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ARMENIAN ARCHAEOASTRONOMY AND ASTRONOMY IN CULTURE

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ABSTRACT

A review is given on archaeoastronomy in Armenia and astronomical knowledge reflected in the Armenian culture. Astronomy in Armenia was popular since ancient times and Armenia is rich in its astronomical heritage, such as the names of the constellations, ancient observatories, Armenian rock art (numerous petroglyphs of astronomical content), ancient and medieval Armenian calendars, astronomical terms and names used in Armenian language since II-I millennia B.C., records of astronomical events by ancient Armenians (e.g. Halley's comet in 87 B.C., supernovae explosion in 1054), the astronomical heritage of the Armenian medieval great thinker Anania Shirakatsi's (612-685), medieval sky maps and astronomical devices by Ghukas (Luca) Vanandetsi (XVII-XVIII centuries) and Mkhitar Sebastatsi (1676-1749), etc. For systemization and further regular studies, we have created a webpage devoted to Armenian archaeoastronomical matters at Armenian Astronomical Society (ArAS) website. Issues on astronomy in culture include astronomy in ancient Armenian cultures, ethnoastronomy, astronomy in Armenian religion and mythology, astronomy and astrology, astronomy in folklore and poetry, astronomy in arts, astrolinguistics and astroheraldry. A similar webpage for Astronomy in Armenian Culture is being created at ArAS website and a permanent section "Archaeoastronomy and Astronomy in Culture" has been created in ArAS Electronic Newsletter. Several meetings on this topic have been organized in Armenia during 2007-2014, including the archaeoastronomical meetings in 2012 and 2014, and a number of books have been published. Several institutions are related to these studies coordinated by Byurakan Astrophysical Observatory (BAO) and researchers from the fields of astronomy, history, archaeology, literature, linguistics, etc. are involved.

KEYWORDS: archaeoastronomy, historical astronomy, cultural astronomy, landscape archaeology, astroarchaeology.

1. INTRODUCTION

Astronomy is one of the ancient sciences in the world, as well as in the Armenian Highland. On the other hand, Armenia is rather rich in archaeoastronomy and the Armenian culture is rich in evidences of astronomical knowledge, both in ancient times and its modern reflections. Being among the most advanced interdisciplinary and multidisciplinary sciences, archaeoastronomy and astronomy in culture (AAC) involve astronomers, historians, archaeologists, ethnographers, philologists, linguists, artists and other representatives of science and culture. That is why it has such popularity.

Armenian AAC include many creations related to astronomical knowledge, including calendars, rock art, mythology, etc. On the other hand, from the professional point of view, this subject is rather poorly developed in Armenia. There are only individual studies on various related issues (especially many studies related to our medieval great thinker Anania Shirakatsi, see below) but not coordinated actions to manage this important field of investigation. This paper is aimed at presenting a general overview to mention and summarize some recent activities. A review is given on archaeoastronomy in Armenia and astronomical knowledge reflected in Armenian culture.

Several Armenian institutions are related to these studies coordinated by Byurakan Astrophysical Observatory (BAO). To systemization and further regular studies, Armenian Astronomical Society (ArAS) has opened a webpage dedicated to AAC (www.aras.am/Archaeoastronomy/astronomyancientarmenia.html). Armenian astronomers are members of SEAC, IAU working groups on *Astronomy and World Heritage*, *Archaeoastronomy and Astronomy in Culture* and other international organizations.

2. ARMENIAN ARCHAEOASTRONOMY

Armenia is one of the most ancient countries in the world. On the other hand, the Middle East (where the Armenian Highland is located) is regarded as the cradle of the civilization.

Astronomy in Armenia was popular since ancient times and Armenia is rich in its astronomical heritage (Herouni, 2006; Mickaelian, 2008; 2014; Parsamian, 1999, 2014; Tumanian, 1985). Armenian archaeoastronomy includes:

- names of the constellations,
- ancient observatories,
- Armenian rock art with astronomical content,
- ancient Armenian calendar and other (medieval) calendars,
- astronomical terms and names,

- records of astronomical events by ancient Armenians,
- Armenian medieval great thinker Anania Shirakatsi's astronomical heritage,
- medieval sky maps,
- medieval astronomical devices, etc.

It has been suggested that the **first division of the sky into constellations** was made a few thousand years ago in the Armenian Highland and nearby areas (Olcott, 1911; Flammarion, 1880). This is based on the names of Zodiacal and some other constellations. The main arguments are the period of visibility, precession calculations, animals involved (that lived in these areas), archaeological studies, cultural traces in the history, folklore, etc. In addition (surprisingly), Zodiacal constellation signs are similar to ancient Armenian symbolism. Many other papers indicate that the first division of the sky into constellations in any case was done in the area of Mesopotamia (e.g. Belmonte, 2015).

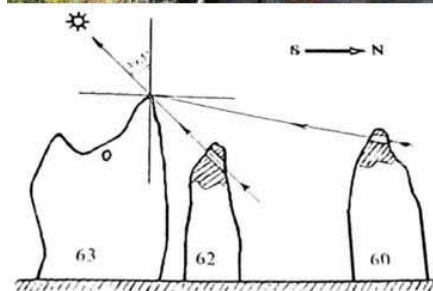


Figure 1. Zorats Karer. Stones Nos. 60, 62 and 63 and a schematic explanation how our ancestors could make observations of the celestial bodies through the holes.
Photo by one of the authors

Two of the ancient observatories discovered in Armenia, namely **Zorats Karer** (or Karahunge) and **Metzamor** are especially well known. Karahunge is the Armenian twin of the Stonehenge and is considered to be even older (Parsamian, 1985a; 1985b;

Bochkarev & Bochkarev, 2005; Herouni, 2006; Martirosyan; 2015). It may be considered as one of the widespread megalithic structures in Europe and Asia (Scuderi et al., 2014). **Figure 1** shows how our ancestors could observe the celestial objects through the holes made in the stones. Beside these two observatories, Sevsar, Astghaber, Portablur and Agarak have also been revealed.

The **Armenian rock art** (numerous petroglyphs of astronomical content) is especially unique and famous (Tokhatyan, 2014; 2015; Ter-Gulanyan, 2014). Most of such carvings are found in historical Armenia and neighbouring countries. We give in **Figure 2** examples of the Armenian rock art and extracted examples of figures from different stones. Original stone with dots and other elements should be related to the calendar. A number of celestial objects (Sun, Moon, planets, comets and stars) are often present.

Ancient and medieval **Armenian calendars** are well studied and described (Tumanian & Mnatsakanian, 1965; Badalian, 1970; Broutian, 1997; 2015; Tumanian, 1972). At least 3 of them are well-known: *Hayots Bun Tvakan* (Armenian Main Calendar, begins on 11 August 2492 B. C.), *Hayots Mets Tvakan* (Armenian Great Calendar, begins on 11 July 552 A. D.) and *Hayots Poqr Tvakan* (begins on 11 August 1084 A. D., Armenian Small Calendar). Ancient Armenian names of the months, days and even of each hour are survived and presently used in the religious (Apostolic) calendar.

Astronomical terms and names used in Armenian language since II-I millennia B. C. (Armenian names of the planets, constellations and some stars) may be divided into two types: 1) those originated in Armenia and being unique, and 2) those taken from ancient Greek and transformed (translated or transliterated) into Armenian (Harutyunian, 2015; Yeghikian, 2015).

Records of astronomical events by ancient Armenians have always been important for the history, particularly for the establishment of exact or possibly true dating. Their role in historical records is well established (e.g. Polcaro et al., 2008), as they help in revealing many unknown to historians facts and dates. Armenians have observed Halley's comet in 87 B. C. and this event was carved on the coin by Armenian king Tigranes II the Great (Gurzadyan & Vardanyan, 2004). According to some authors, the Supernovae explosion in 1054 on the location of the present Crab nebulae was observed in Armenia in May 1054 compared to the Chinese observations in July of the same year (Pskovskij, 1982).

Armenian medieval great thinker **Anania Shirakatsi's** (612-685) astronomical heritage is huge (Anania Shirakatsi, 1962; Conybeare, 1897; Semyonov, 1953; Nazaryan, 2013; 2014; Petri, 1964; Arevshatyan,

2014; Danielyan, 2014; Eynatyan, 2014; Harutyunian & Mickaelian, 2014; Mirumyan, 2015). Among his 29 works, 13 have relation to astronomy (calendars, tables, papers about Earth, Moon and sky). His views were rather advanced for his time. A webpage dedicated to Anania Shirakatsi is available at ArAS website (www.aras.am/FamousAstronomers/shirakatsi.html).



Figure 2. Examples of the Armenian rock art

Other medieval Armenian astronomy-related historians and scientists were Moses Khorenatsi (410-490), Davit Anhaght (VI c.), Hovhannes Yerznkatsi (1230-1293), et al.

Similar to Johann Bayer, Jan Hevelius, Nicolas Louis de La Caille and some others, Armenian scientists have left **medieval sky maps** with the names of constellations and bright stars. Some lists have been survived since Moses Khorenatsi and Anania Shirakatsi, but the most important full sky map was produced by Mkhitar Sebastatsi (1676-1749) in 1749, "*Astghalits Erking*" (**Figure 3**). 63 constellations are drawn with their Armenian names coming from earlier centuries (the mythological ones) or translated from European maps (those introduced during 17th-18th centuries).

Several astronomical instruments were found from the Middle Ages. They are described by B. E. Tumanian (1958; 1985). Particularly interesting is the astronomical-geodetical device astrolabe built by Ghukas (Luca) Vanandetsi (XVII-XVIII centuries).



Figure 3. Armenian medieval sky map "Astghalits Erkinq" by Mkhitar Sebastatsi (1749)

3. ARMENIAN CULTURAL ASTRONOMY

Cultural astronomy is sometimes regarded as the cultural interpretation of archaeological evidence relating to astronomy (Iwaniszewski, 2015a). On the other hand, the astronomical knowledge has been reflected in various cultural creations, from ancient calendars (discussed in Section 2) to modern arts and handicrafts (Stavinschi, M. 2010a; 2010b). Cultural astronomy is represented as a set of interdisciplinary fields studying the astronomical systems of current or ancient societies and cultures. In recent years, considerable attention has been paid to this sphere, particularly international organizations were established, conferences are being held and journals are being published. Armenia is rather rich in various evidences of cultural astronomy.

Here we list the main topics related to Astronomy in Culture (most of them also given in Ruggles, 2015). Issues on astronomy in culture have been described in a number of papers, including by the authors of this paper (Farmanyan & Mickaelian, 2015a; 2015b; Harutyunian, 2000):

- astronomy in ancient Armenia and related cultures (heavily related to Armenian archaeoastronomy),
- ethnoastronomy, which is the study of the knowledge, interpretations, and practices of contemporary cultures regarding celestial objects or phenomena and is tightly connected with the national culture,
- astronomy, religion and mythology (Farmanyan, 2015; Farmanyan & Mickaelian, 2014; Vardumyan G., 2015),
- astronomy and astrology (even though astrology is regarded as false science, it has had a great influence in the history of astronomy and is part of astronomy in culture),
- astronomy in folklore and poetry (Harutyunian, 2014; Arakelyan, 2015),

- astronomy in arts. Astronomy in music (Vardumyan A., 2015),
- astronomy in fashion (clothes, carpets, etc.),
- astronomical terms and astrolinguistics (Harutyunian, 2015; Yeghikian, 2015). As mentioned, many constellations and stars, the 5 planets visible by naked eye, and many other astronomical terms in Armenian are known since the I-II millennia B. C.,
- astroheraldry, i. e. astronomical signs on state flags, coats of arms, coins and banknotes, stamps, etc. (Mickaelian & Farmanyan, 2015). Astronomical signs used in other fields may be combined as astrosymbolism. It is strongly reflected in various Armenian writings: petroglyphs, hieroglyphs, syllabic, and modern alphabets (Figure 4).

PETROGLYPH	HIEROGLYPH	SYLLABIC	ALPHABETS

Figure 4. The evolution of Armenian writing from petroglyphs to hieroglyphs, syllabic, and modern alphabets

A number of recent studies in the Armenian cultural astronomy were carried out by Farmanyan & Mickaelian (2014), Farmanyan (2015) and others.

A similar to Archaeoastronomy webpage for Astronomy in Armenian Culture will be created at ArAS website and a permanent section "Archaeoastronomy and Astronomy in Culture" has been introduced in ArAS Electronic Newsletter "ArASNews" (www.aras.am/ArasNews/arasnews.html).

4. SUMMARY

We reviewed the Armenian astronomical heritage reflected in archaeoastronomical sites and docu-

ments, as well as in ancient, medieval and modern culture.

During the recent years (2007-2014), we have organized a number of meetings, where archaeoastronomy was involved, including those completely devoted to this subject. A number of books have been published. The last meeting, held in 2014 was the first meeting on *Relation of Astronomy to other Sciences and Culture and Society* and for the first time it involved the subject Astronomy in Culture. The list of these **meetings related to AAC** 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.
- Archaeoastronomy seminar dedicated to Anania Shirakatsi's 1400th 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 (Harutyunian et al., 2014).
- 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 (Harutyunian et al., 2015).

Abstracts of JENAM-2007, the meeting "Astronomical Heritage in the National Culture" (2012) and RASCS (2014) are available in Astrophysical Data System (ADS). Proceedings books have been published for the latter two.

A number of institutions in Armenia are involved in AAC. So far, BAO coordinates AAC related actions. UNESCO (UNESCO-IAU Astronomy and World Heritage Initiative (AWHI), e.g. Ruggles, 2013) has officially recognized BAO as the coordinator in Armenia 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, Société Européenne pour l'Astronomie dans la Culture). In Armenia, there are several institutions connected to AAC and involved in related inter- and multi- disciplinary studies:

- NAS RA V. Ambartsumian Byurakan Astrophysical Observatory (BAO) (www.bao.am),
- NAS RA Institute of History (www.academhistory.am/en),
- NAS RA Institute of Archaeology and Ethnography (www.archaeology.sci.am),
- NAS RA M. Abeghyan Institute of Literature (language.sci.am/en),
- NAS RA H. Acharian Institute of Language (litinst.sci.am/en),
- Matenadaran, Mesrop Mashtots Institute of Ancient Manuscripts (www.matenadaran.am).

One can regard **Astrotourism** (which is part of the Scientific Tourism) as part of Astronomy in Culture. Since 2009 (International Year of Astronomy, IYA-2009, declared by UNESCO), we also develop these activities in Armenia that includes observations of starry skies, acquaintance of tourists to native astronomies with the help of archaeo- and ethnoastronomy (Iwaniszewski, 2015b), visits to modern observatories, space museums and planetaria, as well as popular astronomical lectures.

Astronomical journalism is part of the scientific journalism, as most of topics of the latter relate to cosmic subjects: astronomy/astrophysics, space flights, extraterrestrial intelligence, cosmic catastrophes, and even UFOs and astrology (Stavinschi & Mosoia, 2010). In 2010, we have created scientific journalism in Armenia by opening a group of interested journalists and researchers and circulating related regular press-releases to mass-media. Numerous articles, online info materials, radio and TV programs and interviews followed, so that such items increased by a factor of 10-20.

After the foundation of **IAU South West Asian Regional Office of Astronomy for Development** (SWA ROAD) in Armenia, AAC became one of the main directions of its activities. We consider AAC as the most important and appropriate area of astronomy (and perhaps science in general) that can be close to public and play a significant role in the development. SWA ROAD has won a project funded by IAU OAD and a number of events are planned for 2016, including conferences, study of the field, construction of database and webpage, etc. Having SWA ROAD, now the Armenian AAC project also includes regional studies, so that this large area, where very high concentration of world heritage sites and matters are observed, will undergo combined and comparative investigations.

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