ABSOLUTE CHRONOLOGY IN EGYPT IN THE FIRST QUARTER OF THE SECOND MILLENNIUM BC

By Ulrich Luft

Chronology is the skeleton of history. It helps to put events and artefacts in relation to each other in time. This time is not absolute, it is artificial. People have reckoned time in different ways. One method is based on the moon, the other is based on the sun, and another one is based on the stars. All these manners of reckoning were present in the ancient Near East including Egypt in the 2nd millennium BC. We call the mode of reckoning absolute chronology because this system allows establishing the succession of events using the numbers of the Julian calendar. Western researchers have considered the Julian year as a reasonable instrument to prolong the Christian era back before the birth of Christ.

The day is the basic unit of chronology. A certain number of days were united to weeks, months, and years. However, the day remained the basic unit. Our day runs from midnight to midnight as the Julian day. Censorinus, a writer of the 3rd century AD was acquainted with the problems of its beginning.[1] Naturally, he did not claim that the day was the basic element of the calendar. His main interest focussed on the question of the epochs that are formed by a specified number of days, i.e. the year[2] and the month.[3] The title of his pamphlet *de die natalis* "On the Birthday" shows his special interest in the day as chronological unit that he defines as following: "Little remains to say of the day which like the month or the year is partly natural, partly civil. The natural day is the time from sunrise to sunset; his counterpart is the night from sunset to sunrise, however, such a period is called civil day that comprises one rotation of the sky containing one real day and the night. If we say that somebody has lived for 30 days, there are also to add nights too."[4] Censorinus being aware of the different definitions of the day compiles the list of its possible beginnings in Antiquity like before him Pliny: "Astronomers and citizens define such a day in four ways. The Babylonians consider the day from sunrise to sunrise; most of the Umbrian people from noon to noon; Athenians from sunset to sunset; otherwise the Romans estimate the day from midnight to midnight."[5] Pliny explains the last issue more precisely: "the Roman priests and those who define the day in the civil manner like the Egyptians and Hipparch from midnight to midnight."[6] Censorinus and Pliny listed the possibilities of the beginning of the day, while Ptolemy used the Egyptian calendar to fix data in the chronological frame if the data were of Egyptian origin.[7]

First Ludwig Ideler has drawn the attention to the conspicuous dating when Ptolemy refers to

1 Censorinus 1867 is the principal edition. August Böckh 1864, passim has quoted Censorinus.

2 Censorinus 1867, XVIII, 10. Specially the year has found great interest among the scholars. It is natural that Ideler 1825, 126–127. 150–151; Böckh 1864, 308–309; Ginzel 1906, 187–188, tried to find out the reasons of the different forms of year. They formed the phalanx of the principal investigators on this field. See also Herodot II 4: „But as to human affairs, this was the account in which they all aggreed: the Egyptians, they said, were the first men who reckoned by years and made the year consist of twelve divisions of the seasons. They discovered this from the stars (so they said). And their reckoning is, to my mind, a juster one than that of the Greeks; for the Greeks add an intercalary month every other year, so that the seasons agree; but the Egyptians, reckoning thirty days to each of the twelve months, add five days in every year over and above the total, and thus the completed circle of seasons is made to agree with the calendar".

3 Censorinus 1867, XXII 1–2.

4 Censorinus 1867, XXIII 2.

5 Censorinus 1867, XXIII 3.

6 Plinius 1967–70, II 79.

7 Neugebauer 1975, 559: "The Hellenistic astronomers fully realized the usefulness of the Egyptian calendar for computational purposes"; also Pedersen 1974, 124: "Therefore it is the Egyptian Calendar which is the chronological basis for the principal work of Hellenistic astronomy". Pedersen refers on Ginzel I, 150–152 and Parker 1950. Similarly argues Toomer 1984, 9: "He uses the Egyptian year and the era Nabonassar."

data between sunset and sunrise.[8] Hence, if Ptolemy wanted to point at an event within the dawn he used the following outline: regnal year with the name of the sovereign, then he introduces the date with the expression "after the Egyptians" (κατὰ Αἰγυπτίους), giving the name of month, the number of the day and after that he adds the number of the next day with the preposition "until" (εἰς) and at the end he puts ὄρθρου "dawn".[9] Since ὄρθρος is joined to the previous date the period is to be included between the first and the second number of day. This is clear by the use of πρωΐα "first hour" in the following context where Ptolemy first gives the regnal year and after that the allusion on the Egyptians followed by the name of month, the number of the day, and πρωΐας "in the first hour". If the notion of both terms were the same Ptolemy would have used them optionally in both contexts. On contrary, he confirms in one case that the first hour (πρωΐα) follows the beginning of the day.[10]

A singular and trustworthy Egyptian data concerning the beginning of the day can be found in the archive of el-Lâhûn of the Dynasty XII. A letter was copied into the temple diary that informed the temple staff of the heliacal rise of Sirius.[11] The event is announced in Year 7, i.e. the 7th regnal year of King Senwosret III, for the fourth month of *prj.t* season, day 16. The message was copied in the third month of *prj.t* season on day 25. It means that the Egyptians could fix the event in the calendar at least 22 days before its happening. This fact proves the existence of schematic charts that the Egyptians had compiled on the base of the calendar of 365 days. The beginning of the day is of importance defining the given date as the date of the astronomical event or as the date of the feast that generally fell on the day.[12] Thus the Egyptians used to differentiate the night before the feast from the feast itself by different dates. A striking sample is the night of the *w3gj* feast with the date of the first month of the *3ḫ.t* season, day 17 and the *w3gj* feast itself with the date of the first month of the *3ḫ.t* season, day 18.[13] A further piece of the scroll, i.e. the temple diary of Year 7, is preserved with the entry that the offerings of the feast of the heliacal rise of Sirius entered the temple in the fourth month of prj.t season on day 17.[14]

Researchers believe that this entry is wrong because it is "fully demonstrated" as Parker states that the beginning of the day happened at dawn: "If the beginning of the Egyptian day is connected with lunar month, then we must seek a lunar phenomenon associated with the morning."[15] I consider this argumentation weak because the connection should be proved first. However, we have evidence for a solar connection of the Egyptian calendar as the year of 365 days is the closest to the tropical year. Leo Depuydt solves the problem in the Solomonic way when he writes that "the Egyptian calendar is not only independent from the moon, but also from the sun."[16] He describes the civil calendar of Egypt that "a lunar calendar is tied to, or subordinated to, another full-fledged calendar, namely the civil one".[17] People organizing the calendar on the lunar basis did not invent a year of 365 days. The result of reckoning with the lunar calendar is a year of 354 or 383 days minus resp. plus one day. Hence the striking solar event in the morning is more convincing than the argument of an indefinite event at dawn. Parker himself refers on Ludwig Ideler,[18] Richard Lepsius,[19] and Kurt Sethe.[20] Lepsius and much clearer Sethe were convinced that the sunrise marked the beginning of the day. Sol certus, luna incerta. I accepted their statements proving them by the double dates of Ptolemy.[21] Especially Ptolemy, who has used the Egyptian calendar of 365 days as a useful tool in astronomical reckoning, is a persuading witness in this context. If he is obliged to specify hours instead of the normal angles because

8 Ptolemy, VI 5 Hei 477 for a date after midnight and VI 5 Hei 478 for a date before midnight. Ideler's remarks concern the different use of πρωΐας and ὄρθρος in the Almagest, see 100–101. For a full discussion of the problem see Luft 2006, 207–215.

9 E.g. Ptolemy, IV 9 Hei 329.

10 Ptolemy 1898, III, 1 Hei 206.

11 Papyrus Berlin P.10012A rt (17) – (21); Luft 1992, 2.12.7. with literature.

12 For feast-lists connected with dates see Luft 1992, 2.49.

13 Discussed by Winter 1951, 10–13.

14 Papyrus Berlin P.10012B rt (1) – (2); Luft 1992, 2.13.7.

15 Parker 1950, §32.

16 Depuydt 1998, 18.

17 Depuydt 1998, 19.

18 Ideler 1825, 101–102. Ideler speaks on page 102 about the era of Nabonassar.

19 Lepsius 1849, 130–131.

20 Sethe 1920, 130–138. The reference is erroneous because Sethe refuses beginning on page 131 Meyer's thesis that the Egyptian day has begun at dawn.

21 Luft 1987.

he quoted samples recorded in previous periods, he gives equinoctial hours, daily hours, and hours of the night. That shows an uncertainty in terminology still in the 2nd century AD.

The definition of the beginning of the day has a consequence for chronological computing. Comparing the Egyptian calendar with the Julian one by chronological reasons, one has to count the days till the end of the year. The sum of days to the end or to the beginning of the year multiplied by four results the number of years elapsed since the previous coincidence or passing by till the next coincidence of the heliacal rise of Sirius in both forms of year. One day more counted results an error of four years. Rolf Krauss refused my paper on the beginning of the day in 1990.[22] The reason is obvious: If Krauss would have accepted the beginning of the day he had to reckon with one day more until the end of the Egyptian civil year. The result is, calculating the distance of the Sothic date observed in Elephantine to lunar dates of the Lahun archive, an average derivation of one day. Anthony Spalinger adopted anew Parker's view in 1992.[23] He discussed the hours and the term *ḥḏ-tȝ* in different sources, but he did not distinguish between Egyptian sources of the classical, post-classical and Greek-Roman periods.[24] Hence, evidence of the Esna temple that was decorated in the Roman period is not striking because the use of hours was established by this time. Further the religious context should remind of prudence. The Egyptians made several endeavours to organize the night by star clocks or by the division of twelve hours, but in the daily life, I mean in the organisation of work, hours do not appear. The term *ḥḏ-tȝ* was used in the same unspecified manner as we do it. Today, for some people the morning ends by noon, for others the morning is restricted onto the period around the sunrise. The administration needed the calendar to organize the work, to put dead-lines for taxes, to move people for a timed work etc.

When the Greeks detected the impact of the two calendars they invented the Sothic period in a rather schematic way. Shortly, it was said that every 1460 years the heliacal rise of Sirius, in Greek transliteration Sothis of the Egyptian *Spd.t*, coincides with the beginning of the Egyptian year. The figure 365 as the number of days in the Egyptian year is considered to be quite wanted in Antiquity.[25] It means that the heliacal rise of Sirius fell on one day of the Egyptian year for four years. Eudoxos of Cnidos was said to have been the first using the term τετραετηρίς yet in the 4th century BC.[26] Censorinus naturally knows and translates the term in Latin as *quadriennium*: "Their civil year has only 365 days without nothing intercalating. Thus their four-year-epoch is shorter by approximately one day with the result that the beginning returns by 1461 years".[27] Censorinus naturally reviews the Egyptian year in comparison to the Julian year that was in use more than two centuries.

Greek writers took the heliacal rise of Sirius for the beginning of the Egyptian year. A scholiast to Aratos Phainomena has connected the heliacal

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22 Krauss 1990, 54–55.

23 Spalinger 1992, 156.

24 Spalinger questioned my position that I take Ptolemy for a full witness without considering his period. I see a difference between the use of hours and the use of the civil year. Evidence of the first is lacking.

25 Ptolemy has explained the custom with the statement: "We have used our common year reckoning. As one day is intercalated every four years, the events of the stars fall on the same day for a long period." Ideler 1825, 149: Ptolemy, Star Appearances, introduction. Ideler refers to a text that Buttmann has edited. It is, however, not certain that Ptolemy means the Egyptian civil year with the expression when he continues that the date shifts every four year by one day. It reveals the Julian year.

26 Liddell-Scott 1996, 1780; Lassere 1966, 214–215, rightly discusses the authorship of Eudoxos.

27 Censorinus 1867, XVIII 10. Theon has in his commentary on Ptolemy's Hand Tables (Προχείρους κανόνους) precisely compared the two calendars: "En effet, puisque l'année qui nous est donnée selon les Grecs ou les Alexandrins est de 365 jours ¼ et que l'année selon les Egyptiens est, comme nous l'avons dit, de 365 jour seulement, il est clair que tous les quatre ans cette dernière prend un jour d'avance sur l'année alexandrine, et que, tous les 1460 ans, elle prend 365 jours en avance, soit une année selon les Egyptiens; alors les Alexandrins et les Egyptiens commencent à nouveau l'année ensemble, puis les jours et les mois, le temps compté selon les Egyptiens ayant pris une année entière d'avance. Le retour périodique en question, qui se produit tous les 1460 ans au départ d'origine quelconque, a eu lieu la cinquième année du règne d'Auguste, de sorte qu'à partir de ce moment, les Egyptiens ont recommencé à prendre chaque année une avance d'une quart de jour." Translation of Tihon 1978, 303.

rise of Sirius with the beginning of the inundation and the zodiac sign Leo putting the rise in the 11th hour.[28] Sirius and its rise are consecrated to the goddess Isis, he said, clearly in allusion on the Hellenistic goddess Isis. The statement is to be understood in the terms of the Julian year: the 11th hour is the equinoctial hour of the Julian calendar. Diodorus also connected Isis with Sirius quoting of an encomium that Burton compared with the hymn of Cyme.[29] Servius in his commentary of Aeneas gives a more mythical explication of the relation between the beginning of the inundation and Isis. The goddess shuttles her sistrum as symbol of the inundation.[30] The philosopher Porphyry who was Plotin's pupil situated the heliacal rise of Sirius in the zodiac sign of Cancer,[31] but both signs were named as the period of the heliacal rise of Sirius.[32] Porphyry called the New Year's day New Moon (νουμηνία), but the term is not restricted on the Moon because some times the expression κατὰ σελήνην was added.[33] Naturally, Censorinus is acquainted with the problem fixing the heliacal rise of Sirius on the first day of the month Thoth, being the Egyptian New Year's day, but added the shifting of the civil calendar in relation to the tropical year.[34] He is who has given an necessary hint on the last coincidence of the beginning of the Egyptian year with the heliacal rise of Sirius recording that he lives in 100th year after the coincidence.[35] He did not say which year of the tetraeteris it was but I can imagine that it was the last year of the tetraeteris. Computing lunar eclipses of the time of Hadrian assured that the tetraeteris ran from 136 to 139 AD.[36] Ludwig Borchardt has put the tetraeteris from 139 to 142 AD[37] supporting his argument by coins with the figure of a phoenix.[38] In the time of Marcus Aurelius the chronographer Vettius Valens said that the Egyptians began their year by Thoth 1, their natural year by the rise of the canicula.[39] This statement nourished the guess that the Egyptians used two forms of the year one beside the other. Unfortunately, Egyptian evidence lacks for the third and second millennium BC. Geminus stated that the Egyptian abstaining was consciously maintained when he wrote that the Egyptians did not want that the offerings were fixed on one time.[40] This reason is a rather sophisticated one as well as the king's oath not to alter the length of the year.[41]

The next step of establishing the absolute chronology is to equate the given Egyptian date with the Julian date. Since the Julian calendar did not exist before the first century BC the equation is completely hypothetical. The problem could be solved by exploring the Sothic period also unknown before the introduction of the Julian calendar in at least 29 BC when Octavian saved the calendar reform of Caesar. The known late attempt to correct the length of the Egyptian year is an argument for the unwillingness of the Egyptians to acknowledge the deviation of about six hours a year. This view recorded also in the Greek tradition is proved by the failed attempt to adjust the Egyptian year to the tropical year in 238 BC,[42] but in this time too the Greek side wanted to do so, not the Egyptian partners. They, on the other hand, did not accept the proposed change. Thus the knowl-

[28] Scholia in Aratum v. 152, quoted by Ginzel I 1906, 161; Böckh 1863, 309; Ideler 1825, 125. 172; text edited by Martin 1974, 155–156.

[29] Diodorus 1888, I 27.4; text also in Ideler 1825, 125; Bonneau 1964, 266; Bergman, 39–40; comm. by Burton 1972, 114; cf. Müller 1961, 33–35. Diodorus lived in the first century AD while the hymn belongs to the first or second century.

[30] Bergman 1968, 104.

[31] Porphyry de antro nympharum cap. 24, quoted by Bonneau 1964, 269; Ideler 1825, 126. 171–172; text edited by Hercher 1858.

[32] Geminus 1975, VIII 16, quoted by Ideler 1825, 95. 133; text edited by Aujac 1975: Dositheos July 19; Meton July 21; Euktemon and Eudoxos July 23; Kallippos July 26; Euktemon vaning of the star July 28; quoted by Böckh 1863, 59; Ginzel I 1906, 188–189.

[33] See Liddell & Scott 1996, 1183: "new moon: the first day of the month".

[34] Censorinus XVIII 10; quoted by Ginzel I 1906, 187; Böckh 1863, 308–309; Ideler 1825, 126. 151; text edited by Censorinus 1642 and Censorinus 1867.

[35] Censorinus XXI 10–11 with the corrected date XIII Cal. that Neugebauer 1975, 781 ascribes to Scaliger 1609.

[36] Ptolemäus 1963, 463–464.

[37] Borchardt 1935, 15.

[38] The coins date between the 2nd and the 6th year of Antonin Pius, i.e. they scatter over two tetraeteris. Coins presented by Dutilh 1893, 347.

[39] Canon chron. P. 8 ed. Lips., quoted by Ideler 1825, 126. 171; text edited also by Bainbridge 1648.

[40] Geminus VIII 16, quoted by Ideler 1825, 95. 133; text edited by Aujac 1975.

[41] Nigidius Figulus (ed. Swoboda, 124), quoted by Bonneau 1964, 367.

[42] Text *Urk* II 138; for the date see Parker 1976, 186–189.

edge of the derivation seems to lack in the Egyptian consciousness or if it would have been present in Egyptian thought it was neglected. Greek astronomers detected the cause of shifting of the Egyptian year in relation to the tropical year.[43] Many researchers are convinced that the Egyptians precisely observed the movement of the stars and the moon. It is possible that they did so, but there is no evidence. If somebody would take the star clocks as proof he should explain their context too. The star clocks were invented to organize the night, I mean, for the dead. In the netherworld watches would have their own pace. The figure 36[44] connects the star clocks to a year of 360 days, but the Egyptians made the experience that 360 days is to short until the next inundation. Hence they joined five days to their year that were called "days upon the year". The principle is clear: the Egyptians did not use fractions of day. Thus the year consists of 365 units called day, i.e. one daily turn of the earth. Observation was not the Egyptian lifestyle, rather subordination under the natural and social order, called Maat. The eventuality of observing celestial events was excluded from their speculation and not the basis of their thinking.

In 1885 von Oppolzer's investigations on the Sothic cycle showed the result that its length shortens running with the time.[45] Then the Greek tradition of 1460 years for a cycle appeared to be prolonged at least by four years. Von Oppolzer lowered the number of years to 1456 which figure was accepted by the astronomer Paul Viktor Neugebauer who compiled astronomical charts suitable for historians too.[46] However, it turned out that the figure decreased by average two years to present as the English astronomer Ingham has calculated in the 1960ties[47] scrutinizing the scheme to a chart of 1456, 1454, and 1452 years to present. Historians took 139 AD as starting point and counted with 1460 years from this point. Consequently, they used the factor 4 within the interval of two coincidences. The result shows about six years more, the result was 1872 BC for the year in question, i.e. Year 7 of King Senwosret III of Dynasty XII. This result is not precise because researchers did not take into consideration that the Sothic cycle was shorter than 1460 Julian years. Thus starting from Year 136 AD as the first year of the tetraeteris the coincidence would repeat in –1316 and –2771. For the interval between the two coincidences it is appropriated to use a factor less than 4 for multiplying the days between the given date and the end of the Egyptian year. I have explained this method in a paper published in 1989.[48]

The calculation of the Sothic period with 1460 years in Antiquity is proved by the statement of Theon that 1605 years elapsed from Menophris until the beginning of the reign of Diocletian in 284 AD. The calculation is in accord with the calculation from 139 AD.[49] Unfortunately, Censorinus did not give the number of years elapsed "since Menophris", but his statement that he writes *in* the 100th year of the great year also called sun year[50] clearly reveals that he considered the year as a period, not as point. Censorinus gives a hint when the event happened in the Julian year: "However – he writes – their beginning – he means the years after Nabonassar and Philipp – coincides with the first day of the month that the Egyptians call Thoth which happened seven days before the calends of July in this year".[51] He gives also the date of the coincidence 100 years before when he said that "the same day happened 12 days before the calends of August". The disturbing number 12 apparently was emended by Scaliger yet in 1609.[52] The antique tradition was not so precise as two Latin and one Greek sources may demonstrate.[53] Starting from Censorinus' date the year 139 AD was the first match of the coin-

43 I have taken for sure that Meton knew the cause yet in 432 BC, see Luft 1989, 218 note 6.

44 The figure varies, see Parker – Neugebauer.

45 Von Oppolzer 1885, 557–584, especially 579.

46 Neugebauer 1925, cahier III.

47 Ingham 1969, 36–40.

48 Luft 1989, 226–228.

49 Theon quoted by Ideler 1825, 136; Lepsius 1849, 169–174; Ginzel I 1906, 193.

50 ἡλιακός, a quibusdam dicitur, et ab aliis ἡ θεοῦ ἐνιαυτός., Censorinus 1867, XVIII 10; in commentary 1642, 136: id est, Solis. XXI 11 he states that „quare scire etiam licet, anni illius magni, qui, ut supra dictum est, et solaris et canicularis et dei annus vocatur, nunc agi vertentem annum centesimum".

51 Censorinus 1867, XXI 10.

52 Ptolemäus 1963, 701.

53 Solinus XXXIII 13, quoted by Bonneau 1964, 42, worked about the mid 3rd century AD he said that "the priests regard this time for the birth of the world, that is between 13 und 11 days before the calends of August." Palladius 1898, quoted by Ginzel I 1906, 188, bishop of the turn to the 5th century refers to the 14th day before the calends of August, that means the 19th

cidence counting back from 239 AD and taking into consideration that the tetraeteris happened between 136 and 139, further that the Sothic period was shorter than 1460 years accepting Ingham's decreasing figures the years –1316 and –2771 are most reasonable the first years of a tetraeteris in which the heliacal rise of Sirius coincides with the first day of the Egyptian year. Since the given date of the Middle Kingdom falls between two coincidences the factor 3.98 should be used. The result is –1866, a year of a tetraeteris between the two pertinent coincidence.

The heliacal rise of Sirius was probably observed in the same way that Muslims do it nowadays. A Muslim calendar is available in the previous year showing all lunar feasts of the coming year. In spite of that the Muslim world is waiting for the announcement of the end of the holy month Ramadan by the sheikh of Mecca. A similar situation could be reconstructed for the 18^{th} century BC revealing the few evidence of the period. First, there is the announcement of the heliacal rise of Sirius to the staff of the mortuary temple of King Senwosret II in el-Lâhûn for a precise date. Second, the event was announced, i.e. it could be calculated before. Third, the data belongs to a certain place. Four, Jannine Bourriau has published a stele of the Fitzwilliam Museum Cambridge where the nomarkhes is waited by people assembled in front of the Memphite temple that he assures the astronomical event.[54] Hence, researchers should take into consideration that the date could be corrected within the civil calendar from time to time. However, the Egyptians did not consider the heliacal rise of Sirius as the beginning of the year; they took it as sign of the approaching inundation that put a lot of tasks on the provincial administration.

Much ado rose concerning the angle of observation and the place of observation. As I have demonstrated that chronology is a calendar matter, not an astronomical one, astronomy is restricted onto the development of the calendar. Once established the Egyptians maintained the calendar without intercalation to correct the derivation of six hours a year. Hence the local appearance of the star was more important for the local administration. It is why I think that the date of el-Lâhûn is tied to the latitude of the Memphite region because the star appeared approximately one day later in accord with the advancement of the inundation with one degree of latitude from South to North. The place of the observation was additionally supported by relating the Sothic date to lunar dates of the archive in my book of 1992. In 2003 I only want to emphasize the priority of the dates in their relation.[55] The Sothic date is a date of long space because it appears twice on the same day of the Egyptian calendar during 2008 Julian years. On the other hand, lunar dates repeat in the Egyptian calendar every 25 years that means four times in one century. Hence the lunar date can only back up the long timing date.

Concerning the angle of observation I have taken into consideration that the astronomical events were supposedly calculated according to a scheme. Working with lunar dates of the Lâhûn archive I made the experience that there was no lunar calendar in use before Year 9 of Senwosret III. All lunar dates are expressed in the terms of the Egyptian civil calendar of 365 days. Thus, the Egyptian administration has used lunar dates only to appoint feasts as well as lunar months to organise the work in the temple.

of July. Hephaistion 1973, I 23, Hephaistion of Thebes who lived in the fourth century AD considered the 25^{th} day of Epiphi being the day of the heliacal rise of Sirius. Hephaistion 1973, VI–VII considered as regest of Ptolemy, Apostelesmaticorum. If Hephaistion has used the data of Ptolemy as the editor Pingree assumes the date would fall in a year between 10 and 20 AD.

[54] Bourriau 1982, 51–53.

[55] Luft 2003.

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