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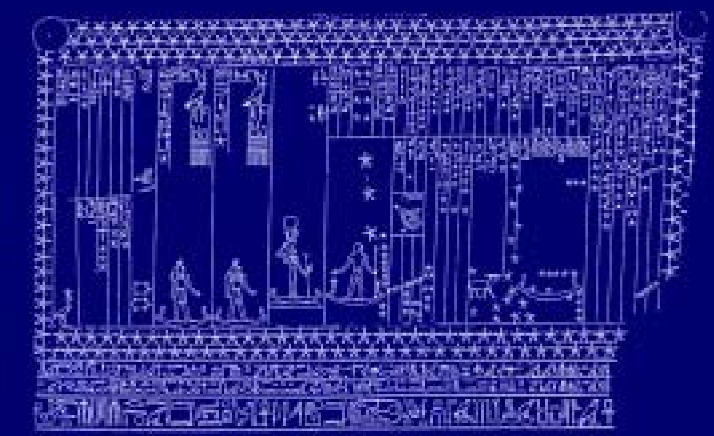
by OVE VON SPAETH



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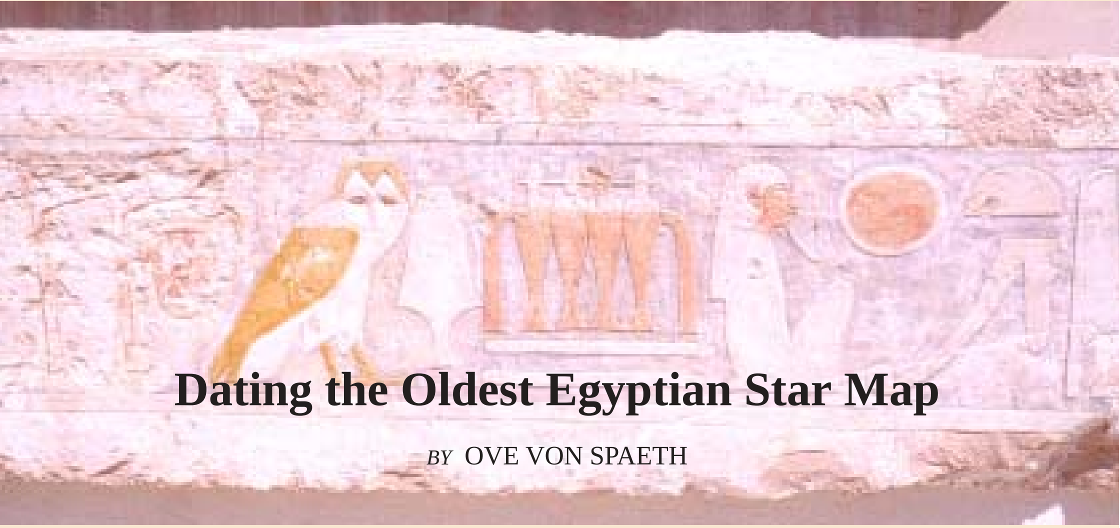

Dating the Oldest Egyptian Star Map

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1. Senmut's Star Map Dated

The earliest known star maps in Egypt are found as a main part of the decor in a tomb (No. TT 353) at Thebes on the West bank of the Nile. The tomb was constructed during the first half of the Egyptian 18th dynasty, probably about 1490 BC, and it belonged to Queen Hatshepsut's vizier and calendar registrar *Senmut* (or *Senenmut)*.

The Senmut maps, Fig. 1, are almost 4 metres long. They are found on the *southern* and *northern* panels of the ceiling, which is shaped as the inner part of a low-pitched roof of the burial chamber hewed out of the subterranean rock.

The map on the southern panel proves to reflect a specific conjunction of planets around the longitude of Sirius. This particular configuration of planets actually occurred in the sky about May 1534 BC. These characteristics of the maps have not been *recognized* before. Egyptologists identified the planets on the maps long ago, but the actual occurrence of their configuration in the sky can now be verified through modern astronomical calculation.

Definite planet configurations repeat themselves at certain intervals and if many planets are involved, at very long intervals. The configuration in question here, however, deals with all the planets except Mars whose position is opposite to the group formed by the other planets. This pattern occurs so seldom that alternative datings can be excluded. Table 1 lists the possible occurrences between 2500 BC and AD 100.

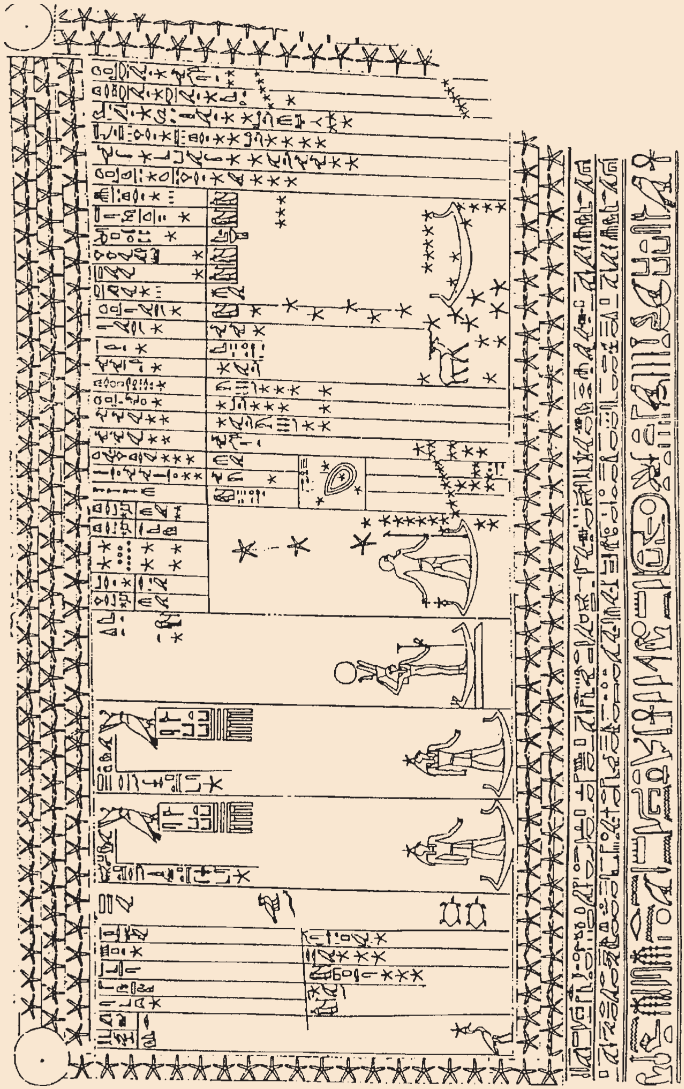

Fig. 1. Senmut's star maps in the ceiling of the tomb. Southern panel.

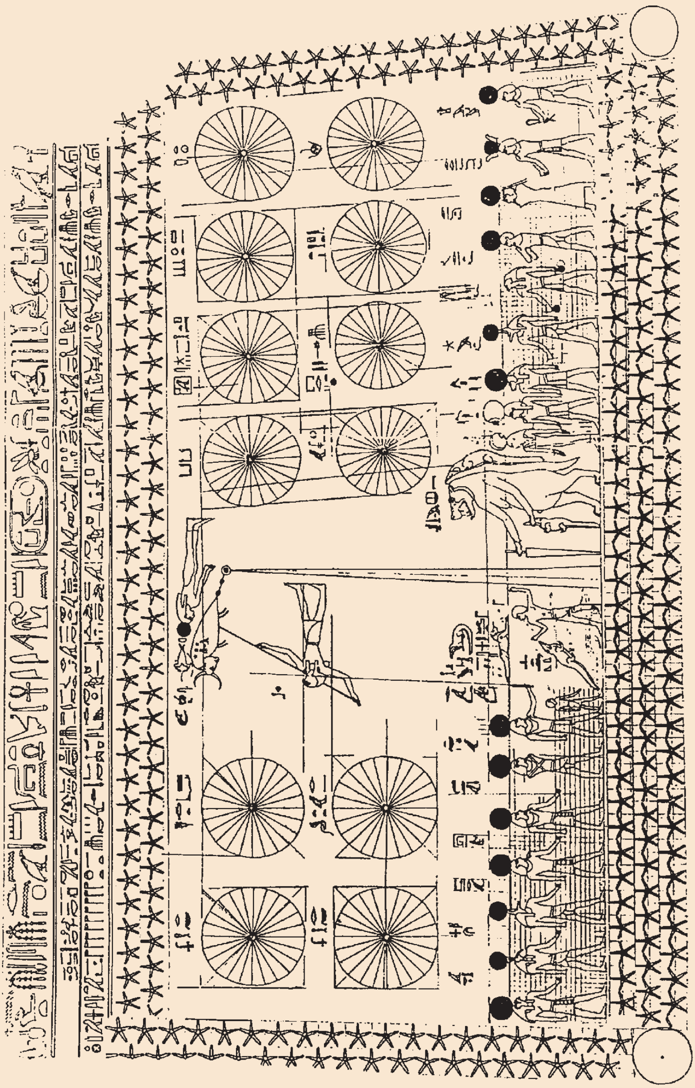

Fig. 1. Senmut's star maps in the ceiling of the tomb. Northern panel.

The Egyptologist H.E. Winlock (1928, 1941) discovered the maps in 1927 during his excavation of Senmut's "second" tomb. Further descriptions were made by his colleagues Christine Meyer (1982) and Peter F. Dorman (1988, 1991). The maps themselves were analysed by the Egyptologists Alexandre Pogo (1930), Christian Leitz (1991), Marshall Clagett (1995), and particularly by Richard A. Parker in cooperation with the historian of science Otto Neugebauer (1962, 1969).

According to datings on potsherds left by the craftsmen working in the tomb of Senmut the entombment was constructed during 11th-l6th years of Hatshepsut's reign. Here the 16th year is about 1493 BC but 10-25 years later according to some lowdating hypothesis. So especially in a highdating type of chronology the conjunction of 1534 BC is likely to have occurred in the earliest years of Senmut's life. During many years investigators have discussed the problematic dating of this Egyptian period. Now the independent dating of these maps may help to settle the chronology.

2. *The Pattern of Planets Around Sirius*

The Egyptians divided the 360 degrees of the ecliptic into 36 sections of 10 degrees each. This division was known already before 2300 BC. Each ten-degree section (later called *decan* from ancient Greek for '10', *deca)* was characterized by an "asterism". These constellations of stars served as marks of recognition. They are lined up along the ecliptica, most of them on its "underside". Because the Earth performs a full rotation in 24 hours, a new decan will, on the average, rise above the horizon every 40 minutes. The system of decans was used for the determination both of night hours and of calendar seasons.

As the belt of decans itself runs parallel to the "orbit" of the sun (the ecliptic), the sun will pass a new decan every 10 days because of the annual motion of the Earth. So each decan constitutes 10 of the "sun's day journeys" whence the Egyptian year calendar contains 36 weeks of 10 days each – and in addition 5 intercalary days at New Year.

If nothing else is indicated in our material, the decans are denominated in accordance with Neugebauer & Parker's "Egyptian Astronomical Texts", (1962-1969).[1]

The map on the *northern* panel of the ceiling has cosmological drawings

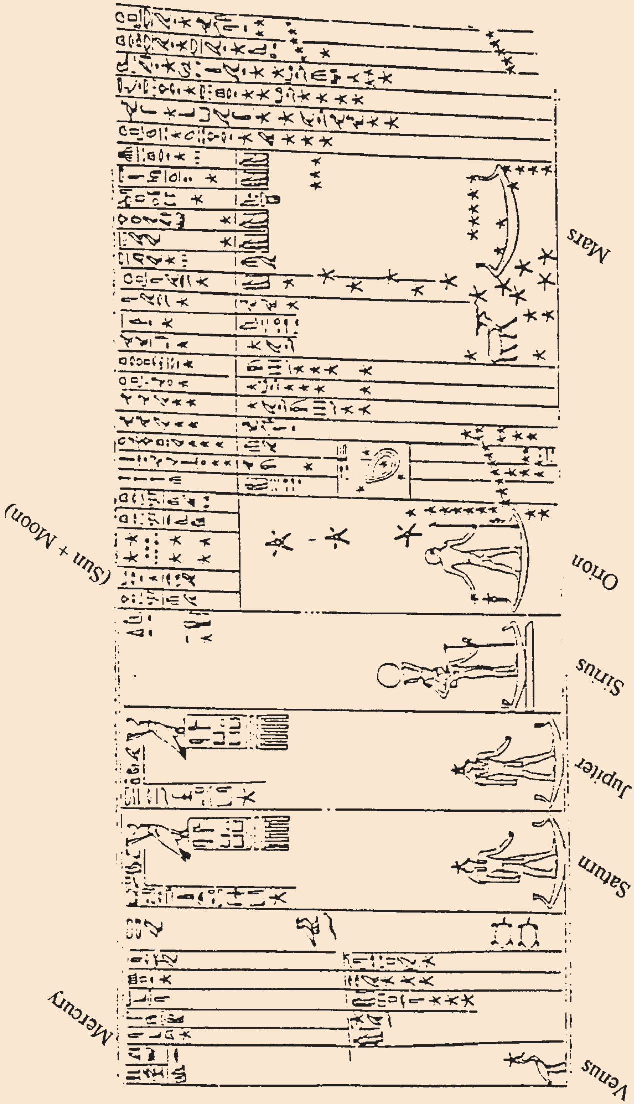

Fig. 2. The planets on the map of the southern ceiling panel. The decan sequence is to be read from right to left.

of star gods or demons. They represent some of the most important days, sacred feast days of the month. Senmut, being also the supreme calendar registrar of the country, had furthermore drawn 12 month-circles, which are not found on later maps.

The map on the *southern* panel, Fig. 2., is *datable* as will be shown below It is divided into many columns. Most of these represent decans in a traditional and firm sequence known from the sidereal clock system. In this system the decan containing Sirius is always the last: no. 36. The map with its sequence of decans is to be read from right to left.

The oldest known Egyptian sidereal clocks, from about 2100 BC, are often seen in the form of a diagonal scheme: decan diagrams (Pogo 1932). Senmut “moved” such schemes from the inside of a coffin lid, their usual place in a tomb, and in an extended version placed them onto the ceiling panel. Senmut simply listed the decans themselves *without* the complicated diagonal diagram, but added more components producing a complete map of the firmament with planets and constellations.

As one of the earliest known constellations or star(s) Senmut has depicted Sirius on the *southern* map. For the Egyptians this star personifies the most important goddess Isis. On the map she occupies the most important decan no. 36 while *Sahu (s3h)*, ‘Orion’, is seen below the decans nos. 31-35.

The planets Jupiter and Saturn, both recognisable by their falcon heads, follow Sirius/Isis. Jupiter is seen in the column next to Isis, who possesses the most honourable place. All of them are equipped with a ceremonial boat (barque). By themselves these boats *also* indicate: ‘sliding movement’, cf. in other connections the well-known picture of the Sun in the sun boat. The columns with planets do not represent decans.

Jupiter and Saturn are followed, to the left, by the “minor” planets: Mercury, only indicated by name, as well as Venus indicated by the bird *Benu*. The planet Mars, however, is not included in the actual grouping and at first sight seems to be missing in the map (but see paragraph 3).

This narrow grouping of planets around Sirius on the *southern* map turns out to reflect a rare occurrence of a conjunction in the Sirius section of the firmament. This paves the way for an exact determination of time – cf. the statistics worked out for relevant conjunctions (Table 1).

It is easy to demonstrate from the traditional order of the decans as well as from their extensions – that *stars* like Sirius and Orion are placed in this southern map at *the positions where they belong* in the sky.

Year BC	Month approx.	Mars/ west	Mars/ east	Mars retrograde	Historical period
2447	April–May		×		
2413	May		×		
2387	April–May		×		
2329	May		×		
2210	April–May		×		
2150	June		×		
2092	May		×		
2090	May		×		
2033	May		×		
2031	April		×		
1973	April–May		×		
1915	June		×		
1913	May–June		×		
1855	June		×		
1853	May		×		
1796	May		×		
1794	April		×		
1736	June		×		
1618	May		×		
1593	May		×		
1534	April–May	×		×	Senmut map
1533	May–June		×		
1475	May–June		×		
1415	May–June		×		Amenhotep III map
1356	April–May		×		
1297	April–May	×		(×)	Seti I map
1296	May–June		×		
1238	April–June		×		Ramses II map
1178	May		×		...
1061	May		×		Hereafter seem similar maps often
1059	May		×		made at times less dependent of
1001	May		×		conjunctions. (Map descriptions are all
941	June		×		reproduced by Neugebauer & Parker).
882	May		×		
824	June		×		
798	May		×		
681	June		×		
621	May		×		
620	June	×		×	
442	May		×		
326	May		×		
205	May		×		
4 BC	May–June	×		×	
57 AD	June		×		

Table 1. Occurrences of the special conjunctions from 2500 BC to AD 100: Jupiter, Saturn, Mercury, and Venus within 30 degrees from the Sirius longitude (which passes from 39 to 68 degrees during the 2600 years). Mars is either included – or is at west positions between 250 and 270 degrees.

In Senmut's map , this principle for the first time has also been applied to *the planets*, as we shall see. So in the same way the positions of the planets can also be determined by reference to the well-known positions of the decan stars. And this in turn leads to a *particular date* for the appearance of the conjunction in question.

3. The Mars Problem – Jupiter and Saturn

The conjunction in the sky in 1534 BC, cf. Table 2 and Fig. 3, contains Sirius, Jupiter, Saturn, Mercury and Venus, but not necessarily in this traditional order. In this case all planets, except Mars, are placed in the Sirius area of the sky. As far as Mars is concerned, two versions of the conjunction must be considered:

a: – At the conjunction in 1534 BC Mars was at a distance from the other planets. According to the statistics of Table 1 Mars is in a special relation – "opposition" – in the actual case 240-270 degrees from the vernal equinox. Mars is, as it will appear below, also pictured in the Senmut map. This has not been noticed in previous literature. In the *western* part of the firmament this planet is seen on its way to the south.

b: – Several later versions of similar Egyptian star maps are showing Mars in a boat, but in the east, i.e. in conjunction with the other planets.

The map of Senmut, however, only pictures an *empty* boat – and this is in the *west.* This seems to refer to the fact that in April-May 1534 BC Mars was *retrograde* so that in this backward movement (well known phenomenon to the Egyptians, see note 3) the Mars position was perhaps not considered to be "concrete".

This boat and the accompanying texts have hitherto been interpreted as being the names of surrounding decans. However, the "empty boat" illustration cannot express a constellation: It has the same form as the other "vehicles" of the celestial gods (Orion, Sirius, and the planets). Furthermore, the two tt'es in the context clearly points to Mars:

> "…The red travels/sails south *(tms hntt (=tjemes khentet))…*".

This is a designation for the always red planet Mars. It was only later that Mars also was mentioned particularly as 'Horus the red' *(Hr dsr).*

The arrangement on the map shows that Mars actually is "…on his way south…" and unequivocally that he is not in the east (not together with the other planets). This is contrary to the position of Mars on all later Egyptian star maps.

On the map of Senmut the planet *Jupiter* is called:

> "…Horus, whose name is: he who divides/demarcates the two countries – star on southern sky…".

Here Jupiter is placed close to a line, important in antiquity, formed by the celestial longitude of Sirius dividing the sky into two halves, "countries" (territories) – southern and northern. At the beginning of the conjunction period the position of Jupiter was close to the Sirius longitude, less than half a degree to the south in accordance with the expression "southern" in the text.[2]

The next planet *Saturn* has, on the map of Senmut, the designation:

> "…whose name is bull of heaven, who ferries/sails – star on eastern sky…".

This too is in full accordance with the situation in 1534 BC. And from the detailed survey in Table 2 and Fig. 3 it appears that, of all planets, Saturn was easternmost placed only 30 degrees from the vernal equinox. And

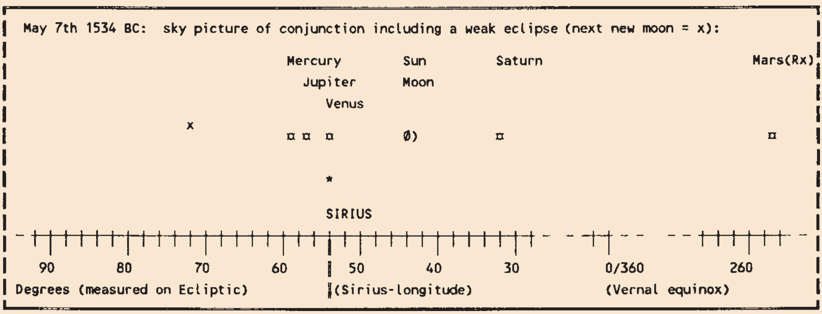

Fig. 3. Survey of the sky in 1534 BC when the planets were gathered around Sirius. The planets are here depicted on a straight line, although in reality, they are placed in different latitudes. However, this does not influence the exactitude of the analysis.

"bull" was often the predicate of a planet; especially the great planets were called "oxens of the sky".

4. *The Year of the Senmut Map Conjunction – Fixed by Astronomy*

Table 1 reveals the frequency of occurrences of the pattern of the conjunction within a defined area of the sky. The grouping on the Senmut map showing the majority of planets within a narrow part of the firmament suggests that the Egyptians dealt with the idea of "conjunction".

However, the extension of their conjunction area is uncertain. Therefore an amply broad margin has been chosen of approx. 30 degrees to either side of Sirius. Thus the conjunction interval covers longitudes between 25 and 85 degrees. In the time of Senmut the star of Sirius was about 54 degrees from the vernal equinox.

A few cases of Table 1 go with a larger margin than the 30 degrees from Sirius because the Egyptians may have counted the situation as a continuation of the conjunction. It might, in such cases, have been extended to the occurrence of the following new moon or – in some cases for reasons of marking the limits of the extension – full moon: The planets could not be observed directly (and their positions were partly calculated) before the sun had left the conjunction.

During 1400 years after Senmut these star maps with similar descriptions were *in principle* imitated or produced in accordance with the very Senmut map design. Table 1 covers the years from 2500 BC to AD 100. Thus the entire period of historical interest is covered and has been given a broad margin at both ends.

Furthermore, it is necessary to take into account the precession of the equinoxes. During 2600 years the longitude of Sirius changed from 39 to 68 degrees.

The method of finding the conjunctions (actually proved to be rational and well functioning, cf. von Spaeth 1994) was executed by a search for the cycles of the slowest planet Saturn: 29.5 years, going to meet with Jupiter: cycles of 11.7 years, and hereafter with Mars: cycles of 1.8 years, etc.

A general method uses the fact that 2 revolutions of Saturn are in resonance with 5 revolutions of Jupiter during 59 solar years. Furthermore, 19 revolutions of Mars are in resonance with 3 revolutions of Jupiter during 35 solar years.

For reasons of coordination, Mars in Table 2 is given 20 degrees for its possible movement: It is a distance this relatively slow planet is not able to surpass within the time which some of the more fast planets inside the eastern group will use to reach their given maximum limits within 60 degrees.

A computer programme for fine assessment was used, but to catch the (two types of) conjunctions the operation was initiated by using the table work of Stahlman & Gingerich (1963) which covers a period of 4500 years. It indicates at 10 days' intervals the positions of the sun and the planets within a clearance of half a degree. The Julian calendar style has in Table 2 been converted into our present Gregorian calendar style.

The designation "BC" starting with year 1 – contrary to astronomical counting starting with year 0 – is used here because it is still most frequently used by historians.

5. *Evaluation*

Out of altogether 44 conjunctions in Table 1 we find 40 of the "modified" non-original version where Mars joins the other planets in the east. The conjunctions listed appear on the average about every 60th year, but actually the intervals vary between 1 and 201 years.

The original Senmut conjunction, however, with Mars in the west occurs no more than four times within the 2600 years considered.

And Mars is strictly "retrograde" in only three of the cases. During the second occurrence – indicated in Table 1 by '(x)' – in 1297 BC Mars is not retrograde before June, and this is at least three weeks after Venus has left the conjunction so that it is no longer complete. This makes it less relevant from a statistical point of view.

Obviously the third and fourth occurrences, in 620 BC and 4 BC, cannot reasonably be connected with Senmut a millennium or more earlier. Thus we are left with the 1534 BC configuration for closer consideration.

Senmut's omission of Mars in the east is reasonably not an "oversight" in this precise map thoroughly elaborated by a specialist. So it appears unlikely that this map should refer to the conjunctions of 1533 BC or 1475 BC. Table 2, demonstrating that the configuration of the Senmut map goes especially well with the 1534 BC conjunction, also emphasizes this.

To conclude: The pattern of the 1534 BC conjunction is rather unique, and it squares with the positions of the planets in Senmut's celestial map. Also this will suggest the highly probable solution that this particular map reflects the actual conjunction in the sky.

6. *Later Conjunctions of This Type Also Depicted*

Further perspectives support the solution: Star maps created through at least 300 years after Senmut also depict, in principle, "his" type of conjunction – the only type. Furthermore our investigation shows that the map constructions were executed at the same time as the conjunctions occurred in the sky.

Table 1 shows similar occurrences of this conjunction in the sky by as we shall see – several recorded events: *a)* May-June 1415 BC, *b)* April-May 1297 BC/April-May 1296 BC, and *c)* April-June 1238 BC. The first date also includes a lunar eclipse. And in all these cases, except for 1297 BC, Mars joined the group in *the east.*

It is a hitherto unknown fact that the years for these cases correspond to the star map-depictions created in the very same periods. These star maps, containing the same principal type of conjunction, belonged to respectively Amenhotep III, Seti I, and Ramses II.[3]

Among the maps concerned, the first one seems to have no signs of Mars, but the two other maps depict Mars in the east – where it also is found in the sky. In all these cases, when copying the principal pattern of Senmut's map, the (empty) boat of Mars in the west, now out of its former use, obviously confused several map copyists. They "obscured" it (by Amenhotep III) or changed it to be either a solar boat (by Ramses II) or a boat with a crew of four gods (by Seti I).

Altogether it shows that the dates of conjunctions, exactly occurring in the times of these pharaohs, also were the dates (periods) of the creation of the star maps. In other words, an established tradition seems to exist: Star maps with this type of conjunctions were – again, at least during 300 years after the Senmut map depicted *only* at times of just those pharaohs under which such a conjunction *de facto* occurred in the sky.

Although it may conflict with certain *low* dating hypotheses, the concrete conditions found may also reflect the following consideration: The obvious probability exists that when the rare conjunction occurred in 1534 BC it was already within the lifetime of Senmut. However this question deserves an independent investigation.

7. *Solar Eclipse Found*

On the Senmut map several inscriptions by and large refer to a special day during the period of the conjunction in May-June 1534 BC.

One of these inscriptions is placed as an immediate continuation of decan no. 31 and shows the hieroglyphs *iret Her (irt Hr),* i.e. 'Eye of Horus'. On the map this is placed above Orion.

In several specific connections *irt Hr* means 'sun' or 'moon': "Horus' right/ left eye" respectively. And this also appears in the old Egyptian text collection now called "The Egyptian Book of the Dead" (Faulkner 1972, Hornung 1979) and has the context "…a defect *jated (j3tt)* in the eye of the sun (Horus)…", this being of astronomical as well as cosmological significance. Cf. *j3tt* in Erman & Grapow (1925, vol. 1, p. 35). And especially chapter 80.4 of "The Egyptian Book of the Dead" has:

> "…The disabled (or 'not correct') condition of the Horus' eye *(irt Hr m j3tt s (=iret Her em jatet es))…*".

And *j3tt* is an expression used for 'eclipse' when mentioned in connection with the sun or moon.[4] Cf. the Egyptologist Renouf's "The Eclipse in Egyptian Texts" (1903, vol. 2, pp. 295-303). And in the same chapter 80 of "Book of the Dead" this concept corresponds to the mentioning of specific days of the lunar month; for the actual days refer to those days in a lunar month, where an eclipse of the sun or the moon may occur. The chapters, 112-116, also contain references to eclipses.

Egyptian specific astronomical reproductions of the sky with stars seldom show the sun or the moon, and neither does the Senmut map show the sun directly e.g. like Horus in a sun boat or the sun disc Aton or the like. However, the text *irt Hr* of the decan no. 31 seems by itself to reflect *more* than the mere presence of the sun or the moon, namely *an eclipse.*

Several of our tables of ancient eclipses have been found less applicable for the present research because of their increasing unreliability for very ancient dates. They often build on more than a hundred years old tables by T. Oppolzer (1884) as well as Paul V. Neugebauer (1929) and later on K. Schock (1930). These investigators did not yet know precisely the precession of the vernal equinox (i.e. concerning accurate values for the secular acceleration in ancient time).

Eclipses depend on the motion of the nodes of the lunar orbit which in their course may deviate up to 1.5 degrees from an average position. This has also been taken in consideration in the present analysis.

Using one of the best works for the purpose, Meus & Mucke: "Canon of Lunar Eclipses –2002 to +2556" (1979), we looked for possible eclipses. The result is found in Table 2. Thus a lunar eclipse was found within the period of the conjunction of 1534 BC, namely on May 22nd (June 5th Julian calendar) at Thebes at approx. 22.30 hours local time.

This information naturally led to look for a solar eclipse which may appear half a month before or after a lunar eclipse. In addition, a more fine assessment have been undertaken by advanced treatment with computer aid from RCCO leading to the following result:[5]

– On May 7th 1534 BC at 10.02 Thebes local time (7h 56m 39s UT) a solar eclipse occurred; it was very small, almost like an insignificant glimpse, which could only be noticed by close attention.

During the solar eclipse the sun and the moon passed the longitude of approx. 45 degrees: It is relatively close to Sirius' longitude, 54;19 degrees. Now the distance between the said eclipse and Sirius seems also to be reflected in the Senmut map showing that between the solar eclipse and Sirius is found one decan i.e. 10 degrees.

The existence of a kind of a traditional sequence or classical rank order of the planets is well known. In most details this order does fit with the 1534-conjunction in the sky. So in order to make the map depict this conjunction and at the same time express the classical sequence, Senmut did not entirely follow the full decan sequence of stardials a few decans are interchanged (a well known fact: Fig. 4). By this minor reshuffle of decans Senmut achieved a solution of several problems: the graphical arrangement on the map should demonstrate the true conjunction and solar eclipse as well as the combination of decans with the traditional sequence of planets.

Thus it was not possible for Saturn to be placed where it should be according to its actual celestial position within the Senmut decan no. 34 (by Neugebauer & Parker) – i.e. between the always joint pair of Sirius and Orion – not without splitting the superior classical sequence.[6]

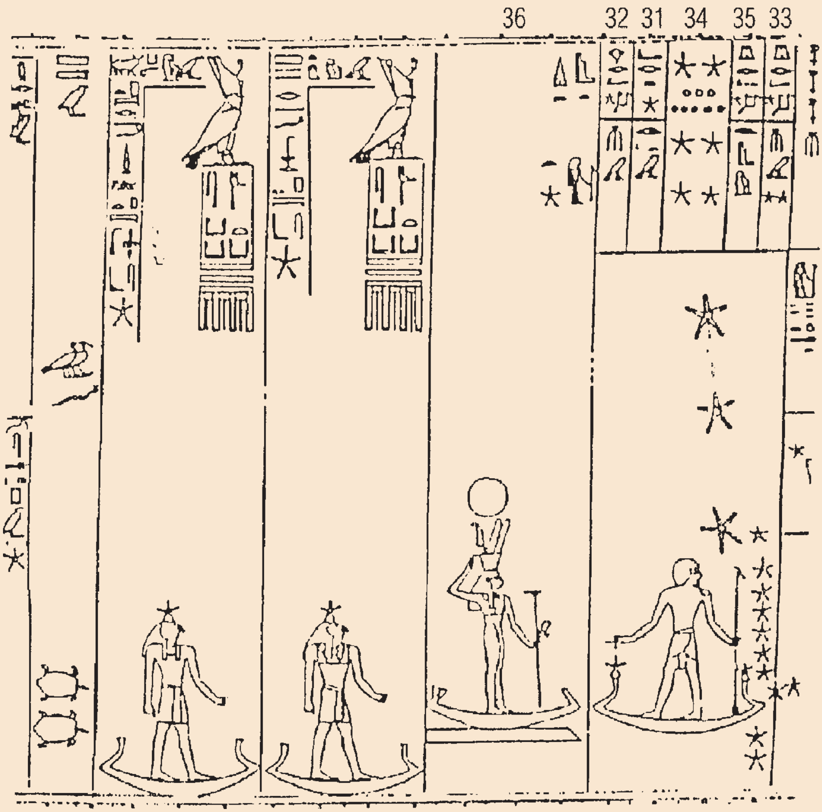

Fig. 4. At the bottom of decan no. 31 just above the Orion "compartment" are shown the hieroglyphical signs for a solar eclipse. To the right, decan no. 34, are shown the 8 globes – while at the bottom of decan no. 35 are shown the signs for Osiris, here as representing "end of month".

8. *Extraordinary Information About the Turn of the Month*

The Egyptians had lunar months in addition to the fixed calendar year of 12 months plus 5 intercalary days. According to R.A. Parker: "The Calendars of Egypt" *(1950)* the lunar months began at the "astronomical new moon", i.e. when the moon, during its period of invisibility passes the sun.

So in the year of interest 1534 BC the 7th of May (new moon, and here withits faint solar eclipse) marks the beginning of the month. This event seems reflected on the *southern* map in decan no. 31 (see Fig. 4.).

The column on its right side, no. 34, appears not to be a decan, but (at that time) a pseudo-decan. Here you will find 8 small circles surrounded by stars. In most of the later Egyptian maps these "globes" have been replaced by a text:

> "…last day of the month, *tjesarek (ts 'rk)…*",

which is a well known concept referring to the turn of the month.

This expression *tjesarek* is later seen adopted as an immobile decan-name in the actual Orion area, in spite of the fact that the turns of lunar months fall on different days in different years.

The small globes seem to signify the great conjunction of celestial bodies "around" Sirius.[7] Next to the globes, to the right, you find in column no. 35 the text "Osiris" – representing the dying old moon, i.e. the end of last month.

To the left of the column no. 34, texts are found in col. no. 31 indicating the above mentioned *irt Hr* as well as *ms Hr* – representing the solar eclipse (like all the new moons 'the birthday of Horus'), and by that: the beginning of the lunar month.

Summary: In the columns nos. 35, 34, and 31 (as their special sequence on the map is in that order) is thus expressed a comprehensive account of the turn of the month which produced a solar eclipse – all included in the conjunction of the celestial bodies "around" Sirius. Thus no. 35: the old moon – no. 34: the very conjunction (the globes) – and no. 31: new moon/eclipse. The star map of Senmut, therefore, seems to be correctly dated *also* in relation to this solar eclipse.

9. *Senmut's Star Map and Conjunctions of That Time*

In both Table 2 and Fig. 3. the longitudes of the planets are shown to the nearest integral degree.

Sirius marks here the defined initial position – from which the limits are fixed for the planet groupings to be researched. So the longitude of Sirius is given to its nearest minute of arc – as calculated by RCCO.

Year BC	Planet sequence related to Sirius, indicated by longitudes						
1534	April 24 – conjunction start, incl. full moon:						
	Saturn	Mercury	Sun	Venus	Jupiter	SIRIUS	Mars/west
	30	30	31	36	54	54;19	255
1534	May 7 – CULMINATION OF CONJUNCTION, incl. faint solar eclipse:						
	Saturn	Sun+Moon	SIRIUS	Venus	Jupiter	Mercury	Mars/westRx
	32	45	54;19	55	57	59	257 Rx
1534	May 22 – end of conjunction, incl. lunar eclipse:						
	Saturn	SIRIUS	Sun	Jupiter	Venus	Mercury	Mars/westRx
	34	54;19	59	60	72	84	255 Rx
1534	June 16 – Venus (103) passes Mercury which becomes S; Mars becomes D						
SENMUT planet positions according to original (star clock) sequence of decans:							
	Saturn	(Sun+ Moon)	SIRIUS	Jupiter	Mercury	Venus	Mars/westRx
texts:	Easthoriz.	Horus-eye		Southern sky			
SENMUT planet positions according to graphical presentation of the sequence:							
	(Sun+ Moon)	SIRIUS	Jupiter	Saturn	Mercury	Venus	Mars/westRx
1533	May 11 – start of conjunction, incl. lunar eclipse:						
	(Venus)	Saturn	Sun	SIRIUS	Mars/east	Mercury	Jupiter
	(7)	45	49	54;20	66	75	83
1533	June 10 – end of conjunction:						
	Venus	Saturn	SIRIUS	Sun	MercuryRx	Mars/east	(Jupiter)
	41	50	54;20	78	78	85	(89)
1475	May 16 – start of conjunction, incl. new moon:						
	Saturn	Mars/east	Jupiter	Venus	Sun+Moon	SIRIUS	Mercury
	35	38	49	52	53	55;08	70
1475	June 15 – end of conjunction, incl. new moon:						
	Saturn	SIRIUS	Mars/east	Jupiter	Sun+Moon	Venus	(Mercury)
	38	55;08	56	58	71	85	(106)
(next conjunction with this pattern was in May-June 1415 BC – i.e. too late).							

Rx=retrograde
S=stationary before/after Rx-turning
D=planet moves directly forward
( )=not formally represented
Dates=modern (Gregorian) calendar

Table 2. Conjunctions at the time of Senmut in relation to his map.

The precession of the equinoxes has been taken into account for Sirius – in accordance with Moesgaard & Kahl Kristensen: The Bright Stars of the Zodiac" (1976).

The proper motion of Sirius was considered by RCCO and it was found to be without significance in this connection. The various conjunctions in Table 1 has been given a duration stretching from one new moon(/eclipse) – or full moon – to the next. Especially cases with new moon were chosen because the moon by joining the group makes the conjunction most complete.

10. Conclusion

During the years being closely examined in Table 2 no other real conjunction in the sky shows a pattern following in all details the original planet sequence from the year 1534. This gives a further indication that *a connection* between a *real conjunction* in the sky and the mapping of the planet pattern was deliberate and intentional.

The basic form of the graphic configuration was created in the Senmut map with its idealized, yet unambiguous picture of a particular configuration in the sky:

The Senmut map depicts an exceptional event in the sky. This seems to have produced a prototype for all later pictures of similar celestial events – but with one exception: In the first depiction, in the time of Senmut, Mars is retrograde in the west when the other planets assemble around Sirius in the east.

So far it has been demonstrated:

1. The Senmut maps contain a cosmological and astromythological expression not only as decoration – as hitherto assumed – but also as a picture of a particular and unique situation in the sky.

2. This configuration of the sky can be exactly dated: 1534 BC. Furthermore one particular day can be identified if the solar eclipse is included as indication.

In addition the star maps may contribute to a better dating of their creator Senmut and also of the contemporary Egyptian pharaohs – at least accurate to within a decade.

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NOTES

1. These authors describe, by and large, all known topics of Egyptian astronomical inscriptions from a period of 2000 years: i.e. star maps and calendars, engravings, manuscripts, etc. totalizing 131 cases – 50 of which are star lists.
2. This longitude in reality passes through the three brightest stars of the sky: Canopus, Sirus, and Lyra (Wega). Together they mark an almost straight line across the sky, along the Milky Way. Canopus is not visible north of the Mediterranean countries, while the greatest part of the course of the line – as from Sirius to Lyra – everywhere has been used as a fixed line of reference (e.g. as late as by the Danish astronomer Ole Römer around the year 1700).

The expression "the two countries" – southern and northern part – was the current way of mentioning Egypt. Following the Egyptian habit this was a natural and precise pun also for the said conditions of the sky – especially as the terminology of surveying often (like in Babylonia) was used by astronomy.

3. The present author is preparing a paper about these phenomena. For a premature information it can be noted about the Seti I map with Mars in the east, to which its text (with reflections from the Senmut case?) says "…star, who travels backwards…", that Mars was never retrograde (impossible, when close to the sun) in any of the positions in the east. The retrograde event occurred in the year before (1496 BC) but here it was by a position in the west. That is why the two consecutive conjunctions, in 1497 BC and 1496 BC, are placed together as case *b)* – in paragraph 6 (A possible further historical reference to the actual eclipse is discussed in vols. 1-2 of the present author's new book-series, cf. web-site http://www.Moses-Egypt.net.
4. In these cases *j3tt* goes with the Latin word *defectus*, both used for 'eclipse' – cf. e.g. Renouf (1905) above.
5. Specifications of elements in the applied technology for astronomical dating: Astronomical calculations have been made by RCCO Ltd, Coin, Spain. Computer: Hewlett-Packard. Precision: as from 15 to 395 decimals, which is normally considered to be overcapacity for historical investigations, however, the achieved precision is important in relation to e.g. solar eclipses.
   To avoid that small deviations may accumulate flagrant errors throughout the span of time back to before 3500 BC, the programme for the movements of the celestial bodies is using authorized elements of planet orbits and has been built up as analytic formulae, i.e. analytic development of sequences (instead of numeric formulae) in order to exploit the capacity better. Thus a precision from less than one tenth to one hundredth of a degree can be achieved – even when components of formulae below half a second have been omitted.
   The programme has used tables and perturbation formulae (Fourier series) by LeVerrier and Gailliot from Observatoire de Paris (1855-1913), formulae from Connaissance du Temps (1954), as well as the lunar formulae by Brown (1895) including later corrections (1925 and 1960) from Stanford University, USA (and Jet Propulsion Laboratory, Pasadena, California, USA).
   Improvement of astronomical research and computer technology may make details further precise but will not affect the basic results of the present analysis.
6. Cf. also Dorman 1991 p. 142.
7. According to a scheme of Neugebauer & Parker (vol. 3, p. 128) our (Gregorian) April at approx. 1500 BC is placed at about the same time of the year as 8th month in the Egyptian year (which has its New Year at approx. July 20th). The 8 "globes" mentioned might later even have been taken for being a sign demarcating the limit of, accordingly, the 8th month. (When during the summer the sun passes into the sector of the sky called decan no. 1 this might originally have marked the beginning of the Egyptian New Year).