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#### ASTRONOMY OF ANCIENT CIVILIZATIONS

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## ASTRONOMY OF ANCIENT CIVILIZATIONS

### The International Conference of the European Society for Astronomy in Culture – SEAC, Moscow, 2000

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The Conference “Astronomy of Ancient Civilizations” of the European Society for Astronomy in Culture (SEAC) was held within the framework of the Joint European and National Astronomical Meeting (JENAM) in Moscow at State Sternberg Astronomical Institute, Moscow State Lomonosov University, on May 23–27, 2000. The Chairperson of the Organizing Committee was V. N. Obridko, Doctor of Science (in Physics and Mathematics).

At the conference there were presented 45 papers by the representatives of 16 countries (Great Britain, Hungary, Germany, Greece, Italy, Spain, Kazakhstan, Mexico, Poland, Russia, Romania, USA, Ukraine, Sweden, Switzerland, Estonia). Such an international conference on problems of archaeoastronomy was held in Russia for the first time. The paper abstracts were published in: JENAM 2000. Associated Symposium “Astronomy of Ancient Civilizations, Editors V. N. Obridko, V. L. Staerman. Moscow: Euro-Asian Astronomical Society, Moscow State University Sternberg Astronomical Institute.

At the conference there were presented the results of scientific quest of archeologists, astronomers, historians, ethnographers, philologists, geophysicists, paleo-climatologists on the problems of archaeoastronomy, a relatively new scientific branch, created at the junction of the humanities and natural sciences. The very circle of the enumerated scientific disciplines and their variety testify to the interdisciplinary character of archaeoastronomy, to a complicated and deep system of relations that exist among different scientific trends tied to archaeoastronomy in different ways.

Without archaeoastronomical “understanding” of certain problems different sciences have it is difficult to comprehend their structural and semantic contents. It especially refers to archaeology where the planning of most archaeological objects corresponds to specific vision

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of the world structure and calendar system inherent in ancient population of certain regions. Archaeoastronomical semantics penetrates all the categories of ancient monuments – sanctuaries, burials, petroglyphs, settlements, which requires the joint methodological approaches of nearly all the above mentioned scientific disciplines.

Archaeoastronomy as a scientific discipline is extremely important for discovery not only of the origins and stages of astronomical knowledge development, but also reconstruction of the ancient world outlook, character and meaning of ancient production cycles, stages of paleoclimatic fluctuation, for defining the chronology of archeological cultures, solving the mysteries of mythological creation, investigating calendar systems and ancient knowledge in general.

Although over 30 years have passed since this scientific branch was moulded, scientists have still been debating how to define the meaning of the term “archaeoastronomy” (“paleoastronomy”) viewed as an independent scientific discipline with a circle of questions embraced by it. And this is quite normal because for any branch of science it is significant to determine its research subject and to work out a system of notions and classification criteria.

As a result there are still essential variant readings referring to archaeoastronomical terminology; the character and bounds of permissibility how to interpret the methods of different sciences on the interdisciplinary level; competence and responsibility of representatives of different sciences to identify their part in interdisciplinary research process. It is quite natural if we take into account that all over the world including Russia the new interdisciplinary branch has been developing at fast speed involving new scholars.

That is why archaeoastronomical tasks are far from being easily tackled, they require responsibility to determine the problems that are to become a common goal of special attention for this interdisciplinary scientific branch. There are grounds to suppose that those difficulties will be gradually overcome by joint efforts of scholars from all over the world thanks to regular meetings at conferences, discussions, co-publications. Materials of Moscow conference SEAC 2000 testify prominently to this.

The papers contributed to the conference deal with a wide range of problems that are important to understand many aspects of history of the ancient society, its logic, psychology, mentality, stimuli of its development, ways of adaptation and experience how to survive. The papers concern a place of archaeoastronomy in the system of modern archaeology and astronomy, a level of ancient astronomical knowledge and its application in different spheres of life led by the ancient population in Europe, the Near East, the Ural-Siberian region, Middle Asia, Mesoamerica. The papers also consider the questions concerning cult and astronomical interpretation of archaeological monuments from different epochs, structures of settlements and ritual complexes, ancient calendar systems and their role in the culture of population, astronomical ideas reflected in the folklore; the solar-earth connections are investigated according to paleo-climatical data.

On the whole the materials of archaeoastronomical investigations presented at the conference show how the ancient people from different epochs comprehended the structure and main essence of the Universe. And there is nothing here that can surprise because the ancient mythology, beliefs and culture are somehow connected with the stellar sky, structure and position of constellations, motion of the planets. According to ancient people it was the heaven wherefrom the main laws and moral norms came, it was the laws of the heavenly beings that seemed to be reflected in the people's life. And vice versa, the existing ideas of beauty, aesthetics, harmony were transferred to the structure of the world and were reflected in scientific knowledge.

The papers contributed to the conference can be grouped according to five key topics reflected in the submitted materials: methodology, archaeoastronomy based on archaeological and historical sources; ethnoastronomy; history of astronomy; paleoclimatology.

Three contributions presented at the conference opening were dedicated to methodological questions of archaeoastronomy.

The report made by V. N. Obridko (Russia) deals with the problems of interaction of two sciences – archaeology and astronomy, thanks to which the scholars have succeeded in gaining interesting results in a number of research directions for the past years. First of all it refers to datings of historical and astronomical events; to a variation of solar-earth connections for long term intervals; to a search for extraterrestrial civilizations (Search for the Extraterrestrial Intelligence, acronym SETI).

The paper contributed by C. Ruggles (Great Britain), one of the leading world specialists on archaeoastronomy, drew our attention to importance and equality of archaeoastronomical trend in archaeological researches in general. On the basis of a number of monuments from different regions of the world taken as an example the author shows a historical perspective of archaeoastronomy. Special attention is paid to a series of pivotal theoretical and methodological ideas that are the most vital for archaeoastronomy today. According to the author the main problem is how to unite different material and historical evidences to gain the most adequate understanding of the past, especially taking into account the fact that the sky perception is dependant on the peculiarities of cultural context.

M. Stavinschi (Romania) in her contribution “Astronomy in Culture” tried to elucidate the role of astronomy in different fields of theoretical and practical knowledge: archeology, history, geography, arts, music, politics, religion, astrology, philosophy etc. The author covers a wide spectrum of interesting and urgent problems. However, the bulky topic prevented her from giving profound, well-balanced and well-grounded interpretation of the subject.

The predominant part of papers is based on the results of archeological researches and dedicated to astronomical knowledge of ancient population at different stages of their development starting from hunters of the Paleolithic Epoch up to modern ethnic communities. Those papers most of all correspond topically to all canons of archaeoastronomy. This is quite logical since our factual store of knowledge in archaeoastronomy lies mostly on evidences obtained due to laborious efforts of archaeologists. Therefore it is noteworthy that examining mortal remains of our far ancestors, their house utensils adornment and weapons, studying peculiarities of their life and economic activity the authors of those papers convincingly show that the eyes of ancient people were turned to the sky.

B. Frolov (Russia), a well-known Russian researcher of primeval graphics, summarizes his long record of work in the field of number symbolism and primitive cosmology. In his report he gives statistical data based on analysis of Paleolithic graphical pictures from Siberia and Eastern Europe, where dominance of rhythms divisible by 7 and 5 is connected with observation of celestial bodies, time calculation and lunar female calendar. Paleolithic calendars of Eurasia reflect cycles of reproduction of hunting animals and man as regards astral time, recording a system of numeric relations that has survived in the same context up to the modern ethnographic reality.

The paper presented by A. Pen'kov (Russia) was dedicated to the early neolithic calendars of Khajyrgas cave on the Lena river in Yakutia (Siberian region). Ornaments found on the surface of needleboxes made from tubular bones of big birds are interpreted as having calendric meaning. There were found calendars of different types: those responding to the synodic lunar cycle (29–30 days) and the five-lunar-month period and those having features of an 8-part division of the solar year (45–46 day periods).

Calendar concepts of the population of the Neolithic Pitted Ware Culture in Northern Europe (3400–2400 BC) are considered in the paper by G. Henriksson (Sweden). The author tried to restore the image of a calendar analyzing the grooves (their total number is about 3600) cut in the bedrock on the Swedish island of Gotland. Some of them are oriented at the stand-still points of the sun and moon. However most of the grooves have an intermediate

orientation between the stand-still extremes. The author puts forward some assumptions concerning the time and reason for the grooves creation. According to him azimuths for rising and setting of the full moon at the winter solstice has the same general shift from north to south as the sequences of grooves. If the grooves were made every 19th year during the period embracing 3300–2000 BC, then a good agreement with the computed azimuths is revealed. For the grooves in the northern part of the island there are two peculiar alignments, that are nearer to the east-west direction.

Five papers deal with the calendars of population lived in the Bronze Age and Early Iron Age on the territory of Western Europe. Two of them are dedicated to the questions of ancient astronomy of the Minoan Culture which existed in the Bronze Age on island Crete.

The report by M. Blomberg, G. Henriksson, M. Papathanassiou (Sweden, Greece) considers calendric functions of a peak sanctuary of the Minoan Culture on Mt. Juktas (island of Crete), which is characterized by monumentality of architecture, richness of finds, presence of an altar. This sanctuary was connected with the palace at Knossos, ca 13 km from Juktas (period ca 2000 BC). The authors established that the sanctuary on Juktas and the sanctuary of the palace at Knossos were used for astronomical observations, especially for watching the rising Sun at the autumnal equinox, which was associated by the Minoans with the beginning of a New Year. A special meaning was attributed to the observation of the stellar sky on the 11th day after the equinox, which was important to define the time for intercalation and to calculate a moon's phase at the autumnal equinox for the next year.

Peak sanctuaries of Petsophas and Traostalos in the eastern part of Crete are described in the report by *P. Blomberg* (Sweden) in connection with reconstruction of the Minoan star map. For his reconstruction the author uses the figurines found at the sanctuaries and dated from ca 2000 BC, which he interprets as images of constellations, and the text *Phenomena* by Aratos (ca 275 BC), which, in the author's opinion, has preserved the oral tradition bearing the description of more ancient positions and names of stars. According to the author nearly all the figurines (ca 99%) having astronomical and cult meaning are identical with description of celestial bodies in Aratos' text. Amongst the comparisons made by *P. Blomberg* the identification of the figurine Bull (Ox) with the Ursa Major constellation deserves much attention. The author comes to the conclusion that most of the modern constellations were known and named in the Middle Minoan period (ca 2000 BC).

*E. Calzolari* and *D. Gori* (Italy) contributed to the conference with the paper "The gilded butterfly of Caprione (Lerici – Italy) at the summer solstice sunset: embodiment and return to the generating constellation". It contains interesting material linked to some sacred megalithic structures found on the cape of Caprione (Italy) that are aligned towards the Cassiopea constellation and supposedly erected by ancient population. In San Lorenzo site at the summer solstice sunset the sunrays going through a quadrilithon opening produce a "gilded butterfly" image. Up to M. Gimbutas the butterfly is like a soul transmigrating to the progenitor who might be some constellation. Although the paper material is not convincingly enough grounded, it could serve as a good source for further investigations in the sense of clearing and summing up the megalithic site linkages with archeological monuments and ancient cultures of this and other regions.

In the paper "Ancient Macedonia and its calendars" presented by E. Theodossiou, E. Danezis, M. Stathopoulou, Th. Grammenos, V. Manimanis (Greece) lunisolar calendar systems existing in Ancient Macedonia are analyzed. One of the systems used the so-called "macedonian year". Introduced in 148 BC this system underlined the importance of the victory won by Roman Consul Quintus Caecilius Metellus over the king of Macedonia Philippos Andriscus. The other system used "respectable year" having its name after Octavius Augustus. Its starting point was the date of the great victory won by Octavius over Marcus Antonius and Cleopatra at Acteon (31 BC). The Macedonian calendar outside

Macedonia existed for centuries after Alexander the Great among the calendar systems of several Asian and Egyptian cities.

I. Simonia (Georgia) in his contribution “On old Georgian bronze cosmogrammes” tried from astronomical viewpoint to analyze archeological findings – discoid bronze plates from ancient burial mounds of Bornigem and Zaden-gora (XVI–XIV centuries BC) on the territory of Georgia. The plates are covered with relief images: around a hole that is in the middle there are series of globe-shaped convex images, alternating with series of crescent and triangle-shaped holes. The author assumes that those plates should be treated as cosmogrammes since the ancient workmen tried to display the sky bodies on their surface: the hole in the middle was to represent the Sun, the crescent and triangle-shaped holes – the Moon and Saturn respectively, the globe-shaped convex images – stars and planets. Unfortunately, the author does not give convincing arguments supported by broader archeological material and similar researches to prove his ideas that remain of speculative character.

Three reports were devoted to the spatial-temporal arrangement of settlements and burial grounds in different regions of steppe Eurasia dated from the Bronze Age. Although the materials are referred to different archeological cultures (the Timber-Grave, Sintasht, Andronov), as far as ethnicity is concerned they are all linked with the Indo-Iranian population. The fact that similar results were gained in respect of different archaeological sites on territories separated by thousands of kilometers attracts special interest.

R. Mimokhod (Ukraine) presented the results of investigation of archeological monuments of the Timber-Grave culture on the Ukrainian territory (XVI–XIIIth centuries BC) in the context of revealing regularities and special features in spatial arrangement of cult constructions as regards a settlement and the cardinal points. The author comes to the conclusion that there are certain rules in localization of sanctuaries on settlements. Usually they are situated on the edge, mainly at the east or north-east border of a site, which is connected with functional significance of sanctuaries providing the link of Man with the sacral world. Sometimes the cult erections are stretched in the direction from the south-west to the north-east.

The dominance of north-east alignment of sanctuaries, which correlates with traditional orientation of the dead in the Timber-Grave burials, stands for special attitude of the Indo-Iranian population towards this direction and according to R. Mimokhod is connected with the sunrise at the summer solstice, which is of a great interest also in terms of semantic reconstruction.

A. Kirillov and D. Zdanovich (Russia) considered the spatial hierarchy based upon the example of fortified settlements of the proto-town type which belonged to the Sintasht culture of the South Urals (XVIII–XVI centuries or XXI–XVII (?) centuries BC). In this region astronomical knowledge was rather developed and represented in the monuments of material culture, which is most brightly manifested in astronomical alignments of a well-known settlement of Arkaim. The fortified settlements naturally blend with the surrounding landscape; they are aligned as regards the azimuths of important astronomical events.

Amongst the main astronomical directions the most significant (sacral) is the north-east, related to the sunrise at the summer solstice. The author emphasized the continuity of the culture as a specific feature, which has survived in the sites of the later Bronze Age in the South Urals and adjacent territories. This conclusion correlates with the results of the other specialists’ researches.

T. Potyomkina (Russia) using the complex approach including archaeoastronomical methods analyzed in detail the burial ground of Dashti-Kozy, (XIV–XII centuries BC) on the Zeravshan river in Central Asia. Examining orientation of the burials (as regards the cardinal points considering the azimuths of sunrise and sunsets), postures of the dead, structures of the burial constructions, types of implements, etc. the author determines that the usual burials (as a result of natural death) are linked to the western sector corresponding to the sunset

in different seasons. The burials with the traces of violent (sacrificial) death are oriented towards the north-east and east corresponding to the sunrise at the summer solstice and equinox. In the former case the author explains the link of the deceased with the direction to the World of dead, the latter case must reflect the ancient cult of the Sun and fire.

The orientation of burials displays the world outlook of the ancient population, the climatic conditions of the region and also the peculiarities of life and economy of the mobile cattle-breeding tribes. The validity of this statement is corroborated both by other archaeological sources (see the report by R. Mimokhod) and by the ethnolinguistic materials, which testify to the different attitude of the Indo-Iranian people towards the cardinal points (see the report by A. Lushnikova).

The materials of those three papers convincingly demonstrate that astronomical knowledge in the ancient societies constituted an integral part of the world outlook and mythology and was tightly incorporated in practical activities and ritual habits of people, which stands for reflection of that knowledge in archaeological monuments from different regions and epochs.

In three papers the reconstruction of astronomical notions and world outlook of the population of the Early Iron Age in Western Siberia and Kazakhstan was proposed on the basis of primitive art.

L. Marsadolov (Russia) told about exploration of the grotto Akbaur in the Western Altai. The grotto walls are decorated with various pictures made with red paint. The pictures bear astronomical and calendric symbolism. The pictures and space amongst them were carefully measured. The author drew attention to different moments of the passage of the sunrays during a day through a round aperture in the grotto ceiling and their interconnection with the pictures. The investigation enabled the scholar to put forward a supposition that in the grotto there had been a stationary astronomical observation post. The sanctuary existed during the late Bronze Age (XII–XIth centuries BC) and the early Scythian period (VIII–VIIth centuries BC).

A well-known Russian archaeologist and writer of popular science, V. Larichev (Russia) spoke about rock pictures in the rock proto-temple that was a part of the monument of the Tagar culture (IIIrd century BC). The author told about a wonderful and, apparently, not yet sufficiently studied world of one of the richest monuments at the foothills of the Kuznetzk Alatau in North Khakasiya. In his opinion, all these objects taken as a whole allow us to reconstruct the true level of astronomical knowledge of the Tagar priesthood, their cosmology, astral mythology and heroic epos.

However the very interpretation of the temple as a highly worshipped place connected with burial cults where the narrators of that epoch told a poetic epos about the hero's life on earth, in the netherworld and in the heavens is not very convincing and unambiguous. Sometimes one can feel that the author is carried away by his creation of images and plots, which do not correlate completely with the factual fragments of pictures.

The topic of the contribution made by *N. Bekbassar* (Kazakhstan) is a ritual calendar of nomads from the steppe zone of Eurasia. The author interprets the lay out and orientation of the burial mounds with ridges (with “mustaches”) from the Early Iron Age as a horizontal solar calendar that divides a year into four or eight periods. To prove this idea ethnographical data are invoked.

A number of contributions were dedicated to Sumer-Babylonian and African astronomy.

I. Svyatopolk-Chetvertynski (Russia) considered the Sumero-Babylonian (Nippur) calendar in its relation to the arrangement and purposes of religious festivals and sacrificial rituals. The author specified the lunar character of the calendar and its connection with the lunar phases. He tries to reconstruct the inner logic of sacrificial rituals, which are incorporated in the calendar system being its ancient basis. Two lists of sacrifices – evident and suggested have been compiled.

In the calendar three levels are singled out – heavenly, earthly and underground. Special attention is focused at the so-called “Astrolabia B” and the categories of Sumerian way of thinking – a hundred of sacred ME, a list of which is found in the Sumerian myth “Inanna and Enki”. The ME categories are used for the purpose of semantic analysis of the symbolism of the calendar months, religious festivals and sacrifices. The reconstruction of the calendar canon is interesting as a new viewpoint at the problem of the Sumero-Babylonian calendar together with the previously existing one proposed in the book by V. Emelianov (Russia).

G. Kurtik (Russia) in his contribution “On the time determination of recognition of constellations in Ancient Mesopotamia” tried to define what period of time the knowledge about constellations in Ancient Mesopotamia could go back to. It is noted that the first lists of stars and explicit mentions about constellations in religious and mythological texts date from the end of III – the beginning of the II mil. BC.

J. Steele (Great Britain) analyzed the peculiarities of the later Babylonian astronomy putting forward and solving tentatively the problems of genesis of mathematical astronomical texts from the Seleucid epoch and their connection with non-mathematical texts as well as of the correlation between astronomical information and astrological practice in Mesopotamia.

In the paper the Babylonian and Uruk astronomical schools are singled out. The author believes that non-mathematical astronomical texts date back rather to Babylon than Uruk, but the tradition of mathematical astronomical texts belongs to Uruk.

The author comes to the conclusion that the astronomical activity in Babylon and Uruk in the Seleucid period was closely connected with astrology (with fortune telling tradition of *Enum Anu Enlil*, with the compiling of horoscopes), which accounts for the fact that non-mathematical astronomical predictions co-existed along with the predictions computed with the aid of mathematical ephemerids.

A. A. Krushinsky (Russia) in his contribution “On the origins of Chinese sexagenary calendar cycle” analyzed one of the most ancient Chinese system of counting out. It has besides a binary structure based on the least common multiple of 10 and 12, a tripartite structure, that explains the sexagenary system of counting out through the least common multiple of 3, 4 and 5. Those figures represent a right-angled triangle with its width equal to 3, length – to 4, diagonal – to 5. The author came to the conclusion that the sexagenary system of counting out turns out to be an example of practical application of Pythagorean theorem.

In the report by J. A. Belmonte, S. Esteban, A. P. Betankort, R. Marrero (Spain) there are given the results of archaeoastronomical investigations in one of the oases in the centre of Sakhara on the territory of Libya. The ancient fortified city of Zinkhekra, the first hilltop capital of the protoberberian Garamantian kingdom, at the end of the II mil. BC is considered as a bright monument of that epoch. From the eastern side of the rock at the border of the cliff there was a rock sanctuary formed by seven large cupmarks carved in the rock. The cupmarks were aligned in the direction of the hill in the middle of the flat sand plain over which the sun rises at the summer solstice. The ancient sanctuary has survived for a long time thanks to landscape peculiarities since it is this sanctuary from where one could observe the sun rising at the summer solstice over a specific point at the horizon. Even when the capital was moved to the city of Garama in the 2nd century BC, Zinkhekra remained a sacred city. The report also tells about prominent festivals and different rituals of the ancient population of Sakhara held on the days of the summer solstice.

The calendric subject (natural phenomena, chronology of historical events, ancient astronomical calendars) remains one of the pivotal topics in archaeoastronomy and it is touched upon in other reports in addition to those mentioned above. Calendar motifs, on the one hand, interlace with general problems of astronomy and archaeology and, on the other, they are one



of the aspects of fundamental problems of the world outlook and cosmivision of the ancient people. The category of time enfolds one way or the other in nearly all the papers. But the analysis of ancient calendars and the problems of the world outlook related to them make up the main contents of contributions by S. Iwaniszewski, A. Davletshin, N. Kuznetsova and L. Tsirulnik on materials of Mesoamerica, by M. Gusakov, A. Zhuravel on archeological and historical sources of Russia.

In the report by S. Iwaniszewski (Poland, Mexico) a very interesting explanation of divergences occurred sometimes inside the complete dates on the monuments of the ancient Maya has been proposed. The fact is that the full record of a date according to the Maya system is quite informative. It may contain a date according to the long count (continuous calculation of time starting from the zero-point), dates according to the 260-day and 365-day calendars and data about a lunar phase. In a number of cases there are non-coincidences: a phase (age) of the moon differs from the phase for a date according to the long count. The author suggests that the Maya rulers deliberately manipulated with the records of lunar phases.

The dates on the stone monuments belonging to the Maya culture are mainly connected with the rulers' activity. Some events from their lives (accession to the throne, ritual practice) had to occur during certain lunar phases due to the existing tradition. In real life the tradition could be violated, but in records it was preserved. That is why not a true lunar phase was put down but the one that should have been. The author believes that the "lunar" traditions of the Maya rulers are the consequence of more ancient traditions related to the accomplishing of various agricultural works during certain lunar phases. This is shown on a single example of one Mayan town, but one can assume that similar practice was followed in other Mayan towns.

A. Davletshin (Russia) examined the Epi-Olmec texts, the most ancient ones in Mesoamerica, which enable him to make some conclusions about the Olmec calendar. It differs from the ancient Maya calendar. To account for that the author puts forward his assumption that zero-point of the Olmec calendar (the Julian day of the initial date of long count) differed by 20 days (one month) from the Maya calendar.

A. Davletshin finds arguments in favor of this hypothesis analyzing a series of texts including those related to Venus. He assumes that the beginning of a 365-day year in the Epi-Olmec calendar was shifted by one month, which explains its difference from the Maya calendar.

In the paper "Nonlinear spectral analysis of  $C^{14}$ , sunspot numbers, space plasma, geomagnetic field, global temperature variations and cycles in astronomical calendars of Mesoamerica" contributed by T. Kuznetsova and L. Tsirulnik (Russia) an analysis of the main periods of Mayan calendar from the viewpoint of planetary astronomical periods was presented. Their analysis shows that the Mayan calendar is based on the exact astronomical observations and its main cycles are brightly reflected in the analyzed spectra, which points to the importance of study of the Mesoamerica astronomy for understanding the global changes in the solar system and on Earth.

The contributions by V. A. Yurevich and A. Lebeuf also concern astronomical ideas of the population in Mesoamerica.

*V. A. Yurevich* (Russia) devoted his paper to a wide and quite disputable topic – comparative analysis of astronomical knowledge of the Old and New World. According to the contributor astronomy of Ancient America passed all those stages in its development as astronomy of the Old World did (calendars, gnomon, horizontal astronomy, zodiac) but being two thousand years behind.

In the paper presented by A. Lebeuf (Poland) there is a historicized legend about the disgraceful fall of the king of Tula, who later burns himself on the western coast and disappears turning into the morning star. The author assumes that in the legend the preparation of a sacrificial victim to the Venus star is described.

M. Gusakov (Russia) in his report analyzed a role of the early Iron Age small hillfort-sanctuaries of the forest zone of Eastern Europe in the system of cult constructions made by ancient people. The author rather substantially proposes to look at the osteological material in terms of ancient practice of religious rituals, which was subordinated to certain calendric rules. M. Gusakov analyzes osteological material from archaeological monuments, examines the sites in terms of archaeoastronomy and draws data of the calendars of hunting peoples of the European North. As a result the author comes to the conclusion that the sites functioned as sanctuaries and the osteological material is in all evidence the remains of sacrificial animals (bear, wolf) killed during calendric-festival rituals.

In his report A. Zhuravel (Russia) presented the results of analysis of numerous variant readings of historical events existing in Russian Annals. According to the author the lunisolar calendar not only predominated in Ancient Russia but it co-existed with Julian calendar on equal terms.

The author used systematically computer programs to define true lunations in the past, which allowed him to look in a new way at the chronology of many historical events that had taken place in Ancient Russia and to reveal a number of new regularities while analyzing Old Russian Annals. Those regularities lead to re-dating some concrete historical events mentioned in the annals, to reconsidering from a new angle notions about the history of Russian chronology, about the history of formation of calendar styles from the World creation.

Although the idea that the lunisolar calendar was used on equal foot with the Julian calendar in Ancient Russia as early as in the XIth century was known to the astronomers thanks to the well-known books by I. Klimishin, a due attention to computer methods, that can be applied to analyze chronology of historical events in Ancient Russia, had not been given by specialists prior to the investigations by A. Zhuravel.

Not long ago modern computer programs applied for calculation of repetitive celestial phenomena belonged solely to the arsenal of astronomers and some specialists on history of astronomy. Nowadays the computer programs are successfully utilized, as we can see from the papers presented by historians, astrophysicists (report by V. Dergachev) and other researchers including those who tackle the problems of the ancient events chronology from philosophical and theological viewpoint (report by M. Ruppengluck)

The report on medieval Hungary made by K. Barlai and S. Nagy (Hungary) corresponds to all canons of archaeoastronomy. Based on the example of a small church (XII century AD) in Kana district not far from Budapest the authors investigate the problem of orientation of the medieval churches long axis in the direction of the sunrise at the vernal equinox.

With the help of two independent methods (the measurement of the Pole star position and the measurement by theodolite of the Sun position when it rises on the dates close to the vernal equinox) the authors determined the orientation of the church long axis. They came to the conclusion that the main axis of the church points at the sunrise 2–4 days towards the north from (or after) the vernal equinox. The mistake could be caused by the fact that the builders of medieval churches were not able to hire well skilled architects.

A series of contributions were dedicated to the investigations on ethnoastronomy, where the pivotal problems concerning the ideas about the structure of the Universe in general, the Ursa Major constellation, the Milky Way and semantics of the cardinal points designations were touched upon.

The paper presented by M. F. Kosarev (Russia) concerned the structure of space and time in Siberian paganism. On the basis of ethnographical and folklore data the investigator reveals a complicated system of marginal, concentric and intersecting vertical and horizontal space structures in the Universe as viewed by paganists of Siberia. According to their vision the Universe has three main spheres (lower, middle and upper)

and three main projections: vertical, horizontal and “mixed” (vertical/horizontal), each of which consists of three spheres of its own.

The reports by R. Frank and A. Lushnikova were dedicated to the origin of the Ursa Major designation, which has been traditionally a popular topic in archaeoastronomy. As it is seen from the contributions, their authors differ in their reconstructions. Thus, it will be even more interesting to compare the viewpoints of these experienced specialists and to draw conclusions of one’s own.

R. Frank (USA) maintains the idea that among the long venerated constellations of the northern sky Ursa Major and Ursa Minor have the most archaic names related to the ancient cult of bear. According to R. Frank’s reconstruction the septenary code lies in the basis of the Polar coordinate system and of the designation of Ursa Major, which together with the Pole star formed the upper (divine) level of the ancient model of the Universe. The author has done a lot of work studying the cultural heritage of different peoples, including tales, myths, legends and rituals concerning the bear cult. The comparison of Slavic and Fenno-Ugric materials with the Bask data from the ritual practice and folk tradition made by the author appears to be rather interesting. The author’s address to the material of the North Euro-Asian peoples in the matter of interpretation of the symbolically encoded objects of traditional culture of the peoples living in quite different regions deserves great acknowledgment.

In the report by A. Lushnikova (Russia) on the basis of the peculiarity of Slavic and Fenno-Ugric ethnolinguistic material, which is not properly known to the western specialists, there is proved a statement that for many peoples, who have been inhabiting the continent of Eurasia from ancient times, the Ursa Major constellation was connected originally with the images of the Elk or Deer. In the paper the semantics of Ursa Major denotations is analyzed (in particular there are given the names bearing not only the septenary code but related to more than seven stars), mythological stories referring to this constellation and linking it to other groups of stars (for example, Bootes and the Pleiades), the images of Elk (Deer) and Bear are considered in terms of the ancient world outlook, their complexity and discrepancy are shown. The Indo-Iranian ethnolinguistic data are invoked since, as it is known, the Indo-Iranian tribes in the distant past inhabited the regions of North-East Europe having close relations with Uralian and Slavic peoples.

Three reports were dedicated to the old notions about the stellar sky and the Milky Way and their reflection in the folklore in Western and Eastern Europe.

The research by I. Pustynnik (Estonia) concerns the folk Estonian names of the brightest for perception stars and constellations and their reflection in Estonian folklore. Lexical and folklore data given in the paper enable close and far comparisons different in their depth. For example, the wolfish name for the star Alkor (*g* in the Big Bear constellation) arouses an interest, for it speaks of an alien character of this star in Ursa Major (cp. an Estonian expression given in the article “a wolf alongside the bull”). It is quite possible that the wolfish designation of the star Alkor is somehow correlated with the Russian name for the Milky Way as Wolf’s Way, recorded by L. Tultseva on the territory of Ryazan Meschera. Slavic-Fenno-Ugric comparisons can be proved by ancient cultural and terrestrial unity.

The main subject of investigation undertaken by L. Tultseva (Russia) is folknames for the Milky Way in Middle Russia. The report is based on new materials of the author’s fieldwork, on reconsideration and verification of data recorded by other researchers. The revealed astronims for the Milky Way are interpreted bearing in mind the knowledge of folklore and ethnographic material. In L. Tultseva’s paper the various data of historical events of Ancient Russia, religious Old Slavic customs (many of which are now known only to clergymen or specialists in history) and folk legends successfully interlace as having something common in their origin. A very interesting find deserving a further deep study appears to be the

author's conclusion that the legendary *Komarina Road* is a peculiar earthly replica of the Milky Way.

M. Ruppenglueck (Germany) summarized different views, ancient legends and myths concerning the Milky Way. He undertakes a courageous attempt to find concrete reflections of the Milky Way position (altering in the course of time due to the precession motion of the Earth rotation axis) in the deepest cultural strata in the form of myths, shaman cosmovisions etc.

At the same time in his paper there are general statements and assertions without due reasoning and proofs, which makes the work rather vulnerable. The very interpretation of periodically altering position of the Milky Way as regards the cardinal points in the sense of genesis acceptable in philosophical and theological treatises can hardly be perceived by astrophysicists and other scientists.

The second report by A. Lushnikova (Russia) contains a thoughtful analysis of semantic concepts and their roots found among the representatives of cognate cultures can serve as a precise instrument of archaeoastronomical researches.

The detailed analysis of semantics of the Indo-Iranian designations related to the original concepts of top and bottom, left and right, north and south, as well as their comparisons with similar concepts known among the Fenno-Ugric nations (who inhabited the regions of the Urals in the past having contacts with the Indo-Iranians) enabled A. Lushnikova to reveal a series of interesting related features and at the same time diametrically opposite denotations as regards the cardinal directions such as north–south. The north was regarded as sacred by the Indo-Iranians, the south was associated with the bottom having the most negative status. For Fenno-Ugrians the distribution of sacral significance of north and south turns out to be mirror opposite to the Indo-Iranian. Such a comparative analysis of semantic peculiarities of cognate concepts in different languages widens the opportunities of investigating the whole number of the most interesting problems concerning genealogy of ancient nations' dissemination on our planet and observation of roots of their cultural heritage.

A series of papers were dedicated to the questions of history of astronomy and philosophy. In the report by S. Zhitomirski (Russia) the structure of the world after Eudoxus is analyzed. In the author's opinion, Eudoxus (an ancient Greek mathematician and astronomer, 408–355 BC) tried to solve the task inevitably within the system of concentric spheres since he wanted to keep the principle of concentric structure of the world. The idea of the spherical sky embracing the Earth is natural and initial for the ancient investigators. Eudoxus overcame difficulties of explaining the motions of planets having created a rather sophisticated scheme. Thus, there appeared the first scheme allowing to account for celestial motions and valid for its comparison with observations.

The other two reports presented by a group of scientists A. Dambis, Yu. Efremov (Russia) and by A. Mironov, A. Zakharov, A. Venkstern (Russia) concern an important aspect common for both astronomy and history, the problem of datings. The authors of the papers touch upon a significant and disputable question about dating of observational data utilized in the "Almagest" by Ptolemy (Ptolemy is an ancient Greek astronomer, ca 90–160 AD), but they regard this question from slightly different viewpoints. This contribution is of a great importance also in the sense that the problem of dating the observational material from the Almagest was used by a group of scientists headed by A. T. Fomenko who made a clumsy attempt to reconsider completely the history of the mankind. Only the qualified astronomers succeeded in understanding the nature of those insinuations to give a clear-cut analysis of the datings.

In the paper "On the origin of the Drago constellation" presented by E. N. Kaurov (Russia) the description of the Drago constellation is given. It is stated that its outer inconspicuous contour being its characteristic feature can also be perceived as alike some zodiacal

constellations that were sometimes considered as constellations – markers. It is noted in the paper as well that the description of this constellation encounters not only in the works by ancient Greek astronomers but also in the Sumerian texts. The author put forward his assumptions about the celestial sphere. The Chinese designations of the stars in the Drago constellation are interpreted as if they had indicated how the celestial Pole shifted alongside the Drago tail, which supposedly was observed in antiquity.

In the discussion in connection with this contribution Yu. N. Efremov (Russia) stated that this state of things means fast and strong fluctuations of the angle between the earth axis and ecliptic plane, which contradicts the laws of celestial mechanics and paleoclimatic data. The author's idea about the presumptive characteristics of the Drago constellation is not quite clear as well.

V. V. Kazyutinsky (Russia) in his contribution “Ancient cosmos and modern cosmology”, comparing ancient and modern cosmological ideas, came to the conclusion that modern cosmologists were premeditatedly inspired by the ideas of classical antiquity. The author's idea is certainly interesting although some of his statements give rise to doubts.

At the conference there were also discussed the questions reflecting the direct influence of cosmic factors on the conditions of existence and development of civilization. This extremely important problem still waits for its solution and provokes heated debates. The fact is that for the time being we do not possess a clear-cut knowledge which factors can decisively shape the historic processes. Up to now this question has not been properly investigated from sociological viewpoint as well. Eventually it is not clear how the very cosmic factors alter in the course of time and what their indirect anticipated manifestations on the Earth could be. Our reliable direct observations of the Sun encompass only the past 300 years. There is practically no information about long time variations of other cosmic factors. It is necessary to claim openly that astrologers often use inadequate state of affairs in this field for their benefit pretending their predictions to be a product of scientific analysis of cosmic factors' influence.

The analysis of interrelations between ancient Man and the Nature in the past is a very complicated problem. The climatic conditions are most important factors in this respect. In the course of the whole history of the Earth and mankind cyclical and sudden changes of the climate were able to determine the change in conditions of living, the emergence of certain civilizations and destruction of others, mass migrations of human communities. Even now we live in the epoch when accumulating changes of the climate can lead to substantial changes in the conditions of the modern civilization existence. Besides, the direct pressure on technological systems is also dangerous for the modern civilization since it can cause catastrophic consequences for people. Available literature on this subject is enormous. Three reports treated this problem.

In the research made by V. Dergachev (Russia) the isotopic methods were used to reconstruct the past changes of the climate and environment on the continents.

It is known that many civilizations and cultures of the world experienced collapse approximately at the same time, ca  $2300 \pm 200$  BC. There are neither direct archaeological nor written data concerning the reasons for those catastrophes. Radiocarbonic technique of analysis and dating of climatic variations showed that natural causes rather than human activity exercised global influence on ancient societies.

In the report “Astrometeorological prognosis as important stimulus of astronomical observations for ancient civilizations” made by B. M. Vladimirov (Russia) dendroclimatological data were analyzed. It was shown that the parameters of weather variations have essential periodic components. All these periods are well-known: 25d–30d, two years, 4–5 years etc. Thus, the simple local prognosis of the weather may be constructed from the analysis of parallel astronomical and weather observations. These phenomenological (non-causative) relations were accentuated when the Earth had small magnetic moment (and reduced

magnetosphere) – about 4000 years BC. It is very important to study folk astronomical weather signs to understand the driving motive of astronomic observations in old societies.

In the paper presented by V. Prokudina and M. Rozanov (Russia) the same question is considered with the use of the historical annals and chronicles data. Witnesses of sudden falls in temperature, inundations, droughts, epidemics, years of bad harvest and famine etc. are invoked. In most cases periodicity of natural disasters (especially of those which are not of a socially conditioned character) is correlated with solar activity.

Besides there were presented 14 posters that touched upon the same subjects as the main papers. Most of them were devoted to the history of astronomy (A. V. Kuzmin, Russia; S. O. Ramazanova, Kazakhstan; A. V. Mironov, A. A. Venkstern, A. I. Zakharov, Russia; E. Theodossiou, E. Danezis, V. Manimanis, Greece; M. Suliman, Moscow). The rest of them were dedicated to ancient calendars (A. M. Rafailov, M. A. Rafailov, Ch. A. Rafailova, Russia; I. A. Sviatopolk-Tchetvertynski, Russia), to cosmogonical semantics (M. S. Dement'ev, Ukraine; W. N. Plakhotnjuk, Russia), to archeological sites with astronomical alignments (M. P. Vokhmintsev, Russia; A. Ph. Lagutin, Ukraine; V. S. Zhitenev, Russia), to paleoclimatic changes (A. V. Kuzmin, Russia; V. S. Prokudina, Russia).

Finally we would like to note that the wide scope of investigations is a great virtue of the Moscow conference. Among new problems, which are for the first time considered at the SEAC conferences, there are questions connected with interaction of cosmic factors with the evolution of the human civilization. The results of archaeoastronomical researches presented at the conference enable us to understand more clearly a level of astronomical knowledge, its applications according to time and territory considered, the ways of interactions and continuity of the world outlook from one epoch to another; to draw attention to the historical factors stimulating the development of cosmological knowledge and its peculiarities in different epochs and regions.

At the conference there were widely presented archaeoastronomical investigations of different contemporary scientific trends in Russia. The works of Russian specialists have not been properly known to a wide international scientific community prior to this conference. This testifies to the fact that the new scientific branch has come into being in Russia and it is gradually getting stronger and influential.