THE MINES of the DR.CONGO

a real geological scandal

The Democratic Republic of the Congo has great potential and significant diversity in terms of mineral resources. It is about: **energy resources** (hydrocarbons and other energy resources), **iron and ferrous alloys, non-ferrous metals** (light metals, base metals, chemical and industrial elements), **stones and precious metals**, **industrial chemical fertilizers and minerals building materials, and more**

The DRC is widely considered the resource-richest country in the world, with vast deposits of copper, cobalt, zinc, iron and uranium in the south, diamonds and gold.

The purpose of this book is not to give a detailed description of all the occurrences of mineral resources present in DRC, but to mention the different types of resources present in the country and to give the reader a key to finding useful information.

DEMOCRATIC REPUBLIC OF THE CONGO

a worthy and attractive mineral investment destination.

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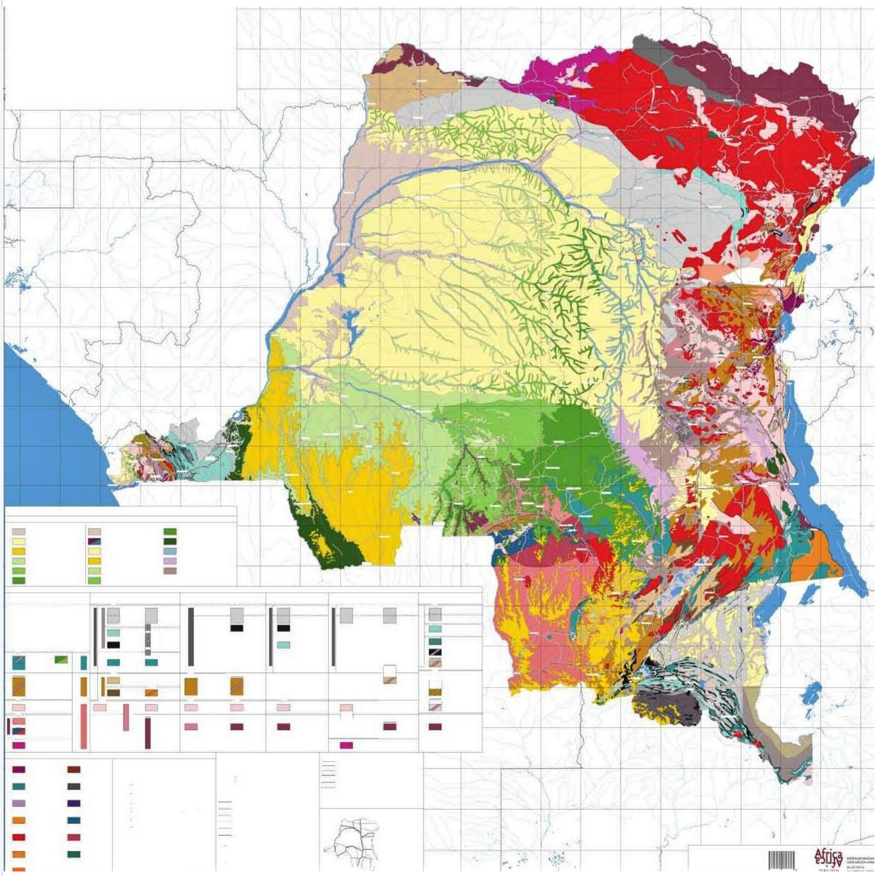
The Democratic Republic of the Congo, a significant potential mineral resources.

The Democratic Republic of the Congo has significant potential in terms of mineral resources, especially for several of its metallogenic provinces and its deposits, which are world-class.



The DRC has potential for energy resources (hydrocarbons and other energy resources), for iron and ferrous alloys, non-ferrous metals (light metals, base metals, chemical and industrial elements), stones and metals. precious, industrial chemical fertilisers and minerals and finally for building materials.

The exploration and organised exploitation of many of these mineral resources in the DRC began very early during the colonial time, and continues till today as evidenced by the presence or the launch of large mining projects, which contribute in part significant to the GDP of the country.

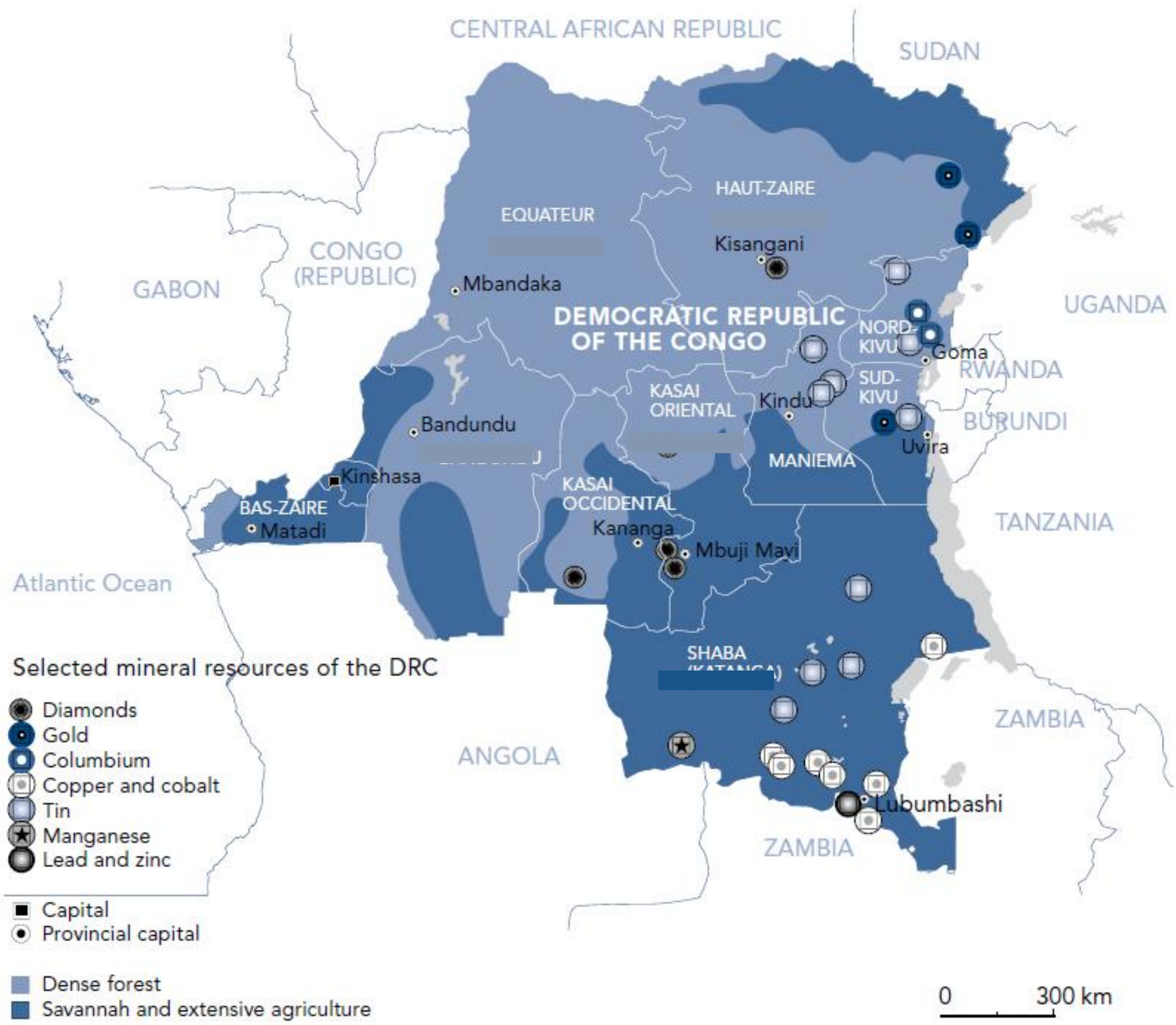
However, despite the many activities that have developed, the mining potential of the country is still to be estimated, which indicates the enormous potential in terms of mineralization.

Should you invest in the DRC right now?

Currently, It is possible to operate profitably in the country, so yes then, surely the DRC remains a worthy investment destination.

A. MINERAL RESOURCES IN THE DEMOCRATIC REPUBLIC OF THE CONGO

There is a vast amount of data acquired during the historical activities and recent mineral prospecting in the DRC, which has been undertaken by private and public institutions and companies.



The Democratic Republic of the Congo is one of Africa's most richly endowed countries in terms of mineral wealth. The country hosts numerous major deposits of diamonds, gold, copper, cobalt, tin, tantalum and lithium. Mining is of high significance for the country's economic development in terms of poverty reduction, employment opportunities, GDP contribution, state revenue generation and export earnings.

The DR Congo supports the foreign investments and the establishment and expansion of local production chains in mining to ensure improved economic development that creates job opportunities.

These data are distributed among the various institutions and active parastatal companies in the field of mineral resources such as the Ministry of Mines, the CTCPM, the CAMI, the CRGM, PUNILU, PUNIKIN, the MIBA, the Gécamines, to name only the most important.

GECAMINES SA is a Commercial Company. Its main activity is Mining and its sole shareholder is the **Congolese** State. Its metal production includes copper, cobalt and zinc.

The Democratic Republic of Congo has great potential and significant diversity in terms of mineral resources. It is about a potential for:

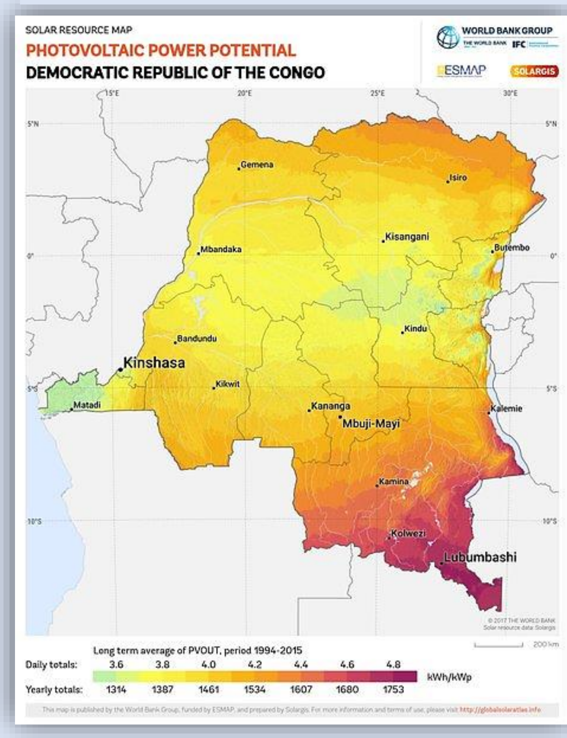
- **energy resources** (hydrocarbons and other energy resources),
- **iron and ferrous alloys,**
- **non-ferrous metals** (light metals, base metals, chemical and industrial elements),
- **stones and precious metals**,
- **industrial chemical fertilizers and minerals**
- **building materials and more**

Since the discovery, during the colonial period, of deposits in DRC, Congolese mineral resources have been the subject of research carried out by scientists and mining companies. Hundreds of scientific articles and mining reports have been published since the end of the 19th century to the present day. All of this scientific work has contributed considerably to increase knowledge about the formation and geology of Congolese deposits.

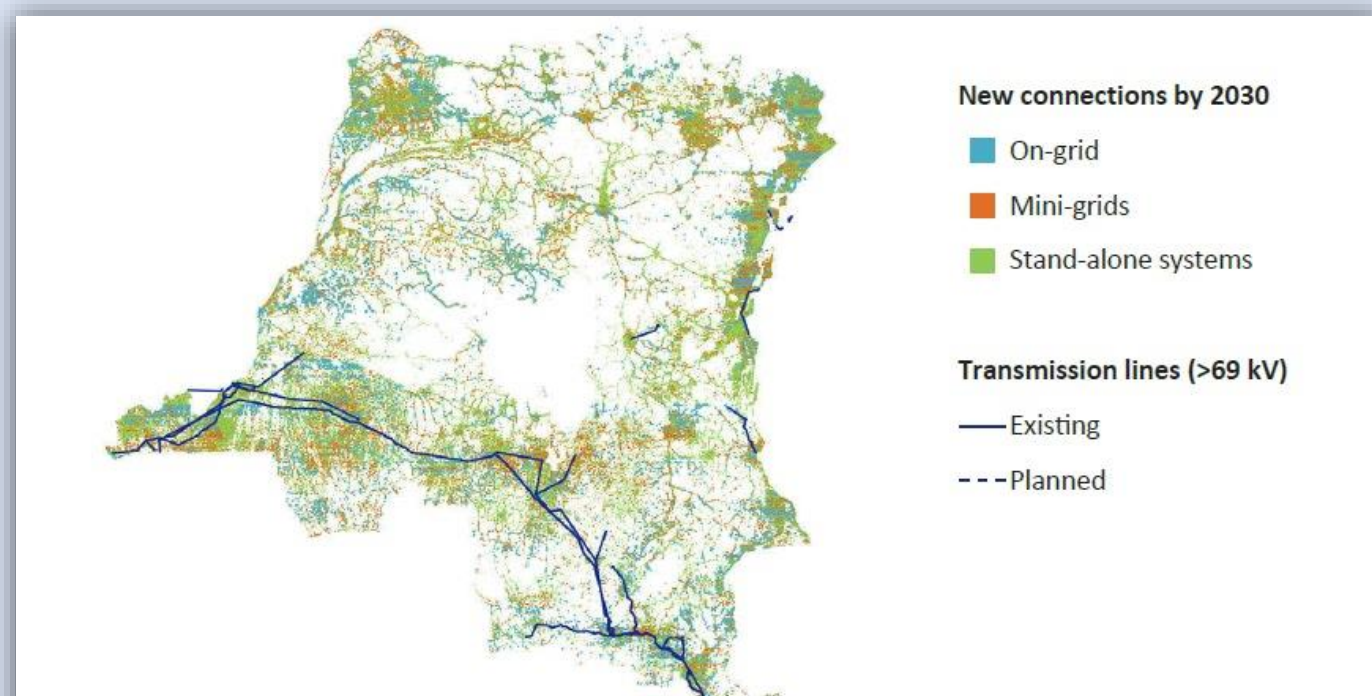
The genetic hypotheses concerning the mineralization of certain metallogenic provinces of the DRC (and of the Great Lakes Region) of certain metals have been reviewed recently. This is particularly the case with the Neoproterozoic Cu-Cu-U mineralization's of the Katanga Copperbelt and the Sn-W-Ta deposits of the KIB and KAB Mesoproterozoic chains, extending from Katanga

Other metallogenic provinces or important mineralization's in the DRC have not been genetically reviewed for several decades, although they constitute an interesting potential. This is typically the case with deposits of diamond, iron, manganese, coal, platinum, Cr-Ni and hydrocarbons.

The DRC's potential to generate energy is very high, having a wide range of both renewable and non-renewable energy sources. The potential renewable sources are hydropower, biomass, solar, wind and geothermal, while the non-renewables would be oil, natural gas & uranium.



Approximatrely 9% of the country's generated domestic power comes from hydropower, specially the two Inga dams (Inga I & Inga II) (Democratic Republic of the Congo, Country Commercial Guide. https://www.export.gov/article?Id=Congo-Democratic-Republic-Energy)



I. ENERGY RESOURCES

The Democratic Republic of the Congo has great potential and significant diversity in terms of mineral resources.

The DRC has potential for energy resources for **hydrocarbons and other energy resources,** for **ferrous alloys, non-ferrous metals** (light metals, base metals, chemical and industrial elements), **stones and iron, for precious metals, industrial chemical fertilizers and minerals,** and finally for **building materials**. We are not going, here, to give a detailed description of all the occurrences of mineral resources present in the DRC, but to mention the different types of resources present in the DRC and to give a review of the main publications that exist on these resources in order to give you a key to finding useful information.

1. Hydrocarbons

Coal, petroleum, natural gas, lignite, peat, sands and oil shales are referred to as fossil energy resources because they consist of debris of plants and animals preserved in rocks over geological time.

Organic matter can be easily changed by geological processes. Most organic matter is broken down by oxidation and recycled to the atmosphere and hydrosphere, but a small portion of this organic matter is preserved during burial in sediment and may evolve into hydrocarbons.

a) Coal - Lignite - Peat

The Plan to drain Congo peat bog for oil could release vast amount of carbon

The world's largest tropical peatlands could be destroyed if plans go ahead to drill for oil under the Congo basin, according to an investigation that suggests draining the area would release the same amount of carbon dioxide as Japan emits annually. **The Guardian/www.theguardian.com**

b) Patrol - Natural Gas

The DRC has proven reserves **of** 180 million barrels, though estimates of total petroleum reserves exceed 5 billion barrels. Along with large recently identified **oil** fields, **the DRC** may hold as many as 30 billion cubic meters **of** methane and **natural gas** in **the** three major **petroleum** deposits.

The DRC contains three sedimentary basins; the Coastal Basin located in Kongo Central, extending offshore past the Congo River estuary, the Central Basin, and the Grabens Albertine and Tanganyika, extending from the Ugandan-DRC border to the southern tip of Lake Tanganyika on the Zambian-DRC border.

Along with large recently identified oil fields, the DRC may hold as many as 30 billion cubic meters of methane and natural gas in the three major petroleum deposits. Lake Kivu, bordering Rwanda and Burundi, has nearly 60 billion cubic meters of dissolved methane in its waters. While the methane gas poses a threat to populations along its shores, this gas can be trapped and converted to electricity **www.privacyshield.gov**

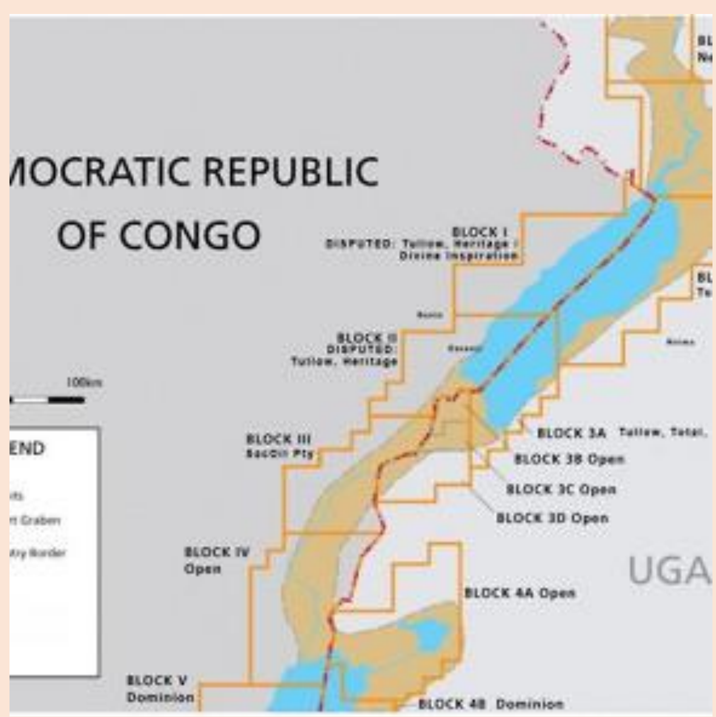
Opportunities

With total oil reserves estimated at three billion barrels, natural gas and methane reserves exceeding 10 billion cubic meters, and a comparatively low production rate of between 20,000 and 25,000 barrels per day, there is enough place for companies that would like to invest in the DRC in the natural gas and petrol sector.

You are welcome

c) Tar sands

Oil sands are a mixture of bitumen and sand. Oil sands production is a carbon-intensive process because it is a hugely inefficient way of extracting and refining the oil.



Like so many other valuable resources sought by rich countries, the Democratic Republic of the Congo contains significant tar sands and oil shale reserves.

Some of the deposits that currently are untapped are in the east of the country near the borders with Rwanda, Uganda, Burundi and Tanzania.

Other deposits in the west may cross over into Angolan or Congo-Brazzaville territory.

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d) Bituminous shale

Oil shale deposits are found all over the world, the largest being in USA, China, Brazil and Estonia, and several industrial plants were taken place to generate electrical energy by direct combustion or high-value fuels by pyrolysis (Dyni 2018; Yen and Chilingarian).

The Democratic Republic of the Congo also has important oil shale reserves, ranked first in the African Continent

There are estimates of 100 bn bbl of oil shale in place throughout the Country. Over 300 mn bbl of tar sands in place, with estimates of over 30 mn bbl recoverable reserves of synthetic oil from bitumen. Recoverable oil from shale not estimated.

2. Others energy resources

a) Nuclear energy

Nuclear energy produces heat through fission reactions. In modern applications, the natural isotope, U, is bombarded with slow neutrons, which increases the rate of isotope fission in smaller fission products. In these reactions, matter is transformed into energy.

The Democratic Republic of the Congo is known for its potential in radioactive ores (eg U, Th) which have been studied for a long time.

b) Geothermal energy

The DRC has an important renewable and non-renewable resources energy distributed almost throughout the national territory among which we can mention hydropower, solar energy, methane gas, wind energy, geothermal energy, etc

Geothermal energy is the small proportion of the earth's heat that can be exploited. This energy manifests itself largely in the form of hot water and natural vapours in natural permeable reservoirs. When the water is hot enough (> 150 C), it can be used to run turbines and generate electricity. When the water is not hot enough, the heat can still be used for residential and industrial heating.

The eastern part of **Democratic Republic of the Congo** has huge **geothermal** potential but not exploited until now. Several **geothermal** sources are found in this part the country belonging to the western branch of East Africa Rift. In general, the African rift valley represents an electric potential not yet exploited but can attain 6500 MW

In the framework of regional cooperation, the European Union is actively supporting the development of energy sector of the Great Lakes region, with EGL (CEPGL's Great Lakes Energy Agency (Energie des Grands Lacs – EGL) being one of the implementing agencies for the currently ongoing European Development Fund (EDF) Financing Agreement "Programme de relance de la CEPGL".

Under this programme, funding has been earmarked for studies of the geothermal resources of the Democratic Republic of the Congo, for the pursuing of which, a partnership has been established between ICEIDA (http://www.iceida.is/english)

c) Hydraulic energy

Hydropower or hydrologic energy is the power that can be generated by the energy of water falling from an altitude or from flowing water. This energy can be used in several applications.

The Hydroelectric power is the main energy resource of the Democratic Republic of the Congo. The DRC ranks first in Africa in terms of its potential (100,000 MW), which accounts for 13% of the global hydropower potential. These resources are a great asset for the supply of low-cost power, making the DRC a strategic player in the continent's electrical energy industry.

The Democratic Republic of the Congo holds the potential to light up a significant portion of Africa. The Congo River, the continent's largest by volume and its most powerful, passes through ten countries before emptying into the Atlantic Ocean. At 150 km from its mouth in DRC, the river holds its greatest hydropower potential at the site of Inga Falls.

The river currently plays host to 40 hydropower projects, nine of which are in DRC, including the country's two largest: Inga I (354 MW) and Inga II (1,424 MW), although they are both currently producing at well below capacity due to insufficient maintenance and lack of funding for refurbishment.

Opportunities

If fully developed, Grand Inga would become the largest hydropower project in the world at 40 GW, and could generate twice as much as the Three Gorges dam in China. With an estimated generation cost of USD 0.03 per kWh, it would also be one of the most affordable sources of energy in Africa and could theoretically provide 40 per cent of Africa's electricity needs.

3. Per and ferrous alloys

Iron and **steel** are vital to our industry and are used in many aspects of our society Steel is an important component in cars, boats, civil constructions, etc. Even energy resources cannot be valued without steel tools, such as pipes, motors, etc. The use of steel in so many industries illustrate its ease of use. In its simplest form, steel contains less than 1% carbon and less than 0.5% manganese.

Ferrous alloys also contain other metals (Cr, Mn, Ni, Si, Co, Mo, V, W, Nb, Ta, etc.) which are mixed with iron. These alloys facilitate the use of steel in many applications.

a) Iron

There are deposits of **iron** ore and gem-quality diamonds in south-central **Congo**, while the central regions are rich in industrial diamonds. In the northeast there are gold, coal, and **iron**-ore deposits; there are prospective deposits of gold, monazite, and diamonds in the north-western regions as well.

The largest iron deposits in the DRC are found in the provinces of Kasai and Katanga (in the north-east); A systematic assessment of potential and systematic exploitation has never been carried out.

b) Ferrous Alloy materials

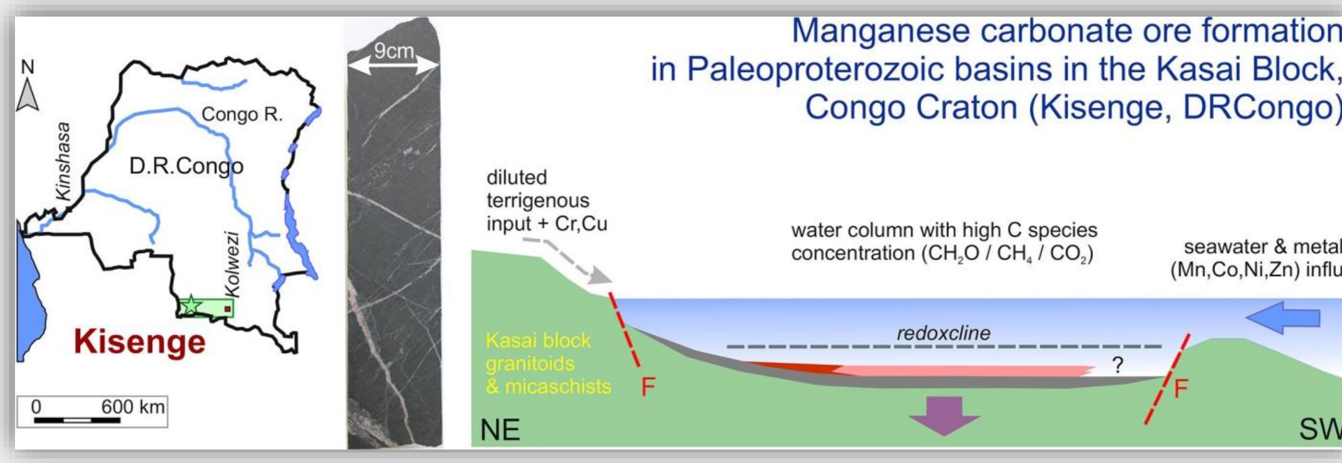
Any solid metal that can be melted can be cast. Foundries are the factories that do this casting work, developing expertise with a handful of metals and methods, and designing standard products to maximize value and efficiency in production.

Ferrous metals are defined as those metals that contain iron. Non-ferrous metals do not.

1- Manganese

Manganese is a chemical element with the symbol Mn and atomic number 25. It is not found as a free element in nature; it is often found in minerals in combination with iron. **Manganese** is a transition metal with a multifaceted array of industrial alloy uses, particularly in stainless steels.

World-class sedimentary manganese deposits of Paleoproterozoic age occur in various parts of Africa and in geologically related parts of South America (cf. Roy, 2006, Kuleshov, 2011, Beukes et al., 2016).



The Kisenge-Kamata manganese deposit in southwestern Katanga in the Democratic Republic of the Congo, is a relatively poorly known member of this World-class sedimentary manganese deposits of Paleoproterozoic group deposits.

The Kisenge-Kamata area is located in the former Katanga province, 250 km west of Kolwezi (Fig. 1a). Geologically, this area belongs to the Kasai block, in the southern part of the Congo Craton. The Kisenge-Kamata deposit hosts sedimentary manganese carbonate and oxide ore occurrences in outcrops along an East-West trending 6 km-long series of small hills, including Kisenge, Kamata and Kapolo (Fig. 1b), besides some localities east of Kapolo. The manganese ore is contained in an East-West

The manganese-rich facies of the Kisenge-Kamata deposits range in composition from manganese carbonate rocks to non-calcareous deposits dominated by manganese-rich garnet. Associated rocks are mainly grey graphitic shales. The Kisenge-Kamata sediments are significantly enriched in Cu, Co, Ni, Zn and other accessory metals (V, Mo, Ga). Primary carbonate ore has relatively low δ13C (−3 to −6‰) and high δ18O (+13 to +20‰) values, confirming their derivation from marine fluids. **https://www.sciencedirect.com/**

2- Nickel

Pure nickel reacts with oxygen and, therefore, is seldom found on the earth's surface, despite being the fifth most abundant element on (and in) our planet. In combination with iron, nickel is extremely stable, which explains both its occurrence in iron-containing ores and its effective use in combination with iron to make stainless steel.

Nickel is very strong and resistant to corrosion, making it excellent for strengthening metal alloys. It is also very ductile and malleable, properties that allow its many alloys to be shaped into wire, rods, tubes, and sheets.

Nickel is a strong, lustrous, silvery-white metal that is a staple of our daily lives and can be found in everything from the batteries that power our television remotes to the stainless steel that is used to make our kitchen sinks.

3- Chromium

Chromium is a chemical element with the symbol Cr and atomic number 24. It is the first element in group 6. It is a steely-grey, lustrous, hard and brittle transition metal. Chromium is the main additive in stainless steel, to which it adds anti-corrosive properties.

The strengthening effect of forming stable metal carbides at the grain boundaries and the strong increase in corrosion resistance made chromium an important alloying material for steel. The high-speed tool steels contain between 3 and 5% chromium.

Stainless steel, the primary corrosion-resistant metal alloy, is formed when chromium is introduced to iron in sufficient concentrations, usually where the chromium concentration is above 11%.[59] For stainless steel's formation, ferrochromium is added to the molten iron. Also, nickel-based alloys increase in strength due to the formation of discrete, stable metal carbide particles at the grain boundaries.

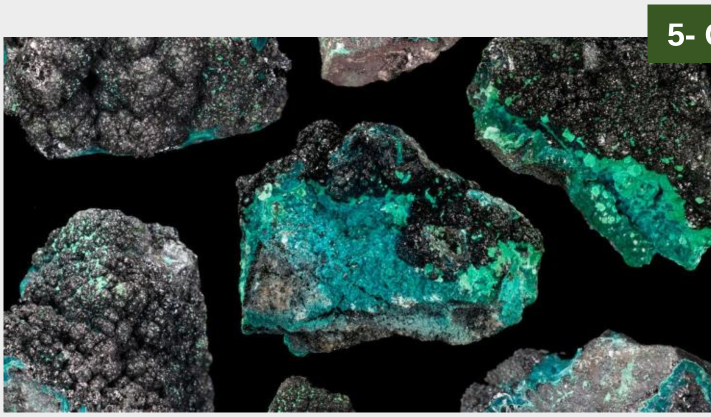
4- Silicon

The Silicon is a chemical element with the symbol Si and atomic number 14. It is a hard, brittle ... Metal-rich silicides tend to have isolated silicon atoms (e. g. Cu5Si); with increasing silicon content, catenation increases, resulting in isolated clusters ...

Most silicon is used commercially without being separated, and often with little processing of the natural minerals. Such use includes industrial construction with clays, silica sand, and stone. Silicates are used in Portland cement for mortar and stucco, and mixed with silica sand and gravel to make concrete for walkways, foundations, and roads.

They are also used in whiteware ceramics such as porcelain, and in traditional silicate-based soda-lime glass and many other specialty glasses. Silicon compounds such as silicon carbide are used as abrasives and components of high-strength ceramics. Silicon is the basis of the widely used synthetic polymers called silicones.

5- Cobalt



Cobalt is a chemical element with the symbol Co and atomic number 27. Like nickel, cobalt is found in the Earth's crust only in a chemically combined form, save for small deposits found in alloys of natural meteoric iron. The free element, produced by reductive smelting, is a hard, lustrous, silver-gray metal.

Cobalt-based blue pigments (cobalt blue) have been used since ancient times for jewelry and paints, and to impart a distinctive blue tint to glass.

More than 70 percent of the world's cobalt is produced in the Democratic Republic of the Congo (DRC), and 15 to 30 percent of the Congolese cobalt is produced by artisanal and small-scale mining (ASM).

6- Molybdenum

Molybdenum is a silvery-white metal that is ductile and highly resistant to corrosion. It has one of the highest melting points of all pure elements — only the elements tantalum and tungsten have higher melting points. Molybdenum is also a micronutrient essential for life.

Molybdenum does not occur naturally as a free metal on Earth; it is found only in various oxidation states in minerals. The free element, a silvery metal with a gray cast, has the sixth-highest melting point of any element. It readily forms hard, stable carbides in alloys, and for this reason most of the world production of the element (about 80%) is used in steel alloys, including high-strength alloys and superalloys.

7- Vanadium

Vanadium is a medium-hard, steel-blue metal. Although a lesser-known metal, it is quite valuable in the manufacturing industry due to its malleable, ductile and corrosion-resistant qualities.

Vanadium rarely exists as a free element in nature but can be found in about 65 different minerals, including magnetite, vanadinite, carnotite and patronite.

It also can be found in phosphate rock and some crude oils.

Vanadium-steel alloys are used to make extremely tough tools such as axles, Armor plates, car gears, springs, cutting tools, piston rods and crankshafts. Vanadium alloys are also used to make nuclear reactors because of their low-neutron-absorbing properties, according to the Royal Society of Chemistry.

8- Tungsten

Tungsten is a rare metal found naturally on Earth almost exclusively combined with other elements in chemical compounds. It was identified as a new element in 1781 and first isolated as a metal in 1783. Its important ores include scheelite, and wolframite, lending the element its alternate name.

Tungsten is the main candidate material for the first wall of a fusion reactor as it is steady against erosion by hydrogen isotopes, has the highest melting point of chemical elements, and shows good behavior under neutron irradiation

9- Tantalum

The Tantalum is a chemical element with the symbol Ta and atomic number 73. Previously known as tantalium. It is a rare, hard, blue-gray, lustrous transition metal that is highly corrosion-resistant. It is part of the refractory metals group, which are widely used as minor components in alloys.

The chemical inertness of tantalum makes it a valuable substance for laboratory equipment, and as a substitute for platinum. Its main use today is in tantalum capacitors in electronic equipment such as mobile phones, DVD players, video game systems and computers.

One of the main uses of tantalum is in the production of electronic components. An oxide layer which forms on the surface of tantalum can act as an insulating (dielectric) layer. Because tantalum can be used to coat other metals with a very thin layer, a high capacitance can be achieved in a small volume. This makes tantalum capacitors attractive for portable electronics such as mobile phones.

Tantalum causes no immune response in mammals, so has found wide use in the making of surgical implants. It can replace bone, for example in skull plates; as foil or wire it connects torn nerves; and as woven gauze it binds abdominal muscle.

It is very resistant to corrosion and so is used in equipment for handling corrosive materials. It has also found uses as electrodes for neon lights, AC/DC rectifiers and in glass for special lenses.

10- Niobium

The Niobium, also known as columbium, is a chemical element with the symbol Nb (formerly Cb) and atomic number 41. Niobium is a light grey, crystalline, and ductile transition metal. Pure niobium has a Mohs hardness rating similar to that of pure titanium and it has similar ductility to iron.

Niobium oxidizes in the earth's atmosphere very slowly, hence its application in jewellery as a hypoallergenic alternative to nickel. It is often found in the minerals pyrochlore and columbite, hence the former name "columbium"

The Niobium is used in various superconducting materials. These superconducting alloys, also containing titanium and tin, are widely used in the superconducting magnets of MRI scanners. Other applications of niobium include welding, nuclear industries, electronics, optics, numismatics, and jewelry. In the last two applications, the low toxicity and iridescence produced by anodization are highly desired properties.

c) Non-ferrous metals

When a **metal** is defined as **non-ferrous** it means that it does not have a significant amount of iron in its chemical composition.

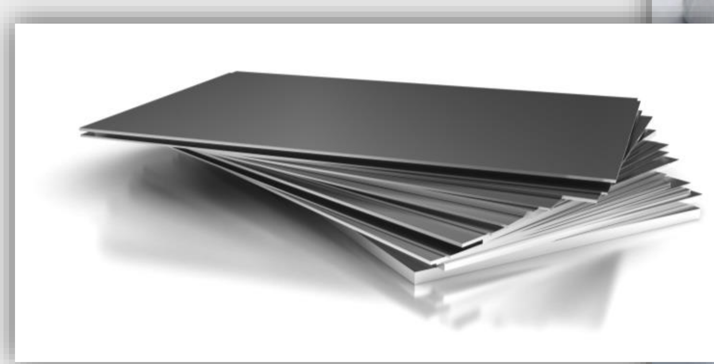
Nonferrous metals, including **aluminum**, **nickel**, lead, **tin**, brass, **silver**, and zinc, are known for their tensile strength and present characteristics that hold an advantage over ferrous metals, mainly by their malleability, lighter weight, and corrosion resistivity.

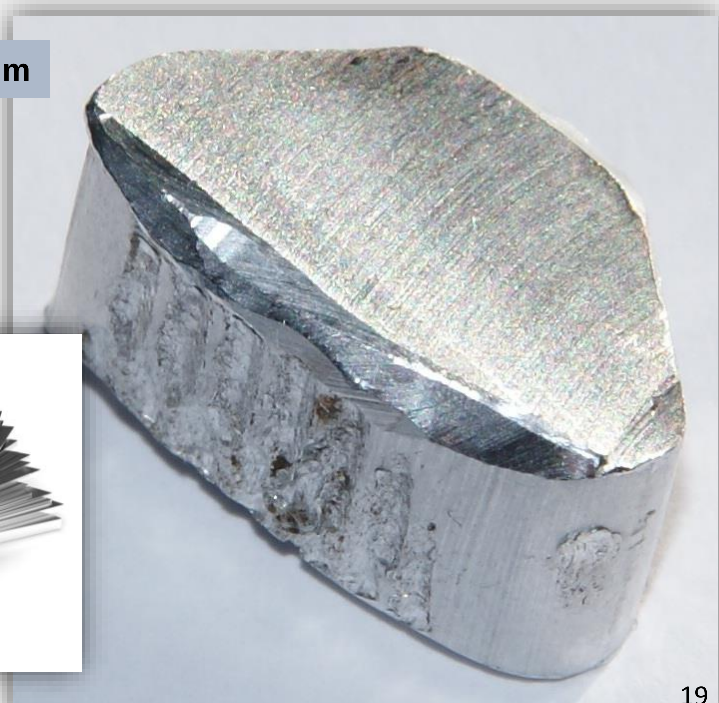
1. Light non-ferrous metals

The light metals are those metals which have a lower density than most metals especially Aluminium, Magnesium, Titanium, Beryllium. Compared with the density of 7.87 g / cm^3 for iron, the density of light metals is 1.74 for magnesium, 2.7 for aluminium and 4.51 for titanium.

1- Aluminium

The Aluminium is a chemical element having a density lower than those of other common metals, at approximately one third that of steel.





2- Magnesium

The Magnesium is an important mineral, playing a role in over 300 enzyme reactions in the human body Its many functions include helping with muscle and nerve function, regulating blood pressure, and supporting the immune system

3- Titanium

The Titanium is a chemical element with the symbol **Ti** and atomic number 22. Its atomic weight is 47.867 measured in Daltons. It is a lustrous transition metal with a silver colour, low density, and high strength. Titanium is resistant to corrosion in sea water, aqua regia, and chlorine.

The Titanium metal has some very valuable properties. In practice, it is pretty unreactive because, like aluminium, it forms a thin protective layer of the oxide.

4- Beryllium

Beryllium is a chemical element with the symbol Be and atomic number 4. It is a relatively rare element in the universe, usually occurring as a product of the spallation of larger atomic nuclei that have collided with cosmic rays.

Within the cores of stars, **beryllium** is depleted as it is fused into heavier elements

2. Base Metals

Base metals include **lead**, **copper**, **nickel**, and **zinc**. They are often more abundant in nature and sometimes easier to mine. That makes base metals far less expensive for use in manufacturing than precious metals, such as gold, silver, and platinum.

1- Copper

The Copper is a chemical element with the symbol Cu (from Latin: cuprum) and atomic number 29. It is a soft, malleable, and ductile metal with very high thermal and electrical conductivity.

A freshly exposed surface of pure copper has a pinkish-orange colour. Copper is used as a conductor of heat and electricity, as a building material, and as a constituent of various metal alloys, such as sterling silver used in jewellery, cupronickel used to make marine hardware and coins, and constantan used in strain gauges and thermocouples for temperature measurement.

2- Zinc

The Zinc is a chemical element with the symbol Zn and atomic number 30. Zinc is a slightly brittle metal at room temperature and has a blue-silvery appearance when oxidation is removed.

It is the first element in group 12 (IIB) of the periodic table. In some respects, zinc is chemically similar to magnesium: both elements exhibit only one normal oxidation state (+2), and the Zn^{2+} and Mg^{2+} ions are of similar size. Zinc is the 24th most abundant element in Earth's crust and has five stable isotopes.

The most common zinc ore is sphalerite (zinc blende), a zinc sulfide mineral. The largest workable lodes are in Australia, Asia, and the United States. Zinc is refined by froth flotation of the ore, roasting, and final extraction using electricity (electrowinning).

3- Lead

The lead is a chemical element with the symbol Pb (from the Latin plumbum) and atomic number 82. It is a heavy metal that is denser than most common materials.

The lead is soft and malleable, and also has a relatively low melting point. When freshly cut, lead is silvery with a hint of blue; it tarnishes to a dull grey colour when exposed to air. The lead has the highest atomic number of any stable element and three of its isotopes are endpoints of major nuclear decay chains of heavier elements.

4- Tin

Tin is a chemical element with the symbol Sn and atomic number 50. Tin is a silvery metal that characteristically has a faint yellow hue.

Tin, like indium, is soft enough to be cut without much force. When a bar of tin is bent, the so-called “tin cry” can be heard as a result of twinning in tin crystals; this trait is shared by indium, cadmium, zinc, and frozen mercury. Pure tin after solidifying keeps a mirror-like appearance similar to most metals.

However, in most tin alloys (such as pewter) the metal solidifies with a dull grey colour. Tin is a post-transition metal in group 14 of the periodic table of elements

3. Chemical and industrial elements

Elements and compounds From a scientific point of view, **chemicals** may be pure substances made up of a single type of component, or mixtures. Pure substances can be **elements** (i.e. composed of a single type of atom) or compounds (i.e. composed of different atoms).

These metals are widely used in chemical and industrial applications. The applications are more specific and fewer than for base metals and light metals. These metals include Rare earths, Cadmium, Antimony, Germanium, Arsenic, Rhenium, Mercury, Zirconium-Hafnium, Indium, Selenium, Bismuth, Thallium.

Understanding the chemical and physical properties of specific elements is important for industry, but leveraging and combining those properties successfully for industrial applications requires skill and expertise.

1- Rare earths

The rare-earth elements, also called the rare-earth metals or (in context) rare-earth oxides, or the lanthanides (though yttrium and scandium are usually included as rare-earths) are a set of 17 nearly indistinguishable lustrous silvery-white soft heavy metals.

Scandium and yttrium are considered rare-earth elements because they tend to occur in the same ore deposits as the lanthanides and exhibit similar chemical properties, but have different electronic and magnetic properties.

These metals, in pure form, tarnish slowly in air at room temperature, and react slowly with cold water to form hydroxides, liberating hydrogen. They react with steam to form oxides, and at elevated temperature (400 °C) ignite spontaneously and burn with a fierce colourful pyrotechnic flame.

The rare earths have diverse applications in electrical and electronic components, lasers, glass, magnetic materials, and industrial processes, though they do not occur as base metals or in lump or visible quantities like iron or aluminium, so their names and properties are unfamiliar in everyday life. One of the most familiar may be unusually powerful neodymium magnets sold as novelties.

2- Cadmium

The Cadmium is a chemical element with the symbol Cd and atomic number 48. This soft, silvery-white metal is chemically similar to the two other stable metals in group 12, zinc and mercury. Like zinc, it demonstrates oxidation state +2 in most of its compounds, and like mercury, it has a lower melting point than the transition metals in groups 3 through 11.

The Cadmium and its congeners in group 12 are often not considered transition metals, in that they do not have partly filled d or f electron shells in the elemental or common oxidation states

Business Opportunities

Cadmium is an important metal for many types of businesses and industrial processes. Cadmium is most often used in the manufacturing sector but worker exposure can also occur in other industry sectors including construction, wholesale trade, and transportation.

3- Antimony

The Antimony is a chemical element with the symbol Sb (from Latin: stibium) and atomic number 51. A lustrous gray metalloid, it is found in nature mainly as the sulfide mineral stibnite (Sb2S3).

Antimony compounds have been known since ancient times and were powdered for use as medicine and cosmetics, often known by the Arabic name kohl. Metallic antimony was also known, but it was erroneously identified as lead upon its discovery

The Antimony is found in minerals such as stibnite, tetrahedrite and jamesonite, which are precipitated from hydrothermal solutions. Tetrahedrite has been described in Kipushi/Katanga in East of the Democratic Republic of the Congo.

Antimony is mainly used as the trioxide for flame-proofing compounds, always in combination with halogenated flame retardants except in halogen-containing polymers. The flame retarding effect of antimony trioxide is produced by the formation of halogenated antimony compounds,[58] which react with hydrogen atoms, and probably also with oxygen atoms and OH radicals, thus inhibiting fire.[59] Markets for these flame-retardants include children's clothing, toys, aircraft, and automobile seat covers. They are also added to polyester resins in fiberglass composites for such items as light aircraft engine covers.

4- Germanium

Germanium is a chemical element with the symbol Ge and atomic number 32. It is a lustrous, hard-brittle, grayfish-white metalloid in the carbon group, chemically similar to its group neighbours silicon and tin
Pure germanium is a semiconductor with an appearance similar to elemental silicon. Like silicon, germanium naturally reacts and forms complexes with oxygen in nature

Silicon-germanium alloys are rapidly becoming an important semiconductor material for high-speed integrated circuits.

Business Opportunities

Solar panels are a major use of germanium. Germanium is the substrate of the wafers for high-efficiency multijunction photovoltaic cells for space applications. High-brightness LEDs, used for automobile headlights and to backlight LCD screens, are an important application. Because germanium and gallium arsenide have very similar lattice constants, germanium substrates can be used to make gallium arsenide solar cells. The Mars Exploration Rovers and several satellites use triple junction gallium arsenide on germanium cells.

Germanium-on-insulator (GeOI) substrates are seen as a potential replacement for silicon on miniaturized chips. CMOS circuit based on GeOI substrates has been reported recently. Other uses in electronics include phosphors in fluorescent lamps and solid-state light-emitting diodes (LEDs).

5- Arsenic

The Arsenic is a chemical element with the symbol As and atomic number 33. Arsenic occurs in many minerals, usually in combination with sulfur and metals, but also as a pure elemental crystal. Arsenic is a metalloid. It has various allotropes, but only the gray form, which has a metallic appearance, is important to industry.

The primary use of arsenic is in alloys of lead (for example, in car batteries and ammunition). Arsenic is a common n-type dopant in semiconductor electronic devices. It is also a component of the III-V compound semiconductor gallium arsenide.

Arsenic and its compounds, especially the trioxide, are used in the production of pesticides, treated wood products, herbicides, and insecticides. These applications are declining with the increasing recognition of the toxicity of arsenic and its compounds.

Business Opportunities

Drinking-water and food
The greatest threat to public health from arsenic originates from contaminated groundwater. Inorganic arsenic is naturally present at high levels in the groundwater of a number of countries, including Argentina, Bangladesh, Chile, China, India, Mexico, and the United States of America. Drinking-water, crops irrigated with contaminated water and food prepared with contaminated water are the sources of exposure.

Fish, shellfish, meat, poultry, dairy products and cereals can also be dietary sources of arsenic, although exposure from these foods is generally much lower compared to exposure through contaminated groundwater. In seafood, arsenic is mainly found in its less toxic organic form.

Industrial processes
Arsenic is used industrially as an alloying agent, as well as in the processing of glass, pigments, textiles, paper, metal adhesives, wood preservatives and ammunition. Arsenic is also used in the hide tanning process and, to a limited extent, in pesticides, feed additives and pharmaceuticals.

6- Rhenium

The Rhenium is a chemical element with the symbol Re and atomic number 75. It is a silvery-gray, heavy, third-row transition metal in group 7 of the periodic table. With an estimated average concentration of 1 part per billion (ppb), rhenium is one of the rarest elements in the Earth's crust. Rhenium has the third-highest melting point and second-highest boiling point of any stable element at 5903 K.

Rhenium resembles manganese and technetium chemically and is mainly obtained as a by-product of the extraction and refinement of molybdenum and copper ores. Rhenium shows in its compounds a wide variety of oxidation states ranging from −1 to +7.

Business Opportunities

What is rhenium used for?

Superalloys

Rhenium is used as an additive in making superalloys together with iron, cobalt, nickel, tungsten and molybdenum. The addition of rhenium improves the overall creep strength of a superalloy, making it an excellent material for jet engine parts and gas turbine engines. For example, nickel-based alloys with 1 to 3 wt% rhenium are used as aircraft turbine blades due to their high strength and oxidation resistance.

Catalyst

Rhenium compounds are used as a catalyst for homogeneous and heterogeneous catalysis in many industries such as petrochemistry, pharmaceutical and organic synthesis processes including isomerisation, hydrogenation and alkylation. Platinum-rhenium catalysts are essential in a chemical process called catalytic reforming in petroleum refineries. This process converts petroleum naphtha from a low octane rating into high octane, unleaded, antiknock fuel products for internal combustion engines and aromatic hydrocarbons for various syntheses

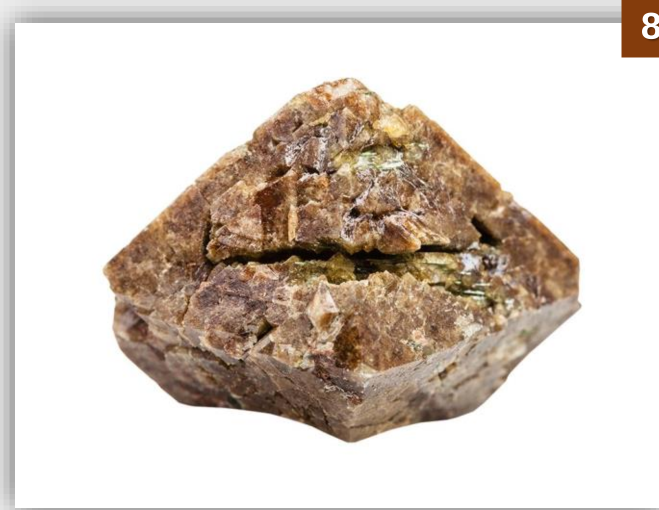
7- Mercury

Mercury is a chemical element with the symbol Hg and atomic number 80. It is commonly known as quicksilver and was formerly named hydrargyrum

A heavy, silvery d-block element, mercury is the only metallic element that is liquid at standard conditions for temperature and pressure; the only other element that is liquid under these conditions is the halogen bromine, though metals such as caesium, gallium, and rubidium melt just above room temperature

Today, mercury is used for the manufacture of industrial chemicals and for electrical and electronic applications. It can be found in meteorological equipment like thermometers and barometers. Mercury batteries, dental amalgams, and even mirrors can make use of mercury.

8- Zirconium



Zirconium is a chemical element with the symbol Zr and atomic number 40. The name zirconium is taken from the name of the mineral zircon, the most important source of zirconium. It is a lustrous, grey-white, strong transition metal that closely resembles hafnium and, to a lesser extent, titanium.

Zirconium is mainly used as a refractory and opacifier, although small amounts are used as an alloying agent for its strong resistance to corrosion. Zirconium forms a variety of inorganic and organometallic compounds such as zirconium dioxide and zirconocene dichloride, respectively.

9- Indium

Indium is a chemical element with the symbol In and atomic number 49. Indium is the softest metal that is not an alkali metal. It is a silvery-white metal that resembles tin in appearance. It is a post-transition metal that makes up 0.21 parts per million of the Earth's crust. Indium has a melting point higher than sodium and gallium, but lower than lithium and tin.

Chemically, indium is similar to gallium and thallium, and it is largely intermediate between the two in terms of its properties

10- Selenium

Selenium is a chemical element with the symbol Se and atomic number 34. It is a nonmetal (more rarely considered a metalloid) with properties that are intermediate between the elements above and below in the periodic table, sulphur and tellurium, and also has similarities to arsenic.

It rarely occurs in its elemental state or as pure ore compounds in the Earth's crust.

11- Bismuth

Bismuth is a chemical element with the symbol Bi and atomic number 83. Elemental bismuth may occur naturally, although its sulfide and oxide form important commercial ores.

It is a brittle metal with a silvery-white colour when freshly produced, but surface oxidation can give it an iridescent tinge in numerous colours. Bismuth is the most naturally diamagnetic element and has one of the lowest values of thermal conductivity among metals

12- Thallium

The Thallium is a chemical element with the symbol Tl and atomic number 81.

It is a gray post-transition metal that is not found free in nature. When isolated, thallium resembles tin, but discolours when exposed to air.

4. Precious stones and metals

Precious stones and metals are rare, naturally occurring metallic chemical elements of high economic value. Chemically, they tend to be less reactive than most elements. They are usually ductile and have a high lustre. In history precious metals were important as currency but are now regarded mainly as investment and industrial commodities. The main examples of precious metals are Gold, Silver and Platinum.

The mining industry of the Democratic Republic of the Congo is a significant factor in the world's production of cobalt, copper, diamond, tantalum, tin, and gold.

Limitless water, from the world's second-largest river, the Congo, a benign climate and rich soil make it fertile, beneath the soil abundant deposits of copper, gold, diamonds, cobalt, uranium, coltan and oil are just some of the minerals that should make it one of the world's richest countries.

1- Gold

Gold is a valuable, yellow metal. Gold is usually found in metamorphic rock. It is found in underground veins of rock where the inside of the Earth heats the water that flows through the rock. Gold has been important all throughout history, it was used in important events by the ancient Egyptians and was important in Bronze Age Ireland.

Due to both it beauty and its durability it is regularly used in jewellery and as a form of currency.

The Democratic Republic of Congo (DRC) is and has been an important gold producer in Africa. The country has been producing large amounts of gold for the past few decades and is known worldwide for its gold.

Investors in the country's gold sector see the potential for increasing gold production despite political instability. The government has also embarked on a campaign to increase the country's gold production by licensing more companies to explore and mine gold.

Invest in Mining Sector in the Democratic Republic of Congo

The Democratic Republic of Congo has a name chiefly for its mining potentialities which make it a real "geological scandal". It possesses an extremely varied range of minerals which offers enormous possibilities of exploitation faced with an exploding global demand – case of demand of Asian emerging countries.

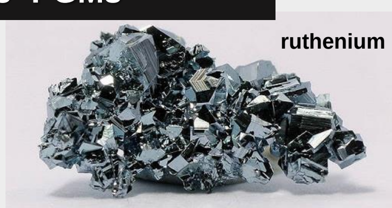
All kinds of minerals are found here: gold, diamond, colombo tantalite, copper, cobalt, tin, iron, petroleum, methane gas, manganese, coal, bauxite, asphalt schist, and so on.

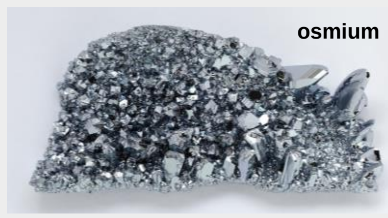
2- Silver

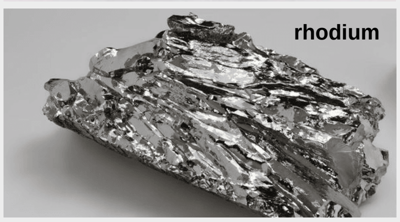
The Silver is a chemical element with the symbol Ag (from the Latin argentum, derived from the Proto-Indo-European $h_2$erǵ: "shiny" or "white") and atomic number 47.

A soft, white, lustrous transition metal, it exhibits the highest electrical conductivity, thermal conductivity, and reflectivity of any metal

3- PGMs







The platinum-group metals (abbreviated as the **PGMs**; alternatively, the platinoids, platinides, platidises, platinum group, platinum metals, platinum family or platinum-group elements (PGEs)) are six noble, precious metallic elements clustered together in the periodic table.

The six platinum-group metals are **ruthenium, rhodium, palladium, osmium, iridium, and platinum**. They have similar physical and chemical properties, and tend to occur together in the same mineral deposits.

All these six metals can be found in abundance in the Democratic Republic of the Congo.

The six PGMs share similar properties, including: Extremely high density (densest element is a PGM), Highly resistant to wear or tarnish, Resist corrosion or chemical attack, Catalytic properties, Stable electrical properties, Stable at high temperatures

Business Opportunities

The PGMs are surrounding us every day in a great variety of applications that are all meant to improve lives. It is estimated that one in four products surrounding us contains PGMs or has been produced with the use of PGMs.

As a result of their high cost of production, PGMs are expensive in comparison with other metals. This leads to a highly economical and responsible usage in applications, such as catalytic converters to control vehicle exhaust emissions. Due to their high value, the attractiveness to recover PGMs from end-of-life products is extremely high.

When you're out driving, PGMs ensure that your airbag operates properly and that the catalytic converter reduces your exhaust emissions.

As you and your family sleep at night, the smoke detector that will alert you to the risk of fire, relies on PGMs.

And if you're ever faced with the tragedy of you or one of your loved ones developing cancer, then it could be PGMs that will be at the forefront of treatment.

4- Gemstones

A gemstone (also called a gem, fine gem, jewel, precious stone, or semi-precious stone) is a piece of mineral crystal which, in cut and polished form, is used to make jewellery or other adornments.

However, certain rocks (such as lapis lazuli and opal) and occasionally organic materials that are not minerals (such as amber, jet, and pearl) are also used for jewellery and are therefore often considered to be gemstones as well.

Most gemstones are hard, but some soft minerals are used in jewellery because of their luster or other physical properties that have aesthetic value. Rarity is another characteristic that lends value to a gemstone.

Diamonds are the most famous gemstones, but there are over 150 natural components that can be used as gemstones.

5- Diamond

The Democratic Republic of the Congo has large reserves of cobalt, gold, gems, copper, timber, and uranium. However, the most valuable resource that the DR. Congo possess is its large reserve of diamonds. Diamonds essentially serve as a pillar to the DRC's struggling economy.

The Democratic Republic of the Congo is among the top five diamond producing countries by volume of production, third only to Russia and Botswana. Despite this impressive statistic, artisanal mining (that is, small-scale digging by individuals, families and communities sing basic technology) is still very much prevalent in the DRC.

Diamonds in the DRC: A Wealth of Potential

According to All About Gems website, artisinal mining of placer diamond deposits in the DRC takes place along the Bushimaïe and Lubilash tributaries to the Sankuru River (Bakwanga Mine) near the town of Mbuji-Maye (formerly Bakwanga) in the Kasaï-Oriental province and along the Tshikapa River (Forminière Diamond Mine) in the Kasaï-Occidental province.

The Democratic Republic of the Congo is one of the leading diamond producing countries not only in Africa but in the world.

6- Beryl group

Beryl is a mineral composed of beryllium aluminium cyclosilicate with the chemical formula Be3Al2Si6O18. Well-known varieties of beryl include emerald and aquamarine. Naturally occurring, hexagonal crystals of beryl can be up to several meters in size, but terminated crystals are relatively rare.

Pure beryl is colorless, but it is frequently tinted by impurities; possible colors are green, blue, yellow, and red (the rarest). Beryl can also be black in color. It is an ore source of beryllium.

Beryl has been described in association with pegmatites at Sangu, Muika, Kimandu, Busoro, Kalima, Numbi, Panga, Kiambi, Buranga and in the Kibara Mountains, in the Democratic republic of the Congo.

7- Corundum group

Corundum is a crystalline form of aluminium oxide (Al2O) typically containing traces of iron, titanium, vanadium and chromium.

It is a rock-forming mineral. It is also a naturally transparent material, but can have different colors depending on the presence of transition metal impurities in its crystalline structure. Corundum has two primary gem varieties: ruby and sapphire. Rubies are red due to the presence of chromium, and sapphires exhibit a range of colors depending on what transition metal is present.

A rare type of sapphire, padparadscha sapphire, is pink-orange.

5. Other semi-precious minerals

The names "semiprecious stones" and "semi-precious metals" are used for all varieties of gemstones that are not categorized as "precious." Any gemstone suitable for being used in personal adornment would be included.

They include gemstones fashioned from: agate, amber, amethyst, aquamarine, aventurine, chalcedony, chrysocolla, chrysoprase, citrine, garnet, hematite, jade, jasper, jet, kunzite, lapis lazuli, malachite, moonstone, obsidian, onyx, peridot, rhodonite, sunstone, tiger's-eye, tanzanite, topaz, turquoise, tourmaline and many other materials.

Calcite, chrysoberyl, cordierite, corundum, diopside, epidote, feldspar, fluorite, various pyroxenes and amphiboles, garnet, serpentine, silica, spinels and tourmaline which are considered as semi-precious stones have been described in several places in DRC.

6. Industrial substances and construction materials

Building material is material used for construction. Many naturally occurring substances, such as clay, rocks, sand, and wood, even twigs and leaves, have been used to construct buildings. Apart from naturally occurring materials, many man-made products are in use, some more and some less synthetic.

There are lot of industrial substances and construction material available in the Democratic Republic of the Congo. There is a lime production and lime blocks are commonly used as construction material. Houses made of adobe blocks are also common. Roofs are most commonly made of thatch or metal sheeting.

1- Limestone, dolomite, and lime

Limestone is a rock with a diversity of uses. It could be the one rock that is used in more ways than any other. Most limestone is made into crushed stone that is used in road base, railroad ballast, foundation stone, drainfields, concrete aggregate, and other construction uses.

Dolomite is used as an ornamental stone, a concrete aggregate, and a source of magnesium oxide, as well as in the Pidgeon process for the production of magnesium. It is an important petroleum reservoir rock, and serves as the host rock for large strata-bound Mississippi Valley-Type (MVT).

Lime used in building materials is broadly classified as "pure", "hydraulic", and "poor" lime;[8] can be natural or artificial; and may be further identified by its magnesium content such as dolomitic or magnesium lime. Uses include lime mortar, lime plaster, lime render, lime-ash floors, tabby concrete, whitewash, silicate mineral paint, and limestone blocks which may be of many types.

2- Phosphates


The rock Phosphates

Phosphates are the naturally occurring form of the element phosphorus, found in many phosphate minerals. In mineralogy and geology, phosphate refers to a rock or ore containing phosphate ions. Inorganic phosphates are mined to obtain phosphorus for use in agriculture and industry.

Use of Polyphosphates for their diverse functionality in water based paints and coatings. They are sed in the Processing of Various Ceramics. For details. Phosphoric acid-based chemical polishes are used primarily to chemically polish (brighten) aluminum and aluminum alloys.

Many phosphorus-containing materials are used as flame-retardants for textiles, plastics, coatings, paper, sealants and mastics. For details. “Phosphates and phosphoric acid have many uses in the treatment of potable (drinking) water. Cleaning solutions with phosphates help clean mildew and stubborn stains on vinyl siding.

3- Potassium chloride

Potassium chloride (also known as Sylvite, KCl, or potassium salt) is a metal halide salt composed of potassium and chlorine. It is odorless and has a white or colorless vitreous crystal appearance.

The solid dissolves readily in water, and its solutions have a salt-like taste. Potassium chloride can be obtained from ancient dried lake deposits.
KCl is used as a fertilizer,[8] in medicine, in scientific applications, and in food processing, where it may be known as E number additive E508.

Fertilizer: The majority of the potassium chloride produced is used for making fertilizer, called potash, since the growth of many plants is limited by potassium availability.

Medical use: Potassium is vital in the human body, and potassium chloride by mouth is the common means to treat low blood potassium, although it can also be given intravenously.

Culinary use: It can be used as a salt substitute for food, but due to its weak, bitter, unsalty flavor, it is often mixed with ordinary table salt (sodium chloride) to improve the taste to form low sodium salt.

Industrial: As a chemical feedstock, it is used for the manufacture of potassium hydroxide and potassium metal. It is also used in medicine, lethal injections, scientific applications, food processing, soaps, and as a sodium-free substitute for table salt for people concerned about the health effects of sodium.

B. METALLOGENIC PROVINCES OF THE DEMOCRATIC REPUBLIC OF THE CONGO

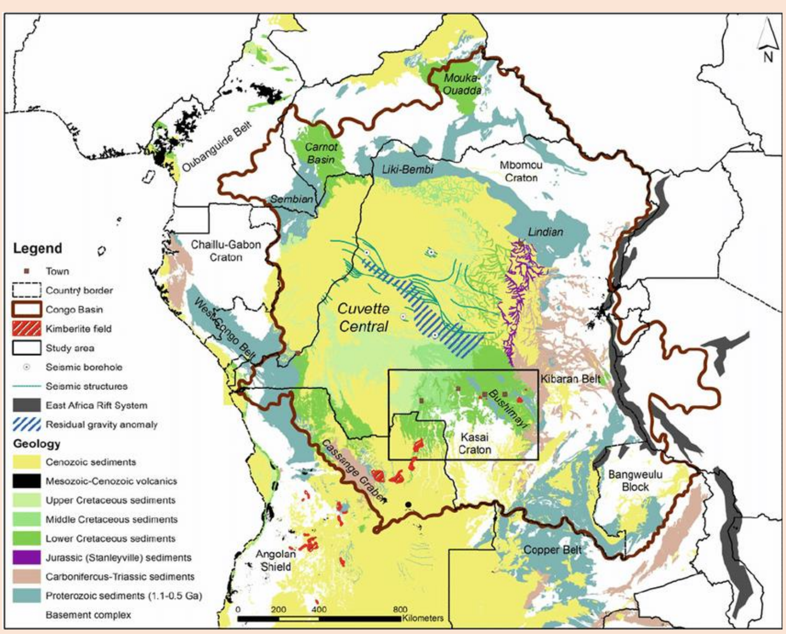
INTRODUCTION

Specific regions which contain a considerable concentration of deposits of a certain metal or of several metals are known as metallogenic provinces. These provinces can be delimited by reference to a single metal or to a combination of different metals **(Evans, 1993).**

The different types of mineralization are not chaotically distributed, neither in time nor in space, but there is a direct link between the occurrence of mineralization and the geology of such a region. There is therefore a direct relationship with the evolution of the crust, the geodynamic history and the formation of mineralization in certain regions. The majority of the world's major deposits are the product of the superposition of different geological processes over a long period in one place, which has therefore led to an abnormal concentration of metals. The formation of metals and the formation of deposits are linked to the same usual geological processes of formation of igneous rocks, sedimentary rocks and metamorphic rocks in the earth's crust. So in the definition of metallogenic provinces, it is necessary to take into account the evolution of the earth's crust in geological time (Windley, 1995). Understanding the processes of crustal formation and the functioning of plate tectonics are essential to approach that of deposit formation.

Specific regions, with a specific geological context and region-specific mineralization can be identified in the Democratic Republic of the Congo, based on geology and mineralization.

1. The Upper Congo bloc.



This metallogenic province is in the northeast of the Democratic Republic of the Congo and consists entirely of Precambrian rocks.

Below the Katangian and lindiennes tabular layers of a Neoproterozoic age, the "Gneisso-amphibolitic Complex of the Bomu (river)" extends northwest into the Central African Republic, and the "Gneissic Complex of West Nile "continues in the north and east towards Sudan and Uganda, bypassing the" granitoid massif of Upper Congo ".

This latter massif forms an ensemble with metasediments and metavolcanic rocks from the western part of the granite soils of the “greenstones of Nyanza-Kibali”, which extends from northern Tanzania towards the Central African Republic **(Lepersonne, 1974, Cahen et al., 1976).**

The region is best known to produce gold. All the gold production comes from “greenstone belts”, located either in the Bomu Complex or in the granitoid massif of Haut-Congo. The “greenstones” are referred to as Ganguien or Kibalien, depending on whether they are found respectively in the Bomu Complex or in the granitoide massif of Haut-Congo **(see Lavreau, 1982; 1984).**

The Ganguian forms four more or less distinct zones (eg. Matundu, Bili) which can be continuous over several square kilometers. It consists of metamorphosed quartzites, schists, jaspillites, talcschists. These rocks are found on or in a gneissic basement. The Kibalian series and slightly diabases are more important from an economic point of view. It outcrops in several areas surrounded by granite areas.

The largest (Moto, Kilo, Mambasa, Ngayu, Isiro) are over 100 km, with the largest being twice this size. Some of these areas form thin chains, less than 10km wide and 30-60 km long. They consist of isoclinally folded units with subvertical axial planes or subhorizontal axes. Other areas are more or less isometric and show an isosynclinal tectonic style.

The Upper Congo Block is characterized by historic mining activities and significant exploitation since the beginning of colonial times. Significant reserves of iron (itabirites), bituminous shale, limestone, asbestos, refractory materials, etc. have been identified. Historical exploitation has mainly been oriented towards the exploitation of gold

The country's major topographical features include a large river basin, a major valley, high plateaus, three mountain ranges, and a low coastal plain. Most of the country is composed of the central Congo basin, a vast rolling plain with an average elevation of about 1,700 feet (520 metres) above sea level.

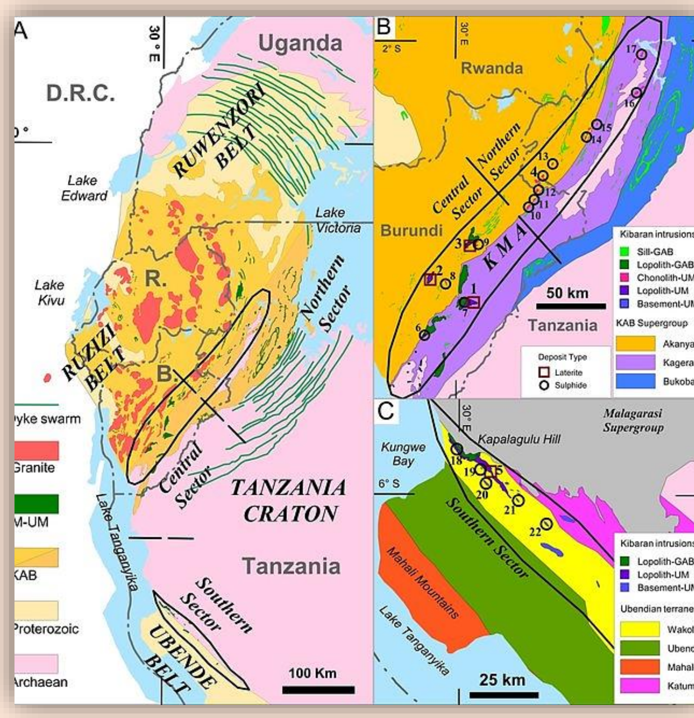
2. The Karagwe-Ankole chain.

The Karagwe-Ankole chain (KAB) in Central Africa extends from the south-eastern part of Yousanda to the province of South Kivu in the DRC.

This chain forms a metallogenic province which contains different types of mineralization linked with granites: cassiterite, columbo-tantalite, tungsten, gold, monazite, amblygonite, beryl, etc.

The Karagwe-Ankole chain, the Democratic Republic of the Congo, is made up of the supracrustal units of Paleo- and Meso-Proterozoic rocks, which largely consist of metasedimentary and metavolcanic rocks, intruded by several generations of granitic (S-type) and mafic rocks (Cahen et al., 1984; Tack et al., 2010).

The intrusion of the largest generation of granites, G1- 3, occurred around 1380 +/- 10 Ma in the paleo- and meso-proterozoic rocks of the Karagwe-Ankole chain. Around 986 Ma, the younger generation E of granites was intruded.



Historically, these granites are called "tin granites", but they are not mineralized themselves. During crystallization and consolidation of the G4 granites, pegmatites and quartz veins formed (~ 960 Ma). These pegmatites can be mineralized with Nb-Ta, cassiterite, amblygonite, spodumene, beryl, etc., and the mineralized quartz veins can contain cassiterite or wolframite.

3. The The Kasai Block .

The Kasai Block is located in the south-central part of the Democratic Republic of Congo. Aside from its long-forgotten iron, gold, chromium, nickel and other base metal potential, the region is best known for its diamond potential which has been known to Plote since the beginning of colonial times.

The most important diamond fields in the DRC are found close to Mbuji-Mayi **(references in Batumike et al., 2009; Pivin et al., 2009; Demaiffe et al., 1991).**

The Mbuji-Mayi kimberlite field and the Luebo exploration area (~ 200 km NW of Mbuji-Mayi) lie on the Congo-Kasai craton.

The Congo-Kasai craton consists of granulites, gneisses, granites and amphibolites, a gabbro-noritic and gabbro-charnockitic complex, and a migmatitic complex, with Archean and Proterozoic ages. The ages of these rocks vary between 3.4 and 2.6 Ga.

The youngest Archean age in this part of the craton was found in the Malafundi granites of the Dibaya Complex and gave an age of 2648 ± 22 Ma (Rb/Sr) and 2595 ± 92 Ma (Rb / Sr).

The Paleoproterozoic, Mesoproterozoic, and Neoproterozoic rocks in this craton have been extensively studied and are witnesses to orogenic events that influenced the Congo-Kasai block, such as the Ubendian orogeny during the Paleoproterozoic, the Kibaran orogeny during the Mesoproterozoic and the Katangian orogeny during the Neoproterozoic.

The Mbuji-Mayi Supergroup was intruded by the Mbuji-Mayi kimberlites.

This Supergroup consists of sedimentary rocks with an age of 1.3-0.95 Ga, which are covered in some areas by basaltic lavas (~ 0.95 Ga) and Cretaceous sandstones (~ 120 Ma). The Mbuji-Mayi kimberlites and their associated diamond deposits have been extensively studied because of their significant economic potential for the region (references in Pivin et al., 2009).

This kimberlite field has been exploited since 1920 by MIBA (Minière de Bakwanga), and consists of two series of chimneys / pipes which cut the Archean craton of Congo-Kasai. We can distinguish two groups.

The northern group (in Mbuji-Mayi itself) is made up of ten chimneys aligned in an east-west direction. The southern group (Tshibua-Kalonji) is formed by five chimneys which outcrop about 30 km to the southwest.

The diatremes of the northern group cut across three geological units in the region: 1) Mbuji-Mayi sedimentary supergroup of the Middle to Upper Proterozoic (1.3-0.95 Ga); and 3) the Cretaceous series of Lualaba (120 Ma). The southern group kimberlites intersect only the first and third bodies of the sequence.

A Cretaceous age was proposed for the kimberlites based on the stratigraphic relationships, which was later confirmed by ID-TIMS U-Pb measurements on zircon and baddeleyite (69.8 ± 0.5 Ma). the Dibaya Archean Migmatitic Complex (2.8-2.4 Ga)

4. The Katanga chain .

The Katanga chain is located in the south-eastern part of the DRC and is part of the "Copperbelt" of central Africa. The "Copperbelt" crosses the border between the Democratic Republic of Congo and Zambia.

This chain contains the largest deposits with the highest grades of stratiform copper sedimentary deposits in the world. Combined production and reserves indicate a total tonnage of ~ 190 Mt Cu about 102 Mt are found in the Congolese part of the Katanga chain. Copper occurs in stratiform or vein-type deposits.

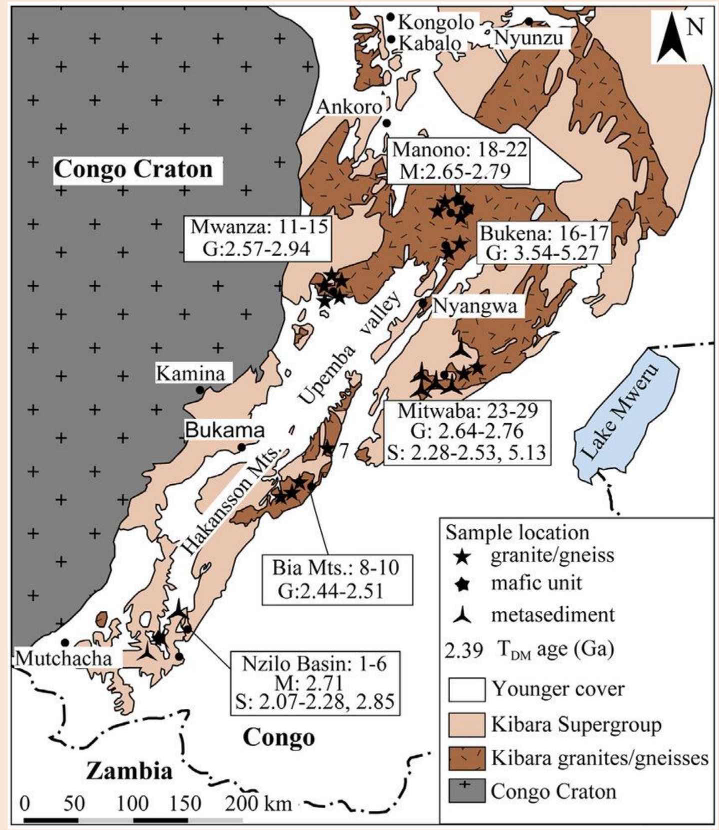
The association of cobalt and copper is typical of these deposits. Stratiform mineralization is continuous from Kolwezi to Kimpe in Democratic Republic of the Congo.

Stratiform copper deposits have been extensively investigated since their discovery in the early 1900s. Most stratiform copper deposits are found in the Lufilian arc of the Katangan range (eg Luiswishi, Kamoto, etc.), but some smaller deposits are found in the foreland (eg Lufukwe, Kibodia, Mwitapile, etc.). In the Katanga chain, the mineralizations of all the stratiform deposits have a pre-to syn-orogenic origin.

The stratiform mineralizations have historically been exploited by the ''**Union Minière du Haute-Katanga (UMHK)'',** then later by ''**Gécamines''**. Although stratiform deposits make up most of the production and reserves, syn- to post-tectonic Zn-Pb-Cu vein-type deposits have also played an important role.

It should be mentioned that various other elements have also been identified in the Katanga chain, associated with the mineralization of Cu-Co or Cu-Pb-Zn, such as U, Th, REE, Au, Fe, Ge, In, etc.

5. The Kibara Range.

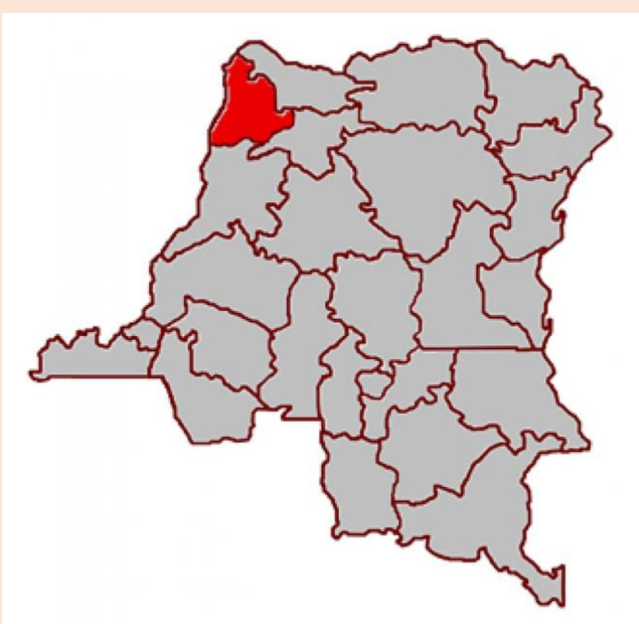


The Kibara Mountains are a range in the Katanga Province of the Democratic Republic of the Congo. They are partly within the Upemba National Park.

This Mesoproterozoic chain consists mainly of Paleo- and Meso-Proterozoic metasediments, covered by younger sedimentary rocks, Neoproterozoic and Phanerozoic (Laghmouch et al., 2012). Paleo- and Meso-Proterozoic rocks have been intruded by several generations of granitic and mafic rocks.

The largest generation of granite A-D was placed around 1380 +/- 10 Ma in Proterozoic rocks of the Kibarian range. Around ~ 986 Ma, the younger generation E of granites intruded. Historically, these granites are called "tin granites", but they are not mineralized themselves. During crystallization and consolidation of E-type granites, pegmatites and quartz veins developed (~ 960 Ma). These pegmatites can be mineralized with Nb-Ta, cassiterite, amblygonite, spodumene, beryl, etc.

6. The Ubangi block



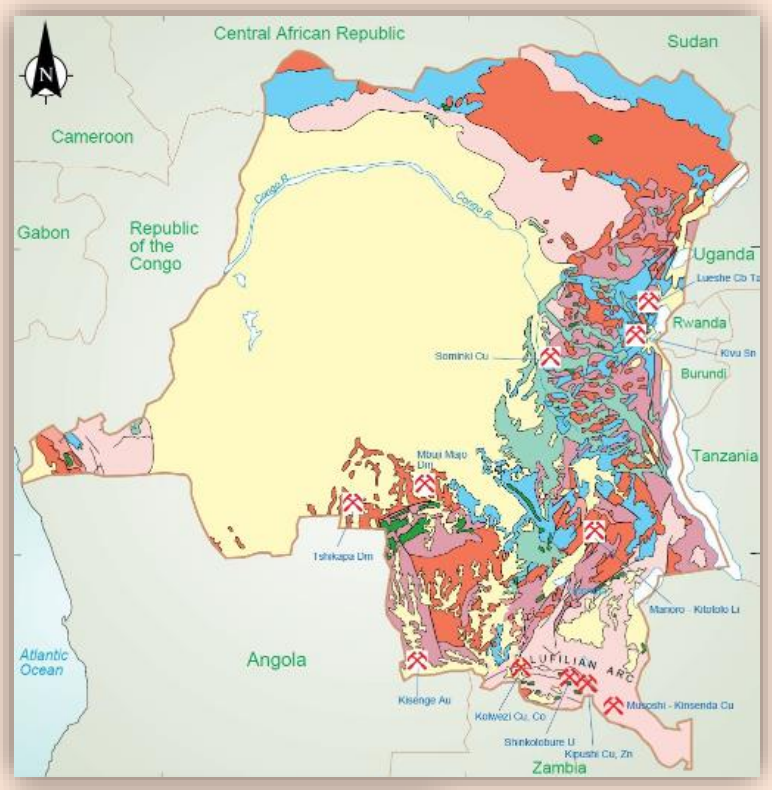
This region is located in the north-western end of the Democratic Republic of the Congo, south of the Ubangi river and west of the town of Gbadolite, but mainly in the Zongo-Bosobolo-Molegbe region

The subsoil rocks have an Archean and Proterozoic age, and are part of the “Bomu Amphibolitic Complex”, the “Ganguien Supergroup”, the “Ubangi Metasedimentary and Magmatic Complex” and the “Liki-Bembien”. A detailed prospecting campaign was carried out by the BRGM between 1969 and 1973 in the region. **(Thibaut, 1983)**

Showings for different minerals have been identified in the Ubangi Block, eg. for gold, diamond, tin, monazite, pyrite, stibnite, galena and various heavy minerals. In addition, many prospecting areas for base metals have been identified. But no mine is in production in this metallogenic province.

Beyond minerals, oil blocks and many others, because these are not renewable, the ‘’Grand Equateur’’, located in the north-west of DRC, with an estimated area of 405,000 km², is the third largest region after the ‘’Grand Katanga’’ and ‘’Grand Province Orientale’’, it contains the most important wealth of the country which is the forest. Its 45 million hectares of forest constitute the country’s most precious heritage,

7. The West-Congo chain



The West-Congo chain lies in the western part of the Democratic Republic of the Congo and is part of an orogenic chain ~ 1400 km long and 150-300 km wide subparallel to the Atlantic Ocean. and which extends between 1 ° S and 12 ° S. This chain is part of the Araçuai-Ouest Congo orogeny, formed during the Pan-African amalgamation of the Gondwana supercontinent.

This chain consists largely of Proterozoic rocks which are covered in the east and west by younger Cretaceous and Cenozoic Formations.

Many types of mineralization are identified in the West-Congo range, eg. gold, tin, iron, phosphates, salts, but the Cu-Pb-Zn-V mineralization that are associated with fault and fracture systems in the foreland of this chain are the most important.

These fault systems are located in rocks that are part of the Western Congo Supergroup and the Inkisi Group. Cu-Pb-Zn mineralization is characterized by a complex paragenesis.

Most of the primary sulphides have been oxidized and the metals have been remobilized to form a complex mineralization of secondary minerals. Cu-Pb-Zn sulphide mineralization consists of veins and lenses that occur in fault zones, which intersect the Lukala limestones or the Inkisi sandstones.

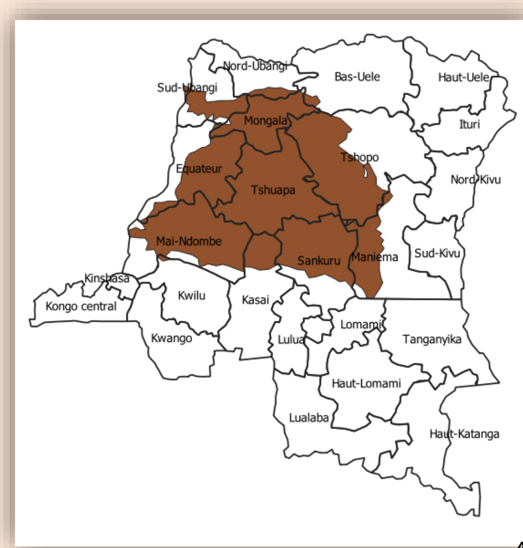
Significant erosion and secondary enrichment have taken place and are evidenced by the formation of supergene deposits and ferruginous laterites. The mineralogical composition of the secondary deposits is complex and contains exotic vanadates, arsenates and molybdates, alongside the more common carbonates and silicates. Supergene alteration involves an interaction of the deposits with meteoric fluids, probably after a period of Cenozoic exhumation.

8. The West-Congo chain

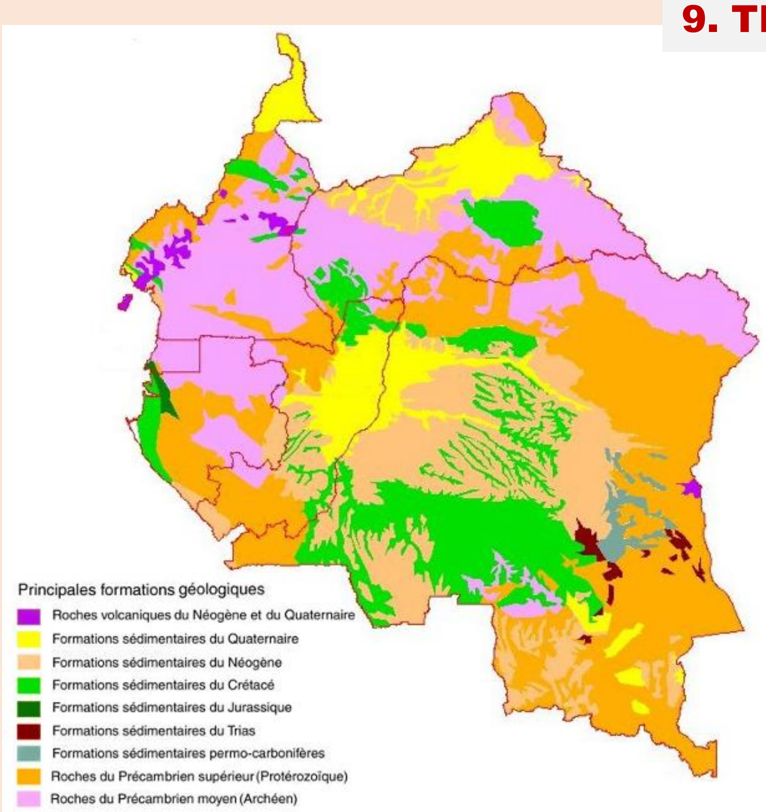
The central basin is in the central part of the DRC and is surrounded by the other metallogenic provinces which are more or less at the peripheral part of the country.

The rocks of the central basin consist largely of Phanerozoic sediments, from the Upper Carboniferous to the Quaternary. Neoproterozoic rocks of the Lindi and Mbuyi-Mayi Supergroups are included in this metallogenic province. The central part of the central basin is mainly a very rich in forest except for the presence of some indications of hydrocarbons, oil shales, etc.

Bituminous shales are found in the marine sediment of the Kisangani and Loïa series which outcrop the border of the Central Basin (Province Orientale, Bas-congo)



9. The central basin



The Cuvette Centrale (French: "Central Basin") is a region of forests and wetlands in the Democratic Republic of the Congo.

It is the sedimentary basin of the Congo River. The Congo Basin is located in Central Africa, in a region known as west equatorial Africa. The Congo Basin region is sometimes known simply as the Congo.

The central basin is located in the central part of the DRC and is surrounded by the other metallogenic provinces which are more or less at the peripheral part of the country.

The rocks of the central basin consist largely of Phanerozoic sediments, from the Upper Carboniferous to the Quaternary. Neoproterozoic rocks of the Lindi and Mbuyi-Mayi Supergroups are included in this metallogenic province.

The central part of the central basin is relatively poor in mineralization except for the presence of some indications of hydrocarbons, oil shales, etc.

The vast forest of the Congo Basin is the second-largest tropical rainforest on Earth and serves as the lungs of Africa. The soils and plants of the Congo Basin rainforest store incredible amounts of carbon, preventing it from being emitted into our atmosphere and fueling climate change. ...

SUMMARY

An eminently mining country, the Democratic Republic of the Congo is the centre of numerous exploitations of most diverse metals in a multitude of mines and quarries. Its soil harbours a wide variety of mineral species with facies of often very high esthetical quality.

The worked deposits are distributed over Precambrian massifs bordering, to the south, east and north-east, a vast sedimentary central basin. Thus, in counter clockwise sense, one encounters successively, from south to north: diamantiferous exploitations of Kasai (Mbuji-Mayi, Tshikapa), as well as a few copper deposits (Tshiniama, Lubi); the copper-bearing arch of southern Shaba, also rich in cobalt and uranium with the mining centres of Kolwezi (Cu-Co), Likasi (Cu), Kambove (Cu-Co), Shinkolobwe (U) and Lubumbashi (Cu), not forgetting the mine of Kipushi which yields zinc, copper and germanium.

Still in Katanga, when ascending northward, one comes across the tin granite of Mitwaba and the stanniferous pegmatite of Manono. The province of Kivu, enclosing the region of Maniema, is particularly rich in tin deposits (Kalima), often accompanied by columbo-tantalite. The pegmatite with beryl, the columbite and uranium of Kobokobo also found here, as well as gold placers of the Mobale river. In the north of the province of Kivu, there are outcrops of carbonatite of Lueshe, rich in pyrochlores, while at the Rwandan border, the region of volcanos contains lavas in which several new silicates have been discovered.

In the north of Congo, in the Oriental Province, there are the famous gold exploitations of Kilo-Moto. At the western extremity of the country, to the west of the capital Kinshasa, the Lower Congo encloses a few deposits of zinc and lead vanadates (Kusu-Senge), whereas the massif of Niari is the centre of fine examples of mineralizations in copper silicates, mainly, however, on the territory of the Democratic Republic of the Congo.

From a mineralogical point of view and more particularly with regard to the esthetical value of the specimens, the names of deposits and their principal resources in nice minerals are indicated in this brochure.

The DRC is located in the Sub-Saharan area which is predominantly savannah pastures but also has mountainous ranges to the west, plateau on the south and presence of active volcanoes. These diverse geographical terrains and topography, give rise to various habitat tourism all over in the country.

Discover Okapi, also known as the Congolese giraffe. It is an artiodactyl mammal found only in the Democratic Republic of the Congo.


A limitless water, a world's second-largest river, a rich soil and a benign climate which make it fertile, a beneath soil full of deposits of copper, gold, diamonds, cobalt, uranium, coltan and oil which are just some of the minerals that make the Democratic Republic of the Congo one of the world's richest countries.
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