GENETIC CLASSIFICATION OF MINERAL DEPOSITS AND MINERAL SUBSTANCES IN THE SOFIA REGION

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ABSTRACT

During the process of differentiation of the mineral masses, when convection currents move the magmatic and metamorphic rocks as well as the sedimentary cycles, the deposits or mineral deposits were formed gradually. A general genetic classification of mineral deposits is agreed upon by learned geologists to facilitate the investigation and exploration of mineral substances. From the mineralization indices proven and listed in Table N°1 and the lithology of the regions that the work in this scientific article has revealed the possible main mineral deposits in the Sofia Region in Madagascar.

The objective is to bring out a genetic classification of the mineral deposits of the Sofia Region. Having a genetic classification of mineral deposits is a great advantage for geological researchers and facilitates research and the discovery of other mineral substances associated with them.

In conclusion, seven (07) main types of mineral deposits are inventoried in the Sofia Region, still hiding many undiscovered mineral substances; some examples of the latter are illustrated in Table N°2.

Keyword: Mineral deposits, deposits, mineralization, domain, tectono-metamorphic



1. INTRODUCTION

The Sofia Region is one of the Regions of Madagascar blessed with mineral resources, following the geodynamic evolutions of the Pan-African orogenies and the geological events of the Precambrian in Madagascar. The Sofia Region is bordered by sedimentary cover [1] and intercalated with Cretaceous basalts in the western part; it is constituted by the Precambrian crystalline base of Madagascar in the eastern part, which is composed of two (02) domains and tectono-metamorphic complexes [1] namely:

- part of the Antananarivo domain which is a vast, poorly differentiated group of gneisses and migmatites of probable Mesoarchean age (> 2,500 Ma) with numerous granitic intrusions at 2,500 Ma and associated magmatism at 800 Ma is well represented, as well as that at 630-500 Ma [1];

- A southern part of the Bemarivo domain, structured East-West, undoubtedly carried over to those located to its south (Betsimisaraka and Antananarivo) and must have merged late with the rest of the Island. In its southern part around the Tsaratanana massif, the metamorphism is more intense, with a large development of charnockites which have been dated at 510-520 Ma [1].

- A large part of the Tsaratanana complex, which is made up of a set of amphibole gneisses and migmatites with which are associated numerous basic and ultrabasic rocks (amphibolites, gabbros, pyroxenolites, etc.), dated at 2500 Ma and 800 Ma, which contain in particular the chromite deposits of Zafindravoay in Befandriana north, and extending to Andriamena, district of Ambatondrazaka.

- And a unit of the Betsimisaraka tectono-metamorphic complex, which is considered as a suture zone between the Indian block (Antongil) and the African block (Antananarivo) in the Neoproterozoic, [1] is formed by gneisses, mica schists and several belts green rocks metamorphosed in the granulite facies. Basic and ultrabasic thrust rocks are characterized by first generation foliations.

In this regard, the necessary natural conditions for the genesis of mineral deposits in the Sofia Region of Madagascar are sufficient to form more of the different types of mineral deposits [2]. The objective of this work is to reveal, based on mineralization indices and lithological arrangements, mineral deposits and other associated undiscovered mineral substances and their respective locations of mineralization in the Sofia Region. That is to say, to have a genetic classification of the mineral deposits [2] of the Sofia Region

In order for the article to be very explicit, the manuscript is planned and composed of an introduction, materials and methods and then followed by the results and discussion and thus closed with the conclusion and perspectives.

MATERIALS AND METHOD

2.1. Materials

Maps of location of indices, lithological maps and maps of mining titles established by the Directorate of Geological and Mining Studies and Promotion within the Ministry of Mines and Strategic Resources and as well as other documents inherent to the geology of the Mineral deposits are the basic data materials used to reveal the results of the types of mineral deposits in the Sofia Region.

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LEGENDE DE LA CARTE DES INDICES MINIERS DE LA REGION DE SOFIA



Matériaux d'empierrement

Monazite

Carte 1 : carte de la localisation des indices minières



Carte 2 : carte de la localisation du titre minier dans la Région Sofia

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Carte 3 : carte lithologique dans la Région Sofia

2.2. Methods

The methodology focuses on bibliographic analysis, by consulting documents and reports [3] written by Engineers LACROIX, H. BAISERIE and others who have worked extensively on Madagascar, particularly in the Sofia Region and as well as the book [2] written by Soviet Academicians and scientists V. SMIRNOV and others.

Field trips, during countless missions by the Interregional Directorate of the Majunga Province, to analyze samples and learn geological and petrographic data from the various regions of the Sofia Region.

The genetic classification of mineral deposits is made up of series, group, class and subclass. The series is composed of the endogenous, the exogenous and the metamorphogenic; In the endogenous series, the following groups are present, namely: magmatic, pegmatitic, carbonatites, skarns, abitization and greisenification, hydrothermal, pyritic masses. As for the exogenous series, the groups are composed of: alteration, clastic (placer), sedimentary, metamorphosed and metamorphic [2]. The classification work in this article stopped at discerning the groups of mineral deposits.

3. RESULTS

The types of mineral deposits are determined in a backward manner, based on existing mineralization indices and lithological characteristics and the geological conditions of deposit formations [2] in the Sofia Region.

\mathbf{N}°	GROUP OF MINERAL DEPOSITS	MINERAL	FORMULA	USE	MNERALIZATION
		SUBSTANCES			LOCALIZATION
	Skarn deposit	SCHEELITE	CaWO4	Automobile industry ;	- Ambararata
		(tungsten or		Industrial Engineering ;	- Mangindrano
		wolfram)		Mining and construction;	- Ambolidibe Est
	Orogenic gold deposit indicator	V		Aerospace;	- Antsiatsiaka
	(complex scheelite – molybdenite	(magnetite)		Metallurgy/Steel;	- Andreba
	deposit), located near moderately acid	(Gold)		Lighting	- Antsahabe
	granitoids, normal leucocrates.			03Chemistry	
				Other metal applications	
01		Molybdenum	MoS2 (Molybdenite)	Strengthen the mechanical resistance of	- Mangindrano
		(Mo)		steels at high temperatures and their	- Mampikony II
		and the second second		resistance to corrosion; rotating anode	
		and the second se		for x-ray and x-ray tomography	
				apparatus.	
	Hydrothermal deposit	Thermal source	Eau enrichie en minéraux	Thermal cure (medical treatment in a	- Mangindrano
	(by volcanic or geothermal activity)			thermal spa)	- Maromandia
	and sometimes pegmatitic deposit		and the second	and the second	- Antsakabary
	Hydrothermal deposit (accessory	Blende	ZnS (zinc sulfide)	Zinc ore	- Maromandia
	mineral)	(Magnetite)			
	Hydrothermal deposit (in mineralized veins associated with silver minerals	Barite	BaSOA	Manufacturing of drilling mud	- Antsamaka/
		Danc	Dast	manufacturing of barium derivatives:	- Antsahaba
				harium carbonatas, chloridas, oxidas	Antsallabe
				barrum carbonates, chiorides, oxides,	

3.1. Recap of the restoration of groups of mineral deposits and the dispersion of mineral indices in respective locations.

	Archaean vein deposit			hydroxides, nitrates, peroxides and	
	Mesothermal deposit			sulfates	
	Deposit linked to a plutonic intrusion	Or	Au	Used in jewelry and jewelry	- Matsondakana
	in an epizonal and sedimentary				- Antsakabary
	environment				- Befandriana nord
	Carlin-type disseminated gold deposit		addining a		- Ambararata
	Massive sulphide deposit and banded				- Tsiamalao
	iron				- Ambohisoa
	Epithermal deposit		and the second sec		- Komaija
	Paleoplacer deposit		and the second sec		- Mampikony
	Archaean vein deposit				- Ampasimatera
	Mesothermal deposit				- Ambaliba
	Deposit linked to a plutonic intrusion				- Ambaimanary
	in an epizonal and sedimentary				- Ambournanary
	environment	Amothyst	SiO2 (giligan diavida)	Used in jourstry (rings, corrings, pendent	- Ambaratan i Sona
02	Hydrothermal veins; pegmatitic	Ameniyst	SIO2 (sincon dioxide)	necklaces or bracelets)	- Lealija Maayaranokoly
-	deposit: magmatic segregation: skarn	Inco	E-/E-20 2 Hometite (main	Head in the manufacture of starls and	- Maevaranokery
	deposit (Fe/ Fe2O 3 Hematite (main	ITOII	Fe/ Fe2O 3 Hematte (main	Used in the manufacture of steels and	- I saratanana
	ore used in industry) with traces of Ti.	11. A	ore used in industry) with	anoys; main constituent of nemogrobin	- Antsakanalabe
	Al. Mn deposits)	NG B	traces of 11, AI, Mn	carrying oxygen.	- Ambodiadabo
	Hydrothermal deposit (high temperature hydrothermal vein):			Counterweight in helicopter rotors and	- Ambodihazoambo
		1.		aircraft parts.	- Ampasimatera
				Protective shield against ionizing	
	Fluvial sedimentary deposit (uranium	1. C.	UO2: Uranite or plechblende	radiation.	
	is found in reduced weathered zone and	Uranium		Component used in the production of	
	oxidized weathered zone			armor-piercing ammunition and high-	
	oxidized weathered zone			strength armor	
				Armor in military vehicles.	
		10 A 10		Obtaining plutonium 239 (nuclear	
				explosives)	
	Hydrothermal deposit (geothermal	Copper	Cu: Cu FeS2 Chalcopyrite	Used as roofing material; as a fungicide	- Mampikony II
	solutions, rich in dissolved metals)	and the second	(more than 50% Cu)	(destruction of fungus)	
	solutions, then in dissolved inetais)			Calcium amendment to bring the pH of	- Tsaratanana I
				the soil to a value close to 7 (reduce the	- Manampaneva
	Carbonatite denosit	Limestone	CaCO3	acidity of the soil)	- Maromandia
	Carbonatte deposit	Linicstone	cueos	Lime manufacturing	
				Line manufacturing	- Antolooozo
					- Antsakabary
					- Alikaloligalla
03					- Ambridhombe
05					- Ankarongana
					- Leanja
	i				- Mandritsara

	Carbonatite deposit (magma enriched in carbon dioxide and calcium).	Pierre Chaux	CaO : Calcium oxide	Used as a flux in the manufacture of steel from cast iron; In the chemical industry, in the sugar industry, in agriculture (agricultural amendment), in oyster farming, in the non-ferrous metals industry and work on roads and thoroughfares, in the paper industry, in in situ construction materials (aerial and hydraulic binders) and prefabricated at the factory (silico-lime bricks and other cellular concretes); aerial lime (for coatings)	 Amborondolo Andohajango Mahadrodroka Antonibe Anjiamangirina Anahidrano Ambodimandresy
	Pegmatite deposit, in quartz veinlets, geodes of siliceous nodules of basalts (when amethyst is heated to more than 550°C, the traces of ferrous iron	Amethyst (Blend)	SiO2 (variety of quartz)	Jewelry and classified as fine stone	 Tsiningia, Ambolobozo, Andranomeva, Andribavontsona, Marovantaza
	 oxidize and take on a yellow tint. This is how it transforms into CITRINE. Pegmatitic deposit, in giant white quartz veins. Forms in rocks in the presence of water (in caves or sites with a humid environment); Pegmatitic deposit, accessory mineral in granites, syenites; sedimentary deposit (alluvial sands) Pegmatitic deposit, accessory mineral in granites, sedimentary, accessory mineral in granites, sedimentary, accessory mineral in granites, sedimentary, begmatitic deposit, accessory mineral in granites, sedimentary, accessory mineral in granites, sedimentary, accessory mineral in granites, sedimentary, begmatitic deposit, accessory mineral in granites, sedimentary, accessory mineral in granites, sedimentary, accessory mineral in granites, sedimentary, begmatitic deposit, accessory mineral in granites, sedimentary, accessory mineral in granites, sedimentary, accessory mineral in granites, sedimentary, begmatitic deposit, accessory mineral in granites, sedimentary, accessory mineral in granites, sedimentary, accessory mineral in granites, sedimentary, begmatitic deposit, accessory mineral in granites, sedimentary, accessory, accessory	Citrine	SiO2 (silicon iron oxide)	jewelry making	 Marovantaza Ambolobozy Andribavontsona Analalava
		Rock crystal (Xenotime)	SiO2 (silicate group with traces of Al, Li, B, Fe, Mg, Ca, Ti, Rb, Na, OH	Used in jewelry	 Antanambaon'amberina, Ambolobozy, Tsarahonenana, Leanja, Andranomeva, Antsiatsiaka, Tsiningia
	syenites; sedimentary deposit (alluvial sands)	Radioactive minerals	Uranium, thorium, radium, radon and potassium 40.	In medicine, they are used in x-ray, scan, scintigraphy etc.	- Ambaliha - Ankazotokana
	Pegmatitic deposit, accessory mineral in granites, syenites; sedimentary	Pottery clay	SiO4 or Al2O3 composed of alumina	Used in pottery exposed to the open air but protected from humidity and ceramics.	- Antsoha
04	deposit (alluvial sands) Pegmatite deposit (in pegmatitic veins and veins Magmatic deposit (in gabbros, diorites, anorthosites, Placer deposit (with magnetite, zircon, rutile)	Monazite	Ce, La, Nd, Th, Sm, Y) PO4 (Rare earth ore)	Used in dating/geochronology and thermochronology (amorphization and recrystallization temperature: 180°C to 300°C), as a homeopathic medicine (rare earth and thorium orthophosohate) Y/Manufacturing of red phosphors for cathode ray screens	- Ambalaromba - Matsondakana

	Pegmatitic deposit			Ce/Cerium: used in catalysis, metallurgy, in glasses and ceramics.	
	Magmatic ($600^{\circ}C - 1100^{\circ}C$) and metamorphic deposit (in hydrothermal veins at high temperatures $450^{\circ}C - 650^{\circ}C$) Granitic pegmatite deposit (with topaz, muscovite) Silicate group, cyclosilicate subgroup.	Ilmenite	Fe ^{II} TiO3 with traces of Mg, Mn and V	Used in the steel industry for its refractory power, sunscreen; Used to modify texture and produce spots or speckles in pastes, glazes and glazes	- Ambodisikidy
		Tourmaline	(Na,Ca) (Mg,Al)6 (B3Al3Si6 (O,OH)30) with volatile and rare compounds (lithium, cesium, rubidium)	Used in jewelry, rings, necklaces, bracelets, brooches or earrings	- Ambatosia
		Beryl gem	Be3Al2Si6O18 with traces of Fe, Mn, Mg, Ca, Cr, Na, Li, K, Rb, Cs, O, H and OH.	Used for making magnifying glasses; in jewelry, jewelry, lapidary	AmbatosiaMampikony IIAmbodihazoambo
	Magmatic deposit of volcanic origin and in ore oxidation zones Volcanic deposit (formed by volcanic basalt projections and having an	Chalcedony (magnetite)	SiO2 (cryptocrystalline variety of quartz)	Manufacturing of tools, figurines and amulets; Ornamental stone	 Tsiningia Ambolobozo Analalava Andribavontsona Marovatolena
	alveolar structure) Basaltic type magmatic deposit at high temperature (1200°C – 1400°C)/basic	Pozzolan (Corundum) (Manganese)	Mineral rich in reactive SiO2 and/or alumina (Al2O3)	Used in gardens for its fertilizing power, ground cover, mineral mulch, base layer in lagoon basins, used as a filter.	 (Between)Beandrarezona and Ambodiampana Bealanana
05	or ultrabasic environment Ultrabasic magmatic or peridotite	Chromite	FeCr2O4 or FeO. Cr2O3 with traces of magnesium, manganese, zinc and aluminum	Used for the production of alloy known as ferrochrome (stainless steel, ceramic decoration, ect)	 Tsarahonenana Befandriana nord Ambodihazoambo Antsakanalabe Amborondolo Ambodiadabo Ampasimatera
	deposit Deposits associated with basic or ultrabasic eruptive magmatic rocks, or sometimes also in quartz veins	Nickel: Ni	Nickel-boussingaultite: (NH4)2 (Ni,Mg) (SO4)2, 6 H2O Nickel-zippeite Ni 2 (UO2) 6 (SO4) 3 (OH) 10, 16 H2O Hydroxycarbonates NiCO3	 Manufacture of household equipment, household appliances, pharmaceutical and surgical equipment Construction of buildings, constructions Development of all kinds of means of transport (train bodywork, etc.). 	- Ambodiadabo
	In river placers with potentially gold-			• Used in pure metal coatings	

	bearing sands	Platinum	Pt: native element	Used in jewelry, dental care, sustainable energy, medicine, electronics.	- Mampikony II
	Magmatic deposit (intrusive rock/diorite and plutonic/gabbro and volcanic/andesite and basalt) Skarn deposit (metasomatosis) Hydrothermal deposit (accessory mineral) Sedimentary deposits (magnetite sand deposits) Deposit of volcanic fumaroles	Magnetite (Corundum) (Ilmenite)	Fe2+Fe23+O4 with traces of magnesium, nickel, chromium, titanium, zinc, manganese, vanadium and aluminum (ferrimagnetic material)	Used as a natural magnet; Source of iron	 Ambarikorano Ambaliha Ambalaromba Ambilombe Ankiakabe foloko Maroala Ambodimahabibo Ampandrianomby Andratamarina Maroala Anjalazala
	Sedimentary deposit: evaporite (deposits found around dry	Rock salt	Na Cl : Halite	Used for cooking and preserving food and for pharmaceutical application.	- Antonibe
	lake beds, marginal inland seas and enclosed bays and estuaries or also in salt springs and underground mines) (chemical alteration; lateritic	Bauxite	Al2O3, nH2O	Ore allowing the production of aluminum and gallium (Ga3+/ in scintigraphy, medical imaging)	 Mangindrano Beandrarezona Ambatosia Antsamaka Marotolana Ambovonomby Manampaneva Ambodiadabo Amborondolo Ambodihazoambo Ambararata-Sofia
S dd at ol	Lignite (Pottery	Lignite (Pottery clay)	Brownish coal (between bituminous coal and peat), fossil	Combustible mineral	- Anjiamangirina - Ambodimadiro
	Sedimentary deposit: Dead and decomposing plants in a marshy atmosphere (50 to 70 million years old).	Bitumen (Ilmenite) (magnetite) (Radioactive minerals)	Cn H2n+2 / Complex hydrocarbon mixture (maltenes or asphaltenes / in liquid or solid state) with a brownish to blackish color. Aromatic (40% to 60%) Resin (13% to 25%) Asphaltene (5% to 25%)	Road construction; Sealing material, sealing clay bricks, maintaining encrustations, manufacturing after distillation of certain crude oils	- Befotaka nord
		Pierre Septaria	CaCO3 (limestone and clay desiccation nodule)	To protect against negative influences and electromagnetic waves (liberating	- Analalava - Tsarahasina

06	(residue of ancient oil deposits and			stone)	- Ambanjabe
	fossils).	Marl	Main component CaCO3 and clay in proportions of 35% to 65%	Manufacture of cement, tiles, ceramics, pigment in paint, coating.	- Tsaratanana I - Ambarijeby sud
	sedimentary rock Sedimentary (alluvial) deposit;	Stonework materials	Gravel or blocks of stones, sand	Used for stoning a driveway or for paving.	 Andranomeva Maevaranohely Tsiningia
	alteration deposit Evaporitic sedimentary deposit Alluvial, detrital deposit; rich pegmatite deposit en muscovite ; gisement métamorphique	Gypsum	CaSO4 2H2O: sulfate dihydrate	 in the manufacturing of construction materials including plaster and cement in dentistry to manufacture different dental materials as a white pigment or filler in paints as a calcium supplement in fooddans le traitement des sols 	 Anjiamangirana Manampaneva Amborondolo Ambodiadabo Bekoratsaka Tsarahasina Ankiririky
		Xenotime	YPO4: Phosphate rich in Yttrium YPO4: Phosphate rich in Yttrium	• used as a source of yttrium (LEDs and phosphors) and heavy lanthanide metals (dysprosium, ytterbium, erbium and gadolinium)	- Mampikony II - Malakialina
	deposit rich in muscovite; metamorphic deposit Alluvial sedimentary deposit	Sand	Granular solid material made up of small particles (composition can reveal up to 180 different minerals (quartz, micas, feldspars, etc.)	Used in masonry, as cement, in electronics to manufacture microprocessors, in foundry of ferrous metals or light alloys, (molds), in cooking (used in the 19th century for preserving meat), as a raw material for glass, filters liquids (water).	- Ambarijeby sud
	Sedimentary deposit: (exogenous rock)	Phosphate	PO4: compound derived from phosphoric acid H3PO4 by loss or substitution of one or more hydrogen atoms, by other atoms or functional groups.	used in agriculture and gardening as fertilizer	- Antonibe
	Metamorphic deposit and magmatic and as well as in meteorites	Graphite	« C » Carbone	Used in metallurgy and battery production, coating of foundry crucibles and various metal casting utensils, in the glass and cement industries.	 Antsoha Ankiabe salohy Ambalaromba Ambaliha Antsahabe Beandrarezona Ambolidibe Est Befandrina nord

					-	Tsiamalao
					-	Amboaboa
	Regional metamorphic deposit of clay rocks	Muscovite	K Al ₂ (OH, F) ₂ (AlSi ₃ O ₁₀)	Used as a mold release agent, drilling mud, cosmetics, decoration, welding electrodes, foundry coatings, friction, paints, plastics and sound-absorbing coating.		- Anjozoromadosy
	Widespread metamorphic deposit of clayey rocks heated to high temperatures. Contact metamorphism	Sillimanite	Al2O(SiO4) (silicate group subgroup of nesosubsilicates with traces of iron)	Manufacture of ceramics with thermal and chemical resistance (acid resistance), used in the glass industry	-	Ambalaromba
	deposit. Metamorphic deposit rich in aluminum (in marbles, mica schist, gneisses,	Corundum	Al2O3 (Sapphire and Ruby)	Precious stone: jewelry, jewelry. Used in cutlery for grinding felts and polishers and manufacturing grindstones and whetstones.	-	Matsondakana
07	metamorphic bauxites) / metasomatic (varied pressure and temperature: bauxitic soils burned during forest fires)	Manganese	MnO2 (Manganese dioxide/trace element)	Used as an alloy, in the manufacture of carbon steel which solidifies and deoxidizes (beams, bodywork sheets, oil pipeline tubes, automobiles	-	Matsondakana Andohajango
	Basalt deposit, deposit: Crystallizes in environments depleted of silica and enriched in alumina (also with the presence of Cr for ruby, Fe, Ti for sapphire) Aluminous magmatic deposit under saturated with silica (syenites, plagioclasite, pegmatitic vein) Metamorphic and eruptive deposit comprising amphibolites and	Garnet	Fe3Al2 (SiO4)3 Iron and Aluminum Nesosilicate.	Use in jewelry; in abrasive (pyrope) and in sintering (cohesion of the part). Today, geothermobarometry, applied to natural garnets, makes it possible to define the pressure and temperature conditions under which a rock was formed, and thus to define the possibility of finding oil or diamond there.	-	Antsiatsiaka Mampikony II Malakialina
	Metamorphic deposit (in the eclogite facies / with P sup at 5x106 hPa); Calcareous or silicate skarn deposit: series of grossular-andradite Ca, Al/Ca3Fe2(SiO4)3.					







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Carte 6 : Répartition de gite de carbonatites (a) et ses formations lithologiques (b)



Carte 7 : Répartition de gite de pegmatites (a) et ses formations lithologiques (b)



Carte 8 : Répartition de gite magmatique (a) et ses formations lithologiques (b)

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Carte 9 : Répartition de gite sédimentaire (a) et ses formations lithologiques (b)



Carte 10 : Répartition de gite métamorphique (a) et ses formations lithologiques (b) ijariie.com

4. DISCUSSION

The mineral substances inventoried in the Sofia Region are dispersed and arranged in seven (07) types of mineral deposits:

1. **Skarn deposits**: these deposits are predominated by metamorphic rocks such as gneiss, mica schist and volcanic rocks such as rhyolite, trachyte and basalts in the municipality of Mangidrano, northern part of Sofia. The north central region is dominated by amphibole gneiss and migmatite, amphibolo-pyroxenite amphibolites. And in the South-Eastern part of the Region, around the commune of Antsiatsiaka, garnet and sillimanite gneiss rocks are the associated formations.

2. Hydrothermal deposits: these deposits are associated with the metamorphic rocks of gneiss, khondalite, Andrababe –Behanana leptynite and Manampotsy migmatite and amphibole, amphibolite and amphibolo-pyroxenite migmatites of the central north and are widespread all the way to the south and shredded by some igneous rocks such as granitic intrusions. In the southwestern part of the Sofia Region, particularly in the municipality of Maivaranohely, basalts, Limburgites, Sakalavites are the rocks associated with hydrothermal deposits.

3. Carbonatite deposits: Lithologically, carbontite deposits in the eastern part of the Sofia Region are inherent in metamorphic rocks, such as gneisses and migmatites with amphibolites, amphibolo-pyroxenites and as well as migmatites, leptynites, khondalite gneiss, migmatite of Manampotsy, which are basic, ultrabasic and alkaline carbonatite complexes giving rise to intrusive zonal ring formations. At the contact zone of sedimentary rock and base, coarse, glauconious and arkosic sandstones and argillaceous limestones are widespread.

4. Pegmatite deposits: In the migmatite granites, granitoid migmatites and graphite migmatites and leptynite and gneisses and as well as the Manampotsy migmatites, pegmatite deposits were formed in the northern and northeastern part of the Sofia Region. The central and south central region are predominated by gneisses and migmatites with amphibolites, amphibolo-pyroxenite and migmatites with graphite and in particular in the southern part, migmatitic granite and granitoid migmatite are scattered there. These deposits are linked to metamorphic rocks, namely garnet, sillimanite and kyanite gneisses in the South East zone of the Region. They are sometimes located in greso-basaltic complexes in the western part of the Sofia Region.

5. Magmatic deposits (basic and hyperbasic) and (intrusive rock/diorite and plutonic/gabbro) Magmatic deposits (basic and hyperbasic) and (intrusive rock/diorite and plutonic/gabbro): (basic and hyperbasic) and (intrusive rock/diorite and plutonic/gabbro): these magmatic deposits are closely related to volcanic rocks in the northern part of the Region and mafic rocks. In the center, they are associated with migmatic granites; while to the West, the magmatic deposits are linked with the greso-basaltic complexes.

6. Sedimentary deposits (lateritic, evaporites): they are generally found in the sedimentary basin of Majunga, with the exception of the lateritic and alluvial deposit of Mangidrano, in the northern part where the bauxites and alluvium of the plains of Mangidrano and as well as the southern regions of the Region.

7. Metamorphic deposits (eclogite, contact and regional facies): these metamorphic deposits are widespread in the eastern part of the crystalline basement where metamorphic rocks like gneisses and migmatites and granitoids are arranged. In the South-West part of the Region, in particular to the South of the commune of Mampikony II and Malakialina, the beginning of the Tsaratanana domain is located, which also contributes to the formation of metamorphic deposits.

Compared to the theories stated by geological scientists and researchers, several mineral substances associated (Table No. 2) with the various mineral deposits mentioned above have not yet been identified in the Sofia Region

5. CONCLUSION:

In the Sofia Region, seven main (07) types of mineral deposits have been inventoried; in all regions of the Region, forty-seven (47) mineral substances have been proven to exist in the form of indices.

In addition to these identified mineral deposits, the Sofia Region still has other important mineral substances [4] linked to the seven (07) deposits and to be investigated. This last problem must be the major concern of all researchers, particularly geologists from the Sofia Region.

TABLEAU N°2 : Récapitulation des autres substances rattachées encore dans au gîte minéral.

MINERAL DEPOSITS GROUP	MINERAL SUBSTANCES ASSOCIATED WITH THE RESPECTIVE DEPOSIT
1. Skarn deposits	Iron, copper, platinum, gold, phlogopite, cobalt, beryllium, uranium, thorium,
2. Hydrothermal deposits	Molybdo-cupro-porphyry; galena-sphalerite-chalcopyrite-pyrite; galena-sphalerite-pyrite-barite gold, silver,
	bismuth (precipitation in native state under reducing conditions);
	goethite and hematite [4].
3. Carbonatite deposits (alkaline rocks)	Destruction of silicate with release of rare elements: Ta, Nb, Zirconium
4. Magmatogenic pegmatitic deposits	Rock crystal, optical fluorite, gems, lithium ores, beryl, cesium, rubidium tin, tungsten, thorium, uranium, niobium, rare earths;
 Metasomatic substitution pegmatite deposits Pegmatitic deposits linked to lepidolites 	Gems: topaz, aquamarine, tourmaline, garnet, amethyst
Metamorphogenic pegmatitic deposits	Accumulation of lithium, spodumene, amblygonite, zinwaldite
5. Magmatic deposits:	Dunite and peridotite: Pt, Cr
Basic and ultrabasic magmatics	Pyroxenes: Fe –Ti
granitic magmatics	gabbro-norite: Fe, Cu, Ni, Pt
	Diorite –grano-diorite- granite: Pb+Zn, Cu, Au, Co
6. Sedimentary deposits	Chemical alteration or non-ferrous metals: talc, uranium, gold, lead, tin, tantalum, niobium, rare earths,
3/ 11	copper, germanium, strontium, vanadium
	Continental denudation and residual or lateritic: iron mine, manganese, bauxite (aluminum)
	Evaporite: sylvine, halite, carnallite, gypsum, anhydrite, Epsomite
	Biochemical: phosphates
7. Metamorphic deposits	Rare metals (yttrium and 15 lanthanides); and alusite
6 REFERENCES	JARIE /

6. REFERENCES

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