



*Supplement of*

## **From mythology to science: the development of scientific hydrological concepts in Greek antiquity and its relevance to modern hydrology**

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**Abstract.** This supplement provides material supporting the analyses and conclusions of the main paper and comprises four sections:

- S1. On the human teeth problem and the debate of Russell and Aristotle
- S2. Modern imaginative explanations of the Nile floods
- S3. The appearance of the term hydrology
- S4. Original texts of the quotations translated in the article to English

### **S1. On the human teeth problem and the debate of Russell and Aristotle**

The problem of the number of humans' teeth and the "debate" of Russell and Aristotle has some merit to examine from an epistemological viewpoint. A relevant question is this. What is actually the number of humans' teeth:

- a constant for all individuals (irrespective of sex)?
- varying among individuals?
- varying among individuals and also varying in time for each individual (like in a stochastic process)?

Modern official statistical data of the USA (Dye et al., 2007) confirm that male humans have a slightly higher number of teeth than females ( $25.1 \pm 0.11$  and  $23.86 \pm 0.14$  respectively in the period 1988-1994, while both numbers increased by about 1 in 1999-2004; notice in both sexes the number is considerably smaller than 32). A first reason for the difference is that the number of teeth decreases with increasing age, and women's life expectancy is longer by several years than men's. A second reason is that women's teeth seem to be more fragile than men's; specifically, official USA statistical data (Harvey, 1981) suggest that the average number of decayed, missing, and filled permanent teeth per person, among adults of 35-74 years of age, was 18.5 and 19.7 for males and females, respectively, in 1960-62 and increased by about one in both sexes in 1971-74. A third reason of sex disparities is the fact that molar agenesis (congenital lack of one or more teeth; Sujon et al., 2016) is lower in males (38.6%) than in females (40.1%). A fourth reason is that hyperdontia (additional teeth in relation to the normal dental formula, which according to observations ranged from 1 to 8) is more common in males (Harris and Clark, 2008).

The gap between the life duration of women and men is currently about 5 years (75.20 for women, 70.41 on a global basis<sup>1</sup>). While life expectancy varies across countries within the range 51 to 88 years, the gap between the two sexes is almost constant, at about 5 years. We can speculate that, because of the more frequent wars in the times of Aristotle, this gap would be greater and, given that the number of teeth is a decreasing function of age, the difference would be greater and Aristotle's observation would be correct. Fragility might also have played a bigger role in ancient times as the dentistry was not as developed as today.

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<sup>1</sup> <https://ourworldindata.org/grapher/life-expectancy-of-women-vs-life-expectancy-of-women>.

## S2. Modern imaginative explanations of the Nile floods

Johann Michael Vansleb (or Vanslebius or Father Vansleb; 1635 – 1679; a German theologian and linguist) who travelled in Egypt in 1672-73 published a book about Egypt in 1677 in French and a year later in English (Vansleb, 1678). Among other things, he provides an imaginative explanation for the Nile floods. He contends that yearly the Nile's level “begins to increase and decrease on a certain day precisely”, namely on 17 June and on 24 September, respectively. He reports some mysterious “drops” that synchronize with the beginning of the inundation, that is “a kind of a Dew which falls towards the last quarter of the night, near the morning”, while the rainfall in Ethiopia starts later, in July. Therefore, he asserts that:

*The increase of the River proceeds from several causes; the first and the chief is, the fermentation caused in it by this Dew*

while he includes in the causes, with secondary role, the rainfall in Ethiopia and the westerly winds, which:

*blow strait into the River Nilus and hinder the fresh water from coming out, so that it returns back, and causeth the River to swell.*<sup>2</sup>

Interestingly, even before Vansleb's trip and book, the French physician and philosopher Marin Cureau de la Chambre (1594 – 1669) published a book citing other travellers to Egypt (e.g., the Venetian physician and botanist Prospero Alpini or Prosper Alpinus; 1553 – 1617), in which he adopts the cause of floods by this mysterious dew, but also introduces the *nitre*<sup>3</sup> “theory” (de la Chambre, 1665). His book was also presented in Britain with a summary published in the Philosophical Transactions (Oxford), from which we quote the following (Anonymous, 1665–1666b):

A DISCOURSE ABOUT THE CAUSES OF THE INUNDATION OF THE NILE, in French. *The Author of this Book is Monsieur dela Chambre, who being perswaded from several Circumstances, that accompany the Overflowing of this River, that it cannot proceed from Rain, ventures to assign for a Cause of it, and of all the other effects that happen at the time of its swelling, the Niter, wherewith that water abounds.*

[...] 'Tis affirm'd, that 3 or 4 days before that River begins to overflow, all its water is troubled: that then there falls a certain Dew, which hath a fermenting vertue, and leavens a Paste exposed to the Air. [...] the Niter, which the Nile is stored with, is the cause of all these strange effects [inundation], and of many others, by him alledged. For, saith he, when the Nitre is heated by the heat of the Sun, it ferments, and mingling with the water, troubles it, and swells it, and makes it pass beyond its banks; after the same manner, as the Spirits in new Wine render it troubled, and make it boyle in the vessel.

[...] the Author undertakes to prove, that all those strange effects cannot be attributed to Rain or Snow, and that the overflowing of the Nile always happens at certain day.

It appears that the dew and nitre “theories” had subsequently become popular in Oxford. Thus, Charles Leigh (English physician and naturalist 1662–1701?) in a letter published in Philosophical Transactions (Leigh, 1684), which was addressed to Robert Plot (“Professor of Chymistry in the University of Oxford” and “Director of Experiments to the Philosophical Society of Oxford, and one of the Secretaries of the Royal Society”; 1640 – 1696), writes:

*By Monsieur de la Chambre, it is affirmed that three or four days before the Nile begins to overflow, there falls a certain dew which hath a fermenting vertue, and leavens a past expos'd to the air, and at that time saith Pliny, and Monsieur de la Chambre the Nitre Pits grow full of Nitre. And Sands, Vanslebius and several say, that tho 500 in a day die in Grand Cairo of the Plague before the beginning of the inundation of Nile, yet the very day after there does not one die, which doubtless could not proceed from any other reason, then because at that time, the air was impregnated with this Volatile Alkaly, for at that time the Nitre Pits grow full and this dew falls; (this I think) may sufficiently hint to us the great use of its volatile spirit especially in pestilential distempers.*

<sup>2</sup> In all quotations we have kept the spelling of the original, which may differ from the common current one.

<sup>3</sup> Also spelled *niter* in some English books.

Subsequently this view was adopted by Plot himself, who wrote (Plot, 1686):

*The Origine of [the] increase [of Nile's level] the learned Vanslebius (who lived there some years and carefully observed it) thinks chiefly to proceed from the fall of certain drops, somewhat like dew, that mixing with the waters cause such a fermentation and corruption in them that they expand themselves and swell to a great height, long before it can any way be possibly effected by the great rains in Habessia [= Abyssinia, Ethiopia].*

He further proceeded to contend:

*The learned Cambraeus as cited by Gassendus [Petrus Gassendi; 1592–1655] thinks this fermentation to be caused by Niter, wherewith the Country and especially the Channel of the River is acknowledged to abound, which being heated by the Sun, thus dilates it self and makes the River to swell.*

From a systematic search in Philosophical Transactions, it turns out that there was at least one scholar who opposed those “theories”: the Dutch manuscript collector Isaac Vossius (Isaac Voss; 1618–1689). His book written in Latin (Vossius, 1666) was also presented in the Transactions (Anonymous, 1665–1666a,c). From the latter presentation we quote this:

*[Vossius] easily gives an account, why the Nile yearly overflows about the end of June: For, as at that time there falls much rain in Æthiopia, it must needs be, that the Nile, whose source is in that Country, should then overflow, when those rains begin, and subside, when they cease.*

Interestingly, Vossius's (1666) view is not far from Aristotle's and he quotes Greek authors to support it, namely, Cleomedes, Nonnosus and Cosmas Indicopleustes (see main paper).

However, Vossius's view remained unpopular. According to Garnier (1892), during the 18<sup>th</sup> century:

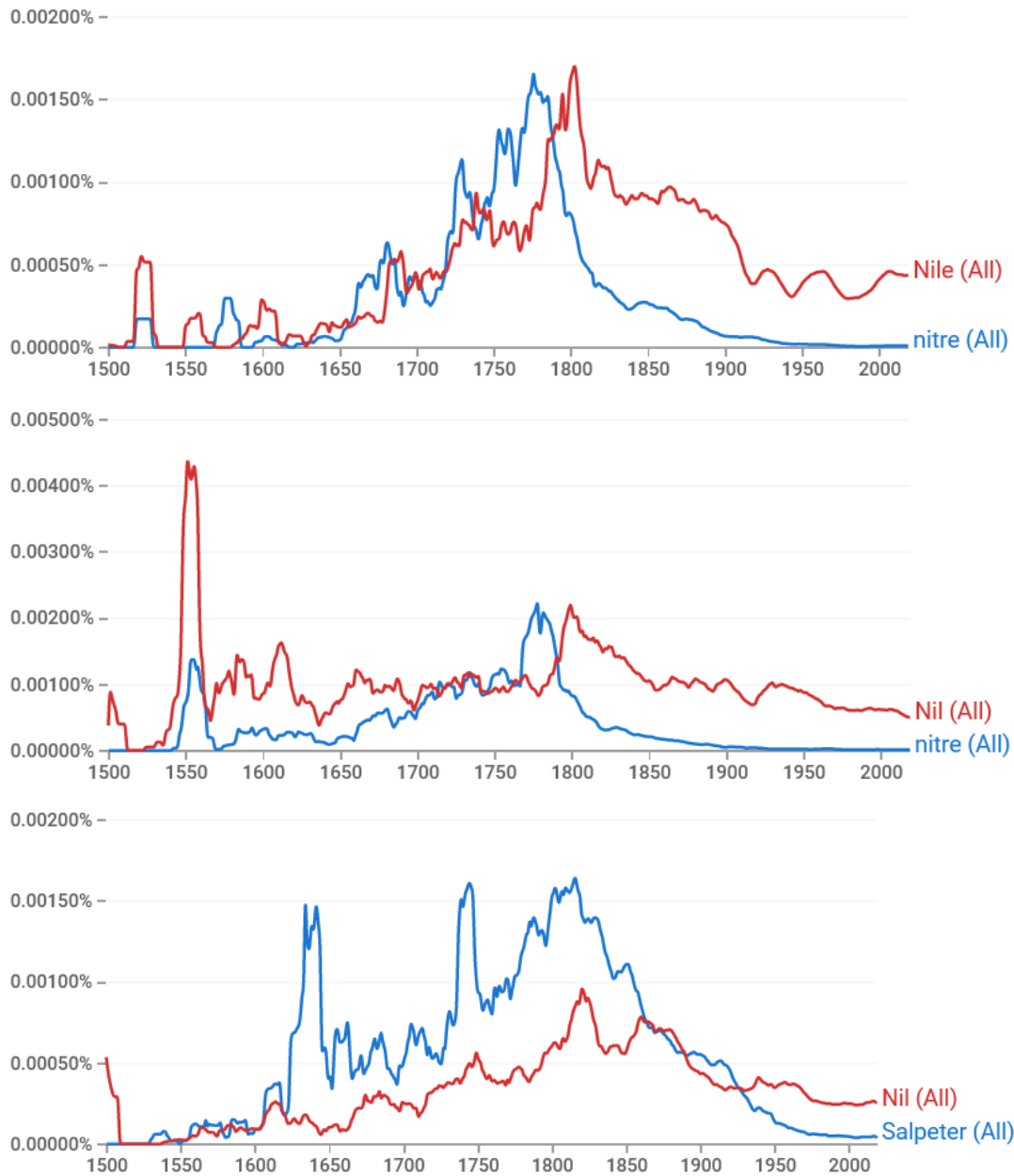
*The learned societies of France, England, and Germany recognised the nitrous salt in the fertilising essence of Nile water, dung, snow, rain water, and other real or imaginary manures; and the whole scientific world extolled in extravagant terms the virtues of a compound the true nature of which it had as yet failed to grasp.*

This is reflected in the popularity of the use of the word *nitre* in books written in the languages of these three countries. As shown in Figure S1 this name is not in use any more, but in the 18<sup>th</sup> century its use had peaked, exceeding those of the word *Nile*.

Complete dismissal of these imaginative “theories” would require additional modern evidence and thus it had to wait a century, up to the end of the 18<sup>th</sup> century. Then, James Bruce (1730–1794), a Scottish traveller and travel writer who visited North Africa and Ethiopia, including the origins of the Blue Nile, wrote with a modest tone of irony (Bruce, 1813):

*I shall now mention a treatise of a modern philosopher, wrote expressly upon this subject; I mean a discourse on the causes of the inundation of the Nile, by M. de la Chambre, printed at Paris in quarto, 1665, where, in a long dedication, he modestly assures the king, he is persuaded that his majesty will consider, as one of the glories of his reign, the discovery of the true cause of the Nile's inundation, which he had then made, after it had baffled the inquiry of all philosophers for the space of 2000 years; and, indeed, the cause and the discovery would have been both very remarkable, had they been attended with the least degree of possibility. [...] M. de la Chambre says, that the nitre, with which the ground in Egypt is impregnated, ferments like a kind of paste, occasioning the Nile to ferment likewise, and thus increases the mass of water so much, that it spreads over the whole land of Egypt.*

*Far be it from me to bear hard upon those attempts with which the ancients endeavoured to solve those phaenomena, when, for want of a sufficient progress in experimental philosophy and observation, they were generally destitute of the proper means; but there is no excuse for a man's either believing or writing, that earth, impregnated with so small a quantity of any mixture as not to be discernible to the eye, smell, or taste, could periodically swell the waters of a river, then almost dry, to such an immensity, as to cover the whole plains of Egypt, and discharge millions of tons every day into the sea.*



**Figure S1:** Frequency of appearance of the indicated words in books hosted in the Google books platform (<https://books.google.com/ngrams/>) in three languages: (upper) English; (middle) French; (lower) German.

### S3. The appearance of the term *hydrology*

Several terms related to hydrology appear in Ancient Greek literature, which are etymologized from the noun *ὕδωρ* (*hydor*, water). Specifically:

- The conveyance of water or liquids is termed *ὕδραγωγία* (ή), and a person (or device) related to it *ὕδραγωγός*.
- The actions of drawing, fetching or distributing water are termed *ὕδρεια*, *ὑδρευσις* and *ὕδροπαροχία*; a person related to them is termed *ὕδροπάροχος* and a guard or inspector of aqueducts or irrigation works *ὕδροφύλαξ*.

- The action or art of seeking or discovering water is termed *ὕδροσκοπία*, *ὕδροσκοπική* or *ὕδροφαντική* (verb: *ὕδροσκοπέω*); a person related to it is *ὕδρόσκοπος*, *ὕδρογνώμων* or *ὕδροφάντης* and a related instrument is *ὕδροσκόπιον*.

These, however, have not been transplanted to the international scientific or technological vocabulary, where words of Latin origin (e.g. aqueduct) dominated. On the other hand, the following Greek terms have become global:

- The modern term *ὕδραυλική* (*hydraulics*) stems from *ὕδραυλικὸν ὄργανον* (*hydraulic organon*), first used by Hero for a musical instrument operated by hydraulics. Earlier, Ctesibius (Κτησίβιος; fl. 285–222 BC) invented the instrument called *ὕδραυλις* (ή) (*hydraulis*), which is played by a musician called *ὕδραύλης* (*hydraules*). Its etymology stems from *ὕδωρ* (water) and *αὐλός* (*aulos*; pipe, flute, clarinet). Thus, the term *hydraulics* was not introduced by Robert Boyle (1627-1691), as commonly written (Biswas, 1970, p. 225), but almost two millennia earlier.
- The term *meteorology* stems from *μετεωρολογία*, which in turn stems from *μετέωρα* (*meteors*; note, in the ancient literature, in addition to hydrometeors, meteors include the heavenly bodies); a person who studies *μετεωρολογία* is *μετεωρολόγος* (*meteorologos*, meteorologist) or *μετεωρολογικός* (*meteorologicos*, meteorologic) (cf. Plato's *Phaedro* 270a and Aristotle's *Meteorologica*).
- The term *climate* stems from *κλίμα* (meaning the inclination angle of the incoming sunbeams; pl. *κλίματα*); a property pertaining to *κλίμα* is *κλιματικός* (Koutsoyiannis, 2021).

*Hydrology* is also a Greek word, i.e., *ὕδρολογία* (feminine noun transliterated in Latin as *hydrologia*), but it does not appear in the Ancient Greek literature.<sup>4</sup> The closest match it contains is *ὕδρολόγιον* (*hydrologion*, a noun in the neuter gender), which however is a water-clock. Its plural, *ὕδρολόγια*, is transliterated in Latin as *hydrologia*, precisely the same as the transliteration of *ὕδρολογία* (notice that in Greek there is a difference in the accented syllable). Among the first books published after the invention by Gutenberg of mechanical printing press, was the *Lexicon of Festus* (in Latin, typically dated to the 2nd century, with original title *De Verborum Significatione* (On the Meaning of Words). This does not contain the term *hydrologia*, but commentaries on it published several years after do. Thus, this term appears in the book of *Commentaries on de Verborum Significatione* by three famous interpreters (Alciatus, Brechaeus, Fornerius, 1589, p. 10) but from the context it becomes clear that it is plural of *hydrologion* (or *hydrologium* in Latin). It also appears with the same meaning in an encyclopaedic collection of mathematical curiosities by Bettinus (1642).

According to our own search in digital archives of old books, the first book containing the term *hydrology* in its French version, *hydrologie*, is that by Landrey (1614). Other books whose title (or subtitle) contains the term *hydrology*, published in the 17<sup>th</sup> through 19<sup>th</sup> century, are listed in Table S1 and illustrated in Figure S2 to Figure S13. It appears that the main orientation of those books was medical. At the end of the 19<sup>th</sup> century an international congress of hydrology and climatology was held at Biarritz, France (in Bay of Biscay close to the Spanish borders) as reported by Symons (1887), in which a distinction was made between *medical hydrology* and *scientific hydrology*. The key persons of that congress, shown in Figure S14, appear to be mostly medical doctors. For most of them we found their details which are as follows:

- Maxime Durand-Fardel (1815-1899), French medical doctor and explorer; coauthor (with Eugène Le Bret and Jules Lefort) of *Dictionnaire Général des Eaux Minérales et d'Hydrologie Médicale*, 4 vol., 1860.<sup>5</sup>
- Joseph Louis Félix Garrigou (1835-1920), French medical doctor and prehistorian; chair of medical hydrology at Toulouse (1891).<sup>6</sup>
- Antoine Thomson d'Abbadie d'Arrast (1810-1897), Irish-born French explorer, geographer, ethnologist, linguist and astronomer.<sup>7</sup>

<sup>4</sup> Indeed, *The Liddell, Scott, Jones Ancient Greek Lexicon* (LSJ; the best-known Ancient Greek dictionary; <https://lsj.gr>) does not contain the entry *ὕδρολογία*.

<sup>5</sup> [https://fr.wikipedia.org/wiki/Maxime\\_Durand-Fardel](https://fr.wikipedia.org/wiki/Maxime_Durand-Fardel).

<sup>6</sup> [https://en.wikipedia.org/wiki/F%C3%A9lix\\_Garrigou](https://en.wikipedia.org/wiki/F%C3%A9lix_Garrigou).

<sup>7</sup> [https://en.wikipedia.org/wiki/Antoine\\_Thomson\\_d'Abbadie](https://en.wikipedia.org/wiki/Antoine_Thomson_d'Abbadie).

- Luigi Chiminelli (1816-1901), Italian medical doctor, specialized in medical hydrology; founder of the periodical *L'Idrologia Medica* (1879), later renamed *L'Idrologia e la Climatologia Medica* (1881).<sup>8</sup>
- Enoch Heinrich Kisch (1841-1918) Austrian medical doctor, balneologist and gynecologist born in Prague; author of *Allgemeine Balneologische Zeitung VI, Book 2: Monatsschrift Für Balneologie, Hydrologie Und Klimatologie* (1867).<sup>9</sup>
- George James Symons (1838-1900), British meteorologist; founder and manager of the British Rainfall Organisation, and a dense and widely distributed network of raingauges throughout the British Isles.<sup>10</sup>

**Table S1.** Books published in the 17<sup>th</sup> to 19<sup>th</sup> century whose title (or subtitle) contains the term hydrology (or the equivalent term in another language).

No.	Author (year)	Title	Language	Scope*	Illustration
1	Landrey (1614)	Hydrologie ou Discours de l'Eaue	French	M,P	Figure S2
2	Licetus (1655)	Hydrologiae Peripateticae Disputationes de Maris Tranquillitate	Latin	P	Figure S3
3	Derham (1685)	Hydrologia Philosophica	English	M,P	Figure S4
4	Melchior (1694)	Hydrologia Brevis Quidem	German	M	Figure S5
5	Vinayma (1738)	Hydrologia, o Tratado de las Aguas Ferrugíneas ...	Spanish	M	Figure C6
6	Wallerius (1751)	Hydrologie	German <sup>†</sup>	C	Figure S7
7	Carthéseur (1758)	Rudimenta hydrologiae systematicae	Latin	M	Figure S8
8	Hanovius (1765)	Philosophiae Naturalis sive Physicae Dogmatica ... Continens Aërologiam et Hydrologiam	Latin	P	Figure S9
9	Monnet (1772)	Nouvelle Hydrologie	French	C	Figure S10
10	Eliseo (1790)	Physicae Experimentalis Elementa ... Hydrostatica, Hydrodinamica, Hydraulica, Hydrologia	Latin	H,N	Figure S11
11	Barrington (1850)	A Treatise on Physical Geography Comprising Hydrology, Geognosy, Geology, Meteorology...	English	G	Figure S12
12	Beardmore (1862)	Manual of Hydrology	English	H	Figure S13

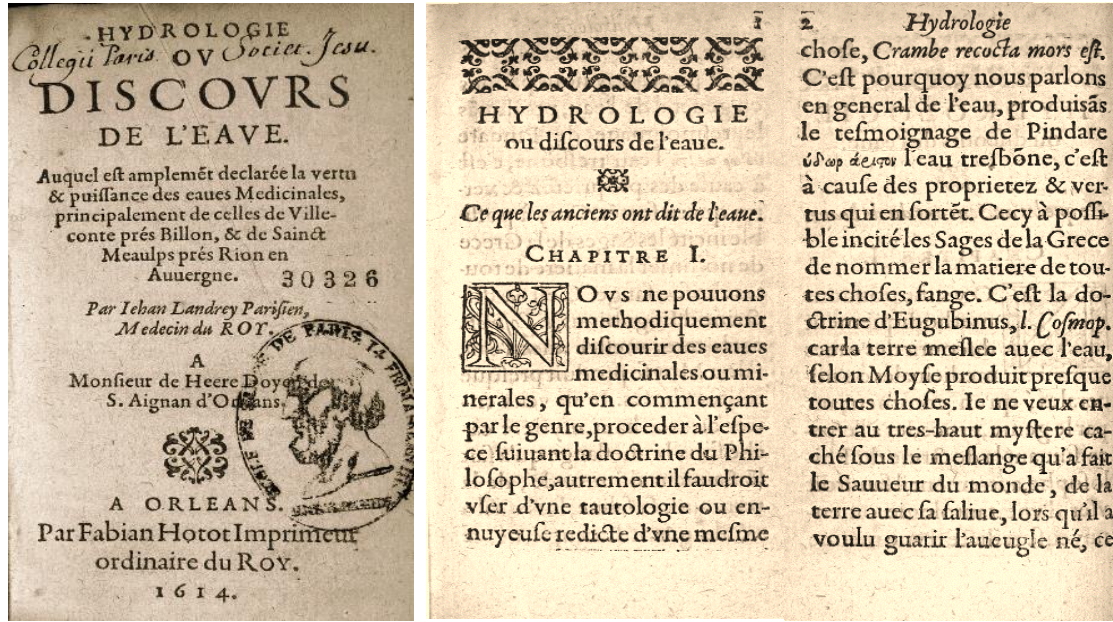
\* Main scope classified as follows: C- Chemistry, mineralogy, G: Geography; H: Hydraulics; M; Medicine; N: Natural sciences (physics, meteorology, climatology); P: Philosophy.

<sup>†</sup> Translation from the original edition in Swedish (Wallerius, 1748).

<sup>8</sup> [https://www.treccani.it/enciclopedia/luigi-chiminelli\\_\(Dizionario-Biografico\)/](https://www.treccani.it/enciclopedia/luigi-chiminelli_(Dizionario-Biografico)/).

<sup>9</sup> [https://en.wikipedia.org/wiki/Enoch\\_Heinrich\\_Kisch](https://en.wikipedia.org/wiki/Enoch_Heinrich_Kisch), <http://jewishencyclopedia.com/articles/9348-kisch>.

<sup>10</sup> [https://en.wikipedia.org/wiki/George\\_James\\_Symons](https://en.wikipedia.org/wiki/George_James_Symons).

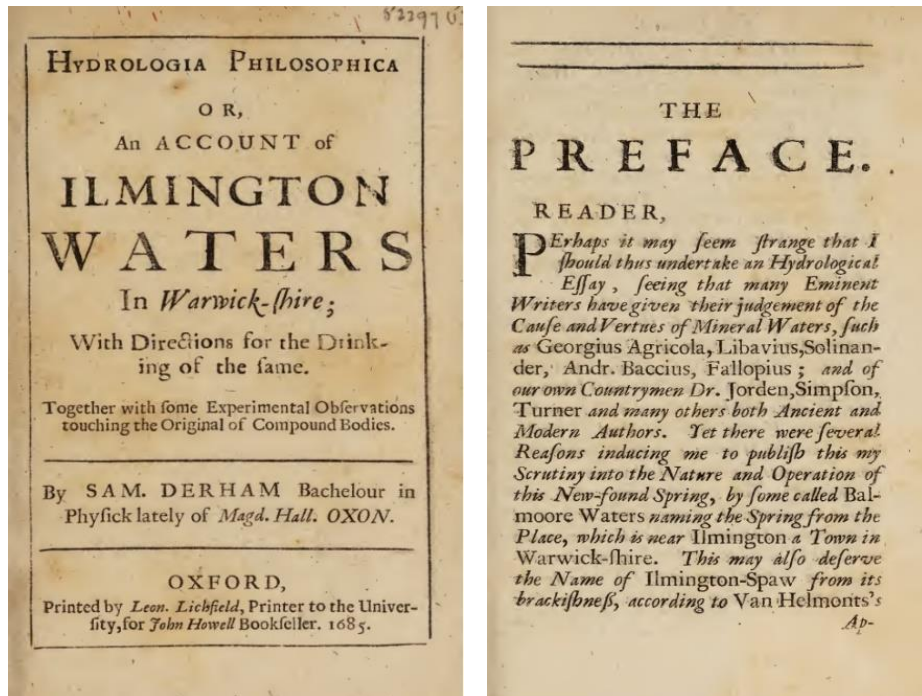


**Figure S2:** Title page and first two pages of the book *Hydrologie ou Discours de l'Eaue* by Jehan (Jean) Landrey (a French King's doctor) (Landrey, 1614). From the title page it becomes clear that the book is about the virtue and power of medicinal waters (la vertu & puissance des eaues médicinales). In the first pages the author declares that he follows the doctrine of the philosopher to begin with the genus and proceed to the species, while he quotes Pindar's verse *ὄδωρ ἀριστον* (l'eau tres bone; water is best; the exact quotation is *ἀριστον μὲν ὄδωρ*, Pindar, Olympan Odes, 1).



**Figure S3:** Title page and first page of the book *Hydrologiae Peripateticae Disputationes de Maris Tranquillitate* by Fortunio Liceti (1577–1657, an Italian physician and philosopher) (Licetus, 1655). The adjective *Peripatetica* in the book title shows the influence of Aristotle (whose School was named Περικατητικὴ Σχολή) on Liceti. The title page summarizes the content of the book (origin of the rivers from the mountains, meteorology, Dead Sea/Lacus Asphaltitis etc.). The names of Aristotle, Plato, Xenophon and Socrates appear already in the first page. The content of the book includes descriptions of various rivers in Asia, Africa (including the Nile) and Europe (mostly Greece).



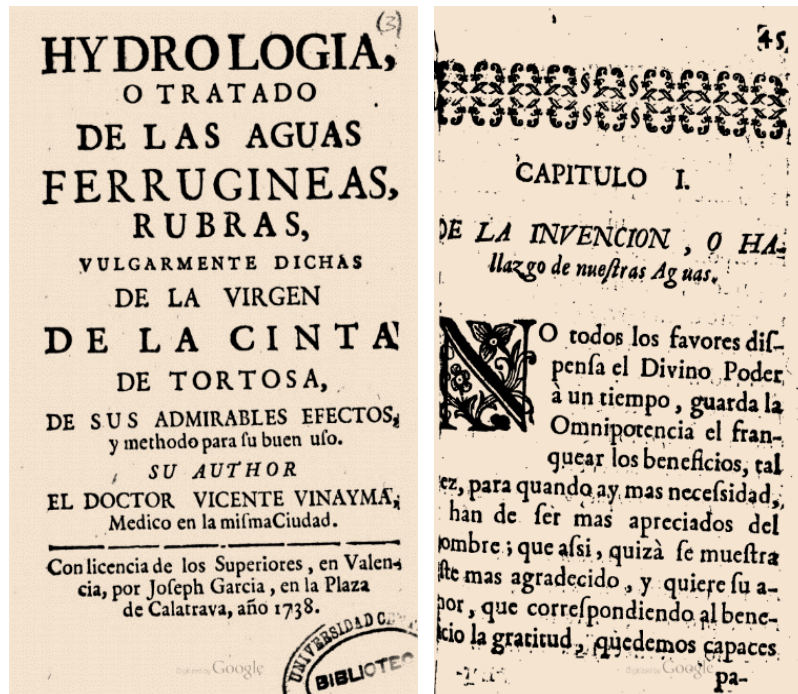


**Figure S4:** Title page and first page of the book *Hydrologia Philosophica* by Samuel Derham (1577–1657, a British physician<sup>11</sup>) (Derham, 1685). As clarified in its subtitle, the book is not quite philosophical but refers to properties of the water of a particular spring.

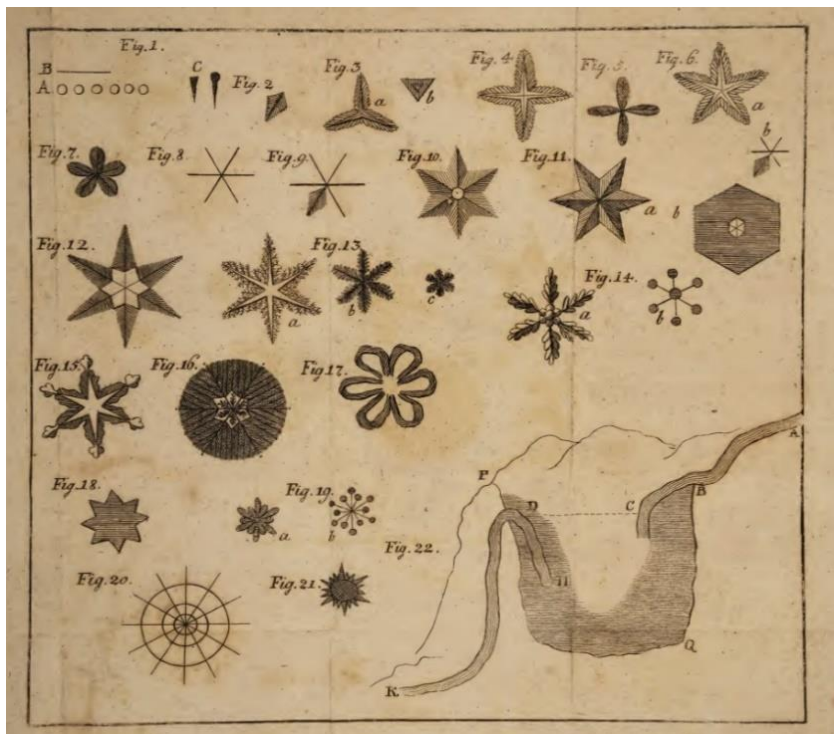


**Figure S5:** Title page and first page of the book *Hydrologia Brevis Quidem* by Eberhard Melchior (unknown details) (Melchior, 1694).

<sup>11</sup> <https://www.oxforddnb.com/view/10.1093/ref:odnb/9780198614128.001.0001/odnb-9780198614128-e-7527>.



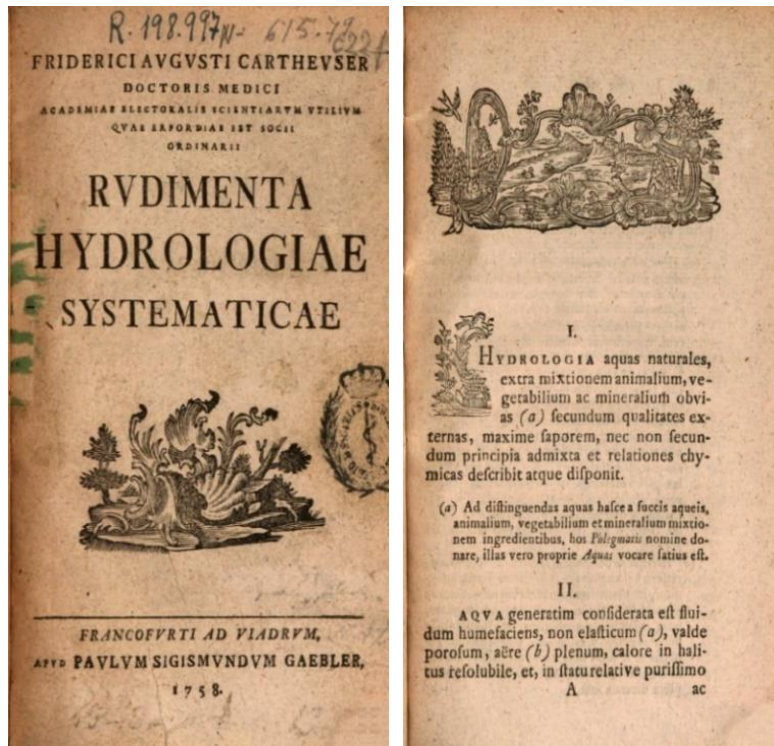
**Figure C6:** Title page and first page of chapter 1 of the book *Hydrologia, o Tratado de las Aguas Ferrugineas ...* by Vicente Vinayma (a Spanish medical doctor; unknown details) (Vinayma, 1738). The book features a divine link of water.



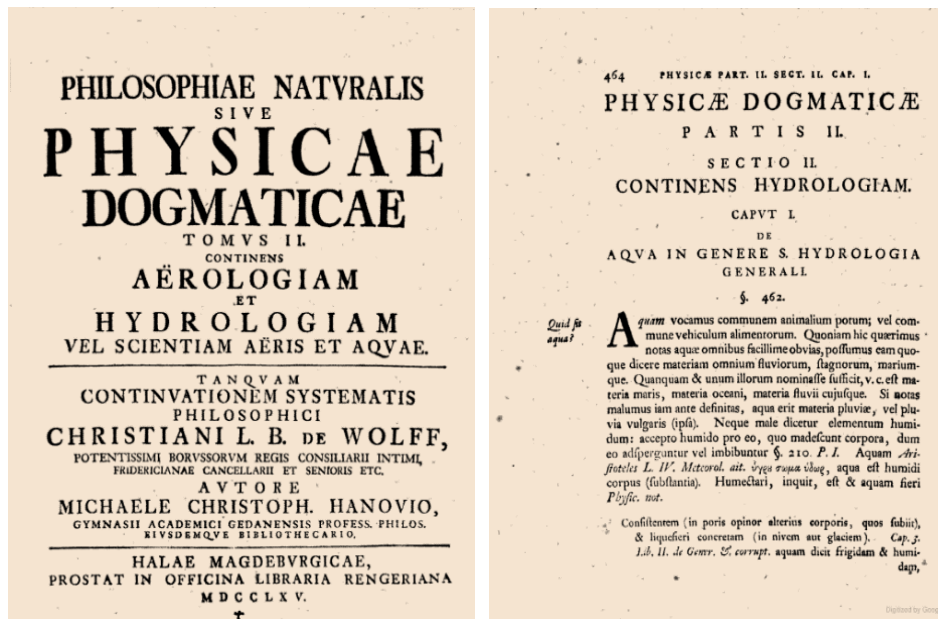
**Figure S7:** Title page and last page with figures of the book *Hydrologie* by Johan Gottschalk Wallerius (1709-1785; a Swedish chemist and mineralogist<sup>12</sup>), translated to German by Johann Daniel Denso<sup>13</sup> (Wallerius, 1751) from the original edition in Swedish (*Hydrologia*; Wallerius, 1748).

<sup>12</sup> [https://en.wikipedia.org/wiki/Johan\\_Gottschalk\\_Wallerius](https://en.wikipedia.org/wiki/Johan_Gottschalk_Wallerius).

<sup>13</sup> [https://de.wikipedia.org/wiki/Johann\\_Daniel\\_Denso](https://de.wikipedia.org/wiki/Johann_Daniel_Denso).



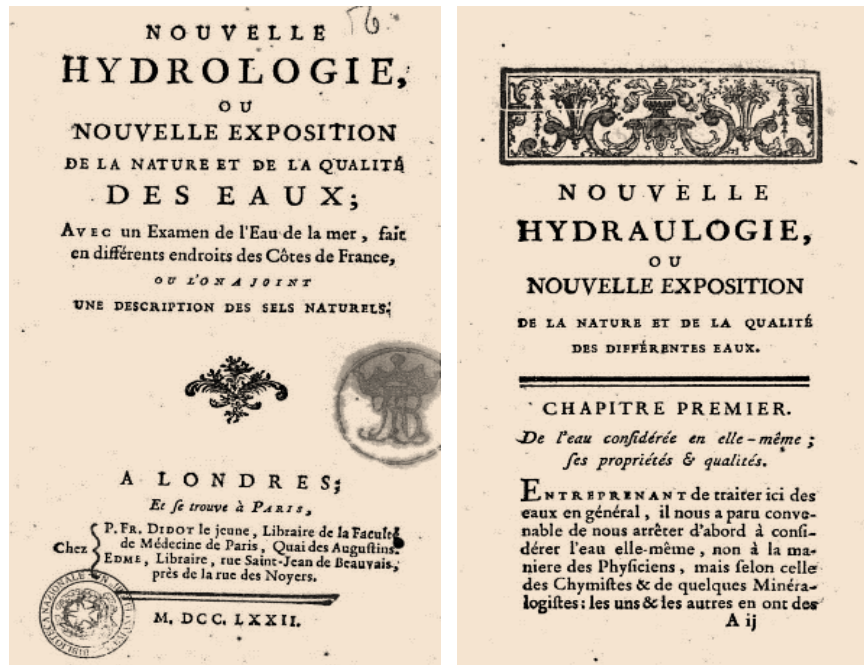
**Figure S8:** Title page and first page of the book *Rudimenta hydrologiae systematicae* by Friedrich August Charteser (medical doctor; unknown further details) (Cartheuser, 1758).



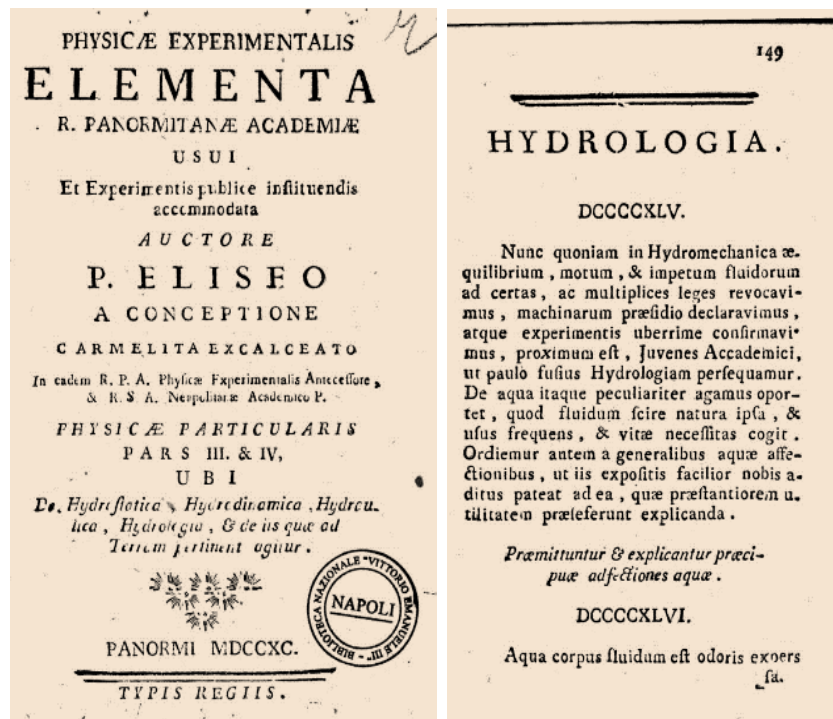
**Figure S9:** Title page and first page of the book *Philosophiae Naturalis sive Physicae Dogmaticae* (vol. 2 of 4) by Michael Christoph Hanovius (Michael Christoph Hanov, 1695-1773; a German meteorologist, historian and mathematician<sup>14</sup>) (Hanovius, 1765). The book cover states that it is a continuation of the philosophical system of the German philosopher Christianus de Wolff<sup>15</sup>. An impressive element in the title is the “dogmatic” character, which today would be regarded inconsistent with physics. In addition to *hydrologia*, the book contains *aerologia*, perhaps influenced by the Hippocratic discourse “Περὶ ἀέρων, υδάτων, τόπων”.

<sup>14</sup> [https://en.wikipedia.org/wiki/Michael\\_Christoph\\_Hanov](https://en.wikipedia.org/wiki/Michael_Christoph_Hanov).

<sup>15</sup> [https://en.wikipedia.org/wiki/Christian\\_Wolff\\_\(philosopher\)](https://en.wikipedia.org/wiki/Christian_Wolff_(philosopher)).



**Figure S10:** Title page and first page of the book *Nouvelle Hydrologie* by Antoine Grimoald Monnet (1734-1817; a French mineralogist<sup>16</sup>) (Monnet, 1772). In addition to the quality of potable water, it examines the sea water and the natural salts (sels naturels). Notable is the spelling *hydraulogie* (likely influenced by *hydraulics*) in the first page, also used throughout the entire book, which is different from that in the book cover, *hydrologie*.



**Figure S11:** Title page and first page of the book *Physicæ Experimentalis Elementa* by p. Eliseo a Conceptione (Eliseo della Concezione, 1725-1809, an Italian scholar<sup>17</sup>) (Eliseo a Conceptione, 1790). The book contains hydrostatics, hydrodynamics, hydraulics and hydrology.

<sup>16</sup> [https://fr.wikipedia.org/wiki/Antoine\\_Grimoald\\_Monnet](https://fr.wikipedia.org/wiki/Antoine_Grimoald_Monnet).

<sup>17</sup> [https://www.treccani.it/enciclopedia/eliseo-della-concezione\\_\(Dizionario-Biografico\)/](https://www.treccani.it/enciclopedia/eliseo-della-concezione_(Dizionario-Biografico)/).

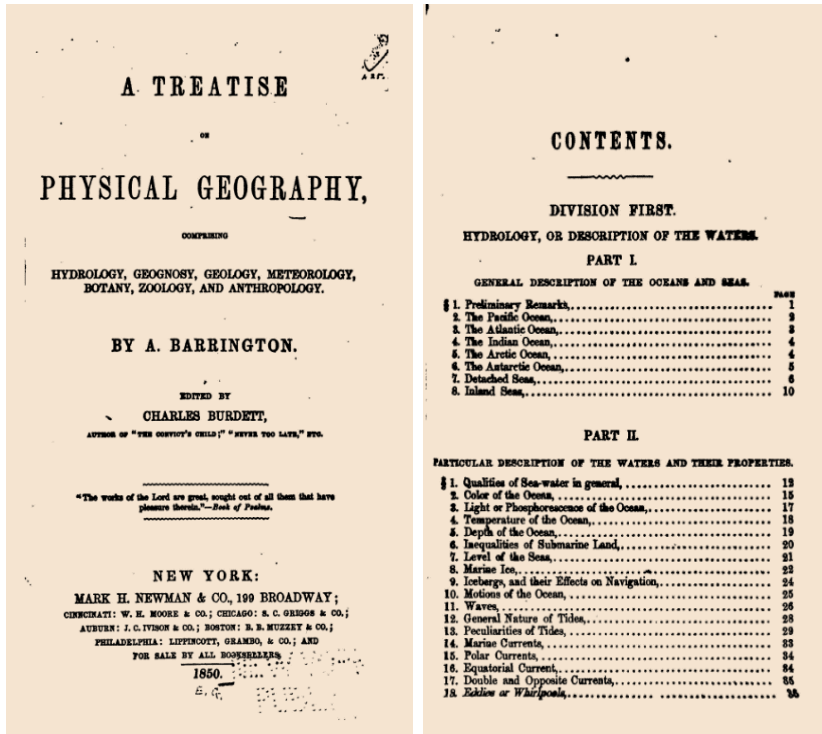


Figure S12: Title page and first page of the Contents of the book *A Treatise on Physical Geography* by A. Barrington (1850), whose first chapter is devoted to hydrology, beginning with a geographic description of the oceans.

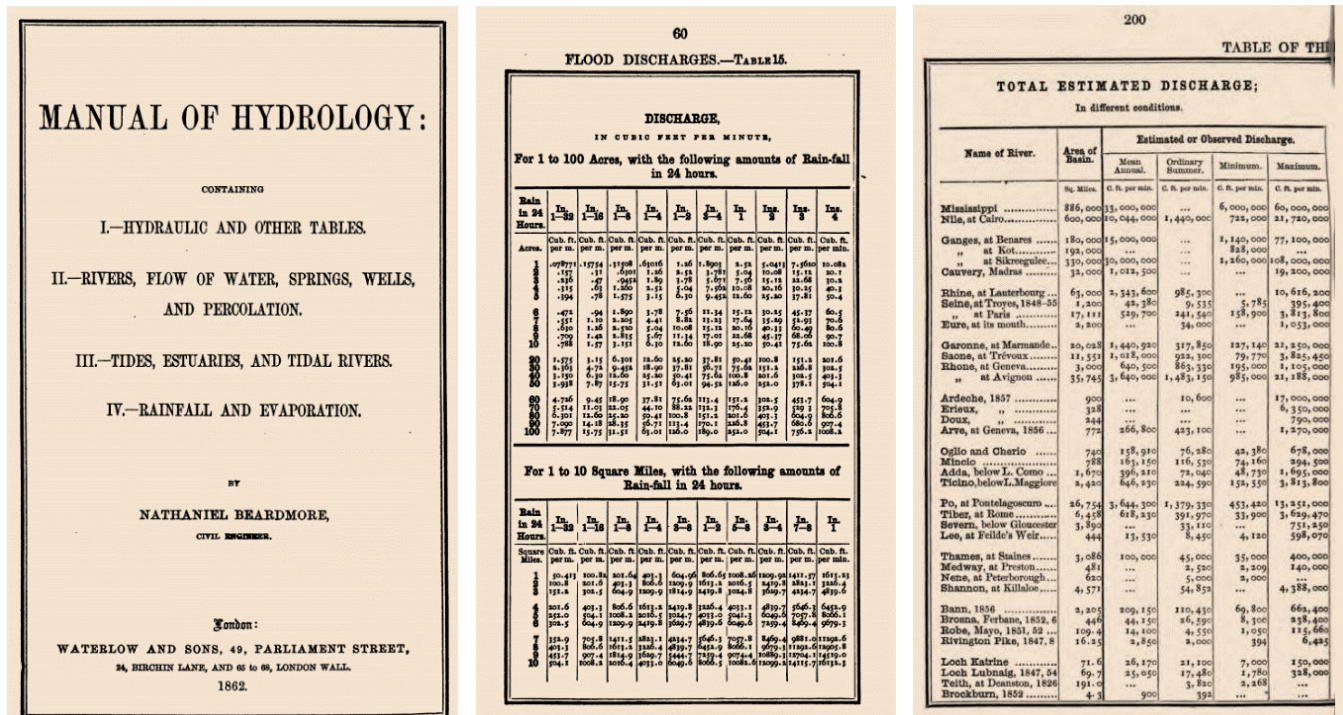
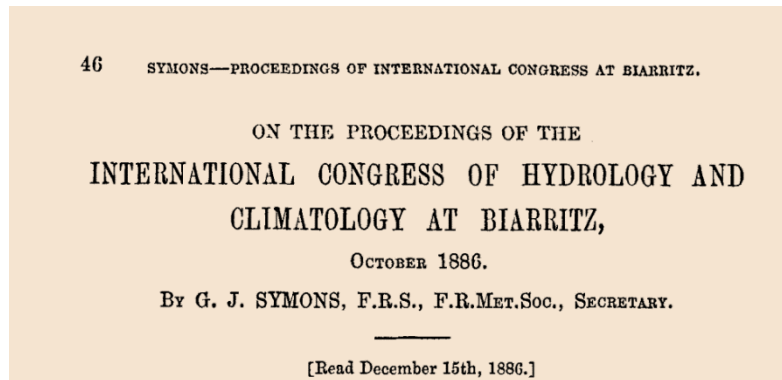


Figure S13: Title page and two pages from the book *Manual of Hydrology* by Nathaniel Beardmore, (1816-1872, a British civil engineer<sup>18</sup>) (Beardmore, 1862). Page 60 provides a generic transformation of rainfall to river discharge and p. 200 gives discharge observations or estimates of big rivers.

<sup>18</sup> [https://en.wikipedia.org/wiki/Nathaniel\\_Beardmore](https://en.wikipedia.org/wiki/Nathaniel_Beardmore).



After several addresses had been delivered the Bureau was constituted as follows, and the meeting closed :—

<i>President.</i>	Dr. Durand-Fardel.
<i>Secretary.</i>	Dr. Garrigou.
<i>Vice-Presidents.</i>	{ M. Antoine d'Abbadie. Dr. Martineau. M. O'Shea.
<i>Vice-Presidents (Foreign).</i>	{ M. Chiminelli, of Florence. M. Kisch, of Prague. M. Soutschinsky, of St. Petersburg. M. Symons, of London. M. Tabonda, of Madrid.

At 8 p.m. there was a reception at the Palais-Biarritz (formerly the Villa Eugénie), in order to facilitate personal intercourse between the members.

On October 2nd the sectional work began, three sections sitting at once. The sittings began at 8.30 a.m. and lasted till about noon; resuming at 2 p.m. and closing about 4 p.m. The list of papers as printed did not by any means include all that were read; but even as it stood the programme was sufficiently formidable, the number of memoirs for each section being respectively—

I. *Scientific Hydrology.*—Water analysis, micro-organisms, collection of mineral waters, geological influences, bathing apparatus, 34.

II. *Medical Hydrology.*—Physiological and medical questions, 40.

III. *Climatology, scientific and medical,* 35.

Figure S14: Part of the paper *On the proceedings of the international congress of hydrology and climatology at Biarritz* (Symons, 1887).

#### S4. Original texts of the quotations translated in the article to English

##### S4.1 Quotations from the Introduction

[OT1]. ἀφ' ἧς αἰτίας καὶ μῦθος ἐπλάσθη τις: ὡς Ἡρακλέους καταπολεμήσαντος τὸν Ἀχελῶν καὶ ἐνεγκαμένου τῆς νίκης ἄθλον τὸν Δηιανείρας γάμον τῆς Οἰνέως θυγατρὸς, ἦν πεποιήκε Σοφοκλῆς τοιαῦτα λέγουσαν «μνηστῆρ γὰρ ἦν μοι ποταμὸς, Ἀχελῶν λέγω, ὃς μ' ἐν τρισὶν μορφαῖσιν ἐξῆται πατρός, φοιτῶν ἐναργῆς ταῦρος, ἄλλοτ' αἰόλος δράκων ἐλικτός, ἄλλοτ' ἀνδρείφ κῦτει βούπρωρος». προστιθέασι δ' ἔνιοι καὶ τὸ τῆς Ἀμαλθείας τοῦτ' εἶναι λέγοντες κέρας, ὃ ἀπέκλασεν ὁ Ἡρακλῆς τοῦ Ἀχελῶου καὶ ἔδωκεν Οἰνεῖ τῶν γάμων ἔδνον· οἱ δ' εἰκάζοντες ἐξ αὐτῶν τάληθες ταύρω μὲν εἰκότα λέγεσθαι τὸν Ἀχελῶν φασι, καθάπερ καὶ τοὺς ἄλλους ποταμούς, ἀπὸ τε τῶν ἤχων καὶ τῶν κατὰ τὰ ρεῖθρα καμπῶν, ἃς καλοῦσι κέρατα, δράκοντι δὲ διὰ τὸ μῆκος καὶ τὴν σκολιότητα, βούπρωρον δὲ διὰ τὴν αὐτὴν αἰτίαν δι' ἣν καὶ ταυρωπὸν τὸν Ἡρακλέα δὲ καὶ ἄλλως εὐεργετικὸν ὄντα καὶ τῷ Οἰνεῖ κηδεύοντα παραχώμασί τε καὶ διοχετείας βιάσασθαι τὸν ποταμὸν πλημμελῶς ῥέοντα καὶ πολλὴν τῆς Παραχελωίτιδος ἀναψύξαι χαριζόμενον τῷ Οἰνεῖ· καὶ τοῦτ' εἶναι τὸ τῆς Ἀμαλθείας κέρας. (Στράβων, *Γεωγραφικά*, 10.2.19)

[OT2]. Ἐχουσι δὲ πλείους οἱ ἄρρηνες τῶν θηλειῶν ὀδόντας καὶ ἐν ἀνθρώποις καὶ ἐπὶ προβάτων καὶ αἰγῶν καὶ ὄνων· ἐπὶ δὲ τῶν ἄλλων οὐ τεθεώρηται πῶ. [...] Φύονται δ' οἱ τελευταῖοι τοῖς ἀνθρώποις γόμφιοι, οὓς καλοῦσι κραντήρας, περὶ τὰ εἴκοσιν ἔτη καὶ ἀνδράσι καὶ γυναιξίν. Ἦδη δὲ τισὶ γυναιξὶ καὶ ὀδοήκοντα ἑτῶν οὐσαις ἔφυσαν γόμφιοι ἐν τοῖς ἐσχάτοις. (Ἀριστοτέλης, *Τῶν περὶ τὰ ζῶα ἱστοριῶν*, 2.3.2 – 2.4.1)

[OT3]. [Σωκράτης:] τοῦτο [το χάσμα] ὅπερ Ὅμηρος εἶπε, λέγων αὐτό “τῆλε μάλ’, ἦχι βάθιστον ὑπὸ χθονός ἐστι βέρεθρον” ὃ καὶ ἄλλοθι καὶ ἐκεῖνος καὶ ἄλλοι πολλοὶ τῶν ποιητῶν Τάρταρον κεκλήκασιν. εἰς γὰρ τοῦτο τὸ χάσμα συρρέουσί τε πάντες οἱ ποταμοὶ καὶ ἐκ τούτου πάλιν ἐκρέουσιν· γίνονται δὲ ἕκαστοι τοιοῦτοι δι’ οἴας ἄν καὶ τῆς γῆς ῥέουσιν. [...] ὅταν τε οὖν ὑποχωρήσῃ τὸ ὕδωρ εἰς τὸν τόπον τὸν δὴ κάτω καλούμενον, τοῖς κατ’ ἐκεῖνα τὰ ῥεύματα διὰ τῆς γῆς εἰσρεῖ τε καὶ πληροῖ αὐτὰ ὡσπερ οἱ ἐπαντλοῦντες· ὅταν τε αὖ ἐκεῖθεν μὲν ἀπολίπη, δεῦρο δὲ ὀρμήσῃ, τὰ ἐνθάδε πληροῖ αὐθις. (Πλάτων, *Φαίδων*, 14.112a)

[OT4]. τὸ κατ’ ἐνιαυτὸν ὕδωρ ἐκαρποῦτ’ ἐκ Διός, οὐχ ὡς νῦν ἀπολλῦσα ῥέον ἀπὸ ψιλῆς τῆς γῆς εἰς θάλατταν, ἀλλὰ πολλὴν ἔχουσα καὶ εἰς αὐτὴν καταδεχομένη, τῇ κεραμίδι στεγουσῆ γῆ διαταμιευομένη, τὸ καταποθὲν ἐκ τῶν ὑψηλῶν ὕδωρ εἰς τὰ κοῦλα ἀφιεῖσα κατὰ πάντας τοὺς τόπους παρείχεται ἄφθονα κρηνῶν καὶ ποταμῶν νάματα. (Πλάτων, *Κριτίας*, 111d)

[OT5]. τὴν μὲν μετὰ λόγου ἀληθῆ δόξαν ἐπιστήμην εἶναι, τὴν δὲ ἄλογον ἐκτὸς ἐπιστήμης, (Πλάτων, *Θεαίτητος*, 201d)

[OT6]. [Γλαύκων:] τοὺς δὲ ἀληθινούς [φιλοσόφους], ἔφη, τίνας λέγεις; [Σωκράτης:] τοὺς τῆς ἀληθείας, ἦν δ’ ἐγώ, φιλοθεάμονας. (Πλάτων, *Πολιτεία*, E, 475e)

#### S4.2 Quotations from section “Hydrology at the birth of science”

[OT7]. «ὕετός δὲ [γίγνεσθαι] ἐκ τῆς ἀτιμίδος τῆς ἐκ γῆς ὑφ’ ἥλιον ἀναδιδομένης» (Ἰππόλυτος, *Φιλοσοφούμενα ἢ Κατὰ Πασῶν Αἰρέσεων Ἐλεγχος*, I, 5)

[OT8]. ἀνέμους δὲ γεννᾶσθαι, ὅταν ἐκ <μέρους> πεπυκνωμένος ἀήρ καὶ ἀρθεῖς φέρεται· συνελθόντα δὲ καὶ ἐπὶ πλεῖον παχυνθέντα νέφη γεννᾶσθαι καὶ οὕτως εἰς ὕδωρ μεταβάλλειν. χάλαζαν δὲ γίνεσθαι, ὅταν ἀπὸ τῶν νεφῶν τὸ ὕδωρ καταφερόμενον παγῆ· χιόνα δὲ, ὅταν αὐτὰ ταῦτα ἐνυγρότερα ὄντα πῆξιν λάβη. ἀστραπὴν δ’ ὅταν τὰ νέφη δισπῆται βίαι πνευμάτων[...] ἶριν δὲ γεννᾶσθαι τῶν ἡλιακῶν ἀγῶν εἰς ἀέρα συνεστῶτα πιπτουσῶν. (Ἰππόλυτος, *Φιλοσοφούμενα ἢ Κατὰ Πασῶν Αἰρέσεων Ἐλεγχος*, I, 6)

[OT9]. πηγὴ δ’ ἐστὶ θάλασσαν ὕδατος, πηγὴ δ’ ἀνέμοιο· οὕτε γὰρ ἐν νέφεσιν <γίνονται κε ἰς ἀνέμοιο ἐκπνεῖοντος> ἔσωθεν ἄνευ πόντου μεγάλοιο οὕτε ῥοαὶ ποταμῶν οὕτ’ αἰ<θέρος> ὄμβριον ὕδωρ, ἀλλὰ μέγας πόντος γενέτωρ νεφῶν ἀνέμων τε καὶ ποταμῶν. (Ξενοφάνης, *Ἐν τῷ Περὶ φύσεως*, Απόσπασμα Β 30)

[OT10]. τοὺς δὲ ποταμούς καὶ ἀπὸ τῶν ὄμβρων λαμβάνειν τὴν ὑπόστασιν καὶ ἐξ ὑδάτων τῶν ἐν τῇ γῆ· εἶναι γὰρ αὐτὴν κοίλην καὶ ἔχειν ὕδωρ ἐν τοῖς κοιλώμασιν. (Ἰππόλυτος, *Φιλοσοφούμενα ἢ Κατὰ Πασῶν Αἰρέσεων Ἐλεγχος*, I, 8)

[OT11]. μάλιστα δὲ τῆς γῆς ἡ ἀρίστη αἰεὶ τὰς μεταβολὰς τῶν οἰκητόρων εἶχεν, ἢ τε νῦν Θεσσαλία καλουμένη καὶ Βοιωτία Πελοποννήσου τε τὰ πολλὰ πλὴν Ἀρκαδίας, τῆς τε ἄλλης ὅσα ἦν κράτιστα. διὰ γὰρ ἀρετὴν γῆς αἶ τε δυνάμεις τισὶ μείζους ἐγγιγνόμεναι στάσεις ἐνεποίουν ἐξ ὧν ἐφθειρόντο, καὶ ἅμα ὑπὸ ἀλλοφύλων μᾶλλον ἐπεβουλεύοντο. τὴν γοῦν Ἀττικὴν ἐκ τοῦ ἐπὶ πλεῖστον διὰ τὸ λεπτόγεων ἀστασίαστον οὐσαν ἀνθρώποι ὄκουν οἱ αὐτοὶ αἰεὶ. καὶ παράδειγμα τότε τοῦ λόγου οὐκ ἐλάχιστόν ἐστι διὰ τὰς μετοικίας ἐς τὰ ἄλλα μὴ ὁμοίως ἀξήθηται· ἐκ γὰρ τῆς ἄλλης Ἑλλάδος οἱ πολέμοι ἢ στάσεις ἐκπίπτοντες παρ’ Ἀθηναίους οἱ δυνατώτατοι ὡς βέβαιον ὄν ἀνεχώρουν, καὶ πολῖται γιγνόμενοι εὐθύς ἀπὸ παλαιοῦ μείζω ἔτι ἐποίησαν πλῆθει ἀνθρώπων τὴν πόλιν, ὥστε καὶ ἐς Ἰωνίαν ὕστερον ὡς οὐχ ἰκανῆς οὐσης τῆς Ἀττικῆς ἀποικίας ἐξέπεμψαν. (Θουκυδίδης, *Ἱστορία τοῦ Πελοποννησιακοῦ Πολέμου*, 1.2.3-6)

[OT12]. περὶ δὲ τῶν ὄμβριων καὶ ὁκόσα ἀπὸ χιόνος φράσω ὅπως ἔχει. τὰ μὲν οὖν ὄμβρια κουφότατα καὶ γλυκύτατα ἐστὶ καὶ λεπτότατα καὶ λαμπρότατα. τὴν τε γὰρ ἀρχὴν ὁ ἥλιος ἀνάγει καὶ ἀναρπάζει τοῦ ὕδατος τό τε λεπτότατον καὶ κουφότατον.

δηλον δὲ οἱ ἄλλες ποιέουσι. τὸ μὲν γὰρ ἄλμυρον λείπεται αὐτοῦ ὑπὸ πάχους καὶ βάρους καὶ γίνεται ἄλλες, τὸ δὲ λεπτότατον ὁ ἥλιος ἀναρπάζει ὑπὸ κουφότητος· ἀνάγει δὲ τὸ τοιοῦτο οὐκ ἀπὸ τῶν ὑδάτων μῦνον τῶν λιμναίων, ἀλλὰ καὶ ἀπὸ τῆς θαλάσσης καὶ ἐξ ἀπάντων ἐν ὁκόσοις ὑγρὸν τι ἔνεστιν. ἔνεστι δὲ ἐν παντὶ χρήματι. καὶ ἐξ αὐτῶν τῶν ἀνθρώπων ἄγει τὸ λεπτότατον τῆς ἰκμάδος καὶ κουφότατον. [...] ἔτι δὲ πρὸς τούτοις ἐπειδὴν ἀρπασθῆ καὶ μετεωρισθῆ περιφερόμενον καὶ καταμιγνύμενον ἐς τὸν ἥερα, τὸ μὲν θολερὸν αὐτοῦ καὶ νυκτοειδὲς ἐκκρίνεται καὶ ἐξίσταται καὶ γίνεται ἠήρ καὶ ὀμίχλη, τὸ δὲ λαμπρότατον [p. 92] καὶ κουφότατον αὐτοῦ λείπεται καὶ γλυκαίνεται ὑπὸ τοῦ ἡλίου καιόμενόν τε καὶ ἐψόμενον. γίνεται δὲ καὶ τᾶλλα πάντα τὰ ἐψόμενα αἰεὶ γλυκύτερα. ἕως μὲν οὖν διεσκεδασμένον ἢ καὶ μήπω συνεστήκη, φέρεται μετέωρον. ὁκόταν δὲ κου ἀθροισθῆ καὶ συστραφῆ ἐς τὸ αὐτὸ ὑπὸ ἀνέμων ἀλλήλοισιν ἐναντιωθέντων ἐξαίφνης, τότε καταρρήγνυται. (Ἱπποκράτης, *Περὶ Ἀέρων, Ὑδάτων, Τόπων*, 8)

[OT13]. ἄριστα [ὑδατα] δὲ ὁκόσα ἐκ μετεώρων χωρίων ρεῖ καὶ λόφων γεηρῶν. αὐτὰ τε γὰρ ἐστὶ γλυκέα καὶ [60] λευκὰ καὶ τὸν οἶνον φέρειν ὀλίγον οἷά τε ἐστίν. τοῦ δὲ χειμῶνος θερμὰ γίνεται, τοῦ δὲ θέρεος ψυχρά. οὕτω γὰρ ἂν εἴη ἐκ βαθυτάτων πηγῶν (Ἱπποκράτης, *Περὶ Ἀέρων, Ὑδάτων, Τόπων*, 7)

#### S4.3 Quotations from section “Aristotle”

[OT14]. φαμὲν δὴ πῦρ καὶ ἀέρα καὶ ὕδωρ καὶ γῆν γίνεσθαι ἐξ ἀλλήλων, καὶ ἕκαστον ἐν ἐκάστῳ ὑπάρχειν τούτων δυνάμει, ὥσπερ καὶ τῶν ἄλλων οἷς ἔν τι καὶ ταυτὸν ὑπόκειται, εἰς ὃ δὴ ἀναλύονται ἔσχατον. (Ἀριστοτέλης, *Μετεωρολογικά*, A1, 339a,b)

[OT15]. ἔτι δ' ἢ ὑπὸ τοῦ ἡλίου ἀναγωγῆ τοῦ ὑγροῦ ὁμοία τοῖς θερμαινόμενοις ἐστὶν ὕδασι ὑπὸ πυρός. (αὐτόθι, B2, 355a 15)

[OT16]. συνίσταται πάλιν ἢ ἀτμὶς ψυχομένη διὰ τε τὴν ἀπόλειψιν τοῦ θερμοῦ καὶ τὸν τόπον, καὶ γίνεται ὕδωρ ἐξ ἀέρος· γενόμενον δὲ πάλιν φέρεται πρὸς τὴν γῆν. ἔστι δ' ἢ μὲν ἐξ ὕδατος ἀναθυμιάσις ἀτμὶς, ἢ δ' ἐξ ἀέρος εἰς ὕδωρ νέφος. (Ἀριστοτέλης, *Μετεωρολογικά*, A9, 346b 30)

[OT17]. ὥστε [τὴν θάλατταν] οὐδέποτε ξηρανεῖται· πάλιν γὰρ ἐκεῖνο φθῆσεται καταβὰν εἰς τὴν αὐτὴν τὸ προανεληθόν. (Ἀριστοτέλης, *Μετεωρολογικά*, B3, 356b 26)

[OT18]. κὰν μὴ κατ' ἐνιαυτὸν ἀποδιδῶ καὶ καθ' ἐκάστην ὁμοίως χώραν, ἀλλ' ἐν γέ τισιν τεταγμένοις χρόνοις ἀποδίδωσι πᾶν τὸ ληφθέν. (Ἀριστοτέλης, *Μετεωρολογικά*, B2, 355a 26)

[OT19]. ἀλλὰ μὴν εἴπερ καὶ οἱ ποταμοὶ γίνονται καὶ φθείρονται καὶ μὴ αἰεὶ οἱ αὐτοὶ τόποι τῆς γῆς ἔνυδροι, καὶ τὴν θάλατταν ἀνάγκη μεταβάλλειν ὁμοίως. τῆς δὲ θαλάττης τὰ μὲν ἀπολείπουσιν τὰ δ' ἐπιούσης αἰεὶ φανερόν ὅτι τῆς πάσης γῆς οὐκ αἰεὶ τὰ αὐτὰ τὰ μὲν ἐστὶν θάλαττα τὰ δ' ἠπειρος, ἀλλὰ μεταβάλλει τῷ χρόνῳ πάντα. (Ἀριστοτέλης, *Μετεωρολογικά*, A.14, 353a 16)

[OT20]. ὅτι δὲ γίνεται ἀτμίζουσα πότιμος καὶ οὐκ εἰς θάλατταν συγκρίνεται τὸ ἀτμίζον, ὅταν συνιστῆται πάλιν, πεπειραμένοι λέγωμεν. (Ἀριστοτέλης, *Μετεωρολογικά*, B3, 358b)

#### S4.4 Quotations from section “The Nile paradox and its solution by Aristotle”

[OT21]. τοῦ ποταμοῦ δὲ φύσις περὶ οὔτε τι τῶν ἰρέων οὔτε ἄλλου οὐδενὸς παραλαβεῖν ἐδυνάσθη. πρόθυμος δὲ ἕα τάδε παρ' αὐτῶν πυθέσθαι, ὃ τι κατέρχεται μὲν ὁ Νεῖλος πληθύνων ἀπὸ τροπέων τῶν θερινῶν ἀρξάμενος ἐπὶ ἑκατὸν ἡμέρας, πελάσας δὲ ἐς τὸν ἀριθμὸν τουτέων τῶν ἡμερέων ὀπίσω ἀπέρχεται ἀπολείπων τὸ ρέεθρον, ὥστε βραχὺς τὸν χειμῶνα ἅπαντα διατελεῖ ἐὼν μέχρι οὗ αὐτὶς τροπέων τῶν θερινῶν. τούτων ὧν περὶ οὐδενὸς οὐδὲν οἷός τε ἐγενόμην παραλαβεῖν παρὰ τῶν Αἰγυπτίων, ἱστορέων αὐτοὺς ἦντινα δύναμιν ἔχει ὁ Νεῖλος τὰ ἔμπαλιν πεφυκέναι τῶν ἄλλων ποταμῶν· ταυτὰ τε δὴ τὰ λελεγμένα βουλόμενος εἰδέναι ἱστόρεον καὶ ὃ τι αὔρας ἀποπνεούσας μῦνος ποταμῶν πάντων οὐ παρέχεται. (Ἡρόδοτος, *Ἱστορίαι*, 2, 19)

[OT22]. ἀλλὰ Ἑλλήνων μὲν τινὲς ἐπίσημοι βουλόμενοι γενέσθαι σοφίην ἔλεξαν περὶ τοῦ ὕδατος τούτου τριφασίας ὁδοῦς· τῶν τὰς μὲν δύο τῶν ὁδῶν οὐδ' ἀξίῳ μνησθῆναι εἰ μὴ ὅσον σημήναι βουλόμενος μῦνον. (Ἡρόδοτος, *Ἱστορίαι*, 2, 20)

[OT23]. τῶν ἢ ἐτέρῃ μὲν λέγει τοὺς ἐτησίας ἀνέμους εἶναι αἰτίους πληθύνειν τὸν ποταμὸν, κωλύοντας ἐς θάλασσαν ἐκρέειν τὸν Νεῖλον. πολλάκις δὲ ἐτησῖαι μὲν οὐκὼν ἔπνευσαν, ὁ δὲ Νεῖλος τῶντοῦ ἐργάζεται. πρὸς δέ, εἰ ἐτησῖαι αἰτίοι ἦσαν, χρῆν καὶ τοὺς ἄλλους ποταμούς, ὅσοι τοῖσι ἐτησίῃσι ἀντίοι ῥέουσι, ὁμοίως πάσχειν καὶ κατὰ τὰ αὐτὰ τῷ Νεῖλῳ, καὶ μᾶλλον ἔτι τοσοῦτω



ὅσα ἐλάσσονες ἐόντες ἀσθενέστερα τὰ ρεύματα παρέχονται. εἰσι δὲ πολλοὶ μὲν ἐν τῇ Συρίῃ ποταμοὶ πολλοὶ δὲ ἐν τῇ Λιβύῃ, οἱ οὐδὲν τοιοῦτο πάσχουσι οἷόν τι καὶ ὁ Νεῖλος. (Ἡρόδοτος, *Ἱστορίαι*, 2, 20)

[OT24]. ἡ δ' ἐτέρη ἀνεπισημονεστέρα μὲν ἐστὶ τῆς λελεγμένης, λόγῳ δὲ εἰπεῖν θωμασιωτέρη· ἢ λέγει ἀπὸ τοῦ Ὠκεανοῦ ρέοντα αὐτὸν ταῦτα μηχανᾶσθαι, τὸν δὲ Ὠκεανὸν γῆν περὶ πᾶσαν ῥέειν. [...] ὁ δὲ περὶ τοῦ Ὠκεανοῦ λέξας ἐς ἀφανὲς τὸν μῦθον ἀνενείκας οὐκ ἔχει ἔλεγχον· οὐ γὰρ τινὰ ἔγωγε οἶδα ποταμὸν Ὠκεανὸν ἐόντα, Ὅμηρον δὲ ἢ τινὰ τῶν πρότερον γενομένων ποιητῶν δοκέω τὸ οὖνομα εὐρόντα ἐς ποίησιν ἐσενείκασθαι. (Ἡρόδοτος, *Ἱστορίαι*, 2, 21&23)

[OT25]. ἡ δὲ τρίτη τῶν ὁδῶν πολλὸν ἐπιεικεστάτη εὐῶσα μάλιστα ἔψευσται· λέγει γὰρ δὴ οὐδ' αὐτὴ οὐδὲν, φαμένη τὸν Νεῖλον ῥέειν ἀπὸ τηκομένης χιόνος· ὃς ῥέει μὲν ἐκ Λιβύης διὰ μέσων Αἰθιοπῶν, ἐκδίδοι δὲ ἐς Αἴγυπτον. κῶς ὦν δῆτα ῥέοι ἂν ἀπὸ χιόνος, ἀπὸ τῶν θερμωτάτων ῥέων ἐς τὰ ψυχρότερα τὰ πολλὰ ἐστὶ· ἀνδρὶ γε λογίζεσθαι τοιούτων πέρι οἷφ' τε ἐόντι, ὡς οὐδὲ οἶκος ἀπὸ χιόνος μιν ῥέειν, πρῶτον μὲν καὶ μέγιστον μαρτύριον οἱ ἄνεμοι παρέχονται πνέοντες ἀπὸ τῶν χωρέων τουτέων θερμοί· δεύτερον δὲ ὅτι ἄνομβρος ἢ χῶρη καὶ ἀκρύσταλλος διατελεῖ εὐῶσα, ἐπὶ δὲ χιόνι πεσοῦση πᾶσα ἀνάγκη ἐστὶ ὕσαι ἐν πέντε ἡμέρησι, ὥστε, εἰ ἐχιόνιζε, ὕετο ἂν ταῦτα τὰ χωρία· τρίτα δὲ οἱ ἄνθρωποι ὑπὸ τοῦ καύματος μέλανες ἐόντες, ἰκτῖνοι δὲ καὶ χελιδόνες δι' ἔτεος ἐόντες οὐκ ἀπολείπουσι, γέρανοι δὲ φεύγουσαι τὸν χειμῶνα τὸν ἐν τῇ Σκυθικῇ χῶρῃ γινόμενον φοιτῶσι ἐς χειμασίην ἐς τοὺς τόπους τούτους. εἰ τοῖνυν ἐχιόνιζε καὶ ὅσον ὦν ταύτην τὴν χῶρην δι' ἧς τε ῥέει καὶ ἐκ τῆς ἄρχεται ῥέων ὁ Νεῖλος, ἦν ἂν τούτων οὐδὲν, ὡς ἡ ἀνάγκη ἐλέγχει. (Ἡρόδοτος, *Ἱστορίαι*, 2, 22)

[OT26]. Θαλῆς τοὺς ἐτήσιος ἀνέμους οἶεται πνέοντας τῇ Αἰγύπτῳ ἀντιπροσώπους ἐπαίρειν τοῦ Νεῖλου τὸν ὄγκον διὰ τὸ τὰς ἐκροάς αὐτοῦ τῇ παροιδίῃσει τοῦ ἀντιπαρήκοντος πελάγους ἀνακόπτεσθαι. (Αἰτίος IV, 1, 1)

[OT27]. εἰ δὲ δεῖ μεμψάμενον γνώμας τὰς προκειμένας αὐτὸν περὶ τῶν ἀφανέων γνώμην ἀποδέξασθαι, φράσω δι' ὃ τι μοι δοκεῖ πληθύνεσθαι ὁ Νεῖλος τοῦ θέρους· τὴν χειμερινὴν ὥρην ἀπελαυνόμενος ὁ ἥλιος ἐκ τῆς ἀρχαίας διεξόδου ὑπὸ τῶν χειμῶνων ἔρχεται τῆς Λιβύης τὰ ἄνω. ὡς μὲν νυν ἐν ἐλαχίστῳ δηλῶσαι, πᾶν εἴρηται· τῆς γὰρ ἂν ἀγχοτάτω τε ἢ χῶρης οὗτος ὁ θεὸς καὶ κατὰ ἦντινα, ταύτην οἶκος διψῆν τε ὑδάτων μάλιστα καὶ τὰ ἐγχώρια ρεύματα μαραίνεσθαι τῶν ποταμῶν. (Ἡρόδοτος, *Ἱστορίαι*, 2, 24)

[OT28]. Ὅτι οἱ ἐτήσια πνέουσι κατὰ τὸν καιρὸν τοῦ ἀκμαιοτάτου θέρους δι' αἰτίαν τοιαύτην. Ὁ ἥλιος μετεωρότερος καὶ ἀπὸ τῶν μεσημβρινῶν τόπων ἀρκτικώτερος γινόμενος λύει τὰ ὑγρά τὰ ἐν ταῖς ἄρκτοις· λυόμενα δὲ ταῦτα ἐξαιερούται, ἐξαιερούμενα δὲ πνευματοῦται, καὶ ἐκ τούτων γίνονται οἱ ἐτήσια ἄνεμοι [...]. Ἐκεῖ δὴ ταῦτα ἐκφερόμενα προσπίπτει τοῖς ὑψηλοτάτοις ὄρεσι τῆς Αἰθιοπίας, καὶ πολλὰ καὶ ἄθρόα γινόμενα ἀπεργάζεται ὑετούς· καὶ ἐκ τῶν ὑετῶν τούτων ὁ Νεῖλος πλημμυρεῖ τοῦ θέρους, ἀπὸ τῶν μεσημβρινῶν καὶ ξηρῶν τόπων ῥέων. Καὶ τοῦτο Ἀριστοτέλης ἐπραγματεύσατο· αὐτὸς γὰρ ἀπὸ τῆς φύσεως ἔργῳ κατενόησεν, ἀξιώσας πέμψαι Ἀλέξανδρον τὸν Μακεδόνα εἰς ἐκείνους τοὺς τόπους καὶ ὄψει τὴν αἰτίαν τῆς τοῦ Νεῖλου αὐξήσεως παραλαβεῖν. Διὸ φησὶν ὡς τοῦτο οὐκέτι πρόβλημά ἐστιν· ὥφθη γὰρ φανερῶς ὅτι ἐξ ὑετῶν αὖξει. Καὶ <λύεται> τὸ παράδοξον, <ὄτι> ἐν τοῖς ξηροτάτοις τόποις τῆς Αἰθιοπίας, ἐν οἷς οὔτε χειμῶν οὔτε ὕδωρ ἐστὶ, ξυμβαίνει τοῦ θέρους πλείστους ὑετούς γίνεσθαι (Φωτίου *Μυριόβιβλον*, Βίος Πυθαγόρου Ἀνωνύμου)

[OT29]. Ἐρατοσθένης δὲ οὐκέτι φησὶν <πρόβλημα εἶναι> οὐδὲ ζητεῖν χρῆναι περὶ τῆς αὐξήσεως τοῦ Νεῖλου, σαφῶς καὶ ἀφικομένων τινῶν εἰς τὰς τοῦ Νεῖλου πηγὰς καὶ τοὺς ὄμβρους τοὺς γιγνομένους ἐωρακότων, ὥστε κρατύνεσθαι τὴν Ἀριστοτέλους ἀπόδοσιν. (Πρόκλος ὁ Λύκιος, *Σχόλια, Πλάτωνος Τίμαιος*, 22 E—I 121)

[OT30]. τῆς γὰρ Αἰθιοπίας ὑψηλοῖς παρὰ τὰ καθ' ἡμᾶς ὄρεσι διεζωσμένης ὑποδεχομένης τε τὰς νεφέλας πρὸς τῶν ἐτησίων ὠθουμένας, ἐκδίδονται τὸν Νεῖλον. ὡς καὶ <Καλλισθένης> ὁ Περιπατητικὸς ἐν τῷ τετάρτῳ βιβλίῳ τῶν Ἑλληνικῶν <φησὶν ἑαυτὸν συστρατεύσασθαι Ἀλεξάνδρῳ τῷ Μακεδόνα, καὶ γενόμενον ἐπὶ τῆς Αἰθιοπίας εὐρεῖν τὸν Νεῖλον ἐξ ἀπίρων ὄμβρων κατ' ἐκείνην γενομένων> καταφερόμενον. (Ἰωάννης Λαυρέντιος ὁ Λυδός, *De mensibus*, 4, 107)

[OT31]. ἐπεὶ καὶ περὶ τὴν Αἰθιοπίαν ὄμβροι συνεχεῖς καταφέρεσθαι ἱστοροῦνται περὶ τὸ θέρος καὶ μάλιστα τὴν ἀκμὴν αὐτοῦ· ἀφ' ὧν καὶ ὁ Νεῖλος πληθύνει τοῦ θέρους ὑπονοεῖται. Ὁ μὲν οὖν Ποσειδῶνιος οὕτω φέρεται. (Κλεομήδους, *Κυκλικὴ Θεωρία Μετεώρων*, 59)

[OT32]. Καλλισθένης δ' ὁ ἱστοριογράφος πρὸς τὰ μικρῶ πρότερον εἰρημένα ὑπ' Ἀναξαγόρου τε καὶ Εὐριπίδου ἀντεῖπεν. αὐτὸς δὲ τὴν αὐτοῦ γνώμην φησὶν, ὑδάτων πολλῶν καὶ λαμπρῶν γινομένων κατὰ τὴν Αἰθιοπίαν κατὰ τὰς τοῦ κυνὸς ἀνατολὰς ἕως τῆς ἐπιτολῆς ἀρκτούρου, καθ' οὓς χρόνους καὶ οἱ ἐτήσια πνέουσιν ἄνεμοι· τούτους γὰρ φησὶ τοὺς ἀνέμους μάλιστα τὰ

νέφη φέρειν πρὸς τὴν Αἰθιοπίαν· ὧν καὶ προσπιπτόντων πρὸς τα ὄρη καταρρήγνυσθαι πολὺ πλῆθος ὕδατος, ἀφ' οὗ τὸν Νεῖλον ἀναβαίνειν. (Ανώνυμος Φλωρεντίνος, *Περὶ τῆς τοῦ Νεῖλου ἀναπληρώσεως διάφοροι δόξαι* ἢ *Περὶ τῆς τοῦ Νεῖλου ἀναβάσεως*)

[OT33]. Τοῦ γὰρ ἡλίου τὸν καρκίνον τε καὶ λέοντα καὶ παρθένον διερχομένου, μέχρι μὲν τῆς Αὔης ὡσπερ καὶ παρ' ἡμῖν θέρος τε καὶ ξηρότης διακρατεῖ τὸν ἀέρα, ἀπὸ δὲ τῆς Αὔης ἐπὶ τὴν Αὐξουμιν καὶ τὴν ἄλλην Αἰθιοπίαν χειμῶν ἐπίκειται σφοδρὸς, οὐ δι' ὅλης ἡμέρας, ἀλλὰ γὰρ ἀπὸ μεσημβρίας ἀρχόμενος ἐκάστοτε, συννεφεῖ τε τὸν ἀέρα ποιῶν καὶ ὄμβροις ῥαγδαίοις τὴν χώραν ἐπικλύζων. Τηνικαῦτα δὲ ἄρα καὶ ὁ Νεῖλος πολὺς ἐπὶ τὴν Αἴγυπτον ἐρχόμενος πελαγίζει τε καὶ κατάρδει τὴν γῆν. Ὅτε δὲ ὁ ἥλιος τὸν αἰγόκερὸν τε καὶ ὑδρηχόον καὶ ἰχθύας ἐπιπορεύεται, ἀνάπαλιν ὁ ἀῆρ τοῖς μὲν Ἀδουλίταις μέχρι τῆς Αὔης ὄμβροις ἐπικλύζει τὴν χώραν, τοῖς δὲ ἀπὸ τῆς Αὔης μέχρι Αὐξούμεως καὶ τῆς ἄλλης Αἰθιοπίας θέρος τέ ἐστι καὶ τὰ ὥραϊα τηνικαῦτα τούτοις ἢ γῆ παραδίδωσιν. (Φωτίου *Μυριόβιβλον*, Νοννόσου *Ἱστορία*)

[OT34]. Propter quid aliis fluminibus in hyeme quidem augmentatis, in estate autem multo factis minoribus, solus eorum qui in mare fluunt, multum estate excedit fitque tantus ut civitates sole supersint velut insule? (*Liber Aristotelis de Inundacione Nili*, 1, script from Beullens, 2014)

[OT35]. τὸ δ' ὅτι ἐξ ὄμβρων αἱ ἀναβάσεις μὴ ζητεῖν, μηδὲ τοιούτων δεῖσθαι μαρτύρων οἷους Ποσειδάωνιος εἴρηκε. φησὶ γὰρ Καλλισθένης λέγειν τὴν ἐκ τῶν ὄμβρων αἰτίαν τῶν θερινῶν παρὰ Ἀριστοτέλους λαβόντα, ἐκεῖνον δὲ παρὰ Θρασύαλου τοῦ Θασιῶ (τῶν ἀρχαίων δὲ φυσικῶν εἷς οὗτος) ἐκεῖνον δὲ παρ' ἄλλου, τὸν δὲ παρ' Ὀμήρου διυπετέα φάσκοντος τὸν Νεῖλον «ἄψ δ' εἰς Αἰγύπτου διυπετέος ποταμοῖο». (Στράβων, *Γεωγραφικά*, 17.1.5)

#### S4.5 Quotations from section “Prominent scientists of the Hellenistic period with relevance to geosciences and hydrology”

[OT36]. Ὑποτίθεται γὰρ [ὑπὸ Ἀριστάρχου τοῦ Σαμίου] τὰ μὲν ἀπλανέα τῶν ἄστρον καὶ τὸν ἄλιον μένειν ἀκίνητον, τὰν δὲ γὰν περιφέρεισθαι περὶ τὸν ἄλιον κατὰ κύκλου περιφέρειαν, ὅς ἐστιν ἐν μέσῳ τῷ δρόμῳ κείμενος, τὰν δὲ τῶν ἀπλανέων ἄστρον σφαῖραν, περὶ τὸ αὐτὸ κέντρον τῷ ἀλίῳ κειμέναν τῷ μεγέθει τηλικαύταν εἶμεν, ὥστε τὸν κύκλον, καθ' ὃν τὰν γὰν ὑποτίθεται περιφέρεισθαι, τοιαύταν ἔχει ἀναλογίαν ποτὶ τὰν τῶν ἀπλανῶν ἀποστασίαν, οἷαν ἔχει τὸ κέντρον τῆς σφαίρας ποτὶ τὰν ἐπιφάνειαν. (Ἀρχιμήδης, *Ψαμμίτης*, I)

[OT37]. Πηγῆς ὑπαρχούσης ἐπισκέψασθαι τὴν ἀπόρρυσιν αὐτῆς, τουτέστι τὴν ἀνάβλυσιν, ὅση ἐστίν. εἰδέναι μέντοι χρὴ ὅτι οὐκ αἰεὶ ἢ ἀνάβλυσις ἢ αὐτὴ διαμένει. ὄμβρων μὲν γὰρ ὄντων ἐπιτείνεται διὰ τὸ ἐπὶ τῶν ὄρων τὸ ὕδωρ πλεονάζον βιαιότερον ἐκθλίβεσθαι, αὐχμῶν δὲ ὄντων ἀπολήγει ἢ ῥύσις διὰ τὸ μὴ ἐπιφέρεισθαι πλέον ὕδωρ. αἱ μέντοι γενναῖαι πηγαὶ οὐ παρὰ πολὺ τὴν ἀνάβλυσιν ἴσχουσιν. δεῖ οὖν περιλαβόντα τὸ πᾶν τῆς πηγῆς ὕδωρ, ὥστε μηδαμόθεν ἀπορρεῖν, σωλῆνα τετράγωνον μολιβοῦν ποιῆσαι, στοχασάμενον μᾶλλον μείζονα πολλῶ τῆς ἀποθύσεως· εἴτα δι' ἐνὸς τόπου ἐναρμόσαι αὐτὸν ὥστε δι' αὐτοῦ τὸ ἐν τῇ πηγῇ ὕδωρ ἀπορρεῖν. δεῖ δὲ αὐτὸν κείσθαι εἰς τὸν ταπεινότερον τῆς πηγῆς τόπον, ὥστε ἔχειν αὐτὴν ἀπόρρυσιν. τὸν δὲ ταπεινότερον ἐπιγνωσόμεθα τῆς πηγῆς τόπον διὰ τῆς δίοπτρας. ἀπολήγεται οὖν τὸ ἀπορρέον διὰ τοῦ σωλῆνος ὕδωρ ἐν τῷ περιστομίῳ τοῦ σωλῆνος· οἷον ἀπολαμβάνει[ν] δακτύλους β'· ἐχέτω δὲ καὶ τὸ πλάτος τοῦ περιστομίου τοῦ σωλῆνος δακτύλους ς· ἐξάκις δύο γίνονται ἰβ' <ἀποφανόμεθα δὴ τὴν ἀνάβλυσιν τῆς πηγῆς δακτύλων ἰβ'>. εἰδέναι δὲ χρὴ ὅτι οὐκ ἐστὶν αὐταρκες πρὸς τὸ ἐπιγῶναι, πόσον χορηγεῖ ὕδωρ ἢ πηγῇ, [ἦ] τὸ εὐρεῖν τὸν ὄγκον τοῦ ρεύματος, ὃν λέγομεν εἶναι δακτύλων ἰβ', ἀλλὰ καὶ τὸ τάχος αὐτοῦ· ταχύτερας μὲν γὰρ οὐσης τῆς ῥύσεως πλέον ἐπιχορηγεῖ τὸ ὕδωρ, βραδυτέρας δὲ μείων. διὸ δεῖ ὑπὸ τὴν τῆς πηγῆς ῥύσιν ὀρύξαντα τάφρον τηρῆσαι ἐξ ἡλιακοῦ ὠροσκοπίου, ἐν τινὶ ὥρᾳ πόσον ἀπορρεῖ ὕδωρ ἐν τῇ τάφρῳ, καὶ οὕτως στοχάσασθαι τὸ ἐπιχορηγούμενον ὕδωρ ἐν τῇ ἡμέρᾳ πόσον ἐστίν, ὥστ' οὐδὲ ἀναγκαῖόν ἐστι τὸν ὄγκον τῆς ῥύσεως τηρεῖν· διὰ γὰρ τοῦ χρόνου δῆλη ἐστὶν ἢ χορηγία. (Ἦρων ὁ Ἀλεξανδρεὺς, *Διόπτρα*, Schoenne, 1976)

[OT38] ἐν τῷ μέντοι τὰ ἀγγεῖα τὰ δοκοῦντα εἶναι τοῖς πολλοῖς κενὰ οὐκ ἐστίν, ὡς ὑπολαμβάνουσι, κενά, ἀέρος δὲ πλήρη. ὁ δὲ ἀῆρ ἐστίν, ὡς τοῖς περὶ φύσεως πραγματευσαμένοις ἀρέσκει, ἐκ λεπτῶν καὶ μικρομερῶν σωμάτων συνεσθηκῶς ἀφανῶν ἡμῖν ὄντων ὡς ἐπὶ <τὸ> πολὺ. ἐὰν γοῦν εἰς τὸ δοκοῦν ἀγγεῖον κενὸν ὑπάρχειν ἐγγεῖ τις ὕδωρ, καθ' ὅσον ἂν πλῆθος τοῦ ὕδατος εἰς τὸ ἀγγεῖον ἐμπίπτῃ, κατὰ τοσοῦτον πλῆθος ἀῆρ ἐκχωρήσει. κατανοήσειε δ' ἂν τις τὸ λεγόμενον ἐκ τοῦ τοιούτου· ἐὰν γὰρ εἰς ὕδωρ καταστρέψας ἀγγεῖον τὸ δοκοῦν εἶναι κενὸν πείξῃ εἰς τὸ κάτω ἀκλινῆς διαφυλάσσει, οὐκ εἰσελεύσεται τὸ ὕδωρ εἰς αὐτό, κἂν ὅλον αὐτὸ κρύψῃ· ὥστε δῆλον εἶναι, ὅτι σῶμα ὑπάρχον ὁ ἀῆρ οὐκ ἐὰν παρεισελθεῖν τὸ ὕδωρ διὰ τὸ πεπληρωκέναι πάντα τὸν ἐν τῷ ἀγγεῖῳ τόπον. ἐὰν γοῦν τρυπήσῃ τις τὸν πυθμένα τοῦ ἀγγεῖου, τὸ μὲν ὕδωρ διὰ τοῦ στόματος εἰς αὐτὸ

εἰσελεύσεται, ὁ δὲ ἀήρ διὰ τοῦ τρυπήματος ἐξελεύσεται. [...] διὸ δὴ ὑποληπτέον εἶναι σῶμα τὸν ἀέρα. γίνεται δὲ πνεῦμα κινήσεις· οὐδὲν γὰρ ἕτερόν ἐστι τὸ πνεῦμα ἢ κινούμενος ἀήρ. ἐὰν γοῦν τετρυπημένου τοῦ ἀγγείου κατὰ τὸν πυθμένα καὶ εἰσπίπτοντος τοῦ ὕδατος παραθῆ τις τῶ τρυπήματι τὴν χεῖρα, αἰσθήσεται τὸ πνεῦμα ἐκπίπτον ἐκ τοῦ ἀγγείου. (Ἦρων ὁ Ἀλεξανδρεὺς, *Πνευματικά*, Schmidt, 1899)

#### S4.6 Quotations from section “From antiquity to modern science”

[OT39]. Mais quand il y auroit de ces pays-là où il ne pleut jamais, cela n’empescherait pas qu’il n’y coulast des Rivieres qui auroient leurs sources en d’autres pays où il pleut, comme fait le Nil qui coule en Egypte où il ne pleut point. [...]

Suite de l’opinion de l’Auteur

Après avoir rejette l’Opinion Commune, après avoir fait voir que l’eau qui coule dans les Rivières pendant une année n’est pas si considérable que se l’est figuré Aristote & ceux qui l’ont suivy, & que les pluies peuvent fournir des eaux suffisamment pour entretenir leur cours durant une année; il ne me reste plus qu’à faire voir comment les eaux de la pluye & de la neige tombées dans les Rivières, peuvent sortir par le haut des montagnes pour faire des sources. (Perrault, 1678, p. 207)

#### S4.7 Quotations from the Epilogue

[OT40]. Φιλοσοφίαν δὲ πρῶτος ὠνόμασε Πυθαγόρας καὶ ἑαυτὸν φιλόσοφον [...]. μηδένα γὰρ εἶναι σοφὸν [ἄνθρωπον] ἀλλ’ ἢ θεόν (Διογένης Λαέρτιος, *Βίοι καὶ γινῶμαι τῶν ἐν φιλοσοφίᾳ εὐδοκίμησάντων*, A.12).

[OT41]. φίλος μὲν Σωκράτης, ἀλλὰ φιλότατη ἡ ἀλήθεια. (*Ἀμμώνιος, Ἀριστοτέλους βίος*) [Latin version: Amicus Socrates, sed magis amica veritas.]

[OT42]. δόξειε δ’ ἂν ἴσως βέλτιον εἶναι καὶ δεῖν ἐπὶ σωτηρία γε τῆς ἀληθείας καὶ τὰ οἰκεῖα ἀναιρεῖν, ἄλλως τε καὶ φιλοσόφους ὄντας: ἀμφοῖν γὰρ ὄντων φίλοιν ὅσιον προτιμᾶν τὴν ἀλήθειαν. (*Ἀριστοτέλης, Ἠθικά Νικομάχεια*, 1096a11)

[OT43]. ὁ γὰρ πρῶτος σαφέστατόν τε πάντων καὶ θαρραλεώτατον περὶ σελήνης καταναγασμῶν καὶ σκιᾶς λόγον εἰς γραφὴν καταθέμενος Ἀναξαγόρας οὐτ’ αὐτὸς ἦν παλαιὸς οὐτε ὁ λόγος ἔνδοξος, ἀλλ’ ἀπόρρητος ἔτι καὶ δι’ ὀλίγων καὶ μετ’ εὐλαβείας τινὸς ἢ πίστεως βαδίζων. οὐ γὰρ ἠνεῖχοντο τοὺς φυσικοὺς καὶ μετεωρολόσχας τότε καλουμένους, ὡς εἰς αἰτίας ἀλόγους καὶ δυνάμεις ἀπρονοήτους καὶ κατηναγασμένα πάθη διατριβόντας τὸ θεῖον, ἀλλὰ καὶ Πρωταγόρας ἔφυγε, καὶ Ἀναξαγόραν εἰρχθέντα μόλις περιεποιήσατο Περικλῆς, καὶ Σωκράτης, οὐδὲν αὐτῶ τῶν γε τοιούτων προσῆκον, ὅμως ἀπώλετο διὰ φιλοσοφίαν. (*Πλουτάρχου, Βίοι Παράλληλοι, Νικίας*, 23)

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