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MARCIN POCZOBUT-ODLANICKI AND HIS DISSERTATION ON THE DATING OF THE DENDERA ZODIAC

Early astronomy is a favourite subject of many scholars – both those dealing with sciences and those who represent humanities. Admittedly, astronomy was born in times of the first civilizations and it is among their remains, where one should look for the answer to contemporary questions about time and universe.

An outstanding Polish astronomer, chancellor of the Vilnius Academy[1], Marcin Poczobut-Odlanicki, too found that concept appealing. He was one of the first scholars in the world to use astronomical method in dating the archaeology artifacts. Poczobut was born in Słomianka, Grodno district[2], on October 30th, 1728. In the year 1740 he began his education in the Jesuit college and later joined the convent in Vilnius at the age of 17[3]. It was under the influence of priest Tomasz Żebrowski, then the head of the Vilnius Academy observatory[4], that Poczobut took up astronomy. In 1754 he was sent to Prague to study math and Greek. Upon finishing his studies, thanks to the financial support of the Czartoryski family, Odlanicki was able to continue education

[1] The Academy was founded by king Stefan Batory in 1579, to be given the rank of the Commonwealth University by pope Gregory XIII.See.: Piechnik L., Puchowski K., *Z dziejów Almae Matris Vilnensis. Księga pamiątkowa ku czci 400-lecia założenia i 75-lecia wskrzeszenia Uniwersytetu. Wileńskiego*, Kraków 1996.

[2] Grodno was one of the more prominent towns in the XVIII-century Poland; currently in Belarus.

[3] Rabowicz E., *Poczobut Marcin* [in:] Polski Słownik Biograficzny, vol. XXVII, 1983, p. 52.

[4] Rybka E., Rybka P., *Historia astronomii w Polsce*, vol. II, Wrocław-Warszawa 1983, p. 38.

Fig.1. Marcin Odlanicki-Poczobut (1728-1810), in: Rybka E., Rybka P., *Historia astronomii w Polsce*, vol II, 1983

abroad – in Italy and France[5]. Majority of his time was spent on observations, with the southern climate especially favorable for it. In Naples he was introduced to English astronomical instruments, considered the most accurate[6]. At the end of the year 1764, Poczobut returned to Vilnius, to receive his M.A. degree in philosophy and liberal arts, shortly after. For a couple of years he gave lectures on maths and astronomy at the Vilnius Academy. Poczobut was also named the head of the local astronomical observatory[7] to which he became completely devoted[8]. Soon after, he managed to establish its exact latitude[9]. He dedicated his achievements to the king Stanisław August, gaining the title of the royal astronomer[10]. Having obtained the Doctor of Theology title[11], Poczobut began in 1768 a journey of various European astronomical institutions, in order to supply his post with the best of instruments. Equipped with English and French tools, the Vilnius observatory could easily compete with the renowned scientific institutions of the continent[12], while the scholar himself was made in 1770 a member of the Royal Society of London for Improving Natural Knowledge[13]. He became famous for his observations of the planet Mercury locations, especially hard to conduct due to the closeness of the Sun[14]. Results of his work were published in 1777 as the first serious astronomy dissertation printed in Poland since Hevelius. Poczobut sent a series of measurements to Joseph Lalande in Paris,

[5] Rabowicz E., *op. cit.*, p. 53.

[6] Śniadecki J., *Żywoty uczonych Polaków*, Kraków 1861, p. 82.

[7] Vilnius observatory was built in 1753 by the aforementioned Tomasz Żebrowski, with the financial help from the duchess Elżbieta Puzynina of Ogiński family, as a two-storey superstructure to the Academy building.

[8] Rabowicz E., *op. cit*., p. 53.

[9] With 2 seconds accuracy.

[10] Rybka E., *op. cit*., p. 40.

[11] Rabowicz E., *op. cit.*, p. 54.

[12] Rybka E., *op. cit.*, pp. 40-41.

[13] Rabowicz E., *op. cit.*, p. 54.

[14] In 1786 Poczobut conducted 60 observations of the planet (compared to only 4 done in Paris) and around 120 in the following year.

which allowed the French scholar to calculate a more precise orbit of the planet[15]. During this time many European institutions were keen on collaboration with Polish astronomer[16]. In 1778, thanks to the numerous publications, he was given a place among the Paris Academy of Sciences correspondents[17]. To show his gratitude to the ever supportive king Poniatowski, Poczobut named a group of 16 stars (nine of which he himself discovered) between the constellations of *Aquila* (Eagle) and *Ophiuchu*s (Snake-holder) as a new set – *Taurus Poniatovii.* Newly christened constellation featured on numerous sky maps of the turn of the XVIII and XIX centuries. In 1780, Poczobut was appointed chancellor of the Vilnius Academy[18]. He remained in this post till 1799, when he resigned to concentrate on planet and planetoid observations. It was at this time, that he became interested in the history of astronomy[19]. In 1805, Poczobut health began deteriorating. Unable to fulfill his duties as the head of the observatory, he induced his close friend Śniadecki, a well-known astronomer from Kraków, to come to Vilnius and take his post. Poczobut died on February 8th (20th),1810 in Daugavpils, aged 82. Famous in the field of astronomy, he was also very popular for his dissertation on dating of the Dendera Zodiac[20].

Dendera, the ancient capital of the 6th Nome of the Upper Egypt, lies on the Nile western bank nearby the modern town of Qina, about 60 km north of Luxor and 600 km south of Cairo. Egyptian name for the city was Iunet, its Greek equivalent – Tentyris. Dendera was the main cult center of the goddess Hathor, worshipped here as early as the Old Kingdom[21].

The local Hathor temple is one of the best preserved examples of Egyptian architecture. It was probably during the reign of Ptolemy XII Auletes, that the work began, presumably replacing the earlier building of Pepy I[22], only to be finished in the times of Nero – from II BC to II AD. The temple was constructed in two stages – the older, sacral part is dated to the Ptolemaic period, while the younger, outer part (pronaos) was completed with all probability by the Roman emperor Tiberius.

Though the building's style is that of a classic Egyptian temple, it lacks such characteristic parts as pylons, portico and a typical courtyard. Surrounded by

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[15] Rybka E., *op. cit.*, pp. 58-59.
[16] Opałek K., *Epoka Oświecenia – Historia Nauki Polskiej*, vol. II, 1970.
[17] Rabowicz E., *op. cit.*, p. 55.
[18] Rybka E., *op. cit.*, pp. 59-60.
[19] *Ibid*., p. 103.
[20] Rabowicz E., *op. cit.*, pp. 60-61.
[21] For more information and literature on Dendera see: Arnold D., *Lexikon der ägyptischen Baukunst*, Zürich 1994, pp. 64-66.
[22] As indicated by one of the temple inscriptions.

Fig. 2. The so-called round Zodiac from the Hathor temple of Dendera, in: *Description de l'Égypte,* vol. IV, pl. 21, with changes

only partly finished high enclosure wall, it faces north[23]. Such an atypical solution results from the city location – at the point where the Nile bends and flows temporarily from the east to the west[24]. In this special case, the sacral role of the east was given to the north.

A prominent pronaos, more than 17 metres high, consisted of four rows of six columns with hathoric capitals. Front row is linked by screen walls[25]. Inner part of the temple housed a small Hypostyle Hall with 6 columns, Offering Hall and a sanctuary, surrounded by the outer wall hiding 11 crypts within. Such hidden rooms can also be found in the underground part of the building, linked by a network of corridors. Two inner staircases led to the upper-extention, where the ceremony of joining between goddess Hathor and the sun disk was held. A shrine, dedicated to Osiris was constructed nearby on the roof. Another important ritual – that of New Year, took place in the western part of the temple[26].

Europe rediscovered Dendera in the year 1799, during one of the excursions of Napoleon's expedition to Upper Egypt. Partially buried in the sand, the temple enchanted French scholars. Inside, apart from, then unknown and mysterious Egyptian symbols, they encountered familiar representations of the Zodiac signs. As early as 1802 drawings of the Zodiac were published in the work of Dominique Vivant Denon *Voyage dans la Basse et la Haute Égypte* and they were later more throughly redrawn in *Description de l'Égypte*[27].

Unfortunately, very little was known at that time about both the Dendera and the zodiac's history, leading to large discrepancies in suggested dating. Beautiful copies were inaccurate (Fig. 4). The scholars were set to prove, that the sensational find was thousands of years old – referring to the Bible, the

[23] Baines J., Málek J., *Wielkie Kultury Świata. Egipt*, Warszawa 1995, pp. 112-113.

[24] Egyptian temples are, for the most part, build in the W-E line, so that their facade could face the Nile.

[25] Lipińska J., *Sztuka starożytnego Egiptu*, Warszawa 2008, p. 275.

[26] Rachet G., *Słownik cywilizacji egipskiej*, Katowice 1994, pp. 81-82.

[27] Unfortunately after Poczobut's death.

very appearance of the signs or their own ideas. Public interest grew after 1820, when the Zodiac was presented in the Louvre for the first time. However, year 1828 brought quite a revelation – Jean François Champollion announced, while exploring the temple, that several inscriptions concern the reign of Roman emperors. Therefore, the temple and its decoration was obviously much younger than originally thought.

Egyptian zodiac history is a short one, the very first example comes from the Ptolemaic period[28], while the concept itself was borrowed from Mesopotamia. A zodiac could be depicted alone or together with pictures of planets, decans and constellations. Only about a dozen such objects have survived, usually decorating the ceilings of temples, as well as, tombs and coffin lids of the nobles. Of this small group, two famous examples come from Hathor temple at Dendera. One of them – so-called round Zodiac (Fig. 2) used to decorate the ceiling of the Osiris shrine[29], another, rectangular one (Fig. 3a, b), still graces the ceiling of the outer Hypostale Hall – a pronaos. The former is dated to the year 30 BC, the latter to the first half of the I AD. Both include all 12 signs we know today, as well as, decans, planets and a large number of constellations. It's this diversity that makes them unique among the astronomy themed artifacts. Apart from the Mesopotamian elements and those familiar to us, also other, indigenous ones, are present. Dendera Zodiacs enabled the scholars, in a fashion similar to the Rosetta Stone, to understand the nature of the symbols depicted and, as a result, to estimate the relative position of some of the Egyptian constellations[30].

Inhabitants of the Nile Valley used to link groups of significant stars into systems, though, mostly, they concentrated on single objects. Of special importance were the northern stars, never setting and therefore called „indestructible". As the Egyptians had their own vision of the constellations, it is particularly difficult to estimate which star group they really represent. One can be quite certain about the Big Dipper, consisting of bright objects visible in the northern hemisphere all year round. It was depicted in the Egyptian art as a front leg of a bull and later also as the animal itself – called Mes(khetiu). Another northern constellation frequently occuring – Hippo – was a female or female hippopotamus, often with a crocodile on its back, holding Meskhetiu on a rope or a chain. Such composition could represent a larger part of the northern sky, associated with the Summer Triangle – stars Vega, Altair and

[28] The oldest zodiac, depicted on the ceiling of the Esna temple, is dated around 200 BC.

[29] Presently in Louvre. The Zodiac exhibited in the temple is a replica.

[30] Neugebauer O., Parker R.A., *Egyptian Astronomical Texts. Decans, Planets, Constellations and Zodiacs*, London 1969, p. 81.

Deneb[31]. Those two constellations are usually accompanied by a god in the human form – An, referred to as a „Horus Fighting"[32]. While the Egyptians didn't know zodiac untill very late in their history, they used a specific method of measuring time – one based on decans. A decan consisted of 36 bright stars, it is impossible to name them though. The ancients knew five planets of the Solar System, those visible with a naked eye. They were identified by a German – Heinrich Brugsch in 1856.

All the objects mentioned above were depicted on the rectangular Dendera Zodiac, which itself is a part of a larger composition created by six bands running from north to south between the rows of columns in the Hypostyle Hall. It is formed by two of them – western and eastern one (10,75x2,09 m), framed by the body of goddess Nut. Each band is divided into two registers, the upper one includes depictions of the night hours, planets and constellations, the lower one – representations of decans. Both bands and registers are surrounded by columns of text, though the majority of inscriptions does not concern astronomy. There are 6 zodiac constellations in each band, the eastern one includes signs from Aquarius to Cancer, the western one from Leo to Capricorn (Fig. 3a, b).They are grouped in the order of appearance in the sky, those rising earlier on the west and those rising later, on the east. It's worth mentioning that the actual north here is the east.

Such is the zodiak construction, that between the consecutive night hours, showed as deities with stars above their heads, constellations and planets are presented. The latter are put in order according to the length of their orbital period around the Sun. Therefore, as hours go by, the objects with shorter revolution period are shown – Saturn, Jupiter, Mars, Venus and Mercury. They appear both in the western and eastern bands, depicted as hawks with various animal heads in the former and gods of a variety of heads and human bodies in the latter[33].

The arrangement of the eastern band is less clear than the other. Attention drawing is the position of Cancer[34] – more a beetle than a crab – at the very edge of the relief, near the goddess Nut legs. A rising Sun is shown just behind it[35]. The scene is a clear reference to the myth of Nut swallowing the Sun in the evening and giving birth to it in the morning. In the same band one can also see Orion, here as the „soul of Osiris", a god standing on

[31] Gingerich O., *op. cit*.
[32] Neugebauer O., Parker R.A., *op. cit*., p. 200.
[33] *Ibid.,* pl. 42.
[34] Though called Cancer, this symbol is really a crab.
[35] Our daily star is represented in the second part of the Zodiac by a scarab, identified in Egypt with the rising Sun.

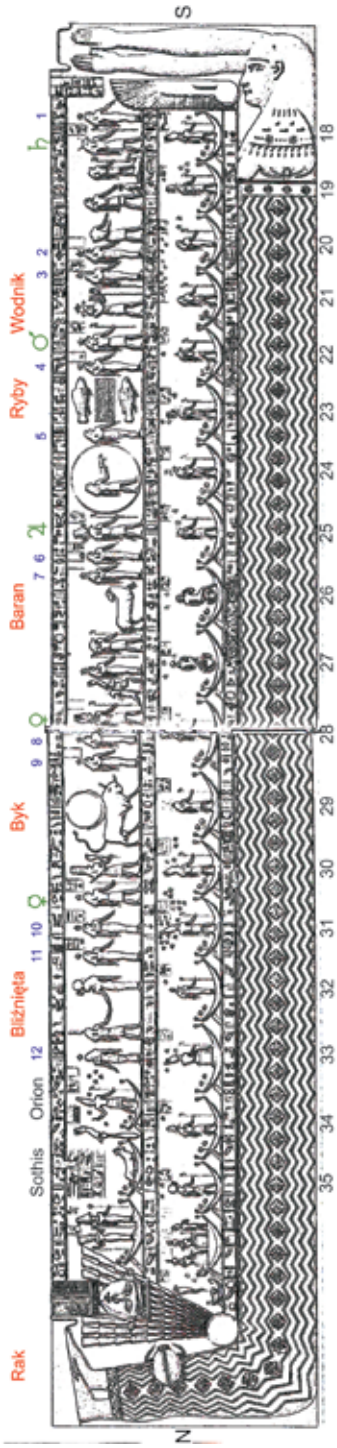

Fig. 3a. Eastern band of the rectangular Zodiac from the Hathor temple of Dendera, in: *Description de l'Égypte*, vol. IV, pl. 20, with changes

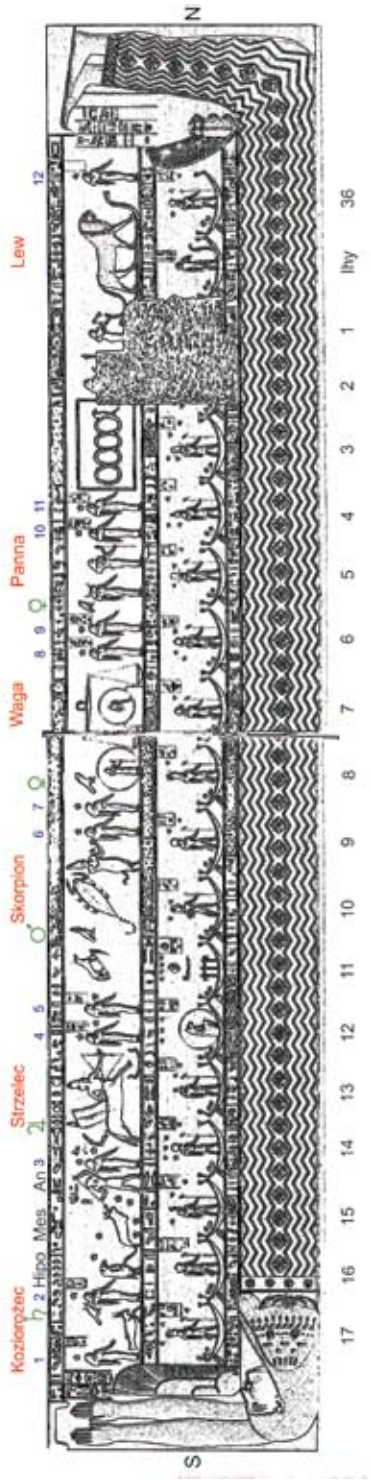

Fig. 3b. Western band of the rectangular Zodiac from the Hathor temple of Dendera, in: *Description de l'Égypte*, vol. IV, pl. 20, with changes

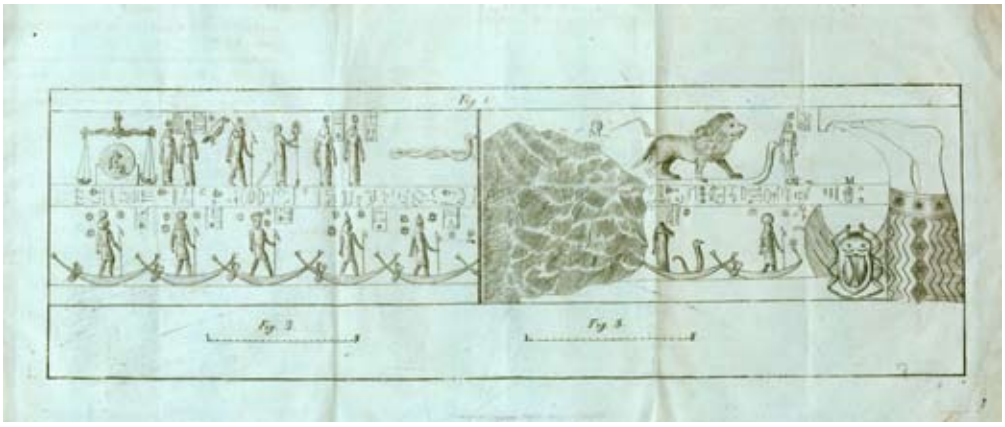

Fig. 4. Part of Denon's redrawing of the rectangular Zodiac used by Poczobut in: *O dawności zodyaka egiptskiego w Denderah (Tinthyris),* Wilno 1803

a barque in a characteristic pose, resembling the constellation shape. Next to him is Sothis in the form of a lying cow, with three lines of text concerning the goddess above. Planets are shown between the night hours, with Mars in Jupiter's place – probably due to the artist's mistake[36]. The zodiac signs are moved in relation to planets and do not form analogical pairs, as can be seen in the western band.

Tab. 1. Position of planets and constellations between consecutive night hours from sunset to sunrise

Night hours	**Western band**	**Eastern band**
1-2	Capricorn and Saturn	Saturn
2-3	Hippo, Mes, An	–
3-4	Sagittarius and Jupiter	Aquarius and Mars
4-5	–	Pisces
5-6	Scorpio and Mars	Jupiter
6-7	–	–
7-8	Libra and Venus	Aries and Venus
8-9	–	–
9-10	Virgo and Mercury	Taurus and Mercury
10-11	–	–
11-12	Leo	Gemini
At sunrise		Cancer, Orion, Sothis

[36] *Ibid.*, p. 80.

Decans present in the Dendera Zodiac are depicted as deities standing on the barques. First decan in the western band is decan 36., after which decan 1. (damaged part of the relief) is shown, separated from the 36. by the figure of Ihy. The eastern part of the Zodiac begins with decan 18. There are two barques presented after the last, 35. decan – Ihy, Horus and Isis sail in the first one, while the Sun occupies the second one[37].

Tab.2. Description of the Zodiac signs from the rectangular Zodiac of Dendera

Zodiac sign	**Description**
Aries	Ram with its head turned towards the Taurus, with front legs raised
Taurus	Bull with front leg digging in the ground
Gemini	Tefnut and Shu facing each other and holding hands
Cancer	Scarab with closed wings
Leo	Lion standing on a snake, his tail held by a woman figure with a flail in her hand
Virgo	Woman figure holding an ear of corn
Libra	Hanging scales with an image of young Horus between them
Scorpio	Scorpion with its sting
Sagittarius	Winged, half-animal, half-human, double-headed figure with the Atef crown
Capricorn	Goat-fish
Aquarius	Standing man with a crown of papyri, pouring water from twin containers
Pisces	Pair of fish facing in the same direction with a water reservoir

Use of astronomy in dating artefacts is nowadays a common occurrence, though only on condition, that the studied object can be linked to the actual astronomical event. It can be solar or lunar eclipse, the relative position of a planet in relation to stars or constellations, as well as, the rising of the Sun during solstice or equinox. The celestial bodies are ruled by the laws of physics, so there are simple methods for estimating their position, both in the past and the future. As the zodiac itself simultaneously functions as a chronometer and the point of reference, the calculations become even easier, providing it shows the correct positions of planets or at least one of the ecliptic cardinal points[38].

Poczobut, unlike those before him and also his successors, based his investigations on this, strictly scientific, method. He managed to obtain Denon's book from the well-stocked library of Joachim Chreptowicz and decided, after

[37] *Ibid.*, pp. 80-81.

[38] Summer and winter solstice, spring and autumnal equinox.

reading, to involve astronomy in his efforts to date the Zodiac – by examining the position of the cardinal point. One should keep in mind though, that at the time Poczobot conducted his research, Egyptian art was a subject virtually unknown, relief inscriptions had yet to be deciphered and nobody knew the zodiac contained depictions of planets, night hours or decans.

Poczobut published his studies in 1803 under the title *O dawności zodyaka egiptskiego w Denderah (Tinthyris)*. He also gave lecture on this subject at the Vilnius University. Translated to French the same year and printed in a slightly altered form as *Essais sur l`époque de l`antiquité du zodiaque de Denderah (Tinthyris)*, the dissertation gained quite a recognition from the scholars. A year later it was reprinted in *Rocznik Towarzystwa Warszawskiego Przyjaciół Nauki,* while Johann Elert Bode's publication in the *Berliner Jahrbuch* popularized it in Europe. Year 1804 brought Russian translation in *Siewerny Wiestnik*. Finally, in 1805 it was published in a lavish form by Franz de Paula Triesnecker, the head of the Vienna University observatory, under the title *Recherches sur l`antiquité du zodiaque de Denderah (Tinthyris)*[39]. This last edition Poczobut sent to the pope[40].

In his work he assumed, that the rectangular Zodiac of Dendera presents an actual view of the night sky with the marked position of the summer solstice point[41]. Poczobut proposed using the precession phenomenon to establish the period of time the solstice took place[42]. Clearly, calculations alone would't be sufficient, interpretation of the artifact itself was necessary. Therefore, following the redrawing available, Poczobut made a few premises.

He accepted the general consensus, that the Zodiac shows summer solstice in Cancer. It wasn't sufficient enough to estimate the age of the artifact, due to the precession of the Earth's orbit. Firstly, it's a serial event, taking place every 25700 years, secondly, it lasts for at least 2100 years[43]. New assumptions had to be made.

First of them concerned the Zodiac representation. Poczobut was of a mind, that the constellations seen in the relief did not differ from the ones of his time. Unfortunately, the history of the zodiac is quite complicated – a fact the scholar

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[39] Estreicher K., *Bibliografia Polska XIX stulecia*, vol. III, Kraków 1872.

[40] Rabowicz E., *op. cit*, p. 61.

[41] Odlanicki-Poczobut M., *O dawności zodyaka egiptskiego w Denderah (Tinthyris),* Wilno 1803.

[42] Due to the non-spheric nature of the Earth, its axis forms a cone in time. As a result, the location of the sunset (e.g. on the day of solstice) moves constantly back in relation to the „immobile" star background, at a pace of about 50,26 arcsecond a year (a second is a 1/3600 of a degree).

[43] Assuming that the Cancer constellation takes up 30 degrees of the sky.

couldn't know. Since Claudius Ptolemy, the zodiac used in Europe wasn't the same as before. Two important changes occured and though the first one does not concern the Dendera Zodiac, it too should be mentioned. Ptolemy, as we do after him, used the tropical zodiac, strictly connected with the ecliptic cardinal points, unlike the original sidereal zodiac, which referred to single stars. The sidereal zodiac shows the actual location of the Sun in relation to the constellations, while the tropical zodiac is „immune" to precession – the Sun on the day of the summer solstice is always connected to the Cancer constellation[44], though in reality it may rise in another. Astronomical interpretation of the exact solstice position is therefore possible only when the sidereal zodiac is used. It is difficult to establish the exact day and place, the tropical zodiac was first used. Undoubtedly, the Sun had to rise in Cancer during solstice at that time, as it does in the Dendera Zodiac. Another important change that took place in the course of the centuries, was the one concerning the span of the individual constellations and the shape of their boundaries. In the original zodiac, each had a span of 30 degrees. At present there are significant differences between the sizes of the constellations[45].

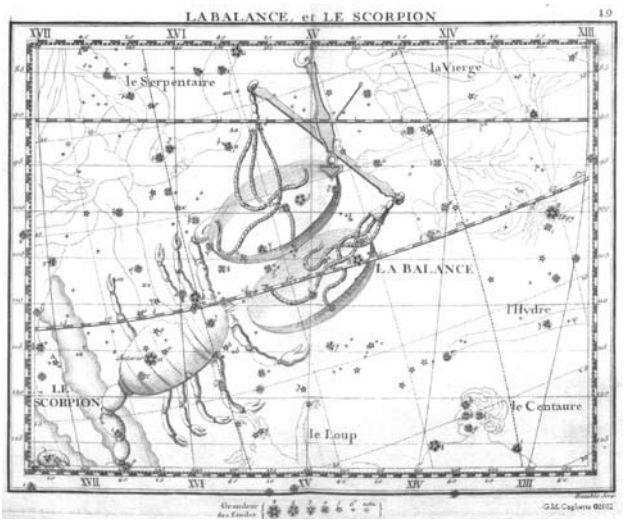

Fig. 5. The *Libra* constellation according to J. Flamsteed, *Atlas Coelestis*, London 1729

Poczobut's third premise was that the *Spica* star or *α Vir* is depicted in the relief as the ear of corn, held by a figure representing the Virgo (Fig. 4). Unfortunately, Dendera Zodiac constellations are purely symbolic, with no reference to the actual stars. Another premise that did not stand the test of time.

The astronomer's last assumption concerned the hand, marked by him with the letter „M", that can be found at the end of Denon's copy (Fig. 4). Poczobut was of a mind that the Zodiac's creator used this image to indicate the summer

[44] Today, as it was at the time the Zodiac was made, summer solstice is said to occur in Cancer, which resulted in the tropic's name. In reality on such a day, the Sun rises in Gemini constellation.

[45] Since the times of Poczobut, the zodiac constellations boundaries underwent a slight change only, they will be referred to later in the article as the contemporary or modern.

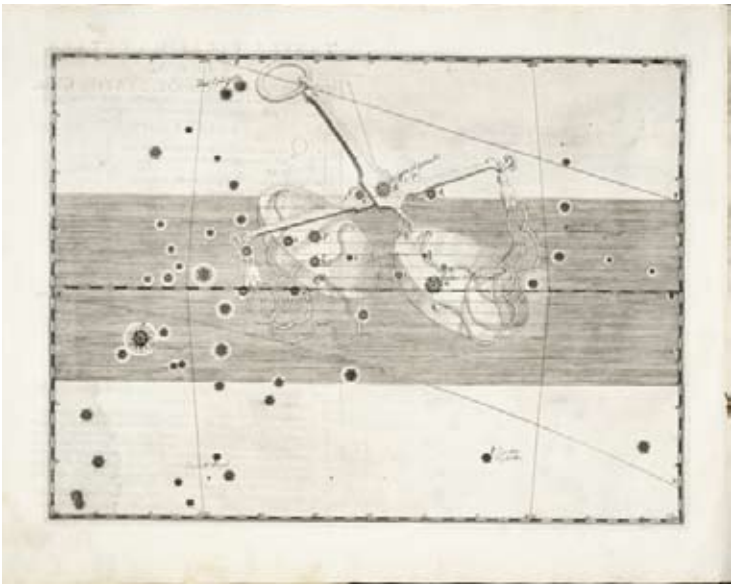

Fig. 6. The *Libra* constellation according to I. Bayer, *Uranometria*, Amsterdam 1603

solstice point. One immediately notices, that this symbol in Denon's redrawing is located slightly differently in relation to the original, where it is placed at the right side, under the figure representing hour 12 of the night. On top of that, it's a common hieroglyphic sign, without any special meaning, marked by Gardiner as D46 in his *Egyptian Grammar*.

With these premises, Poczobut concentrated on a fragment of a Zodiac – from Libra to the end of the western band only. After establishing the *α Vir* position, he searched for another star to scale. As the Egyptians didn't depict constellations together with the stars forming them, he stumbled upon a serious problem and was forced to use later images of the Zodiac. Unfortunately, these types of images change in time, causing new difficulties. Poczobut's attention was brought to a star in the Libra - *α Lib*, located in the Flamsteed atlas[46] near the right end of the right bowl (Fig. 5). Assuming similar position of the star in relief, he measured the distance between *α Lib* and *α Vir*. He then scaled the redrawing, comparing the result to the actual angle distance between those two objects in the sky. Poczobut then observed, that in the scale he used, the figure with a star on its head, positioned immediately behind the Leo symbol, corresponds to the *δ Cnc* star, one of the brighter in the Cancer. The modern constellation takes up less than 20 degrees in the ecliptic boundaries, while the aforementioned celestial body lies around 2 degrees before the constella-

[46] Flamsteed J., *Atlas Coelestis*, London 1729.

tion's center, looking form the Virgo side. Poczobut wasn't satisfied with result achieved, as he was more inclined to see the „M" point as not only the solstice indicator, but also as the Cancer's center, which his calculations placed 5,5 degrees closer. He, therefore, changed the scaling method by using a different Libra image – one from the Bayer atlas[47] (Fig. 6), where *α Lib* appeared on the left edge of the scale, instead of the right. The result has changed significantly, the Cancer's centre was now only about 1,5 degree behind the „M" point.

Knowing that in his times the solstice took place at the 24. degree of Gemini, that is 34 degrees from the Cancer's center, Poczobut calculated, the Sun rose in the very center in the year 633 BC[48], while in the case this place lied around 1,5 degree behind the „M" point – one hundred years later, in 533 BC[49]. An average of these two results, gave Poczobut a final date: 583 BC.

One can see, from the calculations alone, how big a mistake can be made with incorrect scaling of the artifact. Egyptian astronomical images do not reflect the actual view of the sky, as plainly seen in the round Zodiac (Fig. 2)This artifact, in contrast to the rectangular one, actually points to the geographic north. In the center, there is the zenith with northern constellations circling it. The zodiac constellations do not lie symmetrically to the zenith – here the Zodiac creator was correct[50]. Despite this careful and detailed attitude, one would be hard pressed to find in the proportions used, the correct sky positions of individual objects.

Numerous scholars accepted the results of Poczobut's observations. Some, like Jan Śniadecki brought attention to problems resulting from the interpretation taken too far[51]. In the year 1845, a French scholar Jean Antoine Letronne announced[52] that the Egyptian zodiacs cannot be dated by means of astronomical methods as they do not present the actual sky view but only the artistic vision[53]. Therefore, their age can only be estimated by the use of historical and archaeological methods. Still, one should keep in mind that the calculated age of the zodiac site does not have to be accurate for the zodiac itself, as it could be based on the earlier artefact. In this case, the procedure suggested by

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[47] Bayer I., *Uranometria*, Amsterdam 1603. A work older than that of Flamsteed, based on older sky maps.

[48] Poczobut assumes that one degree of sky movement takes 71,65 years. Therefore, 34 · 71,65 = 2436, which gives: year 1803 - 2436 years = 633 BC.

[49] The values are cited after the original.

[50] Zodiac constellations projected on the celestial sphere are at an angle to the horizon.

[51] Rabowicz E., *op. cit.*, p. 60.

[52] Letronne J.A.*, Analyse critique des représentations zodiacales de Dendera et d`Esne*, Paris 1845.

[53] Letronne however does not make a reference to Poczobut's work in his monography.

Poczobut is the only alternative so far. Obviously, one cannot accept the results presented by the scholar, as he was prevented from reaching the right conclusions by the inaccuracy of the redrawings and insufficient knowledge of the ancient Egyptian culture. In case of Dendera, Letronne's statement seems to be true. The use of astronomical methods in dating Zodiacs from this site, with inclusion of planets, constellations and solstice, does not provide unambiguous results.

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