

AN ASTRONOMICAL INVESTIGATION OF THE SEVENTEEN HUNDRED YEAR OLD NEKRESI FIRE TEMPLE IN THE EASTERN PART OF GEORGIA

Irakli Simonia

*Faculty of Physics and Mathematics, Ilia Chavchavadze State University,
5, Cholokashvili str; 0162, Tbilisi, Georgia, and Centre for Astronomy,
James Cook University, Townsville, Queensland 4811, Australia.
E-mail: ir_sim@yahoo.com*

Clive Ruggles

*School of Archaeological Studies, University of Leicester, University Road,
Leicester LE1 7RH, England.
E-mail: rug@leicester.ac.uk*

and

Nodar Bakhtadze

*Georgian National Museum, 3, Rustaveli avenue, 0105, Tbilisi, Georgia.
E-mail: nodarbakh@yahoo.com*

Abstract: The Nekresi Fire Temple is a second to third century A.D. archaeological site in eastern Georgia that was excavated by archaeologists towards the end of the twentieth century. In 2004 we carried out an archaeo-astronomical investigation of this site, which indicated that it was used for astronomical observations. We now suggest that this structure should be renamed the 'Nekresi Sun Temple'.

Keywords: Georgian astronomy, Nekresi Temple, solar observations

1 INTRODUCTION

The cosmological ideas of ancient populations are reflected in different aspects of their cultural heritage, including architecture, artifacts, folklore and written records. Prehistoric monuments, legends and myths tell us how the ancient people reacted to the regularity and the recurrence of celestial phenomena and the diversity and the brightness of different heavenly bodies. Cosmological ideas and activities often were closely connected with religious notions, and rituals and ceremonies played an important role in the accumulation of knowledge about the Sun, the Moon and the stars. Ancient peoples often used this knowledge and experience to orientate themselves in time and in space. Some knowledge was materialized, manifesting itself in stone instruments, temples and sanctuaries, in architectural complexes serving ritual purposes, where the gods were worshipped and astronomical observations were made. These simple 'astronomical observatories' have been discovered in many different countries (see Aveni, 1997; Heggie, 1981; Iwaniszewski, 1994; Ruggles, 1999).

One such nation is Georgia, an ancient country beside the Black Sea. Over the centuries, the Georgian people created and developed their own language, literature, music and architecture (Broun, 1994). Various sciences also flourished, including astronomy and mathematics. Simonia (2001) and Simonia and Simonia (2005) have outlined the main stages in the development of the ancient Georgian astronomical 'world view' between the sixteenth century BC and the eighteenth century AD, and the ethnocosmological symbolism of certain Bronze Age artifacts. In particular, they have shown that the ancient Georgians had a

deep interest in heavenly bodies and astronomical phenomena, as reflected in different artifacts and remnants of stone buildings found during archaeological excavations (see Sanikidze, 2002).

In the final decade of the twentieth century an expedition from the National Museum of Georgia carried out archaeological excavations at Kakheti, in eastern Georgia, where the ruins of the ancient town of Nekresi were discovered (Chilashvili, 2000).¹ Among the ruins at Nekresi was a complex building that was identified as a temple. In this paper we discuss the archaeological features of the Nekresi Fire Temple and then examine its astronomical significance.

2 THE INITIAL ARCHAEOLOGICAL INVESTIGATION OF THE NEKRESI TEMPLE

The first structure at Nekresi investigated by the archaeologists was the stone foundation of a cult building, which was identified as the 'Nekresi Fire Temple'. The aim of the archaeological excavation was to determine the structural peculiarities of this ancient temple and to preserve what remained of it. The temple was located in a field at the foot of Nazvrevi Hill (Figure 1), and Chilashvili (ibid.) noted that on the Hill itself was another temple-like structure which may have been associated with the Nekresi Fire Temple.

The walls and foundations of the Nekresi Fire Temple consisted of mortared cobble-stones and broken stones (Figure 2), but in the upper layer of the construction flat bricks were encountered. The design of the temple was complex. In the center was an almost square building of 76m², around which were four buildings forming the shape of a cross (see Figure 3).

During the archaeological excavations an approximately square area of clay, measuring 4.5m² and containing traces of fire, was discovered in the southwestern corner of the central building (hence the name, 'Nekresi Fire Temple'). Elsewhere, the floor of the central building consisted of brickwork. The eastern building had an entrance in the eastern wall, and on both sides of this extension was a corridor and storerooms. Likewise, the western building had an entrance in the western wall. The length of this western

building was 9.5m, and the walls were 1.5m thick. The eastern and western buildings were almost equal in area, and only differed in the details of their construction. The northern and southern buildings leading off the central building were also surrounded by corridors and storerooms. The central building, the four buildings to the north, south, east and west, and their associated corridors and storerooms were all enclosed by a wall, the entire complex measuring ~50m × 50m.



Figure 1: View of the excavated Nekresi Temple from Nazvrevi Hill.

The following facts seem to be important: the walls of the temple complex were constructed of large stones and mortar, the thickness of the walls averaging 1.5m; the width of the doorways was, on average, also 1.5m; and access to any of the rooms in the complex was possible via doors in the external corridors.

During the excavations ceramics in the form of small red and white sherds and fragments of jugs were found, and these and other artifacts dated to the second, third and fourth centuries AD. Radiocarbon dating of charcoal from the entrance doorway to the temple revealed that the complex was destroyed in the fifth century AD.

On the basis of the accumulated evidence, Chilashvili (ibid.) concluded that this archaeological site is the remains of a temple where rituals associated with fire-worship were performed, and he dubbed it the 'Nekresi Fire Temple'. The main 'area of attraction' was the centrally-positioned square building with its altar, which served as a sanctuary for the fire-worshippers during their ceremonies.



Figure 2: View across the archaeological site showing the stone construction of the walls.

Near the Fire Temple Chilashvili discovered other ruins and artifacts of various ages, some of which we also assigned cult functions associated with the worship of the Sun. He noted that these buildings seemed to be aligned with the point of sunrise on the day of the summer solstice, and that they deviated to the north from the direction to the east by about 30°. He also noted that there is a tendency for the older buildings to be more oriented to the north. It is important to stress, however, that all of these conclusions were based upon estimated orientations not surveyed measurements. On this basis, the Nekresi Fire Temple was clearly an excellent candidate for a detailed archaeoastronomical investigation.

3 THE ASTRONOMICAL ROLE OF THE NEKRESI FIRE TEMPLE

In the autumn of 2004 we began studying the archaeoastronomical parameters of the Nekresi Fire Temple. These investigations were carried out in three stages: fieldwork, followed by the processing of the observational data, and finally the theoretical interpretation of the complex.

The fieldwork included:

1. Visual examination of the Nekresi Fire Temple in

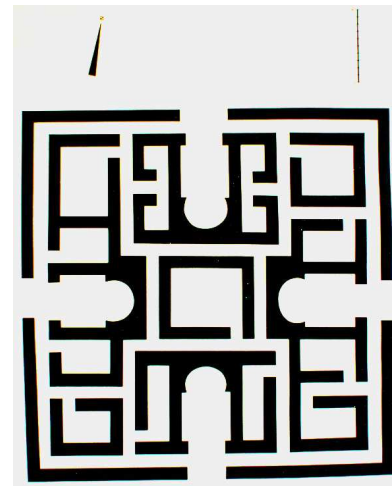


Figure 3: Plan of the Nekresi Fire Temple (after Chilashvili, 2000).

order to determine the architectural and geometrical peculiarities of the construction.

2. Determination of the exact geographic coordinates and orientation of main structural elements of the Temple.
3. Noting the characteristics of the surrounding landscape, including the height of hills and their azimuths.
4. Observation of sunrise from the main structural elements of the Temple.

During the field work we used clinometers, an electronic compass, GPS, digital cameras and other instruments, and we took a series of photographs of the Temple and the surrounding landscape in order to create a photo-catalogue.²

The visual examination of the temple confirmed the complexity of its construction and its multifunctional purpose, including the ritual associations. The approximate mirror symmetry of the main structural elements—the four rooms off the central room—in our opinion, suggest that regular observations of heavenly bodies and phenomena (such as sunrise and sunset, the heliacal rising of stars and the culmination of the Moon) could have been carried out from these rooms (Figure 4). Our measurements of the orientation of the north-eastern (NE), southeastern (SE), northwestern (NW) and southwestern (SW) points of these structural elements and of the central room are listed in Tables 1 and 2. The orientation of structural elements of con-

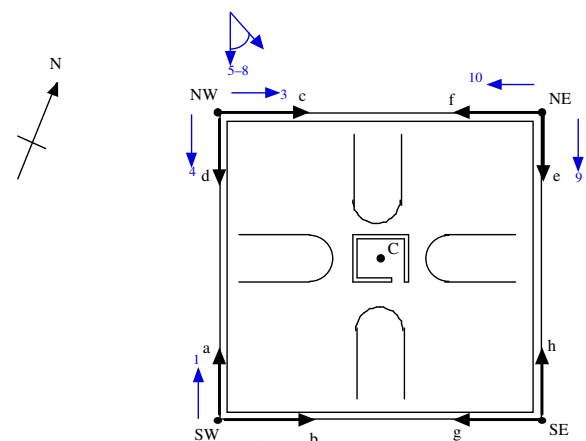


Figure 4: Plan of the Nekresi Fire Temple showing points surveyed during the 2004 expedition.

struction was determined as well, and some features of the surrounding landscape which may have served as orientation points for those observing from the Temple were also recorded. It should also be noted that the hills surrounding the Nekresi Fire Temple have not been thoroughly studied archaeologically, although artifacts and buildings of various ages have been discovered on some of them. Accordingly, the azimuths, heights and distances to various landscape elements were measured.

We also observed the sunrise from the interior of the eastern room and from the central sanctuary. Our observations showed that the first rays of the rising Sun only illuminated some areas of these two rooms, then a little later, the whole Fire Temple was fully sunlit. The peculiarities of illumination of the Fire Temple at the moment of sunrise are connected with the natural landscape in the easterly direction. One cannot exclude the possibility that this landscape may have undergone natural change (e.g. through erosion) over the last thousand years or so. It should also be noted that the landscape (i.e. hills and hillocks) surrounding the Fire Temple does not allow the observer standing in the Temple to fix the moment of sunrise above the horizon.

During the field-work we determined that the Fire Temple is aligned approximately in the direction of the solstice. For an observer standing in the Fire Temple on 22 June the Sun rises over the highest point of eastern part of the visible horizon, while on 22 December the Sun rises over the top of a small hill. It may mean that the summer and winter solstice were important astronomical phenomena for Georgians living in the period of antiquity. Thus, the Fire Temple was aligned such that twice a year, during cult ceremonies, the Sun was seen rising over designated points on the horizon. Only twice a year would the first rays of the rising Sun fall upon some feature in the sanctuary, indicating the beginning of the season for harvesting or sowing the crops. Thus, observation of the rising Sun on the days of the solstice had very important practical significance for the ancient Georgians, by helping them to orient in time and by allowing them to divide the year into two parts. This is the primary astronomical importance of the Nekresi Fire Temple, although this result warrants further investigation.

The next step in the research project was to analyze the data obtained during the fieldwork, which led to some new conclusions.

Using the measured geographical coordinates of certain structural elements of the Fire Temple, as well as data about the sizes of these elements we determined the orientation of the various rooms in the complex. Our calculations showed that two of the rooms off the central sanctuary were oriented towards the northeast

and the southeast, and should be known as the northeastern and southeastern rooms, respectively. In particular, it was determined that the northeastern room was aligned with a point on the horizon with the geodetic azimuth of $A' = 32^\circ 40'$. Meanwhile, the southeastern room was approximately aligned with the point of sunrise on the day of the mid-winter solstice. We believe that this is further evidence of the astronomical functionality of the Nekresi Fire Temple, which should be renamed the 'Nekresi Sun Temple'.

We believe that the ancient Georgians observed the winter solstice from the southeastern room, and that throughout the year they also observed the rising and setting of certain bright stars from the northeastern, northwestern and southwestern rooms. The orientation of the Nekresi Sun Temple indicates that for the ancient Georgians the key zero point in determining time was the winter solstice, since this was the precursor for the sowing of new crops.

Other heavenly bodies and phenomena, including circumpolar stars, the heliacal rising of certain stars, the culmination of the Moon, eclipses of the Sun, etc., could also have been observed from the rooms in the Sun Temple. On the basis of ethnographic analogies (e.g. see Simonia et al., 2008), we suggest that inside the Temple religion and astronomical observations were combined in order to allow a regular 'interaction' between human beings and celestial bodies. The ancient people prayed and conducted astronomical observations believing that their gods would help them personally and the country in general, that the order of the world would remain the same as usual—that a cold season would be followed by a warm season, that the sowing of crops would be followed by the plentiful harvest, and so on. The regularity of the motion of heavenly bodies and of various astronomical phenomena was caused by peculiarities of the ancient belief system and practical necessity associated with agriculture, the cultivation of grapes, and the like.

4 DISCUSSION

At the beginning of 2008, Professor Clive Ruggles, President of IAU Commission 41, prepared and circulated a document titled "Ancient and Historical Properties Relating to Astronomy". The section on Candidate Properties in Europe includes the following entry:

Georgia: Nekresi Fire Temple. This pre-Christian temple, dating to the II – III century AD, takes the form of a rectangular building measuring c. 50 × 50m, with various rooms and corridors surrounding a central space where there is evidence of intensive fire. The temple is approximately aligned with the direction of sunrise on the day of the summer solstice, demonstrating a link between pre-Christian cultic beliefs and astronomical observations.

Table 1: The orientation of different parts of the Nekresi Sun Temple, as determined during the 2004 field expedition (for identification of the different parts see Figure 4).

Point	UTM (WGS84 datum) measured by GPS				Conversion using GRIDLA	
	Zone	Grid easting	Grid northing	Error	Latitude N	Longitude E
NW	38	05 630 16	46 464 68	(4m)	41° 58' 14"	45° 45' 38"
NE	38	05 630 62	46 464 84	(6m)	41° 58' 15"	45° 45' 40"
C	38	05 630 42	46 464 56	(3m)	41° 58' 14"	45° 45' 39"
SW	38	05 630 26	46 464 29	(3m)	41° 58' 13"	45° 45' 39"
SE	38	05 630 74	46 464 40	(6m)	41° 58' 14"	45° 45' 41"

The archaeoastronomical findings presented in Section 3, above, warrant further investigation, but the Nekresi Sun Temple also requires additional study from the archaeological point of view. This applies in particular to the central sanctuary and the northeastern and southeastern rooms. Looking further afield, within a radius of 1.5 km from the center of the Sun Temple and in the directions of horizon points with a geodetic azimuth of $30^{\circ} 40'$ and an astronomical azimuth of $-57^{\circ} 20'$ we can expect to find archaeological artifacts that are associated 'genetically' with the Sun Temple, and we cannot exclude the possibility that the Nekresi Sun Temple is, in fact, merely the center of a larger religious-astronomical complex. Such a point of view seems appropriate given the fact that a structure with probable religious and astronomical significance was discovered some kilometers from the Nekresi Sun Temple but was destroyed during building operations.

5 CONCLUDING REMARKS

In this paper, we describe the most important aspects revealed by the archaeological excavation of a seven-hundred year old temple site in Eastern Georgia. We also describe the results of our initial archaeoastronomical investigation of this site, and show that this temple was oriented towards the summer and winter solstices. On the basis of archaeological and ethnographic evidence we know that the worship of the Sun was an important element in ancient Georgian culture, and we conclude that during the second and third centuries AD the temple at Nekresi was used for solar and other astronomical observations. We suggest that instead of being known as the 'Nekresi Fire Temple' a more appropriate name would be the 'Nekresi Sun Temple'.

We hope that future archaeoastronomical investigations at the Nekresi Sun Temple will reveal interesting new evidence on the ways in which the ancient Georgians developed their astronomical 'world view'.

6 NOTES

1. For information about the ancient city of Nekresi see Kaukhchishvili, 1959: 29.
2. This photo-catalogue has been stored in electronic form, and the various images can be used for future scientific investigations or to illustrate lectures. Copies of individual images can be obtained from the first author of this paper.

Table 2: Azimuths of different parts of the Nekresi Sun Temple.

Direction	Mag az measured ($^{\circ}$)	True az deduced ($^{\circ}$)
a	340.0	345.5
b	69.5	75.0
c	70.5	75.5
d	160.5	165.0
e*	158.0	163.5
f	249.5	255.0
g	248.5	254.0

7 ACKNOWLEDGEMENT

The authors express their gratitude to the anonymous reviewers for their valuable comments, and to Wayne Orchiston for helpful discussions.

8 REFERENCES

- Aveni, A., 1997. *Stairways to the Stars. Skywatching in Three Great Ancient Cultures*. New York, John Wiley.
- Bround, D., 1994. *Georgian Antiquity: A History of Colchis and Transcaucasian Iberia, 550 BC – 562 AD*. Oxford, Oxford University Press.
- Chilashvili, L., 2000. *Pagandom Sanctuaries of Nekresi*. Tbilisi, State Museum of Georgia.
- Heggie, D.C., 1981. *Megalithic Science: Ancient Mathematics and Astronomy in North-West Europe*. London, Thames and Hudson.
- Iwaniszewski, S., 1994. *The Evolution of Astronomy in Mesoamerica: The View from the Other Side of the Atlantic. Time and Astronomy at the Meeting of Two Worlds*. Warszawa, Warsaw University.
- Kaukhchishvili, S. (ed.), 1959. *Kartlis Tskhovreba*. Tbilisi, Sabchota Sakartvelo.
- Ruggles, C., 1999. *Astronomy in Prehistoric Britain and Ireland*. New Haven, Yale University Press.
- Ruggles, C. (ed.), 2008. *Ancient and Historical Properties Relating to Astronomy*. Document prepared by Commission 41 of the International Astronomical Union.
- Sanikidze, T., 2002. *Uplistsikhe: An Essay on the History of Georgian Architecture*. Tbilisi, Universal.
- Simonia, I., 2001. Little known aspects of the history of Georgian astronomy. *Journal of Astronomical History and Heritage*, 4(1), 59-73.
- Simonia, I., and Simonia, Ts., 2005. Metal artifacts as a mirror of ancient Georgian astronomical world view. In Fountain, J.W., and Sinclair, R.M. (eds.). *Oxford 5 Conference. Current Studies in Archaeoastronomy*. Durham (North Carolina), Carolina Academic Press. Pp. 435-440.
- Simonia, I., Ruggles, C., and Chugunava, R., 2008. Ethnographic and literary reflections on ancient Georgian astronomical heritage. *Journal of Astronomical History and Heritage*, 11, 213-218.

Dr Irakli Simonia is an Associate Professor of Cultural Astronomy and Archaeoastronomy at the Ili Chavchavadze State University in Tbilisi and an Adjunct Associate Professor in the Centre of Astronomy at James Cook University (Australia). His history of astronomy research interests are mainly directed towards Georgian archaeoastronomy and cultural astronomy. He is the author of more than 45 research papers, a Committee member of the IAU Working Group on Archives and President of the International Scientific Interdisciplinary Association Astroarchaeocaucasus.

Professor Clive Ruggles is Emeritus Professor of Archaeoastronomy and Ancient History at the University of Leicester. His research interests are directed mainly towards archaeoastronomy and archaeology. He is the author of several books and more than 100 research papers, and is currently the President of IAU Commission 41 (History of Astronomy).

Professor Nodar Bakhtadze works at the Georgian National Museum in Tbilisi (Georgia). His main research interests lie in Georgian archaeology, and the history of architecture.