

Old Georgian Astronomical Manuscripts

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ABSTRACT

A general overview of Georgian astronomical manuscripts is given, and the contents of a few, dating from the 12th to the 19th centuries, are given. A partial translation and commentary of manuscript A883, entitled *Cosmos*, and dating from the 18th century, is presented.

1. Introduction

A set of Georgian astronomical manuscripts is one of the most impressive testimonies of the evolution of the astronomical world view in Georgia, an evidence of development of scientific approach, a unique bearer of astronomical information, that has come down to us through Georgia's centuries-old history. Those hard centuries had brought up thousands of causes and reasons that could erase or consign to oblivion the unique scientific material. This might have happened to many old Georgian manuscripts. Nevertheless, museums, research institutes, libraries in Georgia, France, Russia, Greece and other European countries, and libraries and archives in Oriental countries house hundreds of old Georgian astronomical and astrological manuscripts, written in the old Georgian alphabet *Asomtavruli* (used in the 5th–10th centuries), and *Nuskhuri* (11th–17th centuries) as well as *Mkhedruli* (used since the 18th century up to our days). Usually, the term *Khutsuri*, according to the comments frequently occurring for Georgian manuscripts, implies two Georgian alphabets – *Asomtavruli* and *Nuskhuri* (Machavariani 1984).

2. Astronomical Manuscripts

The astronomical manuscripts contain descriptions of celestial phenomena, the Sun, the Moon and planets, calendar systems, observation and calculation methods and other kinds of information. Many manuscripts give also descriptions of the climate and seasons, of certain geographical points, and mention names of astronomers and philosophers. A part of this complex of manuscripts is clearly of astrological nature, devoted to prophesizing human fortunes according to positions of the celestial bodies and celestial phenomena. This layer of historico-scientific information has been little studied and actually remains unknown to the western world. It is worth mentioning here Chagunava's (1990) *Vakhtang Bagrationi's Activities in Natural Sciences*, in which the author analysed several old Georgian manuscripts. Vakhtang VI Bagrationi (1675–1737) was a Georgian king, military leader and scientist.

Keeping close scientific and cultural contacts with countries of the western and oriental worlds, Georgia with her original old culture and scientific tradition absorbed elements of oriental cultures and cultural achievements of Western Europe. In this way a unique alloy of the original Georgian, Eastern and Western cultures was formed, and is reflected in the Georgian manuscripts, these historico-astronomical “mirrors”.

Old Georgian astronomical manuscripts bear purely Georgian, as well as Persian, Greek and other names of places, persons and terms all written in Georgian; all non-Georgian names or terms being transliterated into Georgian alphabet characters. On the other hand, old Georgian astronomical manuscripts comprise purely Georgian scientific material. Reading their pages one can easily feel the beauty of the language, and the traditional world view of the Georgian author or translator. For many years, Georgian astronomical manuscripts used to be a subject of study only for philologists and linguists, both Georgian and foreign, their scientific aspect and significance remaining somewhat neglected. Now that nations and cultures are mixing, vigorously exchanging information, time has come to change that practice: by allowing the philologists to continue admiring the beauty of the language, it is our task to reveal the astronomical aspects of old Georgian manuscripts to present-day historians and astronomers. We find it essential to create a Georgian-English dictionary of historico-astronomical terms and names with their transcriptions, a project that would require great efforts. Another useful contribution would be the publication of English or French translations of some of the most important Geor-

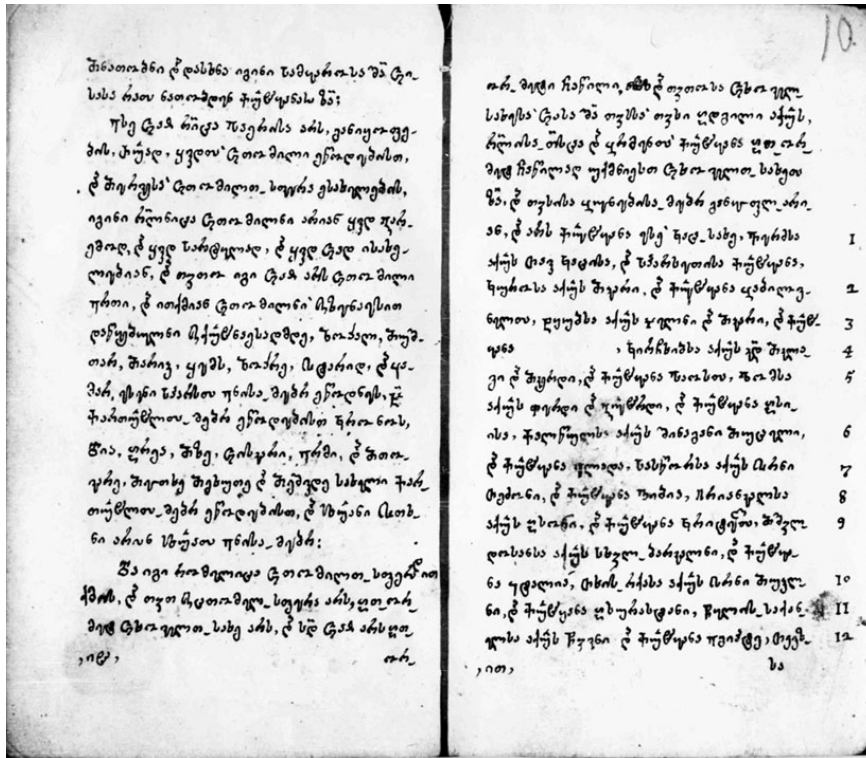


Figure 1. Astronomical manuscript A883, pages 18 and 19.

gian astronomical manuscripts with explanatory notes, comments and glossaries.

It is important to determine the total number of astronomical manuscripts written by Georgian authors, the number of those translated from other languages and the number of mixed manuscripts. This is a multilateral, time-consuming task, since many of the manuscripts were copied and re-copied many times. We hope that this task will be tackled in the future.

We will now consider several old Georgian astronomical manuscripts. The descriptions will contain our approaches and views and will, therefore, vary in volume – some will be brief, others more extensive. Old Georgian astronomical manuscripts are kept in the Research Institute of Manuscripts of the Georgian Academy of Sciences (Simonia 2001). The first catalogue of Georgian astronomical manuscripts was prepared by Kevanishvili (1951); the original is now kept at the Astronomy department of Tbilisi State University.

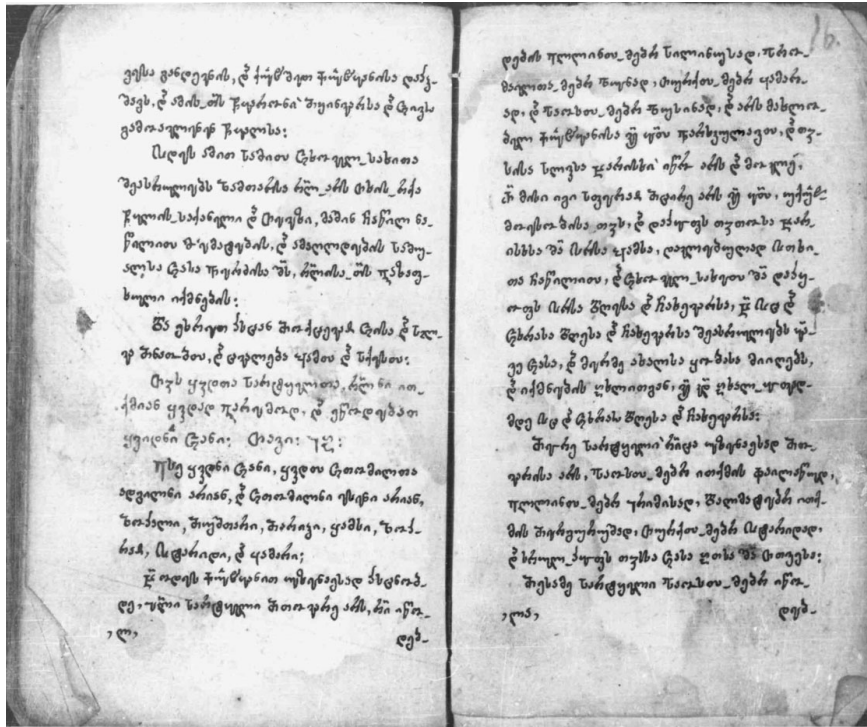


Figure 2. Astronomical Manuscript A883, pages 30 and 31.

Let us now dwell on the description of some manuscripts mentioned in Dr. Kevanishvili’s catalogue. Number A24 is a *Khutsuri* manuscript of the 12th century AD, and signed by Efrem Mtsire, a Georgian philologist, philosopher and translator, who lived around the turn of the 11th to the 12th century. Its page 58 features 12 zodiacal constellations. The manuscript contains two books written by Ioanne Damaskeli (Ioannes Damaskenos) under the title *Legends*. Number A442 is a 75-page *Khutsuri* manuscript from the 15th century, containing a calendar from the 1st day of September to the 31st day of August. Number A684 is a *Khutsuri* manuscript of the 11th century. The manuscript comprises several chapters, one bearing the title *About the World*. The *Khutsuri* manuscript A718 of the 14th century gives descriptions of lunar days.

The *Mkhedruli* manuscript A889 written in the late 18th or early 19th century gives descriptions of the passage of the Moon through the constellations, defining the zodiac, identifying constellations by the stars, giving the entry of the Sun into the constellations, and

the appearance and disappearance of the Moon. Another *Mkhedruli* manuscript, H503, dating from 1808, gives descriptions of the Moon and stars, as well as ephemerides. The *Mkhedruli* manuscript S5237 from the 19th century describes the science of the Sun and the Moon.

This is only a small part of information contained in Dr. Kevanishvili's catalogue. Its descriptions are somewhat irregular, and occasionally rather disordered. We tried to keep the author's style, both in the terms and complete sentences. It is hardly possible to judge the accuracy of the catalogued description of the above listed manuscripts without actually reading them. Therefore, the catalogue can be regarded only as the first approximation of a large unified catalogue of Georgian astronomical manuscripts that has to be created by collective efforts. What makes Dr. Kevanishvili's catalogue particularly valuable is that it is the first regular code of information about Georgian astronomical manuscripts. Among the manuscripts listed above, there are original works of Georgian authors as well as translations. Unfortunately, they have not been studied for their astronomical significance; some of them are in quite poor condition and need to be copied and restored for future generations of researchers.

3. Astronomical Manuscript A883

Let us discuss in detail the *Mkhedruli* manuscript A883 of the 18th century, catalogued under the title *Cosmos*. It consists of 42 pages and is divided into chapters. The first chapter is named *On the Heavens: in what amount the heavens exist, what they are made of, and by whose order*. On the first page the text begins with

“The Creator built this World with His wisdom and power. And He made the World visible... To create the World He used four matters – the fire, the wind, the water and the earth. These are the foundation of everything and each other's opposites. From these matters He created meadows and beasts. And no other matter was heavier than the earth, more fluid than the water; no other matter was more mobile than the air (wind), no other matter was brighter than the fire.”

We will try here to render a translation, as close as possible to the original text, although it is a rather difficult task. The anonymous writer describes, in the first place, the very first steps of creation of

the Universe. There are some exchangeable terms used in the text, for instance *the wind* is replaced by the word *air* as a synonym. Another point worth noticing is that the author refers to the opposition of different forms of matter. Is that a reference to previous sources or does the unknown author realize the differences in the physical nature of these forms of matter? This way of interpreting things was quite common in the 18th century, though.

On the second page of the manuscript we read

“And the Great Prophet Moses said: He created for the basis the Heaven and the world. The Heaven presents two matters – the fire and the air; and the world is made of two matters – the earth and the water. And while He created those four matters, the art of His wisdom showed itself in putting, the heaviest earth below, and placing the water on the earth, and setting the air which was lighter than water, above the water, and placing the fire which was lighter than air, above the air, with moisture observable in the air itself.”

The second chapter of the manuscript begins on page 5 and has the title *About a second Heaven and about its motion*. The author continued with the description of the process of creation of the world referring to the bible, in a way simplifying and abridging the biblical text.

Chapter 7 *about the airy Heaven in which the Luminaries are* starts on page 17. The anonymous author writes:

“As the Holy Bible says, God made lights (Luminaries) and set them in the Heaven to give light upon the Earth. The airy Heaven is divided into 8 parts, 7 of which are called planets and the eighth is the sphere of planets. Those which are planets are called seven circumferences, seven belts, seven Heavens. Each Heaven is one planet. And the planets are listed from the highest to the lowest: Zokhal, Mushtar, Marikh, Shems, Zokhre, Otarid and Kamaz. These names are Persian. For the Georgians they are Kronos, Dia, Area, Mze, Tsiskari, Ermi and Mtovare. The 4th, 5th and 7th names are Georgian; the others are in a different language. And that which is called the sphere of planets and which is a planet-sphere itself, has a face of 12 beasts. The Heaven has 12 parts. Each beast has its place in the Heaven.”

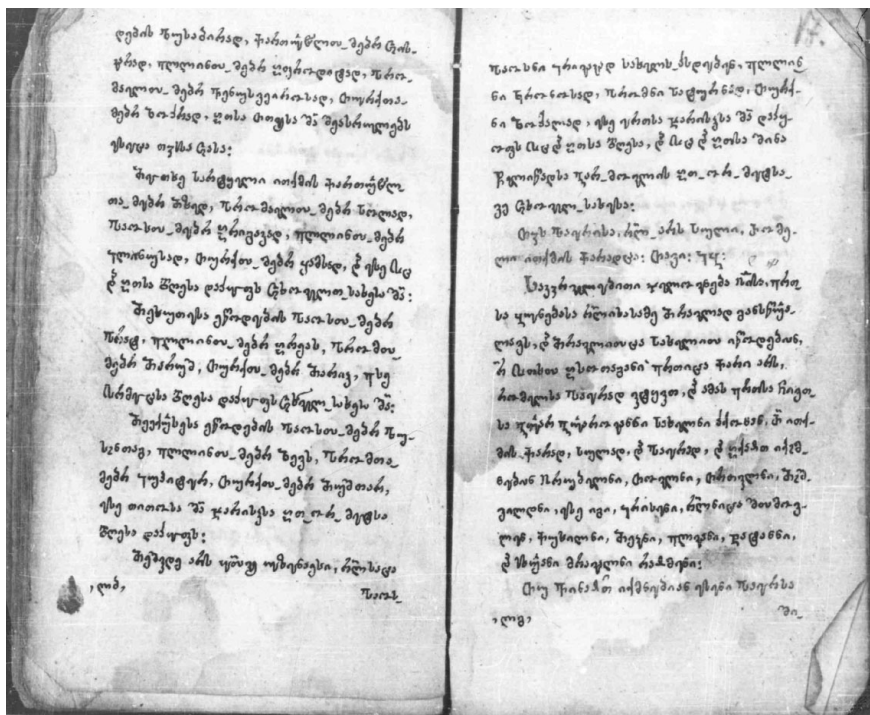


Figure 3. Astronomical manuscript A883, pages 32 and 33.

Then, the author continues to name the zodiacal constellations giving each of them a number and a country. The list of countries includes both Eastern and Western ones. For instance, “Sagittarius has thick thighs and the country is Italy 9, Capricornus has two knees and the country is Asurastan 10, Aquarius has juice and the country is Egypt 11, Pisces has two legs and the country is India 12.” The Gemini constellation had no country and the name followed by a free space and a comma. Fig. 1 shows pages 18–19 of the manuscript with the names of planets and constellations with the respective countries. The pages in this manuscript are lettered. The writer continues:

“and there are 12 beasts in the Heaven and 12 months in a year, and each beast has 30 degrees which are 30 days of a month. The Heaven has 360 degrees which are 360 days of a year, and 5 more additional days appear as small fractions of another chronology.”

Further, the writer describes the calendar system, dividing time into centuries. It should be pointed out that the author uses oriental, Greek and Georgian names of the Luminaries. Many of foreign names acquired a Georgian *tinge*, obviously, owing to their fragmentary use during a long period of time. The author uses 3 names that are purely Georgian: Mze – the Sun, Mtovare – the Moon, Tsiskari – Venus. The questions of origin of the Georgian names and adaptation of foreign names in the Georgian language were analysed by Simonia and Simonia (1994).

It is worth noticing that the author put the heavenly bodies in a certain order, from the most distant Saturn to the nearest to us, the Moon. And what did the author expect to follow the Moon? – It was certainly the Earth. Here we have a clear geocentric world attitude of the author. In the 18th century? Was it late Georgian geocentrism? . . .

Chapter 8 begins on page 20: *How does the Celestial Sphere Move ad Rotate and How Do the Sun, the Moon and the Stars Move?* The author writes:

“what is that motion of the Heaven; at what time will half of the beast’s face rise; this half-face is 15th degree, and 5 degree is equal to one order which is equal to one hour. And when the full face of the beast rises, 2 orders of day will pass.”

It should be mentioned here that the author used the term *tsvai*, which can be translated into English as share, order, quarter.

Then the writer gives an example of finding the Sun in the constellation of Aries (spring). He describes the movement of the zodiacal constellations in the sky, for instance, how Aries would, within a certain period of time set behind the horizon in the West, as he put it, into the inner hemisphere, On page 22, we find a description of repetition of rising and setting of constellations, the Sun, the Moon and stars.

Page 22 opens with Chapter 9: *What Examples Evidence that the Sun and Other Luminaries Move from the East.* The text runs:

“You should also know that the Heaven rotates from the East to the West while the Sun and the Moon and stars move from the West to the East, and their beams will fall southwards.”

Furthermore, the author describes in general terms the phenomenon of culmination of celestial bodies. With some faults though, he touches upon the annual motion of the Sun and other bodies, giving further examples, clarifying the diurnal and the annual motion of celestial bodies,

examples that refer to the life of people and animals. The writer continues: *You should also know, that when the Moon is new, it will move into the Sun and will appear in the West. Day after day, facing the East, it will move and when it becomes 12 days old, it will become faint and appear in the East.* Apparently, the author is trying to describe the lunar phases. Later in the text, the writer refers to the rotation of the Earth around its axis. Then again he goes back to the Sun's annual movement through the zodiacal constellations, giving some of their names.

Analyzing the text of the manuscript, one may come to a dual conclusion, namely that the material was set out in a somewhat irregular and inconsistent way, though, on the other hand, the author was clearly aware of the essence of the phenomena he was describing. Here arises the question whether the author of the manuscript obtained this knowledge from his personal experience and observations, or whether he only compiled data, results and theories of other scientists. He seems to have possessed a regular knowledge of astronomy that he had acquired from contemporary sources. At the same time, he might have accumulated his own, rather rich experience of an observer.

Page 25 starts with chapter 10, *About the four parts of a year.* The text of the chapter tells:

“There is another motion and transition of the luminaries which descend from the North to the South and ascend from the South to the North and give rise to four sections of a year – spring and summer, autumn and winter. There are four sides: East, and West, North and South. And wise men divided the world into 12 parts.

When the Sun goes into Aries and when Libra appears opposite Aries in the West, day and night will become equal and spring will set in. Following this, every day will grow by one part. And the Sun will rise facing the North. And the Sun will pass there faces of beasts – Aries, Taurus, Gemini and there will be spring. When the spring time sets in, seedlings and plants will come to life, people will look beautiful, flowers will bloom, and birds will be born. And after the Sun has moved to the North, though the faces of three beasts, the spring time will be over, and the Sun will go into Cancer and summer time will begin.”

We might have re-shaped stylistically the translation of the narration of the anonymous author, but we consider the manuscript as a

historico-scientific document and give a more or less verbatim translation, retaining its roughness and inconsistency. The author's ideas are quite clear. Despite some lack of perfection, they reveal the author's understanding of the reasons for the annual changes in the Sun's altitude above the horizon depending on its ecliptical motion.

Chapter 11 tells *About Seven Belts Which are Spoken of as Seven Worlds, and they Are Called Seven Heavens*. We read:

“These seven Heavens are places for seven planets. These seven planets are Zokhali, Mushtari, Marikhi, Shamsi, Zokhrai, Otaridi, Kamari. . . The first belt is Mtovare, which is called Silinus by the Hellenes, Luna by the Romans, Kamar by the Turks, Lusin by the Haoses and it is not far from the world of stars, and the degree of its motion is narrow and short. Its sphere is small and it spends two hours in every degree, diminishing by a fourth part, and spends two-and-a-half days in every beast's face, and completes the whole Heaven within 29 and a half days, then gets a new birth and everything begins all over again.”

We see that the author gives different names to the Moon, from Mtovare in Georgian to Lusin in the language of the Haoses (Armenians). He also describes the lunar motion, and defines precisely enough its synodic period. The author continues:

“The second belt that is above the Moon is called Failatsu by the Haos people, Irmi by the Hellenes, Mergurush by the Dalmati people, Otarid by the Turks. This luminary completes its orbit in 10 months. The third belt is Lusabir for the Haoses, Tsiskari for the Georgians, Aphroditi for the Hellenes, Venusveiro for the Romans and Zokhra for the Turks; and this luminary completes its orbit in 10 months. The fourth belt is called Mze by the Georgians, Sola by the Romans, Origav by the Haoses, Ilinus by the Hellenes, Shams by the Turks. This luminary spends 30 days in the face of each beast. The fifth belt is called Khrat by the Haoses, Area by the Hellenes, Marush by the Romans, Marikh by the Turks. This luminary stays in the face of a beast for 40 days. The sixth is called Lusintag by the Haoses, Zevs by the Hellenes, Jupiter by the Romans, Mushtar by the Turks. This luminary stays in each degree for 12 days. The seventh is the uppermost; the Haoses refer

to it as Irivak, the Hellenes as Cronos, the Romans as Saturn and the Turks as Zokhal. This luminary stays in each degree for 30 days, and it will pass through the faces of all 12 beasts in 30 years.”

Figures 2 and 3 show pages 30, 31 and 32, 33, respectively. This is actually the complete 11th chapter of the manuscript.

An analysis of the abovementioned text section reveals the author’s good knowledge of astronomical achievements in different foreign countries. He mentioned Georgians, Hellenes, Romans, Haoses, Dalmats, Turks, which means that he has studied astronomical sources in different languages, such as Greek, Turkish and others. This is evidence of his good general education, in particular, his high level training in astronomy. However, there are some flaws in the definition of periods of rotation of some celestial bodies. Were they errors in the sources or his own mistakes in some measurements? – It is hardly possible to answer this question at present.

The author gives a wrong period of revolution of Mercury. The period of rotation of Venus was given with a smaller error (we mean its sidereal period). However, the author was correct in giving the period of *rotation* of the Sun through the zodiacal constellations. And again, quite a big mistake was made in the period of rotation of Mars.

Assuming, that the term “degree” implied 1.01 angular degrees, the period of rotation of Jupiter will be equal to 4277.2 terrestrial days. This value is close enough to that of the true sidereal period of the planet. The author was quite precise, too, in giving the period of rotation of Saturn. Our assumption that each degree is equal to 1.01 is correct, which is confirmed by the author of the manuscript when he states for Saturn “30 days in one degree”. Calculation based on the assumption of 1 degree being actually 1.01, results in the number 10693, i.e. 29.3 years. The slight difference between the value 29.3 derived from the author’s assumption and the value 30 cited by him elsewhere might have been a result of some errors in the calculations, or using data from two different sources, for instance, an older manuscript and his own calculations.

After the 11th chapter, the contents of the manuscript alters a little, its narration changing from a schematic, step-by-step style to a more generalized one. The author proceeds considering the cyclic character of natural phenomena, though not their agronomical aspects, but climatic ones. The narration itself sounds more like a lecture on nature. It is worth pointing out that in this part of the manuscript the writer, referring to the celestial bodies, no longer used the Georgian

term *mnatobi* meaning *luminary*, that was used in chapters 1 to 11, but another Georgian word, *varskolavi*, meaning *star*. It appears that the author refers to other literary sources while writing this part of the manuscript. Chapters 12 to 22 are devoted to the descriptions of changes in the weather throughout a year, to the wind, mist and other phenomena. The writer describes the rainbow, with quite a correct general perception of its nature. He tries to describe the appearance of a meteor and some other events. On the whole, this part of the manuscript is of somewhat ambiguous character. On the one hand, some events are treated correctly from a physical point of view; on the other, a number of phenomena are misinterpreted. For instance, in the description of the thunderstorm, he does not even suspect that the light and the sound move at different velocities.

The text of the manuscript contains neither mathematical descriptions of natural phenomena, nor graphs and drawings. It is rather of a descriptive, narrative character. Neither the first nor the last pages of the manuscript reveal the name of the author or the writer. Considering the contents and style of the manuscript, it appears to be a brief manual or text book on elementary cosmography. Anyone possessing an intermediate level or respective knowledge could study the material and apply it in practice. The contents of the manuscript seems to have been designed for scholars of intermediate grades, both of clerical and secular schools. The style of the narrative, the author's level of interpretation of natural events, the list of the countries cited and the fact that the writer used the *Mkhedruli* alphabet, as well as characters of the old *Asomtavruli* alphabet, all strongly indicate a 18th century origin of this manuscript. In that age, without technical devices for making copies, rewriting of historical and historico-scientific materials was the only possible way to preserve them. They were copied again and again, year after year, century after century. This is the way how many old Georgian historical and scientific documents have reached us. And here credit goes to scientists and philosophers as well as to numerous clergymen who had been copying for us old Georgian manuscripts and documents. They seemed to take care of the history of science and history of religion, realizing the importance of handing down the inheritance of knowledge, skills, ideas to future generations. If the above considerations are correct, this copy from the 18th century may be based on an original Georgian manuscript of the 11 – 16th centuries, and this fact may give us the clue to the puzzle of the late Georgian geocentrism.

As concerns the dating of the plausible original manuscript, two points should be mentioned: (a) the *Mkhedruli* alphabet used in the

document doubtlessly indicates an 18th century origin of its composition; and (b) the copyist of this elementary cosmography never used the ancient Georgian names of the luminaries: Jimagi (Mercury), Mtiebi (Venus), Tarkhoni (Mars), Obi (Jupiter), Morige (Saturn). These ancient Georgian names had been used both in western and eastern parts of Georgia up to the third century AD (Simonia 2001). Items (a) and (b) may serve as additional indicators in the process of exact dating of this *elementary cosmography*. The scientific contents and the style of narration suggest that the original belonged to the mid-period of the process of formation of the Georgian astronomical world view. A correct dating of the original text is a complicated task calling for further investigation.

The analysis of the “Elementary Cosmography” is certainly not completed. The document ought to be compared with similar foreign sources. In short, it will take quite a lot of efforts, but the first step has been made, and we will appreciate any ideas, questions and counter-arguments.

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References

- Chagunava, R. 1990. *Vakhtang Bagrationi's Activities in Natural Sciences* (Fields of Natural Studies and Technique), Tbilisi.
- Kevanishvili, G. 1951. *Catalogue of Georgian Astronomical Manuscripts*. [Compiled in 1951 and housed at the Department of Astronomy, Tbilisi University].
- Machavariani, E. 1984. *Nuskhuri*, Georgian Encyclopedia, 7, p. 488.
- Simonia, I. 2001. *Little known aspects of the history of Georgian astronomy*. JAHH 4 (1), p. 59.
- Simonia, I., Simonia, Ts., 1994. *The East and The West and Astronomy in Georgia*. Procs. International Symp. 1992, Frombork, Poland.

