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ANALYSIS OF APPROVED EXPLORATION AREAS FOR DETAILED GEOLOGICAL EXPLORATIONS, VERIFIED RESERVES OF SOLID MINERAL RESOURCES AND INVESTMENTS IN THE PERIOD 2010-2014

Abstract

The Ministry of Mining and Energy (MME) in accordance with the Law on Mining and Geological Explorations ("Official Gazette RS" No. 88/2011) issues a solution for detailed geological explorations in the area of the Republic of Serbia, except the province of Vojvodina. This paper gives an analysis the approved exploration areas for detailed geological explorations, investments and verified reserves of solid mineral resources in the period 2010-2014.

Keywords: *MME, metals and nonmetals, detailed geological explorations, metallic raw materials, nonmetallic raw materials, reserves*

1 INTRODUCTION

Considering the overview of approved exploration rights for detailed geological explorations and verified reserves of mineral resources, certainly it must be taken into account that these analyses provide a broader picture of general condition for capital interest in geological explorations in Serbia.

2 THE EXISTING LEGAL REGULATIVE

The Ministry of Mining and Energy (MME) in accordance with the Law on Mining and Geological Explorations ("Official Gazette RS" No. 88/2011) issues a solution for detailed geological explorations in the area of the Republic of Serbia, except the province of Vojvodina. By this Law, in Article 1, among other things is that "this law regulates the conditions and method of performance the geological explora-

tions and utilization the results of these explorations".

In addition, this law also regulates development the studies on completed geological explorations, Article 3, paragraph 19 of this law states that the "study on the resources and reserves of mineral resources, groundwater and geothermal resources is a document on the results of geological explorations [1].

Development the study on geological explorations is regulated by the "Rulebook on contents of projects of geological explorations and studies on results of geological explorations" ("Official Gazette of RS" No. 51/96). This Rulebook shall determine the contents of projects of geological explorations and studies on results of geological explorations [2].

In accordance with the Law on Mining and Geological Explorations ("Official Gazette of RS" No. 88/2011), the company

* *Ministry of Mining and Energy of the Republic of Serbia*

3 APPROVED EXPLORATION RIGHTS FOR DETAILED GEOLOGICAL EXPLORATIONS

exploiting mineral raw materials submits the study to the relevant Ministry on classification the reserves of mineral raw materials on exploratory or exploitation area for the purpose of determining and verifying the mineral reserves. Determining and verification of sorted mineral resources is performed by a commission formed by the minister in charge of geology.

Analyzing the approved detailed geological explorations in the past five years, more precisely since the beginning of 2010 until the end of 2014, a significant variability in the number of approved investigations by years can be observed. The total of 413 geological explorations of various mineral raw materials was approved. By years, it looks like in Table 1.

Table 1 Review of approved explorations by years

Year	2010	2011	2012	2013	2014	Total
No. of explorations	108	111	115	41	38	<u>413</u>

Processed data are related to the approved research in the specified period regardless of whether they are later extended, terminated, completed or interrupted

for various reasons.

Figure 1 presents the number of approved detailed geological investigations by years.

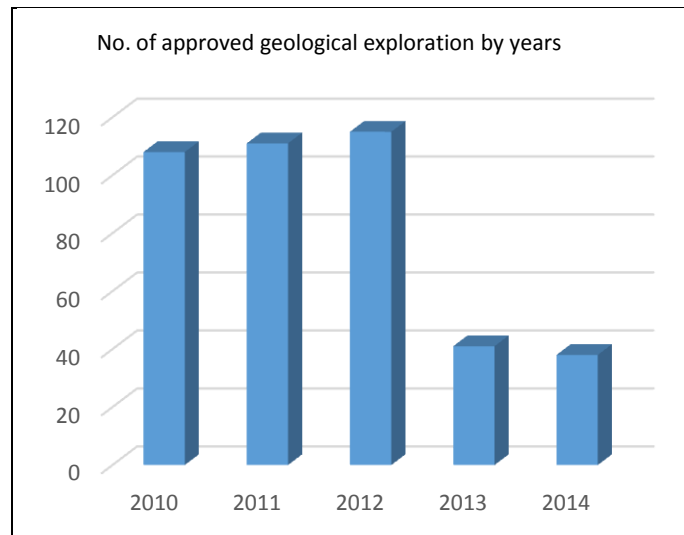


Figure 1 Detailed geological explorations

Data are individually processed for each year, by type of mineral resources which are approved for exploration as well as total for the entire period. Mineral resources of 28 kinds are selected, provided that mineral resources that are being explored from the same occurrences (for certain exploration field, paragenesis), are treated as one kind of raw material.

In total share of metallic and nonmetallic raw materials by years depending on exploratory year, a greater variability of exploration was observed in the field of mineral resources while the interest in non-metallic mineral resources is more or less constant in each year. Figure 2 presents the percentage share of types of mineral resources within the procedures of approved detailed geological explorations in 2012.

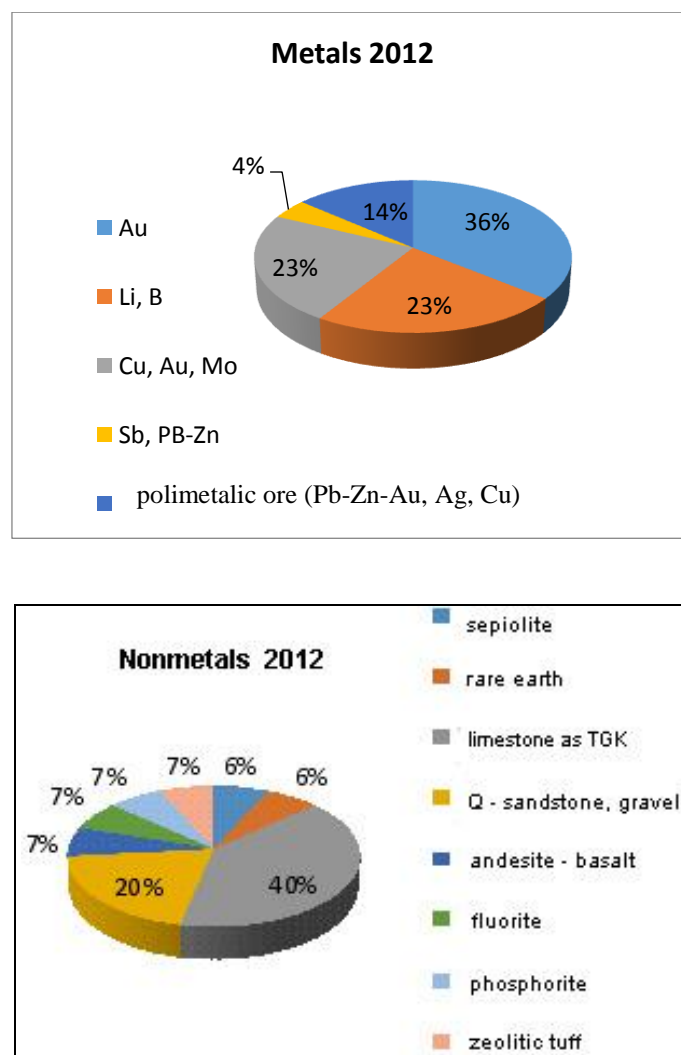


Figure 2 Approved geological explorations in 2012, metals - nonmetals

In terms of issued approvals for detailed geological explorations, the year 2012 is clearly separated during which the highest number of approvals was issued and therefore it deserves a separate analysis due to the observed trend of increasing interest in exploration of metallic mineral resources.

Just in 2012, the metallic mineral raw materials were explored on 95 exploration areas, and nonmetallic raw materials on 17 exploration areas, while geological or geotechnical explorations were approved on remaining 3 exploration areas within the mine waste dump in Bor, the factory "Magnohrom" and PD "TE-KO Kostolac". In 2012, the greatest interest was shown for gold exploration (34 exploration areas or 36%), lithium and boron (22 exploration areas or 23%), ore of copper, gold and molybdenum (22 exploration areas or 23%), as well as polymetallic ores Pb-Zn-Au-Ag-Cu (13 exploration areas or 14%) and antimony ore (4 exploration areas or 4%). It can be seen on a diagram of nonmetallic mineral resources that particularly interesting geological explorations were for rare earth (RE from lanthanide) and sepiolite as non-traditional mineral resources and zeolitic tuff. In accordance with the multi-year research explorations, in 2012, earlier started explorations were continued for oil and gas in the entire territory of the Republic of Serbia; coal in the western part of the Kostolac coal basin and the western field of the coal bearing basin Sjenica; gold on the exploration areas "Potaj Čuka Tisnica" and "Breza" near Bor as well as lithium within the Jadar basin [4].

Geological explorations in 2014 were approved for different mineral resources,

mainly metallic (gold on 4 exploration fields (17%), ore of copper, gold and associated metals on 8 exploration fields (29%); boron and lithium-B, Li on 3 exploration fields (13%), lead and zinc ore on 2 exploration fields (8%), Pb, Zn, Ag (13%) on 3 exploration fields, polymetallic ore (4%); iron ore on one exploration field and others.), and coal of energy resources.

In nonmetallic raw materials, the interest significantly increased in brick clay (28%), quartz quartz sandstone (18%), limestone (18%), dacite, zeolitic tuff, marble onyx (Figure 3). Metallic raw materials are investigated on 24 exploration areas, which make 63% of the total number (38) of approved explorations (Figure 4). If previously approved explorations of mineral resources are taken into account, which are still active, it appears that in 2014, the geological explorations of these mineral resources were performed on total of one hundred and thirty five (135) exploration areas. During 2014, earlier started explorations were continued such as lithium and boron in the Jadar neogene basin, gold in sedimentary formations, west of the Timok Magmatic Complex on exploration areas "Potaj Čuka Tisnica", gold on exploration areas "Brestovac-Jasikovo", "Ždrelo - Goli vrh", "Železnik-Topla-Bor Lake-Manojlica" and "Breza" near Bor, copper-gold on exploration area "Brestovac-Jasikovo", oil and gas on the whole territory of Serbia, coal in the western part of the Kostolac coal basin and others. Compared to the past few years, the explorations of architectural and technical construction stone have significantly stagnated both sedimentary (limestone and dolomite) and volcanic rocks.

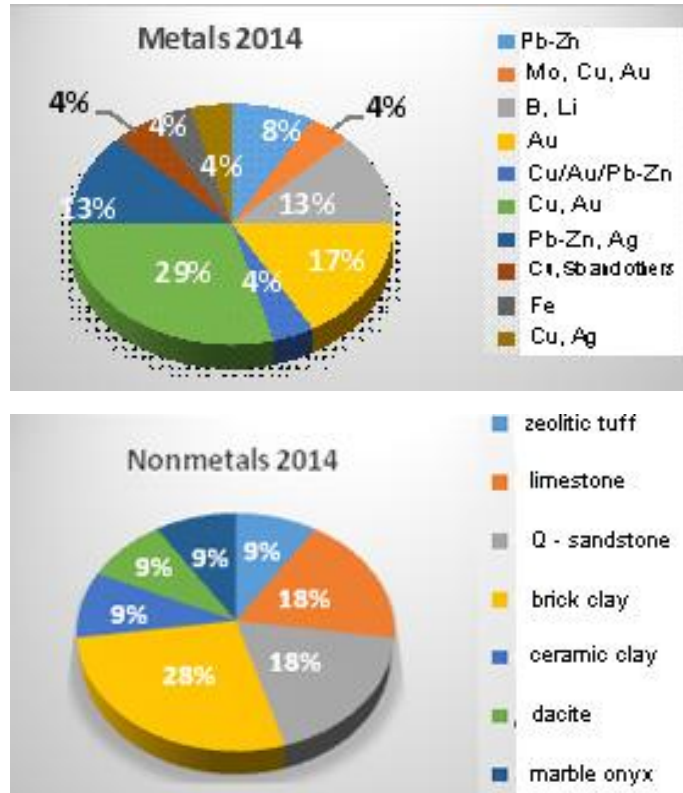


Figure 3 Approved detailed geological explorations in 2014, metals - nonmetals

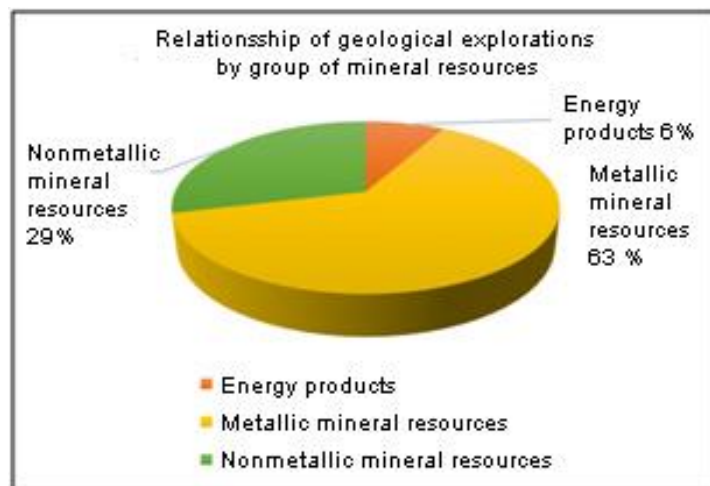


Figure 4 Relationship of geological explorations by groups of mineral raw materials - 2014

3.1 Conclusion on Approved Exploration Rights for Detailed Geological Explorations

Based on the above mentioned, it can be stated that the approvals for geological explorations of mineral raw materials were the most intense in 2012 and this year represents the year with almost double number of the new exploration rights than the approved ones in 2013 and 2014, together. This can be partly explained by higher interest of mainly foreign companies and continuing exploration trends from the previous period. After 2012, there was a sudden fall in the new approvals for exploration and in the last two

years it is kept at ten-year minimum. The year 2014 presents the year with the least number of new explorations.

4 VERIFIED RESERVES OF MINERAL RESOURCES

On the territory of Serbia, the total of 147 reserves of mineral resources was verified. Based on the Book of Balance (2010, 2011, 2012, 2013 and 2014 - in preparation) by years, it looks like in Table 2.

Table 2 *Verified reserves by years*

Year	2010	2011	2012	2013	2014	Total
No. of reserves	38	49	24	17	19	<u>147</u>

The processed data are related to the total verified reserves, regardless of whether those are innovated reserves, verified reserves in the existing mining field or after presented explorations.

Figure 5 presents a graph showing the relationship of verified reserves of mineral raw materials by years.



Figure 5 *Verified reserves by years*

4.1 Conclusion on verified reserves of mineral resources

From verified mineral reserves, the total of 147 reserves was verified, out of which the largest number of 49 in 2011. The largest number of verified reserves, as well as in exploration, was for raw materials for use in construction as architectural-construction stone and technical-construction stone.

5 INVESTMENTS OF DESIGNED EXPLORATION WORKS

Total value of all designed exploration works, approved in 2014, amounts to 344,194,440 RSD, or about € 2,821,266

(1 € = 122.0 RSD). If the value of exploration works, transferred from previous years $\approx 77,106,250$ RSD (referring to the same projects from previous years) is added to this sum and the value of investments in several major multi-year projects of geological explorations of mineral resources, which are entered in the second or third phase of exploration, except oil and gas, which amounts to 2,621,189,103 RSD, it follows that the value of investments in geological explorations of mineral resources in 2014 amounted to approximately: 3,042,489,793 RSD or around € 24,938,441.

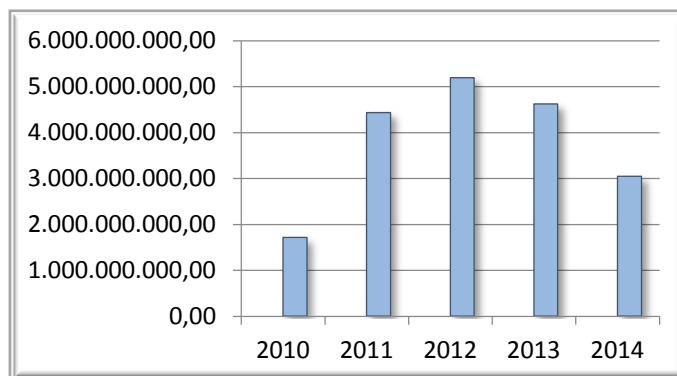


Figure 6 Investments in Euros

CONCLUSION

Investments in the field of geological explorations in Serbia for the period 2010 to the end of 2014 had different trends. It turned out that the highest intensity of increase was in 2012, and later in 2013 and 2014 there was a decline in issued approvals for detailed geological explorations, as it can be seen in the shown diagrams. A significant decline was registered in 2014.

High sensitivity of this industrial branch can be seen through the presentation of this basic analysis, whereby it should be noted that the expected increase in the plan of intensifying the geological explorations in the next period.

These analyses open a space for further data processing in this way. Further data processing is imminent, in terms of the rela

tionship between the number of new exploration rights and verified reserves in the same areas, as well as the ratio of the number of old and innovated reserves. Also, comparative analyses can be further carried out by municipalities, as well as the areas of exploration works with the areas where the reserves are verified. Very interesting analyses, in addition, would be also to referred to the graphic presentation of relationship of the obtained exploration rights by raw materials, years and municipalities [7].

REFERENCES

- [1] Law on Mining and Geological Explorations ("Official Gazette of RS" No. 88/2011), 2011;
- [2] Rulebook on Contents of Projects of Geological Explorations and Studies on Results of Geological Explorations ("Official Gazette of RS" No. 51/96), 1996;
- [3] Balance of Reserves and Resources of Mineral Raw Materials in the Republic of Serbia on 31/12/2014, Ministry of Mines and Energy, Belgrade (in Preparation);
- [4] Balance of Reserves and Resources of Mineral Raw Materials in the Republic of Serbia on 31/12/2013, Belgrade;
- [5] Balance of Reserves and Resources of Mineral Raw Materials in the Republic of Serbia on 31/12/2012, Ministry of Natural Resources, Mining and Spatial Planning, Belgrade, 2013;
- [6] Balance of Reserves and Resources of Mineral Raw Materials in the Republic of Serbia on 31/12/2011, Ministry of Natural Resources, Mining and Spatial Planning, Belgrade, 2012;
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ANALIZA ODOBRENIH ISTRAŽNIH PROSTORA ZA DETALJNA GEOLOŠKA ISTRAŽIVANJA, OVERENIH REZERVI ČVRSTIH MINERALNIH SIROVINA I INVESTICIJA U PERIODU 2010 - 2014. GODINE

Izvod

Ministarstvo rudarstva i energetike (MRE) u skladu sa Zakonom o rudarstvu i geološkim istraživanjima („Službeni glasnik RS“ broj 88/2011), izdaje rešenja za detaljna geološka istraživanja na području Srbije, osim pokrajine Vojvodine. U ovom radu analizirani su odobreni istražni prostori za detaljna geološka istraživanja, investicije i overene rezerve čvrstih mineralnih sirovina u periodu od 2010-2014 godine.

Cljučne reči: MRE, metali i nemetali, detaljna geološka istraživanja, metalne mineralne sirovine, nemetalne mineralne sirovine, rezerve

1. UVOD

Kada je reč o pregledu podataka odobrenih istražnih prava za detaljna geološka istraživanja i overenim rezervama mineralnih sirovina, svakako se moraju uzeti u obzir da ove analize daju jednu širu sliku opšteg stanja zainteresovanosti kapitala za geološka istraživanja u Srbiji.

2. POSTOJEĆA ZAKONSKA REGULATIVA

Ministarstvo rudarstva i energetike (MRE) u skladu sa svojim nadležnostima po Zakonu o rudarstvu i geološkim istraživanjima („Službeni glasnik RS“ broj 88/2011), izdaje odobrenja za detaljna geološka istraživanja na području Srbije, osim pokrajine Vojvodine. Ovim zakonom, u članu 1. između ostalog stoji, da se „ovim zakonom uređuju uslovi i način izvođenja geoloških

istraživanja i korišćenja rezultata tih istraživanja“.

Osim toga, ovaj zakon uređuje i izradu elaborata o završenim geološkim istraživanjima, čl. 3., stav 19. ovoga zakona kaže, da „elaborat o resursima i rezervama mineralnih sirovina, podzemnih voda i geotermalnih resursa je dokument o rezultatima geoloških istraživanja [1].

Izrada elaborata o geološkim istraživanjima regulisana je „Pravilnikom o sadržini projekata geoloških istraživanja i elaborata o rezultatima geoloških istraživanja“ („Službeni glasnik RS“ broj 51/96). Ovim pravilnikom bliže se određuje sadržina projekata geoloških istraživanja i elaborata o rezultatima geoloških istraživanja [2].

U skladu sa Zakonom o rudarstvu i geološkim istraživanjima („Službeni glasnik RS“ broj 88/2011) preduzeće koje vrši eksploataciju mineralnih sirovina dostavlja

* *Ministarstvo rudarstva i energetike Republike Srbije*

3. ODOBRENA ISTRAŽNA PRAVA ZA DETALJNA GEOLOŠKA ISTRAŽIVANJA

resornom Ministarstvu elaborat o razvrstavanju rezervi mineralnih sirovina na istražnom, odnosno eksploatacionom prostoru radi utvrđivanja i overavanja rezervi mineralnih sirovina. Utvrđivanje i overu razvrstanih mineralnih sirovina vrši komisija koju obrazuje ministar nadležan za poslove geologije.

Analizirajući odobrena detaljna geološka istraživanja u prethodnih pet godina, tačnije od početka 2010. godine, pa do kraja 2014. godine, može se uočiti značajna promjenljivost u broju odobrenih istraživanja po godinama. Ukupno je odobreno 413 geoloških istraživanja za različite mineralne sirovine, po godinama to izgleda kao u tabeli 1.

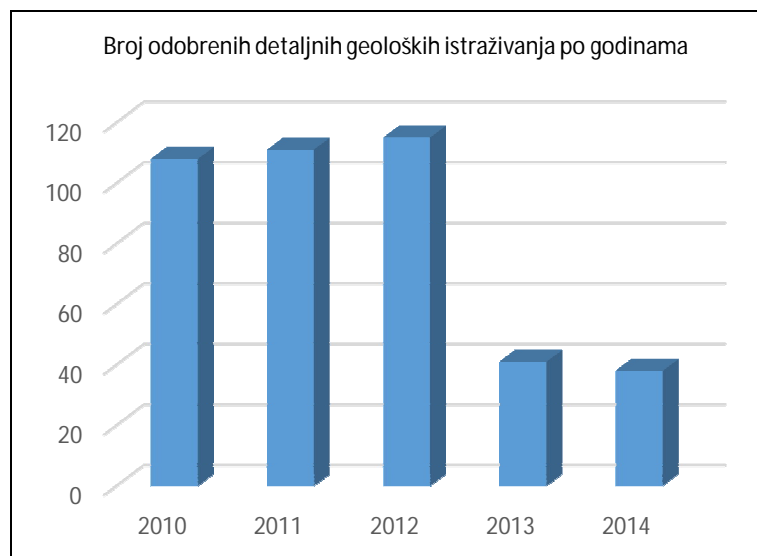
Tabela 1. Prikaz odobrenih istraživanja po god.

Godina	2010.	2011.	2012.	2013.	2014.	Ukupno
Broj istraživanja	108	111	115	41	38	413

Obrađeni podaci se odnose na odobrena istraživanja u naznačenom periodu bez obzira da li su kasnije produžena, ukinuta,

završena ili prekinuta iz različitih razloga.

Na slici 1. prikazan je broj odobrenih detaljnih geoloških istraživanja po godinama.

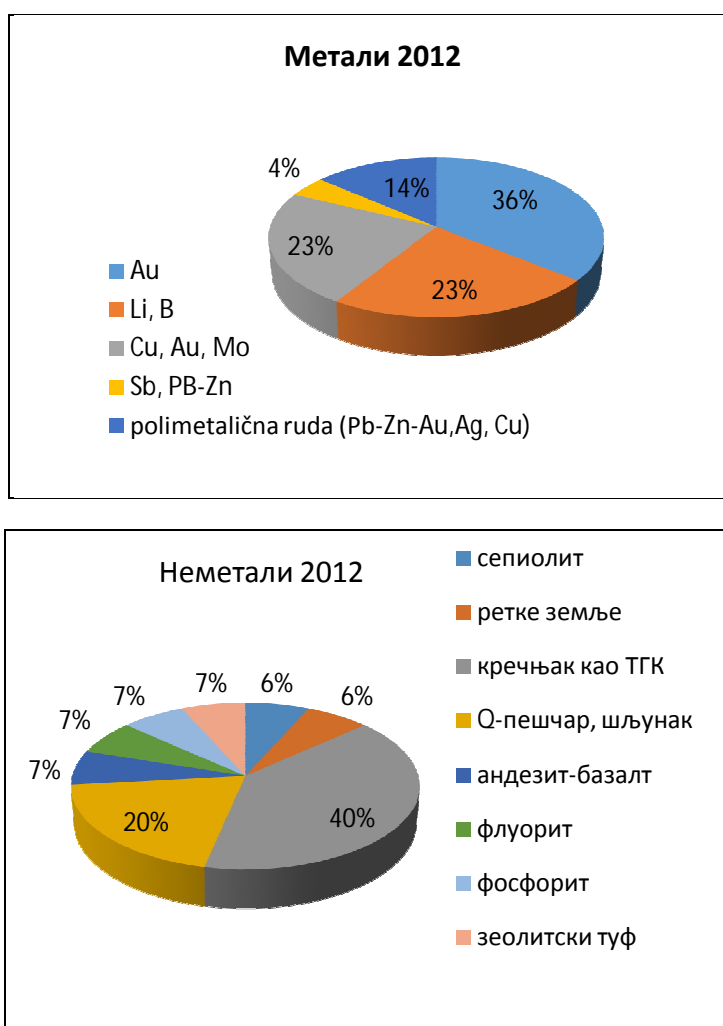


Sl. 1. Detaljna geološka istraživanja

Обрађени су подаци појединачно за сваку годину, по врсти минералне сировине које су одobreне за истраживање, као и укупно за ceo период. Издвојене су 28 врсте минералних сировина, с тим, да су сировине које се истражују из истих појава (за одређено истражно поље, парaгeнеза), третиране као једна врста сировине.

У укупном уделу металичних и неметаличних сировина по годинама у зависности од

истражне године уочена је већа променљивост истраживања у области металичних минералних сировина док је заинтересованост за неметаличне минералне сировине мање више, константно у свакој години. На слици 2. представљено је процентуално учешће врста минералних сировина у оквиру поступака одобрених детаљних геолошких истраживања у 2012. години.



Sl. 2. Одобрена детаљна геолошка истраживања у 2012. години, метали - неметали

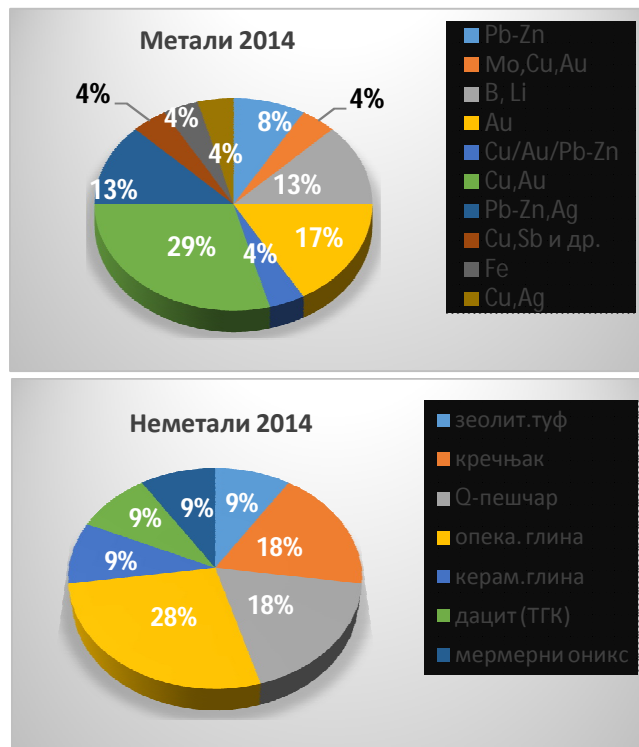
U pogledu izdatih odobrenja za detaljna geološka istraživanja jasno se izdvaja 2012. godina tokom koje je izdat najveći broj odobrenja pa samim tim ona zaslužuje posebnu analizu, jer se uočava trend porasta zainteresovanosti za istraživanja metaličnih mineralnih sirovina.

Samo u 2012. godini na 95. istražnih prostora istraživale su se metalične mineralne sirovine, a na 17. istražnih prostora nemetalne sirovine, dok su na preostala 3. istražna prostora u okviru rudničkog jalo-višta u Boru, u krugu fabrike „Magnohrom“ i PD „TE-KO Kostolac“, bila odobrena geološka, odnosno geomehanička istraživanja. U 2012. godini, najveće interesovanje je iskazano za istraživanje zlata (34. istražna prostora ili 36%), litijuma i bora (22 istražna prostora ili 23%), rude bakra, zlata i molibdena (22 istražna prostora ili 23%), kao i polimetalčnih ruda Pb-Zn-Au-Ag-Cu (13 istražnih prostora ili 14%) i rude antimona (na 4. istražna prostora ili 4%). Na dijagramu nemetalčnih mineralnih sirovina vidi se da su bila posebno interesantna geološka istraživanja retkih zemalja (RZ - iz grupe lantanida) i sepiolita, kao netradicionalnih mineralnih sirovina i zeolitskog tufa. U skladu sa projektima višegodišnjih istraživanja, u 2012. godini su nastavljena ranije započeta istraživanja: nafte i gasa na celoj teritoriji Republike Srbije; uglja u zapadnom delu Kostolačkog ugljenog basena i zapadnom polju ugljonosnog basena Sjenice; zlata na istražnim prostorima „Potaj Čuka Tisnica“ i „Breza“ kod Bora, kao i litijuma u okviru Jaderskog basena [4].

Geološka istraživanja u 2014. godini odobrena su za različite mineralne sirovine,

pretežno metalne (zlato na 4 istražna polja (17%), rude bakra, zlata i pratećih metala na 8 istražnih polja (29%); bor i litijum-B, Li na 3 istražna polja (13%), rude olova i cinka na 2 istražna polja (8%), Pb, Zn, Ag (13%) na 3 istražna polja, polimetalna ruda (4%); rude gvožđa na jednom istražnom polju i dr.), a od energetskih sirovina uglj.

Kod nemetalnih sirovina značajno je poraslo interesovanje za opekarsku glinu (28%), kvarcni peščar (18%), krečnjak (18%), dacit, zeolitski tuf, mermerni oniks (slika 3). Metalne mineralne sirovine se istražuju na 24 istražnih prostora, što čini 63% od ukupnog broja (38) odobrenih istraživanja (slika 4.). Ako se uzmu u obzir i ranije odobrena istraživanja mineralnih resursa koja su još uvek aktivna, proizilazi da su se u 2014. godini geološka istraživanja ovih mineralnih sirovina izvodila na ukupno sto trideset pet (135) istražna prostora. U toku 2014. godine nastavljena su ranije započeta istraživanja kao što su: litijum i bor u Jaderskom neogenom basenu, zlato u sedimentnim formacijama, zapadno od Timočke eruptivne oblasti, na istražnim prostorima „Potaj Čuka Tisnica“, zlato na istražnim prostorima „Brestovac-Jasikovo“, „Ždrelo-Goli vrh“, „Železnik-Topla-Borsko jezero - Manojlica“ i „Breza“ kod Bora, bakar-zlato na istražnom prostoru „Brestovac-Jasikovo“ nafte i gasa na celoj teritoriji Srbije, uglj u zapadnom delu Kostolačkog ugljenog basena i dr. U odnosu na prethodnih nekoliko godina, značajno su stagnirala istraživanja arhitektonskog i tehničkog građevinskog kamena, kako sedimentnih (krečnjaka i dolomita) tako i eruptivnih stena.



SI. 3. *Odobrena detaljna geološka istraživanja u 2014. godini, metali - nemetali*



SI. 4. *Odnos geoloških istraživanja po grupama mineralni sirovina – 2014. g.*

3.1. Zaključak o odobrenim istražnim pravima za detaljna geološka istraživanja

Na osnovu gore iznetog može se konstatovati da su odobrenja za geološka istraživanja čvrstih mineralnih sirovina bila najintenzivnija u 2012. i ta godina predstavlja godinu sa skoro duplo većim brojem novih istražnih prava, nego odobrenih u 2013. i 2014. godini, zajedno. To se može jednim delom objasniti većom zainteresovanošću pre svega stranih kompanija i nastavkom tendencije istraživanja iz predhodnog perioda. Posle 2012. godine dolazi do naglog pada novih odobrenja za istraživanja i u pos-

lednje dve godine drži se na desetogodišnjem minimumu. Godina 2014. predstavlja godinu sa najmanje novih istraživanja.

4. OVERENE REZERVE MINERALNIH SIROVINA

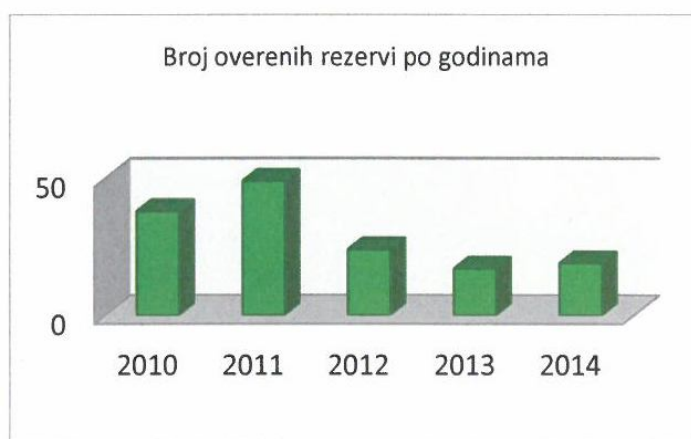
Na prostoru Srbije, overeno je ukupno 147 rezervi mineralnih sirovina. Na osnovu Knjige Bilansa (2010, 2011, 2012, 2013 i 2014 – u pripremi) po godinama to izgleda kao u tabeli 2.

Tabela 2. Overene rezerve po godinama

Godina	2010.	2011.	2012.	2013.	2014.	Ukupno
Broj rezervi	38	49	24	17	19	147

Obrađeni podaci se odnose na ukupne overene rezerve, bez obzira da li se radi o inoviranim rezervama, overenim rezervama na postojećem eksploatacio-

nom polju ili nakon prikazanih istraživanja. Na slici 5. je grafički prikazan odnos overenih rezervi mineralnih sirovina po godinama.



Sl. 5. Overene rezerve po godinama

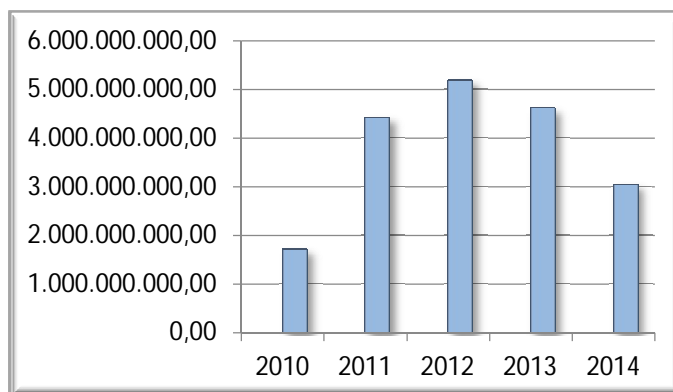
4.1. Zaključak overenih rezervi mineralnih sirovina

Od overenih rezervi mineralnih sirovina ukupno je overeno 147, od čega najviše u 2011. godini, 49. Najveći broj overenih rezervi se kao i kod istraživanja odnosio na sirovine za upotrebu u građevinarstvu i to arhitektonsko-građevinski kamen i tehničko-građevinski kamen.

5. INVESTICIJE PROJEKTOVANIH ISTRAŽNIH RADOVA

Ukupna vrednost svih projektovanih istražnih radova, odobrenih u 2014. godini iznosi: 344.194.440 dinara, ili oko **2.821.266 €**

(1 € = 122,0 din.). Ako se ovoj sumi doda vrednost istražnih radova prenetih iz prethodnih godina $\approx 77.106.250$ dinara (odnosi se na istraživanja istih projekata iz prethodnih godina) i vrednost investicionih ulaganja na nekoliko najvećih višegodišnjih projekata geoloških istraživanja mineralnih resursa, koji su ušli u drugu ili treću fazu istraživanja, sem nafte i gasa koja iznosi 2.621.189.103 din. proizilazi, da je vrednost investicionih ulaganja u geološka istraživanja mineralnih resursa u 2014. godini iznosio približno oko: 3.042.489.793 dinara, ili oko 24.938.441 €



Sl. 6. Investiciona ulaganja u evrima

ZAKLJUČAK

Ulaganje u oblasti geoloških istraživanja u Srbiji za period 2010. god., do kraja 2014., su imala različite trendove. Pokazalo se da je najveći intenzitet porasta bio u 2012. godini, da bi kasnije u 2013 i 2014. godini došlo do opadanja izdatih odobrenja za detaljna geološka istraživanja, što se može videti na prikazanim dijagramima. Značajan pad se registruje u 2014. godini.

Velika osetljivost ove industrijske grane se može videti kroz prikaz ove osnovne analize, pri čemu treba naglasiti da se očekuje porast na planu inteziviranja geoloških istraživanja u narednom periodu.

Ove analize otvaraju prostor za dalju obradu podataka na ovakav način. Predstoji dalja obrada podataka, u smislu odnosa između broja novih istražnih prava i overe-

nih rezervi na istim prostorima, kao i odnos broja starih i inoviranih rezervi. Takođe se dalje mogu vršiti uporedne analize po opštinama, kao i područja na kojima se vrše istražni radovi, sa područjima na kojima se overavaju rezerve. Veoma interesante analize, osim toga, svakako bi se odnosile na grafički prikaz odnosa dobijenih istražnih prava po sirovinama, po godinama i opštinama [7].

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