

A HISTORY OF GEODESIC MEASUREMENTS – AN OVERVIEW OF THE TERRESTRIAL MEASUREMENTS

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Abstract

The aim of this paper is to presenting the history of land measurement. The history of these measurements began by the human desire to study Earth's shape and size. This has led to a series of discover and today we have the advantage of technology and informatization. Measurements of land open a broader perspective on understanding the environment. And studying the earth has never been more important than now.

Keywords: Measurement, geodesic, cartography, publication

1. INTRODUCTION

Measurement history begins in about 8000 BC when people began to become sedentary. Then, the construction of villages and fields were needed surveyors division. They should already know the concept of measurement, to compare measurements between them. For the land on which to build to be shared among villagers, there was a need simple method to measuring and calculating the surface.

For the land on which to build to be shared among villagers, there was a need simple method for measuring and calculating the surface. Thus are examples of Megalith. 7000 years ago, the people of Vir Lepinski, the present territory of Serbia, its built basics huts with a trapezoidal section, with strings and sticks. When the cities and expansion of irrigation with their techniques, it is likely that the Assyrians and Babylonians, like the ancient Egyptians, have hired experts in measurement.

A plan of in 3000 BC shows that topographer shared in geometric regular parcels and they measure them as triangles, rectangles or trapezoids. The Babylonians knew how to divide the circle into six parts, using solar clock and split the day in 12 parts. From Mesopotamia are plans draw on clay that represents land towns, which are 4000 years old.

2. MATERIAL AND METHOD

However, scientific analysis of the geometry comes from the Egyptians. They had to measure the Nile Delta in every year since the floods and to establish new limits plots.

Measurements were made with a hemp rope, which have one node at equal distances. Specialists were called harpedonati measurements. The oldest evidence of the knowledge they needed topography is so-called "RhindPapyrus", manual collection of exercises at the same time, to calculate the triangles, trapezoids, circles, etc. .. Papyrus dating from 1700 BC.

Eratosthenes (275-194) Head of the Library of Alexandria, he settled in 240 BC first meridian. He noted that in Aswan (Assuan), the sun is in summer solstice in a perpendicular position to the Earth. It was the first to calculate the perimeter of the earth, which was known the length of Aswan, Alexandria and azimuth angle. He reached a length of the meridian of 11,573,750 m (compared to 10,000,855, 764 Bessel's see -1830 AD).

Romans Cartography took very little from the Greeks. The maps were draw by geometric measurements, but after the interests of military and administrative requirements of military and administrative requirements. However, the Romans were the ones who had the most comprehensive topographic science, because the immense Roman Empire could be administered only by highly developed technical means. Advanced state of the art measurements and thereby allowed the

formidable construction of streets, bridges and tunnels, as well as the cities, or heat or sewage systems.



Figure 1. Measurement of basic sections by pharaoh and goddess in temple

Thus was created a sewer network with a length of 100 km, which was built partly underground to the surface and removed from Metternich. This was supplied with city water Koeln. Romans geometrized those practices have been standardized and town plan in such a degree that the people of the entire Roman Empire had the same system implemented almost any city new build.

The Romans, as a state administrative very severely, have developed a comprehensive system for measuring land. This system was applied in all countries occupied by them. Thus, each province had an "Office of Finance (tabularium) centre, while the Germans were in Trier. Roman Empire, which included up to dry. Fifth and a large part of Germany today, the division conducted a land cadastre in tax rates (capital) and lists (capitum registers), but later they disappeared. From capitum capitastra format = land registers, one of many interpretations about the origin of the word. Every author who deals with this issue, find another interpretation.

Ovidiu (43 BC - 18 AD) clearly describes in his poem "Fasti" ritual, which takes place on 23 February. During these festivities in honour of Terminus boundaries were searched all border terminals, crowned with flowers by each owner, each stone was there and built a shrine in honour of preparing a fire. Each stone was cover with the blood of a lamb or a pig. Afterwards, the children offered honeycombs and wine.

In Etruscan law wrote: "He who touches or moves a landmark will be judged by the gods, his home will be gone, his people will perish, their lands will not bear fruit, and hail will destroy the heat of harvest, limbs offenders will be covered by sores and will rot"



Figure 2. Eratostene World

In the Middle Ages has fallen, as well as other branches of science, and topography. Looked at from a Christian standpoint, the topography over the old teachings, according to which the Earth was flat and surrounded by an ocean. It was transferred to the global map schematic of the monk Kosmas Indicopleutes Byzantine pilgrim, in VI century, and because they fully meet the needs of the Church, was taken altogether. The monks, who have drawn between sec. seventh and the fifteenth-century maps as the monasteries did not meet the research, but be guided by the writings of the Bible or other writings recognized by the Church. Ptolomeica perception of the world on its spherical shape has been forgotten.

Thus, the task remained the Arabs to continue the progress of science legacy left by the Greeks and Romans. Arabs had no doubt that the Earth is spherical, which have also demonstrated through repeated measurements. How important was the knowledge that can be seen from the Great Tamerlane son Caliph is personally involved in such measurements. They have redefined the perimeter around the Earth 827 - 40 392 km continued development of astrolabe, and then used some 1000 years.

Most terms come from the Arabs of geodesy, namely:

- algorithm - the name comes from the Persian mathematician Al Chwarismi, formerly called decimal computing style implemented in Europe around the year 1600
- Azimuth - the horizontal angle in a polar coordinate system,
- Zenit - point bisectrix
- Nadir - the point opposite the zenith,
- Alidada - name for the device arm concentric semi-circle of view,
- Algebra - solving equations and systems of equations
- theodolite - from British manufacturers of instruments in. XVI, century from the expression "of the hidade.

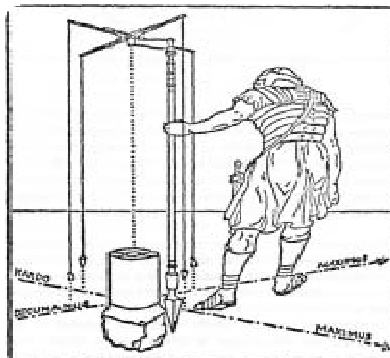


Figure 3. Double alidada

3. RESULTS AND DISCUSSIONS

New cities and land books are born

Unlike science, legal and administrative system of the early Roman Empire took over the German kingdoms (Westgotten, Salieri, Alemannen, Burgunder). Documents written on the sales, exchanges and donations of land mostly dating from the Emperor Carol The Great (April 2/742 - 28 January 814). He issued many laws that served to set boundaries and respect the Romans took over the unit of measurement and weighing systems, and Roman cadastre. Records were taken then over and continued by the church.

Measurements was made in cities since antiquity measuring strings. The string of measurement can be made every step, requiring a high degree of accuracy. With the length of the triangle 3: 4: 5 to get the right angle. String with 12 knots ($3 \ 4 \ 5 = 12$) was a very common device used to facilitate construction of these triangles.

In 1230 it was used in a document for the first time the word "property". Around the year 1250 was introduced the principle of registration in the Land Registry, even if only regional. For evidence, that such records were legal changes. Thus, they became legal document (legal affairs). Later, the introduction of Roman law, transfer of ownership is made less formally, by contract or teaching, possibly in the record books for special contracts. State records, church and towns have followed since the eighteenth century, records made by landowners. They contained drawings relating to the rights, property, entrances.

In French law, these contracts were registered at the registration offices for rent. But we can not say that the property was protected precisely, the transfer of property is usually simply because it was very difficult to prove ownership of that land.

Revival of ancient scholars

Renaissance became dry. XV key word in Italy and then throughout the West. It was about the rebirth of ancient erudition, of which they were born then we feel the love of life and focus on this life, not the next. Geography of Ptolemy's work brought the Byzantine refugees in Italy, was translated into Italian and printed in 1406 for the first time in 1475 Vicenza.

In 1525, the French personal physician of Queen Catherine de Medici, Dr. Fernelle has made a direct measurement of the degree between Paris and Amiens and longitude calculated at 10,011,000 m. He measured the distance with a measuring wheel, mounted on a carriage. 19 December 1576 the Parliament of Hessen decides Trayasa a tax on land. This law was for centuries the basis for legislation on taxes in Hessen.

1608: Johannes Kepler (1571-1630) Astronomer and mathematician discovers among other things, optical and thereby binoculars. This will significantly influence surveying, land measurement allowed for in relation to each other.

1667 Issue of instructions on the measurements to calculate the land surface. After this instruction, the mayor with „a scribe” who has vowed to keep silent made finding the surface. For measurement of land, all property had to find their place. Marked boundary points seem to be significant. Because, geodesy working together with the aid sent by the local administration. For each field length and width to be calculated from these data and calculated the surface.

French Revolution, Napoleon and modern measurements

A cadastral plan of great importance for many countries was a French Revolution of 1789. The need for equality has been a radical renunciation of all privileges of the nobility and the Church. Now he was at a fair and equal division. For a correct assessment of the land needed for new land unit plans for the country. It began in France, with plots measuring introducing a new plan for land tax. These political and social changes have made their presence felt throughout Europe.

After the fall of Napoleon, Prussia and other German states remaining in 1815 took over the entire French system of mapping and cadastral plan of the plots and they have improved. Each state makes a plan now own land, which was only meant to be proof of tax.

Influence of the French Revolution and continued course of Hessen. As one of the first German states, in Hesse-Darmstadt in 1820 a constitution was drafted. On 30 June 1821, Grand Duke Ludwig I signed the Law on the order in localities. This was first elected mayors, deputies and popular advice to people. Thus ended the period Schultheißen implemented by landowners.

A better development of science, evolution in the construction of instruments and new provisions relating to measurements French were the main reasons was born in Hesse-Darmstadt Landgraf a new era of topography

French measurement of triangles and stretched over Hessen, Captain George Delcross engineer took part in the measurements, a triangular network to link the network Hessen Gotha's planned in Strasbourg. In 1809, Eckhardt, together with Delcross received permission to perform trigonometric measurements throughout Hesse. For the implementation of these measures, officials have been appointed to provide assistance.

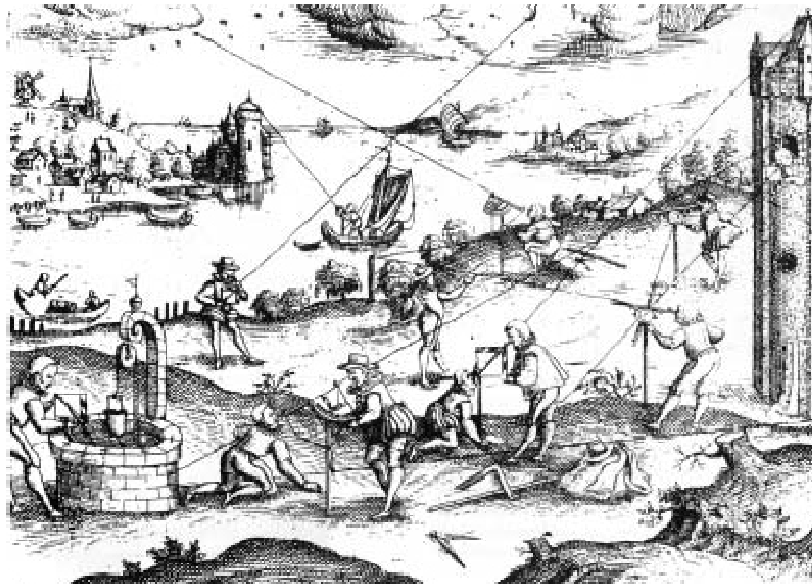


Figure 4. Topograph performing the boundaries and border points with chains and sticks

After Delcross they "were determined by a solid wall, which was sunk in the ground. This massive take the form of a prism with a single stone cvadrice area in the center of which there is a copper cylinder, whose center corresponded to the measured end point of the line "



Figure 5. Network map - a -based triangulation Darmstadt-Griesheim

4. CONCLUSIONS

Romania after 1940

Land-Bulletin published the periodical publication organ of the Society of Engineering Technicians public surveyors (SINTEC) in Bucharest, in 1937, 1939 and 1940. We know these numbers with a total of 18 articles. Bulletin of the cadastre and land books with two well-known annual numbers (1942 and 1943) was published by the Department of Land Books and Land Cadastre of the

Ministry of Justice. Engineer's Bulletin-bound publication which has appeared as an organ of the Association of General advertising boundaries engineers in Bucharest, in 1944.

Newsletter topographic technical-scientific periodical publication published by the Department of Military Topography for three years (1957-1959). He appeared trimester (total 12 issues) and has published 74 articles in geodesy, surveying, photogrammetric and cartography, containing original scientific research, production and practical results of scientific and technical information.

Newsletter geodesic informative periodical publication (two issues per year) occurred in 1988-1989 under aegis of the National Council Department of Geodetic Engineers and Technicians and Engineers and Technicians of Institute Commission of Geodesy, Photogrammetric, Cartography and Land.

Institute of Geodesy, Photogrammetric, Cartography and Land (IGFCOT) – institution specializing in performing surveying and mapping work which was founded under the name of Photogrammetric Centre on 10 February 1958, as the unit of the Ministry of Agriculture and Forestry.

National Centre of Geodesy, Cartography, Photogrammetric and Remote Sensing (CNGCFT) - an institution founded in 2004 by reorganizing the coming Institute of Cadastre, Geodesy, Photogrammetric and Cartography which, in turn, is the successor of the Institute of Geodesy, Photogrammetric, Cartography and Land .

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