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Perspective of the Rare Earth Metals and other Metals Exploration in the Republic of South Africa

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Abstract

The Republic of South Africa has a lot of minerals wealth. Their mining industry is one of the main sources of the income for their national budget. At the same time cause of the membership of South Africa in the group nations BRICS (Brazil, Russia, India, China, South Africa) this country can effect on the future of mining all over the world. The article shows the characterization, perspective of the development of South Africa's mining industry and the specification in exploration of the rare earth metals in the world.

Keywords: Mining, Geology, South Africa, Mining Industry, Metals Commodities.

Introduction

South Africa is one of the world's major metal producers. The gold rush that took place in the 19th century brought many colonizers from Europe to the area. The growing British Empire took over these areas for many decades and led to the great development of South Africa in many ways. The mining industry of this country is one of the main branches of the economy which employs almost 0.5 million people and is stable. The production and documented deposits of platinum and other metals in South Africa have been among the largest of all countries in the world for many years and will probably continue to play a very important role in the world economy.

The mining industry in the Republic of South Africa

The South African mining industry is one of the most interesting in the world. There are located the deepest (about 4000 meters) mines. South African government agencies ensure that revenues, employment levels, other data and indicators related to the mining sector are properly documented.

Table 1: South Africa's Mining Industry Revenues by Mining Sector (2012-2022)

Type of mining	2012		2015		2019		2022	
	R million	% contribution	R million	% contribution	R million	% contribution	R million	% contribution
Mining of coal and lignite	96 097	24,4	133 451	29,8	144 756	28,4	198 914	21,9
Mining of gold and uranium ore	66 957	17,0	64 026	14,3	62 745	12,3	81 928	9,0
Mining of iron ore	68 061	17,3	60 687	13,5	60 686	11,9	119 241	13,2
Mining of chrome ore	11 412	2,9	16 951	3,8	15 028	2,9	25 771	2,8
Mining of manganese ore	10 254	2,6	17 196	3,8	33 797	6,6	36 188	4,0
Mining of platinum group metal ore	106 555	27,2	108 912	24,3	142 765	28,0	373 222	41,2
Dimension stone (granite, marble, slate and sandstone)	630	0,2	1 146	0,3	1 745	0,3	1 762	0,2
Limestone and limeworks	2 398	0,6	2 800	0,6	4 037	0,8	4 461	0,5
Other stone quarrying, including stone crushing and clay and sandpits	10 289	2,6	10 753	2,4	10 916	2,1	9 358	1,0
Mining of diamonds (including alluvial diamonds)	8 694	2,2	15 056	3,4	14 030	2,8	25 310	2,8
Other chemical and fertiliser mineral mining	3 330	0,8	5 889	1,3	6 082	1,2	3 130	0,3
Extraction and evaporation of salt	280	0,1	207	0,0	282	0,1	498	0,1
Other mining activities and service activities incidental to mining	7 822	2,0	10 294	2,3	11 526	2,3	25 017	2,8
Other minerals and materials n.e.c.	582	0,1	733	0,2	1 412	0,3	1 890	0,2
Total	**393 361**	**100,0**	**448 101**	**100,0**	**509 807**	**100,0**	**906 690**	**100,0**

Source: Statistics South Africa, Mining industry, 2022. Pretoria: Statistics South Africa, 2024.

The revenues of the South African mining sector for the government budget have been growing steadily between 2012 and 2022. The largest increases were documented in the mining of hard coal, iron ore and platinum group metals of which South Africa is the largest producer in the world. As I mentioned in the introduction the employment in south africa's mining sector is about half a milion people.

Table 2: Employment in South Africa's Mining Sectors (2012-2022)

Type of mining	2012		2015		2019		2022	
	Number	% contribution	Number	% contribution	Number	% contribution	Number	% contribution
Mining of coal and lignite	91 605	17,0	110 818	21,7	88 916	21,3	95 863	22,6
Mining of gold and uranium ore	144 084	26,8	104 369	20,4	90 216	21,6	88 451	20,9
Mining of iron ore	26 975	5,0	25 536	5,0	21 927	5,3	21 987	5,2
Mining of chrome ore	20 540	3,8	17 144	3,4	18 375	4,4	14 747	3,5
Mining of manganese ore	6 812	1,3	7 279	1,4	9 630	2,3	6 956	1,6
Mining of platinum group metal ore	206 764	38,5	206 957	40,4	144 382	34,6	148 388	35,1
Dimension stone (granite, marble, slate and sandstone)	1 741	0,3	1 801	0,4	2 444	0,6	2 583	0,6
Limestone and limeworks	3 384	0,6	2 679	0,5	4 242	1,0	4 018	0,9
Other stone quarrying, including stone crushing and clay and sandpits	15 131	2,8	9 105	1,8	13 538	3,2	12 325	2,9
Mining of diamonds (including alluvial diamonds)	11 943	2,2	15 410	3,0	12 449	3,0	14 344	3,4
Other chemical and fertiliser mineral mining	2 023	0,4	1 555	0,3	1 847	0,4	2 689	0,6
Extraction and evaporation of salt	741	0,1	444	0,1	815	0,2	1 099	0,3
Other mining activities and service activities incidental to mining	5 489	1,0	7 189	1,4	7 954	1,9	9 330	2,2
Other minerals and materials n.e.c.	912	0,2	836	0,2	845	0,2	1 049	0,2
Total	**538 144**	**100,0**	**511 122**	**100,0**	**417 580**	**100,0**	**423 829**	**100,0**

Source: Statistics South Africa, Mining industry, 2022. Pretoria: Statistics South Africa, 2024.

The employment in the South Africa's mining sector was on the level of about 540 thousands people in 2012 and started to decrease. In 2015 it was about 510 thousands people. Then, in years 2019-2022 the level of employment in the South Africa's mining sector was about 420 thousands people. The biggest employment (about 35-40%) was noticed in the mining of platinum group metal ore sector on the level of 206 764 people in 2012, 206 957 people in 2015 and decreased to the level of 144 382 people in 2019 and 148 388 people in 2022. The second and third biggest employment were in the mining of coal and lignite sector (about 20-27%) and the mining of gold and uranium ore (about 17-22%).

The Explored Rare Earth Metals in the World Until Today

As the explored rare earth metals we can acknowledge 17 elements noticed in the periodic table. Firstly, we should start with the skandium (Sc) and the yttrium (Y). Futhermore, the main group of rare earth metals are the 15 lanthanide series elements. All of these elements are pointed out in the figure 1.

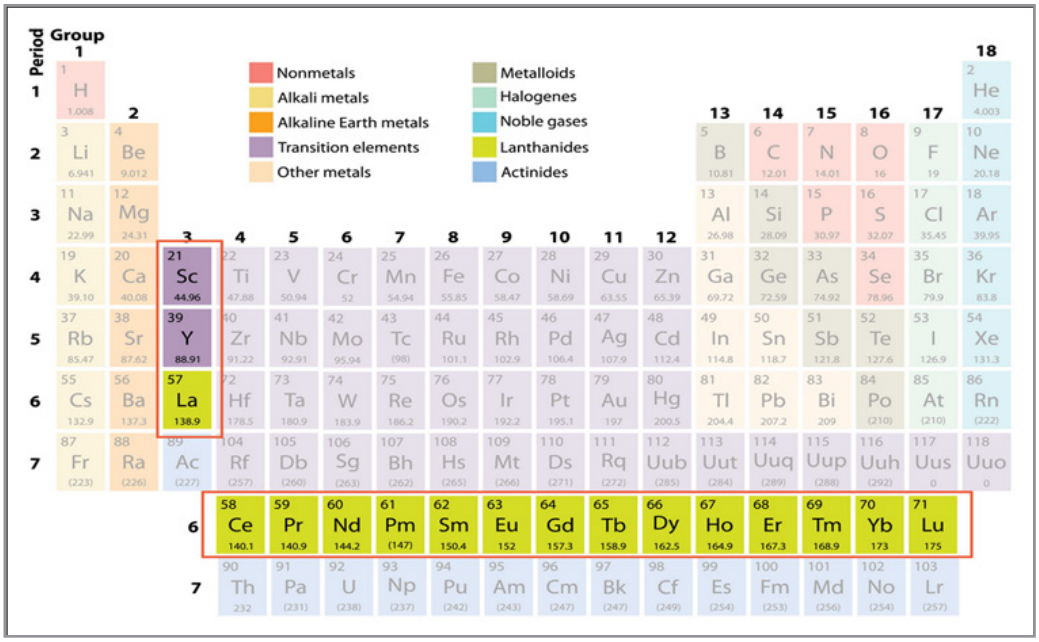

Figure 1: The rare earth metals in the periodic table
Source: www.rareelementresources.com/rare-earth-elements

The exact names of the 15 lanthanide elements are: lanthanum (La), cerium (Ce), praseodymium (Pr), neodymium (Nd), promethium (Pm), samarium (Sm), europium (Eu), gadolinium (Gd), terbium (Tb), dysprosium (Dy), holmium (Ho), erbium (Er), thulium (Tm), ytterbium (Yb) and lutetium (Lu).

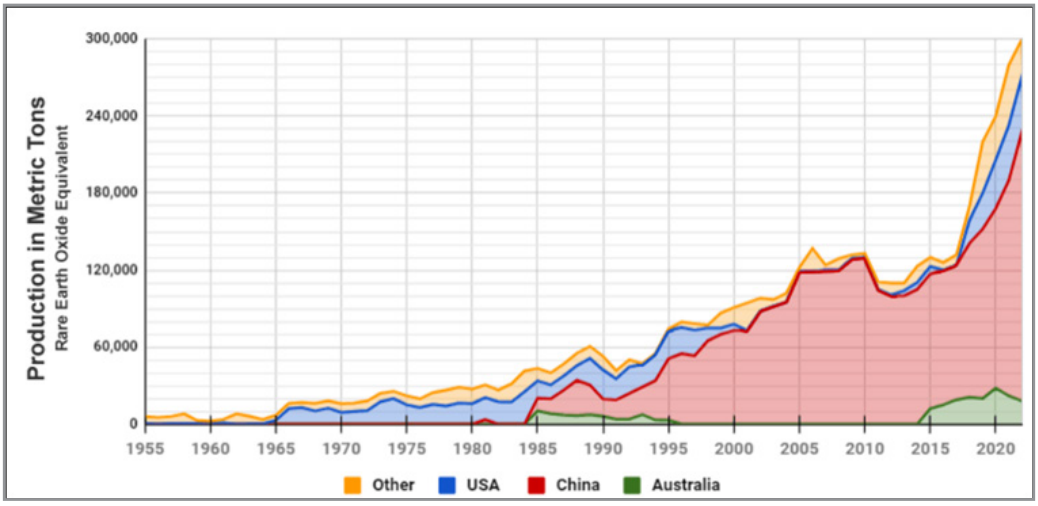

Figure 2: World production of the rare earth metals (1950-2022)
Source: Geology.com.

According to the figure 2. the biggest producer of the rare earth metals is China. Before China it was United States. On the figure 2. we can see also Australia, but the amount of the rare earth metals produced in this country is quite low in comparison to other places. The exploration of the rare earth metals increased especially in the last decade because of the huge demand in the mobile technology sector. More detailed informations are listed below in the tab 1. It is very important to point out that statistics from the tab 1. are estimated and China does not publish all data about their market.

Table 1: The rare earth metals world production and reserves.

World Mine Production and Reserves: Reserves for Australia, Russia, Thailand, and the United States were revised based on company and Government reports.

	Mine production[e]		Reserves[9]
	2022	2023	
United States	42,000	43,000	1,800,000
Australia	18,000	18,000	[10]5,700,000
Brazil	80	80	21,000,000
Burma	12,000	38,000	NA
Canada	—	—	830,000
China	[11]210,000	[11]240,000	44,000,000
Greenland	—	—	1,500,000
India	2,900	2,900	6,900,000
Madagascar	960	960	NA
Malaysia	80	80	NA
Russia	2,600	2,600	10,000,000
South Africa	—	—	790,000
Tanzania	—	—	890,000
Thailand	7,100	7,100	4,500
Vietnam	1,200	600	22,000,000
World total (rounded)	300,000	350,000	110,000,000

Source: U.S. Geological Survey.

Reserves of the Rare Earth Metals in the World

The biggest reserves of the documented rare earth metals are in China. Taking into consideration perspectives of the production rare earths in the world we must think about different scenarios. At this moment more than a half of world reserves have two countries – China (about 44 million tons) and Vietnam (about 22 million tons). The next country listed according to the tab 1. is Brazil with reserves of the rare earths on the level about 21 million tons. Other countries listed are Russia (about 10 million tons), India (about 7 million tons), Australia (about 6 million tons). Statistics are well presented on the fig 3.

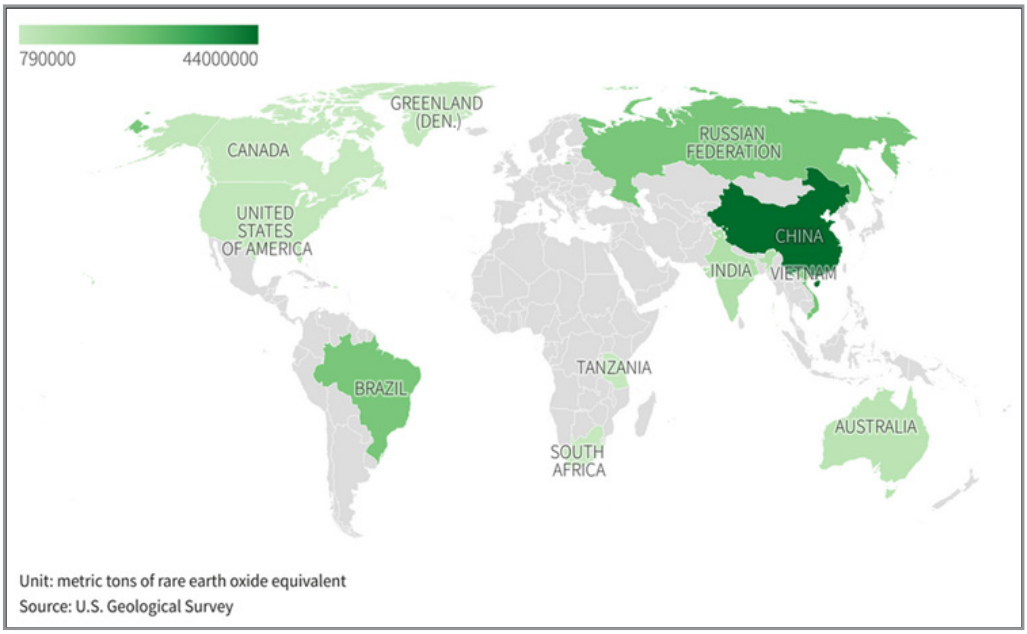

Figure 3: World reserves of the rare earths
Source: U.S. Geological Survey.

South Africa's reserves are estimated on the level about 790,000 tons. If we decide to measure the possibility of exploitation the rare earths in the future only because of the level of estimated reserves, South Africa will not be on the top of the list. But there is a lot of different factors which make a big affect on the final decision where will be opened mines of the rare earth metals such as a labor forces, the highly-skilled workforce, a low taxation of the mining activities, an ease of getting a concession, a cost effectiveness and any others.

Conclusions

The mining industry in South Africa is well developed. Taking into consideration that the country is the world leader in a production of the platinum group metals, it could be a good forecaster in developing of the rare earth metals production in the RSA. Even though there are some countries which have more reserves of the rare earths, the world production of the rare earth elements is still quite low in comparison to the other metals production. Except the BRICS group countries there are high reserves of the rare earths in Vietnam and Australia [1-5].

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