THE PUBLISHING HISTORY OF THE GEOLOGICAL AND PEDOGEOMORPHOLOGICAL CARTOGRAPHIC MATERIALS IN ROMANIA. STUDY CASE – LUGOJ HILLS’ AREA

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Abstract: The Publishing History of the Geological and Pedogeomorphological Cartographic Materials in Romania. Study case – Lugoj Hills’ Area. The publishing of the cartographical materials from Romania in geology, pedogeography and geomorphology domain has a long tradition. Someone can remark that the geological cartographic materials for the territory of our country have started to be edited even from the end of the 19th century, and the pedological ones since the first years of the next century. The most complex maps made in all of the three scientifically analyzed domains and which cover the entire area of Romania are the ones on scale 1:200,000. Each of these maps is formed from 50 individual sheets which respect the arrangement and the nomenclature of the Gauss-Krüger projection. Unfortunately, a part of the sheets which make up the Geomorphological map of Romania (on scale 1:200,000) are no longer found in the archives or they are incomplete, having to be remade. For the geographical space occupied by the Lugoj Hills there are several cartographic materials made on more general or more detailed scales and in different periods. That is way, for exemplification, this area was chosen.

Rezumat: Istoricul editării materialelor cartografice, geologice şi pedogeomorfologice în România. Studiu de caz – zona Dealurilor Lugojului. Editarea materialelor cartografice din România în domeniul geologiei, pedogeografiei şi geomorfologiei are o tradiţie îndelungată. Se remarca faptul că materialele cartografice geologice pentru teritoriul țării noastre au început să apară chiar de la sfarsitul secolului al XIX-lea, iar cele pedologice încă din primii ani ai secolului următor. Cele mai
complexes maps realized in all three scientific domains and their coverage an entire Romania are scale 1:200,000. It is noted that maps are made up of 50 individual sheets. Each of these maps is made up of 50 individual sheets. The place, a part of which is part of the geometry of Romania (scale 1:200,000) are no longer found in archives or are incomplete, they need to be re-created. For the geographical space occupied by the hills of Lugoj there are more materials cartographic realized on smaller and more detailed scales at different periods. Therefore, for illustration, this area was chosen.

1. THE EDITING HISTORY OF GEOLOGICAL CARTOGRAPHICAL MATERIALS

Regarding the editing history of the geological maps in our country, this activity has started since the end of the 19th century. Clichici (1975) writes a short history of the geological cartography evolution in Romania. This author specifies that, after 1895, many Romanian geologists, but also from abroad, have made research studies in the actual space of our country. They also made with this occasion a series of geological maps. The geological maps have been numerous and more early realized on the territory of Transylvania, Banat and Bucovina which have been under Austro-Hungarian administration. For these areas have been edited more series of geological maps on different scales – 1:350,000, 1:200,000 and 1:75,000.

The first important geological map of Romania’s territory from that period has been made by Gr. Ştefănescu in 1898, on scale 1:175,000.

Until 1918, the Romanian Geological Institute had between its attributions to create the Geological map of Romania, on scale 1:50,000. This map had to be realized on multiple sheets, from which only one came to be printed (Vălenii de Munte, in 1911). The rest were not printed because of the beginning of the First World War, remaining in manuscript.

During the interwar period, in 1921, under the guidance of I. P. Voiteşti, the Geological map of unified Romania was realized on scale 1:500,000. This map, subsequently enlarged and completed, has been reedited on scale 1:200,000.

Starting with 1936, under the aegis of the Geological Institute of our country, the printing of a new Geological map of Romania on scale 1:500,000 was initiated. This map was about to be formed by 12 sheets. From these sheets, until 1942 only the first 6 ones were printed during 1951-1959.

At the end of the ‘50s, in our country the creation of the geological maps on the large scales was started. So, between 1958 and 1959 some sheets of the Romania’s territory on scale 1:100,000 started to be realized. From these, only 16 sheets have been printed. They cover some parts of the territory like this: 4 sheets are situated in the north-western part, 2 sheets in the south of Apuseni Mountains and 10 are situated in the central south-eastern part of Romania.
In 1966, under the aegis of the Geological Institute from Bucharest, the Geological map of Romania made on scale 1:1,000,000 was published. Later, the Geological Institute will publish two more national editions on scale 1:500,000.

Also during the '60s, in our country the creation of the geological maps on scale 1:200,000 started. The publishing itself of the geological map’s sheets on scale 1:200,000 started in 1964, the work being completed in 1968. The sheets of the geological map on scale 1:200,000 cover the entire territory of Romania as it can be observed in figure 1.

The Geological map of Romania on scale 1:200,000 is formed from 50 individual sheets. The map’s sheets respect the disposal and the nomenclature of Gauss-Krüger projections on scale 1:200,000. Some marginal map’s sheets, which cover only a very small part of our country’s territory, have been joined to the neighboring ones. Besides Gauss-Krüger nomenclature, each map sheet has related a unique number (between 1 to 50 – the counting of the sheets being made from north to south and from west to east), and also the name of the most important locality within the map (fig. 1).

![Figure 1: The sheets of the Geological map, 1:200,000-scale map, published in our country](image)

Each map sheet is accompanied by a series of annexes. So, out of the map’s frame it can be found the geological sections (which present the main features of the deep structure of the territory of each map sheet) and the stratigraphic columns (they have the
purpose to present the ensemble of the existing formations in the territory represented on
the map, also including the formations which don’t appear at the surface). On each sheet
also appears a figure with the used materials and a sketch of Romania’s territory where it is
presented the situation of sheets’ printing and the location of each one within our country.

In an external document (a book with a B 5 format) there are presented also the explanatory texts (bilingual description - Romanian and French - regarding the lithological and paleontological formations’ content, their distribution and some considerations about the geological evolution of the territory).

The most part of the Lugoj Hills’ territory is contained on the 25-Deva sheet and
and only a small area from the north-western part is found on the 24-Timisoara sheet. Both
sheets were edited in 1967, the graphical design and the printing being realized within the
workshops of the Romanian geological Institute from Bucharest. A representative collective
of researchers has been involved in realization and printing of these cartographic materials.

The sheet 24-Timisoara (I-34-XXII) represents the geological data after the
situation from 1966. For its realization the next specialists were involved:

- editor coordinator: Al. Codarcea;
- editors: Adela Drăgulescu, Luciana Hînculov, N. Mihăilă, Ecaterina Nica;
- cartographers: I. Petrescu and Virginia Dâuş.

The explanatory note was realized by Adela Drăgulescu, Luciana Hînculov and
N. Mihăilă in 1968.

The sheet 25-Deva (I-34-XXIII) has been realized according to the geological
data after the situation from 1965 and it has been made by the next experts:

- editors coordinators: Al. Codarcea and R. Diniţescu;
- editors: N. Gherasi, M. Mureşan, G. Mureşan, H. Kräutner, Florentina
Kräutner, N. Lupu, F. Marinescu, H. Savu, A. Arghir Drăgulescu;
- cartographers: I. Petrescu and Elena Mitroi.

In 1968, N. Gherasi, in collaboration with M. Mureşan, M. Lupu, Josefina
Stancu and H. Savu, elaborates the explanatory note of this sheet.

The most detailed series of the geological maps realized in Romania is that on
scale 1:50,000. This series is edited, like those before it, by the Romanian Geological
Institute. By the sheets of this map the coverage of the entire territory of the country was
wanted. This project is still ongoing because, until now, in the period 1970-1998, the
printing of only 135 sheets was made. These map sheets cover mostly the mountain area of
Romania (fig. 2).

Analyzing the disposition of the geological map’s sheets on scale 1:50,000 on
Romania’s territory (fig. 2 and 3), it can be observed that the Lugoj Hills’ area is found on
the next sheets (analyzed from north to south and from west to east): 88 a, 88 b, 87 d, 88 c, 
88 d, 103 b and 104 a. From these 7 sheets, only 4 of them (88 b, 88 c, 88 d and 104 a)
have been printed until now (fig. 3).

The most part of the surface of the Lugoj Hills is found fortunately on already
printed sheets. From the parts that are not included on the printed sheets, it is missing that
from the north-western section which should be found on the sheet 87 d. On the other two
not printed yet sheets (88 a and 103 b), only a few tangential sections can be found as
follows: in the south-western part of 88 a sheet small portion situated on south of Bega
valley, and on 103 b sheet a very narrow perimeter on the north-eastern part of the sheet.
Figure 2: The sheets of the Geological map of Romania (1:500,000-scale map) published until now

Figure 3: The location of the sheets of the Geological map, on scale 1:50,000, on the Romania’s territory
The printed sheets from our interest area were edited in a quite long period of time between 1971 and 1991 and they appeared under the care of a vast group of authors and cartographers. Their graphic realization and printing have been effectuated in the workshops of the Geological Institute. Further, the sheets are presented chronologically.

The sheet 88 c Gladna (L-34-81-C) appeared in 1971, having as editors H. G. Kräutner, Florentina Kräutner, T. Orășanu and Elena Potoceanu, and as cartographers I. Petrescu and Ligia Bălaşa.

In 1972 the sheet 88 d Luncani (L-34-81-D) and 104 a Nădăr (L-34-93-A) were published. The editors of the first one were M. Mureșan and Th. Orășanu, and cartographers I. Petrescu, Geogeta Enea and V. Vlad. For the second one, the editors were H. G. Kräutner, Florentina Kräutner, T. Orășanu, Elena Potoceanu and Al. Dincă, and cartographers: I. Petrescu, Virginia Dăuş and V. Vlad.

The sheet 88 b Lăpugi-Coștei (L-34-81-B) was printed much later, only in 1991. The editors of this sheet were M. Lupu, F. Marinescu, E. Roșu, I. Nicolae, M. Mureșan and Ag. Popescu, and the responsible of the cartographic part were V. Vlad and Aneta Stan.

2. THE HISTORY OF PUBLISHING OF THE PEDOGEOGRAPHICAL CARTOGRAPHIC MATERIALS

The activity of drawing the soils’ maps for different areas of the Romanian space started at the beginning of the 20th century. The first soils’ map of Romanian Principalities, created by Gh. Murgoci on scale 1:2,500,000, appears in 1911.

During the interwar period, in 1927, a group including Gh. Murgoci, E. Protopopescu Pache, P. Enculescu, T. Saidel and N. Florov executes the Soils’ map of the greater Romania, on scale 1:500,000.

Starting with the second part of the last century, the research in the pedological domain from Romania develops significantly. So, a lot of field and laboratory studies started to be effectuated and soils mapping on middle and large scales for the hill and plain areas began to be realized. For the mountain space, the mapping is realized with the sleepers’ method and precise research studies (Davidescu et al., 2010). On the basis of these research activities, in the next period, more maps of Romania’s soils on different scales were edited: 1:1,500,000 (1960, 1971), 1:1,000,000 (1964, 1970, 1978), 1:500,000 (1970-1971). The last one had as coordinators N. Florea, Ana Conea and I. Munteanu, and graphical realization and printing were effectuated within the workshops of the Geological Institute. It includes another two maps on a smaller scale (1:3,000,000); a general pedological one and one of pedogeographical regionalization in Romania.

The pedological cartographic materials doesn’t resume only to the soils’ distribution maps or to maps which present only the soils’ favorability for different agricultural uses. That is way, over time, more complex soils’ maps have been executed. One of them is the Map with the granulometric composition of Romania’s soils, published in 1970, on scale 1:1,000,000, in care of N. Florea and H. Asvadurov. It was created on basis of the soils’ map, on scale 1:1,000,000, and other pedological data existing in the archive of the Geological Institute. Besides texture, this material highlights also some geotechnical features of the soils (contractile soils, compacted soils etc.).
The activity of creating the Map of Romania’s soils on scale 1:200,000 started in 1963. This action debuted at the Geological Institute under the coordination of N. Cernescu and M. Popovăț and it was continued by the Forestry and Agricultural Sciences Academy (A.S.A.S.) and Agrochemical and Pedological Research Institute (I.C.P.A.), under the general coordination of N. Florea. The work has been realized by means of a representative group of experts formed from more regional coordinators, main editors and collaborators editors.

The map is formed by 50 sheets gradually published during 1963-1993 and covers the entire surface of the country (fig. 4). A few marginal sheets of the map, on which we can find small parts of the national territory, were jointed to the neighboring ones. So the sheets 3, 14, 22, 30, 38, 39, 47, 49 and 50 have received small additional surfaces.

The first 27 sheets were printed at the Geological Institute during 1963-1970, and the next ones were edited and printed by the Geodesy, Photogrammetry, Cartography and Territorial Planning Institute (IGFCOT).

A new sheet with the general legend of the map was created in 1994. This sheet includes the soils’ names according to the Romanian System of Soils’ Classification from 1980. The legend contains, besides the soils’ types and subtypes, specifications for soils’ texture in the upper horizon. On this board also appear the names of all the persons who contributed of the creation of this work. On its frame is also included a small map of Romania where the biopedoclimatical facies and the numbering and location of the 50 compounded sheets of the soils’ map are represented (fig. 4).

![Figure 4: The numbering and location of the compounded sheets of the Pedological map of Romania, on scale 1:200,000](image)

The sheets are numbered, each one having assigned a unique identification number, from 1 to 50, as it can be observed from the figure above. The sheets numbering is not made after their printing year, but after the order of the territorial repartition from north to south and from west to east. For example, analyzing the situation of the map’s sheets at the level of the year 1989 (fig. 5) it can be observed that all the sheets have allocated an identification number, even if 10 of them weren’t printed yet.
Figure 5: The situation of the printed sheets, at the level of the year 1989, for the Map of Romania’s soils, on scale 1:200,000

Besides the identification number, on each sheet of the map also appears the code generated by the Gauss-Krüger nomenclature and the name of the most important locality (fig. 6).

On each sheet there is some additional information, like for example a geomorphological and lithological sketch, on scale 1:500,000, and a map with geobotanical and climatological data, on the same scale. Also, on each sheet there are mentioned the pedomorphological profiles made for the most representative areas of that board. In the same time, there can be found a sketch with the materials used to realize the board, and also a map of Romania on which it can be observed the sheet’s location within the national territory and the situation of the sheets edited until that date (fig. 5).

The Lugoj Hills are found on 24-Timişoara sheet (a small part of them from the north-western area) and on 25-Deva sheet (the most part of their surface) (fig. 6). Further it is presented a brief analysis of these two map sheets in the chronological order of their appearance.

The sheet 24-Timişoara (L-34-XXII) was printed in 1989, but the pedological data are presented after the situation from 1982. The editorial group was formed from many experts: N. Florea (editor coordinator), I. Piciu (main editor), Gh. Curelariu and Marcela Jalbă (editors) and I. Dragu (geobotanical data).

The sheet 25-Deva (L-34-XXIII) was published in 1990 and it presents pedological data after the situation from 1977. For its realization, more researchers with different tasks worked: coordinating editors – N. Florea and V. Bălăceanu; main editors – V. Bălăceanu and Georgeta Untaru; editors – Elisabeta Marian, I. Rășnoveanu,

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Anişoara Râşnoveanu, O. Solomon and M. Parichi. The auxiliary map with the botanical data was made by I. Dragu.

Figure 6: The location of the Pedological map’s sheets on scale 1:200,000, in the contents of which it is located the area of the Lugoj Hills

In 2003, in Romania it was adopted a new soils’ classification system (SRTS-2003) with the purpose to replace the old one from 1980. Based on the new system, the pedological information has been updated, creating in the same time new cartographic materials adapted to the new taxonomy. So, in 2007, within the National Research and Development Institute for Soil Science Agro-Chemistry and Environment – I.C.P.A. Bucharest, in care of N. Florea two new pedological maps on small scale are created: the Soils’ map of Romania, dominat class level of soil, on scale 1:3,000,000, and the Soils’ map of Romania, dominant type level of soil, on scale 1:2,000,000. In the next year, the same author, in collaboration with N. Munteanu, edited the Map of soils’ association of Romania, on scale 1:1,000,000, also under the aegis of I.C.P.A.

In 2012, new improvements were made on the soils’ classification system, a new system – SRTS-2012 being created. Although the modifications from the new system are
not very numerous on level of classes and types of soil, the old maps will have to be updated according to the new taxonomy.

Besides the cartographic materials which show the soils’ spatial distribution for the entire country level, also pedological maps at local or county level have been realized. The Lugoj Hills area has been included within the soils’ map from Banat and from Timiş County.

Analyzing the history of pedological researches in Banat, Zisu (2007) specifies that the activity of mapping, on large scale, the soils from the south-western part of our country started in the second part of the last century. The first soils’ maps of some areas from Banat were published only during 70’s, after the completion of the first cycle of pedological mapping in this region, and it is due to the activities made within the Agrochemical and Pedological Research Office (O.S.P.A.) from Timişoara.

The first soils’ maps of Timiş County on scale 1:100,000 and 1:50,000 were realized in 1970 under the coordination of I. Crişan, M. Iliescu, O. Dejeu and I. Baumstark. These cartographic materials were created on basis of the pedological studies executed between 1955-1970 on scale 1:10,000 and 1:20,000. After that, in 1975, I. Crişan, M. Iliescu, I. Baumstark and I. Puşcă updated the graphical presentation of this map on an overall plan on scale 1:200,000. The cartographic realization was executed by M. Luca (Ianoş, 1995).

The second pedological mapping cycle, made between 1970 and 1993, provided additional information which determined the remaking of the pedological map of Timiş County. The map, created in 1993 on scale 1:50,000 by Gh. Ianoş, I. Puşcă and D. Tărau and graphically realized by M. Luca, Ecaterina Maior and Gh. Chisăliţă, benefits by an ample explanatory text and information data on qualitative state of agricultural lands. Under the same coordination, in 1994, it was made the Map of Banat’s soils, on scale 1:100,000, with a graphical presentation by M. Luca. A group of experts from O.S.P.A. Timişoara, coordinated by D. Tărau, will update this map in 1997. The updating had the support of the pedological and agrochemical studies realized within the office between 1975 and 1997.

All these cartographic materials serve as support for creating the new digital databases and maps realized by means of the different computer software (ArcGIS, IDRISI etc.).

So, in 2008, within a project developed by S.C. Pfandl & Mayer SRL from Timişoara, the digitally Pedological map of Timiş County (fig. 7) was realized. It was created starting from the analogical existing map on scale 1:50,000 which was scanned and introduced in the program WinGIS. The next executed operations consisted in georeferencing in the Stereo 70 projection system (the official mapping projection in Romania), digitizing surface type elements and collecting the alphanumeric data and their introduction in the database.

In figure 8 it is represented a schematic map of the soils from Timiş County realized with the computer program ArcGIS 9.3 and having as input data the information listed also from the old maps.
Figure 7: The digital Pedological map of Timiș County (http://www.gisromania.ro/ProiecteGIS.htm)

Figure 8: The general soils’ map of Timiș County
3. THE EDITING HISTORY OF THE GEOMORPHOLOGICAL CARTOGRAPHIC MATERIALS

Rădoane et al. (2011) effectuates a synthesis of the main realizations from the Romanian geomorphological cartography which started to develop in the second part of the 20th century. So, the first Geomorphological map of Romania was elaborated only in 1960, on scale 1:1,000,000, in the “Geographical monograph of Popular Republic of Romania” by a geographers group coordinate by P. Cotet.

A little bit later, in 1964, the first general geomorphologic legend from Romania will appear (on scale 1:50,000) effectuated by G. Posea and N. Popescu. During the ‘70s, a new geomorphological legend will be created. C. Martiniuc realizes, in 1971, a legend version which will remain only in manuscript. After that, in 1978. Irina Ungureanu, on the basis of Martiniuc’s studies, will realize a detailed geomorphological legend which is actually an adaptation after the Polish legend of Klimaszewski from 1963. None of these two authors has realized maps based on this legend, but the followers of Martiniuc have used it in their works.

In 1976, at the Geography Institute of Romanian Academy, it is published the Geomorphological map of Romania, on scale 1:1,000,000, realized by a research team coordinated by L. Badea. Also under his coordination, during 1976-1987, it was developed a project for creating a new geomorphological map of Romania, on scale 1:200,000, which would be formed from more sheets. The cartographical sheets remained only in stage of manuscript, not being published because of the technical difficulties in drawing the colors, hatches and symbols and also because of the very high costs.

Buza (1997) mentions that between 1976 and 1990, at the Geographical Institute, the General geomorphological map of Romania was elaborated, on scale 1:200,000, formed from 50 sheets (fig. 9 and 10). Unfortunately, a part of them is no longer found in the archives and some of them are incomplete.

Fortunately, the Lugoj Hills’ area is found on the existing sheets (fig. 9 and 10) being framed on the map sheets Hunedoara (L.-34-XXIII) and Timişoara (L.-34-XXII). The first one was printed in 1986 and the authors’ group including L. Badea, M. Buza, A. Cioacă, Mihaela Dinu, Maria Sandu and D. Călin, realized also an ample explanatory material for it. The second sheet will be edited in 1988 in care of Ileana Steia and W. Schreiber who offer also a short description of it.

In 1980, a new geomorphological map of our country will be published, on scale 1:400,000, having as authors G. Posea and L. Badea. The map’s conception is based on the geomorphological legend created by G. Posea and N. Popescu in 1964.

From 1991, a project for realizing the new geomorphological maps on large scale (1:25,000 and 1:50,000) started. Buza (1997) specifies that these general geomorphological maps are accompanied by the other two auxiliary maps (a map of the relief units and a morphostructural one) and by three transversal geomorphological sections which also present, besides the relief forms and the geological structure, the mineralogical composition of rocks and the inclination direction of the layers.

In 2000, N. Popescu and M. Ielenicz realize the general geomorphological map of our country, on scale 1:50,000, designed on multiple sheets.

After the year 2000, Rădoane et al. (2011) observe an interest for creating geomorphological maps using GIS techniques. Though, the preoccupations for realizing
general maps are no longer distinguished. The approach on certain areas and interest domains it is preferred today. For example, the geomorphological risks and hazards’ maps focus more on a certain region and on the phenomena manifested there.

Figure 9: The situation of the Geomorphological map’s sheets (scale 1:200,000) and their lay out within Romania’s territory (http://geomorf.rosa.ro/rezultate.htm)

Between 2008 and 2011 a research project coordinated by Romanian Space Agency called “Complex methods for creating the digital geomorphological map of Romania using GIS/remote sensing technologies support to implement the European environment directives” has developed. The main purpose of this project was to create the database which will contain the Digital geomorphological map of Romania and the digital library of conventional signs on scale 1:200,000. The figure 10 shows the geomorphological map of Romania, on scale 1:200,000, obtained through classical methods, processed by scanning, georeferencing and mosaicking. Unfortunately, it can be observed the lack of some sheets which will have to be remade.
Figure 10: The geomorphological map of Romania (on scale 1:200,000) realized through classical methods, processed by scanning, georeferencing and mosaicking (http://geomorf.rosa.ro/rezultate.htm)

4. CONCLUSIONS

Analyzing the publishing history of the geological and pedogeomorphological cartographic materials in Romania, it can be observed some very well made maps which cover the entire territory of our country even on medium and large scale. In the same time it can be also distinguished the existence of some ample projects which are suspended in the last period. An example in this direction is the Geological map of Romania, on scale 1:50,000, which, through its 135 already printed sheets, covers less then half part of our national territory.

The geological map, the soils’ map and the geomorphological one, on scale 1:200,000, for the entire surface of Romania’s territory, have been created. Each of these three maps contains 50 sheets edited in different periods of time.

Each sheet of the Geological map is accompanied by a book which contains the bilingual explanatory texts (Romanian and French) which offer information about the lithological and paleontological content of the formations and also about their distribution and evolution.

From the 50 sheets which compose the Geomorphological map of Romania (on scale 1:200,000), 7 are missing and some of them are incomplete. The space occupied by
the Lugoj Hills is found on two sheets (24-Timişoara and 25-Hunedoara) which, fortunately, are between the complete existing ones.

In pedology, besides the cartographic materials which present the spatial distribution of soils for the entire country, also some soils’ maps on regional or county level have been made. The area of the Lugoj Hills was framed within the soils’ maps of Banat and Timiş County. The legends of the pedogeographical materials need to be systematically adapted to the changes of the soils’ nomenclature from our country.

The current mapping is in an ample process of restructuration and modernization and the old cartographic materials serve as support for creating the new databases and digital maps. Also it can be observed that in the last period of time preoccupations for creating general maps can no longer be remarked, preferring increasingly the approach on some small interest research areas.

REFERENCES


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