

Chronology and characterisation of mining development in Romania

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Abstract Archaeological research on the Romanian territory showed that many deposits have been mined and valorized since before the Roman conquest of Dacia (106 A.D.), as pointed out by the ancient works of Herodot, Plinius and Lydus, as well as by more recent articles and books on archaeology and mining history. During the Neolithic and the transition toward the Bronze Age, gold was recovered from alluvial deposits of Crișul Alb river (Apuseni Mountains), and rock salt was extracted from brines at Cacica, Solca and Poduri (northern Moldova). This mining activity was continued during the Bronze Age, when copper and iron began to be extracted mainly in the northern part of the East Carpathians (Baia Mare area), in the western part of the South Carpathians (at Baia de Aramă) and in Dobrogea (at Ceamurlia). In the Iron Age, mining activity was targeted at the same type of resources, i.e. gold, rock salt, iron and copper, with increased production. Historians have estimated that, during the Bronze and Iron Age periods, ca. 250 t of gold and 370 t of silver have been obtained. During the Roman occupation of Dacia (106-272 A.D.), iron mining was developed in the South Carpathians (Poiana Ruscă and Banat), Apuseni Mountains (Trascău Mts.) and Dobrogea. Based on historical data, the gold production during the Roman time was estimated to ca. 498 t. For several centuries after the Roman period, few data are available, consisting of scarce proofs of continuation of gold and rock salt mining. Later, in the 16th Century, iron ores in the South Carpathians (Poiana Ruscă and Banat) and the East Carpathians (Harghita Mts.) have been relatively intensively mined and clay, limestone, quartz and sand began to be used in the manufacturing industry. Scientific studies on minerals and ore deposits can be reported from the XVII-XIX centuries, accompanying the stronger development of mining activities. Increased mineral production (non-metalliferous included) was registered in the period 1849-1918 as the state interests in mining increased, as well. In the period between the two World Wars, the mining activity was strongly developed and diversified. New types of mineral commodities have been mined (Zn, Sb, Sr, Al, Mn, Hg, bauxite, mica, feldspar, gypsum, clays, dolomite, asbestos), with a significant output that induced an increase of industrial entities using domestic ores and non-metalliferous mineral commodities. About 750 such industrial entities have been settled up in the period 1918-1925. The Mining Law in 1929 stated that all mineral resources belong to the Romanian State and enabled a strong development of all kinds of geological research. After the World War II, under the communist administration, all mineral resources in Romania have been intensively mined, in total disregard of the economic profitability and of the environmental impact. Extensive prospecting and exploration programmes led to an increase of localities with mineral resource to over 1, 000, out of which only few proved to be economic (mainly non-metalliferous). Under the consideration of low profitability, in 2008, more than 40 ore mines have been closed, sometimes without the evaluation of the remaining resources. Only four mines (Roșia Poieni and Moldova Nouă – Cu ores, Băița Bihor – Mo, Bi, base metals, W and Au-Ag ores and Crucea – for U) were maintained in operation. The fate of the Roșia Montană gold deposit is still uncertain as there are some unsolved problems of environment protection, preservation of old mining adits (some of them dating back to the Roman time) and other archaeological sites.

Keywords: mining history, Romania, gold, rock salt, iron, base metal

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1. Introduction

The Romanian territory was blessed with a great diversity of mineral resources (metallic and non-metallic), and energetic resources (coal, oil, gas, radioactive elements), some of these being

quite abundant. These resources were exploited during thousands of years, being a main reason for several periods of economic and social development. These rich resources also represented, since the pre-Roman ancient times, a permanent attraction and the reason of many wars.

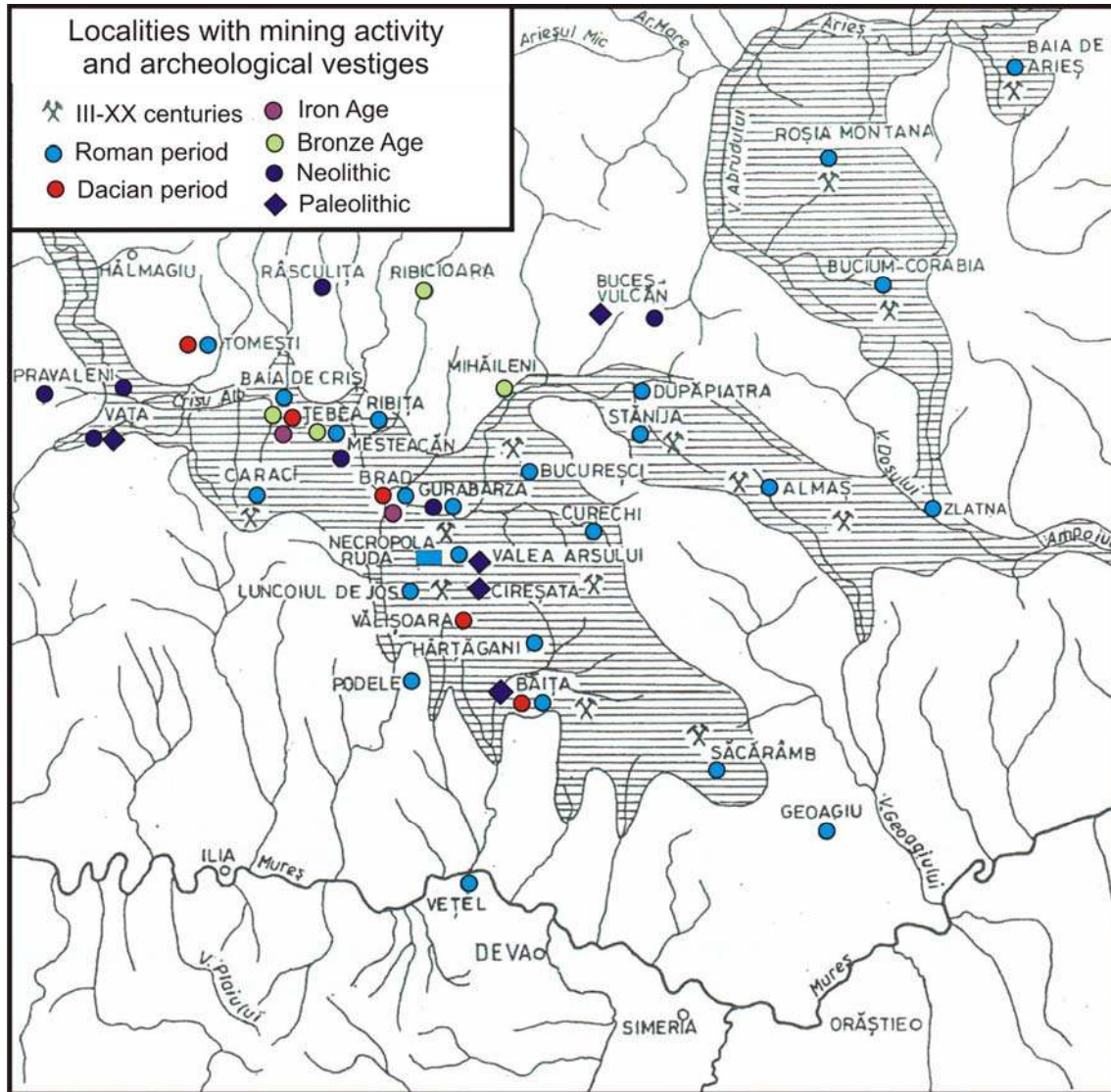


Fig. 1. Area corresponding to the Golden Quadrilateral of the Apuseni Mountains, defined by the localities Brad, Săcărâmb, Zlatna, Stănija, Bucium, Corabia and Baia de Arieș. This area recorded a very long period of gold ore extraction (an interval larger than 4,500 years, from the Neolithic to present, with rare interruptions), with primitive methods or mining works (map from the Gold Museum in Brad).

2. Pre-Roman period

The oldest archeological proofs, most of them indirect, as well as the historical writings, place the first activities of extraction and processing of metals in the late Neolithic, Bronze Age and Iron Age (Herodot, 5th century B.C.; Plinius, 1st century A.D.; Lydus, 1st century

A.D.; Densușianu, 1913; Pârvan, 1926, 1972; Abrudeanu, 1933; Haiduc, 1940; Popescu, 1956; Daicoviciu, 1960; Acker, 1965; Feneșan, 1967; Bujor and Roșu, 1968; Maghiar and Olteanu, 1970; Olteanu, 1971; Zah, 1971; Zsambok, 1985; Csiky, 1985; Sîntimbrean, 1989; Marinescu et al., 1990; Wolman, 1996; Bejan, 1998).

Gold and salt have been extracted since the late Neolithic (the "Decea Mureșului" and "Cucuteni" cultures). Salt was extracted from brines in Moldavia (Cacica, Solca and Poduri). Gold was extracted in Transylvania (Apuseni Mountains) by panning the alluvia from the upstream tributaries of the upper Crișul Alb river (Fig. 1).

During the Bronze Age (1800-1150 B.C.), salt extraction is also attested at Coștiui and Șugatag (in the actual Maramureș County), and in the southern Subcarpathian zone (e.g., Ocnîța). Gold extraction from alluvia was widespread in the Metaliferi Mountains (Fig.1). Local copper ore extraction is indicated by vestiges of numerous bronze storage places and bronze objects manufacturing in Apuseni Mountains, in the Baia Mare zone, at Baia de Aramă and in North Dobrogea.

In the Iron Age (1,150 B.C.-160 A.D.), there are proofs of mining for salt, gold, iron and copper (Marinescu et al., 1990). In the Hallstatt period (1,150-650 B.C.) there were at least 8 centers of salt extraction in the Transylvanian Basin. In the South Carpathians, East Carpathians and Dobrogea, iron was extracted in several places from Orăștie Mountains, Harghita Mountains and North Dobrogea, where the mining concerned mainly the oxidation zones of the deposits. In the proximity of these areas, furnaces for iron reduction were found, as well as ore fragments, slug boulders and ceramic fragments, the latter certifying the age of the vestiges. Gold recovery from alluvia continued on the main river courses from the Apuseni Mountains; similar activities took place on the large rivers that drain the mountain slopes in the central-western part of the South Carpathians.

In the second period of the Iron Age - La Tène (650 B.C.-160 A.D.), corresponding to the Dacian (Getic) period, many of the earlier mining sites were kept in operation. Additionally new salt resources were mined in the Transylvanian Basin, new iron resources were discovered in Trascău Mountains, at Rimetea (Mârza, 1962), and gold probably began to be extracted from outcrops, as well, at Roșia Montană (Fig. 1).

The amount of gold and silver extracted in the Bronze and Iron Ages were estimated to 250 t Au and 370 t Ag (Haiduc, 1940; Lăzărescu and Brana, 1972), based mostly on the contemporary information regarding the treasure captured at the Roman conquest of Dacia, which is considered as the greatest capture in the history

of the Roman wars (Lydus, *De Magistratibus*, 1st century). The captured Dacian treasure was estimated to more than four times the value of the public treasure of the Roman empire at the time of the conquest of Dacia (Densușianu, 1913, cf. Plinius). It is possible that the amount of metals mentioned by historians might have been exaggerated, as its assessment was based mostly on comparisons with other war captures (Bejan, 1998).

3. The Roman period

During the Roman occupation in Dacia (106-272 A.D.) the mining activity was organized and administered coherently over the entire occupied territory. Within a short time interval, the richest accumulations of native gold (at Barza, Băița, Caraci, Zlatna, Roșia Montană and Abrud) were identified and partially delimited. These were mined at surface and underground, from veins and stockworks with extremely high grade native gold ore. There are documents mentioning the work schedule, ownership, legislation, organization of mining system, transport and storage of production. The existence of these mining activities is also certified by archeological vestiges (old adits, inclines, transport devices, systems of water removal and aeration and mining tools), as well as inscriptions on monuments (shrines and funeral stones) and wax tablets (Sîntimbrean, 1989).

During the Roman period, iron mining extended around the old extraction centers from Poiana Ruscă and from the East Carpathians, known since the Dacian (Getic) period, as well as in many other locations with smaller reserves from the South Carpathians (in the vicinity of Șercaia, Șura Mică and Ilova-Cerna). Iron extraction was archeologically evidenced in Trascău Mountains, at Rimetea, from limonitized siderite (Mârza, 1962), and in Dobrogea, from ferruginous sands, at Boclugea Hill, Dervent Hill and Zmeica Lake, as indicated by fragments of slug and charcoal and by several remnants of furnaces for iron ore reduction (Marinescu et al., 1990). Based on similar arguments, iron and copper extraction is evidenced at Ceamurlia de Sus and Altân-Tepe (in Dobrogea), and especially at Baia de Aramă (a Romanian name for Copper Mine), where copper ore extraction and processing were remnants of smelters with ore fragments, bronze storage

places and dumps are preserved at Bratilov, a neighbouring village. Other mining and processing centers were located in Banat, at Moldova Nouă, Sasca, Bocşa Montană, Ocna de Fier and Dognecea, where, probably, the extraction of gold from base metal ores was performed.

The Roman administration organized exploration expeditions in the Northern Apuseni Mountains, at Băișoara (in Nyerghes perimeter), and also outside the occupied territory, in the southern part of the Gutâi massif (at Săsar, Valea Roşie and Valea Borcutului). In the absence of a systematic record, the production of metals during the Roman period was estimated to 498 t Au and 950 t Ag (Haiduc, 1940; Lăzărescu, Brana, 1972).

Among the non-metalliferous resources, the previously-discovered rock salt accumulations continued to be intensely exploited. New rock salt resources were discovered, the most important being near Turda and Praid (Fig. 2). The salt deposit at Oenița (South Carpathians), known since the pre-Roman times, became one of the main salt sources, with great production. It developed as an important commercial center, from which the salt was exported along the so-called "Salt Road", following the course of Olt river, then across the Danube, in the Balkan area (Tudor, 1968). The number of quarries for construction materials (limestone, marble, sandstone, andesite and shale) increased continuously during the Roman occupation, stimulated by the extensive road construction and maintenance.

4. The post-Roman period

After the Roman retreat from Dacia, during the 4th-10th centuries A.D., successive migrations crossed Dacia from the east to the west, with temporary occupation of the areas with mining activity. Gradually, the systematic extraction of mineral resources diminished and even ceased in many places. Nevertheless, two centers of iron extraction are mentioned in this period: Budureasa, in Apuseni Mountains, and Capidava, in Dobrogea (Maghiar and Olteanu, 1970). Beginning with the 10th century and in the 11th century, the mining activity was resumed, mostly for gold and salt in the Transylvanian Basin, but also for salt in Wallachia and Moldavia (Fig. 2).

5. The Middle Ages period

In the 12th-13th centuries, period corresponding with the early feudalism in Transylvania, the metal extraction was reactivated in the old mining centers (Maghiar and Olteanu, 1970). During this period, several mining centers were attested in official documents: Băița Bihor (1270), Baia Sprie, Cavnic and Rodna (1255), which subsequently were among the mines with the greatest productions of lead ore rich in gold and silver (Zsamboki, 1985). In 1327, the mining of gold, silver and copper was attested at Băișoara (Gilău Mountains).

Contemporary documents mention that during the 13th century, the extraction, transport and export of salt, on land and by ship, were considered privileged activities. Salt mines were mentioned in Transylvania (Turda, Dej, Ocna Sibiului), Wallachia (Ocnele Mari) and Moldova (Chilia and Târgu Ocna) (Gusti, 1939).

In the 14th-16th centuries, the lead ores rich in gold and silver from Baia Mare and Rodna Massif were mined. In the same period, the extraction of the iron ore from Poiana Ruscă Massif, Trascău Mountains, Hărghita Mountains and Banat took place on a quasi-permanent basis. Furnaces with increasingly greater capacity were built. Similar development involved the exploitation of copper ore in the Altân Tepe deposit.

In Transylvania, the ownership of gold resources was the object of a dispute between the Hungarian kings, the Catholic church and local nobility. The operation of the salt mines in Moldavia and Wallachia was the monopoly of the monarchy. Since the 15th century, the mining of the non-metalliferous resources has begun to develop constantly, stimulated by the more liberal policy towards the manufacturing activities.

6. The industrial period before the World War I

During the 17th-19th centuries, the scientific and technical progress allowed the opening of the deposits to greater depths and increased the capability of extraction and transport. Concomitantly, more effective crushing installations were used and the first metallurgical factories were built for lead ore processing and for the separation of lead from copper and gold and separation of gold from silver.

There are numerous documents concerning mining industry in the 18th and 19th centuries

(mine production registers, acts of privilege granting, acts of ownership, concession, mine closure etc), kept in the state archives from Baia Mare, Cluj-Napoca, Deva and Timișoara. These data show that, in 1841, more than 2,000 gold mines were operating in the Metaliferi Mountains. In the Baia Mare zone, 34 mines were in operation, plus several other in the Rodna Masif. In Banat, in the period 1749-1761 concessions were issued in 128 mining perimeters, which were operated with profit at least until the second half of the 19th century. The annual gold production in Transylvania increased in the interval 1770-1841 from several hundred kilograms to 1,200 kg. Banat province was a main European region with mines of copper and iron, including, as main centers, Oravița, Sasca, Moldova Nouă, Ocna de Fier and Dognecea in Banat. According to the official archives, in 1773-1778, Moldova Nouă deposit produced 4,427 t Cu, 225 t Pb and 124 t Ag; in 1777-1854, Dognecea, produced ca 1,850 kg Ag; at Ocna de Fier, in 1720-1814, at least 100,000 t of iron ore were extracted (Brîndză, 1985). In support of mining industry, railways were constructed in Banat, between Oravița and Buziaș (1854), and on the route Secu-Reșița-Bocșa-Ocna de Fier (1873). Gold separation from alluvia was attested near Bozovici, in 1769, and continued with profit toward the end of the 18th century.

Beside salt, shales, limestones and various construction stones, the quartz-rich sands began to be extensively used in the glass factories, the first of them being established in 1650, at Târgoviște, in Wallachia.

In 1848-1918, most mines for gold and salt from Transylvania were transferred in the state ownership, with good effects for the increase of production. The annual gold production of the Transylvanian mines in the period 1841-1880 increased from 700 kg to 1,570 kg, reaching a maximum of 2,270 kg in the period 1890-1908. In 1864, the Civil Code of the unified Wallachia and Moldavia created more homogeneous and clear regulations for mining activities, with special distinctions regarding the ownership of the surface and underground in the mining areas. In the Romanian Kingdom, the Mining Law adopted in 1885 had the purpose to stimulate the exploitation of mineral resources and to develop the industries related to mining activities. The first version of the "National Map of Mines and Vegetation of the Region between the Rivers Nistru and Tisa" was published in the "Atlas of

Romania and of the neighbouring countries" (Murgoci and Popa Burcă, 1902).

7. The Interbellum

According to the Romanian Constitution in 1923 and the Mining Law in 1924 (modified in 1929), all underground resources were owned by the Romanian state. The Mining Law was meant to ensure a rational exploitation of mineral resources and to regulate the rights of ownership and concession; it also stipulated the creation of mining tribunals.

In the period 1919-1945, Romania had the best strategy of mining development and of harmonisation with the related activities. Actions were taken toward the conservation of mineral resources, both by a more profitable processing of imported raw materials and by Romanian participation to exploration abroad. The national research programs were intensified and amplified in correlation with the development of new industries, leading to the identification of new deposits, containing new commodities (Zn, Sb, Cr, Al, Mn, Hg, Al, mica, feldspar, talc, gypsum, bentonite, kaolin, shales, dolomite, asbestos, strontium, silica). Additionally, the prospecting and exploration increased the reserves of metaliferous and non-metalliferous commodities, as presented in the Mining Indicator of Romania (MIC, 1925), Statistical Yearbook of Romania for the year 1938 (ICS, 1939), and in the Encyclopaedia of Romania (Gusti, 1939), the latter containing the second (revised) version of the National Map of Mining in Romania with information updated to the year 1939, made with the data from the Geological Institute of Romania (founded in 1906).

The first national evaluation of the reserves of Fe, Mn, pyrite and Cr was published by Ghițulescu and Gavăt (1931) and included the following data:

Fe ore: ca. 26 mil. t (25-50% Fe), more than 60% hosted in Poiana Ruscă massif;

Mn + Fe: ca. 9 mil. t (36% Mn, 9% Fe), ca. 60% located in the East Carpathians;

Pyrite: ca. 8 mil. t (\pm Cu, \pm Au), 50% in Baia Mare zone, 25% in Apuseni Mountains,

Cr ore: ca. 2 mil. t (38-52% Cr₂O₃), 100% in Banat.

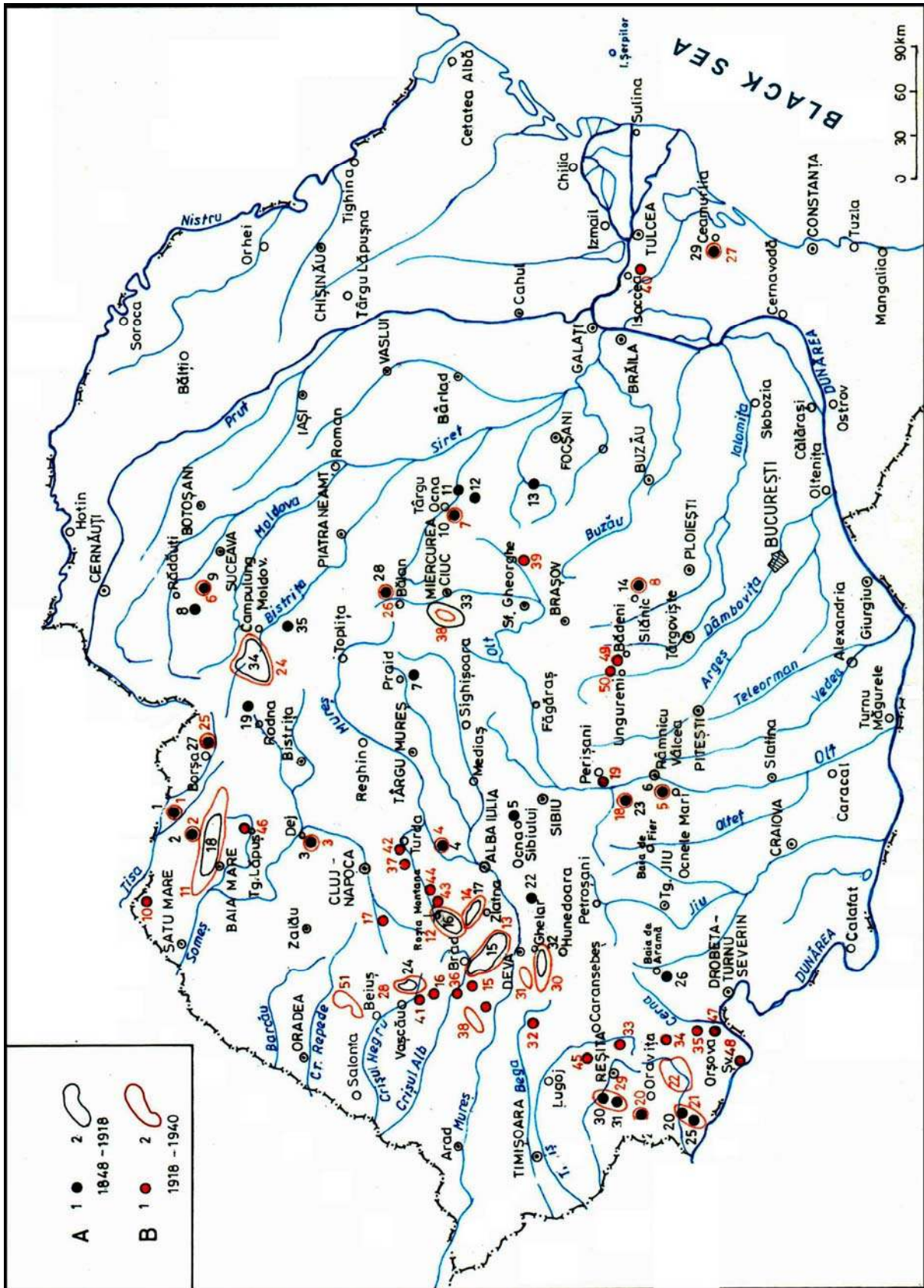


Fig. 2 The location of the mined metalliferous accumulations and salt deposits in Romania. Background map: Romania between 1918 and 1940.

- A: BEFORE 1918:* a. Mining fields and districts; b. Isolated accumulations; SALT (1. Coștiui, 2. Ocna Șugatag, 3. Ocna Dej, 4. Ocna Mureș, 5. Ocna Sibiului, 6. Ocnele Mari, 7. Praid, 8. Solca, 9. Cacica, 10. Tg. Ocna, 11. Dragomirești, 12. Nistoroiaia, 13. Valea Sării, 14. Slănic). Au, Ag-Pb, Zn±Cu ORE (15. Barza - Săcărâmb, 16. Roșia Montană - Bucium - Baia de Arieș district, 17. Zlatna-Amaș+Hg district, 18. Baia Mare district, 19. Rodna, 20. Sasca, 21. Oravița, 22. Pianu, 23. Valea lui Stan). Cu, PyCu ± Au, Ag, Pb ores (24. Băița-Bihor, 25. Moldova Nouă, 26. Baia de Aramă). Pb, Zn, Cu, Py ores (27. Borșa, 28. Bălan, 29. Altîn Tepe+Fe). Fe, Cu ± Pb, Zn, Au, Ag ores (30. Ocna de Fier, 31. Dognecea, 32. Teliuc-Ghelar IRON 33. Mădăraș-Lueta-Vlăhița Fe district). Mn-Fe; Pb, Zn, Cu, Py ores (34. Iacobeni-Vatra Dornei-Pojorâta district, 35. Brusturi Fe)
- B: After 1918:* a. Mining fields and districts; b. Isolated accumulations; SALT (1. Coștiui, 2. Ocna Șugatag, 3. Ocna Dej, 4. Ocna Mureș, 5. Ocnele Mari, 6. Cacica, 7. Tg. Ocna, 8. Slănic, 9. Tuzla). Au, Ag; Pb, Zn±Cu±Au, Ag ore (10. Tarna Mare district Au, Ag±Pb, Zn, Pb, Zn-Au, Ag, 11. Baia Mare district Au, Ag; Pb, Zn±Cu±Au, Ag±Sb, 12. Roșia Montană-Bucium-Baia de Arieș district Au, Ag; PyAu; Pb, Zn, Cu±Au, Ag, 13. Brad-Săcărâmb district Au, Ag ± Te; Pb, Zn-Au, Ag, 14. Almaș district Au, Ag ± Te; Pb, Zn-Au, Ag + Hg, 15. Caraci Au, Ag, 16. Brusturi Au, Ag-Pb, Zn ± Cu, 17. Someșul Rece Au, Ag-Pb, Zn ± Cu, 18. Valea lui Stan Au, Ag, 19. Perișani, Au, Ag). Cu; PyCu; Pb, Zn, Cu±Au, Ag±Bi, Co; Fe ores (20. Oravița Cu, Pb, Zn, Py, Mo, Bi, Co, 21. Sasca-Moldova Nouă district Cu, Pb, Zn±Au, Ag; PyCu, Mo, Bi, 22. Lăpușnicul Mare-Șopotul Nou-Bozovici-Bănia district, Dalboșet Cu; PyCu±Au, Ag; Au, Ag; Fe). PyCu; Pb, Zn; Fe, Mn; Fe ores (23. Drocea district). Py; PyCu; Mn-Fe ores (24. Munții Bistriței district, 25. Borșa Py; PyCu, 26. Bălan, Py; PyCu, 27. Altîn-Tepe PyCu-Fe, 28. Băița-Bihor district Pb, Zn, Cu ± Au, Ag±Mo, Bi). Cu, Pb, Zn-Au, Ag±Mo, Bi, W; Fe ores (29. Ocna de Fier-Dognecea district) Fe ores (30. Teliuc-Ghelar district Fe, 31. Valea Cernei, 32. Gladna-Nădrag, 33. Teregova, 34. Iablanița, 35. Topleț, 36. Vața de Sus, 37. Cacova, 38. Mădăraș-Ciuc-Homorod district, 39. Covasna, 40. Balabancea). Fe, Mn ores (41. Moneasa, 42. Buru, 43. Cioara, 44. Sălciua de Jos, 45. Delinești, 46. Mașca). Cr, Ni, Fe ores (47. Ogradena, 48. Plavișevița, Dubavăț, Tișovița, Eibenthal), Ni (49. Bădeni, 50. Ungureni) BAUXITE (51. Pădurea Craiului Mountains district: Vadul Crișului, Bratea, Remeți, Roșia, Dobrești, Pietroasa)

As a result of the new policy concerning the research on mineral resources, more than 750 factories were established in industrial branches that used commodities from the mining industry. Beside metal-processing activities, a new development was registered in the production of glass, chemical compounds, cement, lime, ceramics, refractory materials etc.

New types of ores were discovered, keeping the pace with the technical advances in metal extraction from the ores (Ni, Co, Bi, Ti, Mo, W, Mg). The Geological Institute of Romania published the first map with quarries for construction stones in Romania, at the scale 1:750,000 (Cantuniari, 1936).

During the Second World War (1939-1944), all deposits (mainly the metalliferous ones) were exploited in emergency regime, with the preferential extraction of the higher grade zones.

During the war, the Cr reserves from Banat were exhausted.

8. The communist period

During the first years after the Second World War, very rich uranium deposits were discovered in the Apuseni Mountains, which, were entirely exhausted in their richest zones before the end of the 1960s, the raw ore being transported to the Soviet Union as war damages. In the same intensive regime were exploited almost all metalliferous deposits, especially the gold deposits from the Metalliferi Mountains. The remaining resources were subsequently managed mostly in conditions of marginal profitability and even at a loss, which led to a gradual decline in mine industry. The policy of industrial development with minimal import of raw materials lead to the

extraction of subeconomic ores, with state subventions up to \$12,000 for \$1,000 production. Examples of subeconomic exploitations are those of native sulphur at Negoiu Românesc, cinnabar at Sântimbru, heavy minerals (Ti-Zr) from the southern Subcarpathian zone, silicates and oxides of Mn in South Carpathians, several porphyry type mineralizations (Cu-Au and Cu-Mo) from Apuseni Mountains and Banat, and several accumulations of base metal sulfides, Fe and Mn-Fe from Apuseni Mountains, East Carpathians and South Carpathians.

The prevalence of the political reasons over the economic criteria led to the neglect of rare elements (Te, Se, Tl, Cd, Ga, In, Sb, Bi, Ge, Sn), although they were found with economic grades in several deposits (Cheşu, 1983; Pandelescu et al., 1986).

Nevertheless, the years 1945-1990 were characterized by the extensive use of the geological, geophysical and geochemical methods, resulting in a comprehensive knowledge on many deposits and their surrounding areas. On the other hand, the extended exploration and mining produced the accumulation of a huge volume of mining and processing waste of more than 1000 mil. m³ (out of which 1/3 are mining waste and 2/3 processing waste), which cover a total area of more than 3,000 ha (Lăzărescu, 1983).

9. The post-communist period

The period 1990-present was marked by a radical revision of the state development strategy, which led to dramatic funding reduction in the geological exploration and mining, thus triggering the collapse of the ore mining industry and of the associated research activity (Rădulescu et al., 1991). Unlike the metalliferous resources, the non-metalliferous commodities began to be better managed after the year 1990, mainly by the elimination of the state subvention and the stimulation of the private companies (both Romanian and foreign) to perform exploration and mining. In 1994, the National Agency for Mineral Resources was created, with the mission of governmental administrator of the mineral resources in Romania. In 1998, the first post-communist Mining Law was enforced. It imposed the use of the UNFC classification in the assessment of resources and reserves, regulated the issue of exploration and exploitation concession licenses

by public auction and implemented clear regulations regarding the responsibility of the license holders for the environmental restoration of the mining sites. Since 1998, more than 2,500 companies were granted licenses (including the ones expired meanwhile) for prospecting, exploration and exploitation of non-metalliferous resources. Numerous abandoned exploitations of kaoline-rich shales, bentonite, brucite, nepheline sienite, quartz sands, feldspars etc began to be mined again (Harosa et al., 1998; Borcoş et al., 2003). In 2007, most metalliferous mines were closed. After 2008, only 4 mining perimeters out of 49 remained in operation: Roşia Poieni and Moldova Nouă for Cu, Crucea for U and Băiţa Bihor for Mo, Bi, W, base metals and Au-Ag. Roşia Montană deposit, ready for exploitation, and the gold-bearing pyrite accumulations in the perimeters Coranda-Hondol and Căinel are the main prospective gold resources.

10. Conclusions

The Romanian territory contained large amounts of mineral resources of varied commodities, which have been extracted for a long time (hundreds to thousands years). In the present, the non-metalliferous mineral resources show the largest volumes and are mined most extensively. Almost all metalliferous deposits are either totally exhausted or preserve only their mineralized parts with subeconomic grade. However, the available data suggest that, given the evolution of metal prices, the profitability of some closed mines should be reconsidered, especially if modern methods of extraction and processing are used. This would allow the capitalization of a relatively large volume of resources of base metals, copper, gold and iron ± manganese. Moreover, the recent success of several exploration programs in Romania and in other countries from the Balkan area suggests that new deposits can be found by the application of modern exploration methods in zones where former projects failed.

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