fact that the arc LFL of the epicycle is so much shorter than the arc LEL, it follows that, although the extreme limit in L is the same on both sides, nonetheless, the celestial planet needs more time when it travels through E than when it travels through F. Hence it seems that it moves faster when it returns from the station on the side G to the evening occultation in F" (Ibid., 199).

mention the debates over the reconcilability of such Ptolemaic devices with natural philosophy in general, and the *axioma astronomicum* that planetary motions are circular and uniform about their centers, in particular[1] As un-reflected as Ziegler's reading might seem, his approach shows, first, his conviction that mathematics (mathematical astronomy) was an essential tool for philological work and, second, his effort to revive the 'objective' meaning of the text. In other words, he was not interested in *historicizing* his source, as modern historians of science would, but rather to *actualize* it, making it accessible and useful to his contemporaries.

4. Further Discussion of Pliny's Second Book: Jakob Milich between Erasmus and Melanchthon

Ziegler's publication was only the first step in the humanistic mathematical appropriation of Pliny's astronomical book. Short after the issue of his commentary, as early as 1535, a former pupil of Erasmus of Rotterdam, Jacob Milich (1501-1559), then professor of mathematics in Melanchthon's Wittenberg, printed in Hannover an edition, with commentary, of the same book as *Commentarii in librum secundum historiae mundi C. Plinii* (*Commentaries on the Second Book of Pliny's World History*). The approach is very similar to Ziegler's

[1] Pierre Duhem raised this issue in ΣΩΖΕΙΝ ΤΑ ΦΑΙΝΟΜΕΝΑ: *Essai sur la notion de théorie physique de Platon à Galilée* (Paris: Hermann, 1908). The limits of his conventionalist approach have been corrected, among others, by Geoffrey Ernest Richard Lloyd, "Saving the Appearances", in *Methods and Problems in Greek Science* (Cambridge: UP, 1991), 248-77, and Peter Barker and Bernard R. Goldstein, "Realism and Instrumentalism in Sixteenth Century Astronomy: A Reappraisal", in *Perspectives on Science* 6/3 (1998): 232-58.

as far as the hermeneutical use of geometrical modeling for planetary motions is concerned. This edition, much easier to consultat, was directed to students of the Faculty of the Arts and proved successful as a textbook, judging by its numerous reprinted versions (Schwäbisch Hall, 1538, Frankfurt on Main, 1543, 1552/1553 and 1563, Leipzig 1573). For its first revision, Milich benefited from the advice of one of his most brilliant pupils, the mathematical astronomer Erasmus Reinhold (1511-1553). Some of his manuscript annotations and drawings, which served as a basis for this revision, are still extant and inserted between astronomical commentaries of Ptolemy and of Copernicus[1].

Milich was a learned scholar and physician from Freiburg. He was first educated in his hometown under the influence of Erasmus of Rotterdam and his associates, scholars such as Udalricus Zasius (1461-1535), Konrad Heresbach (1496-1576), Heinrich Glareanus (1488-1563) and Nikolaus Gerbel (ca. 1485-1560). Milich completed his formal education in medicine at Vienna and eventually headed to Wittenberg. At that Lutheran-Melanchthonian University, he became particularly familiar with Joachim Camerarius (1500-1574) and the neo-Latin poet Helius Eobanus Hessus (1488-1540)[2]. Milich first occupied the chair of "pedagogy" (from 1525 to 1529), taught "lower" mathematics from 1529 to 1536, and eventually entered the Faculty of Medicine[3], It ought to be noted that, at Wittenberg, a special class, the *Lectio Pliniana*, was devoted to Pliny's *Natural History*. Milich was in charge of this class in 1527. Among his predecessors, we ought to mention the reformer of the German studies, Philip Melanchthon (1497-1560) and Camerarius, who had this teaching duty in 1520 and between 1522 and 1524, respectively[4].

Johann Heinrich Zedler, in his famous Universal-Lexicon, presented Milich's

[1] These annotations are comprised in a manuscript volume known as *Commentarius in opus Revolutionum Copernici*, which is preserved in the Staatsbibliothek zu Berlin as Ms. lat. fol. 391. The manuscript is available in ECHO, under the link: `http://echo.mpiwg-berlin.mpg.de/ECHOdocuView?mode=imagepath&url=/mpiwg/online/permanent/library/MCE8830N/pageimg` (December 4, 2013). A preliminary discussion is included in Pietro D. Omodeo and Irina Tupikova, "Visual and Verbal Commentaries in the European Renaissance: Erasmus Reinhold's Treatment of Classical Sources on Astronomy", in *Philological Encounters* (2014) (*in press*).

[2] ADB 21 (1885), 745.

[3] Cf. Heinz Kathe, *Die Wittenberger philosophische Fakultät 1502-1817* (Cologne-Weimar-Vienna: Böhlau, 2002): 114-15.

[4] Ibid., 466-67.

trajectory from the Erasmian environment to the Melanchthonian one in a quite linear way: "*Den Grund seiner Studien legte er an diesem seinem Geburts-Ort, weil er aber von Erasmo Roterdamo vielfältig die grosse Gemüths-Gaben des Melanchthons rühmen hören, konte er nicht eher ruhen, als bis er diesen berühmten Mann selbsten gesprochen*"[1]. To be sure, this is an oversimplification but it rests on a common Lutheran narrative. Zedler did not invent this story; he picked it up from the Renaissance oration on Milich's life by the Wittenberg professor Eusebius Menius. In this oration, the author expanded both on Milich's familiarity with Erasmus, and on Erasmus's prediction that Melanchthon was the raising star of the humanistic firmament who was to obscure the fame of his predecessors:

"De Erasmi privata et domestica consuetudine ac sermonibus multa narrare solebat cum magna voluptate: Quomodo diurnas operas partiri, et ut matutino tempore rebus seriis vacare commodius posset, veterum more tardius prandere. Inde vel amicis sese dedere, vel obambulare, et inter obambulandum vel colloquiis suavibus se invitare ad hilaritate, atque oblectere, vel ea recitare solitus sit, quae ex ore eius excerpta, postea familiarium Colloquiorum titulo prodierunt. Cum censuras referret, quas Erasmus in efflorescentia sub id tempus ingenia Germaniae suo more, et pro ea qua valuit autoritate liberius agere consueverat, aiebat, illum de Philippo adolescente adfirmasse; Quod in quamcunque artem nervos ingenii intensurus esset, in ea omnes summos artifices esset superaturus. Hac voce Erasmi [Milichius] aiebat se incensum fuisse ingenti cupiditate Philippi visendi"[2].

[1] Zedler, *Universal-Lexicon*, 21 (1973, repr. 1995), 195.

[2] Eusebius Menius, *De vita Iacobi Milichii* (Witebergae: Excudebant Haeredes Georgii Rhauu, 1562), f. A8*r*-*v*: "He used to recount with great pleasure much about Erasmus' private and domestic habits and conversation: How he organized the daily duties and how, to make it easier to devote the morning to serious matters, he had a late lunch in the manner of the ancients. Later he used either to dedicate himself to his friends, or to stroll and, during these walks, either he would be led to laughter and amuse himself in amiable conversations; or he used to declaim those [dialogues] that, taken from his talks, were later issued under the title of *Familiar Colloquies.* Milich reported that, when Erasmus assessed the intellects flourishing in Germany in his time, [the intellects of those] who became used to behave more freely following his example instead of the authority of the past, he judged Philip [Melanchthon], who was then an adolescent, in the following manner. [Erasmus declared] that, no matter to what art he would dedicate his intellectual energies, in any he was to exceed all the most illustrious specialists. Milich said that, hearing this words by Erasmus, he burned with immense desire to meet Philip".

In order to explain Milich's mathematical preparation, it is relevant to notice that, before reaching Wittenberg, he stopped off in Vienna. The local University had a long and famous tradition of astronomical studies. It counted among his former professors scholars of the stature of Johannes Gmunden (ca. 1385-1442), Georg Peuerbach (1423-1461) and Johannes Regiomontanus (1436-1476). Moreover, arriving in Wittenberg, he entered an environment in which the study of mathematical subjects was seen as an important element of the basic education at the Faculty of the Arts. Melanchthon's support to mathematics and astronomy was noticeable and was connected with a special interest in astrology, seen as the science of Divine Providence. Melanchthon himself worked on a translation of Ptolemy's *Quadripartitum* together with Cameriarius. Thus, Wittenberg was a very suited place where Erasmian philological competences and Viennese mathematical preparation could merge in a pedagogical program. This is the key to read Milich's confrontation with the second book of the *Natural History*[1].

In the aforementioned oration, the Wittenberg professor Menius mentioned Milich's commentary on Pliny as one of his most important intellectual achievements. In this textbook, Menius observed, all difficulties entailed in the second book of the *Natural History* were solved on the basis of Aristotle and Ptolemy:

"Quam fideliter et utiliter servierit Scholae, et quantum navaverit atque effecerit ad posteritatem, testatur enarratio Secundi libri Plinii, in qua ex doctrinae Ptolemaicae et Aristotelicae fontibus nodi ac Labyrinthi astronomici et Physici plerique ita sunt explicati et illustrati, ut difficultas, quae visa fuit rudiori saeculo superiori inesse maxima, evicta atque discussa omnis videatur. Neque extat magis perspicua enarratio"[2].

[1] On the relevance of Wittenberg for the development of mathematical and astronomical studies in Germany, see, among others, Robert S. Westman, "The Melanchthon Circle, Rheticus and the Wittenberg Interpretation of the Copernican Theory", *Isis* 66 (1975): 163-93, Sachiko Kusukawa, *The Transformation of Natural Philosophy: The Case of Philip Melanchthon* (Cambridge: UP, 1995), and Franz Fuchs (ed.), *Mathematik und Naturwissenschaften in der Zeit von Philipp Melanchthon* (Wiesbaden: Harrassowitz, 2012).

[2] Menius, *De vita Iacobi Milichii*, f. B3r: "How loyally and usefully he served universities and how much he devoted himself to the interest of later generations is witnessed by his commentary on Pliny's second book. In it, many astronomical and physical intricacies and labyrinths are explained and illustrated by means of Ptolemaic and Aristotelian doctrines so [clearly] that all those difficulties that were insurmountable for the previous rougher age seem to be all solved and eliminated. And no better understandable commentary exists".

Studies on medieval representations of planetary motions confirm this remark that, for the "rougher centuries", Pliny's astronomical and physical "labyrinths" were insurmountable. Thus, as anachronistic as it might be, Milich's way of resorting to Aristotelian physics and Ptolemaic astronomy in his interpretation of controversial passages of the *Natural History* had the advantage of offering a 'reasonable' (or rather 'rationalized') reading of this classic. This approach is the same as Ziegler's and bore witness to the efforts of a generation of learned scholars, trained in the humanistic environment of Erasmus, to extend the boundaries of philology. Mathematical astronomy, in this context, became an important instrument in the service of the recovery and interpretation of classical sources.

5. Concluding Remarks

The humanistic Reception of the second book of Pliny's *Natural History* during the sixteenth century bears witness to the closeness between philological interests and mathematical expertise by scholars who were devoted to Erasmus of Rotterdam. Jacob Ziegler and Jacob Milich, authors of important commentaries appearing in the 1530s, belonged to the intimate collaborators of the leading humanist. Their commented editions of the astronomical part of the *Natural History* have similar approaches, based on the application of the mathematical astronomy of the day. Both resorted to Ptolemaic theories in order to interpret Pliny's statements concerning heavenly phenomena. However anachronistic, this method documents the interdisciplinary character of scholarly editions of classical sources in the early sixteenth century. In this context mathematics, astronomy, even natural philosophy came to support philology. Yet this aid was not unidirectional. Philology supported the advance of mathematical astronomy, as well. Erasmus's Basel was the place where ancient and modern astronomical and cosmographical works were reedited and printed. Erasmus himself supported the publication of Ptolemy's *Geographia* (1533), [1] while the *editio princeps* of Ptolemy's *Almagest* with Theon's commentary was carried out by Simon Grynaeus (1493-1541) and Joachim Camerarius, in 1538[2]. The second edition of the major work of the *Ptolemaeus alter*, Nicholas Copernicus, appeared in the same cultural and editorial center, a couple of decades later. The relevance of the recovery of ancient sources, including Pliny, for Renaissance astronomers is also witnessed by the inclusion of Reinhold's manuscript commentaries of Pliny's planetary theory among his commentaries of and annotations on Ptolemy's *Almagest* and Copernicus's *De revolutionibus*[3]. Furthermore, while Ziegler's commented edition of the Plinian book on astronomy can be seen as a work more directly emerging from the Erasmian milieu, Milich's work makes it possible to trace the cultural line connecting Erasmus's Basel with the major center of German later humanism, namely Melanchthon's Wittenberg. The latter guided a new generation of astronomers who had a key role in the post-Copernican developments of their discipline. Among them, Reinhold, Rheticus (1514-1574), and Kaspar Peucer (1525-1602)[4].

Abbreviations

Allen = *Opus Epistolarum Des. Erasmi Roterodami*, 12 vols., ed. Percy Stafford Allen, Helen Mary Allen and Heathcote W. Garrod. Oxford: Clarendon Press, 1906-1958.

ASD = *Erasmi Opera Omnia*, recognita ed adnotatione critica instructa notisque illustrata, Amsterdam: North Holland Publishing and Elsevier, 1969 f.

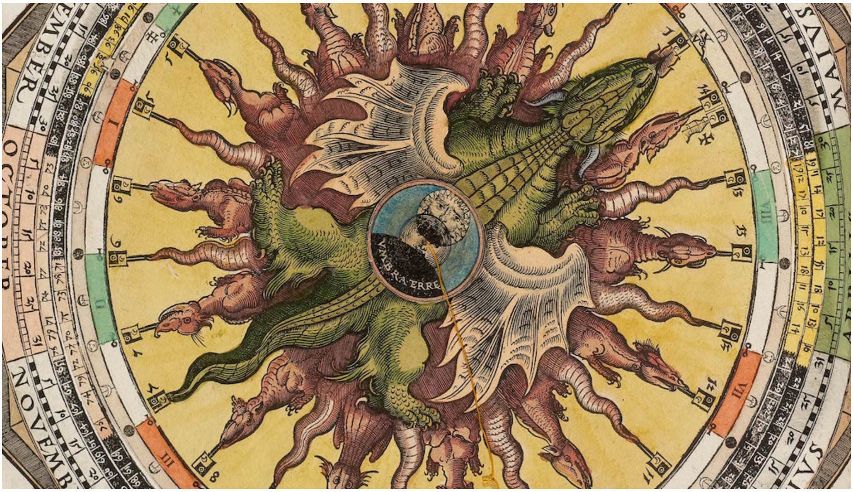
[1] Cf. Klaus Vogel, "Cosmography", in *The Cambridge History of Science*, vol. 3, *Early Modern Science*, ed. by Karin Park and Lorraine Daston (Cambridge: UP, 2006), 469-96, 469-70.

[2] For Grynaeus's and Camerarius's 1538 edition, based on a manuscript previously owned by Regiomontanus, see K. Manitius, *Einleitung* to Ptolemäus, *Handbuch der Astronomie*, translated and annotated by K. Manitius (Leipzig, 1963), vol. 1, xxi, and E. Zinner, *Leben und Wirken des Joh. Müller von Königsberg genannt Regiomontanus* (Osnabrück, 1968), 333 and 245-74.

[3] Cf. Nicholas Copernicus, *Gesamtausgabe*, vol. VIII/1, *Receptio Copernicana* (Berlin: Akademie Verlag, 2002), 589-90.

[4] The reader will find a *Technical Note on Epicyclical Interpretations of Pliny's Planetary Theory* by I. Tupikova in the following item of this issue.

CoE = *Contemporaries of Erasmus. A Biographical Register of the Renaissance and Reformation*, ed. Peter G. Bietenholz and Thomas B. Deutscher. 3 vols. Toronto, Buffalo and London: University of Toronto Press, 1985-1987.



Peter Apian (Apianus), Astronomicum Caesareum, *Ingolstadii 1540. Titlepage, particular.*