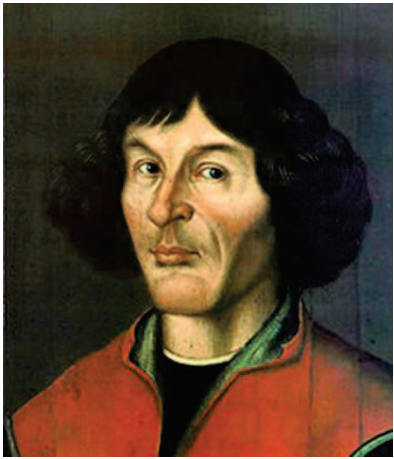


Reconsidering the Scientific Revolution by 'Cosmographical Revolution' including Copernican and Stenonian Revolutions

48th Cracow INHIGEO Symposium, 3 August 2023



Toshihiro Yamada

Taisho University, Tokyo; Japanese INHIGEO Member

Contents

- Introduction: anniversaries and the pedagogical point of view
- ‘Copernican revolution’ revisited: two spheres considered
- A genre of cosmography flourished: triadic spheres focused on
- ‘Cosmographical revolution’ emerged: ecumenical/ architectonical
- Two aspects of the revolution: mathematical/ descriptive
- ‘Stenonian revolution’ reconsidered: history of nature and mine development
- Conclusion

Introduction: 550yrs anniversary

- This paper aims to reconsider the narrative of the Scientific Revolution, which have placed importance on the origin of modern physics from Copernicus to Newton.
- Nicolaus Copernicus (1473-1543) studied in Cracow 1491-95.
- 480 yrs from the publication of *De revolutionibus* (On the revolutions of the heavenly orbs, 1543).
- Complete translation into Japanese by the professor Ken'ichi Takahashi, published in 2017.



- *EUREKA* in Japanese
- Special issue for Copernicus
- January 2023, Tokyo: Seido-sha

Pedagogical point of view: Changing historiography from the biased toward physics to the balanced

- The mainstream of the narration have been based on the history of modern mathematical physics:
 - From Copernicus
 - Via Kepler and Galileo
 - To Newton
- Historiographical text is changing, more balanced:
 - Osler 2010 pays attention to chemical and biological domains.
 - Moreover, Principe 2011 (right)/ 2014jp
 - Triad cosmos:
 - ‘Macrocosmos’, the superlunar world
 - ‘Geocosmos’, the sublunar world
 - ‘Microcosmos’, human body and the living world, and
 - Building a world of science



General Education and Anthropocene in the 'Big History'

- Instructions 'GeoSustainability' at Taisho University in Tokyo 2020-2023;
- 100 min * 2/ week with writing training.
- Three professors: Inoguchi, Yamada, and Miki;
- 1QT: GeoPhilosophia-Anthropocene, I
- 2QT: GeoHistoria-Scientific Revolution, Y
- 3QT: [Field or Laboratory Works]
- 4QT: GeoEthica-Environmental Ethics, M

- Texts for the 'Big History':
- Space history,
- Earth history,
- Anthropocene.

- The story-telling should be reviewed through the historiography.



Copernican revolution revisited

- The intellectual change has been sometimes called ‘Copernican revolution’ such as Thomas Kuhn’s famous book of 1957.
- However, close investigations into the ‘Copernican revolution’ has revealed a need for reconsideration.
- Because it was the culmination of ancient and medieval astronomy in technical tradition in a new framework, not a new explanation for the revolution (Cohen 1985, Miller 2014, Takahashi 2017).
- Although Kuhn mentioned to two spheres in the cosmos i.e. the Earth and the Heavens, he scarcely treated with the former, just focusing only on the latter, an astronomical revolution.
- Moreover, they have neglected the development of the genre of ‘cosmographia’.



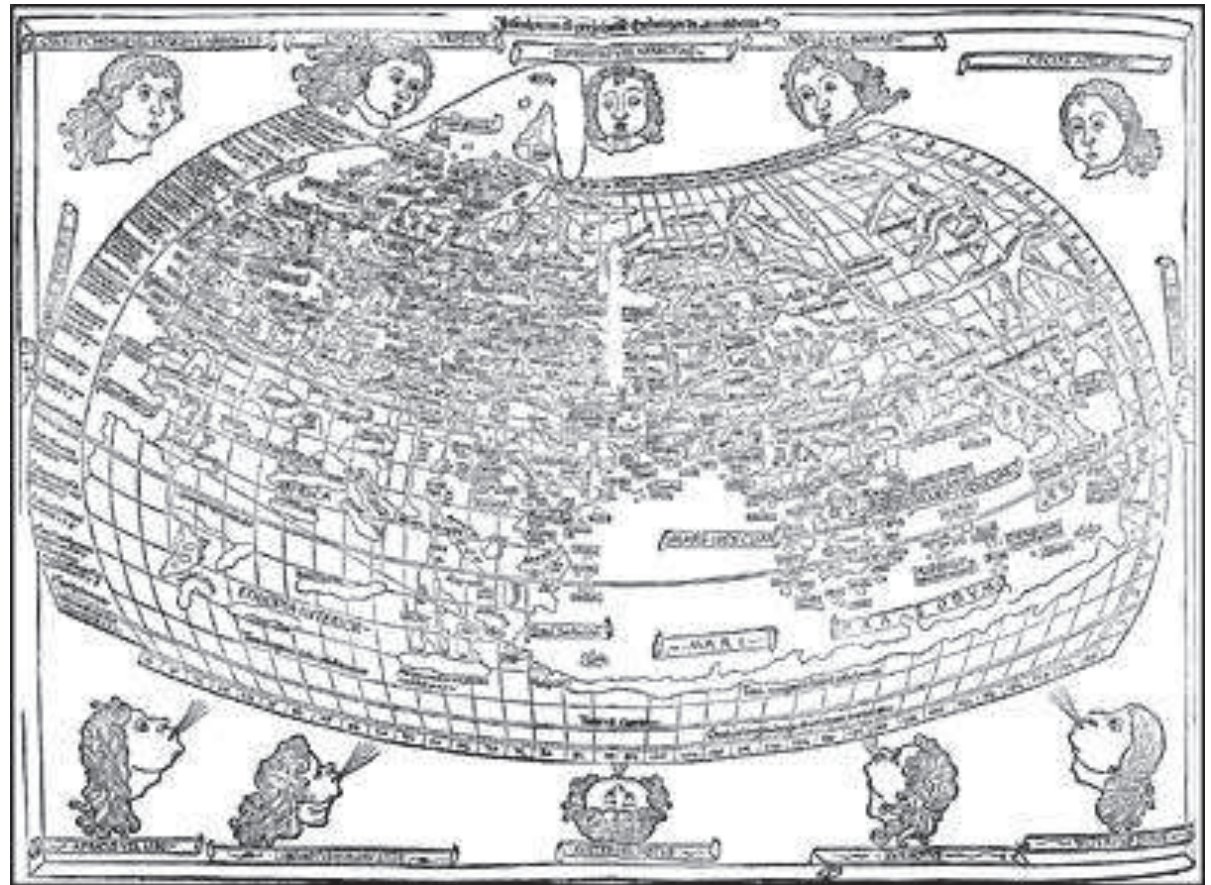
NICOLAI COPERNICI TORINENSIS
DE REVOLUTIONIBUS ORBI-
um cœlestium, Libri VII.

.Habet in hoc opere iam recens nato, & ædito, studiose lector, Motus stellarum, tam fixarum, quàm erraticarum, cum ex veteribus, tum etiam ex recentibus observationibus restitutos: & novis insuper ac admirabilibus hypothesibus ornatos. Habet etiam Tabulas expeditissimas, ex quibus eisdem ad quodvis tempus quàm facillime calculare poteris. Igitur eme, lege, fructe.

Ἐξαίρετον ἴδιον ἔστιν.

A genre of Cosmography: Ecumenical expansion

- When we review the history of cartography, we easily recognize the diffusion of revised Ptolemy's geography as 'cosmographia' in the 15th and 16th centuries,
- which apparently featured first mathematical geography such as the Ulm edition of 1482 and then descriptive geography like Sebastian Münster's Universal Cosmography of 1550.



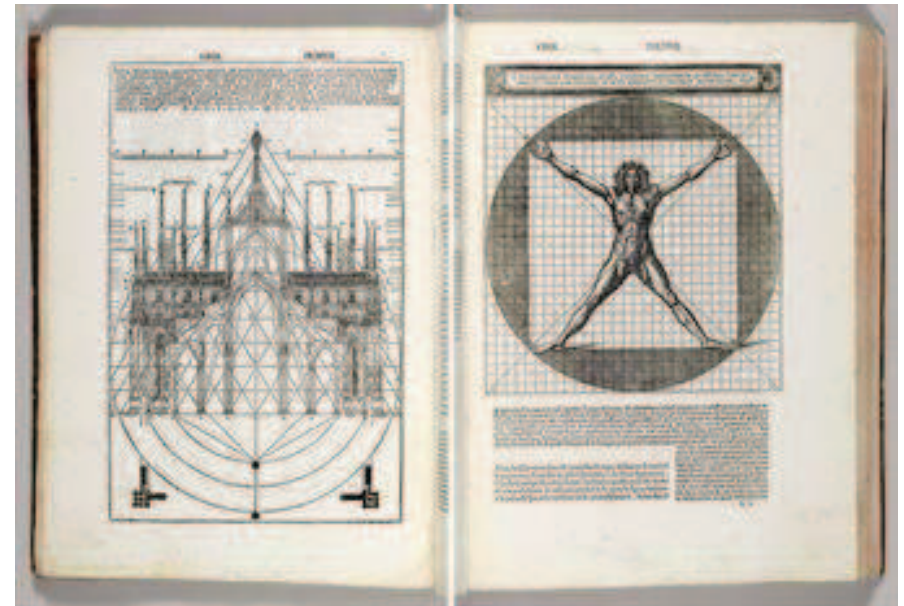
'Cosmographical revolution': Spheres and projection

- Apian 1524: Three spheres in the world: siderial, terrestrial, and the human eye (right). This reflects the third projection of Ptolemy's geography.
- It indicated how to interpret the relative movements on the sphere and their projections.
- Not just the general background of the revolution but a substantial base for the reconsideration of physical macrocosmic space.
- Although it is a geo-centered model, we should note that it also implies a relative positions on planets from the view outside the sphere.



Architectonical aspect: Vitruvius and the triad

- It is quite interesting to know after the expansion of Ptolemy's ecumenical zone, the Vitruvian architecture book (1547) indicating geocosmic environmental elements.
- For example, it refers not only to various kind of stones for building materials (lib. 1) but hydrospheric activities including coagulating juice (succus) and hydrosphare (lib. 8), which Varenius (1650) later referred.
- It is well known it reveals Vitruvian microcosmic symmetry of human body (lib. 3). It also deals with construction of sundial and astrology (macrocosm) (lib. 9).



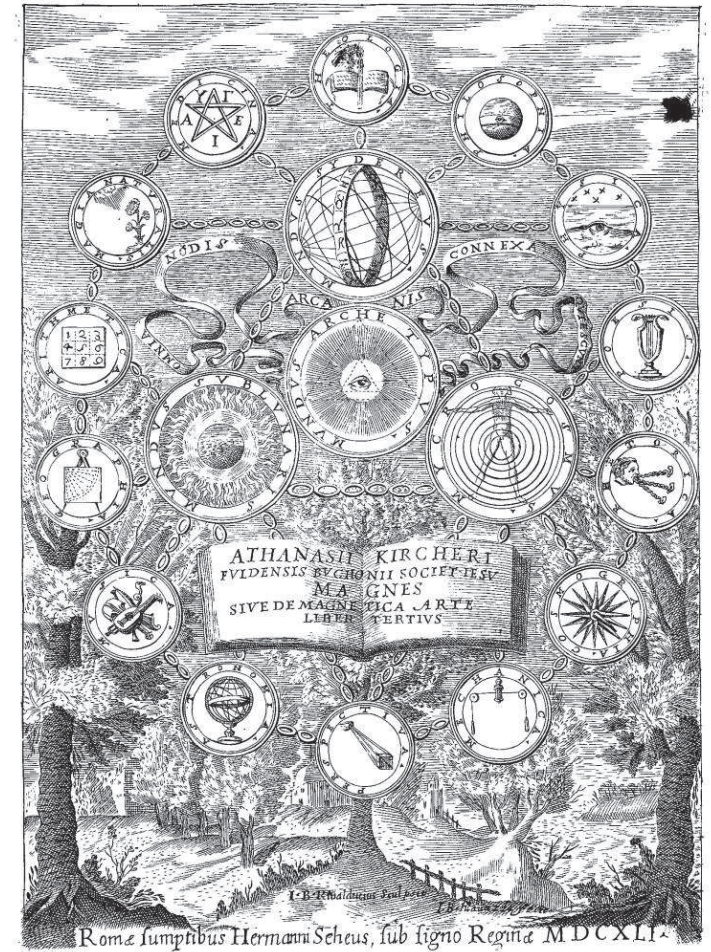
Vitruvian Cosmic figures added

- Leonardo:
Microcosmic
Symmetry
(1487?)



Yamada_2023/08/03

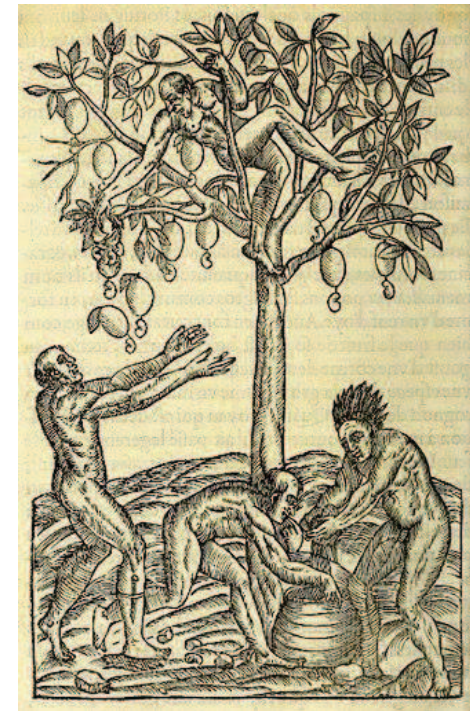
- Kircher:
Triadic
Cosmic
View
(1641)



INHIGEO2023Cracow

‘Cosmographical revolution’: Descriptive step

- If we admit what the American historian of geography Denis Cosgrove (2001) suggested about the cosmographical projection, which changed the way of view of the world before the Copernican turn on the macrocosm, we have to rather call it ‘cosmographical revolution’ in which Copernican one was included.
- Moreover, the French historian Frank Lestringant (1991/1994) investigated the mythological meaning behind particular indigenous legends reported in such cosmographer as André Thevet (right: *Les singularitez de la France antarctique*, 1557), a successor of Münster.



Stenonian revolution reconsidered

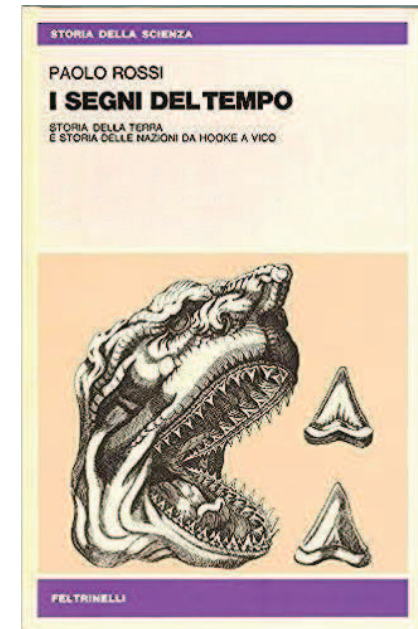
- This implied one more step in the revolution which would be led to the universal history in the 17th century. Thus, in this context, we can rethink the Stenonian revolution, which the Irish geologist historian Gordon Herries Davies (1989) claimed, as a result of this kind of enlarged cosmographical revolution, which made natural history into geological history.
- We may understand this is a result of the second step of the Cosmographical revolution.
- Interpretation revolution of Bible text suggested by Anthony Grafton (1991) may well be adapted to the natural historical text. We would see a parallelism between Spinoza and Steno, the former interpreted the Bible text whereas the latter interpreted natural history.



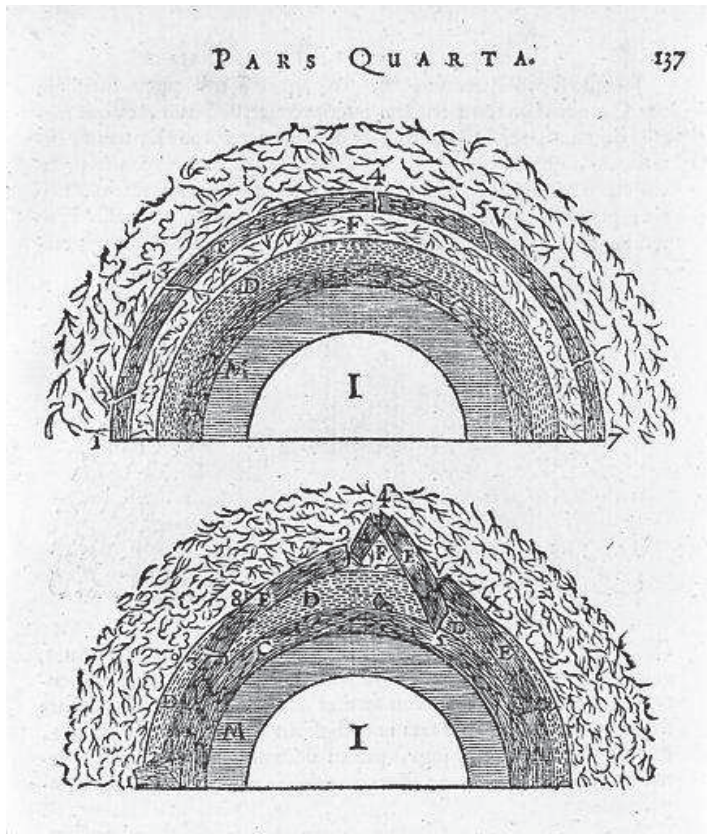
- Steno 1669: *Prodromus de solido ...*

Enlarged Stenonian revolution

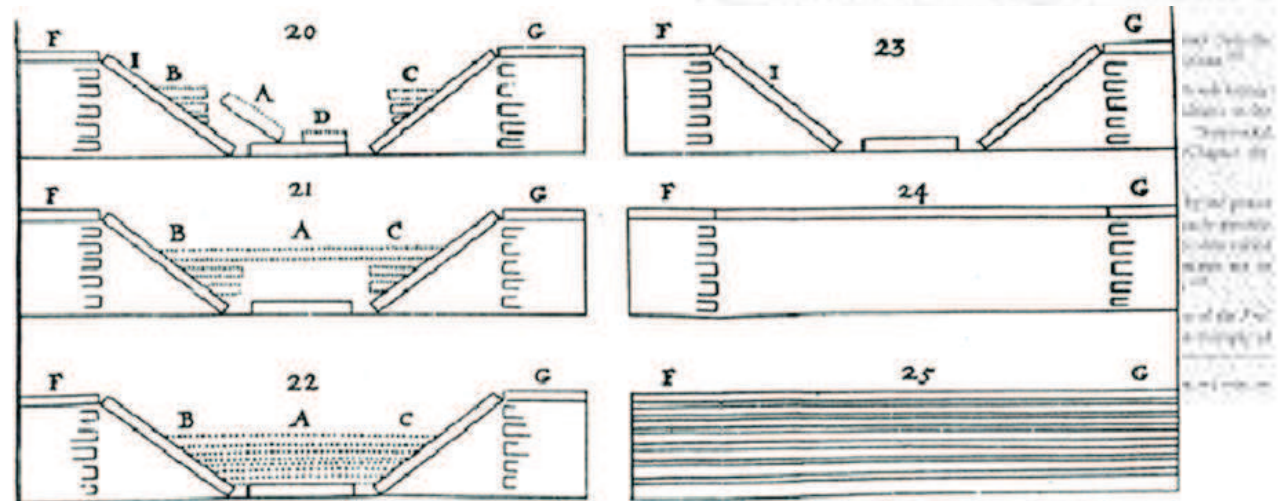
- The Italian savant Paolo Rossi (1979/ 1987) suggested the importance of the revolution (the second step of the cosmographical revolution, here I have talked), which leads to the discovery of the dark abyss of deep time during the ages between Hooke and Vico and changed the position of human being in Nature as well as, or even more seriously than, Copernican one did.
- If we admit the Copernican revolution which includes the achievements of Kepler, Galileo, and Newton, we may think about Stenonian revolution which includes the contributions of Spinoza's Bible interpretation and of Leibniz's mining development under the guidance of the Stenonian theory of the Earth; the emergence of 'geology'.



Ref. Geotectonical mapping in the 17th Century



- Descartes (1644) ←
- Steno (1669) ↓
- Leibniz (c.1691) →



Discussion: How to reconsider the narrative

- I think a growing responsibility to reconsider and revise the historiography of science. In the domain of earth and planetary sciences, it is, of course, important to teach heliocentric system (Copernican revolution) and plate tectonics theory (Wegenerian revolution). But the times are changing.
- The special section of *ISIS* (113-2, 2022) delivered a several articles, focusing the historiography of science in the Anthropocene. One of those is questioning the meaning of the earth system sciences in the history (Simon & Thomas 2022).
- From a pedagogical point of view of Anthropocene, it would be necessary for us to reconsider the 'Scientific Revolution' itself, here I have discussed, and then 'Lyellian revolution' which includes the emergency of geological survey system, and the 'Wegenerian revolution' which triggered the plate tectonics theory and the earth system science as a whole. (Cf. Yamada 2020.)

Conclusions

- A close investigation into the ‘Copernican revolution’ reveals that it was a result of de-centralization of viewpoints, that is a selection of possible centers of relative movement derived from the ‘cosmographical revolution’. The narration of the history of mathematical physics from Copernicus to Newton is not an only necessary one.
- Another story of the Scientific Revolution should be considered as Paolo Rossi and others have suggested, that is the ‘Stenonian revolution’. We may understand this is a second step of the cosmographical revolution, which de-centralized narratives of every history of nation and nature, thus introduced a concept of history of nature in the search for universal history.
- It would be suggested that these processes were accompanied with the reconstruction of three cosmic views, that is meant a transformation of a sort of environmental (including architectonical) consciousness.
- This kind of revision of the Scientific Revolution might lead us to reconsider the whole history of science as is pedagogically fitted to the age of Anthropocene.

Select bibliography

- Cohen, I. B. 1985: *Revolution in Science*, Cambridge Mass.: Harvard U. P.
- Cosgrove, D. 2001: *Apollo's Eye: A Cartographic Genealogy of the Earth in the Western Imagination*, Johns Hopkins U. P.
- Lestringant, F. 1994: *Mapping the Renaissance World*, Berkeley: University of California Press.
- Miller, D. M. 2014: *Representing Space in the Scientific Revolution*, Cambridge: Cambridge University Press.
- Osler, M. 2010: *Reconfiguring the World: Nature, God, and Human Understanding from the Middle Ages to Early Modern Europe*, Baltimore: Johns Hopkins U. P.
- Principe, L. M. 2011: *The Scientific Revolution: A Very Short Introduction*, Oxford: Oxford U. P.
- Simon, Z. B. and Thomas, J. A. 2022: Earth System Science, Anthropocene Historiography, and Three Forms of Human Agency, *Isis*, 113-2, 396-406.
- Takahashi K. 2017: Annotation to the complete translation of Copernicus *De revolutionibus*. [jp]
- Yamada T. 2017: *The Transformation of 'Geocosmos': From Descartes to Leibniz*, Tokyo: Keiso shobo. [jp]
- Yamada, T. 2020: Rethinking the 'Stenonian Revolution': From the Perspective of Anthropocene Issues, *JAHIGEO Newsletter*, 22, 9-16.
- Yamada T. 2023: The rethinking triadic Cosmos: From Copernican revolution to Stenonian revolution, *EURIKA*, 55-1, pp. 77-88. [jp]