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Armenian Archaeoastronomy and Astronomy in Culture

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Abstract. We give a review on the Armenian Archaeoastronomy and Astronomy in Culture, including a short overview of archaeoastronomical matters: rock art, zodiacal constellations, ancient observatories, calendars, records of astronomical events by ancient Armenians, and Armenian Medieval astronomy. The current situation with cultural astronomical studies is presented. A comprehensive list of related literature is compiled. Related Armenian institutions involved in archaeoastronomical and cultural astronomical matters are listed and related meetings held in Armenia are described.

1. Introduction

Armenia is extremely rich in archaeoastronomy and culture, including many creations related to astronomical knowledge; ancient calendars, rock art, mythology, etc. On the other hand, this subject is rather poorly developed in Armenia; there are only individual studies on various related issues (especially many studies related to the medieval thinker Anania Shirakatsi, see below) but not coordinated actions to manage this important field of investigation. This article is about Armenian Archaeoastronomy and Astronomy in Culture, a general overview to mention and summarize some activities and related organizations.

2. Armenian Archaeoastronomy

The listing of archaeoastronomical issues include:

- **Zodiac Constellations.** It is believed that the first division of the sky into constellations was made a few thousand years ago, in the 30^{th}-28^{th} centuries B.C., in the Armenian Highland (see *Olcott, W. T. 1911; Flammarion, C. 1880*). According to the American astronomer and historian of science Olcott, the signs of zodiac contain such animals that lived many thousands of years ago in the territory of Armenia and around. It is very probable that ancient people named the constellations after animals living in their countries rather than known from elsewhere. Moreover, many constellations have their own Armenian names which are different from the Greek ones, however, many of them correspond to each other by the meaning.

- **Ancient Observatories.** Two observatories, Zorats Karer,[1] or Karahunge,[2] and Metzamor are especially well known. *Karahunge* is the Armenian twin of the Stonehenge and is considered to be even older. The name derives from kar "stone" and may mean "singing stones." The other famous name is Zorats Kar, and it is the most fascinating historical astronomical building. It is a megalithic assemblage, 200 km from Yerevan, and 3 km from the town Sisian, at an altitude of 1,770 m. The northern latitude is 39°34′, and eastern longitude is 46°01′. It is an assemblage of many stones put in a circle and a few arms starting from it. Like many other such buildings, Karahunge was thought to be a religious assemblage. However, only in the middle of the 1980s, Karahunge was first interpreted as an archaeoastronomical monument and was studied by Prof. E. S. Parsamian (1999) and Prof. P. M. Herouni (1998). Estimations give from 7700 to 4000 years ago for the age of Karahunge. There are 222 stones with a total extent exceeding 250 metres, including 84 with holes (with 4-5 cm diameters). Dozens of astronomical stone instruments with an accuracy of 30 arcsec may be found. Forty stones form the central ellipse with 45×36 m sizes, having a ruined stone-cluster in the centre. There is a 8 m wide 8-stone road to the N-E. Some stones were used to find the directions to definite stars. By some estimations (observations of definite stars), the observatory was used during 7700-2200 B.C., for about 5500 years. According to many authors (e.g., Bochkarev & Bochkarev 2005), a comparison of the present state of the monument with its situation a hundred years ago reveals a considerable degradation. Thus, the monument needs urgent protection. The monument is unique of its kind at least in the Trans-Caucasian region and could even be the oldest known observatory in the world. If the estimated age of Karahunge is confirmed by archaeological methods, it clearly should be included in the UNESCO World Heritage list of the most important cultural memorials of our planet.

  Metzamor is the other ancient observatory in Armenia. Metzamor was an ancient town near river Metzamor, 35 km from Yerevan, in Armavir province. There was a settlement since the 5th millennium B.C. It was first interpreted as an archaeoastronomical monument in the middle of the 1960s by Prof. E. S. Parsamian (1985). There is an observatory located outside of the fortress. The most probable estimation of the age is 4600 years. Like Karahunge, Metzamor also needs better study and proper attention both from the Armenian government and world archaeoastronomical community. There are a few other sites in Armenia (Sevsar, Astghaberd, Portablur, Agarak, etc.) that are associated with astronomical activity of our ancient habitants.

- **Armenian Rock Art.**[3] There are numerous petroglyphs of astronomical content in Armenia. Studies of the Armenian rock art present in the territory of modern Armenia (historic Armenia was ten times larger, having a 300,000 square km area) show that the Armenians were interested in heavenly bodies and phenomena. The Earth, the Sun, the Moon, planets, comets, Milky Way, stars, and

[1] http://en.wikipedia.org/wiki/Zorats_Karer

[2] http://www.armeniapedia.org/wiki/Karahunj

[3] http://www.armrockart.nt.am/

constellations are reflected in these pictures drawn on rocks in mountains around Lake Sevan and elsewhere in Armenia. These pictures and drawings are being studied by a number of historians, archaeologists, and astronomers. However, there is not enough governmental support to organize large-scale studies or at least try to catalog and preserve these ancient treasures.

- **Ancient Armenian Calendar.**[4,5] Ancient (since 2492 B.C.) and medieval (552 and 1085) calendars. According to investigations by H. S. Badalian (1970), B. E. Tumanian (1985), and G. H. Broutian (1997), the Armenian calendar was one of the most ancient in the world, and may even be the most ancient one. Armenians used a Lunar, then Luni-Solar calendar, and since the middle of the 1st millennium B.C. they changed to a Solar calendar, which contained 365 days (12 months by 30 days and an additional month of 5 days). The new year began in Navasard (corresponding to August 11), when the grape harvest was underway and the constellation Orion (Armenian "Haik") became visible in the night sky. Together with the months, all days of any month also had proper names. The year 2492 B.C. was adopted as the beginning. The Armenian Great Calendar was introduced in the VI century, and the difference with the Julian one was re-calculated. It is remarkable that the Mkhitarians from Venice are the oldest publishers of the Armenian and world calendars (since 1775).

- **Astronomical Terms and Names** used in Armenian language since the second and first millennia B.C. (Armenian names of the planets, constellations and some stars).

- **Records of Astronomical Events** by ancient Armenians (e.g., Halley's comet on the 87 B.C. coin by Armenian king Tigranes II the Great, supernovae explosion in 1054 on the location of present Crab nebulae). The coins of Armenian king Tigranes II the Great (95-55 B.C.), silver and copper-bronze tetradrachms and drachms, clearly reveal a star with a tail on the royal tiara which may be associated with the Halley's comet passage of 87 B.C. If so, one has another case when astronomical events can be useful for historical chronological problems; this would be a far earlier record of Halley in Armenia than was previously known from chronicles and also one of the earliest known images of Halley's comet. According to Prof. Pskovskiy, the 1054 Supernova was first seen and recorded in Armenia in May 1054 (and only later in the summer in China). Interestingly, its remnant, the famous Crab nebula, has been studied in detail in

[4] `http://haytomar.com/`

[5] `http://en.wikipedia.org/wiki/Armenian_calendar`

the Byurakan Astrophysical Observatory and was one of its famous objects of investigation. This nebula has been a natural laboratory for many astrophysical investigations in various multiwavelength ranges.

- **Anania Shirakatsi's** (612-685) **Astronomical Heritage**.[6] One of the most remarkable scientists in the Middle Ages was Anania Shirakatsi (VII century), who had rather progressive astronomical ideas for those times. He was the most important scientist in Armenia, as he was a philosopher, mathematician, geographer, astronomer, chronologist, etc. He has left a few books and writings that survived up to nowadays. Many of them are kept in Matenadaran, the museum of ancient manuscripts. Anania Shirakatsi knew about the spherical shape of the Earth. He also accepted that the Milky Way consisted of numerous faint stars, could correctly interpret Lunar and Solar eclipses, and had other progressive astronomical knowledge for that time. Anania compiled chronological tables, astronomical textbooks, etc. Anania Shirakatsi's works serve as the main source for establishing the ancient Armenian astronomical terminology, including the names of constellations and stars.

- **Medieval Sky Maps and Astronomical Devices** by Ghukas (Luca) Vanandetsi[7] and Mkhitar Sebastatsi[8]. Ghukas Vanandetsi (17^{th}-18^{th} centuries) and Mkhitar Sebastatsi (1676-1749) lived and worked in Europe in the 17^{th}-18^{th} centuries and are known for their detailed charts of the heavens. Lukas Vanandetsi made astronomical instruments, and published the first sky chart with Armenian names of constellations in Amsterdam at the beginning of XVIII century. Mkhitar Sebastatsi was the person who founded the Armenian Catholic Church community in St. Lazar island near Venice, a touristic site for many visitors.



3. Armenian Astronomy in Culture

We are going to open a similar webpage for **Armenian Astronomy in Culture**. Here we list the main topics related to Astronomy in Culture:

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[6] http://www.aras.am/Shirakatsi/index.html

[7] http://hy.wikipedia.org/wiki/%D5%82%D5%B8%D6%82%D5%AF%D5%A1%D5%BD_%D5%8E%D5%A1%D5%B6%D5%A1%D5%B6%D5%A4%D5%A5%D6%81%D5%AB

[8] http://en.wikipedia.org/wiki/Mkhitar_Sebastatsi

- Astronomy in Ancient Cultures
- Ethnoastronomy
- Astronomy, Religion and Mythology
- Astronomical Bases of Philosophy
- Astronomy and Astrology
- Astronomy in Folklore and Poetry
- Astronomy in Arts
- Astronomy in Fashion
- Astrolinguistics; Astronomical Terms and Names
- Astroheraldry and Astrosymbolism
- Astro Tourism

We have established a research department in the Byurakan Astrophysical Observatory "Archaeo- and Cultural Astronomy," where related studies are being carried out.

4. Publications on Armenian Archaeoastronomy and History of Astronomy in Armenia

Here we give a comprehensive list of 69 references related to Armenian archaeoastronomy and History of astronomy in Armenia:[9]

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[9] see also `http://www.iatp.am/ara/library/index.html`

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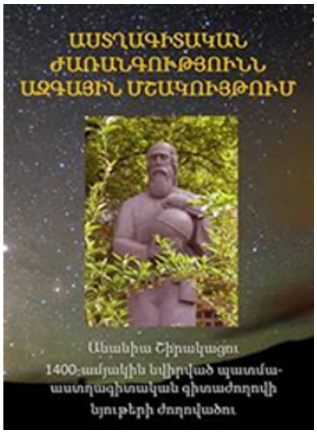

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5. Institutions in Armenia involved in AAC

So far, Byurakan Astrophysical Observatory (BAO) coordinates AAC related actions. UNESCO has officially recognized BAO as the coordinator in the field of Astronomy and World Heritage, a sub-project of UNESCO World Heritage project. BAO representatives also are involved in IAU Working Groups *Astronomy and World Heritage (WGAWH)* and *Archaeoastronomy and Astronomy in Culture (WGAAC)* and the European Society for Astronomy in Culture (SEAC, Societé Européenne pour l'Astronomie dans la Culture). Along with BAO, there are several other institutions related to AAC:

- NAS RA V. Ambartsumian Byurakan Astrophysical Observatory (BAO)[10]
- NAS RA Institute of History[11]
- NAS RA Institute of Archaeology and Ethnography[12]
- NAS RA M. Abeghyan Institute of Literature[13]
- NAS RA H. Acharian Institute of Language[14]
- Matenadaran, Mesrop Mashtots Institute of Ancient Manuscripts[15]

6. Meetings in Armenia Related to AAC

During recent years, we have organized a number of meetings, where archaeoastronomy was involved, including those completely devoted to this subject. The last one, held in 2014 was the first meeting on *Relation of Astronomy to other Sciences and Culture* and for the first time it involved the subject *Astronomy in Culture*. The list of these meetings is as follows:

- Joint European and National Astronomy Meeting (JENAM-2007), **Special Session #6: "Archaeoastronomy"**, 21 Aug 2007, Yerevan
- ArAS VIII Annual Meeting "Astronomy and Society," **Session "Archaeoastronomy"**, 7 July 2009, Byurakan

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[10] http://www.bao.am/

[11] http://www.academhistory.am/en/

[12] http://www.archaeology.sci.am/

[13] http://litinst.sci.am/en/

[14] http://language.sci.am/en

[15] http://www.matenadaran.am/

- **Archaeoastronomy seminar** dedicated to Anania Shirakatsi's 1400$^{\text{th}}$ anniversary, 13-14 July 2011, Byurakan
- **Archaeoastronomical meeting** "Astronomical Heritage in the National Culture" dedicated to Anania Shirakatsi's 1400th anniversary combined with ArAS XI Annual Meeting, 25-26 Sep 2012, Byurakan
- **Meeting "Relation of Astronomy to other Sciences, Culture and Society"** (RASCS) combined with ArAS XIII Annual Meeting, Sessions "Archaeoastronomy" and "Astronomy in Culture," 7-9 Oct 2014, Yerevan
- **Young Scientists Conference "Cultural Astronomy in Armenian Highland"**, 20-23 June 2016, Yerevan
- **Meeting "Armenian Astronomical Heritage"**, dedicated to Benik Tumanian's 100$^{\text{th}}$ anniversary, 2-3 May 2017, Yerevan
- **International Conference "Astronomical Heritage of the Middle East"**, 13-17 Nov 2017, Yerevan

Abstracts of *JENAM-2007*, the meeting *"Astronomical Heritage in the National Culture"* (2012), *RASCS-2014* and Young Scientists Conference *"Cultural Astronomy in Armenian Highland"* are available in Astrophysical Data System (ADS). Proceedings books have been published for all these meetings except *JENAM-2007* and another one is being published for the International Conference *"Astronomical Heritage of the Middle East"*.