

THE POTENTIAL OF THE NONMETALLIC MINERAL RESOURCES IN THE REPUBLIC OF MACEDONIA

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Abstract

In this paper, an attempt has been made to briefly present the potential of the nonmetallic mineral resources in the Republic of Macedonia. A presentation of the condition of the nonmetallic mineral resources is done with a compilation approach, and the given data are result of the various types of geological research, done continuously during a long period of time. A special attention will be paid to the economical significant locations, and for some of them there will be a suggestion of perspective areas for further research.

The nonmetallic mineral resources are mostly located in the range of the Pelagonian massif (locations and presence of feldspars, micas, marbles, marble onyx, dysten, staurolites, granites, syenites, diatomaceous earth, etc.) but there are also many other locations which are not equally located and other geotectonic units, like bentonite, secondary quartzite, native sulfur, opalites, etc., (Serbian-Macedonian massif), then the talc, marl, travertine, etc., (Vardar area), plaster, marbles, etc., (Western Macedonian area).

Key words: nonmetallic mineral resources, Republic of Macedonia, Quantity, Type of resource, potential, perspective areas,

INTRODUCTION

It is well known that the area, the territory which belongs to the Republic of Macedonia and its immediate surrounding is geologically more complex and interesting. It is an area through which a few large geotectonic units pass (Vardar area, Serbian-Macedonian mass, Pelagonian massif, Serbian-Macedonian mass, etc.) which are characterized with their own lithostratigraphic, structural, geotectonic and metalogenetic regime, which basically contribute to the fact that these large individual units can be defined as separate metalogenetic units (Figure 1). In these areas there are often instances of crossing of numerous linear fault structures of different degrees with different intensities, as well as an evidence of great number of different in time magmatic and mineralizing process. All this leads to the creation of various mineral resources located in various structural, magmatic and lithological environments.

The nonmetallic mineral resources are mostly located within the Pelagonian massif (locations and presence of feldspars, micas,

marbles, marble onyx, dysten, staurolites, granites, syenites, diatomaceous earth, etc.) but there are also other locations which are not equally located and other geotectonic units, like bentonite, secondary quartzite, native sulfur, opalites, etc., (Serbian-Macedonian massif), then the talc, marl, travertine, etc., (Vardar area), plaster, marbels, etc., (Western Macedonian area).

A REVIEW OF THE MINERAL-RESOURCE POTENTIAL

With all research and observations done so far on the territory of R. of Macedonia, numerous locations, phenomena and potential locations have been determined for further research and observations of the nonmetallic resources, which fundamentally represent the mineral-resource potential of our country (Figure 2).

In order to get a more complete insight of the nonmetallic mineral resources, their potential and location, in the further review we will focus on the more significant locations.



Figure 1. Geotectonic regions in R. Macedonia (Arsovski 1997)

I Cukali – Krasta zone; II – Western Macedonian zone; III - Pelagonian massif; IV - Vardar zone; V – Serbian-Macedonian massif VI – Kraistide zone



Figure 2. Presented draft review of Macedonia with geotectonic units and ore mineralizations and occurrences non-ferrous mineral resources

Feldspar resources (1. Hamzli, 2. Ravna Niva); *Bentonite and plaster for rough ceramics* (3-Ginovci and Rankovci, 4-Elata-Pehcevo, 5-GornaBrca, Rakovec, Para Niva, 6-Progun-Negotino); *Silica resources* (7-CrnVrv, 8-Sinkovica, 9-Lakavica, 10-Markova Reka); *Diatomaceous earth* (11-Manastir – Mariovo); *Dysten* (12-Prilepec); *Magnesium* (13-Pcinja); *Talc*(14-Izvor – Veles); *Pumice* (15-Vitacevo); *Opal breccia* (16-Spacevo), *Basalt* (17-EzevoBrdo, 18-MladoNagoricani); *Cement marl* (19-Ulje); *Native sulfur* (20-Plesencin); *Asbestos* (21-Bogoslovec); *Plaster* (22-Debar); *Barytes* (23-Nezilovo); *Dolomite* (24-Sivec); *Marble* (15-Sivec, 26-Cer, 27-Gostivar, 28-Lojane, 29-Mavrovo, 30-Blace-Tetovo); *Travertine*(31-Lipkovo, 32-Matka, 33-Svilare, 34-Kuckovo, 35-Beciste, 36-Velmej-Ohrid); *Green breccias* (37-Vevcani); *Syenites*(38-DolnoDupeni).

THE NON-FERROUS MINERAL RESOURCES

There many different types of non-ferrous mineral resources on the territory on the Republic of Macedonia which have great influence on the industrial development of our country. Due to the many intensive geological research, especially done in the second half of the last century, there are more than 50 mining plants operating today in Macedonia, which exploit various types of non-ferrous mineral resources, which find their most different application in the civil engineering, chemical, glass, porcelain and ceramic industry, also in the refractory, in the industry for dyes and lacquers, etc.

Compared to the metallic mineral resources, this type of resources significant advantages which provide fast research and activation of mining capacities, and at the same time these are resources that are in abundance and have significant perspectives. Another great advantage in the process of research and the use of the non-ferrous mineral resources is that they are found on the surface itself or in the immediate surroundings so the exploitation does not cause additional costs which will further influence the price of the final product. All these parameters have naturally contributed the use of the nonmetallic mineral resources to be intensified and their complex valorization to be planned.

The Republic of Macedonia has various types of non-ferrous mineral resources, some of which are very rare on the Balkans and in the region (Na feldspars, pumice, pumicite, crystal plaster, asbestos, etc.) but the fact still remains that this natural potential is not used in proper extent. Furthermore, there are also instances where instead of opening new plants, the existing ones are closed (like the examples in the plants which produce resources for the glass and the ceramics industry). In order to get a more concrete review of the potential in R. Macedonia in the field of non-ferrous mineral resources in the table that follows, (Table 1) the quantity characteristics are presented of some traditional mineral resources within our more significant locations, especially the locations where the reserves of the mineral resources are already determined. In the table the locations are not given and the phenomena of decorative stone because a special review will be done separately.

Table 1. *Quantity characteristics of the traditional non-ferrous mineral resources in the Republic of Macedonia.*

| Type of resource | Location | Quantity (t) |
|--------------------------|---|--------------|
| Na - feldspar | Ograzden | 3 500 000 |
| K –feldspar | Ravna Reka | 500 000 |
| Illite clays | Pehcevo | 8 200 000 |
| Quartz sediments | Markova Reka | 1 900 000 |
| Metamorphic quartz | Sinkovica | 2 900 000 |
| Dolomite | Sivec | 2 500 000 |
| Diatomaceous earth | Manastir Mariovo, Vesje, Negotino | 550 000 |
| Dysten | Prilepec | 760 000 |
| Magnezite | Peinja | 145 000 |
| Bentonite plaster | Rankovci, Ginovci | 18 000 000 |
| Talc | Izvor - Veles | 1 040 000 |
| Pyrophyllite | Babino – DemirHisar | 970 000 |
| Opal breccia | Opalit- Spancevo | 3 500 000 |
| Secondary quartzite | Crn Vrv - Kratovo | 4 000 000 |
| Quartz | Lakavica | 10 000 000 |
| Cement marl | Usje - Skopje | 72 000 000 |
| Plaster | Debar | 1 700 000 |
| Native sulfur | Plesenci - Probistip | 800 000 |
| Parlite | Gradesnica - Bitola | 1 180 000 |
| Pumice (m ³) | Vitacevo | 200 000 |
| Asbestos | Bogoslovec | 750 000 |

From the presented table 1 it can be noticed that with the detailed research and with the exploitation (in most parts) more than twenty different types of nonmetallic mineral resources are determined with quite large quantities of mining reserves. But one part of some very significant resources in the line of the alunites, borates, volcanic glass, granites, corundum, micas, zeolites, etc., are slightly treated only because of the low level of research. The received data so far point to the fact that there are perspectives to find greater quantities of these mineral resources.

From this Table 1 it can be stated that in Macedonia there are significant quantities of feldspars (Na and K). The Na-feldspars (even though very rare) can prospectively be researched in the surroundings of the location Hamzali, while the K-Feldspars have wider perspective, not just in the pegmatic locations of the Pelagonian massif but also in other intrusive and volcano rocks which have high quantity of K-feldspars.

Apart from the large quantities of bentonite and illite clays, on the territory of R. of Macedonia there can also be found certain quantities of kaolinite clays, especially in the areas with more intensive volcanic activity, but for now the level of research is very low.

In the domain of plaster resources, it should be noted that apart from the crystal plasters, in the area of debar and its immediate surroundings, significant quantities of alabaster have been determined and there is also a possibility to determine large quantities of anhydrite.

From the nonmetallic resources which are related to the volcanic areas, apart from the opalite, opal breccias, perlite, also the hydrothermally changed volcanic tuffs in Strmos are also worth mentioning, then the secondary quartzite in CrnVrv represent a relatively rare resource in the world. From these secondary quartzite – silex, many silex balls and silex segments are produced for inlaying mills.

Apart from the mentioned nonmetallic mineral resources, the R. of Macedonia has also a great potential for resources of decorative stone. The tradition to use and exploit decorative stone in these areas is from ancient times, which is proved by the archeological remains and cultural sights. Based on this, and also due to the continuing geological researches in Macedonia today there are many large plants for exploitation of decorative stone. We can mention the Mermerenkombinat – Prilep, the travertine in Lipkovo and Tetovo, Granites and gneiss in Prilep, roof shales in Veles, etc.

In the following table (Table 2) the quantity characteristics of some significant locations of decorative stone in our country have been presented.

From the presented table 2 it can be noted that R. Macedonia is in possession of large quantities of, primarily marbles, as we mentioned the large mining capacities, then the travertine, which are also exploited, then the merble onyx, granite, sienite, and lately the focus is on the andesites and the volcanic breccia, which proved good quality.

Apart from the mentioned locations, there are also many other locations on the territory on the R. of Macedonia which can have decorative stone and which can produce commercial blocks, but the level of their research is still very low. But this review can present the fact that Macedonia is rich in decorative stone but it's not yet valorized and commercialized. There are many problems that are concerned with this, especially the bad design should be pointed of the produced objects in our plants.

Table 2. *Quantity characteristics of the decorative stone in R.Macedonia*

| Type of resource | Location | Quantity (m ³) |
|------------------|----------------------|----------------------------|
| Marble | Sivec - Prilep | 280 000 |
| Marble | Debrešte | 34 000 |
| Marble | Markov Stap | 54 000 |
| Marble | Kozjak | 40 000 |
| Marble | Vuksan | 376 000 |
| Marble | Lojane | 3 800 000 |
| Marble | Gaber | 56 000 |
| Marble | Cer - Kicevo | 716 000 |
| Marble | Plandiste - Gostivar | 302 000 |
| Marble | Radovo - DemirHisar | 240 000 |
| Marble | Blace - Tetovo | 25 000 |
| Marble | Mavrovo | 13 000 |
| Travertine | Svilari | 1 000 000 |
| Travertine | Matka | 600 000 |
| Travertine | Lipkovo | 40 000 |
| Travertine | Kuckovo | 13 000 |
| Travertine | Velmej – Ohrid | 2 900 000 |
| Onyx | Manastir | 18 000 |
| Onyx | Beciste - Mavrovo | 1 600 000 |
| Granite | Kukup | 170 000 |
| Granite | Teovo | 80 000 |
| Gneiss | Drenovci | 318 000 |
| Andesite | Ketenovo - Kratovo | 8 000 |
| Sienite | DolnoDupeni | 300 000 |
| Green breccia | Vevcani - Struga | 60 000 |

From the nonmetallic mineral resources which Macedonia has at its possession, the half-precious stones should also be mentioned, which, at this point, are only in the line of the potential. We can mentioned corundum (Sivec), jasper (Rzanovo), Opal (Stracin, Bajlovci, Spancevo), precious serpentine (Lojane), Amazonite (Mariovo) etc.

CONCLUSION

From the stated it can be concluded that the areas where Macedonia is as a territory are high in potential of various different nonmetallic mineral resources. This is probably due to the complexity of these areas from stratigraphic, structural and metalogenetic aspect. Namely, there is one group of mineral resources which are related only to the old (paleozoic) complexes, and

another one related to mostly volcanic complexes while the third one is about the resources related to the young sediment fields. According to this, the diversity of the geological and the structural content of the areas produce various types of natural mineral resources.

It should be stated also that in R. of Macedonia as potential resources should primarily be noted the marble, travertine and the onyx, the silica resources, the clay and the feldspars.

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