RÉPUBLIQUE ISLAMIQUE DE MAURITANIE

MINISTÈRE DES MINES ET DE L'INDUSTRIE

PROJET DE RENFORCEMENT INSTITUTIONNEL

DU SECTEUR MINIER (PRISM)

GUIDE FOR THE MINING INVESTOR IN MAURITANIA

GUIDE DE L'INVESTISSEUR MINIER EN MAURITANIE

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1. THE ISLAMIC REPUBLIC OF MAURITANIA (RIM)

Mainly a desert country, facing the ocean on one side, Mauritania is characterised by the meeting of the Sahara desert and the Atlantic Ocean, at the extreme western part of the African continent. It is a large country when considering the surface, however, it is hardly populated due to climatic roughness.

Mauritania created as such by French colonists in 1902, is a contact and buffer zone between black Africa in the south and the Maghreb countries in the north. The capital, Nouakchott, has a very short history as it was founded in the middle of the 20th century only, by the French colonial power. After independence in 1960, the country experienced a slow and chaotic evolution leading to a presidential and democratic government and an economic development.

The Constitution which was approved by the July 1991 referendum, appointed a president of the Republic, holder of the executive power, and elected by direct vote for a period of six years, assisted by a prime minister and a two-chamber parliament, composed of a National Assembly and a Senate
.
Since august 3rd 2005, a transitional Government has been implemented for two years. the actual President is Colonel Ely Ould Mohamed Vall.

1.1. Geography

Mauritania is among the "large" countries of the African continent, with an area of more than one million square kilometres (1,030,700 km²). It is bound by western Sahara, Morocco and Algeria in the north, Mali in the east and south, Senegal in the south-east and the Atlantic Ocean in the west.

There is little relief in the entire territory which consists mainly of an old shield partly covered by two large sedimentary basins. Only the edges of these basins forming escarpments in the north-east, the centre and the south-east, and some inselbergs - Guelb - scattered over the basement of the R'Gueïbat Ridge and the Mauritanides Range form significant relief elements contrasting the overall monotony of the landscape.

Most of the territory is covered by sediments, rock debris (regs) and sandy deposits (dunes). Here and there, shallow rock massifs - usually tabular - stand out, dismantled by an intensive eolian erosion. An vast flat reg extends over the edge of the large Taoudeni depression in the extreme north, in the centre of the Sahara.

The Adrar massif, in the centre, raises to an average height of 500 m (825 m at the Teniagouri pic) in magnificent landscapes (Amodjar pass). The Guelb er Richat, an extraordinary geological curiosity with a forty-kilometre-wide bubble burst shape, completes the Adrar in the east. The relief continues in the south with the Tagant massif extending towards the Senegal valley with the narrow massif Assaba (464 m) and the Afollé mountains (600 m). The Dhar Tichit, a small sand covered rock outcrop, joins the Tagant to Dhar Néma, close to the malian border. The town of Nouakchott, on the ocean shore, sits in the centre of a sedimentary plain, formerly flooded by the sea, and part of the Senegalo-mauritanian sedimentary basin.

Finally, the entire central part of Mauritania is covered by huge dune ridges aligned along a the SW - NE strike.

Climate is essentially desertic. If not the Senegal and Mali border zones, an agricultural area during the rainy season, and a coastal strip of a 300 km-width suitable for cattle breeding, the remaining part of the country - nearly half of its surface - has a very dry climate, and the landscape is mainly desert. Diurnal average temperature is about 37.8°C over more than six months a year, with cool nights. The coastal area is more temperate.

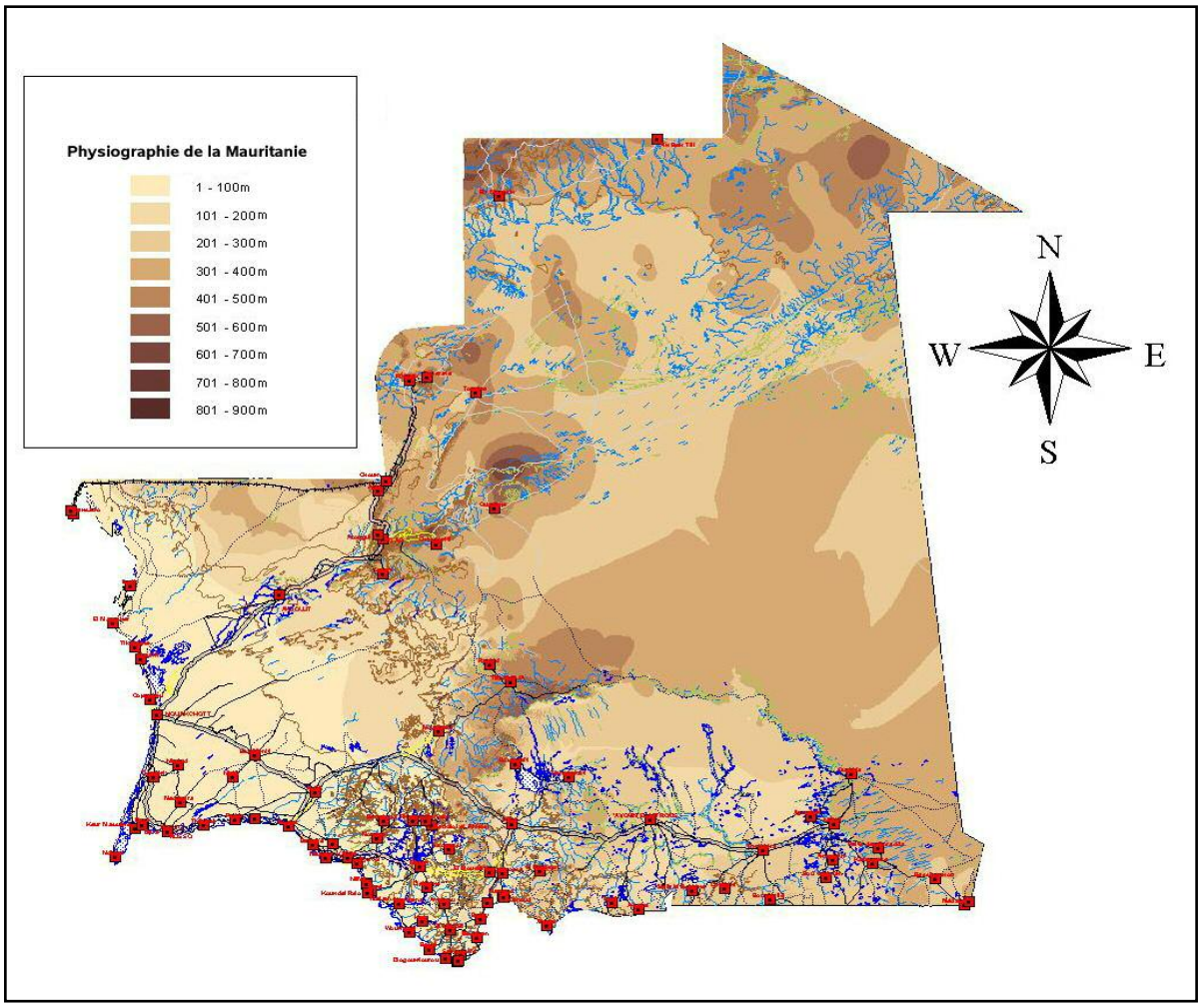

Figure 1. Physiographic and hydrographic map of Mauritania.

1.2. Population

Meeting point of desert and Sahel, Mauritania is also the site of a mixture between Arabo-Berber and Sudanese ethnic groups.

The Mauritanian population is estimated to be 3 million inhabitants mainly concentrated in the western part of the country, coming up to a global density of 2.9 inhabitants per square kilometre. At the beginning of the 1990ies, the yearly growth rate of the population came up to 2.5 %, infant mortality was 101 per 1,000 children. The life expectancy was 51 years.

The official language is Arab, French is the working language. Hassanya, Peul, Wolof and Soninké are national languages. Arab and French are widely used as communication and exchange languages. The educational system is based on the teaching of both these languages.

1.3. Economy

In spite of the dryness of the country, agriculture, fishery and cattle breeding contribute to the PNB at an annual average of between one quarter and one third. The remaining part is mainly contributed by the industrial and mining sectors, and mainly the tertiary system (50%). However, the irregularity of agricultural and livestock productions due to the global raise of earth temperature leading to more frequent and longer draughts in Mauritania, and the decrease of the fishing resource lead to an irregular contribution of these resources to the national economy.

67 % of the active population work in the agricultural sector, contributing to one quarter of the PNB. In 1997, livestock was 11 million animals. The agricultural area is mainly located in the south and in the oases.

The main crop products are millet, sorghum, rice, legumes, sweet potatoes and maize. In the oases, barley, vegetables (tomatoes, onions) and dates allow to keep a minimum of inhabitants in the emigration oriented areas.

The potential for sea fishery ressources is known to be very high along the mauritanian coast, and the government took actions to protect its fishing areas which ensure substantial income. Yearly fish production is estimated to reach up to 93,000 tons.

Tourism in Mauritania is currently in a major reform phase, with tourism infrastructure and facilities already provided mainly in areas of high tourist attraction. The quantity of tourists in Mauritania has constantly increased during the last few years.

The mining sector contributes 12% of the PNB, mainly due to the exploitation of iron-bearing resources in the north of Mauritania. The iron deposits of Fderik-Zouerate and Guelb are the main resource of the country. Phosphate deposits have been found in the Senegal valley, and sulphur, yttrium, copper and gold resources have been located in the basement rocks.

During the last decade, interest for other mineral resources has started to develop - gold, diamonds, copper and energy resources - leading to the discovery of new resources potentially exploitable. This effort is ongoing and even increased to develop this sector.

The promotion, diversification and development of the mining sector have now become obvious priorities, potential now being proven, to ensure a sustainable development of Mauritania and compensate the uncertainty that affect the other economic sectors.

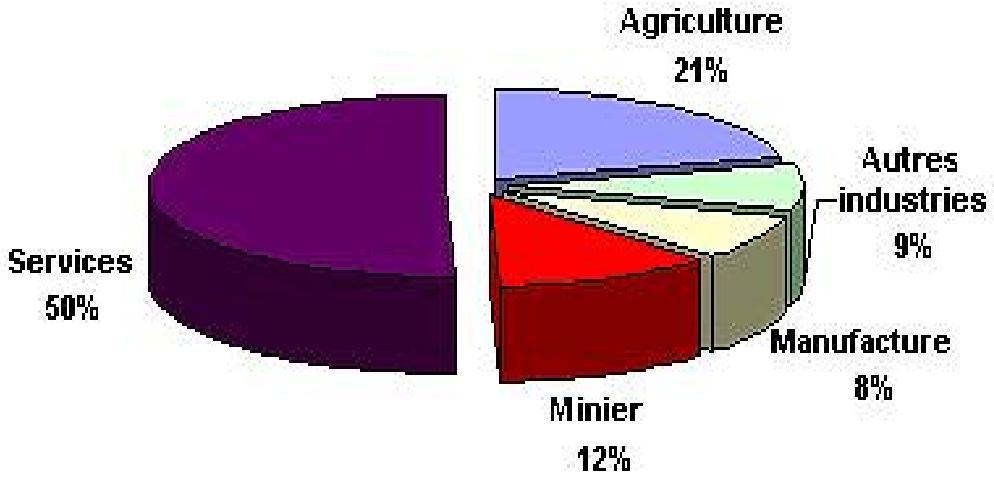

Figure 2. Contribution of the various economic sectors to the PNB.

1.4. Infrastructure

1.4.1. Communication Network

The Trans-Mauritanian Nouakchott-Néma road (Route de l'Espoir), a paved road requiring constant removal of eolian sand, was inaugurated in 1978. The coastal road serves Rosso, Nouakchott, Akjoujt and extends towards Atar.

The road surfacing of the road network, consisting mainly of dirt roads, was renewed and certain sections, mainly Nouakchott-Nouadhibou strip (470 km), are still under construction. This road will allow connecting Nouakchott and Morocco by a completely paved road facilitating by far the exchange with the Maghreb countries (Morocco, Algeria).

A 690 km-long and 1.435 m (standard)-wide railway line joins Nouadhibou and the mining camp of Fderik-Zouerate. This line is used by SNIM mainly to transport iron ore, but also for the procurement of supplies and goods, and transport of people to the mining sites.

A railway rehabilitation project is under way, and another railway project is being studied for the southern part of the country.

With a coastline of 754 km-long, Mauritania is clearly a country open to the sea, and shipping and seaborn trade play an important role. The two main coastal cities, Nouadhibou and Nouakchott, are equipped with a deep water port. In the perspective of the development of the oil and / or gas production, the intensity of harbour traffic must also increase, which is accounted for in currently planned infrastructure projects.

Nouadhibou and Nouakchott both enjoy an international airport from which regular flights to Europe and most of the regional capitals (Dakar, Bamako, Alger, Casablanca, Tunis, Banjul, Abidjan, Conakry etc.) are carried out by the national company (Air Mauritanie), Air Sénégal, Air Maroc, Tunisair, Air France and Air Iberia. International connections were also established with Atar (charter flights), which has become a privileged tourism destination for Europeans.

Interior transport is ensured by air to all areas by Air Mauritania, which runs three large civil transport airplanes to serve up to 28 regional airports.

Projects for the rehabilitation of the airports of Nouadhibou and Néma and for the construction of a new airport in Nouakchott are also in the planning phase.

1.4.2. Water Supply

Water supply is one of the main problems Mauritania faces as the country is situated in a desert area, except for the Senegal River valley in the southern part. However, the state of Mauritania started research programmes to re-evaluate the hydraulic resources of the country, mainly close to urban areas and to those regions which will probably undergo industrial development (PRISM), and to establish new supply sources. The industrial and, in particular, the mining development are largely taken into consideration for this planning in order to anticipate the water needs of the future industrial and mining development sites.

1.4.3. Electricity

At the end of the 1980ies, the country disposed of an electric power station having a capacity of 114000 kilowatts, and a yearly production of about 120 million kWh, mainly generated from thermal installations.

A recent electrification programme provided the main cities of the country with a power station.

1.4.4. Telecommunications

Mauritania disposes of a great variety of telecommunication networks which offer the users a large range of communication means, including:

- a system of cabled lines and of aerial cables,
- very modern GSM mobile telephony,
- microwave radio links and radio communication stations,
- FM radio and TV stations,
- satellite stations: INTELSAT and ARABSAT.

2. THE ORGANISATION OF THE MINING SECTOR

The organisation of the mining sector is based on the Ministry of Mines and Industry (MMI) and its various services, and the SNIM, the main mining company of the country.

2.1. The Ministry of Mines and Industry (MMI)

The Ministry of Mines and Industry is responsible for enacting the Mining Code and for the coordination of all activities in the mining sector across the whole country, following the new mining policy adopted by the Government in March 1997. The execution of the Government's policy is guaranteed by the administrative and technical departments of the Ministry of Mines and Industry, and in particular the **Direction des Mines et de la Géologie (DMG)**, the **Unité du Cadastre Minier (UCM)**, the **Office Mauritanien de Recherche Géologique Research (OMRG)**, the new **Direction des Hydrocarbures (DH)** and the temporary structure of the **Projet de Renforcement Institutionnel du Secteur Minier (PRISM)**.

2.1.1. The Direction des Mines et de la Géologie (DMG)

The Direction des Mines et de Géologie (DMG) centralises the geological and mining information of the RIM in order to make it available to potential investors in this activity sector, to promote the sector and play an active role in the administration and development of the Mauritanian mining wealth.

The main responsibilities and roles of the DMG (decree no. 030/99 of April 13th, 1999) are defined as follows:

- create, develop and participate in projects, in legislation and approvals in the fields of geology and mining;
- supervise the application and enforcement of laws and regulations in the fields of research, prospecting, mining and treatment of mineral substances as well as environmental protection;
- centralise and disseminate geological and mining information to the public.

To carry these various actions out, DMG is split up into three sections:

- The Mining Section (Service des Mines)
- The Geological Section (Service Géologique)
- The Environmental Section (Service de l'Environnement)

The former Hydrocarbon Section was restructured to form the new Direction des Hydrocarbures (Hydrocarbon Departement) to be able to ensure better development of this very promising sector following the recent discoveries.

DMG is one of the main beneficiaries of help and assistance from the Government and international organisations to develop the mining sector.

2.1.2. SIGM

SIGM is a structure integrated in the Geological Section. It consists of a system integrating various types of georeferenced thematic information, such as geology, mineral deposits and occurrences, mining, hydrology, topography, infrastructures, geophysics, satellite imagery, geochemistry, documents and bibliography, etc.

SIGM was implemented in the framework of PRISM by the British Geological Survey (BGS), in parallel to the Cartography Project for Mauritania from 2001 to 2003. It is based on a performing networked system, using ArcView as GIS, a database manager software and top computer and peripheral hardware. SIGM is designed as a single counter or window for all documentation requests about the mining sector and geosciences. Its specific tasks include data collection and acquisition, data evaluation, administration and interpretation and the edition and output of standard products for general customers or of specific products upon special request by various kinds of users and in the format requested by them (analogous or digital), and finally the dissemination of these products.

2.2. Other Players

Among the other players in the field of geosciences and mining, there are the Office Mauritanien des Recherches Géologiques (OMRG) and the Faculty of Sciences of the University of Nouakchott. The latter plays an educational role and supplies the qualified personnel operating in the field of the Earth sciences.

The OMRG is the Governmental operator in the field of mineral exploration. It is the role of the OMRG to evaluate areas of the national territory with specific mineral potential, in order to confirm or disprove this potential and, in the first case, promote this potential towards private investors to develop new mineral deposits.

Among the exploration projects carried out by OMRG, there are:

- the South Mauritanides project funded by the European Union and the State of Mauritania;
- the Sulphur project north of Nouakchott;
- the Adrar Base Metals project (Cu-Pb-Zn) funded by the French Cooperation (FAC) and the State of Mauritania;
- the Peat project in the southwest of Mauritania, funded by the State of Mauritania;
- the Inchiri Gold project (State of Mauritania, BRGM and GGI);
- the Tasiast – Tijirit Gold project funded by the European Union and the State of Mauritania.

OMRG is staffed with qualified professionals in the fields of geological mapping, mineral exploration, drilling and geochemical analyses. It is equiped with all necessary equipment for the execution of field surveys, core drilling and the preparation and analyses of samples; it also offers technical services for mining operators in these fields.

2.3. PRISM

In 1999, the Government of Mauritania designed together with the World Bank, the PRISM program to improve the capacity and competitiveness of Mauritania to attract private investments for the development of the mining sector. The project is funded by the World Bank, together with the Islamic Development Bank, the French Cooperation Agency and the Government of Mauritania. The entire funding of PRISM exceeds 30 million US$ and is planned to last from 1999 until 2008. The project is planned and carried out in two phases, PRISM 1 and PRISM 2.

The actions of PRISM considerably improved the geoscientific and mining documentary database of Mauritania. Among others, the acquisition of new geophysical airborne data extended the coverage of the national territory to about two thirds (2/3) (Fig. 3), the acquisition of new regional geochemical data and, above all, the update of the geological mapping for the whole country at the the 1/500,000 scale, and for the R'Gueïbat Ridge and the Mauritanides at the scale of 1/200,000 (Fig. 4) considerably improved the national geodatabase.

The main objective of this work is to improve the capacity of attracting private investments in the mining sector and to reinforce the institutional capacity to provide efficient and transparent administrative services. Moreover, a system of environmental management was set up, and basic geological information is produced and disseminated.

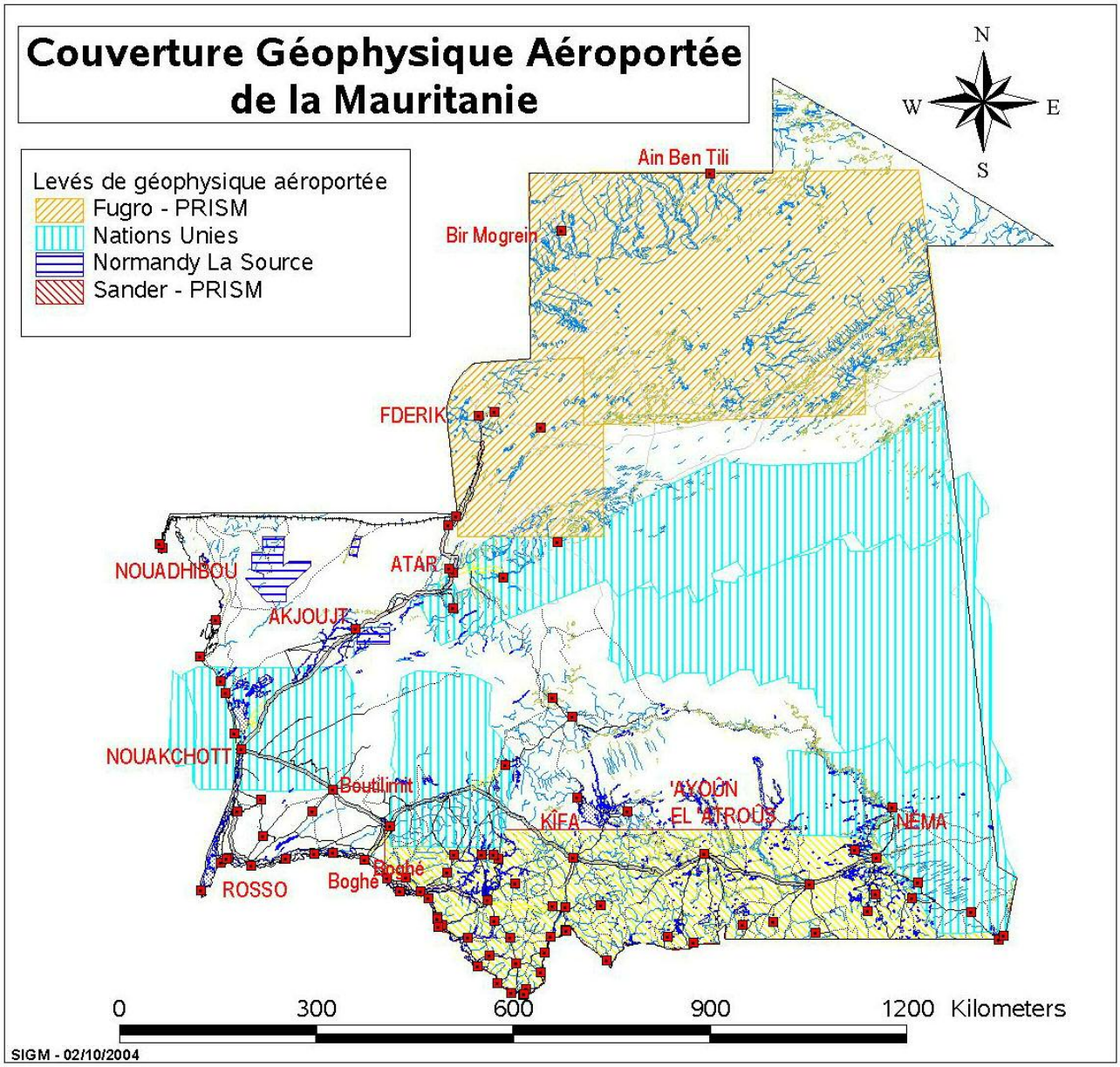

Figure 3. Airborne geophysical coverage of the Mauritanian territory.

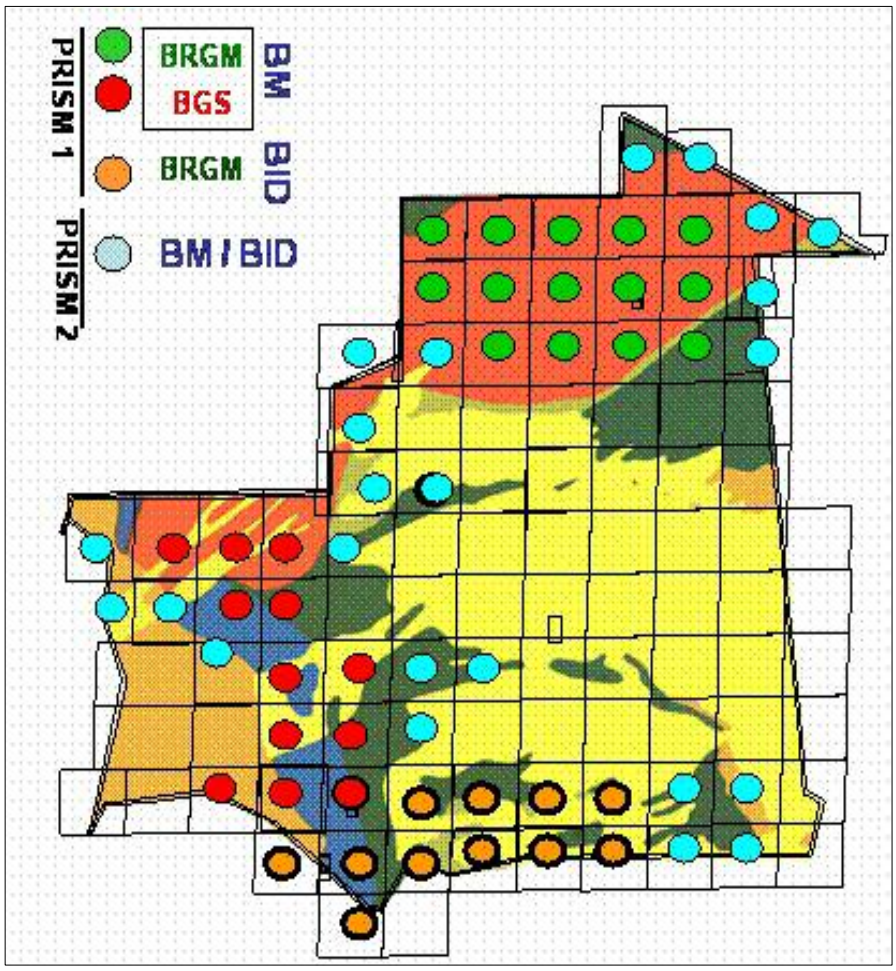

Figure 4. Distribution of 1/200,000 geological survey sheets.

3. LEGAL FRAMEWORK OF ACTIVITIES IN THE MINING SECTOR

3.1. Legal Framework

Concerned about attracting more investors, Mauritania adopted a legal and tax operational framework for oil and mineral research and exploitation activities which is deemed to be among the most competitive internationally. It is ruled by the following codes:

- ✓ The **Investment Code** of 2002, including substantial legal rights and incentives granted to national and foreign investors in a non-discriminatory way; within the framework of this code, the BIC is reduced to 25% before being subsequently reduced to only 20% by the 2003 Budget Act;
- ✓ The **Mining Code** of 1999 and its enforcement texts offering competitive incentives for the mining title holders: tax exemption during the exploration phase and the initial 5 years of exploitation, plus guaranty of the stability of the taxation regime and low royalty rate;

- ✓ The **Standard Mining Convention** which supplements the Mining Code and protects further the investors with its guaranteed stability of the taxation regime during exploitation over a 30 years period;
- ✓ The **Oil Code** of 1988 ruling the exploration and exploitation activities for hydrocarbons; it is secured with a standard and very competitive oil production-sharing contract.

These legal texts can be procured with the Mauritanian Administration (see Appendix 1) or downloaded from the web sites of the Ministry of Mines and Industry (www.mmi.mr).

3.2. The Mining Register Unit (Unité du Cadastre Minier)

The Mining Register Unit (UCM) was created on April 13th, 1999, by decree in order to improve the administration of the titles and territories allocated to research and exploitation of the mineral resources of Mauritania. UCM is installed in the offices of the Ministry of Mines and Industry (MMI) directly under its patronage.

In order to allow UCM to play fully its role of registry management, a geodetic network refered to the World Geodetic System (WGS 84) was physically setup in the field by monuments allowing a more precise location of the mining title boundaries, and UCM was equipped with a GIS system with a relational database to ensure an updated administration of the various titles.

The Unit ensures quick licensing procedures following the "first arrived – first served" principle.

The Appendix includes the detailed procedures for title application and the licensing conditions.

From a legal point of view, the mineral deposits are ruled either under the Mines Plan or the Quarries Plan. The mineral commodities ruled by the Mines Plan are classified in 7 groups (see table below). The commodities not listed in this table are ruled by the Quarries Plan.

Groups of substances	
Groups	**Substances**
1	Iron, manganese, titanium (in rock), chromium, vanadium
2	Copper, lead, zinc, cadmium, germanium, indium, selenium, tellurium, molybdenum, tin, tungsten, nickel, cobalt, PGE, gold, silver, magnesium, antimony, barium, boron, fluorine, sulphur, arsenic, bismuth, strontium, mercury, titanium and zirconium (in sand), Rare Earth Elements
3	Coal and other fossil fuels
4	Uranium and other radioactive elements
5	Phosphate, bauxite, sodium and potassium salts, alum, sulphate - others than alkalino-earthy sulphates - and all industrial rocks other than cement manufacture or direct use as construction material, such as: asbestos, talc, mica, graphite, kaolin, pyrophylite, onyx, chalcedony, opal
6	Ruby, emerald, garnet, beryllium, topaz and all other precious stones
7	Diamond

4. THE MAIN GEOLOGICAL UNITS OF MAURITANIA

Most of the litho-stratigraphic and structural units of West Africa are exposed in Mauritania. Effectively, five main geological units are identified:

- the R'Gueïbat Ridge
- the Taoudeni Sedimentary Basin
- the Tindouf Sedimentary Basin
- the Mauritanides Range
- the Senegalo-mauritanian coastal basin.

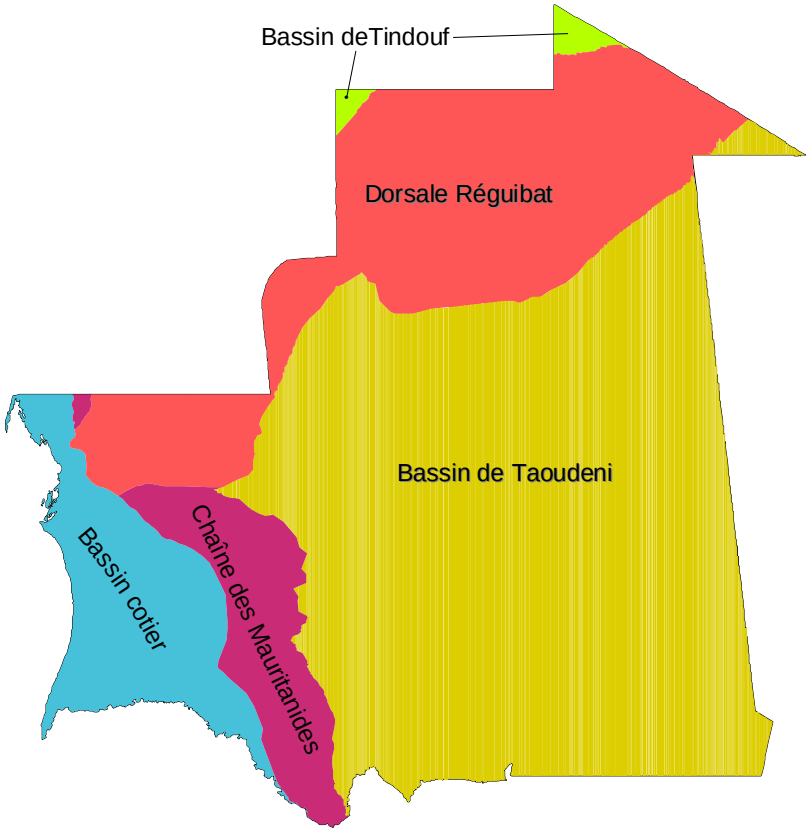

Figure 5. The main lithostructural units of Mauritania.

4.1. The R'Gueïbat Ridge

As the northern part of the West African shield, the R'Gueïbat Ridge is formed, pro parte of Proterozoic terranes (> 2,500 Ma) in the western part, including metamorphic, plutonic rocks and supracrustal formations, and of a paleoProterozoic domain in the east, consisting of iron-bearing volcano-sedimentary and felsic volcanic belts separated by two intrusive suites and cut by a late alkalic to sub-alkalic plutonic suite. The volcano-sedimentary greenstone belts, equivalent to the birimian belts in the eastern and southern parts of the West African Shield, are favourable gold targets.

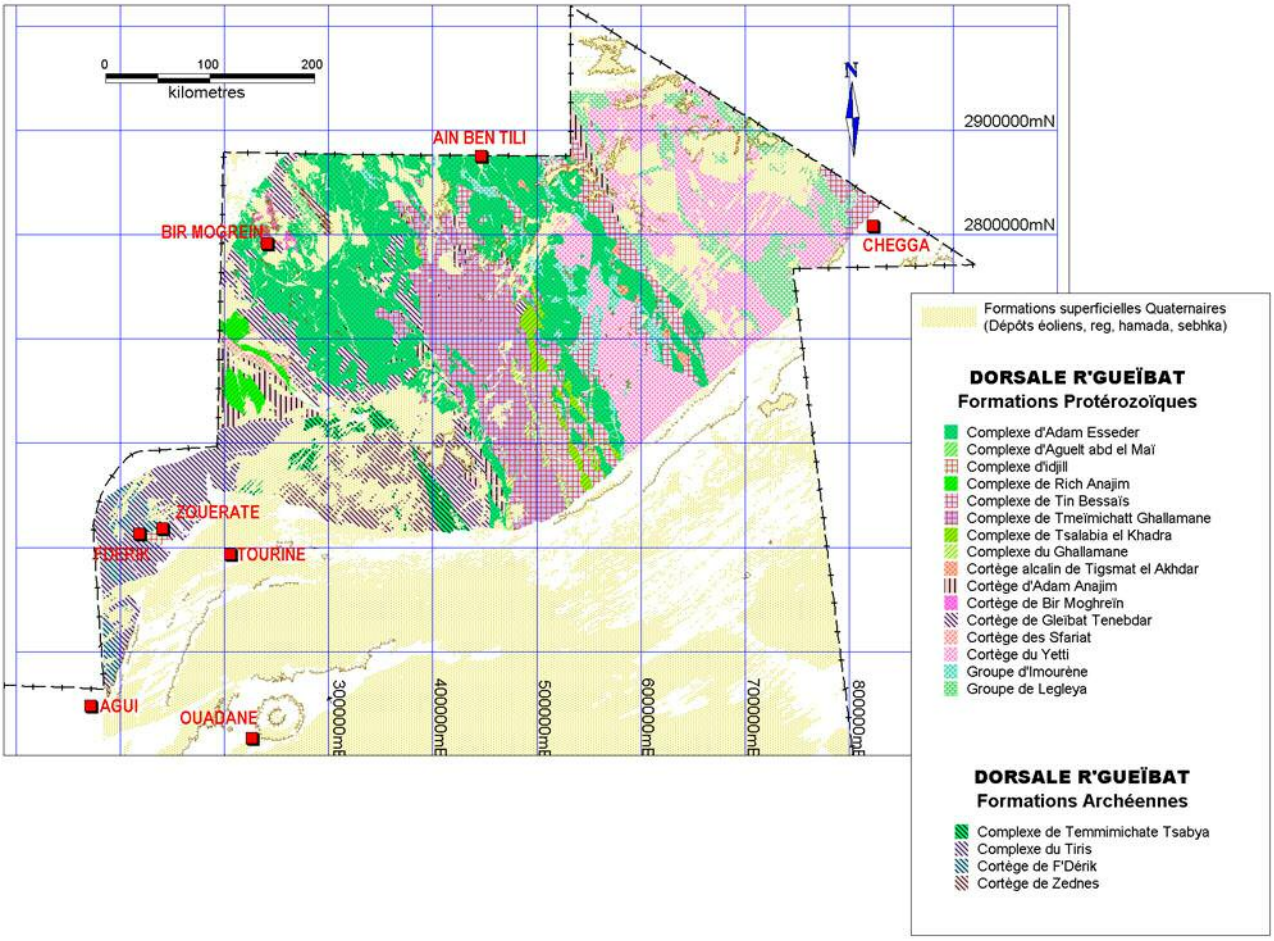

Figure 6. Geology of the R'Gueïbat Ridge

It is an extensive inlier (4,500,000 km²) forming an arc from Akjoujt in the south-west to Algeria in the north-east. It comprises the physiographic provinces of Tasiast, Tijirit, Amsaga, Tiris, Ouassat, Ghallaman, Karet and Yetti. It is bounded to the north and west by the orogenetic pan-African to hercynian belts, to the south by the Taoudeni Basin and in the west by the Coastal Basin.

It forms an extensive peneplain, spread by isolated hills and inselbergs (Guelbs in Arabic) such as those of Tiris - Kediat d'Ijil is the highest point of the Ridge with a height of 917 m - and of course, those of Bir Moghrein. The average height is relatively shallow (150 to 350 m eastward) and raises slightly northward (600 to 700 m) translating into an apron topography inclined to the south.

4.1.1. The Archean formations

The Archean block comprises mainly metamorphosed plutonic formations and granitoids. At least three distinct plutonic activity cycles can be identified:

- a meso-Archean cycle (ante-Leonian, i.e. > 3.05 Ga), comprising metaplutonic ultramafic to felsic granulitic formations;
- a Leonian cycle (~ 3.05 Ga), represented by banded granitoids;
- a Liberian cycle (~ 2.9-2.8 Ga), represented by granodiorite and granite commonly porphyroid.

The meso-Archean metaplutonic ultramafic to felsic formations, ***Temmimichate Tsabya Complex,*** are interpreted as the root of an island arc. A number of subunits are distinguished, all metamorphosed at the amphitolite to granulite facies, including serpentine dunite, garnet-bearing gabbro and anorthosite, gabbronorite, garnet leptynite, amphibolite and marble.

The Leonian to Liberian granitoid intrusions forming the ***Zednes Suite*** and cutting this arc, show a geochemical affinity compatible with plate convergence and confrontation areas (oceanic plates or others) producing more or less potassic magma. It consists of banded tonalite and granodiorite, porphyroid granodiorite, monzonite and monzo-granite.

Metamorphic non granulitic volcano-sedimentary formations locally overlay the Archean terranes. They witness a late neo-Archean mainly mafic to ultramafic plutonic cycle (< 2,8 Ga). Geochemical affinity is within the range of back-arc basinal basalts suggesting a geodynamic evolution of this environment within an already typical Birimian context.

4.1.2. The Paleo-Proterozoic formations

The paleo-Proterozoic domain mainly comprises granitoids and volcano-sedimentary formations connected to four major tectono-magmatic events:

- An eo-Birimian episode (> 2150 Ma), of mainly mafic and ultramafic nature, associated with arkose, carbonate sandstone, pelitic and epiclastic sediments deposits;
- A meso-Birimian episode (~ 2150-2120 Ma), of intermediate composition, followed in the central part of the Ridge by a late felsic to peraluminous meso-Birimian episode (~ 2120-2080 Ma);
- A late Birimian episode (~ 2070-2060 Ma), characterised by the emplacement of volcano-sedimentary belts comprising felsic to intermediate lavas and a granodioritic batholith at the fringe of the Archean block;
- A neo-Birimian episode (~ 2040-2000 Ma), marked by an intensive granitisation associated to the local intrusion of mafic magma and an episode of migmatisation in the northern foothills of the Sfariat. Finally, the paleo-Proterozoic plutonic history ends with the intrusion of alkalic felsic or undersaturated massifs.

The **eo-Birimian** assemblages comprise several groups (***Rich Anajim Complex, Aguelt abd el Maï Complex, Ghallamane Complex, Tsalabia el Khadra Complex***), all of which with the following composition:

1) one unit of amphibolite facies gabbro and basalt, interpreted as a back-arc basin oceanic floor ;
2) one unit of quartzite and marble;
3) one unit of paragneiss, derived from former pelitic and carbonate sandstone sediments.

The geochemical signature of the mafic rocks suggests emplacement in open oceanic basins at the fringe of the Archean block. Associated calc-alkalic rocks further define a subduction context responsible for the erection of the first volcanic arcs. The epiclastic meta-sediments comply with the proximal reworking of the volcanic structures.

The **meso-Birimian** magmatism (~2080-2150 Ma) is represented by two successive assemblages which are geographically distinct:

- tonalite and granodiorite of the **Tin Bessaïs Group**
- granodiorite, granite and leucogranite of the **Tmeïmichatt Ghallamane Complex**

These formations have distinctive "orogenic" signatures suggesting emplacement in a plate convergence context. Magma source is believed to be mainly crustal, derived by melting of subducted oceanic plates. Following this hypothesis, the Tmeïmichatt Ghallamane block would be a suture zone between two crustal terranes during the early Birimian, resulting in the granitisation and stabilisation of this area which was not remobilised during subsequent tectono-magmatic episodes.

The **Tardibirimien** consists of 3 litho-stratigraphic groups, from west to east:

- the **Legleya Group** containing andesite, dacite, rhyolite and granophyre;
- the **Imourène Group** containing dacitic tuff, micro-granodiorite, micro-granite and rhyolite;
- the **Blekhzaymat Group** containing andesite and rhyodacite.

Globally, the bulk of the volcanics seem to form a strongly potassic felsic to intermediate calc-alkalic suite, comparable to the volcanic series of the actual central Andes. This petrologic homogeneity is well in accordance with the contemporary occurrences in the various belts (~ 2065-2075 Ma) and proves the existence of a calc-alkalic a late Birimian volcanic province of in the R'Gueïbat Ridge. These volcanics are emplaced during the opening of shallow basins - witnessed by abundant ignimbrites - in the meso-Birimian granitoid basement. At the bottom of these basins, detritic sequences are deposited deriving from the erosion of the meso-Birimian substratum (conglomerate, arkose). They are followed by the deposit of epiclastites (cinder, lahar). Late Birimian volcanism and granitoid intrusions show compatible signatures with subduction environment.

Neo-Birimian magmatism is mainly represented by potassic and leucocratic, often porphyric, granitoids **(Sfariats, Yetti, Bir Moghrein,** and **Tigsmat el Akhdar suites)**. They are derived from the in situ differentiation of a quasi-eutectic magma composition. In the Sfariat area (Tourassin sheet, Sfariat Suite), pink granites make their way for an extensive domain of migmatite and anatectic granite. These are evidence for *in situ* melting of meta-sedimentary rocks, deposited in a trough at the fringe of the Archean block.

The ultramafic and mafic rocks - gabbro, gabbronorite, leucogabbro, granodiorite, mozodiorite, quartz-diorite - of the **Adam Esseder Complex** show a variety of affinities (komatiitic, boninitic, calc-alkalic, tholeiitic, N-type MORB) suggesting melting of domains with very heterogenous compositions compatible with the root of Andean-type orogen (plate collision).

Finally the peralkalic granite and syenite massifs are evidence of the local intrusion of alkalic magma derived from the intensive granitisation phase of the neo-Birimian.

4.1.3. Tectonic Setting of the Precambrian Basement

Large post- or late neo-Birimian transcurrent structures form the most striking tectonic feature of the R'Gueïbat Ridge. This deformation is preferably located in the metre to hundreds of metres wide proto- to ultra-mylonitic shear zones. They belong to two main structural trends oriented NNW-SSE (to NW-SW) and E-W (to ESE-WNW).

Along NNW-SSE structures, the mylonitic foliation is generally steep to sub-vertical with indications of mainly dextral relative displacement in certain areas, and vertical ones in others. The overall kinematic observations suggest a compressive strain pattern resulting most likely from a NE-SW contraction.

In this general frame, the NW-SE area of the Sfariat has a particular position being oriented perpendicularly to this shortening direction. The granitoid intrusions in this area have also undergone strong deformation (mylonites to ultra-mylonites). Foliation is steep to vertical. In the magnetite quartzite, deformation is mainly featured by WNW-plunging fold axes and boudinage. In the deformed granitoids, mylonitic foliation is associated with a NW-dipping lineation. As a whole, the Sfariat area can be considered as a major tectonic structure at the scale of the R'Gueïbat Ridge.

4.2. Taoudeni Sedimentary Basin

Largest Proterozoic and Paleozoic sedimentary basin of Africa, the Taoudeni Basin, with an area in excess of 1,500,000 km², comprises mainly Precambrian and Paleozoic series, poorly deformed, except along the borders with the eastern and western mobile belts. It is an intracratonic shelf basin, limited in the northern part by the R'Gueïbat Ridge erosion surface. Western and eastern margins are tectonic and limited by the mobile pan-African and Hercynian belts. With only about 6,200 km of seismic profile and 2 boreholes (Abolag and Ouassa), the Taoudeni Basin is poorly known and to a large extent under-explored with respect to mineral and oil research. However, its northern edge shows structures which are favourable for the existence of mineral occurrences, such as kimberlites and stratiform base metal deposits (Pb, Zn).

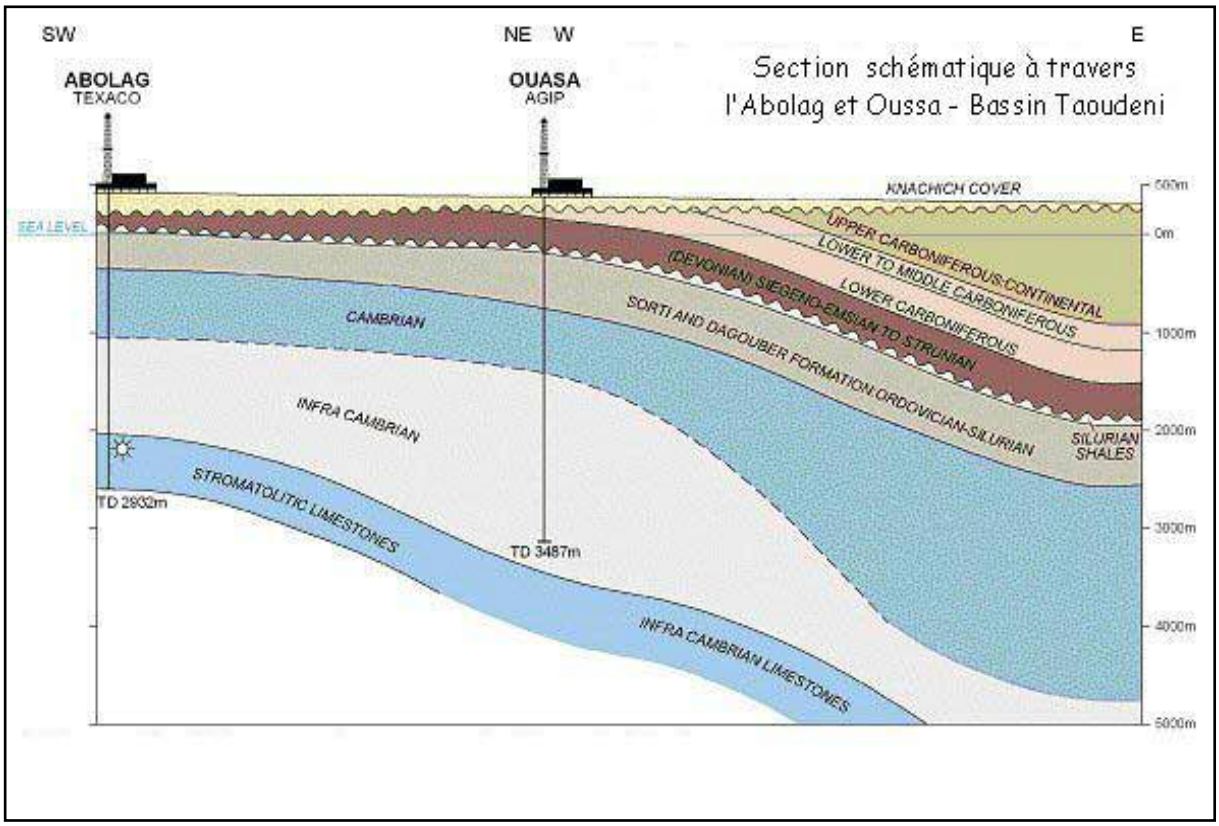

Figure 7. Composite SW-NE and W-E section across the western side of the Taoudeni Basin

The most recent formations are exposed in the centre of the basin. In the north and south part, the sediments unconformably overlay Archean and Lower Proterozoic basement of the R'Gueïbat and Leo ridges (fig. 1). In the western and eastern parts, depending on their age, they are either partially or totally overprinted by the mobile zones orogens.

The long sedimentary history and stratigraphy and of the Taoudeni Basin, with about tens distinct unconformities and gaps, are summarised in the lithostratigraphic column of Figure 6. The sedimentary succession is subdivided into three supergroups:

1) The Neoproterozoic **Hodh**,
2) the Lower Paleozoic **Adrar** (Cambrian-Ordovician), and
3) the Middle to Upper Paleozoic **Dahr**,(end of Ordovician, Carboniferous).

The sedimentation starts with the deposit of the **Char and Douik Groups** and the **lower Atar and El Mreïti sub-groups** – the later separated from the former by an erosional unconformity. They characterise an initial long sedimentation period (about 1,000 to 900 Ma) of the Taoudeni Basin, intracratonic with a weak subsidence and regionally homogenous sedimentation. At the start, continental and along shore, the envornment evolves into marine stromatolite-bearing, transgressive on the cratonic basement of shield (first discontinuity).

The deposits of the **upper El Mreïti and Atar sub-groups** with a dominant carbonate and clay component, characterise a second period (~ 900 à 660-620 Ma) of the Taoudeni Basin evolution, of the ***extensional basin-type***, with associated syn-sedimentary faults and the individualisation of sub-basins with prograde filling towards the western edge of the West African shield. These deposits are comporaneous of the rifting phase of the West African shield and the opening of the pan-African Ocean (~800 Ma).

A third discontinuity (D3) is marked by the erosional unconformity of the **Assabet el Hassiane Group** over the **Atar Group** in the west and by the angular unconfomity of the **Cheikhia Group** over the El Mreïti Group. The deposits of the Assabet el Hassiane and Cheikhia Groups, overall detritic, characterise a third evolution period (~ 620 à 600 Ma) of the Taoudeni Basin, of the ***foreshore basin-type***, including strong subsidence and thickening of the detritic "molassic" deposits towards the west, as the Pan-African collision has started.

The fourth discontinuity (D4) is underlined and confirmed by the "lower tillite" of the **Jbeliat Group** and complies with a glacial and weak angular unconformity, well expressed at the 1/500,000 scale of the geological map. It follows a long period of emergence of the Taoudeni Basin, caused by the general rise of the entire West African shield and the pan-African border ranges, and the important continental erosion predating the Varanger ice-age inlandsis which covers a large part of the West African shield during the upper Neoproterozoic.

The continental tillite, followed by the thin horizon of marine barytine-carbonate of the Jbeliat Group underline the deglaciaiton at the transition from Neoproterozoic to Cambrian, before the main Cambrian marine transgression. This marks the beginning of the deepening and strong subsidence of the Taoudeni Basin, particularly in its southwestern part (Kiffa Basin) where large ignimbrite and associated volcano-sedimentary deposits occur. The basin was filled quickly by sanstone and shale deposits at the transition from lower to middle Cambrian.

The fifth discontinuity (D5) is marked by a second large Cambrian marine transgression, during the middle Cambrian, at the basis of the **Nouatil and Kreb en Naga groups**. It features a cartographic unconformity west of Adrar: the **Terjit-Aguinjob** formation sanstones overlain by marine carbonates of the **Amogjar formation** cap the Amsaga basement west of Terjit. This discontinuity corresponds with a new episode of extensional tectonics of the west African margin, introducing a period of ***extensional*** evolution of the basin.

The sixth discontinuity (D6) is an erosional unconformity in **Adrar, Khatt and Hank** marked out by upper Ordovician, mainly sanstone, glacial deposits **(Tichit Group)**, with grooved blocks. They are referred to as the "superior tillite". This erosional unconformity is more pervasive at the Mauritanides front and is doubled by an angular unconformity in the Tagant. This discontinuity translates into the emersion of the basin and short-lived continental erosion at the Ordovician-Silurian transition.

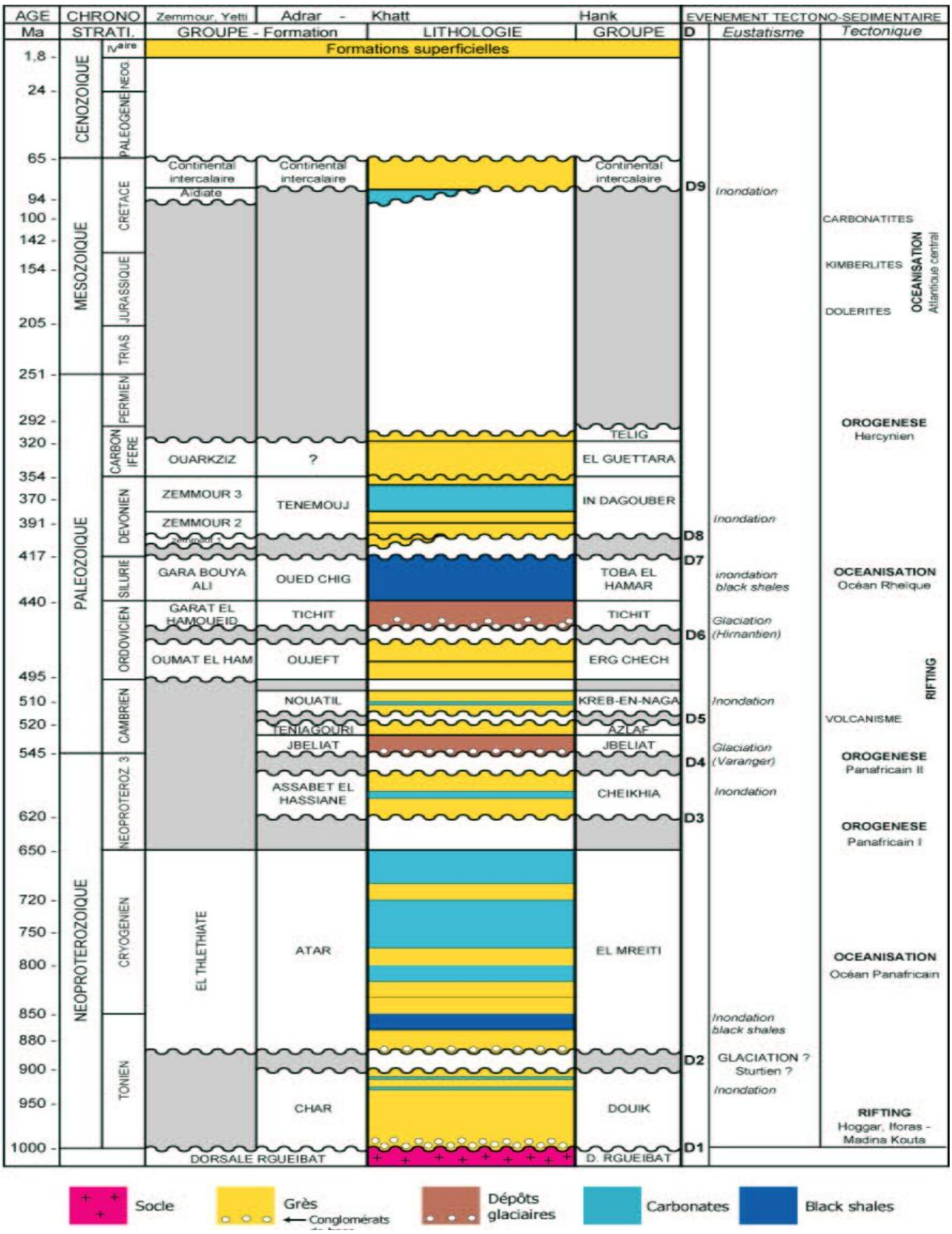

Figure 8. Stratigraphic synthetic column of the Proterozoic and Paleozoic formations of the northern part of the Taoudeni Basin.

The glacial formations are covered by graptolitic mudstone (**Oued Chig Group** in the Adrar, **Toba el Hamar Group** in the Hank, **Gara Bouya Ali Group** in the Black Zemmour and in the Yetti) derived form the vast Silurian marine transgression. It largely overlaps the Taoudeni and Tindouf Basins, into the Saharian basins, in continuity from the African platform throughout the Algerian and Libyan Sahara. In Mauritania, the R'Gueïbat Ridge is flooded ensuring the link between the Taoudeni and the Tindouf basins.

The seventh discontinuity (D7), at the scale of the large Silurian-Devonian carboniferous basin of Taoudeni - Tindouf, corresponds to an erosional unconformity of the Devonian over several, partially eroded, argillitic Silurian continental units, or over the Ordovician sandstone. A new Devonian transgression **(Telemouj Group)** progresses eastward from the western african margin of the Rheïque Ocean. The sequence of deposits - sand, mudstone, limestone - is similar from west to east, with however a more detritic component in the west (Tenemouj Group in Adrar) and heterolitic "sanstone - mustone - carbonate" to evaporatic facies in the east (In Dagouber Group, Taoudeni Basin), revealing a differentiation and ***instability of the basin*** to the Devonian period.

In the eastern part of the Taoudeni Basin, the Devono-Carboniferous sequence is completed by lower Carboniferous marine deposits of the **El Guettara Group**, and continental deposits of the **Telig Group**. At the end of the Paleozoic, after the collision of Gondwana with North America - the hercynian orogen, the Taoudeni and Tindouf Basins dry up. The hercynian tectonic phase translates in the Taoudeni Basin by a syncline structure in the Adrar and bundles of sub-meridian folds in the Carboniferous of the Taoudeni Basin.

The **Continental intercalaire** is in angular unconformity (D9) on the continental Carboniferous, and even older stratigraphic units the Taoudeni Basin; they consist of quartz-sanstone with fossil wood, post-dating liasic doleritic intrusions which they cover locally, and are deposited on a stable most likely Senonian peneplain which, after a long period of continental erosion.

4.3. Tindouf Sedimentary Basin

The Tindouf Basin assemblages in Mauritania are exposed in the Black Zemmour and North Yetti, respectively in the extreme north-west and extreme north-east of the country. The age of the sedimentary formations ranges from the Upper Proterozoic to actual time.

Smaller than the Taoudeni Basin, the Tindouf Basin is a narrow elongated WSW-ENE basin, bounded in the south by the R'Gueïbat Ridge. Tabular and shallowly dipping in the North Yetti, the sedimentary cover is progressively deformed westward, in the Black Zemmour.

From base to top, the sedimentary sequence of the Black Zemmour contains:

- a Proterozoic sequence with stromatolitic dolomite and sandtone: the El Thiethyate Group;
- the marine sandstone-schist Ordovician sequence of the Oumat el Ham Group;
- the glacial detritic sequence with conglomerate and sanstone intercalations of the Garat el Hammoueïd Group, of the Upper Ordovician;
- a Silurian graptolitic mudstone sequence: the Gara Bouya Ali Group;
- Devonian carbonate-mudstone and sanstone formations of the Zemmour Group;
- Cretaceous terrigenous, transgressive sequence with cherty marine intercalations, as outlying hillocks showing angular unconformity on the Paleozoic or basement: the Aïdiate formation.

Structurally, several tectonic units characterised by various intensities of folding and arranged as NNE-SSW striking belts, occur in the Mauritanian section of the Black Zemmour. These tectonic units and their folds are attributed to hercynian orogen.

In **North Yetti**, the stratigraphic succession can be summarised as follows:

- An Ordovician unit, composed of poorly consolidated sandstone with pudding stone and cross-bedded stratifications: the Aoulnet Bel Egraa sandstone;
- The Silurian graptolitic mudstone (Gara Bouya Ali), with rare intercalated carbonate layers;
- The interlayered Devonian detritic (conglomerate, sandstone and mudstone) and carbonate sequence of the Zemmour Group, including coral-reef horizons;
- The Carboniferous mudstone, marl and limestone of the Quarkziz Group.

The North Yetti structure is monoclinal, shallowly dipping towards the north, unfolded and poorly faulted.

The evolution of the Tindouf Basin is clearly the same as that of the Taoudeni Basin. But during the Hercynian tectonic phase, the Black Zemmour was more severely deformed in the form of tight folds and imbricated thrusting with NE-SW axes.

4.4. The Mauritanides Range

The Mauritanides Range, as such extends between the latitudes of 15° and 20° N and the longitudes of 12° and 15° W. It is a long belt extending from the Western Sahara towards in the north, up to Sierra Leone in the south, extending through western Mauritania and the eastern part of Senegal.

In the west, the Mauritanides bound the West African shield. They consist of strongly folded and tectonised sedimentary and metamorphic formations, deformed during the Pan-African (late Precambrian to Cambrian: 650 - 550 Ma), Caledonian (Cambro-Ordovician) and Hercynian (Lower Caroniferous: 300 Ma) orogenic events.

It contains the Akjoujt copper and gold deposits, and many other copper, gold and chromium occurrences.

Four large structural zones are distinguished, generally bounded by tectonic thrust contacts following a sub-meridian strike:

- the Autochtonous
- the Parautochtonous
- the Median Zone
- the Intermediate Zone

The **Autochtonous** is defined as the western border of the West African shield. It contains subhorizontal sanstone formations, of the Adrar, Tagant and Assaba and form the western edge of the Taoudeni Basin. These sandstones overlay unconfomably the Bouly Group series which are clearly more tectonised. The contact between these series and the thrusted material (front of range) can only be seen in the field at the edge of Adrar and a few spots in Assaba.

The **Parautochtonous** is formed by extensively folded, thrusted and sheeted sedimentary assemblages in which some terms of the Taoudeni Basin can be recognised. It is accompanied by andesitic or basaltic volcanism.

The **Median** or **axial Zone** is composed of several units which, apart from sedimentary green schists, include ferrous jasper, associated to mainly mafic volcanic and volcano-sedimentary assemblages and serpentinised ultrmafic rocks, as well as granitic rocks. The numerous identified thrust sheets are distributed into three major structural units (units A, B and C) corresponding to distinct paleo-geographic domains. This median zone appears to be a complex assemblage of alternatively oceanic or continental units. This zone includes nearly all mineral occurrences of the Mauritanides, and particularly those of copper and chromium.

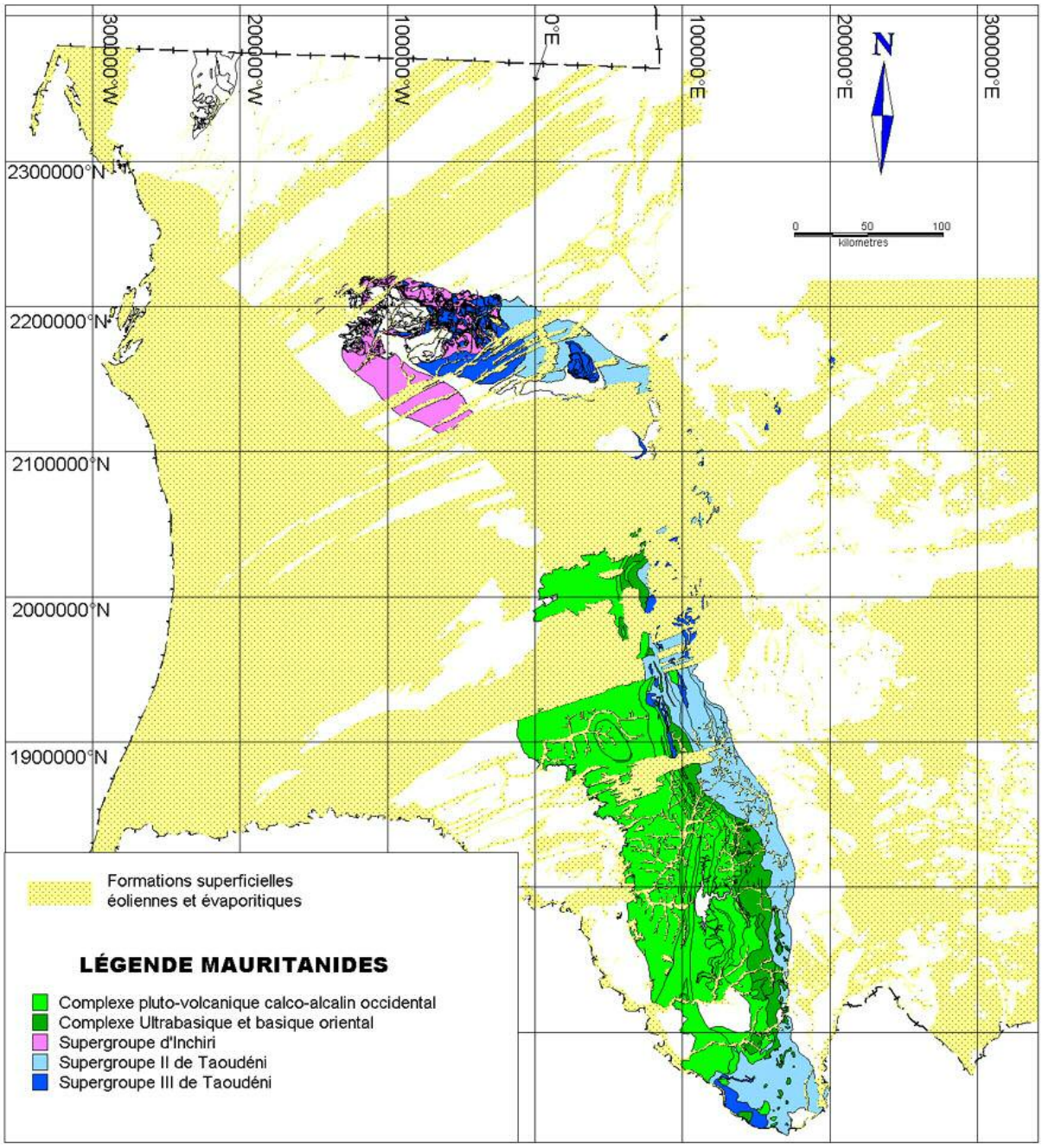

Figure 9. Geological map of the Mauritanides Range.

The **Intermediate Zone** is represented by epi-metamorphic assemblages equivalent to the upper units of the Taoudeni Basin, lying on top of meta-dacites and meta-andesites.

The occurrence of an major positive gravimetric anomaly over the Mauritanides is interpreted as the intrusion of a high density body at shallow depth. This body could correspond to an uprise of mantle rocks along the generallised thrusting og the Mauritanides Range. These features tend to support the interpretation of the Mauritanides as a suture zone between the West-African Shield in the east and a block of continental crust actually hidden under the Senegalo-Mauritanian basin. The overthrusting of the latter on the shield during the Pan-African orogen would have generated this mantle uprise.

4.5. The Coastal Basin of Mauritania-Senegal

The Coastal Basin is a passive margin basin which originated following the opening of the Atlantic Ocean. It forms a well developed continental shelf and undergoes a strong subsidence controlled by the marginal normal faults of the Atlantic Basin. Sedmentary deposits range from Trias to Quaternary. The basinal stratigraphy is somewhat disturbed by the intrusion of salt domes which perforated the sedimentary structure of the continental shelf during the upper Trias - lower Lias. The offshore exploration work currently carried out led to the discovery of two oil fields which should enter production starting 2005.

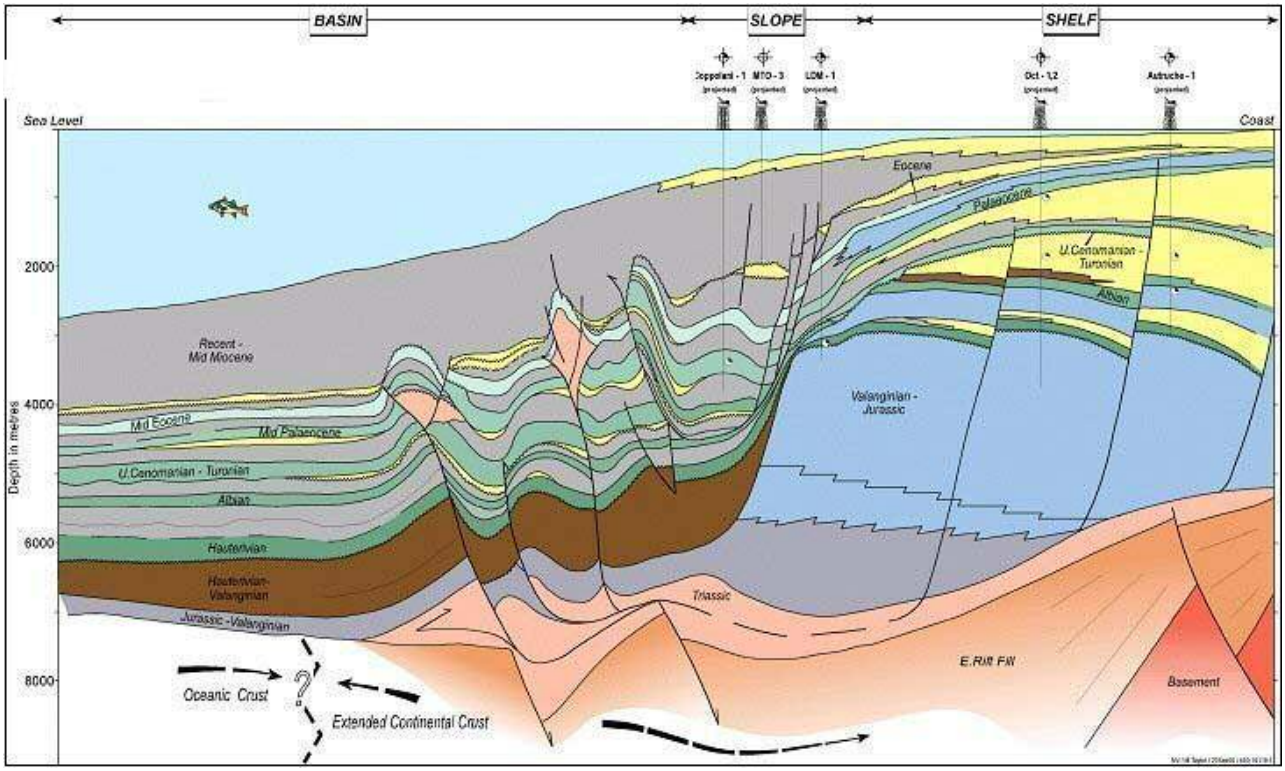

Figure 10. Composite cut W-E across the western range of the Coastal Basin.

5. ECONOMIC GEOLOGY

Mauritania is fortunate to have a favourable geological environment for a large variety of minerals. Presently, mining is one of the most important sectors of the national economy, with an iron mining industry contributing up to 12 % of the Nations's PNB , and representing more than half of the export incomes of the country.

The mining sector in Mauritania is currently in a growing process. Measures adopted by the Mauritanian Government to promote the growth of the mining sector start to bear fruit. The quantity of foreign companies applying for prospecting licenses is constantly growing, and there are currently in Mauritania projects at various development stages, ranging from grass-root exploration up to mine development.

Large multinational exploration and mining groups work or have recently worked in Mauritania, among them Ashton Mining (Group Rio Tinto), Rex Mining, Diamet (Group BHP Billiton), Rio Narcea and de Beers. However, a growing quantity of junior companies joins exploration efforts. Gold and diamonds are the main target products, but there is also sustained interest in base (Cu, Pb, Zn) and industrial (iron) metals.

The actual of resources inventory of Mauritania is listed in the following table.

COMMODITY	IDENTIFIED RESOURCES
1. Iron ore	reserves secured on January 1st, 2001
❍ Naturally rich concentrates	❍ 185 million tons
❒ Kediat d'Idjil	❒ 85 million tons
❒ M'Haoudatt	❒ 100 million tons
❍ Ferruginous quartzites	❍ 60 million tons
❒ Guelbs (Rhein, Arwagen and Merizet)	
2. C**opper minerals** (Mine Moghrein)	22.6 million tons
3. Phosphates (Bofal-Loubboira)	160 million tons
4. Gypsum (Ndrahamcha)	9 million tons
5. Salt (Lekcheime)	120 million tons
6. Sulphur (Cuprit)	In excess of 1 million tons
7. Peat	0.4 million tons
8. **Gold** (Tasiast Mine)	30 tons
9. Ornamental stones:	Several sites have been identified and are being mined by « Granites et Marbres de Mauritanie » (subsidiary of **SNIM)**.

In addition to the above mentioned products, several exploration programmes are under way for other minerals, mainly - diamonds, chromium, Platinum group elements (EGP), REE, gemmes and hydrocarbons. For the latter, Mauritania is currently going through a real "black gold rush", after the discovery of several oil and gas deposits in the Coastal Basin off-shore.

5.1. Iron, Titanium and Manganese

Mauritania's mining sector has always been lead by the exploitation of the Tiris iron mine, where operations started in 1963 in Kedia d'Idjil, R'Gueïbat Belt. The National Industrial and Mining Company (SNIM) ensured operating continuity. However, the iron deposits were most likely identified and exploited in Mauritania since Antique times.

In the Idjil complex, there is a clear distinction between high grade hematite mineralisation and the sedimentary hematitic iron formations (BIF). The former are nearly exclusively found in the Tazadit unit, where mineralisation is concentrated in the central and upper parts of the sequence by replacement of hematitic BIF. The age of iron formations in the Idjil complex is 2.1 Ga. The average grade of the BIF is 38 % Fe (46 % Fe_2O_3) and 51% SiO_2. This contrasts with the hematite crude ore with average grade of 65 % Fe. The BIF grade is highly variable, ranging from 16 to 62 % Fe_2O_3. Nearly all the Tazadit sequence contains ferruginous quartzite, but the highest concentration of iron formations is found in the central and upper sequences of the Unit.

The mineralogy of the BIFs may be subdivided into 3 paragenesis:

- quartzite + hematite ± magnetite ± chlorite
- quartzite + hematite ± magnetite ± green blue-amphibole
- quartzite + hematite + magnetite + aluminous ferro-actinolite

Associated meta-sedimentary rocks assemblages reveal that metamorphic peak reached the amphibolite facies (biotite, garnet and staurolite), followed by a phase of retromorphosis in the talc-chlorite green-schist facies.

The iron ore reserves are estimated to be 185 million tons of hematite ore, ranging from 60 to 68 % Fe and 660 Mt of lower quality magnetite ore ranging from 36 to 40 % Fe. SNIM is actually the only iron concentrate producer in the province of Tiris, producing in excess of 12 Mt of iron concentrate per year; the majority of this production is exported toward Europe. At the moment, iron ore is produced from 5 deposits: Tazadit T014, Tazadit T5/6 (2 small open-air mines) and Seyala in the Kediat Ijil area; M'Haoudat 2 and 3; and Guelb el Rhein.

The Australian company Sphere Investments is a new competitor, being interested in the Guelb el Aouj deposits located close to the currently exploited deposits of SNIM, about fifty kilometres north of Fderik. The deposits at Guelb el Aouj are estimated to yield some 500 Mt of magnetite ore.

The exploitation of iron ore which is actually carried out by SNIM, started during the era of French colonialism in the area of Zouerate. The ore is extracted from open-pit mines (effectively real ore hills, the Guelb) and transported to the Nouadhibou harbour terminal by railway through the desert over more than 600 km, along the Western Sahara border. The bulk-ore train is one of the World's largest ones, comprising three rail engines and about one hundred carloads with a weight of several thousands of tons.

Figure 11. SNIM mineral train between Zouerate and Nouadhibou.

SNIM was founded in 1974 after the nationalisation of the Mines de Fer de Mauritanie (MIFERMA) which was founded in 1952 to exploit the iron deposits in the area of the Kedia d'Idjil massif near Zouerate. The Government actually holds a 78 % share in SNIM, and the remaining between five Arabic financial and mining organisations. It actually stands as the seventh largest iron ore production company in the world.

A new player in the Mauritanian mining sector, the Australian company **Sphere Investments**, signed an agreement with SNIM for the development of the gigantic magnetic iron deposit of Guelb el Aouj in the north part of Mauritania. Located 35 km away from the Tiris mine, this deposit yields a currently estimated resource of 225 million tons of magnetite. Mining will be open cast at a rate of 18 million tons of iron ore per year, and a treatment factory will be built. The actual infrastructure of SNIM will allow the transport of iron concentrates by railway to Nouadhibou harbour at the Atlantic coast.

The geological environment of Mauritania, in particular its Archean and Proterozoic crystalline massifs, the abundance of sandstone formations and the existence of titaniferous resources in the littorial sands in Senegal also give every reason to believe that there is a titaniferous potential in Mauritania. Studies of the black sands of the Atlantic coast of Mauritania in the middle of the past century showed a certain potential of titanium in the form of ilmenite: grades ranging from 2.5 to 4 % TiO_2 were reported in deposits reaching up to 2 million m³ in the area of Cap d'Arguin and the Lemsid Dunes north of Nouakchott.

A titaniferous mineralisation with grades of 14 % was also reported in the sands of Assaba, in association with Zr, Nb and Ta.

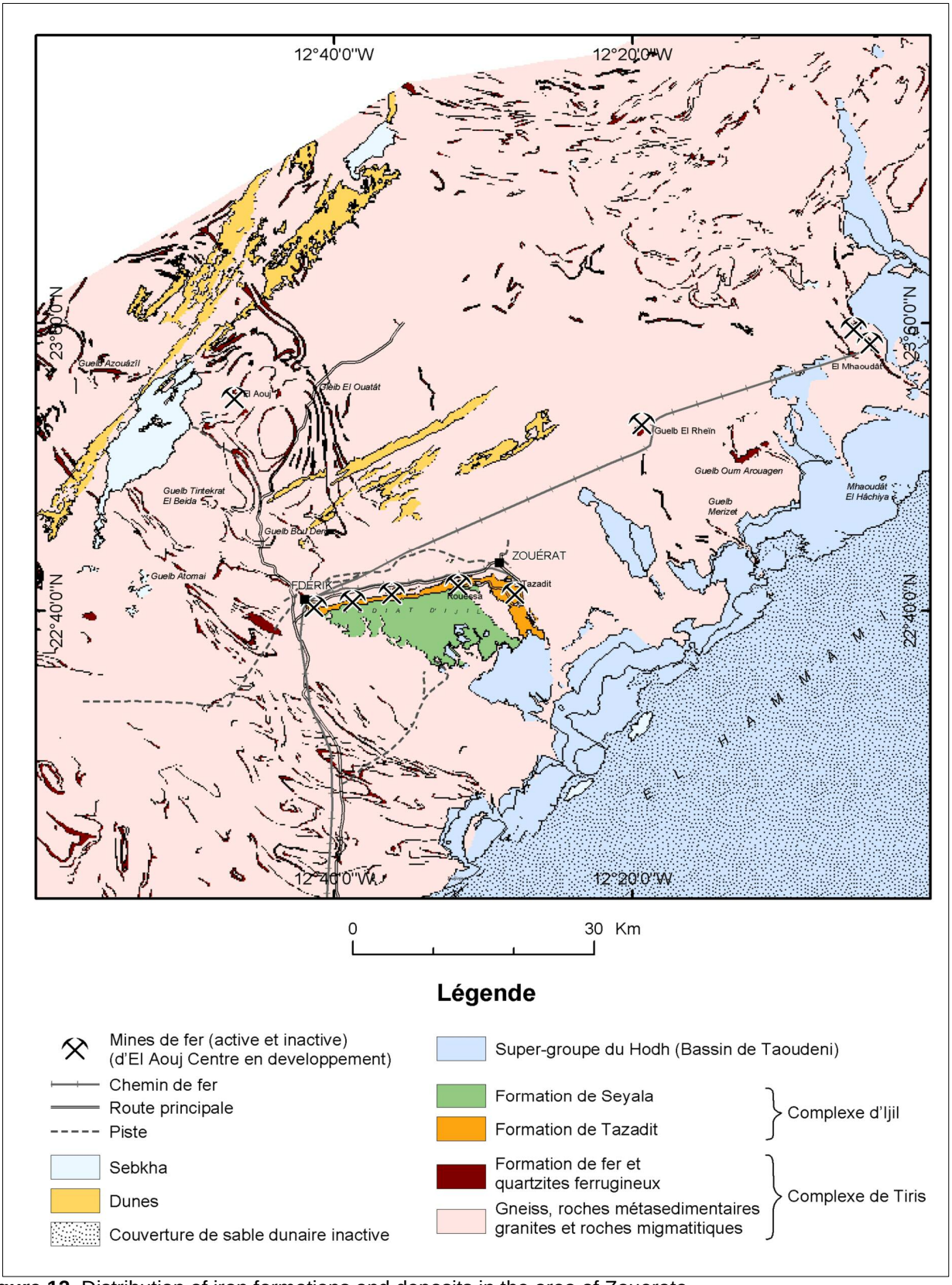

Figure 12. Distribution of iron formations and deposits in the area of Zouerate.

5.2. Gold

There are actually two gold deposits in Mauritania: the **Tasiast** gold and the **Guelb Moghrein** Cu-Au deposits in the Akjoujt area. The Tasiast gold deposits, located in the western Archean part of the R'Gueïbat Ridge are directly associated to ferruginous, strongly deformed quartz horizons and cut by a network of quartz-carbonate-sulphides (pyrite-pyrrhotite) veins. The development of this one million ounces gold deposits (30 tons) are actually being developed, and production is intended to start in 2006.

In the Guelb Moghrein deposit, the gold is associated with superficially oxidized cupriferous or primary sulphide mineralisation. This deposit has already been exploitated in the past, and a reactivation project is being carried out.

In the R'Gueibat ridge, in addition to the numerous gold occurrences, a number of areas with remarquable gold potential were identified. They are:

- ***Seven large shear zones*** potential hosts to contemporaneous to late orogenic fault-associated mineralisation (Au, Zn, As, Sb, Cu, Ni, Co),; the most prospective shear zones show associated siliceous and pyritiferous alteration zones and gold anomalies in rocks or regolith.
- ***Gleïbat Tenebdar granitoids*** (Tenebdar – Legleya) representing a potential for polymetallic mineralisations (Au, Ag, Cu, Sn, W and Sb), controlled by granitoids. The discovery of silica-muscovite "greisens" and epi-syenites supports this type of mineralisation.
- ***Late acid volcanic belts*** of Legleya and Imourène – Alous Tmar and the volcano-sedimentary belt of Aguelt Nebkha where the large silicious and pyritiferous alterations recall **epithermal mineralisations.** No existing mineral occurrence is presently associated.
- ***Detritic sandstone-conglomerate formations*** of epiclastic character which occur in some volcano-detritic Paleoproterozoic belts could contain gold (and diamond) mineralisation of the **paleoplacer** type in syntectonic marginal basins (example: Kawere Group in the basal Tarkwaien, and monogenetic gold bearing conglomerates of the Banket Group in Tarkwa, both in Ghana).
- The birbirates of the Archean shield yield local evidence for a residual gold-enrichment (and Ni, EGP).

The potential of mesothermal gold is well-founded on the level of the large **NW-SE shearing of Florence-el Khdar**, where exploration work carried out by Ashton on a 200 km-long segment confirmed gold bearing potential. This tectonic structure which shares similarities with the West African D2 strain zones, major host to gold deposits and occurrences, deserves to be prospected for gold on its full extent.

Two more gold-bearing mineralisations are suspected to occur in the Taoudeni Basin. These are Carlin- and Witwatersrand-type mineralisations. The Carlin-type or gold-bearing sedimentary deposits are among the World's most important gold deposits, with respect to their size and low exploitation costs. They include stratiform and concordant disseminated gold deposits, and heterogeneous, discordant, brecciated deposits in carbonated siltstones. Gold is often associated with pyrite and arsenopyrite sulphide mineralisation. The environment of this deposits corresponds to continental platforms undergoing extensional tectonics (normal faults), subsequent thrusting and granitic intrusions.

Witwatersrand- or paleoplacer-type gold deposits consist of pyritic horizons in late Archean to lower Proterozoic quartz-pebble conglomerates or sandstones. These are major gold sources in the Witwatersrand Basin of South Africa and the Tarkwa Basin in Ghana, but also of uranium in the Elliot Lake District in Ontario (Canada). They are proximal fluvial or deltaic gravity concentrates along the margins of intracratonic sedimentary basins.

5.3. Other Precious Metals (Ag, EGP)

The silver potential areas of Mauritania are directly associated with the gold and base metal potential areas where silver is associated in Au-Ag or Pb-Zn-Ag deposit types.

Concerning the platinum group metal (PGE) potential for which only one supergene occurrence is recorded in Mauritania, in most cases these metals are associated with sulphide mineralisation containing Ni, Ni-Co and Ni-Cu or even chromium, and to mafic-ultramafic rocks. As a result, the main potential targets for such mineralisation are intracratonic complexes of subalkaline to komatiitic mafic-ultramafic compositions.

In the syn-orogenetic Alaska-Oural-type massifs of the Archean domain, mineralisation occurs either as titaniferous magnetite accumulations or as nickel-sulphide sub-products in chromatite horizons.

Rex Mining's work in the Tenoumer area showed that supergene alteration concentrated primary Cr-Ni-EGP content of mafic-ultramafic rocks up to economic to sub-economic grades.

In the Paleoproterozoic domain, several stratified mafic-ultramafic ring complexes, highly magnetic, with disseminated iron sulphides and associated aplite-pegmatite, constitutes a second mineralisation with PGE, Cr, Ni, Cu, Au potential.

The occurrence of anorthosite to gabbronoritic complexes in the granulitic assemblages of the R'Gueïbat Ridge renders the domain a favourable target for the search of Voisey Bay-type deposits - nickel primary and PGE sub-product, - but also Lac-des-Iles-type palladium deposits.

5.4. Chromium and Nickel

Chromium and nickel mineralisations (+/- Co, EGP) are generally associated with mafic-ultramafic rock assemblages. Chromium occurs generally in the form of stratiform chromite segregations in large mafic-ultramafic stratiform complexes (Bushveld, Stillwater, Great Dyke, etc.) or as podiform deposits associated with ophiolitic complexes (Antalya, Oman, Thedford Mines, etc.). Nickel may alternatively occur as primary sulphide deposits (massive or disseminated sulphides), associated to mafic-ultramafic magmatic complexes (generally at the margins of the intrusions) or as secondary alteration products - lateritic nickel - by residual nickel enrichment of mafic-ultramafic rocks containing nickel-rich olivine (mainly in the case of ophiolites).

The Mauritanides Range is characterised by the occurrence of ophiolites, with ultramafic facies and chromite lenses of sub-economic size. Two main copper-iron gossans of significant size, are documented in the area: Kadiar and Diaguili. The Kadiar deposit corresponds to a magnesium-carbonate and Cu-sulphide (pyrite, chalcopyrite) lense, superficialy oxidized with traces of Co-Ni and Au. The copper grades are close to 2 % and the metal resource identified in the 1970s is about 15,000 tons. The Diaguili deposit located in the far south of the range is of comparable size, context and type. These two deposits have often been compared to the Bleida deposit (Bou Azzer, Morocco) and compared to the Gabou deposit in Senegal.

5.5. Base Metals (Cu, Pb, Zn)

In the Archean domain, the supracrustal formations are under-explored from the massive sulphide exploration view point; its potential is still untouched. In the Paleoproterozoic domain, the more complete and well exposed **Tsalabia el Khadra** belt, showing numerous indications for volcano-sedimentary or exhalative-sedimentary mineral potential, appears most promising. Although less documented, the **Ghallamane** and **Aguelt abd el Maï** belts offer a similar potential, and similarly in the east, the Aguelt el Fersig area in the **Blekhzaymat** belt.

The ***Tsalabia el Khadra belt*** is characterised by a classic volcano-sedimentary complex (magnetite-hematite cherts, carbonates, partly siliceous or carbonated and manganese-garnet-bearing black siltstones, amphibolites, mafic sub-aqueous metavolcanics), and a volcano-detritic assemblage, characterised by a sanstone series with conglomerate intercalations of continental influence. Numerous Mn occurrences are known, some of which including indications for gold and poly-metals (Au ± As, Cu, Ag or Mn ± Au, As, Cu) mainly in the chert and hematite ± magnetite ± secondary Mn-minerals-bearing quartzite facies. These occurrences compare to those hosting the volcanogenic massive sulphide Zn-Ag Perkoa deposit in Burkina Faso.

Taking into account regional and local metallotects in the Neoproterozoic of the **Taoudeni Basin**, known mineral occurrences, age and deposit-models of ore deposits associated with comparable environments, the infra-Cambrian is propective for Cu, Pb-Zn and REE, ± Nb, Ti, Zr, U, Th. Two potential types of mineralisation are identified:

- **Copper** deposits in the pelites, sandstones, carbonates, with chalcosite and native copper, including cupriferous shales, and conglomerates and cupriferous sandstones (red bed), but also continental basalts in connection with rifts and their derived conglomerates. These mineralisations occur in extensional, intracratonic basins often in association with mafic volcanism.
- The **Pb-Zn-F** deposits of the sedimentary cover: base-metals are abundant in the lower levels of the sedimentary cover. These mineralisations occur in intracratonic basins, even rifts, in the marginal zones of stable or epi-orogenic platforms, in the occasional presence of alkalic magmatic activity (Morocco). Often associated with particular facies (karsts, salt domes, reefs), these deposits are commonly hosted by dolomites.

The Taoudeni Basin offers a potential for Mississippi Valley type (MVT) deposits and stratiform sedimentary copper type. It is a deep basin, submitting large volumes of rocks to the interaction of hydrothermal fluids. There are numerous similarities with the copper deposit environment in the Zambian Coppper Belt.

5.6. Tin and Tungsten

Until now, limited tin or tungsten occurrences have been documented in the mineral inventory of Mauritania.

In the eastern part of the R'Gueïbat Ridge, close to the Cu-Pb occurrences of the BIA zone, the Bou Ameina Pb and Sn occurrences are related to silica, muscovite "greisens" and episyenite, according to recent mapping results.

In the west, Aneinat-Tourassin granite area yielded an anormal, hardly explained value for Sn (875 g/t), at the contact between two granites.

A single tungsten occurrence has been discovered so far: the Tabrinkout wolfram occurrence close to Akjoujt. Grades in the range of 30-35 % of WO_3 have been reported in quartz-carbonate veins (ankerite and quartz) in calc-chloritoschists and chlorite schists of the Mauritanides.

5.7. Rare Earth and Associated commodities (Nb, Ta, Be, Li)

5.7.1. Rare Earth (REE) and Rare Metals (RM)

Rare Earth Elements and rare metals record increased usage in the high-tech industry, resulting in increased demand for these commodities. There are few occurrences of rare earth, and they are spread over the entire territory. They belong to the following three main types:

- Occurrences associated with alkalic to hyper-alkalic suites
- Occurrences in the Ordovician
- Occurences in beach sands

5.7.2. Occurrences associated with alkalic to hyper-alkalic suites

These occurrences are associated to sulphide, fluorite and barite-bearing alkalic to hyper-alkalic granites. They are located in the north of Mauritania, in the R'Gueïbat Ridge.

The subvolcanic Bou Naga alkalic complex, Precambrian suite containing syenite, rhyolite and volcanic breccia supports a sub-economic vein-type mineralisation of Y (4 %), F and Th (1 %). These metals are expressed in the form of xenotime, rutile, zircon, fluorite, barite, poly-morphite, jarosite, hematite and thoride. The grades of the mineralised zones are sub-economic, but known reserves are very limited. On the other hand, it must be noted that this suite is poorly documented from ancient data.

In **Tingsmat el Khadra**, the hyper-alkalic granite shows a magmatic banding and agpaitic structure with some pegmatite lenses as residual filling (quartz, amphibolite and other ferro-magnesium etc.). It is injected a micro-veinlets in the ignimbritic sequence on top of it.

At **Tabatant**, a small massif known for its rare earth occurrence, a syenodiorite / syenogabbro including sodalite and pyrite is exposed 1 km from a magnetic anomaly with associated K, Th, U anomaly. The strike of the outcrop (N 80-90) and the association of fine-grained facies suggest a vein-type deposit intrusive in a plagioclase laths, ascicular amphibole / pyroxene, allanite, cancrinite, pyrite and sodalite-bearing granite. This occurrence is known for a NW-SE strike length of 500m, but its investigation is not finalised.

Finally, the carbonates such as associated with **Guelb Er Richat** have generally a high rare-earth and rare metals potential and are worth systematic economic exploration and evaluation.

5.7.3. Ordovician deposits

In the south part of Mauritania, the Ordovician sedimentary rocks at the base of the Taoudeni Basin and their equivalents in the north, at the edge of the Tindouf Basin, are host to a paleo-placers detritic mineralisation containing ilmenite, zircon, colombo-tantalite, apatite, monazite... This kind of occurrences in the sand and quartzite of Ordovician are known all over the world, mainly for their associated economic mineralisations of Europium-bearing grey monazite.

5.7.4. Beach sands deposits

Practically on the whole length of the Mauritanian coast, there are deposits of heavy minerals in actual or fossil littoral sands. These heavy minerals were checked for their ilmenite content, but really no particular attention was paid to the base minerals of rare soils and rare metals. Monazite is indicated, but has never been evaluated, neither with respect to quantity nor to quality.

5.7.5. Niobium (Columbium) & Tantalum

The niobium and tantalum occurrences are generally associated with more significant rare-earth (REE)occurrences. Three types of deposits are documented in Mauritania:

- Nb and Ta in pegmatitic massifs: occurrences discovered so far are small and associated with R'Gueïbat Ridge Archean rocks. They have only been worked by explorers when REEs or beryl was associated such as at Knefissat, for example.
- Nb and Ta in the Ordovician sandstones: this is the same context than for the Rare-Earth mineralisation.
- Nb and Ta in the beach sands: deposits of heavy minerals are present in the actual or fossil beach sands along the entire Mauritanian coast. Their colombo-tantalite potential must still be evaluated, but exists most likely.

Another potential source of colombo-tantalite concerns the intrusions of carbonatites found by diamantiferous exploration and recent geological mapping. The central region of Mauritania, between Richat and Bou Naga, is characterised by the occurrence of intrusive veins of carbonatites which are apparently connected to the intrusion of the Guelb Er Richat dome. Carbonatites are rarely isolated, and it is very likely that other such ocurrences will be found in the near future. Considering the Nb resources associated with the Monteregean hills plutonic suite of Quebec, pendant of Mauritania in North Amrica during the north Atlantic Ocean rifting, and of same Cretaceous age as Guelb er Richat, a Nb potential and rare earth is associated to this area.

The recent increase for tantalum demand in the high-tech industry make the exploration for this potential a priority in Mauritania.

5.8. Radioactive substances

The exploration work for uranium has been carried out in Mauritania since 1959 by CEA, Total and Minatom, mainly in the R'Gueïbat Ridge and the Coastal Basin.

Known guide marks are exclusively situated in the R'Gueïbat Ridge, from Tasiast in the west part up to Yetti in the east (Fig....). They belong to two types:

- The primary disseminated uraninite and pitchblende or as crack filling occurrences in the potassic syenite, rhyolite and granite facies. They can bear locally high grades, but are discontinuous and of limited extension.
- The sedimentary occurrences of sedimentary continental cover (conglomerate, sandstones, calcrete). Uranium commonly associated with iron or gypsum occurs in the form of phosphates and vanadates (yellow products). Mineralisation has the same form as in the economic Yellirie deposits exploited in Australia.

The kind of lithologic accumulations in the sedimentary basins of Taoudeni and Tindouf also indicates a uranium bearing potential; first of all, due to the large quantity of conglomerate and sanstone detritic formations. The main source of these deposits is the R'Gueïbat Ridge with its crystalline formations in which a uranium bearing potential has been documented. Finally, the frequency of discontinuity of these formations in crystalline accumulations, and in particular the granitoids, is also a reason for supposing the possibility of uranium bearing catching material of stratification discontinuity (Athabasca type).

5.9. Gems, Precious and Ornamental Stones

Kimberlite occurrences and **diamond** discoveries are common all over the West African shield - Niger, Mali, Liberia, Sierra Leone, Guinea, Ghana, Ivory Coast - but also in the mobile belts which surround it as in the Algerian Hoggar.

In Mali, in the diamantiferous province of Kenieba, the closest one to Mauritania, the kimberlites cross the basement and the overlaying sandstone cover. The maximum extension of this province along its N-S strike is 120 -140 km, comparable to the Sierra Leone and western Liberia province.

At last in middle of the 1990s, several companies showed interest in the diamond potential of Mauritania: among them REX Mining, Ashton Mining, De Beers, BHP and DiaMet. REX Mining was the first one to discover kimberlites and diamonds in the north of Mauritania.

According to REX, two kimberlite provinces were discovered in the north of Mauritania, and would be controlled by a major structural lineament striking SW-NE, close to the northern margin of the Taoudeni Basin. The western kimberlite cluster is said to be close to the Guelb Er Richat dome. The eastern field in which twenty kimberlites were identified, among which six diamond-bearing, is located east of Tenoumer. These kimberlites are of Jurassic age and belong to a deeply eroded hypabyssal facies. None of the occurrences found up to now are economic, but exploraiton is actively going on.

The kimberlites occur as dykes (300 m to 7 km extension, 0.25 to 5 m width), isolated or in clusters (1 to 4 dykes per cluster), with or without local swelling (up to 50 m diameter) and in small pipes (80 to 100 m diameter). They were identified on the basis of remote sensing studies and aeromagnetic surveys, followed by soil and exploration pit sampling. The best grade obtained so far is 0.4 ct/t for about ten stones.

The Archean R'Gueïbat Ridge belt yields a diamantiferous potential, confirmed by the late discoveries. But the slightly magnetic kimberlites, coupled to the large amount of recent, mainly eolian sedimentary cover increase the difficulty of locating the intrusive kimberlite bodies. It is more than likely that continued exploration effort will lead to the discovery of other kimberlites, and, very probably, economic diamantiferous resources.

The occurrence of **beryl** and **tourmaline** is reported in the Amsaga and Tasiast pegmatites. The search for beryl resources has only focused so far on it being a BeO resource from the view point of its industrial use. However, an evaluation of the gem potential of these pegmatite formations has never been carried out. This potential could also be valid for the derived detritic sedimentary formations as placers and paleo-placers. The same analysis is valid for **garnet** and **corundum** in the Archean to Proterozoic metamorphic and granitic assembalges, and their derived placers, for the potential of gem garnet and sapphire-ruby.

5.10. Phosphate and Salt

Salt has traditionally been exploited in the N'terert (Trarza) and Sebkha d'Idjil (Tiris) brine sumps. Currently, SOMISEL and local promoters hold a salt exploitation permit at the brine sumps of Lekcheime, north of Nouakchott. Current salt resources amount to 120 million tons.

Gypsum bearing horizon are associated with the salt occurrences. North of Nouakchott, in the Sebkha N'Dramcha area, gypsum is found in two forms: 1) Stratiform beds of compact gypsum; 2) gypsum dunes. A gypsum deposit having a purity in excess of 95 % is being exploited by the SAMIA company in Sebkha N'Dramcha. As for salt, the economic feasibility of such mineralisations does, of course, depend on the nearby consumer markets and the transport network.

Sedimentary **phosphate** deposits occur usually in the **Taoudeni Basin** formations. The host rocks are mostly the Neoproterozoic Jbeliat and Teniagouri groups in the Adrar area, but smaller deposits are found in the Atar and Assabet el Hassiane Groups. The Adrar deposits, north and west of the Taoudeni Basin, are systematically associated with fine grained carbonate and silicious sedimentary beds, immediately above a glacial episode characterised by the Jbeliat Group tillites. Such occurrences of ill-defined potential are known elsewhere in the West African shield where they may form considerable deposits with several hundred

million tons of resources (Volta Basin). The Dedougou-Nouna deposit in Burkina Faso is estimated to be 10 billion tons, and similar deposits are known in Benin and Niger. Important phosphate resources were also found in Senegal in the Thies area.

However, the main source of phosphate mineral is the **Coastal Basin** which includes phosphate-bearing beds in its Eocene series, between the Gorgol sandstones and the Continental Terminal (CT), in the Bofal-Loubboïra area. They consist of sand, clay and sandstone with abundant phosphate component, consisting of pellets (70 - 80 %), lithoclasts (10 %), bone fragments and coproliths. Apatite grains appear as secondary recrystallisation.

Clearly, the Coastal Basin is the main exploration target for these commodities, due to its geological context, but also its proximity to large cities (Nouakchott, Nouadhibou, Rosso), to the road network and to the coast. The Taoudeni Basin, given its access and distance to potential markets, is a lesser priority target for the exploitation of these mineralisations.

5.11. Materials (Ornamental Stones, Limestone, Aggregat, Gravel, Sand...)

5.11.1. Ornamental Stones

Marble and banded grey-white and green diopsid-bearing cipolin, associated with the Archean and Proterozoic R'Gueïbat Belt formations, have a certain visual appeal as ornamental stones after cutting and polishing. Other potential ornamental lithologies have been identified, such as anorthosite, gabbro, some granite or syenite, and possibly stromatolite-bearing limestone and dolomite. The exploitation of the deposits will surely again depend on the proximity to transport infrastructures, and, above all, to the bulk-ore railroad of Nouadhibou - Fderik.

The proximity to Europe, the access to the ocean and the lack of thick weathering profiles are very favourable points for the development of an "ornamental stones" resource by the private sector in the form of semi-industrial mining companies.

A subsidiary of SNIM is already exploiting ornamental stones in the Archean, close to the bulk-ore railroad.

5.11.2. Sands and Pebbels

In the Nouakchott region, active exploitation of sand and shelly limestone (Nouakchottian) supplies the local building market.

An extraction quarry for sand and gravel is located north-east of Zouerate, on the road of Guelb el Rhein. The exploited material is the reg above the Neoproterozoic Agueni formation Char Group): it consists of white quartz pebbles in relatively pure sand which is sieved and classified before being shipped by truck to local suppliers or by railway to Nouadhibou.

5.12. Industrial Commodoties (Silicium, Aluminium, Graphite...)

5.12.1. Silicious Sands and Quartzites

Mauritania yields important recent sand formations in the form of dune ridges and barchan fields. This is one of the world wide known characteristics of the country for desert travellers.

Further, there are numerous sand and quartzite deposits in the various sedimentary (Taoudeni and Coastal Basin) and metamorphic (R'Gueïbat Ridge, Mauritanides) formations of Mauritania.

There has not been up to now a valid study of the silicious sand potential in Mauritania, but it is quite probable that such a potential does exist. Evaluation and marketing studies will be required to define this potential and constrain it, mainly with respect to the vicinity of transport infrastructure and potentiel consumption markets (glass and ceramics industry, abrasives, pumice bricks, smelting and aluminium foundry; ballast for sea freight, silicon and silicon carbon used in high-tech industries etc.).

From the ore deposit view point, the environment corresponds to sedimentary sand or sandstone deposited in an epi-continental context. From an economic point of view the most interesting silicious sands are sedimentary sands reworked in eolian conditions, that can be mined by excavator, in quarries without overburden. Sands of higher purity are produced by magnetic separation and flotation in order to extract heavy minerals. Very pure quartzites may also yield a significant economic potential, particularly for the production of silicon metal and ferro-silicium, glass and optical fibres.

Only one occurrence is documented in the Tiguint area, south of Nouakchott. After verification, this resource may have an economic potential due to its quality and proximity to the road to Nouakchott and Rosso. A systematic study has still to be carried out.

5.12.2. Graphite

Even though there is no actual indication of graphite deposits in Mauritania, the geological context - mainly the exposed basement – is in favour of potential economic graphite concentratioin. Potential zones of interest could be easily derived from the interpretion of recent airborne geophysical surveys and of the geological mapping carried out within the framework of the PRISM project. As a first step, the meta-sedimentary contexts should be evaluated as a priority.

5.12.3. Aluminium

The lateritic occurrences in Mauritania are limited to relicts of lateritic overburden, very discontinous in the southeastern part of Mauritania, and mainly in:

- the Tasiast region
- the Inchiri
- the Tagant
- the Hodh
- the Mauritanides Range

The residual character of laterites in Mauritania and the extensive erosional reworking of the regolith result in a very hypothetical bauxite potential. Only one bauxite occurrence is documented in Mauritania. It was described in 1954 in the north part of the Mauritanides, at Ynk dans Agan. It consists of corundum-bearing pisolitic white bauxite, of unknown extension, its reconnaissance having never been carried out.

There is another metal detection for bauxite in Mauritania, in the form of the levels of the interconnected Continental (Jurassic - Cretaceous) and Terminal (Eocene - Miocene), characterised by strong lateritic and bauxite alterations which, in other countries, are part of the world's bauxite reserves.

5.12.4. Sulphur

A sulphur deposit was discovered at Cuprit, with associated gypsum-bearing beds, in the N'Dramcha Sebkha. These are nodules of native sulphur, spread over limestone, bituminous marl and gypsum. The deposit is estimated to have a size of more than one million tons.

5.12.5. Peat

Peat deposits found between Nouakchott and Rosso correspond to accumulations of marine organic material (algae and herbs) in the inter-dune depressions, and they are buried under littoral sand and are decomposing. They contain inner layers of limestone and impure diatomaceous earth.

5.13. Fossil Fuels (Petroleum, Gas and Coal)

5.13.1. Fuel Resources of the Taoudeni Basin

The sedimentary formations of the ***Taoudeni Basin*** offer a certain number of favourable characteristics for the development and occurrence of fossil hydrocarbons or fuels:

- The lower Atar Group formations – Tarioufet and Aouleigate Formations – include organic matter- and fines-enriched units, making them good hydrocarbon source rocks.
- The dolomitic units of the Atar Group and the clastic sediments of the Nouatil and Oudjeft Group show hydrocarbon reservoir characteristics.

These source rocks are located adjacent to the gas-bearing stromatolitic limestone reservoirs from which gas recovery was demonstrated in Abolag-1 borehole.

There are some large structural horsts across the Taoudeni Basin. Among these, the North-East Rise along the Abolag-Ouasa trend defines two sub-basins: the Maqteir depression in the west and the main Taoudeni depression in the east. These are large potential reservoirs, relatively unstructured, although 2D seismic data identified large structures such as the El Mrayer Horst.

In the far south of Mauritania, a Cretaceous rift basin overlaps the Taoudeni Basin. The occurrence of this poorly known basin was interpreted from gravimetric data. The Nara Rift is a north-east striking structure with good potential, still unexplored, which crosses the southern border of Mauritania. It is likely that this structure shares certain similarities with some North African Cretaceous rifts, including those of Chad and Niger, with identified hydrocarbon potential and oil resources of several billion barrels.

The Taoudeni Basin experienced only one recent exploration period during the 1970s, when Agip and Texaxo carried out aeromagnetic surveys, seismic profiles and two boreholes:

- Texaco bored the Abolag-1 well and found gas occurrences (480,000 scf/day) in the Middle Infracambrian limestones.
- Agip drilled the Ouassa-1 well, without success.

In spite of the gas recovery at Abolag-1, no further oil exploration has been carried out since 1974.

The characteristics of the sedimentary sequences of the Taoudeni Basin are favourable to the occurrence of hydrocarbons given that hydrocarbon source rocks, potential reservoirs and structural traps are present. The Taoudeni Basin was under explored in the past, but increasing interest is shown by international oil companies in order to re-evaluate the potential, and production-sharing agreements were signed recently.

5.13.2. Fuel Resources of the Coastal Basin

The Coastal Basin of Mauritania is a passive margin basin. It belongs to a series of basins developed alongside the east Atlantic margin, following the oceanic rifting. Two mega-sequences with hydrocarbon potential were identified inside the basins of the West African coast:

- **The Upper Trias - Lower Jurassic syn-rift sequence:** This sequence includes terrigenous detritic sediments, overlain by evaporitic deposits (salt, among others). This interval comprises hydrocarbon source rocks known both sides of the Atlantic in association with evaporites. Seismic data reveal block-faulting in the on-shore area. Evaporites and halite represent a transitory phase between the rifting and continental drift phases.
- **The Middle Jurassic - Tertiary post-rift sequence**: This sequence includes the marine Cretaceous hydrocarbon source rocks known all over the World, alongside most of the West African margin, and yielding oil reserves of several billions of barrels in Southwestern Africa. Salt domes – potential traps - are well identified on t Mauritania's continental shelf.

The Coastal Basin has over 9 km thickness in its centre, located offshore at the latitude of Nouakchott. The Mauritanian Basin can roughly be subdivided into four main regions: the saliferous Basin, the Ral el Baida Delta, the Cap Timiris offshore zone and the Near-shore area.

Oil exploration in the Coastal Basin started in 1960. Since 1968, about 13 wells have been bored. This led to the definition of a number of important hydrocarbon anomalies in offshore wells, within the sedimentary sequences of the Atlantic basin. Exploration in the offshore basin was delayed, but with the development of the exploration and extraction techniques allowing drilling in deeper water, there has been a progressive increase in exploration activities. Exploration mainly concentrated on the continental shelf, with one near-shore well and three deep-sea wells. More recently actitivities started on the coastal onshore portion of the Coastal Basin where exploration activities are currently being carried out.

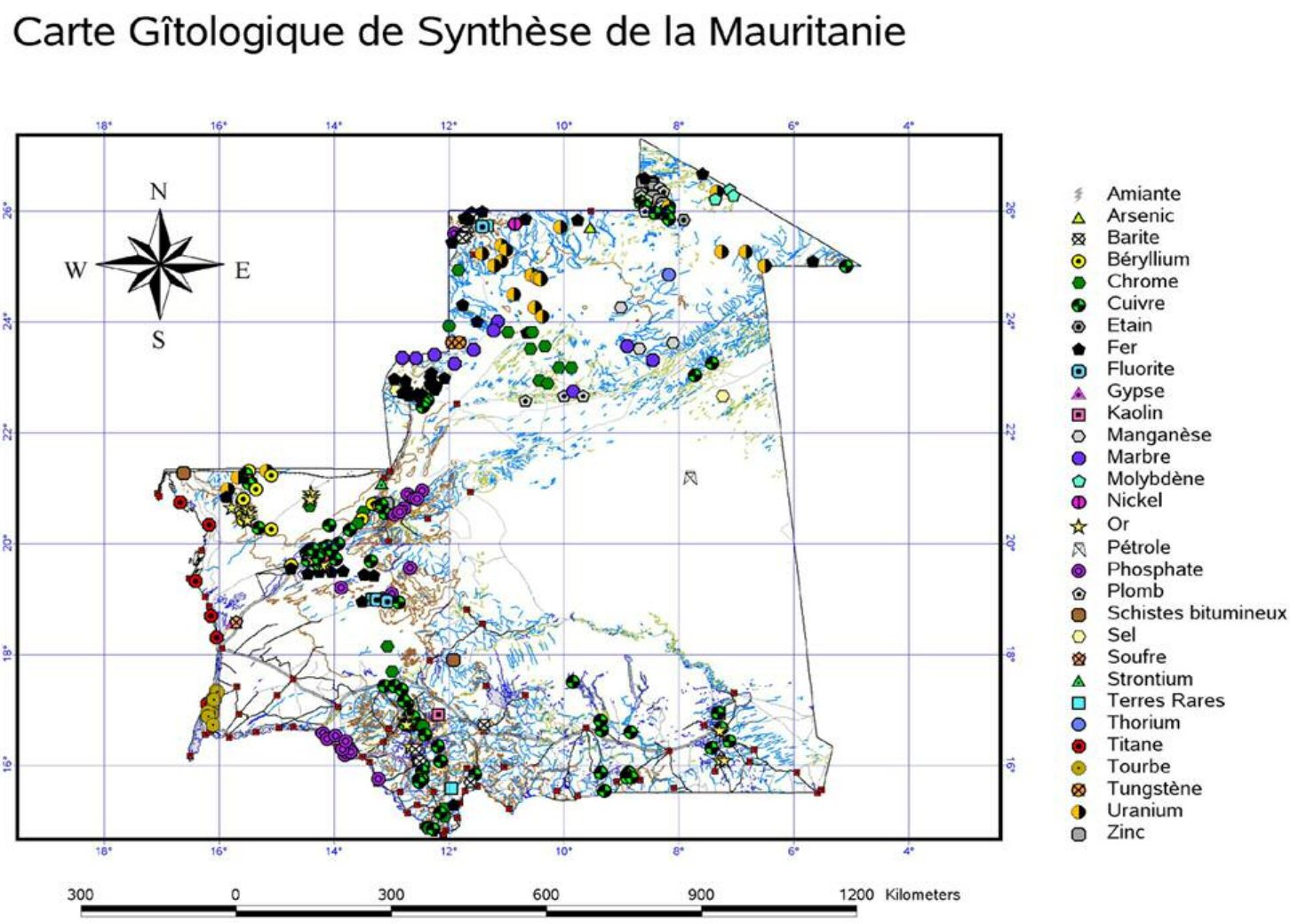

Figure 13. Synoptic mineral occurences map of the Islamic Republic of Mauritania.

6. RECENT EXPLORATION RESULTS

Even though the mining potential seems to be rich and varied (more than 300 mineral occurrences have been registered), recent exploration activity mainly concentrated on oil, gold and diamonds and is lead by about twenty mining operators in various parts of the country.

The research work revealed a number of significant mineral occurrences for a variety of commodities: iron, copper, gold, gypsum, phosphate, salt, diamonds, platinoids, nickel, ornamental stone (granitoid, marble and slate), black sands, kaolin and peat.

It is important to state that Ashton detected a diamantiferous kimberlite in one of its permits for which evaluation studies are currently being carried out.

Some occurrences yield an economic potential for commodities such as: cooper (Akjoujt), gold (Tasiast) and phosphate (Boufal) and are currently at an advanced development stage in the perspective of their expoitation by foreign partners.

On the other hand, a number of deposits are already or have been mined, such as iron by SNIM, gypsum by SAMIA, salt by SOMISEL and copper in association with gold at the Guelb Moghrein deposit.

As far as oil is concerned, Woodside discovered an important oil resource in the "Chinguetti offshore Oil field"; its exploitation is targeted for the end of 2005.

6.1. Tasiast Gold

The Tasiast gold project which actually comprises 12 exploration licenses in the Aouéouat Archean greenstone belt, was identified in the middle of the 90ies by **OMRG**. Normandy LaSource Development SAS, a subsidiary of Australian **Normandy Mining** (Newmont Group), acquired the project towards the end of the 90ies and carried it to pre-feasibility stage. Several companies took over successively (**Midas, Géomaque, Defiance Mining**) to lead the project towards the feasibility study stage. By the end of 2004, **Río Narcea** finally took over project control after the acquisition of Defiance Mining and intends to develop the project in 2005 at a total cost of 48 million US$.

The gold mineralisation mainly consists of free gold associated with BIF-type iron formations. Gold is controlled by quartz-carbonate stockwerk and veinlets associated with iron sulphides (Py-Po).

The Tasiast mine will be a 1 million ounces (30 tons) of gold open-pit mine, mining 3,000 tons of ore per day at a grade of 3 g/t gold, for a duration of 9 years. Tasiast will be the first gold mine of the Islamic Republic of Mauritania.

6.2. Adrar - Amsaga Diamonds

Initiated in 1995 by Ashton Mining and Rex Diamond Corporation, diamond exploration in Mauritania continues to be the focus of several foreign companies, including **Ashton Mining** (Rio Tinto Group), **DiaMet** (BHP - Billiton Group), Brick Capital Corporation, Franjuan and **De Beers** as well as **SNIM**.

Rex Mining started exploration in Mauritania in 1995 upon receipt of an exploration license of 100,000 km² in the north of Mauritania, covering mainly the R'Gueïbat Ridge and its southern margin. Rex carried out airborne magnetic and radiometric surveys on more than 250,000 km² and collected in excess of 20,000 soil samples. This resulted in the discovery of more than twenty kimberlites among which six contain micro-diamonds. However, none of these kimberlites proved to be of economic interest.

In 1995, **Ashton Mining** (integrated to the Rio Tinto Group in 2002) started exploration for diamonds in Mauritania, leading to the first discovery of diamantiferous kimberlites in the **R'Gueïbat Ridge** in 1998. Further work concluded to the economic diamond potential of the area. In 1999, Ashton implemented a project together with DiaMet subsequently taken over by BHP in June 2001. Until 2003, Ashton and DiaMet were associated on 19 licenses covering an area of about 224,000 km² in the **R'Gueïbat Ridge**. During the first six months of 2002, Ashton and DiaMet announced the discovery of diamantiferous kimberlites in the Maqteir license, northern Mauritania. The processing of a selected core samples resulted in the recovery of 78 diamonds and diamond fragments for a total weight of 2.86 carats.

De Beers started diamond exploration work in July 2000 after signing an agreement with Rex for the Akchar license (13,426 km² in the north-west of the country). De Beers may gain a 60 % share in the project by spending 24 million US$ or by producing a bankable feasibility study within five years. De Beers started the first exploration phase at the end of 2000 with a high resolution airborne magnetic survey, followed by a heliborne magnetic survey at a smaller scale in May 2001.

The summary of these activities shows that diamond exploration in Mauritania is now, after less than a decade of activities, is still at its very beginning, and there is little doubt that pending on the new input of geological and geophysical data by PRISM, companies interested to invest in this sector will finally dispose of an updated and more complete geoscientific database to initiate and refine their research.

6.3. Inchiri Copper (Guelb Moghrein - Akjoujt)

Discovered in 1946, the Akjoujt or Guelb Moghrein Cu-Au deposit - named after one of the deposits' guelbs - is located 4 km west of the town of Akjoujt, Inchiri area, in the Mauritanides, 260 km northwest of the capital Nouakchott.

It is an accumulation of carbonates, with copper sulphide, oxide, carbonate and silicate mineralisation, of about 350 m per 250 m extension. Mineralisation at depth being a primary sulphide mineralisation without carbonates, the superficial formations of the deposit and in particular its gossan and carbonate mineralisation were derived by a cementation-type supergene alteration process (oxidation and selective dissolution of certain mineral phases). Such processes can be associated with lateritisation.

Initial evaluation and exploration works were carried out in the 50ies by BUFIMOM (1952) and Pennaroya (1953): the resource was then estimated to be 600,000 tons of copper metal. Since that time, several potential producers held the deposit (Charter Consolidated, SOMIMA, SAMIN, GGI) in order to put the mine into operation. In 1967, Société Minière de la Mauritanie (SOMIMA) extracted the oxidised copper ore at a rate of 25,000 tons Cu per year, but the mine ceased operations in 1978 for economic reasons.

The most recent evaluation of resources gives a figure of 24 Mt of copper ore grading 1.9 % copper (oxide and sulphide) and 1.4 g/t gold. Recently, Kvaerner won the construction contract of the mine for a capital cost of about 181 million US$. More recently, a UAE company, **WADI AL RAWDA Mining,** acquired a 75 % share of the MCM (Mines de Cuivre de Mauritanie).

Figure 14. The site of the Guelb Moghrein Cu-Au mine (Akjoujt).

6.4. Bofal Phosphate

Phosphate deposits have been exploited in Senegal for several decades in formations comparable to those of the middle Eocene of the Senegalo-Mauritanian Basin. These exploitations represent up to 17 % of Senegalese exports, and a part of this production is processed locally.

With identified resources in excess of 130 Mt grading 20 % P_2O_5 in the Bofal-Loubeira area, Mauritania disposes clearly of a considerable easily extracted mineral resource, close to communication networks and, above all, access to the ocean.

Private economic operators acquired permits to develop a phosphate exploitation north of the Senegal River. Foreign investment is, however, required to develop this resource industrially and implement a local processing and transformation industry (fertiliser, pesticides, agro-food products).

6.5. Inchiri and the R'Gueïbat Ridge Cu-Ni-EGP

While exploring for diamonds in 2001, Rex Diamond Mining Corporation discovered a supergene nickel and precious metals mineralisation in the form of a gossan on its Karet-South license. The drilling of the discovery revealed an enriched horizon in excess of 20 m grading up to 0.89 % Ni and 1.64 g/t Au+Pt+Pd+other PGE.

Even though limited information has been published about this occurrence, it appears to be a supergene concentration of nickel and precious metals (gold and platinum group metals), resulting from the weathering of ultramafic rocks. The occurrence of significant grades in these rocks, strongly support potential for these metals in both supergene alteration deposits, and primary deposits realted to magmatic or hydrothermal concentrations.

6.6. Coastal Basin Petroleum

Hydrocarbon resources of the Mauritanian Coastal Basin have lately been the focus of increasing interest of a number of junior oil exploration and production companies, and more recently also by majors.

The Mauritanian subsidiary of **Woodside Energy**, the largest independant Australian hydrocarbon exploration and production company (Woodside Mauritania), has been exploring offshore the Mauritanian coastline since 1998. It operates in joint venture with partners (AGIP, Hardman Resources, Roc Oil and Fusion Oil and Gas) and has carried out seismic and well boring works.

Chinguetti-1 well, drilled in 2001 by Woodside in area B of block 4, 80 km away from the coast and 800 m deep, crossed a 115 m petroleum column confirming at the same time the petroleum potential of the Coastal Basin. Four more wells were drilled in 2002: the first two, Chinguetti-4-2 and Chinguetti-4-3, intersected 94 m and 133 m oil columns respectively, with an overlying 23 m gas column in the latter one. Since that time, the **Chinguetti** oil field was granted an extraction decision which should become effective in 2005, for a production period of 8 to 15 years at a rate of 75,000 barrels per day. The company also discovered two additional deposits, **Tiof** in the same block, and **Banda** in the adjacent eastern block.

Dana Petroleum, one of the largest independent oil and gas companies in the United Kingdom, is another player in Mauritania. It manages three offshore Production Sharing Contracts on blocks 1, 7 and 8. After carrying out seismic surveys on the entire mining blocks, Dana drilled the first wells, Pelican-1 in 2003, on block 7 and detected a gas resource of 600 to 800 bcf. There is also potential for an oil resource at depth.

Other oil companies such as Brimax Petroleum International Ltd., International Petroleum Grouping (IPG), Belhasa International, Total, etc. have expressed their interest for the offshore, as well as the onshore fossil fuel resources of the Coastal and the Taoudeni Basins.

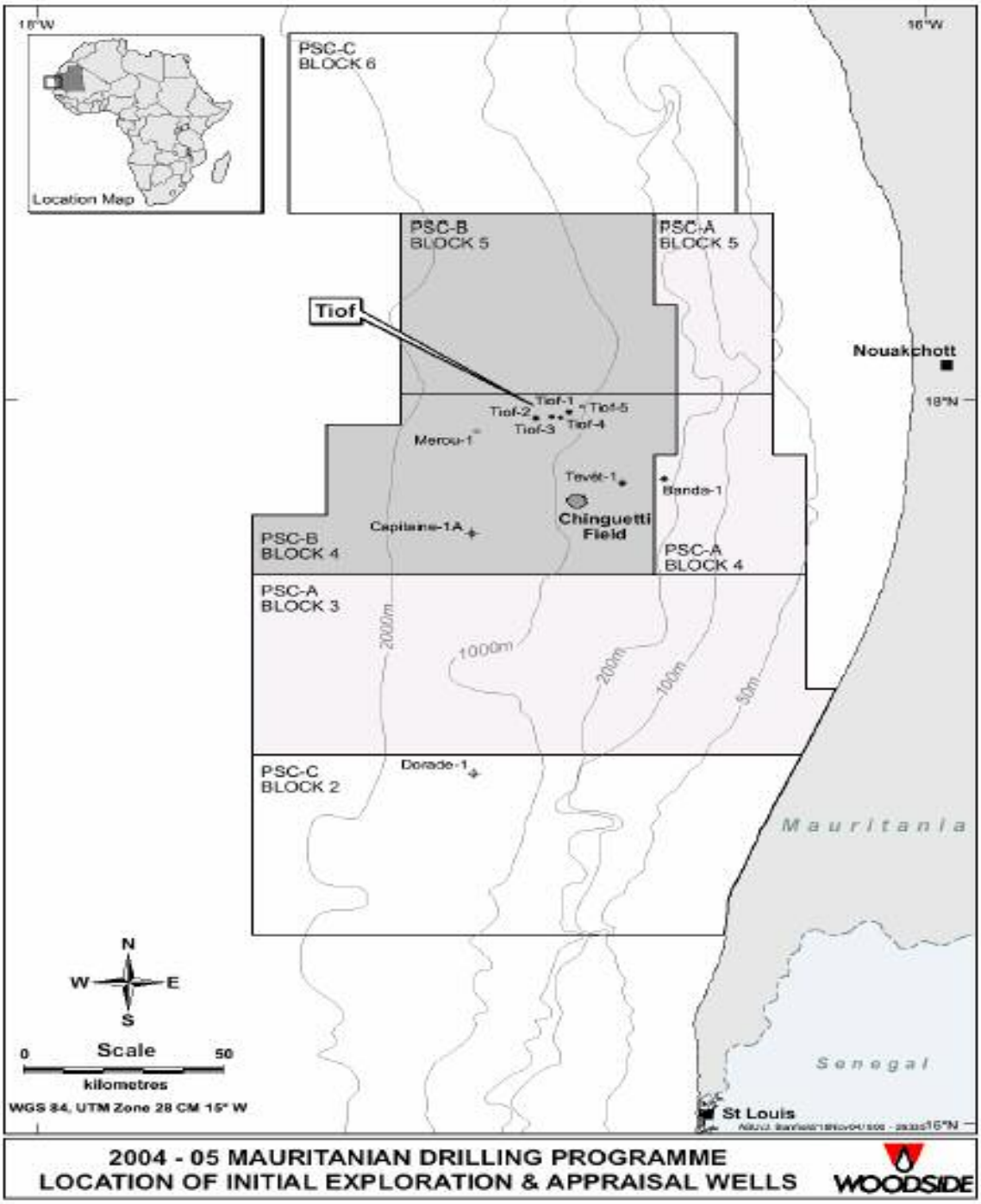

Figure 15. Location Plan of Oil Discoveries on the Continental Shelf of Mauritania.

7. THE MINING SECTOR INVESTMENT ENVIRONMENT

The investment environment for the mining sector, as well as for other economic sectors, is rather favourable, and during the latest years, public administration has made significant efforts to drive and stimulate such investments. Opportunities are numerous - for local as well as for international investments - to initiate commercial and industrial activities needed to achieve the development of the country. This investment environment is especially characterised by:

- Entrepreneurial freedom: According to the Investment Code, Mauritania guarantees every physical or corporate person willing to settle an activity on its territory, the freedom of establishing and capital investment in accordance with effective laws and regulations.
- The existence of numerous mineral resources to be mined in the country and the discovery potential for other resources at short and medium term as a result of on-going exploration and mining activities.
- Abundant, cheap and better qualified human resources due to recent efforts made by public authorities in the field of occupational training and the desire of Mauritanian individuals to improve their work skills.
- Modern communication, road, harbour and airport infrastructures developed over the latest years following important State investments in these sectors.
- The public safety and political stability of the country.
- And finally an incentive plan - including guarantees and exemptions – specific to mining investment which is a high risk activity given the high level of investments to be made as well at the exploration, than the development and production stages of mining projects.

7.1. Foreign Investment Regulations

Foreign investment regulations as covered by the Investment Code encompasses various types of activities, including activities referring to mining and oil production.

According to this code, every legally established company in Mauritania is free to:

- import all goods required for its activities
- export its products and manufactures
- establish and conduct its production, commercialisation and employment policy
- choose its customers and suppliers and fix its prices.

In addition, the Mauritanian Government grants the investors a certain number of guarantees:

- No nationalisation, requisition or expropriation measure can be taken except for reasons of public interest, on a non discriminatory basis and following a legal procedure by compensation.
- Free transfer of dividends (full amount for foreign equity companies and pro rata of the foreign equity for mixed equity companies), of foreign equity in case of cession or termination of activities, of paid compensation in case of expropriation, nationalisation or requisition, in foreign convertible currencies exempted from all fees, taxes or duties.
- Transfer of the foreign employees professional income.

Finally, the capital gain derived from the sale to nationals of corporate security or company shares corresponding to a foreign equity investment are exempted from all fees, taxes and duties.

As to the employment of expatriates, the enterprise may employ up to four foreign supervisory or management officers without requiring any approvals or permissions to work, provided that equivalent national skills are not available. These expatriate officers are granted:

- the right to import tax an duty free all their personnal belongings and a passenger car;

a personnal income taxation ceiling of 20 % of the gross amounts.

7.2. Exemption from Taxes and Customs Duties

The equipments, supplies, consummables and products of all kinds, including fuels required for the exploration of mineral commodities benefit complete customs duty, import tax, tax and fee exemptions, or exceptional temporary admission plan with suspended tax and custom duties.

This exemption remains valid until the start of permanent production as established by decree of the Minister in chage of mines, and it will continue for the first five years of production. At the end of this period, an unique 5 % rate will be applicable to all goods and products imported by the mining company and its subsidiaries and subcontractors, except for fuel, lubricants and spare parts.

Mining companies being mainly producers of mineral commodities for export will take advantage of the "Points Francs" plan, a special incentive plan for exportation. Among the incentives granted by this plan, one will find:

Custom benefits for production means (development phase):

- import of construction material, machines, tools and equipment and spare parts as well as commercial vehicles and heavy equipment, free of all fees and taxes;
- exemption of all registration and stamping fees;
- exemption of all property taxes;
- same exemptions for all equipment extensions, modernizations and renewals.

Custom benefits for mining:

- complete fee and import tax exemptions for all raw materials and semi-finished products required for production.

7.3. Profits Taxes

The profit tax rate is fixed at 25 % of profits, and the minimum flat rate tax is 2 % of the annual turnover, and consitutes a down payment on the profits taxes.

During the exploration phase, the company does not generate any profits, and is de facto exempted from profits taxes.

When entering the production phase, the mining company is exempted from taxes on profits for a period of three years.

8. INTERNATIONAL FINANCIAL RELATIONS

8.1. Monetary Facts

The national currency is Ouguiya (UM), the actual exchange rate (November 2005) is 319 UM for one Euro and about 285 UM for one US$.

The issuing institution of the national currency is the Banque Centrale de Mauritanie (BCM).

8.2. Exchange Control Regulations

Exchange control is generally rather severe, but mining sector investors and officers benefit from a special plan authorising repatriation of their dividends and profits in foreign currency.

The exchange market was strengthened in 1999 to make fluctuations more sensitive to market conditions and to limit the difference between official and parallel market rates. To ensure the convergence of the exchange rates between foreign exchange dealers, the inter-banking market and the parallel market, the authorities unified the inter-banking market and foreign exchange dealers in April 2000. The official rate is fixed every day, based on procedures defined with IMF assistance during a fixing session of the unified market. This led to terminate the multiple exchange rates practice.

Since September 2000, the Mauritanian nationals are allowed to hold foreign currency deposits, for which interest is paid at market rates. Further, the share of export profits in foreign currency, other than those from mineral products, which the exporter may keep at their disposal, was carried to 100 % in December 2000 and for an unlimited period of time.

8.3. Financial Guarantees

The Mauritanian Government guarantees the holder and mining company free movement of invested capital and corresponding capital gains, and in particular:

- Free conversion and transfer of funds intended for the payment of foreign currency debts (main debts and interests), to foreign creditors and suppliers;
- Free conversion and transfer of net profits to be paid to non-Mauritanian associates and of all amounts intended for the reimbursement of all funding the holder and the mining company received from non-Mauritanian institutions and associated companies;
- Free conversion and transfer of profits and equity resulting from the liquidation of assets; and

Free conversion and transfer by the foreign personnel employed by the holder and the mining company of savings on their salaries, funds resulting from the liquidation of investments in the Islamic Republic of Mauritania or the sale of their personal belongings.

9. BIBLIOGRAPHY

The bibliography covering geology and the mineral resources in Mauritania is abundant; it can be referred to in the libraries of DMG and OMRG. Note also that SIGM disposes of a bibliographic, geo-scientific and mining data bank; part of this can be consulted in digital format (pdf).

We only list below general references and those resulting from recent projects, and in particular those which were carried out within the framework of the PRISM project:

BLANCHOT, A., 1949 - Aperçu sur le Précambrien de Mauritanie Occidentale. Soc. Geol. Fr (FRA), 1949, PP85-105; DMG (A083). (Short view of the Pre-Cambrian in Western Mauritania)

BLANCHOT, A., 1975 - Plan minéral de la République Islamique de Mauritanie. Ministère de la Planification et du Développement Industriel. Direction des Mines et de la Géologie. Ed. BRGM, 567p. (Mineral plan of the Islamic Republic of Mauritania)

BLANCHOT, A., 1975 - Mineral Plan of the Islamic Republic of Mauritania. Ministère de la Planification et du Développement Industriel. Direction des Mines et de la Géologie. Ed. BRGM, 567p. (Mineral plan of the Islamic Republic of Mauritania)

CARUBA, R. & DARS, R., 1991 - Géologie de la Mauritanie. Institut Supérieur Scientifique. Nouakchott & Nice Université Sophia Antipolis, 321 p. (Geology of Mauritania)

CARUBA, R., 1986 - Itinéaires géologiques dans le Sud Ouest mauritanien : basse vallée du fleuve Sénégal, Gorgol, Assaba et Tamkaskart. Ed. Universite de Nouakchott & Ecole Nationale Superieure (Nice) 1986/01, 136 p. (Geologic itineraries in the south-west part of Mauritania: lower valley of the Senegal River)

FURON, R., 1968 - Géologie de l'Afrique. Ed. PAYOT (PARIS), 1968, 374 p. (Geology of Africa)

GUNN, A.G., PITFIELD, P.E.J., McKERVEY, J.A., KEY, R.M., WATERS, C.N. & BARNES, R.P., 2004 – Notice explicative des cartes géologiques et gîtologiques à 1/200.000 et 1/500.000 du Sud de la Mauritanie. Volume 2 – Potentiel Minier, DMG, Ministère des Mines et de l'Industrie, Nouakchott. (Explaining note for geological and deposit maps at a scale of 1/200,000 and 1/500,000 of the south part of Mauritania)

LAHONDERE D., THIEBLEMONT D., GOUJOU J.-C., ROGER J., MOUSSINE-POUCHKINE A., LE METOUR J., COCHERIE A., GUERROT C., 2003. Notice explicative des cartes géologiques et gîtologiques à 1/200 000 et 1/500 000 du Nord de la Mauritanie. Volume 1. DMG, Ministère des Mines et de l'Industrie, Nouakchott. (Explaining note for geological and deposit maps at a scale of 1/200,000 and 1/500,000 of the north part of Mauritania)

LAHONDERE D., ROGER J., THIEBLEMONT D., GOUJOU J.-C´ß., MARCHAND J., BRONNER G., LE METOUR J., 2003. Cartes géologiques à 1/500 000 du Nord de la Mauritanie, 9 coupures. DMG, Ministère des Mines et de l'Industrie, Nouakchott. (Geological maps at scale of 1/500,000 of the north part of Mauritania, 9 cuts)

PITFIELD, P.E.J., KEY, R.M., WATERS, C.N., HAWKINS, M.P.H., SCHOFIELD, D.I., LOUGHLIN, S. & BARNES, R.P., 2004 – Notice explicative des cartes géologiques et gîtologiques à 1/200.000 et 1/500.000 du Sud de la Mauritanie. Volume 1 – Géologie. DMG, Ministère des Mines et de l'Industrie, Nouakchott. (Explaining note for geological and deposit maps at a scale of 1/200,000 and 1/500,000 of the south part of Mauritania)

THIEBLEMONT D., LAHONDERE D., GOUJOU J.-C., ROGER J., LE METOUR J., MARCHAND J., GATTA B., O/ HADI, M., DIABIRA F. B., THIAM B., 2003. Cartes géologiques à 1/200 000 du Nord de la Mauritanie, 14 coupures. DMG, Ministère des Mines et de l'Industrie, Nouakchott. (Geological maps at a scale of 1/200,000 of the north part of Mauritania, 14 cuts)

APPENDIXES

A1 – LIST & REFERENCES OF REGULATORY & LEGAL TEXTS ON MINING ACTIVITIES AND INVESTMENTS IN MAURITANIA

- **CODE MINIER (1999)**
  Le texte de référence est la **Loi n° 99.013 portant Code Minier,** assortie du **Décret n° 99.160 PM/MMI portant sur les Titres Miniers,** du **Décret n° 139 - 2000 PM/MMI portant sur la Police des Mines** et de la **Loi n° 2002/02 portant Convention Minière Type** dont on peut obtenir copies à la Direction de la Géologie et des Mines**.**

- **CODE PÉTROLIER (1988)**
  Le texte de référence est l'**Ordonnance n° 88.151 Relative au Regime Juridique et Fiscal de la Recherche et de l'Exploitation des Hydrocarbures,** dont on peut obtenir copie à la Direction des Hydrocarbures.

- **CODE DE L'ENVIRONNEMENT (2000)**
  Le texte de référence est la **Loi N° 200045 portant Loi Cadre sur L'Environnement, et son Décret d'Application** dans le cadre de la loi sur les mines (en cours d'élaboration). Ces documents sont disponible à la Direction de la Géologie et des Mines / Service des Affaires Environnementales. La Loi Cadre sur l'Environnement est également disponible au Ministère de l'Environnement.

- **CODE DES INVESTISSEMENTS (2002)**

- **CODE DU COMMERCE (2002)**

A2 – PROCEDURE GUIDE
&
MINING TITLE APPLICATION FORMS

PROCEDURE GUIDE & GRANTING OF EXPLORATION AND MINING PERMITS

Mining Titles

The Mining Register Unit receives applications for reconnaissance authorisations and mining titles as well as requests for approval of acceptance as well as requests for renewal, extension, reduction, lease, transfer and cancellation of applications, and operates in compliance with the provisions of the Mining Code and the decree referring to mining titles.

For all mining titles and acceptance approvals, the application must include the payment receipt of acceptance fees and the duly completed official form.

This form must contain the following information:

- The identity and domicile of the applicant and his representative
- The UTM coordinates of the corners of the requested perimeter, in conformity with the provisions of articles 3, 4 and 5 of the decree referring to mining titles, decree N° 99.160 [available in PDF format]
- The requested surface acreage
- The substance group as provided in article 5 of the Mining Code.

There are four categories for which an application can be made:

- Reconnaissance authorisation (autorisation de reconnaissance)
- Exploration permit (permis de recherche)
- Permit for small scale mining (permis de petite exploitation)
- Mining permit (permis d`exploitation)

1. Reconnaissance authorisation

Every physical person acting in his own name or in the name of a legal person who wishes to enter into reconnaissance activities on the earth or in the air must in every case request a permit or authorisation to do so. This is granted by letter of the Minister responsible for Mines, valid for a period of six months and renewable once only for the same period of time.

The reconnaissance activity may be carried out over the entire territory of Mauritania, except for promotional or reserved areas, and excluding existing mining title perimeters.

2. Exploration permit

An exploration permit is granted to the first physical or legal person who submits an application for that area, provided that he has the technical and financial capacities required for carrying out the research work.

The validity period of the permit is three years; it is renewable twice, and the duration of every renewal period is three years.

The surface of a exploration area cannot exceed 1,500 km² for the substances covered by all groups, except for group 7.

An exploration area requested for group 7 cannot exceed 10,000 km².

For groups 1 to 6, a physical or legal person cannot hold more than 20 exploration permits at the same time, and, for group 7, a physical or legal person cannot hold more than 10 exploration permits at the same time.

Documentation to be supplied (in three copies) together with the exploration permit application:

- Payment of acceptance fees;
- The professional title of the exploration project leader and a description of his experience;
- Description of the technical means to be used for research and the programme of planned work;
- Bank declarations;
- Last three balance sheets and profit and loss calculations or, if not available, entry in the Trade Register;

- Financial commitments (minimum amount of costs to be paid);
- List of affiliated persons.

3. Mining permit

A mining permit can only be granted to a Mauritanian company, founded by the holder of a exploration permit and exclusively intended for mining operations at the deposit.

It only covers the area of the exploration permit and the substances belonging to the group for which it was granted.

It is granted legitimately if the holder of the exploration permit has fulfilled his obligations.

The exploration permit remains valid after granting the mining permit for any area lying outside the mining permit coverage.

The mining permit is granted by decree, according to the provisions of the Mining Code and of the decree referring to mining titles, for a period of 30 years, and it is renewable several times, for a period of 10 years each.

It is an immovable right of limited duration, different from the ownership of the ground and subject to mortgages. It can be ceded, leased or divided and may be an object of inclusion in a company.

Documentation to be supplied by the applicant:

The application submitted to the Mining Register Unit must include the duly completed official application form for granting the mining permit.

This application form must include the following elements:

- The identity and domicile of the applicant who is the holder of the Exploration permit;
- The registration number of the Mauritanian company;
- The location of the requested perimeter and the UTM coordinates of its corners, in conformity with the provisions of title I, chapter I of the decree referring to mining titles;
- The identification code of the existing exploration permit;
- The requested substance group.

The applicant must submit three copies of the application, which must contain the following documents and elements:

- Payment of acceptance fees;
- Description of the capacities and professional experience of the project leader;
- Description of the technical means and the programme of planned work;
- Description of the investment plan and its amount;
- Bank declaration;
- Last three balance sheets and calculations of results;
- Feasibility study;
- Environmental study;
- Planned production capacity;
- Agreement of the owner of the property.

4. Permit for small scale mining

The small scale mining permit grants the holder exclusive rights for exploration, mining, exploitation and disposal of extracted products for the substances belonging to any of the groups defined by article 5 of the Mining Law, under the conditions fixed by the Mining Law and within the limits of the defined perimeter and up to a depth of 150 metres.

It is awarded by decree of the Minister responsible for Mines to the first physical or legal person submitting an application for that area.

The arrangements of attribution, exploitation and cession of the mine working granted by the small scale mining permit are stipulated by an application decree.

The small scale mining permit cannot exceed a surface of two square kilometres (2 km²); it is granted for a period of three years and is renewable twice for the same period of time.

It cannot be granted within an existing mining title or overlap an existing permit for small mining.

Finally, the permit for small scale mining cannot be granted inside a reserved or otherwise blocked area.

Application procedure for mining titles:

The applications for all mining titles must be submitted to the UCM office in Nouakchott.

Such applications are signed both by the applicant and the responsible person at the UCM and are then entered in the register book and also signed by the applicant and / or his representative and the responsible person at the UCM.

UCM then performs a technical check of the application which consists of:

- Exact calculation of the requested surface;
- Correct location of the requested perimeters;
- Size check of the requested surface;
- Check of illegal overlapping with other titles;
- Check of total quantity of permits held by the applicant.

UCM may also request any additional information or correction of errors. The applicant is granted a period of two weeks for compliance with a request for additional information and correction.

After provisional registration, UCM transmits the dossier to DMG for technical and financial evaluation. DMG is has a period of 15 days for checking the dossier.

After receipt of the definitive note about the technical and financial evaluation of the application, UCM prepares the draft of an decree of award of the mining title or the justified refusal letter, as the case may be, and submits it to the Minister responsible for mines.

In case of acceptance, the Minister responsible for mines submits the project an decree of award to the Council of Ministers for approval. After approval and signature, the decree is handed over to UCM for notification of the applicant who will sign the letter of receipt of the decree which grants him the validity of the mining title.

5. Duration of the procedure

The admissible duration for notification of approval must not exceed four months from the date of registration of the application onwards.

If the applicant submits the required documentation and fulfils the technical and financial conditions described in the decree relating to mining titles, decree N°99.160, the approval can be granted within 15 days.

6. Taxes and royalties

The mining titles are subject to a remuneration tax and a yearly surface fee, the amounts of which are fixed by the Mining Convention, Law No 2002/02 of January 2002.

7. Remuneration tax

Annual surface fee:

The annual surface fee is fixed as follows for:

1. Exploration permit:
   - 1st period of validity : 250 UM/km^2
   - 2nd period of validity : 500 UM/km^2
   - 3rd period of validity : 1000 UM/km^2
2. Mining permit: 25 000 UM/km2

The payment conditions for this fee are detailed in the decree relating to mining taxes and fees.

Mining fee or royalties

The mining fee for products depends on the substance group to which the mineral belongs and from which the product subject to this fee was derived and produced. The substance group is defined in article 5 of the Mining Law This fee is fixed as follows:

- Group 1: 1.5%;
- Group 2: 1.5 % except for gold for which an amount of 3% is applicable;
- Group 3: 3%;
- Group 4: 1.5%;
- Group 5: 3%;
- Group 6: 5%;
- Group 7: 5%.

Forms for mining titles

The forms must be completed in accordance with the decrees relating to Mining Titles and are supplied in French. Please apply to UCM for any further information required. The various forms used by the Mining Register are listed on the next page and may be downloaded from the web site of MMI (www.mmi.mr/).

List of forms for mining titles

Autorisation de reconnaissance
Formulaire de demande pour une autorisation de reconnaissance
Vérification technique de la demande et renouvellement d'une autorisation de reconnaissance
Formulaire de renouvellement pour une autorisation de reconnaissance
Vérification technique pour l'expiration d'une autorisation de reconnaissance
Permis de recherche
Formulaire de demande d'un permis de recherche
Formulaire pour la mutation d'un permis de recherche
Formulaire de demande d'extension d'un permis de recherche
Formulaire de demande, renouvellement, extension ou réduction d'un permis de recherche
Petite exploitation
Formulaire de demande d'un permis de petite exploitation
Vérification technique de la demande d'un permis de petite exploitation
Formulaire pour le renouvellement d'un permis de petite exploitation
Vérification technique de le renouvellement d'un permis de petite exploitation
Formulaire pour la mutation d'un permis de petite exploitation
Vérification technique de la mutation d'un permis de petite exploitation
Formulaire pour la résiliation d'un permis de petite exploitation
Vérification technique de la résiliation d'un permis de petite exploitation
Permis d'exploitation
Formulaire pour la demande d'un permis d'exploitation
Vérification technique de la demande d'un permis d'exploitation
Formulaire pour le renouvellement d'un permis d'exploitation
Vérification technique de le renouvellement d'un permis d'exploitation
Vérification technique de la réduction d'un permis d'exploitation
Formulaire de demande de mutation d'un permis d'exploitation
Vérification technique de la mutation ou d'amodiation d'un permis d'exploitation
Formulaire pour la résiliation d'un permis d'exploitation
Vérification technique de la résiliation d'un permis d'exploitation

A3 – LIST OF MAIN SERVICES, FINANCIAL INSTITUTIONS, DIPLOMATIC REPRESENTATIONS IN MAURITANIA

In order to facilitate the access of mining investors to Mauritania the following list of some essential services is given.

This list seeks to provide only some first guidance. The list is a selection only and is not exhaustive. The information shall not be interpreted as an endorsement. No warranty can be given for the accuracy, completeness, or usefulness of the information.

The information reflects the status at the begin of the year 2005.

HOTELS

HODA HOTEL:
NOUAKCHOTT B.P:04,
TEL (222)5259171, (222)5259186 - FAX: (222)5252011
Email: houdahotel@toptechnology.mr
Site Web: www. toptechnology .mr /houdahotel - www.houdasabah.mr

HOTEL SABAH :
NOUAKCHOTT B.P :452
TEL : (222)5251564, (222)5242422-FAX (222)5251552
Email :hotelsabah@mouritel .mr
Site Web :www.houdasabah.mr

HOTEL MAEHABA :
Nouakchott B .P :2391
TEL :(222)5295050-FAX : (222)5295055
Email :H3308@accor-hotel.com

HOTEL NOVOTEL:
Avenue Charles de Gaulle B.P :40157 Nouakchott
TEL :(222)5257400, FAX : (222)5257429
Email :H3754@accor-hotel.com

HOTEL EL AZIZA: Tevragh-Zeine E-NORD
B.P:2181
TEL :(222)5295603 - FAX :(222)5294448
Email:hotelaziza@mauritel.mr

HOTEL EL KHATER:
ZRT LOT 483
B.P:40001 ET
TEL (222)5291112

HOTEL HALIMA:
B.P 5144
TEL (222)5257920/21, FAX (222)5257922
www.hotelhalima.com

BANKS

BACIM BANK: Nouakchott B.P:913, TEL (222)5291900
FAX: (222)5291360 et TELEX: BACIMBJ504MTN

BANQUE BADH: Nouakchott B.P 5559
TEL:(222)5255953, FAX (222)5253495
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Dahl, R., 2004 – Guide de l'Investisseur Minier en Mauritanie – Guide for the Mining Investor in Mauritania. Services d'Assistance Technique pour l'Exploitation et l'Application pratique du Système d'information Géologique et Minière. SAT/SIGM – Phase III : Volet Promotion. GAF-AG, Munich, Rapport confidentiel , n°5, 57p.