Poster

MILAN J. ANDONOVIĆ (1849-1926) AND HIS CONTRIBUTION TO THE DEVELOPMENT OF ASTRONOMY AMONG SERBS

V. TRAJKOVSKA and V. PROTITCH-BENISHEK

Astronomical Observatory, Volgina 7, 11160 Belgrade-74, Yugoslavia
E-mail vtrajkovska@aob.aob.bg.ac.yu
E-mail vprotic@aob.aob.bg.ac.yu

Abstract. The name of Milan J. Andonović (1849-1926), Professor of Geodesy at the Grand School and University of Belgrade, is closely related with the development of astronomy among Serbs in the second half of the 19th century.

His most important work is a textbook for higher forms of secondary and teacher schools entitled "Kosmografija sa osnovnim astronomskim napomenama" (Cosmography with basic Astronomical Notes). In it the author using the contemporaneous astronomical literature succeeded in synthetising almost all the knowledges which were at the top of actuality in astronomical science. This book, published in Belgrade in 1888 and printed in the Royal Serbian State Printing House, was a real publishing achievement of that time: it has 530 pages, 25 tables and 141 figures. All was done following the manner of the best European textbook editions.

As a versatily educated person and following the progress of European scientific thought he considered that "the science of the universe" was a progressive one, a "powerful means in educating" and that it "makes superior by its very content everyone dealing with it".

It is difficult to say decisively what are prerequisites leading to the growth of knowledge in some fields of human activity, although the modern science of sciences has a standpoint of exact classification of premises.

However, as for the historiographic factors, they are undoubtedly decisive (in both positive and negative senses) to the development of general and special educating systems within a social community.

In Serbia of 19th century a few historical turnpoints and dates were important to her educational system.

From the fall of the Serbian medieval states till 1804 "even in hundred villages there were not a single school in any of them" as said by Vuk Karadžić (1852), except in monasteries.

One may say that only from 1830, with the proclamation of "Hatišerif", there begins free opening of schools which about 1841 reached a significant number in Serbia, as many as 631 (Janković, 1990; Karić, 1886). In 1833 a document concerning public schools within the Principality of Serbia ("Ustav narodni škola") was proclaimed by Prince Miloš. There is another similar document from 1844 ("Ustrojenije javnog učilišnog nastavlenija") by which the teaching in all schools in the Principality of Serbia was defined. In this connexion detailed programmes for primary and secondary

schools were enacted, on the basis of which use was made of textbooks that were either compilations or translations of the most reputed foreign ones of that time. Besides, Serbian teachers and eminent experts of that time wrote their own textbooks. The tradition of science teaching in primary and secondary schools was largely developed. This, of course, concerns the "matematičko, fizičko i političko zemljopisanije" (mathematical, physical and political geography) within which the astronomical knowledges were also taught. Astronomical contents were also present in the physics textbooks.

A sufficiently important change took place in 1863 when according to a law concerning gymnasiums ("Zakon ustrojstva gimnazija") among the subjects was envisaged "matematičko i fizičko zemljopisanije" (mathematical and physical geography). In 1873 according to an amendment to this law geography should have be taught together with cosmography, in the 2nd, 3rd and 4th forms of gymnasiums (including both types, grammar and real ones) (Janković, 1990).

The need of adequate and adapted-to-time textbooks was very sharp so that beginning with 1850 during the next 50 years there appeared a number of them. In them astronomical topics were treated more or less successfully.

In the pleiad of the most prolific writers of textbooks and, in general, books containing astronomical topics from the mentioned period, in addition to Milan J. Andonović, there were also Jovan Dragašević, Vladimir Karić, Djordje Stanojević, Milan Nedeljković, Vuk Marinković and others.

In the entire textbook series of that time the most important is the one having appeared in Belgrade in 1888 entitled "Kosmografija sa osnovnim astronomskim napomenama" (Cosmography with basical Astronomical Notes) for higher forms of secondary and teacher schools by Milan J. Andonović (1849-1926), Professor of Geodesy at the Grand School.

Who was Milan J. Andonović? He graduated from the Engineering Faculty of the Belgrade University, continued his engineering education in Karlsruhe and Aachen as a holder of a state scholarship. For some time he was engaged as a real- gymnasium teacher in Belgrade (1875-1878). Then he left for Munich to join the Polytechnic University. There he acquired and widened his knowledge in geodesy and kindred sciences. In 1885 he became a lecturer of geodesy at the Grand School in Belgrade. There he founded the Geodesy Department; he also founded a private Academy of Geodesy and Civil Engineering.

Taward the end of his life he became an honorary member in the Royal Serbian Academy of Sciences.

He was an important person, man of practice, excellent exspert in many scientifical fields and a good pedagogue. He appears as the author of several papers on geodesy and kindred sciences; he also wrote statements with political contents, especially those concerning the national question.

The most important papers of Milan J. Andonović dealing with astronomy and geodesy are:

"Kosmografija sa osnovnim astronomskim napomenama" (Cosmography with basical Astronomical Notes), Beograd 1888;

"O kosmosu" (About Cosmos), Beograd 1889;

"Niža geodezija sa osobitim pogledom na katastarski pregled" (Lower Geodesy with

a Special Reference to Cadastre Surveying), Beograd 1890;

"Oblik i veličina Zemlje" (Shape and Size of Earth), Beograd 1886;

"O obliku i veličini naše Zemlje" (On the Shape and Size of Our Earth), Beograd 1889;

"Osnove računa verovatnoće i teorije najmanjih kvadrata" (The Fundamentals of the Probability Calculus and of the Least-Square Theory), Beograd 1886.

As already said, Andonović's *Cosmography* is among the most important and most complete textbooks in Serbia of that time. Printed in Belgrade in the Royal Serbian State Printing House and prepared in a manner following the best European textbook editions it was a true publishing accomplishment of that time (Fig. 1). It contained 530 pages, 25 tables, 141 illustrations within the text and 5 out of text. A suitable map entitled "Polutarska zona i zodijak" (Equator Zone and Zodiac) was also given. For these illustrations Milan Andonović expressed his gratitude to Dr E. Weiss, Director of the Vienna Observatory, "who was very glad to take on to adorn this work with illustrations from his most recent work".

Using the astronomical literature actual at that time, above all the works of Wetzel, Müller, Klein, Bruns, Littrow and of a few others, he succeeded to synthetise in this textbook almost all the knowledge of current interest at that time in astronomy.

Accepting the "science on universe as a powerful means in education" Milan Andonović wished through this work to elevate "the school literature of that time towards that height at which it is also in the other progressive world" and simultaneously to make more easy and convenient for his pupils the studying of this science.

Giving at the beginning of his well conceived (but also too high priced) textbook "A Word in Advance" (preface) Andonović says:

"The science on universe as a natural science puts and leads a human being into the nature. It elevates and makes lofty by its very substance everyone engaged i n it, it puts a human being to a viewpoint at which the natural, sound and true observing, as well as conceiving, of things is also possible."

In what follows he notes that he has enriched the cosmographical terminology by introducing new expressions and considers that "all necessary is to be denoted by Serbian terms", but unclear points appear for which he gives parallelly also the earlier terminology.

This textbook consists of eight parts in the framework of which there are 24 chapters and 181 sections. This time we shall not enter in details the analysis of the contents, but we present the titles of the chapters whence one can get an insight into what was comprised by the author with this book. Here are the contents: I. Star Sky, Rotation and Division of Celestial Sphere, II. Astrognosy of Visible Star Clusters, III. Shape and Size of our Earth, IV. Rotation of the Earth, V. Coordinate System in Astronomy, VI. Annual Solar Motion, VII. Annual Motion of the Earth around the Sun, VIII. Mathematical- geographical Notes, IX. On Time in General, X. On Counting, Time Division and Calendar, XI. Fixed Stars, XII. On the Solar System in General, XIII. On the Sun, XIV. The Major Planets, XV. Physical Description of the Major Planets, XVI. Moderate-Size Planets, XVII. "Tailed Stars" (Comets), XVIII. "Starlike Objects" (Meteorites), XIX. Nebular Halo (Zodiacal Light - the author's note), XX. Solving of a few Problems, XXI. Problems, XXII. Perturbations in the

Solar System and in General, XXIII. Tide and Ebb, XXIV. Notes on the Origin of the World.

These copious contents of the book miss an essential section - that dedicated to astronomical instruments and methods. Probably because the author planned to publish it two years later in another textbook entitled "Lower Geodesy with a Special Reference to Cadastre Surveying".

We note that the mathhematical methods applicable in astronomy found their place in the already published work "The Fundamentals of the Probability Calculus and of the Least-Square Theory".

Going to make this set of topical problems to broad public as close as possible Milan Andonović delivered popular lectures at the Grand School. On the shape and size of the Earth he delivered two lectures - the first one was printed in 1886 and the second one, delivered on December 18, 1888, was printed after one year. In these lectures he presented in an interesting way the knowledge on this matter by that time, beginning with the positions of the ancient peoples towards "European Measurements of Meridian Arc Length and Further Progress". Then he gives explicitely "the foundations on which it is concluded that the Earth has a spherical shape".

His public lecture "About Cosmos", printed in Belgrade in 1889, is a rich illustrated technical and poetical collage concerning the state of knowledge and importance of the "science of universe". On about 30 pages followed by a large number of illustrations (a total of 34) the author described our Solar System (Sun, Moon, planets, comets, meteors and zodiacal light) in an interesting way by using verses of poets inspired by the universe and celestial bodies (Dragaš, Lj. Nenadović and J. Jovanović-Zmaj).

At concluding this lecture he says "a detailed contact with individual celestial bodies, and approach to their mutual influences, and also learning of inevitable consequences of all of these influences, will be subject of later lectures".

At the end we should remember what was said by Andonović on the science of the universe: "The science of the universe is a progressive sience. It makes progress every day, its contents is being enlarged, the results obtained by it become every day more complete and more accurate".

Thus were formulated these sentences at the end of the last century. At the very end of the present century we are witnesses of an exceptional blossom of sciences and of incessant and fruitful successes of the astronomical thought.

References

Janković, Dj. N.: 1990, *Zbornik za historiju školstva i prosvjete*, Zagreb, **23**, 13.
Karić, V.: 1886, *Školovanje u Srbiji i njegovi rezultati*, Beograd, **11**.