

Academic Mining Surveying Education in Romania, 60 Years of History

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SUMMARY

The branch of mining surveying science and engineering that uses measurements made in the field, and also subsequent geometric constructions, as a basis for the study of the structure of a deposit, the spatial arrangement of mine workings, and the processes of stresses in rock and the earth's surface in connection with mining work. It also reflects the dynamics of the production process of a mining enterprise. Mine surveying work is done by means of mine surveying instruments. Data from mine surveying are synthesized in mine documentation, which is a set of diagrams produced by geometric projection. Mine surveying is a composite science that is closely related to many scientific disciplines: mathematics, engineering, physics, astronomical geodesy, geology and mineralogy, geological exploration, the technology of exploitation of deposits, and construction.

The paper presents the Academic surveying mining education history in Romania, provided only by the University of Petrosani with all three cycles of university education: BA, MA, PhD.



The University of Petroșani, Romania

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1. THE CITY OF PETROȘANI, SHORT PRESENTATION

The Petroșani municipality is located in central Romania, in the southern part of Hunedoara County, at the confluence of the river Jiu East with Jiu West, the administrative area of the municipality having 19,556 hectares, including the villages: Slătinoara, Peștera Boli, Dâlja Mare and Dâlja Mică. GPS coordinates of the city are located between limits 45°24'44 "N and 23°22'24"E. Petroșani is located on two major road communication routes: National Road 66, Targu Jiu - Simeria at the junction with National Road 66A Petroșani - Uricani - Câmpu lui Neag, with extension to Herculan and National Road 7A, which connects the city to the Olt Valley (Petroșani - Voineasa and Brezoi). In terms of distance from major cities, Petroșani is located at 350 km from the capital city of Bucharest and 91 km from the capital of the Hunedoara County, Deva municipality. Other major nearby cities are: Târgu Jiu (50 km), Craiova (150 km), Timișoara (250 km), Alba Iulia (200 km), Sibiu (220 km). Also, Petroșani lies on the north-south railway axis, linking Oltenia to Transylvania, through the Jiu Valley (Simeria- Petroșani -Târgu-Jiu-Filiași). For the region of Transylvania there is the Petroșani - Simeria railway axis, one of the oldest railway lines in Romania's railway network, with ramifications for cities Deva, Arad, Cluj. Petroșani relief is typical for a depression, being surrounded by mountains. To the east lies Parâng Massif, to the west Godeanu massif, to the north Retezat massive and south Vâlcan massive. The town is situated at an altitude of 615-620 m, the highest elevation in the area being recorded in Parângul Mare Peak, 2519 m. The climatic conditions are influenced by its geographical position, so that the area benefits from average temperatures, with winters without heavy blizzards and with beautiful springs, cool summers and late autumns.

2. THE UNIVERSITY OF PETROȘANI

Superior training of specialists for the mining field in Romania dates from 1867. It is a historical period in which the specializing process for training forms has been continuous, being in close correlation with existing techniques and technologies in different periods of time. The Mining Institute, today called the University of Petrosani, was the main pillar in the process of achieving a competitive higher education, nationally and internationally. The specialization "Mining topography" was integrated interdisciplinary in the development process of mining higher education.

The University of Petroșani (<http://www.upet.ro/en/istoric.htm>) is an academic education institution whose beginnings date back in 1948, when, as a result of the publication of Decree no. 175/1948 for education reform in Official Gazette no. 177/ August 3, 1948, and of the minister's of Public Education Decision regarding the organization of higher education, published in Official Gazette no. 249/ October 26, 1948, the following education institutions

were founded: the Institute of Geology and Mining Technique Bucharest, consisting of two faculties (Geology; Mining Technique); the Institute of Ferrous Ores Timișoara; the Institute of Non – ferrous Brad; and the *Coal Institute – Faculty of Mining and Processing of Coal Deposits - at Petroșani* with a duration of academic studies of 4 years. In 1952 the two Institutes in Timișoara – descendant of the Faculty of Mining and Metallurgy of the Polytechnic School Timișoara – and in Brad cease their activity, their students being transferred to the Mining Institute in Bucharest, resulting from the merger between the Institute of Geology and Mining Technique Bucharest and the Institutes of Ores in Timișoara and Brad. The foundation of the Coal Institute at Petroșani in 1948 represents an important moment in the social, economic and cultural life of the Jiu Valley, proving, from a historical perspective, beneficial both for our area and for the general evolution of Romanian economy, with particular emphasis on the field of mining. The higher education establishment at Petroșani has not appeared on an arid ground. There was already a tradition of higher mining education in Romania, beginning with the decree of king Alexandru Ioan Cuza in October 1, 1864 regarding the foundation, in Bucharest, of the School of Bridges and Highways, Mines and Architecture, and, later on, the decree of king Carol I in October 30, 1867 for the setting up, in Bucharest, of the School of Bridges, Highways and Mines, with a duration of academic studies of five years and two departments: the Department of Bridges and Highways; the Department of Mines. The School is organized on modern principles beginning with 1881; it didn't specifically train mining engineers, but a number of the graduates of the School of Bridges and Highways – beginning with 1888 the National School of Bridges and Highways – acknowledged after 1890 as third rank engineers, worked in mining units in the country. Mining higher education enters a new stage in the interwar period. Thus, on June 10, 1920, king Ferdinand signs the Decree – Law no. 2521, by which it approved „ the setting up and organization of Polytechnical Schools in Romania” as „technical higher education institutions, culturally assimilated with universities. Their goal is the training of engineers and depend on the Ministry of Public Affairs”.



Figure 1. University of Petroșani 1950, 2010

Their goal is the training of engineers and depend on the Ministry of Public Affairs". The first such school was the Polytechnical School of Bucharest, set up by the transformation of the National School of Bridges and Highways, with four specializations, among which that of „Mining and Metallurgy”; the royal Decree no. 4822/ November 11, 1920, stipulated, in accordance with the Decree – Law no. 2521/ June 10, 1920, the setting up, beginning with November 15, 1920, a Polytechnical School of Timișoara with two departments: Electromechanics; Mining and Metallurgy. By the Law of November 4, 1938, regarding the change of the laws regarding higher and special education, the departments Mining and Metallurgy of the two Politechnical Schools turn into Faculties of Mining and Metallurgy, where, besides the fundamental subjects imposed to all the faculties, special subjects are also taught. Mining higher education will function with this structure until 1948.

On the other hand, the Jiu Valley was one of the few industrial, highly urban areas in Romania, thus displaying the conditions for hosting such an institution. It was also a strong industrial center with top specialists, which provided a suitable framework for applied education. The Coal Institute in Petroșani opened up on la December 7, 1948 with 135 students in the first year of study (entrance exam), as well as the second and the third (transferred from the Faculties of Mines of the Polytechnic Schools in Timișoara and Bucharest). The Institute had one department: “The mining and processing of coal deposits”, its dean being Prof. Vasile Poboran, assisted by 28 academic staff, of which only 8 held tenure in the Institute. In academic year 1949-1950 a new department is set up: “Mining electromechanics”, and the department of “Mining survey”. With the reorganization of higher mining education in 1952, the Coal Institute changes into the Mining Institute Petroșani, its activity developing in two departments: Mining Operations, with specializations: a. Mining Operations; b. Mining Survey; c. Processing of useful minerals; Mining Electromechanics.

The diversification of fields and specializations after 1990 brought about major changes within the higher school in Petroșani and, consequently, technical education continues alongside with the emergence specializations in the field of economy, mathematics socio – humanistic, computer processing, and public administration. This will also determine a change the change of name, which reflects both a management, and a content change.

Thus, by the Order of the Minister of Education no. 4894/1991 the Mining Institute in Petroșani – consisting of two faculties: the Faculty of Mining Engineering and the Faculty of Electromechanical Machines and Installations, and the Academic Technical and Administration College in Petroșani, founded in 1990 – changes its name into the Technical University of Petroșani. Beginning with 1995, by H.G. no. 568/1995 the Technical University of Petroșani becomes the University of Petroșani, consisting of three faculties: the Faculty of Mining Engineering, the Faculty of Electromechanical Machines and Installations, the Faculty of Sciences and the Academic Technical and Administration College.

At present, as by Law no. 288/2004, short term higher education such as the one developing within the Academic College was gradually removed, the University of Petroșani consists of three faculties : The Faculty of Mining Engineering(1948), The Faculty of Mechanical and Electrical Engineering(1957), The Faculty of Sciences(1993). The mission of the University of Petroșani is education and research within the European context. The University of Petroșani takes on a fundamental role in the creation and treasuring of cultural and civilization

values, the promotion of scientific research, the participation of Romanian culture and civilization to the world circulation of material and spiritual values, the assertion of our national cultural identity and the development of the Romanian society within a free and democratic state.

Since its foundation in 1948, and especially after 1957, the University of Petroșani has had the mission to train graduate specialists for all the fields of activity specific for the mining industry, as well as for activities with mining character in other industrial branches, or in other branches such as: mining machines and installations, technological equipment, energetics and process automation. Besides the training of the staff necessary especially for the Romanian mining, the higher education institution in Petroșani specialized staff for the above mentioned fields for about 20 countries in Asia, Africa, South America, North America and Europe.

It should be pointed out that, the training of over 35,000 graduates, mainly in the technical field, but also in the field of economy, mathematics, and socio – humanistic studies in the history of over 60 years of the University of Petroșani, required a strong material basis: teaching facilities consisting of course and seminar rooms, as well as laboratories; the library, having over 304,000 volumes: reference, technical, fiction books and journals; a workshop for practical training; a sports complex, consisting of a gym, a stadium, football and tennis grounds; students hostels, cafeteria, guest rooms, the Academic Staff House, practical training facilities in the Parâng Mountains and at Câmpu lui Neag. Highly skilled academic staff has been formed at the same time, which provided part of the staff that, after 1990, started new technical, economic, mathematical, socio – humanistic, and data processing specializations, which constitute at present the Faculty of Sciences. The new social, economic and political context after December 1989 allowed a constructive approach regarding the expanding of fields and specializations within the University of Petroșani. As a result, the educational offer expanded every year, so that, at present, the University provides, in graduate studies, 26 academic programs de (specializations), of which 17 are validated, within 22 fields of study.

At the same time, the offer of graduate and post – graduate studies has constantly diversified, so that in academic year 2008-2009 there are 27 academic programs (specializations), in 17 fields. Further training by doctoral studies represents the third advanced academic training cycle. The University of Petroșani is validated as an organizer of doctoral studies and ensures, through the Doctoral and Continual Training Center, doctoral studies in the field of Engineering, with the following specializations:

- *Mines, oil and gases;*
- *Industrial Engineering;*
- *Electrical Engineering;*
- *Systems Engineering.*

3. THE SURVEYING ACADEMIC EDUCADION

3.1 Introduction

The development of the structure of education followed, by establishing the MINING TOPOGRAPHY specialization, as a result of the requirements imposed by production, research and design activities, rising at that time. Over a period of over half a century the

specialization MINING TOPOGRAPHY worked without interruption through various studies and forms of education:

- Long-term studies, of five years, full time;
- Short-term studies, day and evening classes, 3 and 5 years respectively.

Graduates of these forms of education have received the diploma of engineer and Junior Engineer properly. Perfecting the training for graduates with an engineering degree was provided by doctoral programs completed with a Ph.D. degree and legalized, from the founding of the Institute (1948). Currently, the higher education mining institution in Petrosani "University of Petrosani" has a complex structure, and the specialization "Mining topography" has a well-defined position in the Mines, Oil and Gas domain.

Higher training is provided in three cycles:

1. Cycle 1 (4 years), concluded with an undergraduate Degree;
2. Cycle 2 (2 years), concluded with a Master's Degree;
3. Cycle 3 is concluded with a PhD Degree.

3.2 Content of teaching process

It is provided by the subjects included in the plans and curricula corresponding to the three cycles, as follows:

In cycle 1, in addition to fundamental and general technical disciplines (Mathematics, Physics, Chemistry, Mechanics, Electro-techniques, Strength of Materials, and Topography) are provided disciplines which provide specialized training (Topography, Geodesy, Cartography, Mining topography, Extraction and Recovery of useful minerals, etc.).

In cycle 2, specific to the program of study "Computerized mining topography and surveying" are (the computerization of topographic work, current methods of land measurement processing, special works of mining topography, optimization and increasing efficiency of geodesy work, topography and surveying, design of mine constructions, European norms and standards in surveying, etc.).

In cycle 3, provides training through doctoral academic studies (use of information technology in research, experimental data processing, methodology of research in the field and optional subjects established in accordance with the direction of research. Educational programs for the disciplines included in the curricula at cycles 1 and 2 are made with regard to the role that they have in ensuring the skills and activities.

Professional Skills:

For undergraduate studies:

- Execution of surface and underground mining works, techniques and technologies used;
- Establishment of information base required to develop plans, topographical and cartographic maps;
- Methods and devices used in survey operations and topographic outlining activities;
- Processing of measured sizes and methods used in reporting in plane the results obtained through processing.

For Masters Degrees:

- Organization and management of topographic and geodetic works consistent with the mining objectives achieved at the surface and underground;

- Design of geodetic and topographic works in line with quality requirements imposed;
- Optimizing the database carried out for different works and processing methods;
- Computerization of mining topography and land surveying operations;
- Linking land surveying and topographic documentation with legislation in force.

Related Skills:

For undergraduate studies:

- Correlation of mining activities with the topographic activities;
- A review of existing mining operations and the establishing the development strategy of a mining unit;
- Evaluation of reserves and extracted production;
- Monitoring the stability of open mining works, training and exploitation, planning the correction operations that are required;
- Prepare necessary documentation for the systematization of targets on the surface and underground.

For Masters Degrees:

- Use of space positioning systems for points materialized on the earth's surface and underground;
- Compiling topographic documentation made through static and dynamic methods in 3D space;
- The interdependence between different coordinate systems;
- Development of existing program systems according to the requirements imposed by the efficiency of mining activities.

Cross Skills:

For undergraduate studies:

- Applying effective and responsible work strategies, punctuality, reliability and accountability based on principles, norms and values of professional ethics code;
- Applying multidisciplinary effective individual and team work techniques at different hierarchical levels;
- Professional and personal development through continuous education.

For Masters Degrees:

- Managerial and leadership skills for topographic mining and land surveying activities;
- Ability and desire for professional and scientific training;
- Applying the principles, norms and values of professional ethics code.

3.3 Teaching staff

Teachers that provide specialized training activities are predominantly based within the University. The staff is made full with associated teachers from outside the University and who have a PhD title or who are involved in the preparation of the doctorate.

The teaching staff is divided into all teaching positions, over 30% of them having a professor or associate degree.

The material base includes classical and modern devices to perform topographic, geodetic and photogrammetric measurements and the necessary equipment in order to process and materialize the information.

3.4 Scientific research

Made in various forms, it has a similar tradition with that of the educational process. As part of the research activity, fundamental issues in the field of mining topography were addressed, but also many different applied themes required by various branches of national economy: mining, industrial and civil engineering, hydraulic structures, communications, organization and systematization of territory, tracking different targets over time, etc.

Results of the research have been recovered through teaching material, publications in scientific journals in the country and abroad, and communications in congresses and scientific sessions or directly in production, research and design.

Major themes within the scientific realm are developed in doctoral theses or are under preparation and include a relatively large range of activities relating to:

- Orientation of underground topographic networks.
- Improvement of topographic works in the breakdown mining works.
- Using satellite observations to execute geodetic networks and mining survey works.
- Tracking industrial and hydraulic construction over time.
- Studies on the movement of surfaces due to underground exploitations.
- Computerization of topographic activity in underground and surface mining exploitations.

4. FINAL CONSIDERATIONS

The specialization "Mining topography", because of its mission, presents the necessary motivation to continue being a part of the educational structure of the University, in the future. Specialists with undergraduate, master and doctoral degrees of the University of Petrosani in the field, have a higher education, appropriate to favorably meet the conditions imposed by the labor market. Experience in mining topography and geodesy, proven by renowned scientific personalities from the countries with a mining tradition creates the necessary conditions for improving the educational process and scientific research at the University of Petrosani, for the field to which the above references were made.



Figure 2. University of Petroșani, Central Building: Rector's Office

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BIOGRAPHICAL NOTES

Nicolae Dima, professor in the academic area of Mining Surveying, University of Petrosani, Romania

Nicolae Dima Ph.D. eng. Born on February 6th 1939, Graduated from the University of Petroșani in 1961, He received his Ph.D. in 1971, Occupies a professor position since 1980, and has been a PhD since 1982, He is a member of: -International Society of Mining Topography, -International Society of Mining Teachers; He is a member of the Academy of Sciences of Ukraine

- Has the medal of “scientific merit” and is a Doctor Honoris Causa, title offered to him by two universities

- From 1976, continuously, has occupied the positions: vice-dean, dean, vice-rector, rector and president of the university.

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