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CLAUDIUS PTOLEMAEUS IN THE EYES OF THE ARABS IN THE EXAMPLE OF AL-QAZWĪNĪ

Introduction

Zakariyā' ibn Muḥammad ibn Maḥmūd al-Qazwīnī (1203-1283) - an Arabic cosmographer and geographer lived and worked mainly in Damascus. He travelled a lot in Syria, Persia and Iraq, where he held the position of *qāḍī* (judge). The author of the two eminent works: *Kitāb 'ağā'ib al-maḥlūqāt wa ḡarā'ib al-mawḡūdāt* (*Marvels of Created Things and their Singularities*) - a cosmography considered the best of the kind in Arabic literature (hence the nickname of *Arabic Pliny*); and *Kitāb āṭār al-bilād wa aḥbār al-'ibād* (*Souvenirs of Lands and Human Lore*) - a sort of universal geography, was known for his careful citing of the sources. Among others he quoted various ancient Men of Science. In this article we will refer to Al-Qazwīnī's views on *Claudius Ptolemy*.

Life and Work of Ptolemy

"Out of Greece came *Biṭlīmūs* (Ptolemy), the author of 'Almagest', who managed to know the movements of the caelestial spheres along with star orbits on the basis of mathematical reasons. He also mentioned that some of the stars move from the west eastwards and some others in the opposite direction. Some of them move quickly while the others slowly. Some stars rotate, some others revolve yet still others circle. The movements of the stars are subjected to the movements of the spheres¹ - and those in turn are divided into the ones which go round the Earth and the others that do not.

¹ See: al-Fārābī in: *Al-Fārābī, Kommentarii k' "Almagestu" Ptolemeya*, edit. by A. Kubiesova and G. ad-Dabbāh, Aḥma-Ata 1975, p.49-53.

Certain spheres have got their centre in the middle of the Earth and the others beyond it. Ptolemy based all this data on geometrical arguments and measured the spheres with the signs of zodiac, degrees and minutes, so at an appointed hour there must occur a solstice or eclipse - and they happen in accordance to his words. The most amazing is the way in which Ptolemy, helped by mathematical laws explained the declination² of the space stretching between the firmament and the Earth, the declination of each sphere below the mentioned area and the declination of its orbit and diameter. What is surprising, Ptolemy invented the astrolabium and composed a calendar - so thanks and glory be to The One Who taught the man things he had not known before.³

The author of *Kitāb 'aḡā'ib al-mahlūqāt* treats the scientific heritage of Ptolemy in a way somehow different from his attitudes towards the majority of the other ancient scholars he described. First of all he reduces to a large extent the apocryphal stories composing the main part of the other ancient Men of Science's quotations. To tell the truth al-Qazwīnī seldom refers to the writer of *Almagest* at all but as a recompense he carries out a minute analysis of the ideas ascribed to the Alexandrian scholar. The description of the great astronomer and mathematician is almost deprived of legends and tales which 'Arabic Pliny' seemed to take a strong taste at. The explanation can be various but not necessarily contradictory. As for *Almagest* and *Geography* by Ptolemy, Al-Qazwīnī might have made use of excellent translations and commentaries which - as will be shown below - must have been largely available in Syria, having in mind that the country evaded the Mongol invasion. The argument is however weakened by the fact that the majority of works of the other ancient Men of Science quoted by the Arabic cosmographer had already seen as good and numerous translations and commentaries as the ones created by Ptolemy. We can assume that the affinity of al-Qazwīnī's and the Greek astronomer's interests and their fields of activity might have played a certain role. Al-Qazwīnī composed two works we know about: one purely geographic⁴ and the latter being a cosmography dotted with obvious influence of physical geography. In a sense they shared the same scientific domain. The Arabic writer must have known and understood Ptolemy's works quite well. The author of *Almagest* created a partly wrong

² I.e. so-called *angular co-ordinates*.

³ Al-Qazwīnī, *Kitāb āṭār al-bilād*, edit. by: F. Wüstenfeld, Göttingen 1849, p.384, v.719.

⁴ Al-Qazwīnī's geographical work, *Kitāb āṭār al-bilād wa aḥbār al-'ibād* has been subject to numerous articles by prof. Maria Kowalska from the Arabic Section of the Institute of Oriental Philology of the Jagiellonian University in Cracow.

but certainly coherent system and one of every system's characteristics is its inability to accept partial solutions without changing the general structure. To some extent it must have corrected possible mistakes committed by various copyists and commentators - along with some deliberate attempts to interweave apocryphal stories into the ptolemaic heritage. Thus in the introductory quotation the wrong - from our standpoint - ideas concerning for instance the apparent movement of the stars in the firmament are due to the obvious mistakes of the ptolemaic system.

There is only one striking mismatch: the *astrolabium*⁵ was certainly invented in Antiquity but its construction is ascribed to *Hipparchos*⁶. We can assume with a considerable deal of probability that the scientific heritage of *Hipparchos* was known to Arabic readers thanks to Ptolemy who in his part was not used to refer to the quoted authors in a detailed mode. It may justify al-Qazwīnī's mistake to some extent.

It seems that the Muslim writer made use of the commentary to *Almagest* by al-Fārābī⁷ - at least some bits of information coming from that book can be found in his work. Al-Fārābī treats the celestial mechanics in a larger description than the one presented in a summary by al-Qazwīnī yet the general sense rests intact.

Now let us see how the Alexandrian scholar is described in modern studies:

Claudius Ptolemaeus (Gr. Klaudios Ptolemaios - lived about 100-178) was a Greek astronomer, mathematician, geographer, astrologer, doctor and chronologist⁸. He lived and worked in Alexandria - still famous as an eminent centre of science and culture. The most prevailing part of the glory is due to his astronomical works and first of all *Mathematike syntaxis* (*Mathematics' system*) in 13 volumes, later called *Megale syntaxis* or *Megiste syntaxis* (*Great System*), hence Arabic *Almagest*, which is the common known title of the book.

Ptolemy made use of his predecessors' works; mainly *Hipparchos*⁹ of *Nikaya* and *Apollonios of Perge*¹⁰ (262-180 B.C.). An outstanding historian of science *George Sarton* pointed out that the main part of Hipparch's works

⁵ An old astronomical appliance to fix the apparent altitude of the stars and in this way to calculate the latitude of the observation post.

⁶ *Le Dictionnaire de Notre Temps*, edit. by: M. Gatard, Hachette 1989, p.94.

⁷ Al-Fārābī, *op. cit.*

⁸ G. Sarton, *Appreciation of Ancient and Medieval Science during the Renaissance*, Philadelphia 1953, p.144.

⁹ Gr. *Hipparchos* - lived in the second half of the second century B.C. He worked mainly in *Rodos* and *Alexandria*.

¹⁰ Greek mathematician and surveyor.

was lost to a notable extent because they had been replaced by Ptolemy's who perhaps was not a better astronomer, but he surpassed Hipparch as an efficient educator and writer.¹¹

Ptolemy not only gathered all the astronomical knowledge of Antiquity which he enriched with his own observation, but he also gave the first systematic exposition of mathematical astronomy. He still developed the theory of planets in his later work *Hypotheseis ton planomenon* (*Hypothesis of Planets*), only partly preserved in an Arabic translation. Another - this time astrological - work by Ptolemy *Tetrabiblos* (*Tetralogy*) enjoyed almost as great popularity as *Almagest*, arranging systematically all data referring to the influence exerted by the planets and stars on people's lives and all the events on the Earth. The great astronomer was also occupied with music in the book entitled the *Harmonika*, which has seen its translation into Arabic. *Optike pragmateia* in five volumes has been preserved only in a Latin translation of an Arabic version.¹² In his principal geographic work *Geographike hyphgesis* composed in eight volumes Ptolemy treated this discipline as a way of describing the Earth by the means of drafts based on astronomical and mathematical laws.¹³

The accomplishments of the Alexandrian scholar are especially eminent on the background of his contemporaries. An outstanding lover and connoisseur of Antiquity, Kazimierz Kumaniecki wrote:

*'Compared with the Hellenistic period, which was marked by intensive and creative scientific work, the imperial period is characterised rather by its trend to encyclopaedism and to digest the results achieved previously. Yet even at that time appeared some eminent talents like Claudius Ptolemaeus in geography and astronomy, and Claudius Galenus¹⁴ in medicine.'*¹⁵

Ptolemy's scientific heritage was not free of mistakes and mismatches what was pointed out especially by the astronomers of Arabic Spain¹⁶. Ptolemy's universe is still and motionless, with the Earth surrounded by a number of concentric spheres.¹⁷ However, it is hard to prophesy in the domain of exact sciences since they do not create interdependently relative systems, but lay down some universal rules of nature and thus any amend-

¹¹ G. Sarton, *Appreciation...*, p.144.

¹² See: C. Ptolemaeus, *L'Optique*, Paris 1956.

¹³ T. Rabenda in: *Słownik pisarzy antycznych*, edit by: A. Świderekówna, Warszawa 1990, p.395-397.

¹⁴ Both *Ptolemy* and *Galen* were elaborately described in *al-Qazwīnī's* work.

¹⁵ K. Kumaniecki, *Historia kultury starożytnej Grecji i Rzymu*, Warszawa 1964, p.511.

¹⁶ See below.

¹⁷ Harry Austryn Wolfson, *Crescas' Critique of Aristotle*, Cambridge-Harvard 1929, p.118.

ments cancel the previous laws. *Almagest* was astronomic *Holy Bible* of a kind till the middle of the sixteenth century while *Geography* influenced the development of the natural sciences for as long a time.¹⁸

Before the Arabs took interest in Ptolemy, the ancient astronomer paid them some attention, hence we know - following his *Geography* - that *Mecca* - *Macoraba*¹⁹ and *Medina*, mentioned as *Jathrippa*²⁰, lay within the geographical horizon of the Ancient.

Arabic Translations of Ptolemy's Works²¹

The very number of Ptolemy's works' Arabic versions shows to what degree he was popular and held in high esteem. As till the sixteenth century *Almagest* remained a *Holy Bible*, or rather, in the case of the Muslim word, a *Qur'an* of astronomers, the work had to be subject to numerous translations.

At times a similar role was ascribed to *Geography*; in *Burzliwe dzieje kalifatu bagdadzkiego* (*Turbulent History of the Bagdad Caliphate*) by J. Hauziński we can read for instance:

*'Translations from Greek had unquestionable influence on geographic Arabic works. The Arabic version of Ptolemy's Geography played a special role among those books.'*²²

A similar opinion was expressed by Józef Bielawski in his *Klasyczna literatura arabska* (*Classical Arabic Literature*):

*'Works by Ptolemy and other Greek scientists translated into Arabic supplied the Arabs with mathematical concepts lying at the basis of the scientific geography represented mainly by al-Huwārizmī (9th century)²³, al-Battānī (about 859-929)²⁴ and al-Bīrūnī.'*²⁵

Perhaps referring to ancient authors the term *translation* is not the most exact one, because from the very beginning Arabic astronomers elaborated

¹⁸ G. Sarton, *Appreciation...*, p.144.

¹⁹ From Sabeian *Macuraba* which means: *temple*: C. Ptolemaeus, *Geographia*, Paris 1883-1901, ch.7, §32; cit. after: P. K. Hitti, *Dzieje Arabów*, Warszawa 1968, p.89; B. Lewis, *Arabowie w historii*, Warszawa 1995, p.42.

²⁰ C. Ptolemaeus, *op. cit.*, ch.7, §31; cit. after: P. K. Hitti, *op. cit.*, p.90.

²¹ Arabic translators of the works by Ptolemy have been arranged in chronological order.

²² J. Hauziński, *Burzliwe dzieje kalifatu bagdadzkiego*, Warszawa-Kraków 1993, p.333.

²³ *Muhammad ibn Mūsā al-Mağūsī al-Huwārizmī*.

²⁴ *Abū 'Abdallāh Muhammad ibn Ġābir al-Battānī*, known in Europe as *Albategnius* - one of the greatest Arabic astronomers.

²⁵ J. Bielawski, *Klasyczna literatura arabska*, Warszawa 1995, p.183, 184.

Ptolemy's heritage and did not merely copy it. Hence many differences among various manuscripts of ancient Men of Science preserved in their Arabic versions; along with the process of translation a kind of *creative interpretation* or *critic* of the text was being done - and from here only one step to a commentary. As it seems Muslim writers did not pay a special attention to the difference between the terms: *translation* and *commentary*. As a good example may serve the coranic *tafāsīr* (sing. *tafsīr* - commentary) by an outstanding historian and commentator of *Coran* at-Ṭabarī (838-923)²⁶ - to a large extent immediate translation of the holy book into Persian, written for simple believers unable of reading in Arabic.

The survey of the most significant translation works will begin with *Almagest* - inseparably bound to the world of Islam. The very word *almagest* derives from the Greek title along with the Arabic definite article *al-*. The original title was the: *Mathematicē syntaxis* or *Megaē syntaxis tes astronomias* (*Great Astronomical Thesis*). With time the work began to be called *Megiste syntaxis* (*The Greatest*) until one of its first Arabic translators *al-Ḥaġġāġ ibn Maṭar* (786-833) entitled it *Kitāb al-Miġistī* - hence *Almagest*.²⁷

Simultaneously with *Quadripartium*, i.e. in the second part of the eighth century *Almagest* might have been transferred into Arabic by *Abū Yaḥyā ibn al-Baṭrīq*. All those works saw revision and correction under the rule of *Hārūn ar-Rašīd* and *al-Ma'mūn*.²⁸ In this way the early translation of *Almagest* was followed by two new and better ones; i.e. the work by *al-Ḥaġġāġ ibn Maṭar*, finished in 812 A.H. and the version by *Hunayn ibn Ishāq* also revised by *Tābit ibn Qurra*. According to *Philip K. Hitti* the honour of the first translation of *Almagest* was ascribed to *al-Ḥaġġāġ ibn Yūsuf ibn Maṭar* and the work had been done for *al-Ma'mūn* before *Hunayn* accomplished his version²⁹. *Paul Kunitzsch* mentioned that *al-Ḥaġġāġ ibn Yūsuf ibn Maṭar* was helped in the translation of *Almagest* (accomplished in 827/828) by *Sargūn ibn Hilīyā ar-Rūmī*.³⁰

Abū Yūsuf Ya'qūb ibn Ishāq al-Kindī transferred into Arabic some books and in their number also *Almagest* - immediately from Greek which he seemed to know.³¹ *Al-Kindī*, called *faylasūf al-'Arab* (*The Philosopher of the Ar-*

²⁶ *Abū Ġa'far Muhammad ibn Ġarīr at-Ṭabarī*.

²⁷ G. Sarton, *Appreciation...*, p.216, endnote 38.

²⁸ P. K. Hitti, *op. cit.*, p.257.

²⁹ Ibidem, p.259-260.

³⁰ *Ibn as-Ṣalāḥ Zur Kritik der Koordinatenüberlieferung im Sternkatalog des "Almagest"*, edit. by Paul Kunitzsch, Wiesbaden 1974, p.10.

³¹ D. Campbell, *Arabian Medicine and its Influence on the Middle Ages*, Amsterdam 1974, p. 64.

abs), also translated, edited or commented on not only *Ptolemy's* but also *Aristotle's* and *Euclide's* works.³² *Philip K. Hitti* said that *Ptolemy's Geography* was translated into Arabic either directly or through Syriac by *Ya'qūb ibn Ishāq al-Kindī* by 874 and also by *Tābit ibn Qurra*.³³ The eminent historian added that the above version was a model for famous *al-Ḥuwārizmī*, the author of *Ṣūrat al-arḍ* (*Picture of the Earth*) which served as the basis for future works.³⁴

Abū Wafā' Muḥammad al-Buzġānī al-Hāsib (about 940-997/998), one of the greatest Muslim mathematicians and astronomers took to a later translation of *Almagest*. Another later translator of mathematical and physical works was *Quṣṭa ibn Lūqa*, a Christian from *Ba'albek*.³⁵

As for other *Ptolemy's* books, one of the pioneers of translation works from Greek, *Abū Yaḥyā ibn al-Baṭrīq* reputedly transferred - as it has been mentioned - *Quadripartitum* into Arabic.³⁶

Ptolemy was a recognised music theoretician in the work *Harmonikā* which also saw its Arabic version. What is significant, his *Optikē pragmateia* in five volumes has been preserved only thanks to the Latin translation from the Arabic one.³⁷

Of course the above list does not explore the subject at the length it deserves. Both partial and overall translations of the Alexandrian scholar's works must have been accomplished almost in every centre leading astronomical observation: for example *Harrān* - the place of astronomical studies of *al-Fārābī* and his Christian mentor - *Yuḥanna ibn Ḥaylān*.³⁸ We cannot help noticing Nestorians and Sabeans as whole scientific schools; collective work often lay at the basis of success of such outstanding translators as *Quṣṭa ibn Lūqa* or *Tābit ibn Qurra*, but only few like *Sargūn ibn Hilīyā ar-Rūmī* saw any mention.

From the standpoint of our cultural circle the role played by Arabic manuscripts in the process of preserving and passing the ptolemaic heritage on to modern Europe is crucial. Special regards should be given to the two centres lying at the point of contact of the two civilisations: Arabic Spain famous for its eminent astronomic and mathematical school - still alive in the times of slow decline of sciences in the Arabic East; as well as Sicily where under the

³² J. Bielawski, *Klasyczna literatura arabska*, p.248.

³³ P. K. Hitti, *op. cit.*, p.319.

³⁴ Ibidem.

³⁵ P. K. Hitti, *op. cit.*, p.259-260.

³⁶ Ibidem, p.257.

³⁷ T. Rabenda in: *Słownik pisarzy antycznych*, p.395-397.

³⁸ Lived in 9th century.

rule of enlightened Norman kings of Palermo the glorious tradition of Arabic written culture was carefully cultivated.³⁹

Arabic Commentaries on Ptolemy's Treatises⁴⁰

*'Biṭūlīmūs (Ptolemy) - a great Greek astronomer and geographer living in the second century. He left traces in music, geography and mathematics. His most important book is 'Almagest' containing 13 chapters concerning stars. Ptolemy's activity exerted immense influence on the Islamic civilisation.'*⁴¹

It is amazing how much attention Islamic commentaries paid to the theory of music worked out in the hands of ancient scientists; mediaeval writers like al-Qazwīnī as well as modern ones - of the sort of the mentioned-above Iranian philologist Zahrā-ye Hānālī. Yet there is nothing surprising in underlining the immense influence of the Alexandrian scholar on the Islamic civilisation. Among all the works by Ptolemy *Almagest* seems to have impressed the most significant mark on science in the empire of caliphs⁴², thus practically giving a propelling impulse to the development of astronomy in the Middle East. It was a subject of numerous works by al-Battānī, al-Fārābī, al-Bīrūnī, Nāṣir ad-Dīn aṭ-Ṭūsī (1202-1274) and the others.⁴³

Muslim Men of Science used - to some extent - imitation, but creative and critical. They also developed their own fields of activity within the general confines of astronomy and physical geography inherited after Ptolemy. A French scientist, mainly interested in *Ibn Ruṣd*, Léon Gauthier wrote for example: *'the ancient did not dare to calculate the Universe and only Arabic astronomers had courage to take to the task.'*⁴⁴

For the Muslim astronomy events taking place more than 100 years before the expansion of Islam and Arabic language had especially innumerable consequences. Thus following the final closure of the *Academy of Plato* in 529⁴⁵ astronomy had to move eastwards. It returned to the Mediterranean in

³⁹ See: C. Haskins, *The Sicilian Translator of the Twelfth Century and the First Latin Version of Ptolemy's 'Almagest'*, Harvard 1916.

⁴⁰ In chronological order.

⁴¹ Zahrā-ye Hānālī, *Farhang-e adabiyāt-e fārsī-ye dari*, Tehrān 1348 A.H.S., p.90-91.

⁴² The term is used only in cultural and not political context.

⁴³ Al-Fārābī, *op. cit.*, p.9.

⁴⁴ L. Gauthier, *Ibn Ruṣd*, Paris 1948, p.114.

⁴⁵ Emperor *Iustinianus* decided to break with the last remnants of paganism including the still active Academy.

Arabic, worked out by al-Ḥaḡḡāḡ ibn Yūsuf, al-Ḥwārizmī and - especially - al-Fargānī (9th century)⁴⁶.

Through notorious lack of information it is hard to say anything about Arabic astronomy under the rule of Banū 'Umayya, however the forthcoming bloom must have been germinating at the time. The only certain point is the activity exerted by Christian and Sabeian Men of Science though their books should have been referred to the former age. Genuine scientific work started as late as with the establishment of the famous *Bayt al-Ḥikma* (The House of Wisdom) in Baghdad; let us read what J. Hauziński writes in his: *Burzliwe dzieje kalifatu bagdadzkiego*:

*'At the side of Bayt al-Ḥikma research was run at an astronomical observatory in Baghdad situated at the gate called Aṣ-Ṣamsiyya. An outstanding Italian expert on the subject, C. A. Nallino remarked on the fact that scientists employed there did not only lead systematic observation of the sky but also with a precision worth mentioning checked all the basic parts of 'Almagest' like: the ecliptic gradient, anticipating the equinoctial points, the length of the solar year etc. Incidentally Ptolemy's 'Almagest' saw at the time (827/828) a scientific translation accomplished by al-Ḥaḡḡāḡ ibn Maṭar.'*⁴⁷

One of the first commentators of the Alexandrian scholar's books was 'Umar ibn Farruḥān (8th/9th cent.) who was ascribed a commentary on the treaty *Quadripartitus* by Ptolemy translated by al-Bīṭrīq at the time of al-Manṣūr.⁴⁸

Abū al-'Abbās Aḥmad ibn Muḥammad al-Fargānī was known in mediaeval Europe as *Alfraganus*. That astronomer and mathematician coming from Transoxana was also famous for constructing - ordered by al-Mutawakkil - the *Manyal* (Nilometre)⁴⁹ in al-Fuṣṭāṭ⁵⁰. He wrote for instance *Ġawāmi' 'ilm an-nuḡūm wa al-ḥarakāt as-samawiyya* (Collection of Studies on Stars and Movements of Celestial Bodies) and *Usūl 'ilm an-nuḡūm* (Basics of the Science on Stars). He also revised the famous mathematical tables by Ptolemy.

⁴⁶ Abū al-'Abbās Aḥmad ibn Muḥammad al-Fargānī - known in mediaeval Europe as *Alfraganus*. An astronomer and mathematician born in Transoxana; G. Sarton, *Appreciation...*, p.145.

⁴⁷ J. Hauziński, *op. cit.*, p.313.

⁴⁸ Ibn an-Nadīm, *Kitāb al-Fihrist*, edit by: G. Flügel, Leipzig 1872, p.395; see: Majid Fakhr, *Histoire de la philosophie islamique*, Paris 1989, p.31.

⁴⁹ A device on the Nile built in Antiquity and constantly rebuilt, or rather built anew. It measures the river level on appointed days of the year in order to forecast the size of floods.

⁵⁰ A town in Lower Egypt, today a district of Cairo; see: P. K. Hitti, *op. cit.*, p.311.

Even *al-Kindī* commented on Ptolemy's treatises.⁵¹

Not less eminent yet living almost a century later than the above commentators *Abū 'Abdallāh Muḥammad ibn Ḡābir Al-Battānī* wrote among others 4 mathematical-astronomical works, but only one - *Kitāb az-zīg aṣ-Ṣabī* (*Book of the Sabeian Astronomical Tables*) has been preserved. That treatise influenced both Arabic and mediaeval European astronomy to an immeasurably large extent.⁵² According to C. A. Nallino al-Battānī's tables were borrowed from a work being an adaptation of Ptolemy's *Geography*.⁵³ Nallino ascribed that version to a Sabeian translator of Greek astronomical books - *Ṭābit ibn Qurra*.⁵⁴ The same Harrānean astronomer inserted some amendments into Ptolemy's works and corrected his figures of the Moon's and some planets' orbits⁵⁵; he also disproved the theory about immobility of the solar apogee. Among other works Al-Battānī wrote *Šarḥ maqālāt al-arbā 'a li-Bīṭālamayūs* (*Explanation of Four Ptolemy's Treatises*). His activity started so-called *critical stage* of Muslim commentaries on Alexandrian scholar's works.

*Ibn al-Faqīh al-Hamaḏānī*⁵⁶, arabicized Iranian, wrote an interesting geographical treatise including folklore and entitled *Kitāb al-buldān* (*Book of Lands*) of which only an excerpt dating back to the eleventh century has been preserved. In that typical *adab* work the author quotes some cosmogenic theories borrowed from Ptolemy.⁵⁷

One of the most eminent Muslim scholars occupied with the Alexandrian scientist's books was Al-Fārābī. His commentaries on *Almagest* were based on an abstract and work by very Ptolemy. Hence the author sometimes called his treatise *Muḥtaṣar al-maḡistī* (*Summary of Almagest*).⁵⁸ Despite the progress which had taken place in celestial mechanics (to a large degree thanks to previous astronomers) al-Fārābī confirms Ptolemy's mistake repeating that the Earth did not move at all.⁵⁹

Beside outstanding individuals also whole schools or cultural currents (and undercurrents) were based on Ptolemy's heritage; an example of such an

activity may be the famous movement of the *Iḥwān aṣ-Ṣafā'* (*The Brotherhood of Purity*). In their writings called *Rasā'il Iḥwān aṣ-Ṣafā'* (*Letters of the Brotherhood of Purity*) natural and anthropological issues were worked out according to Galen's and Ptolemy's treatises.⁶⁰

Another chapter of interpretation of not only ptolemaic, but generally scientific texts was opened by scientists coming from Arabic Spain and North Africa.⁶¹ Philip K. Hitti pointed out that: '*Arabic astronomers from Spain reconstructed the aristotelic system - so different from the ptolemaic one and, in the name of Aristotle, attacked Ptolemy's way of describing celestial bodies' movements.*'⁶² Léon Gauthier remarked that the system which astronomers of Arabic Spain tried to replace Ptolemy's one with, was based on the system of homocentric spheres by *Eudoksos* (about 391-338 BC)⁶³, adopted among others by Aristotle.⁶⁴ However it does not mean that the western pole of the Arabic World completely abandoned the heritage of the great Alexandrian or his followers. The so-called *Tables of Toledo*, based on observation and researches accomplished by numerous Arabic and Jewish astronomers from Spain, can show the continuity and evolutionary rather than revolutionary development of mathematical thought.

The tables include some geographical data of ptolemaic or al-Ḥuwarizmī's descent as well.

Ptolemy's excessive estimate of the length of the *Mediterranean*, reduced by al-Ḥuwarizmī to 52°, was then probably reduced again to an approximately correct figure of 42° by *Abū Ishāq Ibrāhīm ibn Yahyā az-Zarqālī* (Lat. *Arzachel*).⁶⁵

The influence of the author of *Almagest* was also sensed in other - than astronomy and geography - scientific domains. *Abū 'Alī al-Ḥasan ibn al-Ḥayṭam* (Lat. *Alhazen*, about 965-1039), a physicist and optician who was ascribed around 100 works on mathematics, astronomy, philosophy and medicine, could serve as an example. He was famous mainly for his *Kitāb al-*

⁵¹ J. Legowicz, *Historia filozofii średniowiecznej*, Warszawa 1986, p.55.

⁵² See: F. Rosenthal, *Al-Kindī and Ptolemy, Studi Orientalistici in onore di G. Levi della Vida II*, Roma 1956, p.436.

⁵³ See: al-Battānī, *Az-zīg aṣ-Ṣabī*, edit. by: C. A. Nallino.

⁵⁴ C. A. Nallino, art. *Al-Battānī* in: *E.Ī²*, v.I: p.709.

⁵⁵ J. Hauziński, *op. cit.*, p.336.

⁵⁶ P. K. Hitti, *op. cit.*, p.312.

⁵⁷ D. 903.

⁵⁸ J. Bielawski, *Klasyczna literatura arabska*, p.185-187.

⁵⁹ Al-Fārābī, *op. cit.*, p.12.

⁶⁰ Ibidem, p.16-17.

⁶¹ The deadline between scientists of the two areas is hardly possible to draw - if ever, especially under the rule of the two great Berber dynasties - the *Almoravides* and the *Almohades*. Men of Science often moved from Europe to Africa and/or in the opposite direction: e.g. *Ibn Ṭufayl* or *Ibn Ruṣd*.

⁶² P. K. Hitti, *op. cit.*, p.481.

⁶³ Greek. *Eudoksos of Knidos* - writer, mathematician, astronomer, physician and philosopher; Plato's disciple.

⁶⁴ Léon Gauthier, *Une réforme du système astronomique de Ptolémée, tentée par les philosophes arabes du XIIe siècle*, dans: *Journal Asiatique*, nov.-déc. 1909; see: Léon Gauthier, *op. cit.*, p.124.

⁶⁵ P. K. Hitti, *op. cit.*, p.481.

manāẓir, in which he rightly fought one of Euclide's and Ptolemy's theories saying that the eye sends optic rays to the examined object.⁶⁶

In closing let us move once again to the Near East where Ptolemy's works were commented by *Abū al-Futūḥ Aḥmad ibn Muḥammad ibn as-Sarī Nağm (Kamāl) ad-Dīn*, known under the name of *Ibn aṣ-Ṣalāḥ* (d. 1154). He lived and worked in Baghdad but ultimately died in Damascus.⁶⁷

Ptolemy in al-Qazwīnī's works

All the quotations ascribed to Ptolemy can be included into 3 groups: 1) excerpts without reference to the preserved works of the ancient scholar's authorship, yet in regard to their scientific value not necessarily apocryphal, 2) apocrypha, 3) biographical excerpts.

The whole corpus contains 7 quotations, in that number 4 referring to astronomy.

al-Aflāk (Spheres)	Kawkabat as-Safīna (Constellation of the Ship)
Dā'irat al-Burūğ (Sphere of the Zodiac Signs)	Aṣ-Ṣuwar (Images in the Sky)

One citation concerns geography: 3. Baḥr al-Hind (Indian Ocean); two excerpts describe Ptolemy - or rather two *Ptolemies*:

Biṭūlīmāyūs (Ptolemy)	Biṭūlīmūs (Ptolemy)
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Presumable apocrypha:

aṣ-Ṣuwar (Images in the Sky):

'Every image contains its own stars and they form an image confirmed by Ptolemy in the 'Almagest'. Some of them are situated in the northern part of the sky, some others in the sphere of the zodiac signs - which in turn are on the way of the planets. Certain constellations are placed over the southern hemisphere and each image is named after the object it resembles. In this

⁶⁶ P. K. Hitti, *op. cit.*, p.529.

⁶⁷ *Ibn aṣ-Ṣalāḥ Zur Kritik der Koordinatenüberlieferung im Sternkatalog des 'Almagest'*, edit. by Paul Kunitzsch, p.13; further data about the reception of Claudius Ptolemy in Arabic literature: M. Plessner in: *É.I.*, v.I, p.1133-1135.

*way some of them look like a human like Gemini (Arab. al-Ġawzā'); while some others bear a likeness to sea creatures like Cancer (Arab. as-Saraṭān); and still others resemble terrestrial animals like Camel (Arab. al-Ġamal); certain constellations look like birds - e.g. Eagle (Arab. al-'Uqāb); while others go beyond imitations of animal images like Libra (Arab. al-Mīzān) and Virgo (Arab. as-Sunbula - /cereal/Ear). There exist also images that do not form a complete creature like Part of Horse (Arab. Qiṭ'at al-Fars); while some others partly resemble one creature and partly another like Sagittarius (Arab. ar-Rāmī). Some constellations are complete only after adding a star shared with another constellation like Aquarius (Arab. Mumassik al-'inna), because its image completes the form with the addition of a shining star situated at the edge of the northern corner of Taurus (Arab. at-Tawr). Thus that star is a common part of the two constellations and it is situated in the corner of Taurus and on the leg of Aquarius. So the image has been removed and given the above-mentioned names so that each star will have its name to be called when shown. In this way have been calculated: the position of the star in the sphere of the zodiac signs and then in the north and the south of the orbit passing through the centre of the sphere of the zodiac signs - and all that in order to know the times of the night and of the Stars of Destiny (Arab. at-Ṭawālī') at any moment.'*⁶⁸

In this case there is a great deal of probability that al-Qazwīnī made use of the work by *Ibn aṣ-Ṣalāḥ*⁶⁹; a premise could be the fact that the author of the astronomical commentary spent the last period of his activity in Damascus and died there - and that was in about half a century before the writer of the Arabic cosmography. The above excerpt is a concise - if not terse - introduction to the catalogue of the *Almagest*. No close comparison of Ptolemy's text to its equivalent in *Kitāb 'ağā'ib al-maḥlūqāt* is possible as both - in al-Fārābī's⁷⁰ and in Ibn aṣ-Ṣalāḥ's⁷¹ versions - star catalogues contain stars and constellations along with their precise coordinates while al-Qazwīnī shows the reader - in a popular rather than scientific way - the view of the sky as seen by Ptolemy. Let us add that it did not differ from the outlook of the night sky experienced by the Muslim cosmographer, because they both worked in the same area of the Mediterranean and in similar weather conditions (what influences the quality of observation). However all the

⁶⁸ Al-Qazwīnī, *Kitāb 'ağā'ib al-maḥlūqāt, wa ġarā'ib al-mawğūdāt*, Al-Qāhira 1255 A.H., vol.I, p.41-43.

⁶⁹ Ibn as-Salāḥ, *op. cit.*

⁷⁰ See: exp.1.

⁷¹ See: exp.67.

mentioned celestial bodies were subject to the description of the Alexandrian scholar and - what follows - there is no reason to surmise that they derived from another astronomical school.

Kawkabat as-Safīna (Constellation of the Ship)

*'Ptolemy wrote that the big, shining star situated in the southern row of the constellation is called as-Suhayl (Canopus) - and that is the star most remote of its own constellation, marked on astrolabes.'*⁷²

Canopus is a star of the Southern Hemisphere used at present as a point of reference to orientate spaceship telescopes⁷³ - what can be in itself a hint about the degree of brightness of the celestial body. So there is nothing surprising in the interest of the Arabs - and the Ancient. Even if the mention did not come from Ptolemy it is a valuable contribution to his description of the sky. It strikes why with reference to just this star al-Qazwīnī thought fit to appeal to such an eminent authority as the author of *Almagest*. The question comes to mind especially in connection with another presumable apocryphal citation some tens of pages below:

Baḥr al-Hind (Indian Ocean)

*'Ptolemy said in that sea there are more than 20.000 islands and innumerable peoples, yet the best known of those folks is the one which inhabitants of our land reach to'*⁷⁴

The information on the Indian Ocean was not available in the works by Ptolemy, however - at first sight exaggerated - the report about over 20.000 islands is actually an undervalued estimate, taking into account a countless number of tiny islands - particularly within the archipelago of *Sunda Isles*. The more so reliable is the mention about a considerable number of peoples inhabiting those islands. Compared together, the two excerpts seem to indicate a source of some data on southern seas ascribed to Ptolemy - or being his own heritage, yet not authenticated. As a hint can serve the second part of the citation reporting about: *'a folk inhabitants of our land reach to'*. We do not know for sure if al-Qazwīnī writing *'our'* quotes exact Ptolemy's words whether he simply meant Muslim sailors. The first option seems more probable as the geographical horizon of the Arabs in the thirteenth century contained the whole northern part of the Indian Ocean - in such a situation narrowing the report down to a single, indeterminate island would sound

⁷² Ibidem, v.I, p.60.

⁷³ *Le dictionnaire de notre temps*, p.215.

⁷⁴ Al-Qazwīnī, *Kitāb 'aḡā'ib al-maḥlūqāt*, v.I, p.165, v.II, p.33-40.

strange in the mouth of quite a good geographer. What follows, the hypothesis about the authentic authorship of Ptolemy - or at least of one of the scientists prior to al-Qazwīnī by a few centuries - takes a more real shape. However we have to keep in mind that an astrolabe was a navigation appliance used before the invention of a sextant; in this connection the presence of *Canopus* on it⁷⁵ would suggest the necessity of navigating at low - or even southern - latitudes, what in turn remained the domain of the Arabs rather than the ancient. Such a conclusion to a large degree writes off the value of the previous argument.

Apocrypha

Two of Ptolemy's quotations in *Kitāb 'aḡā'ib al-maḥlūqāt* are unquestionable apocryphal statements. They give definite dimensions of certain parts of the Universe while only Muslim astronomers first dared to make such measurements. Léon Gauthier in his book on Ibn Ruṣd pointed out that the ancient refrained from the task leaving only angular co-ordinates⁷⁶:

Dā'irat al-Burūḡ (Sphere of the Zodiac Signs)

*'Ptolemy remarked that the Sphere of the Zodiac Signs numbers 486,259,721 miles and one seventh. Thus the length of each zodiac sign is 39,388,310 miles - and a half and one sixth. In turn the width of a zodiac sign numbers 1,322,943 miles and one third - and God Almighty will support right deeds.'*⁷⁷

al-Aflāk (spheres)

*'Ptolemy pointed out that there was nothing difficult in (calculating) the reach of each sphere, its orbit and diameter. They only cause difficulties for the people who do not know anything about geometry. The one who learnt it from Euclide's works - if clever - will do it with ease'*⁷⁸ The quotation expresses the conviction that calculating the dimensions of the Universe is possible. The opinion seems right - even if concealed by the fact that had the calculation been so easy either Ptolemy or an ancient commentator of his would have done it before.

⁷⁵ See: cit.2.

⁷⁶ L. Gauthier, *op. cit.*, p.114.

⁷⁷ Al-Qazwīnī, *Kitāb 'aḡā'ib al-maḥlūqāt*, v.I, p.78.

⁷⁸ Ibidem, v.I, p.13-22.

Biographical excerpts

This category is represented by only two statements: one referring to Claudius Ptolemy - quoted at the preface; and this is the second one:

Bitūlīmāyūs (Ptolemy)

'Out of Greece came Ptolemy who possessed astronomical knowledge. The sequence of events in the movements of celestial bodies presumably reached him gradually - in an empirical way. In this connection there is not such evidence as in the 'Almagest'. However it seems that he was based on various works and maps which are hardly available at our time.'⁷⁹

Al-Qazwīnī, in a way a good expert on Ptolemy and astronomy as such, seems to describe another Ptolemy. It may be that such a person never existed and the features ascribed to him were a product of the research run on Claudius Ptolemy. However the way the Muslim cosmographer describes him, shows his strong belief that he referred to a really existing man. So al-Qazwīnī writes his name in a different way (*Bitūlīmāyūs* - *Bitūlīmūs*) and gives him a separate description, and ultimately accentuates his research style differing from the Alexandrian scholar's one. Al-Qazwīnī's conviction that the mentioned Man of Science must have made use of some more ancient materials, hardly accessible at the time being, is also meaningful. We can only feel unsatisfied that the author of *Kitāb ātār al-bilād* did not enclose any sample of the mysterious writer's works, though - as he admitted - he must have seen them.

Bibliography

- Al-Battānī, *Az-zīg aṣ-ṣābi*', edit. by: C. A. Nallino.
 Bielawski J., *Klasyczna literatura arabska*, Warszawa 1995.
 Campbell D., *Arabian medicine and its influence on the Middle Ages*, Amsterdam 1974.
Le Dictionnaire de Notre Temps, edit. by: M. Gatard, Hachette 1989.
 Fakhry M., *Histoire de la philosophie islamique*, Paris 1989.
 Al-Fārābī, *Kommentarii k' "Almagestu" Ptolemieja*, edit. by: A. Kubiesowa and G. Ad-Dabbāh, Alma-Ata 1975.

⁷⁹ Al-Qazwīnī, *Kitāb ātār al-bilād*, p.384.

- Gauthier L., *Ibn Rochd*, Paris 1948.
 Gauthier L., *Une réforme du système astronomique de Ptolémée, tentée par les philosophes arabes du XIIe siècle*, Journal Asiatique, nov.-déc. 1909.
 Hānālī Z., *Farhang-e adabiyāt-e fārsī-ye dari*, Tehrān 1348 A.H.S.
 Haskins C., *The Sicilian Translator of the Twelfth Century and the First Latin Version of Ptolemy's "Almagest"*, Harvard 1916.
 Hauziński J., *Burzliwe dzieje kalifatu bagdadzkiego*, Warszawa-Kraków 1993.
 Hitti P. K., *Dzieje Arabów*, Warszawa 1968.
 Ibn an-Nadīm, *Kitāb al-Fihrist*, edit. by: G. Flügel, Leipzig 1872.
 Kumaniecki K., *Historia kultury starożytnej Grecji i Rzymu*, Warszawa 1964.
 Kunitzsch P., *Almagest: die Syntaxis mathematica des Claudius Ptolemäus in arabisch-lateinischer Überlieferung*, Wiesbaden 1974.
 Legowicz J., *Historia filozofii średniowiecznej*, Warszawa 1986.
 Lewis B., *Arabowie w historii*, Warszawa 1995.
 Nallino C. A., art. *Al-Battānī* in: *E.I.*², v.I: A-D, p.709.
 Plessner in: *E.I.*², v.I, p.1133-1135.
 Ptolemaeus C., *Geographia*, Paris 1883-1901.
 Ptolemaeus C., *L'Optique*, Paris 1956.
 Al-Qazwīnī, *Kitāb ātār al-bilād wa aḥbār al-'ibād*, edit. by: F. Wüstenfeld, Göttingen 1849.
 Al-Qazwīnī, *Kitāb 'aḡā'ib al-maḥlūqāt wa ḡarā'ib al-mawḡūdāt*, edit. by: F. Wüstenfeld, Göttingen 1849.
 Al-Qazwīnī, *Kitāb 'aḡā'ib al-maḥlūqāt wa ḡarā'ib al-mawḡūdāt*, Al-Qāhira 1255 A.H.
 Rabenda T. in: *Słownik pisarzy antycznych*, edit by: A. Świderkówna, Warszawa 1990.
 Rosenthal F., *Al-Kindī and Ptolemy, Studi Orientalistici in onore di G. Levi della vida II*, Roma 1956.
 Sarton G., *Appreciation of Ancient and Medieval Science during the Renaissance*, Philadelphia 1953.
 Wolfson H. A., *Crescas' Critique of Aristotle*, Cambridge-Harvard 1929.