

Archaeology and the newest technologies

Recreation of an objective picture of the past is becoming paramount in terms of forming national unity, statehood and sovereignty of the Republic of Kazakhstan. That is the reason why scientific research of history, which holds the fate of the people and its self-consciousness, is the base for brining up feelings of citizenship and patriotism in every person and the people in general.

Archeology is one of the youngest humanitarian studies and it is one of the most important tool of formation of people consciousness.

Archaeology revolutionized history science. Per figurative expression of the famous British archeologist G.Child, «it expanded special horizons of the history is almost the same the telescope did for astronomy. It has uncovered hundreds of layers of the past history to humanity, same was the microscope uncovered the micro life of cells going under covers of exterior of bigger organisms. Finally, it introduced same changes into volume and content of the history science as radioactivity did into chemistry» [1].

Archaeology bears special significance in those countries where written history record is either completely or almost completely missing. This is true for the history of Kazakhstan, the deeper knowledge of which comes from archaeology. It is almost impossible to exhaust archaeological sources. It is extremely difficult to find another region in Eurasia that would compare with this one in terms of number of them; Kazakhstan is a true open-air museum. The brightest expositions may be found in Aral Sea surrounding areas, ancient Syrdarya river delta, Mangyshlak, Saryarka, Zhetysu, Mugodzhary and Itrysh areas.

Scientists have recreated a relatively comprehensive picture of historical development of ancient Kazakhstan and culture during the years of existence of archaeology in Kazakhstan.

Archaeology is the science that both contributes to and steals lots from other knowledge. Various directions that emerge on intersections of different sciences become more and more common nowadays. They are the main driver of the Western archaeology success.

Lately, having absorbed newest technological progress fruit, archaeology has opened new prospects of studying the past. Archaeologists are now armed with magnet- and electro-exploration equipment, satellite pictures and geo-informative systems, 3D-modelling and various methods of dating that have become more reliable and precise.

World archaeological science disposes of a number of different directions and schools that constantly add newest research methods into their toolboxes. The use of such technologies, without a doubt, uncovers huge amount of new fact material.

As a rule, nowadays any archaeological research begins with a thorough study of aerial photographs and topographic maps. The development of digital equipment now allows for a fresh look at the aerial photos through the manipulation of sharpness and contrast of the image. Moreover, compounding a large number of images into one using one of various computer programs accelerates and facilitates the routine of the research.

The use of GIS and aerial photographs allowed scientists to reach unprecedented heights in the analytical field. To receive the many details that often cannot be seen on a simple black-and-white or color photograph taken from the air, they use infrared-sensitive film that maps

temperature and humidity fluctuations. Total station (laser theodolite) data, in combination with aerial photographs allow for application of the image scaling technique.

Receiving, processing and analysis of topographic data has recently become of particular importance, mainly due to widespread adoption of electronic total stations and specific software. Microtopography is very popular in archaeological circles: when an object selected for the study gets documented in high detail. Transferred into an interactive environment, digitized topographic information now appears in the form of three-dimensional models, allowing one to not only enhance visualization, but also solve a number of issues concerning the study of ancient and modern landscape situations [2].

Some time ago, Earth photographs taken from space were of little use in archeology because of their large scale and lack of detail. But after the start of widespread use of data from satellites like LANDSAT, SPOT that fix the Earth's surface by recording the intensity of light reflection as well as infrared and electronic data transfer into photographic images, satellite images have become super popular in the archaeological community. Space imagery is now one of the base aspects in projects aimed at studying agro-irrigation systems, ancient landscapes and towns [3].

All the more "fashionable" become so-called dig-free methods of documentation of archaeological sites. Of course, neither space- or aerial photos nor topography may show specific details, such as buildings under the ground. A range of long-distance data collection methods are widely and successfully used in the world of science to receive those hidden in the earth thicker data without using radical methods (ie, excavation and sampling), or to specify the layout of the object for more accurate and at the same time quick research. These methods include seismic and acoustic research. The use of sound waves which are fixed on the basis of the findings drives conclusions about location of the buried structures. The principle of electrical resistance: the moister the soil, the higher the conductivity and vice versa, has become fundamental to the use of a new method of the remote research that most actively used mainly throughout Europe.

Magnetic survey is the most popular way successfully used in the search and location of buildings made of baked clay. These structures have a magnetic field, which can be locked using magnetometers. The use of metal detectors, not only in the search for metallic objects, but also other structures under the ground, became successful in the course of a series of scientific archaeological projects. As of today, methods of fixation of radioactivity and neutron scattering are new and not very widely used, mainly for the reason that the differences of backgrounds, i.e. the moat and its filling, is not high enough to differentiate between the latter. Thermography, detailed mapping of vegetation, soil geochemical analysis represent natural scientific methodology adopted by archeology as aids of scientific research

Computer as a tool that not only allows for accelerating all kinds of processes in various fields of science and technology, but also opening a whole new hitherto unknown horizons of scientific knowledge, has burst into all ongoing scientific research and, in many cases, changed their direction. In the West, a term that has become very popular over the last decade is now widely used - virtual archaeology.

Methods for creating virtual reality in archeology are represented by reconstruction, three-dimensional graphics, and immersive display. They can turn the information that is difficult to see into a more affordable visual, dialogue (interactive) format, as well as open new ways of presenting the studies. Simulation in virtual archeology allows using of all our modern knowledge, thinking about the object in an interactive user presentation [4].

Lots of various computer programs and technical equipment come to help archaeologists in collecting and processing the necessary information. The most popular computer programs are AutoCAD with its numerous applications, as well as geographic information systems (eg, Arc View or Mapinfo), a huge number of programs for creating and managing databases. As for the technical equipment, the undisputed leader here is total stations of different models and versions, digital cameras that were mentioned above, and also very commonly and widely used global positioning system receivers (GPS). A simple enumeration of the software developed specifically for archeology or computer programs that are widely used in various areas, including archeology, would take more than one page. It is some kind of a new direction in archeology - careful documentation and analysis of the collected data by using advanced technology and equipment [5].

Great results have been achieved by the archaeological science in terms of chronology and the newest natural science methods of the so-called relative and absolute dating. Below we will mention some of them: radiocarbon dating, potassium-argon, uranium isotope, chlorine-36, thermoluminescent method, archaeological and paleomagnetism, the method of determining the degree of oxidation of the carbon, dating by pollen, faunal remains, dendrochronology, etc. New extensive data obtained from the use of various dating methods allows one to adjust previously established theories and to build new chronological chains. In short - to find a place for the facts in the historical canvas. Rapid development and wide use of multiple methods of dating makes up-to-datedness and priority of this area very visual.

Recently, there has been a need for scientific technical focus groups, a kind of avant-garde, the one that will first elaborate the software in theory, and then apply the latest computer programs in Kazakhstan archaeological research in real life.

So-called CAD (computer aided) format, and GIS software have become unquestionable leaders in the use of computer programs in the field of archaeological research. CAD is a series of programs that are widely used mainly by experts relating to the creation of all sorts of drawings, diagrams and other graphics. Geographic Information System, a new technology that, despite its recent appearance, is widely used in many scientific disciplines, represents GIS. GIS has been used successfully, for example, in areas such as forestry, management of water system, geology, economics, crime, etc. The capabilities of these systems are well known by the scientific community in Kazakhstan, but the application of the latter is quite rare. Most of these programs are used by foreign specialists that work in Kazakhstan when they practice and publish research findings. However, the Kazakhstani archeologists have implemented a number of large-scale projects using the abovementioned programs. This site lets you learn more about implementation of another GIS project: «Formation of the GIS database of archaeological sites in Kazakhstan».

Archaeologists often turn to the exact sciences and welcome co-specialists - geologists, chemists, soil scientists, palynologists, geomorphologists, etc. Complex data open new perspectives for research. Unfortunately, the methods available at service of these scientists need to be modernized and often completely replaced by alternative latest developments. For example, geophysical methods of remote site research are "in infancy" condition and do not yield expected results when used. While constant testing and improving to the way of geophysical research by Western experts give extremely accurate results.

Archeologists must be armed with all kinds of latest computer design, technical facilities, ability to work with large amounts of data satellite land research, methods of exact sciences that will help in establishing an absolute age and provide data on the location of the structures hidden in the ground, as well as analyze composition of solutions used in ancient masonry, etc.

Some lag that Kazakhstan archeology experiences in terms of archaeological science research approach is only a temporary phenomenon, but we cannot silence it.

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