

Opera Mathematica, Tomus Tertius — complectens Commentarium in Sphaeram Ioannis de Sacro Bosco, & Astrolabium — Editorial footnotes (draft)

Christoph Clavius (1538–1612), S.J. — commentary on the De sphaera of Johannes de Sacrobosco (c. 1195–c. 1256). Drafted editorial footnotes for review before publication. Each note is keyed to its anchor in the **manuscript-grade complete edition** — the collated output that retains the per-batch/page scaffolding the anchors reference (produced by `ms`). The reading in the main text is **preserved as printed/transcribed** and is not altered by these notes. The note text below is a **draft** — review and edit before publication.

The notes are classified as follows:

- **Category B — source compositor error.** A printing, compositor, or scribal error in the source itself (a wrong letter or digit, a dropped or doubled word, a non-resolving citation). The likely intended reading is noted, but the main text preserves exactly what is printed.
- **Category C — author/source anomaly.** An anomaly originating with the author or the source rather than the typesetting (a factual or geographic slip, a misattribution, an internal inconsistency, or a deliberate but unusual feature). Recorded as written.
- **Missing-source lacuna.** A point where source text is missing, damaged, or illegible. The note states what should stand at the gap and points to an alternate witness where one is known.

#	Anchor	Cat.	Item
1	batch_011 / p.33 (ALTER paragraph)	B	Obliquity printed 32°33′ where 23°33′ is required
2	batches 011 / 016 / 017 / 046 / 053 / 054	C	Obliquity of the ecliptic quoted at several different values
3	batch_012 / pp.34–36	C	Corrupt name-forms for three ancient astronomers
4	batch_014 / pp.40–42	C	Saturn's daily motion given without a seconds place

#	Anchor	Cat.	Item
5	batch_015 / pp.43–45	C	Werner's 1514 datum called a "declination" but used as a meridian altitude
6	batch_025 / pp.74–75	C	Depth of the land given as 3579 miles on one page and 3500 on the next
7	batch_027 / pp.80–81 (QVINTO)	C	Line-label BC used for two different lines
8	batch_030 / p.88 (Ursa Maior)	B	Ursa Maior magnitude summary disagrees with the table cells
9	batch_031 / p.92 (Auriga XII, star 4)	B	Auriga star 4 magnitude printed 5 where the summary requires 2
1 0	batch_031 / p.91 (Engonasis VII)	C	Numeric columns carry one row more than the description column
1 1	batch_032 / pp.94–96 (Pegasus, Constellatio XIX)	B	Pegasus magnitude summary disagrees with the table cells by one
1 2	batch_034 / p.100 (Sagittarius, star 11)	B	Sagittarius star 11 longitude printed 152° for 252°
1 3	batch_034 / p.102 (Aquarius)	B	Aquarius magnitude summary disagrees with the table cells
1 4	batch_042 / pp.113–114	B	Earth's diameter and radius printed with inconsistent fractions
1 5	batch_042 / pp.113–114 (Great cubit)	C	The "great cubit" of 9 feet / 36 palms
1 6	batch_043 / p.127 (Vnus gradus in terra habet, Eratosthenes row)	B	Eratosthenes' degree printed 77½ miles where the table's own ratio gives 87½
1 7	batch_043 / p.129 (Crassitudines coelorum, Moon row)	B	Lunar orb thickness printed 31 7/15 where the flanking tables give 30 7/15
1 8	batch_045 / pp.133–135 (DEINDE ... LIQVIDO)	C	The mile defined as 100,000 digits and later as 80,000

#	Anchor	Cat.	Item
1 9	batch_056 / p.167 (declination table, argument $25^{\circ}40'$, □ □)	B	Declination cell printed $10^{\circ}13'$ where the column requires $19^{\circ}13'$
2 0	batch_061 / p.183 (Hierapolis, Aleppo)	B	Longitude minutes printed 73
2 1	batch_061 / p.183 (Gades)	B	Latitude of Cádiz printed $22^{\circ}20'$
2 2	batches 061–063 / pp.182–187 (table of longitudes and latitudes)	C	Longitudes greater than 180° in the gazetteer
2 3	batch_062 / p.186 (letter R)	C	"Rupella" entered twice with identical coordinates
2 4	batch_064 / pp.191–192 (Rome– Cusco example)	B	Longitude difference printed $80^{\circ}50'$ where the subtraction gives $90^{\circ}50'$
2 5	batch_074 / p.221 (oblique ascensions, lat. 36° , □ 0°)	B	Oblique ascension of the autumnal equinox printed $180^{\circ}9'$
2 6	batch_074 / p.222 (oblique ascensions, lat. 37° , □ 25°)	B	Oblique ascension printed $127^{\circ}6'$ where $137^{\circ}6'$ is required
2 7	batch_099 / p.295 (table of climes, pole elevation 81°)	B	Continuous-day hours printed 31
2 8	batch_101 / p.301 (climes table, clime XX Medium)	B	Longest day printed 22h40m where the column's progression gives 22h30m
2 9	batch_101 / p.301 (climes table, climes XVII–XVIII)	C	Clime amplitudes disagree with the pole-elevation differences by $\pm 3'$
3 0	batch_134 / p.400 (Lemma, "Denique" sub-proof)	lacuna	Five to six lines at the foot of p.400 not transcribed
3 1	batch_136 / p.408 (Lemma XXXII)	C	"Quarta figura" cited for two different diagrams
3 2	batch_149 / p.445 (RECTAM paragraph)	C	The tangent line lettered HN and HG in the same proof
3 3	batch_150 / p.450 (rising- amplitude table, Cancer, lat. 42°)	B	Printed Remainder does not equal the difference of the

#	Anchor	Cat.	Item
			tabulated sines
3 4	batch_162 / p.133 (Astrolabium, item 7)	C	Oblique circle lettered FKGI once, FKGL thereafter
3 5	batch_175 / pp.523–525	C	Body and margin cite different propositions of Euclid III
3 6	batch_191 / p.221 (Astrolabium, §§16–17)	C	Vertical circle lettered PHSI, PSHI and PHSL
3 7	batch_192 / pp.574–576 (Propositio IX §1)	C	Grammatically irregular relative clause
3 8	batch_195 / p.585 §4 (Hircus / Capella)	B	Capella's longitude given as 76°25' then used as 76°15'
3 9	Astrolabium, Books II–III (throughout)	C	Problems and propositions numbered in two parallel series

1. batch_011 / p.33 (ALTER paragraph) — Category B — source compositor error

The source prints the poles' distance as "32. gradib. & 33. min." (32°33'). This contradicts the Sacrobosco lemma four lines above ("23. gradibus, & 33. minutis"), the clause immediately following ("nempe gr. 23. & m. 30. ferme"), and the obliquity observed under al-Ma'mūn; contextually it should be 23°33', a compositor's transposition of 23 to 32. Preserved as printed.

2. batches 011 / 016 / 017 / 046 / 053 / 054 — Category C — author/source anomaly

Clavius reports the greatest declination of the ecliptic at markedly different values in different places: Ptolemy's 23°51', al-Ma'mūn's 23°33', a mean of 23°40' with the true value oscillating between 23°52' and 23°28' in his eleven-heaven model, and the 23°30' he adopts for his own tables. These are not errors but the competing observational and model-dependent parameters of the tradition he is summarising; each is transcribed as printed at its own place.

3. batch_012 / pp.34–36 — Category C — author/source anomaly

The source prints "Arsatilis" (for Aristyllus), "Agrias" (apparently for Agrippa), and "Mileus Geometra, qui & Menelaus" (for Menelaus of Alexandria). These are the printed forms of names already corrupted in the transmission Clavius drew on, not compositor slips peculiar to this edition; the identifications are supplied in brackets in the text and the printed forms preserved.

4. batch_014 / pp.40–42 — Category C — author/source anomaly

Saturn's daily motion is printed "minuta quasi 2. & tertia 35" — minutes and thirds, with the seconds place apparently omitted. Transcribed verbatim and marked "[as printed]"; it is most likely a compositor's omission of the seconds figure, but no correct value can be established from the page.

5. batch_015 / pp.43–45 — Category C — author/source anomaly

Schreckenfuchs's report of Johann Werner's 1514 Nuremberg observation of Spica is printed as a "declinationem ... grad. 32. Min. 7," yet the computation that follows subtracts it from the altitude of the equator, which treats 32°7' as an observed meridian altitude rather than a declination. The looseness of terms is the source's own; the passage is rendered as printed.

6. batch_025 / pp.74–75 — Category C — author/source anomaly

Facing pages give the same quantity — the whole depth of the land to the centre — as "milliaria 3579" (p.74) and "milliaria 3500" (p.75), both referred forward to the identical chapter-end computation. 3579 miles is the Ptolemaic terrestrial semidiameter Clavius uses elsewhere in the work, so p.75's 3500 is presumably a rounding or a compositor's slip. Both readings preserved as printed.

7. batch_027 / pp.80–81 (QVINTO) — Category C — author/source anomaly

The phrase "qui per rectam BC, ducuntur" employs the label BC, which on the preceding page designates the axis of the world, immediately after the parallel clause "cuiusmodi est BD." Either the compositor set BC for another pair of letters, or the author reused the label; the geometric referent is inconsistent. Preserved as printed and not emended.

8. batch_030 / p.88 (Ursa Maior) — Category B — source compositor error

The printed per-constellation summary reads "Secundæ magnitud. 6. Tertiæ 8." while the twenty-seven tabulated magnitudes yield seven second-magnitude and eight third-magnitude stars (fourth, fifth and the total of 27 all agree). One of the two tallies — the summary or a single magnitude cell — is off by one. Cells and summary both preserved as printed; a cold re-reading of the tiles confirmed the printed values.

9. batch_031 / p.92 (Auriga XII, star 4) — Category B — source compositor error

The magnitude of the star "in the right shoulder" (56°10' / 20°0') is printed 5, but the constellation summary (Secundæ 1, Quintæ 2) requires a 2 in this cell, and the

star — β Aurigae, Menkalinan — is in fact of the second magnitude. The source therefore prints 5 where 2 is required. Preserved as printed.

10. batch_031 / p.91 (Engonasis VII) — Category C — author/source anomaly

At the foot of Engonasis the numeric columns of the catalogue carry one line more than the column of star-descriptions, so that one row of coordinates has no description against it. The surplus line is either the shared "ultima" star excluded from the count or its true coordinates; the source's own alignment cannot be recovered from the page, and the table is preserved as printed.

11. batch_032 / pp.94–96 (Pegasus, Constellatio XIX) — Category B — source compositor error

The printed summary reads "Secundæ 4. Tertiæ 4. Quartæ 9. Quintæ 3." while the tabulated magnitudes distribute the last twelve stars as fourth 8 / fifth 4 (both distributions total 20). Either one of the four cells read as fifth magnitude is a printed 4, or the summary tally is itself off by one. Cells and summary both preserved as printed; a cold re-reading confirmed the printed values.

12. batch_034 / p.100 (Sagittarius, star 11) — Category B — source compositor error

The longitude-degrees cell prints 152, which breaks the monotone run $251 \rightarrow 254$ and falls far outside the Sagittarius band of roughly 240° – 262° ; contextually it should be 252. The glyph is legibly a 1, so this is a compositor's error rather than a reading difficulty. Preserved as printed.

13. batch_034 / p.102 (Aquarius) — Category B — source compositor error

The printed summary gives 9 third-magnitude and 13 fifth-magnitude stars, while the tabulated cells give 10 and 12; first, fourth and sixth magnitudes and the total of 42 all agree. The two classes are off by one in opposite directions, which would reconcile if a single cell printed 3 were in fact 5 (star 18 is the only candidate). Cells and summary both preserved as printed.

14. batch_042 / pp.113–114 — Category B — source compositor error

The source prints the earth's diameter as "80181 $\frac{9}{22}$ " stadia on p.113 but "80181 $\frac{9}{11}$ " on p.114; $\frac{9}{11}$ is the arithmetically correct value ($252,000 \times \frac{7}{22}$). The radius is likewise printed "40090 $\frac{7}{22}$ " twice on p.113 against "40090 $\frac{9}{22}$ " on p.114, where half the stated diameter is $40090 \frac{10}{11}$. The fractions are compositor's errors in a small type-size; all readings preserved as printed.

15. batch_042 / pp.113–114 (Great cubit) — Category C — author/source anomaly

The table of measures gives the *cubitus magnus* as 9 feet or 36 palms — six times the small cubit of $1\frac{1}{2}$ feet, and anomalously large for a cubit. Clavius himself notes that this measure is a late addition admitted "on account of Origen, found in no other writer," so the figure appears to be a genuine feature of his source rather than a misprint. Preserved as printed.

16. batch_043 / p.127 (Vnus gradus in terra habet, Eratosthenes row) — Category B — source compositor error

The Milliaria column prints "77 $\frac{1}{2}$ " for the Eratosthenean degree. By this table's own stadia-to-mile ratio of 8 (700 stadia $\div$ 8), the value should be $87\frac{1}{2}$; the leading digit is a compositor's 7 for 8. Preserved as printed.

17. batch_043 / p.129 (Crassitudines coelorum, Moon row) — Category B — source compositor error

The terrestrial-semidiameter column prints "31 $\frac{7}{15}$ " for the thickness of the Moon's orb. The difference of the flanking semidiameter rows (convex Moon $64\frac{1}{6}$ – concave Moon $33\frac{7}{10}$) is $30\frac{7}{15}$, so the leading integer should be 30. Preserved as printed.

18. batch_045 / pp.133–135 (DEINDE ... LIQVIDO) — Category C — author/source anomaly

In the DEINDE paragraph the mile is defined as "digitos 100000. constituere vnum milliare," but the LIQVIDO recapitulation describes the same miles as "quorum singula 80000. digitos continent." Both figures are clearly printed and both are Clavius's own; the discrepancy is in the source, and neither has been harmonised.

19. batch_056 / p.167 (declination table, argument $25^{\circ}40'$, □ □) — Category B — source compositor error

The cell prints "10 13," breaking the monotone rise of its column ($25^{\circ}35' = 19^{\circ}12'$; $25^{\circ}45' = 19^{\circ}15'$). The tens digit is a compositor's error for $19^{\circ}13'$ (or $19^{\circ}14'$). Preserved as printed.

20. batch_061 / p.183 (Hierapolis, Aleppo) — Category B — source compositor error

The longitude of Hierapolis (Aleppo) is printed "70 | 73": minutes cannot exceed 59, so the figure is impossible as printed and is presumably a compositor's error for 13 or 33. Preserved as printed.

21. batch_061 / p.183 (Gades) — Category B — source compositor error

Gades (Cádiz) is given a latitude of $22^{\circ}20'$, whereas the city lies near 36° N. The coordinate is legibly and well-formedly printed, so the error is the source's — most probably a compositor's transposition of the degree figure. Preserved as printed.

22. batches 061–063 / pp.182–187 (table of longitudes and latitudes) — Category C — author/source anomaly

A number of entries carry longitudes well beyond 180° — e.g. Ciuitas regum in Peru 280° , Panama $281^{\circ}15'$, Quito $303^{\circ}5'$, Pernambuco 338° , Lima $280^{\circ}15'$, Japan 204° , the Moluccas 187° . These are not misprints: the table reckons longitude continuously eastward from the first meridian through the Canaries, so New-World and Far-Eastern places necessarily exceed 180° . Transcribed as printed throughout.

23. batch_062 / p.186 (letter R) — Category C — author/source anomaly

The gazetteer prints two entries under R — "Rochelle, Rupella" and a bare "Rupella" — with identical coordinates ($16^{\circ}30' / 47^{\circ}10'$). Both denote La Rochelle; the duplication is in the source's own list. Both entries preserved as printed.

24. batch_064 / pp.191–192 (Rome–Cusco example) — Category B — source compositor error

The shorter difference of longitudes between Rome and Cusco is printed "gr. 80. min. 50," but $360^{\circ} - 269^{\circ}10' = 90^{\circ}50'$. The erroneous $80^{\circ}50'$ is then carried consistently through the rest of the worked example ($180^{\circ} - 80^{\circ}50' = 99^{\circ}10'$), so the slip is the source's own and propagates through the passage. Preserved as printed.

25. batch_074 / p.221 (oblique ascensions, lat. 36° , $\square 0^{\circ}$) — Category B — source compositor error

The oblique ascension of Libra 0° must be exactly $180^{\circ}0'$ at every latitude, and is so printed in the facing latitude- 37° table; here the source prints $180^{\circ}9'$. The anomalously small first difference to Libra 1° ($+1^{\circ}3'$ against the column's regular $+1^{\circ}13'$) confirms that the minutes figure is erroneous. Preserved as printed.

26. batch_074 / p.222 (oblique ascensions, lat. 37° , $\square 25^{\circ}$) — Category B — source compositor error

The cell prints 127°6' between 135°52' (Leo 24°) and 138°24' (Leo 26°), which is impossible in a monotone column; the intended value is 137°6', the tens stroke of the degree figure having failed to print. Preserved as printed.

27. batch_099 / p.295 (table of climes, pole elevation 81°) — Category B — source compositor error

The "Continuous day" hours column prints 31 for a pole elevation of 81°. An hours value cannot exceed 24, and the neighbouring rows show 4 and 6; the figure is a compositor's error. Preserved as printed.

28. batch_101 / p.301 (climes table, clime XX Medium) — Category B — source compositor error

The "Maxima dies" minutes cell for the middle of clime XX prints 40, where the column's otherwise uniform fifteen-minute progression (principium 22h15m, finis 22h45m) requires 30. Preserved as printed.

29. batch_101 / p.301 (climes table, climes XVII–XVIII) — Category C — author/source anomaly

At clime XVII the printed amplitude 0°36' does not equal the difference of its pole elevations ($64^{\circ}30' \rightarrow 65^{\circ}9' = 39'$), and at clime XVIII the printed 0°29' does not equal its difference ($65^{\circ}9' \rightarrow 65^{\circ}35' = 26'$). The two discrepancies are equal and opposite, and every other clime in the table agrees exactly — the pattern of a single transposition in the source's own computation. Values preserved as printed.

30. batch_134 / p.400 (Lemma, "Denique" sub-proof) — Missing-source lacuna

About five or six lines at the very foot of p.400 — running approximately from "Nam arcus EV, AO, toti æquales sunt..." to "...à centris t, u,..." — fell below the reach of the page images used for this translation and are not represented in the text; the argument resumes verbatim at the head of p.401, and the marginal citations standing beside the gap (o, p, q, r, s, t, u, x) are recorded at that point. The passage is present in the source and can be supplied from any complete scan of the Mainz 1611 edition.

31. batch_136 / p.408 (Lemma XXXII) — Category C — author/source anomaly

The phrase "quarta figura" is used for two distinct cases of Lemma XXXII — the equality reductio ("SIT deinde ... vt in quarta figura") and the common-part case ("AD extremum ... vt in proxima quarta figura"). The second reference must be to

a further figure; the figure-numbering is inconsistent in the source. Both references preserved as printed.

32. batch_149 / p.445 (RECTAM paragraph) — Category C — author/source anomaly

The tangent is introduced as "quando recta HN, circulum tangit in M" but the conclusion names HG ("Igitur HG, Ellipsim continget"), while the ALITER and DENIQVE passages use HS. Whether the source means one line under varying labels or genuinely distinct lines cannot be settled from the page; the letters are given as printed and not harmonised.

33. batch_150 / p.450 (rising-amplitude table, Cancer, lat. 42°) — Category B — source compositor error

The printed Remainder 1073134 does not equal the difference of the two tabulated sines as printed ($9623762 - 8520628 = 1103134$), although it halves cleanly to the printed Half 536567. Either one digit of a tabulated sine or the Remainder itself is a compositor's error; every other table in this series satisfies $\text{Remainder} = \text{difference}$ and $\text{Half} = \text{Remainder} \div 2$ exactly. All figures preserved as printed.

34. batch_162 / p.133 (Astrolabium, item 7) — Category C — author/source anomaly

At its first mention the oblique circle is lettered FKGI; every later mention, and the figures, give FKGL. The first form is presumably a compositor's slip, but both are legibly printed and neither has been silently corrected.

35. batch_175 / pp.523–525 — Category C — author/source anomaly

The body cites "ex scholio propos. 27. lib. 3. Eucl." while the marginal reference beside it reads "3. tertij" (Euclid III.3). Both point to Book III but to different propositions — a cross-reference inconsistency in Clavius's own apparatus (his Euclid scholia are numbered differently from the received text). Both preserved as printed.

36. batch_191 / p.221 (Astrolabium, §§16–17) — Category C — author/source anomaly

The same vertical circle is designated PHSI (predominantly), PSHI at §17 and PHSL at §16. The variants are compositor's inconsistencies in the setting of the letter-strings rather than distinct circles; each is transcribed at its own place and none silently harmonised.

37. batch_192 / pp.574–576 (Propositio IX §1) — Category C — author/source anomaly

The source reads "quos Germani, Hispani, & Galli emittantur," pairing an accusative relative with what looks like a passive verb. The sense is plainly "which the Germans, Spaniards and French use," and the printed text is most likely a compositor's corruption of something like "quibus ... vtuntur"; since no certain correction can be demonstrated from the page, the reading is preserved as printed and rendered for sense.

38. batch_195 / p.585 §4 (Hircus / Capella) — Category B — source compositor error

Capella's true longitude is printed $76^{\circ}25'$ at its first mention, but every computation that follows on the same page uses $76^{\circ}15'$ ($76^{\circ}15' = \text{Gemini } 16^{\circ}15'$; $90^{\circ} - 76^{\circ}15' = 13^{\circ}45'$; $360^{\circ} - 76^{\circ}15' = 283^{\circ}45'$). The opening figure is therefore erroneous — a compositor's 2 for 1 in the minutes. Preserved as printed.

39. Astrolabium, Books II–III (throughout) — Category C — author/source anomaly

Throughout Books II and III of the *Astrolabium* each item carries two numbers, the Problem number running three behind the Proposition number (Probl. N = Propos. N+3). This is a feature of the source's own layout, not a numbering error, and both series are given as printed.