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978-1-108-06256-5 - Archimedis Opera Omnia: Volume 2
Edited by Johan Ludvig Heiberg
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From the Renaissance to the nineteenth century, Latin and Greek were compulsory subjects in almost all European universities, and most early modern scholars published their research and conducted international correspondence in Latin. Latin had continued in use in Western Europe long after the fall of the Roman empire as the lingua franca of the educated classes and of law, diplomacy, religion and university teaching. The flight of Greek scholars to the West after the fall of Constantinople in 1453 gave impetus to the study of ancient Greek literature and the Greek New Testament. Eventually, just as nineteenth-century reforms of university curricula were beginning to erode this ascendancy, developments in textual criticism and linguistic analysis, and new ways of studying ancient societies, especially archaeology, led to renewed enthusiasm for the Classics. This collection offers works of criticism, interpretation and synthesis by the outstanding scholars of the nineteenth century.

Archimedis Opera Omnia

Published in 1880–1, this three-volume edition of the extant works of the Greek mathematician Archimedes of Syracuse (c.287–c.212 BCE) was edited by the Danish philologist and historian Johan Ludvig Heiberg (1854–1928), whose *Quaestiones Archimedee* (1879) is also reissued in this series. He later discovered a medieval palimpsest containing lost works by Archimedes, which significantly expanded the canon, but the present collection was produced long before this and therefore contains the works known at the time of publication. Heiberg consulted a Florentine codex, which he painstakingly compared with other sources to produce his edition. This second volume contains *On Spirals*, *On the Equilibrium of Planes*, *The Sand Reckoner*, *The Quadrature of the Parabola*, *On Floating Bodies*, the *Liber Assumptorum* (now thought to be apocryphal), the cattle problem and fragments. The texts are given in the original Greek with parallel Latin translation, notes and introductory material.

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VOLUME 2

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ARCHIMEDIS
OPERA OMNIA

CUM COMMENTARIIS EUTOCHII.

E CODICE FLORENTINO RECENSUIT, LATINE UERTIT

NOTISQUE ILLUSTRUIT

J. L. HEIBERG

DR. PHIL.

VOLUMEN II.



LIPSIAE

IN AEDIBUS B. G. TEUBNERI.

MDCCLXXXI.

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LIPSIÆ: TYPIS B. G. TEUBNERI.

PRAEFATIO.

Cum in uolumine primo satis, ut opinor, de consilio, genere adiumentisque huius editionis praefatus sim, huic praefationi nihil relinquitur, nisi ut pauca quaedam uel addam uel corrigam.

In adnotatione igitur critica uoluminis I haec addantur, de quibus postea demum, quam prodierat uolumen illud, ab Henrico Lebègue certior factus sum:

I p. 56, 17 etiam in *A* est *περιφερείας*; quare scrib. „corr. ed. Basil.“.

I p. 116, 2 post „ed. Basil.“ ponenda erat stellula (nam ubi stellula nomini editoris recentioris adponitur, hoc significatur, codices Parisinos denuo inspectos cum cod. Florentino congruere).

I p. 122, 7 post „uulgo“ stellula ponatur.

I p. 132, 13 deleatur „corr. ed. Basil.“ nam in omnibus codd. est *τό* (excepto Florentino).

I p. 132, 18 post „ed. Basil.“ ponatur stellula.

I p. 150, 3 post „ed. Basil.“ ponatur stellula.

I p. 190, 19 pro „corr. ed. Basil.“ scribatur „corr. *B* manu 2*“.

I p. 216, 17 cod. *C* prorsus idem habet, quod *F*; in *B* ita scribitur: *ἡ βδ πρὸς δχ· ὥστε καὶ ὡς τὸ ἀπὸ κλ πρὸς λδ ἢ βδ πρὸς δχ· ὥστε καὶ ὡς τὸ ἀπὸ κλ cet.*

I p. 452, 20 *οὔτε* cum omnibus codd. Parisinis recipiendum erat.

postremum moneo, sicubi signum interrogationis scripturae cod. Florentini adponatur, hoc non significari, me de collatione mea dubitare, sed codicem ipsum lectu difficilem esse, ita ut prorsus certo dignosci ne-

IV

PRAEFATIO.

queat, quae sit scriptura eius. unus tamen locus excipiendus est II p. 352, 19. ibi enim ad Torellii scripturam *τυδάματος* nihil e cod. Florentino adnotavi; sed cum et ante et post in eadem pagina legamus *τυῆμα*, non dubito, quin errauerim, et hoc quoque loco *η* in cod. Florentino reperiatur.

In uolumine altero p. 359 sq. recepi interpretationem Tartaleae librorum, qui sunt *περὶ ὀχουμένων*, quia intellexeram, Commandinum suo Marte plurima mutasse, ita ut forma genuina, in qua libri illi nobis traditi sunt, ex Tartalea solo cognosci possit. itaque cum liber eius satis rarus sit, interesse putavi, ut denuo cum fide ederetur quasi fundamentum hosce libros emendandi. sed hac ipsa re accidit, ut libri illi forma corruptissima et ita, ut interdum intellegi non possint, prodirent. sed cum intellexerim, eos tam fideliter e Graeco conuersos esse, ut pristina forma ubique fere adpareat, constitui, postea aliquando, si otium mihi contigerit, hos libros Graece conuertere. tum demum licebit de lacunis explendis et erroribus plurimis foedissimisque corrigendis seuerè cogitare. dum hoc fiat, habitu barbaro et dilacerato, quo ad nos peruenerunt, hic quoque prodeant. hoc loco interponere libet, quae Carolus Thurot u. d. ad emendandos libros illos contulit (Recherches sur le principe d'Archimède. Revue archéologique 1868—69).

II p. 356, 4: *ὠθειῖσθαι*] delet C. Thurot.

II p. 356, 6: *πάντων αὐτοῦ μερῶν*] *πάντα δὲ τὰ αὐτοῦ μέρη* idem.

II p. 357, 10: *ἰσοβαρῆ*] iam suspicatus est Thurot.

II p. 358, 10: *καταβαίνωσι*] *καταβῶσι* idem.

II p. 358, 2: *ἰσοβαρῆ*] iam Thurot.

praeterea in uerbis Tartaleae citandis saepe ea uel corrigat uel explicat additis Graecis, in quo saepe in

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PRAEFATIO.

V

eadem incidit, quae ego in adnotationibus posui. de lacuna p. 369, 5 haec habet: peut-être y avait-il: en effet, si a n'était pas entièrement au-dessous de la surface, le volume du liquide égal à la portion plongée aurait un poids moindre que ad . idem uir doctus (Revue critique 1880 nr. 2) quaestionem obscuram ac difficilem, utrum Tartalea ipse codicem Graecum habuerit necne, ita soluere conatur, ut putet, libros illos Tartaleae causa ab homine Graecae linguae satis perit, sed qui mathematicam non calleret, e Graeco conuersos esse. praeterea consensum Thuroti (Recherches etc. p. 12 not. 2) de auctoritate editionis Tartaleae laetus commemoro, de qua ita iudicat: nous montrerons plus bas que cette publication est la seule base authentique qui puisse jusqu'ici servir à établir le texte de ce traité d'Archimède. — sero animaduerti, pro littera \mathcal{X} usurpandam fuisse litteram Ψ , ut fecit Commandinus; nam apud Tartaleam haec littera, quae saepius formam litterae x prae se fert, interdum tamen litterae Ψ simillima est, ita ut ueri simile sit, Tartaleam semper hanc litteram reddi uoluisse.

De lemmatis hoc addendum uidetur, Mauritium Cantor (Vorlesungen über d. Gesch. der Math. p. 255—57) nuper pluribus de quibusdam eorum propositionibus egisse. quae Curtzius et Steinschneiderus de huius libri apud Arabes fatis disputauerunt, breui recensere in animo mihi est.

De codice Parisino problematis bouini e litteris Henrici Lebègue haec cognoui. codex Graecus 2448 inter alia hoc epigramma et id quidem tertio loco continet. de eo in Catalogo codd. mss. bibliothecae regiae II p. 504 haec leguntur:

MMCDXLVIII.

„— 3^o. Archimedis supposititia ad Eratosthenem

VI

PRAEFATIO.

epistola sive problema Alexandrinis versibus scriptum
 de bobus solis sacris —.

Codex bombycinus, olim Colbertinus.

Is codex saeculo decimo quarto exaratus videtur.
 conspectus scripturae discrepantiae, in quo de accentibus
 et *ι* subscripto (quod saepe omittitur) tacui, hic est:

- u. 4: *δασσαμένη*] *δασαμένη* cod. Paris. 2448.
- u. 5: *ἀλάσσοντα*] alterum *σ* supra Paris. 2448.
- u. 12: *τεράτω τε*] sic cod. Paris. 2448.
- u. 13: *πᾶσιν*] sic. cod. Paris. 2448.
- u. 16: *αὔτις*] *αὐτούς*.
- u. 16: *ἰσαζομένους*] *ἰδαιομένους*.
- u. 19: *τεράτω*] sic.
- u. 20: *τεράτω*] sic.
- u. 22: *πάσης*] *πάσαις*.
- u. 22: *ἐρχομένης*] *ἐρχομένας*.
- u. 23: *ἀγέλης*] *δ' ἀγέλης* (et sic Struuius).
- u. 24: *τετραχῆ*] *τετραχεῖ*.
- u. 27: *βοῶν*] *βόες*.
- u. 29: *χρωῶμα*] *χροιάν*.
- u. 30: *λέγοι'*] *λέγοιο*.
- u. 31: *ἐναρίθμιος*] sic.
- u. 38: *ἀμβολάδην*] *ἀμβολάνδην*.
- u. 40: *οὔτ' ἐπιλειπομένων*] *οὔτ' πιλειπομένων*.
- u. 41: *πραπίδεσσι*] *πραπίδεσιν*.
- u. 41: *ἀθροίσας*] *ἀθρήσας*.
- u. 42: *ὦ ξένε*] *ξείνε τά*.
- u. 44: *ταύτη*] *ταύτης*.

hoc problema Archimedi re uera tribuendum esse,
 quamquam dubitari possit, an ipsi uersiculi ab eo con-
 scripti non sint (quod ipse admiseram Quaest. Archim.
 p. 26 not. 1), etiam Krumbiegelius censet; quem de
 explicando uerbo *πλίνθου* u. 36 (si modo explicari
 potest) mecum consentire (l. l. p. 134) gaudeo. sed

in eo sententiam meam minus recte intellexit, quod putauit, me causis a me adlatis demonstrare uoluisse, Archimedem huius epigrammatis auctorem esse. nam hoc solum ostendere conatus sum, nihil esse, cur ab eo discederemus, quod traditum est, his uersibus contineri problema ab Archimede propositum. de re aptissime me monuit L. Oppermannus, eo quoque confirmari originem problematis Archimedeam, quod numeri tam scite electi sint, ut cito ad ingentes numeros perueniatur, in quo ipso auctor problematis praecipuam eius difficultatem inesse uoluerit. coniecturam meam in u. 24:

ποικίλη ἰσάριθμον πλήθος ἔχουσ' ἐφάνη,

quam palaeographice explicare posse uideor, tamen nunc improbaui, quia *ποικίλη* tum de grege vaccarum variarum, non de toto grege vario, accipiendum erat, quod fieri uix potest. — etiam iudicium Mauritiū Cantor u. d. de hoc problemate adferre iuuat: Vorlesungen über d. Gesch. d. Math. I p. 268: Zu einem Ergebnisse kommen wir allerdings auch hier: dass nämlich ein Grund das Rinderproblem darum für untergeschoben zu erklären, weil Archimed es nicht habe lösen können, in keiner Weise vorliegt.

Inter fragmenta catoptricum recipere potueram Michaelis Pselli locum in synopsis mathematicae. p. 73 ed. Xylandri: *δυνατὸν μέντοι καὶ ἄλλως ἀπορία διόπτρας τῇ μεθόδῳ χρῆσασθαι, καθὰ δήπου καὶ Ἀρχιμήδης· ὅς ποτέ τινων ἐρομένων¹⁾ περὶ τῆς ὑπ' ὄψιν πυραμίδος, ὁπόση ἂν εἴη τὸ μέγεθος, τὴν ῥάβδον ἐτοιμῶς ὄρθιον πρὸς τὴν ἐξ ἡλίου τῆς πυραμίδος καταπήξας σκιάν, ὡς τὰς ἀμφοῖν τῆς τε ῥάβδου καὶ τῆς πυραμίδος ἐξ ἴσου συναποπερατοῦσθαι σκιάς. καὶ δύο ἐντεῦθεν ἀποτελέσας ἰσογώνια αὐτόθεν ἐπήγαγεν· ὃν λόγον ἢ ἐν ἐπιπέδῳ κειμένη σκιά τῆς ῥάβδου πρὸς αὐτὴν*

1) ἐρομένων Xylander.

VIII

PRAEFATIO.

ἔχει τὴν ῥάβδον, τὸν αὐτὸν καὶ ἡ ἐν ἐπιπέδῳ τῆς πυραμίδος σκιά πρὸς αὐτὴν ἔχει τὴν πυραμίδα. καὶ λοιπὸν τῇ διαμετρήσει τῆς σκιάς τῆς πυραμίδος τὸ τῆς πυραμίδος ὕψος τοῖς ἐρωτήσασιν δῆλον κατέστησεν. nam ueri simile est, hanc narratiunculam inde ortam esse, quod in catoptriciis Archimedis inueniebatur propositio aliqua de altitudinibus ex umbra dimetiendis, qualis est Euclidis optic. prop. 18.

ultimo loco adnotabo errores typographicos, quos quidem adhuc deprehenderim.

Scriptum est: Scribendum erat:

I p. 24, 15:	<i>περιγράψαι</i>	<i>περιγράψαι.</i>
I p. 46, 7:	<i>ἰσοῦψη</i>	<i>ἰσοῦψῆ.</i>
I p. 106, 9:	<i>η</i>	<i>ἡ.</i>
I p. 240, 20:	<i>τμημα. ὡς</i>	<i>τμημα, ὡς</i>
I p. 380, 25:	<i>κορυφα</i>	<i>κορυφᾶ</i>
I p. 424, 5:	<i>οὐδὲ</i>	<i>οὐδὲ</i>
II p. 146, 20:	<i>ἔχοντι</i>	<i>ἔχωντι; et in notis p.147 addendum: „20. εχοντι F, uulgo.“</i>

in figura I p. 360 littera Γ excidit, quae ponenda erat in dextra parte extrema parabolae. I p. 244 in figura ducatur linea AK .

praeterea non raro in accentibus more Doriensium ponendis erraui, uelut quod in futuri tertia persona num. sing. circumflexum non posui, et omnino in dialecto restituenda fortasse parum mihi constiti. sed huic rei aliquatenus mederi me posse spero, collectis omnibus dialecti Doricae uestigiis, quae apud Archimedem occurrunt. hoc et materiem disputandi uberiorem et, ut arbitror, fructuosiore, certe mihi familiarior, quam praebet quaestio de codicibus aestimandis, praefationi uoluminis tertii sepono.

Scrib. Hauniae Cal. Februariis MDCCLXXXI.