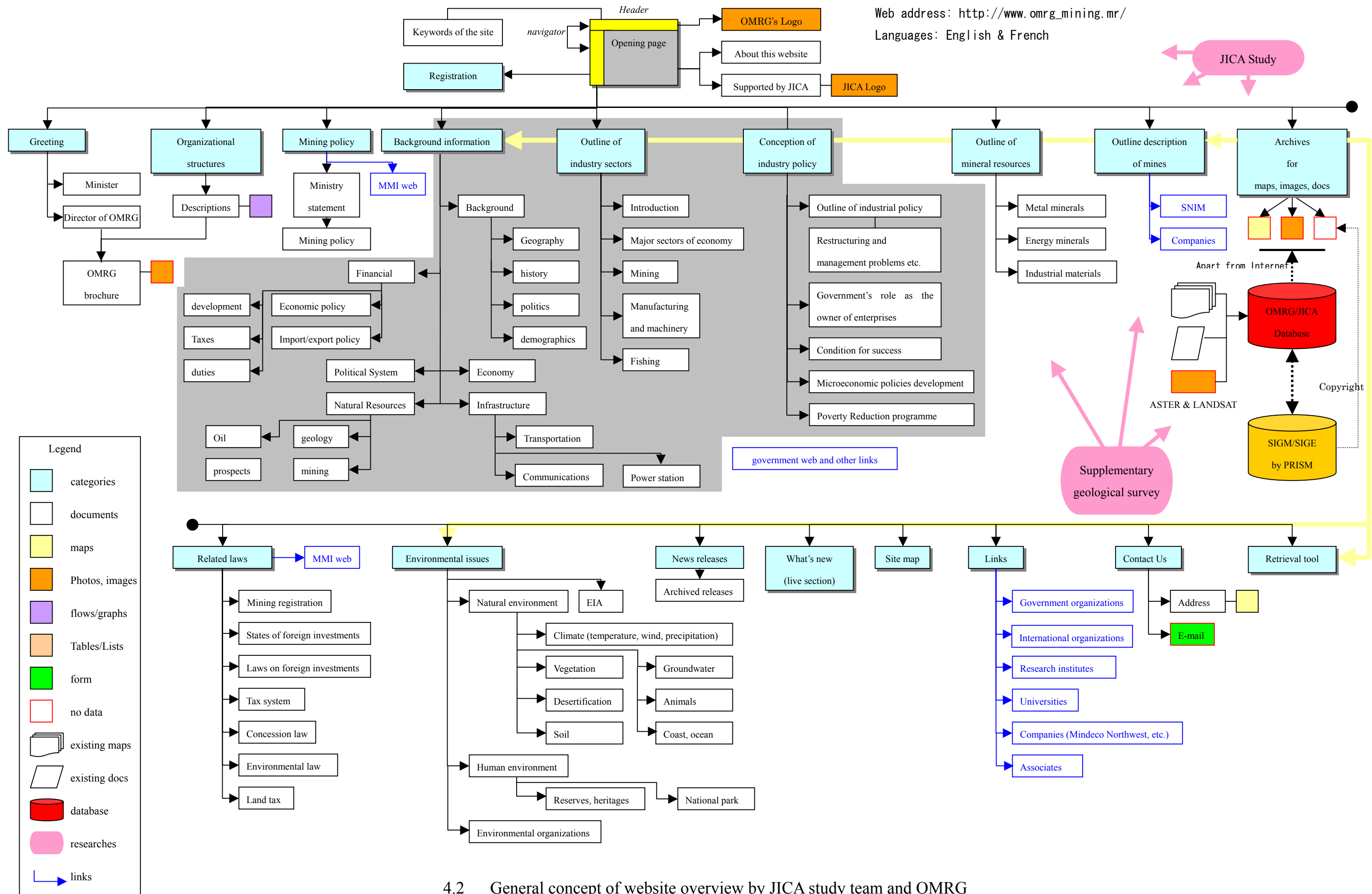


4.1 Directory structure of OMRG/JICA mineral resource database

Directories						Files	File format	Content	
1st	2nd	3rd	4th	5th	6th				
						sigm.apr	AcrView3.2	Map document files for ArcView3.2	
						Borne1.apr	AcrView3.2		
						geophysique_PC04.apr	AcrView3.2		
						global.apr	AcrView3.2		
						proj4.apr	AcrView3.2		
						afr_pays_pol.shp	shape		
						commune.shp	shape	Communes	
						Cote_200M.shp	shape	Bathometric lines	
						hydro_ligne.shp	shape		
						hydro_pol.shp	shape		
						hydro_pt.shp	shape		
						mines.shp	shape	Mines	
						nationalpark.shp	shape	Two national park areas	
						orog_ligne.shp	shape		
						orog_pt.shp	shape		
						pays.shp	shape		
						physiographie_ligne.shp	shape		
						powerstation.dbf	dbf	Power stations	
						pt-eau.shp	shape	Water springs	
						pt-rouge.shp	shape	Location of Gossans by satellite imagery	
						rail.shp	shape	Railroad	
						regions.shp	shape	Regions	
						routes.shp	shape	Road	
						t_aviation.shp	shape	Airport	
						villes.shp	shape	Villages	
						villes_principal.shp	shape		
						m40_petrogsample.shp	shape		
						m40_regblegsample_9697.shp	shape		
						m40_regdrainsample_9697.shp	shape		
						m40_regrocksample_9697.shp	shape		
						m40_regsoilsample_9697.shp	shape		
						README_GGI_GEOCHEM.txt	text		
						FED_FTJ_Soil.shp	shape	Soil sampling points by FED (European Fund for Development)	
						fedstra.shp	shape	Sampling points by FED (European Fund for Development)	
						Fedtact.shp	shape	Sampling points by FED (European Fund for Development)	
						tasiast_analyses_brgm.shp	shape	?	
						tasiast_analyses_hadji.shp	shape	?	
						JICA	Excel	Chemical analysis data obtained by JICA supplementaly geological survey	
						geochimique_locs.shp	shape		
						Geologie_1M	*.tif	tuf	
						Geologie_200m	Mbout	-	
						Geologie_500m			
						a_circulaire.shp	shape	Circular anomalies	
						maurit_min_potential.shp	shape	Mineral potential	
						nord_geol_line.shp	shape	Geological maps in the northern part of Mauritania	
						nord_geol_pol.shp	shape	1/500,000	
						nord_min_potential.shp	shape	Mineral potential maps in northern part of Mauritania	
						sud_geol_line.shp	shape	Geological maps in the southern part of Mauritania	
						sud_geol_pol.shp	shape	1/500,000	
						sud_min_potential.shp	shape	Mineral potential maps in southern part of Mauritania	
						z_p_geochimie.shp	shape	Geochemical map	
						tagant.jpg	jpg		
						indexmap200k	geol_200_index	shape	indexmap for 200k geological maps
						geol_200_PDF	*.pdf	PDF	PDF files of 200k geological maps
						ahmeyim	Ahmey_geol.shp, Ahmey_geol.shp,...	shape,DBF	All GIS files for 200k geological maps produce by SIGM in June,2005
						Ain_ben_Tili	Ain_ben_Tili_geol.shp,...	shape,DBF	
						Akjoujt	Akjoujt_geol.shp,...	shape,DBF	
						Aleg	Aleg_geol.shp,...	shape,DBF	
						Atar	Atar_geol.shp,...	shape,DBF	
						Bel_Guerdan	Bel_Guerdan_geol.shp,...	shape,DBF	
						Bir_Allah	Bir_Allah_geol.shp,...	shape,DBF	
						Bir_lemjed	Bir_lemjed_geol.shp,...	shape,DBF	
						Bir_Moghrein	Bir_Moghrein_geol.shp,...	shape,DBF	
						Blekhzaymat	Blekhzaymat_geol.shp,...	shape,DBF	
						Chami	Chami_geol.shp,...	shape,DBF	
						Char	Char_geol.shp,...	shape,DBF	
						Chinguetti	Chinguetti_geol.shp,...	shape,DBF	
						El_Gleitat	El_Gleitat_geol.shp,...	shape,DBF	
						El_Hassan_ould_Hamed	El_Hassan_ould_Hamed_geol.shp,...	shape,DBF	
						El_Mreiti	El_Mreiti_geol.shp,...	shape,DBF	
						Fderik	Fderik_geol.shp,...	shape,DBF	
						Gleibat_Tenebdar	Gleibat_Tenebdar_geol.shp,...	shape,DBF	
						GuelErRichat	GuelErRichat_geol.shp,...	shape,DBF	
						Kaedi	Kaedi_geol.shp,...	shape,DBF	
						Ksar_El_Barka	Ksar_El_Barka_geol.shp,...	shape,DBF	
						Mbout	Mbout_geol.shp,...	shape,DBF	
						Moudjeria	Moudjeria_geol.shp,...	shape,DBF	
						OummDfeirat	OummDfeirat_geol.shp,...	shape,DBF	
						Podor	Podor_geol.shp,...	shape,DBF	
						Rhall_Amane	Rhall_Amane_geol.shp,...	shape,DBF	
						Sud_Phse1_Structure_Donee	Sud_Phse1_Structure_Donees_geol.shp,...	shape,DBF	
						Tigsmat	Tigsmat_geol.shp,...	shape,DBF	
						Zednes	Zednes_geol.shp,...	shape,DBF	
						indexmap500k	index_500_geol.shp,...	shape	indexmap for 500k geological maps
						Geol_500_PDF	*.pdf	PDF	PDF files of 500k geological maps
						SIG_Geol_500	Nord_Geol_Pol_Phase1.shp, Sud_Geol_Pol_Pase1.shp	shape,DBF	All GIS files for 500k geological maps produce by SIGM in June,2005
						indexmap_metal500k	index_500_metallo.shp,...	shape	indexmap for 500k metalological maps
						Metallo_500k_PDF	*.pdf	PDF	PDF files of 500k metalological maps
						SIG_Metallo_500k	ECH_GITO.shp, Echan_gito_phase1.shp,...	shape,DBF	All GIS files for 500k metalological maps produce by SIGM in June,2005
						Geologie_general	geol_1500000.shp	shape	
						Geodeticdata	geodetic_base	Access	Geodetic base stations supplied from UMC
						Grilles (grid)	carte_topographie.shp	shape	
							grille.shp	shape	
							LexCoupure.dbf	Geodatabase	
						Geologie_Comilation_Synthese (Geological compilation)	Nord_GCS	-	
							Sud_GCS Used_But_Not_Rectified	*.tif	tif
							Mauritanie_IGN_1-2_500_000.tif	tif	
						Geophysique	Nord_g	-	
							Inchiri		
							inch_k (raster)		Geophysical data (K)
							inch_tc (raster)		Geophysical data (Total Count)
							inch_th (raster)		Geophysical data (Th)
							inch_u (raster)		Geophysical data (U)
							Inchiri_amag.tif		Geophysical data (Magnetic Anomaly)
							Inchiri_faults.shp	shape	Faults in Inchiri area
							Inchiri_intrusions.shp	shape	Intrusions in Inchiri area
							Inchiri_lineaments.shp	shape	Lineaments in Inchiri area
							ternim8.JPG	jpg	
							Nations unies		
							geophysique_locs.shp	shape	
							all_data_tc.tif	tif	
							Readme.txt	text	
							Tasiast		
							imgcat.dbf	geodatabase	Database in Tasiast area
							Tasiast_faults.shp	shape	Faults in Tasiast area
							Tasiast_lineaments.shp	shape	Lineaments in Tasiast area
							. (raster)		
							Tijirit		
							clip6.shp	shape	Relevant files in Tijirit area
							clip7.shp	shape	
							clip8.shp	shape	
							clip9.shp	shape	
							clip10.shp	shape	
							clip11.shp	shape	
							clip12.shp	shape	
							clip13.shp	shape	
							clip14.shp	shape	
							ternim7.jpg	jpg	
							. (raster)		

Information_SIG

SIGM			Tijirit_faults.shp	shape	Faults in Tijirit area	
			Tijirit_intrusions.shp	shape	Intrusions in Tijirit area	
			Tijirit_lineaments.shp	shape	Lineaments in Tijirit area	
			Inchiri_Tasiast_Tijirit_Normandy_Airmag_surveys_m.jpg	jpg	Aero-magnetic maps	
			geophysique_locs.shp	shape		
	Images	Satellite	GGI_s	*.tif	tif	Landsat imagery in GGI area
			Nord_s	*.tif	tif	Landsat imagery in northern Mauritania
			Sud_s	*.tif	tif	Landsat imagery in southern Mauritania
			area4_1&5	*.tif	geotiff	Aster data Band1-14&DEM
			area4_2&5	*.tif	geotiff	Aster data Band1-14&DEM
			area4_3	*.tif	geotiff	Aster data Band1-14&DEM
			area4_4	*.tif	geotiff	Aster data Band1-14&DEM
			area8_1	*.tif	geotiff	Aster data Band1-14&DEM
			area11	*.tif	geotiff	Aster data Band1-14&DEM
			area11_1	*.tif	geotiff	Aster data Band1-14&DEM
			area11_2	*.tif	geotiff	Aster data Band1-14&DEM
			area11_3	*.tif	geotiff	Aster data Band1-14&DEM
			area11_4	*.tif	geotiff	Aster data Band1-14&DEM
			area11_5	*.tif	geotiff	Aster data Band1-14&DEM
			area11_6	*.tif	geotiff	Aster data Band1-14&DEM
			area11_7	*.tif	geotiff	Aster data Band1-14&DEM
			area13_1	*.tif	geotiff	Aster data Band1-14&DEM
			area14	*.tif	geotiff	Aster data Band1-14&DEM
			area17	*.tif	geotiff	Aster data Band1-14&DEM
			area18_1	*.tif	geotiff	Aster data Band1-14&DEM
			area18_2	*.tif	geotiff	Aster data Band1-14&DEM
			area19_1	*.tif	geotiff	Aster data Band1-14&DEM
			area19_2	*.tif	geotiff	Aster data Band1-14&DEM
			area20_2	*.tif	geotiff	Aster data Band1-14&DEM
			area20_3	*.tif	geotiff	Aster data Band1-14&DEM
			area26	*.tif	geotiff	Aster data Band1-14&DEM
			area45	*.tif	geotiff	Aster data Band1-14&DEM
			area1417	*.tif	geotiff	Aster data Band1-14&DEM
			area1819	*.tif	geotiff	Aster data Band1-14&DEM
			area2223	*.tif	geotiff	Aster data Band1-14&DEM
			processed	*.tif	geotiff	Processed imagery in Akjoujt_Takrinbout & Kadier_indice_78
			File011	*.tif	geotiff	Aster data Band1-14&DEM requested from OMRG
			File012	*.tif	geotiff	Aster data Band1-14&DEM requested from OMRG
			File013	*.tif	geotiff	Aster data Band1-14&DEM requested from OMRG
			File014	*.tif	geotiff	Aster data Band1-14&DEM requested from OMRG
			File015	*.tif	geotiff	Aster data Band1-14&DEM requested from OMRG
			south_mosaic	south_dem.tif	geotiff	SRTM DEM in the southern Mauritania
			area11	*.tif	geotiff	LANDSAT data Band1-7
			area45	*.tif	geotiff	LANDSAT data Band1-7
			area1417	*.tif	geotiff	LANDSAT data Band1-7
			area1819	*.tif	geotiff	LANDSAT data Band1-7
			P199R043	*.tif	geotiff	LANDSAT data Band1-7
			P200R042	*.tif	geotiff	LANDSAT data Band1-7
			P200R043	*.tif	geotiff	LANDSAT data Band1-7
			P201R042	*.tif	geotiff	LANDSAT data Band1-7
			P201R043	*.tif	geotiff	LANDSAT data Band1-7
			P202R042	*.tif	geotiff	LANDSAT data Band1-7
			P202R043	*.tif	geotiff	LANDSAT data Band1-7
			P202R044	*.tif	geotiff	LANDSAT data Band1-7
			P202R049	*.tif	geotiff	LANDSAT data Band1-7
			P202R050	*.tif	geotiff	LANDSAT data Band1-7
			P203R042	*.tif	geotiff	LANDSAT data Band1-7
			P203R043	*.tif	geotiff	LANDSAT data Band1-7
			P203R044	*.tif	geotiff	LANDSAT data Band1-7
			P203R045	*.tif	geotiff	LANDSAT data Band1-7
			P203R046	*.tif	geotiff	LANDSAT data Band1-7
			P203R047	*.tif	geotiff	LANDSAT data Band1-7
	P203R048	*.tif	geotiff	LANDSAT data Band1-7		
	P203R049	*.tif	geotiff	LANDSAT data Band1-7		
	P204R044	*.tif	geotiff	LANDSAT data Band1-7		
	P204R045	*.tif	geotiff	LANDSAT data Band1-7		
	P204R046	*.tif	geotiff	LANDSAT data Band1-7		
	P204R047	*.tif	geotiff	LANDSAT data Band1-7		
	P204R048	*.tif	geotiff	LANDSAT data Band1-7		
	P204R049	*.tif	geotiff	LANDSAT data Band1-7		
	P205R045	*.tif	geotiff	LANDSAT data Band1-7		
	P205R046	*.tif	geotiff	LANDSAT data Band1-7		
	P205R047	*.tif	geotiff	LANDSAT data Band1-7		
	P205R048	*.tif	geotiff	LANDSAT data Band1-7		
	P206R045	*.tif	geotiff	LANDSAT data Band1-7		
	P206R046	*.tif	geotiff	LANDSAT data Band1-7		
	SRTM	N14W011-N27W009	*.tif	geotiff	SRTM DEM data in each degree covering the whole Mauritania	
		SRTM_mosaic	*.tif	geotiff	mosaic DEM and shade file covering the whole Mauritania	
			image_satellite.shp	shape		
			image_satellite_utm29.shp	shape		
			mosaique_satellite.shp	shape		
	Topographique	Nord_t	*.tif	tif		
		Sud_t	*.tif	tif		
		Mauritanie	*.tif	tif		
			mauritanie_ign_1-2_500_000.tif	tif		
			nord_image_hydro.shp	shape		
		nord_image_oro.shp	shape			
		nord_image_topo.shp	shape	name and number of maps in the northern part of Mauritania		
		sud_image_topo.shp	shape	name and number of maps in the southern part of Mauritania		
Legendes	new	aster_location	Aster_location	shape	Location of Aster imagery	
		geology_500m	English_Legend	Access		
		landsat_location	LANDSAT_loc.shp	shape	Location of LANDSAT imagery	
PDF_shapefiles			PDF_points.dbf	geodatabase		
Permis d'exploitation	Carrières (quarry)		carr_region.shp	shape	Quarry location	
	Mines		-			
Permis d'exploration (Exploration licences)			exploitations.shp	shape	Mining areas	
			fer.shp	shape	Iron ore exploration licences	
			groupe2.shp	shape	Gold and base metals exploration licences	
			groupe7.shp	shape	Diamond exploration licences	
			testx.tif	tif		
Soil			soil.shp	tif	Soil distribution from Atlas de la Republique Islamique de Mauritanie	
Projects			project.shp	shape	Project areas	
logo			*.gif, *.jpg	tif_gif	Logos for JICA, OMRG, MINDECO and PRISM for web	
cadastre			*.shp	shape	Mining cadastre area data for each category supplied from UCM	
Environment	climate		*.gif, *.dbf	gif_geodatabase	weather information in some large cities	
	pre19502000		precipitation1950.shp, precipitation2000.shp	shape	precipitation data comparison between 1950 and 2000 from SAM	
	waterresources	watersupply	watersup.dbf	geodatabase		
			dam, oasis_cultiv, water_resources, waterpipeline.shp	shape	Water resource related information from CNRE/MHE	
deposit_overview			deposit_all	geodatabase	References for major deposits for web	
Topographique	DEM_GTOPO30		maurit_dem	DEM	DEM from GTOPO30	
	Topo_200K		maurit_dem.shp	shape	Elevation contours from GTOPO30	
			-			
Acrobat_pdf			*.pdf	pdf		
APR_SIG			*	*		
Bibliographie			Base_Mauritanie_BRGM_2000	Access	Database for references	
			Base_Mauritanie_BRGM_2000_Backup	Access		
			BGS_Scanned_docs	Excel		
			Index_pdf_scans	Excel		
			Index_Scan_Auteur	Excel		
			Pangis15_v2000	Access		
			Pangis15_v2000_Backup	Access		
Geochemistry			Base de données des échantillons.mdb	geodatabase	Database for geo-chemistry	
			Geochimique.mdb	geodatabase		
Indice (mineral occurrence)			Indice_2002.mdb	geodatabase	Database for mineral occurrences	
			Indice_2002_backup.mdb	geodatabase		
			shape3.shp	shape		
Index	legend		index_eng_Events.lyr	ArcView_layer	Layer file for English legend of mineral occurrences	
			Indice_2002New.mdb	geodatabase	English legend for mineral occurrences	
pdf_pour_brgm			*.pdf	pdf		



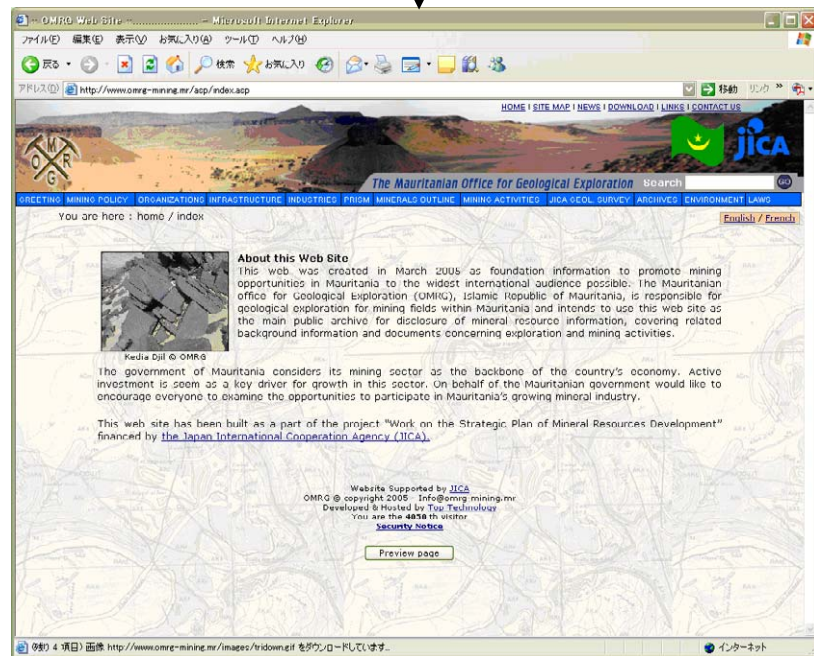
4.2 General concept of website overview by JICA study team and OMRG

4.3 Representative Website related to Mauritania

Organization/Company	URL	Languages*		
		F	E	A
International Archives				
The World Factbook, CIA	http://www.cia.gov/cia/publications/factbook/geos/mr.html	-	o	-
2004 Index of Economic Freedom, the Heritage Foundation	http://cf.heritage.org/index2004test/country2.cfm?id=Mauritania	-	o	-
Country Study Library of Congress, portal site to the world	http://www.loc.gov/rr/international/amed/Mauritania/mauritania.html	-	o	-
USGS, Mineral Information	http://minerals.usgs.gov/minerals/pubs/country/africa.html#mr	-	o	-
International Monetary Fund	http://www.imf.org/external/np/prsp/2000/mrt/01/	-	o	-
The World Bank, Mauritania	http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/AFRICAEXT/MAURITANIAEXTN/0,,menuPK:362346~pagePK:141159~piPK:141110~theSitePK:362340,00.html	-	o	-
African Information Society Initiative(AISI), information and communication infrastructure in African countries	http://www2.sn.apc.org/africa/	-	o	-
Country guide presents general economic, political, and cultural data about Mauritania	http://i-cias.com/cgi-bin/eo-direct-frame.pl?http://i-cias.com/e.o/mauritan.htm		o	
Describes the history and politics of this country that is a bridge between the Arab Maghreb and western sub-Saharan Africa.	http://news.bbc.co.uk/2/hi/middle_east/country_profiles/791083.stm		o	
Arabic countries news / Mauritania	http://www.middle-east-online.com/english/mauritania/		o	
UN related				
United Nations in Mauritania, portal site of activity of UN in Mauritania with a lot of links	http://www.un.mr/	o	-	-
Partners for development of Mauritania	http://www.pdm.mr/	o	-	-
United Nation Population Fund, Mauritania	http://www.unfpa.mr/	o	-	-
PNUD, UN Program for Development	http://www.pnud.mr/	o	-	-
Government sites				
Premier Ministere, New government portal sites to all governmental sites	http://www.gov.mr/	o	-	-
Ministry of foreign affairs and cooperations	http://www.diplomatie.gov.mr/	o	-	-
Ministere des Finances	http://www.finances.gov.mr/	o	o	-
Mauritania Government Official Web site, official portal site	http://www.mauritania.mr/	o	-	o
SETN.mr, Secrétariat d'Etat auprès du Premier Ministre Chargé des Technologies Nouvelles	http://www.mauritania.mr/rim/fr/admin/gov/setn/setn.asp	o	-	-
Ministry of Mines and Industry, PRISM	http://www.mmi.mr/	o	o	-
Office of National Statistics	http://www.ons.mr/	o	-	-
Global Development Learning Network, Mauritania	http://www.gdln.org/country/mauritania.html	o	o	-
Ministere de l'Hydraulique et de l'Energie	http://www.hydraulique.gov.mr/#	o	-	-
Ministere du Developpement Rural et de l'Environnement	http://www.environnement.gov.mr/	o	-	-

Authority of Regulations in Mauritania	http://www.are.mr/	o	-	o
GLOBAL REGAL INFORMATION NETWORK, database that allows you to access different legal instruments and other complementary legal sources	http://www.glin.mr/	o	o	o
Mauritania Consitution	http://www.oefre.unibe.ch/law/icl/mr00t___html		o	
News				
Africa.com, news in Mauritania	http://www.africetime.com/mauritanie/	o	o	-
Agence Mauritanienne d'Information, official government news agency	http://www.ami.mr/	o	-	o
Mauritanienne de Presse d'Edition de Communication et d'Impression, news press	http://www.mapeci.com/	o	-	o
ALLAFRICA.COM, current new from the UN's IRIN, African newspapers	http://allafrica.com/mauritania/	o	o	-
Companies				
TOP TECHNOLOGY, electronic devices, Web service	http://www.toptechnology.mr/	o	-	-
DIGITEK, electronic devices	http://www.digitek.mr/	o	-	-
BSA	http://www.bsa.mr/	o	-	-
WIMEX SYSTEMS, electronic devices	http://www.wimex.mr/	o	-	-
CyberForum, Internet	http://www.cyberforum.mr/	o	-	-
Air Mauritania	http://www.airmauritanie.mr/airframeset.htm	o	-	-
University of Nouakchott	http://www.univ-nkc.mr/	o	o	o
MAURITEL, Mauritanian telephone company	http://www.mauritel.mr/	o	-	-
Mauritel Mobiles	http://www.mauritelmobiles.mr/	o	-	-
VOTRA, Mauritanian shipping lines companies	http://www.votra.net/	o	o	-
SNIM (Societe Nationale Industrielle et Miniere),	http://www.snim.com/	o	o	-
CIMENT DE MAURITANIE, leading cement company in Mauritania	http://www.ciment.mr/	o	o	o
Miscellaneous [tools, diplomatic, tourism, others]				
Chinguetti, World heritage of the UNESCO	http://www.chinguetti-net.com/	o	o	-
Mauritania Embassy in the Unites States of America	http://www.ambarim-dc.org/		o	
Maurifemme, Mauritanian woman site	http://www.maurifemme.mr/	o	-	-
Other countries in Mauritania	http://www.helplinedatabase.com/embassy-database/other-countries-in-country/mauritania.html		o	
Mauritanian embassies in other countries	http://www.helplinedatabase.com/embassy-database/country-in-other-countries/mauritania.html		o	
Search Engines				
Inforim – Mauritania Online, a lot of links	http://www.inforim.mr/	o	-	-
Maghreb Unition search engine (Mauritania, Morocco, Tunisia, Algeria and Lybia)	http://www.marweb.net/	o	o	-

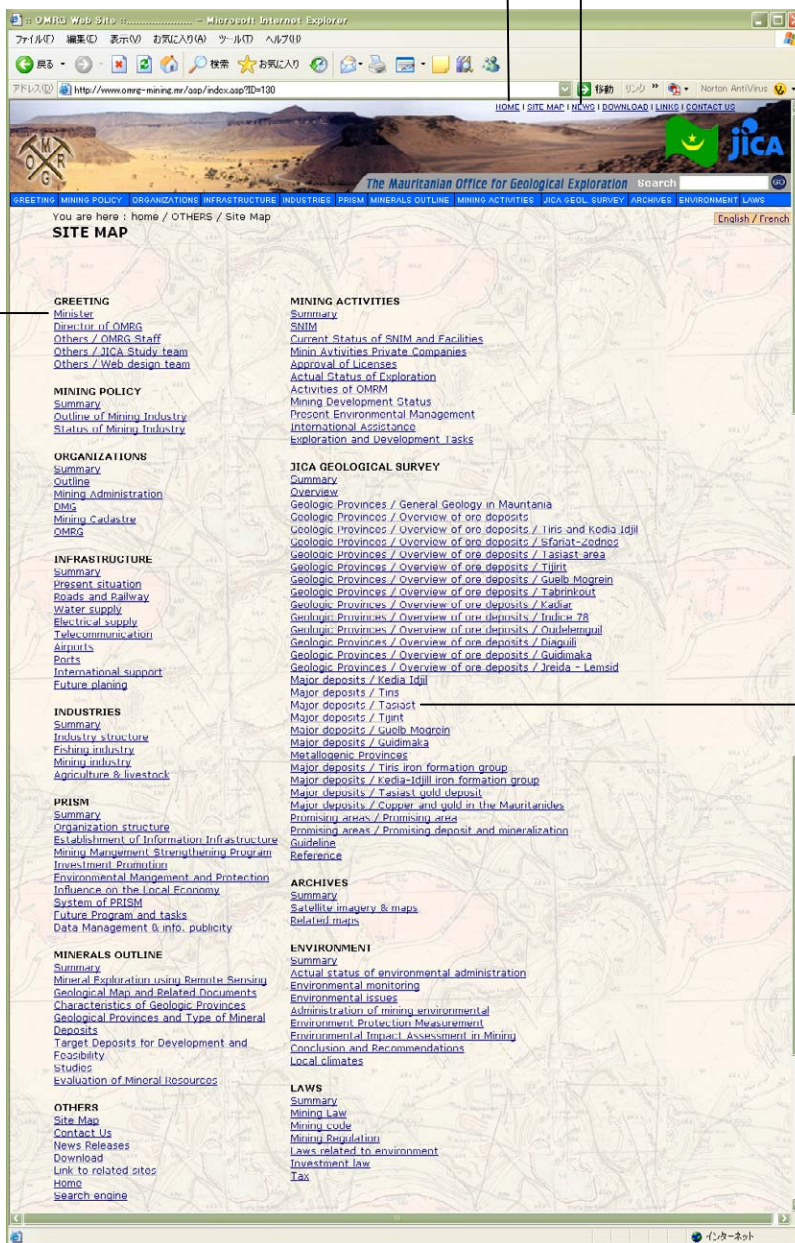
*F: French, E: English, A: Arabic



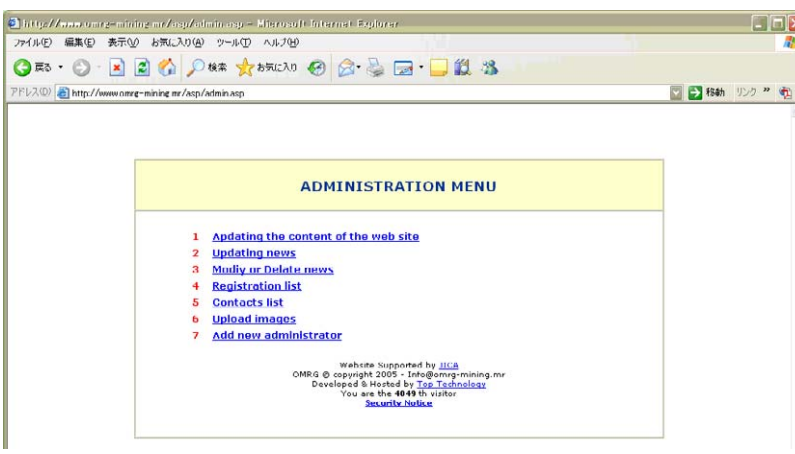
a) Top page of the OMRG web site



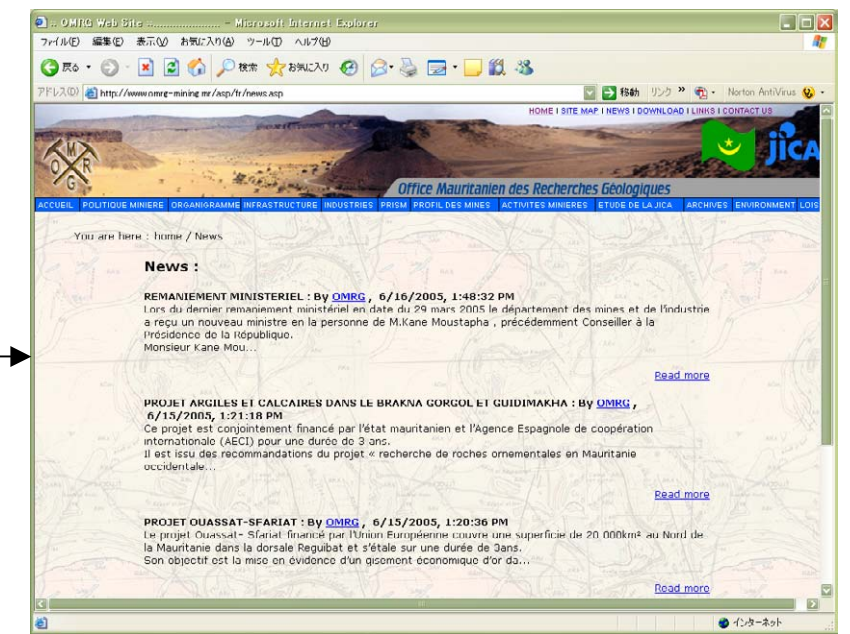
b) Minister's address



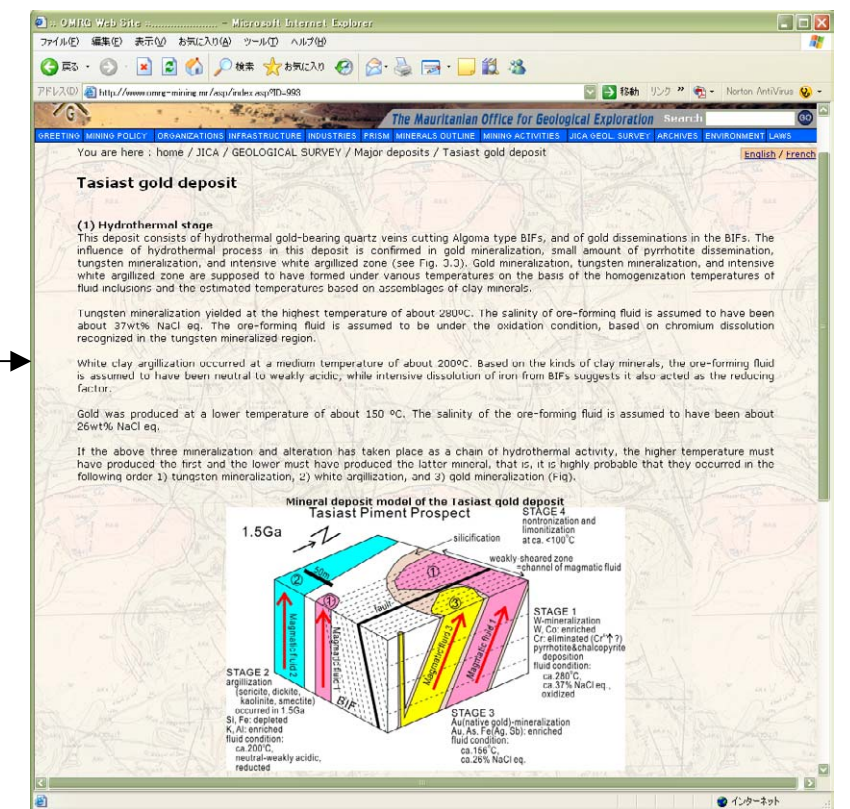
c) Site map



d) Administration menu



e) News from government (web content is supplied in English and French)



f) Results of supplementary geological survey

4.4 OMRG website

5.1 Mauritanian Environment

1. Natural Environment

1.1 Weather

Mauritanian climate consists of two– dry and rainy – seasons;

- The dry season lasts from October to June. Strong winds including sand storms sometimes occur from February to June.
- Rainy season starts in June and lasts till October. The rain is sometimes accompanied by thunder, and the southern and southeastern areas like Gorgol, Guidimaka and Hodhs have comparatively more precipitation.

Two-thirds of the northern territory have Sahara weather, while the southern and southeastern areas are influenced by the weather in Sahel. At the boundary of the Sahara and Sahel weather, which has moved southward since the 1950s, is the 150mm annual rainfall level. Before serious droughts from 1971 Route 3 divided the desert and green areas. Fig. 1.1 shows the change in rainfall levels.

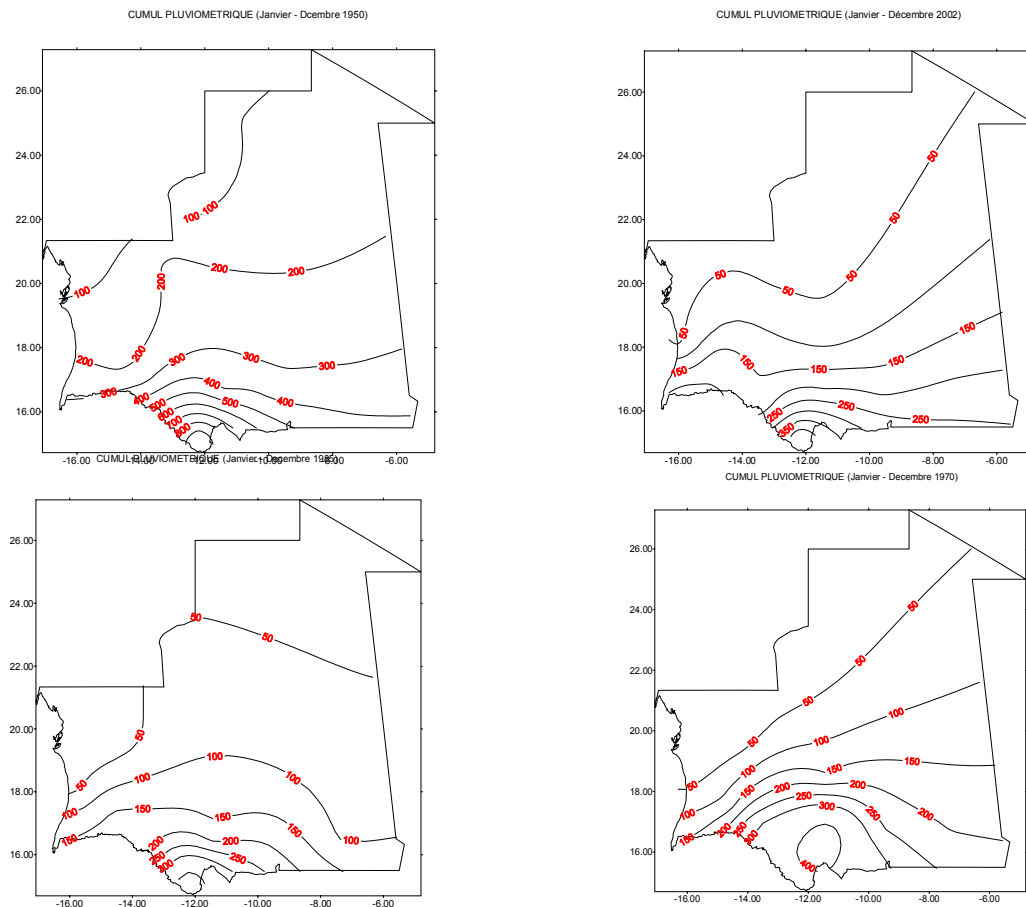


Fig. 1.1 Comparison of annual rainfall level (top left: 1950, right: 1970, bottom left: 1985, right: 2002)

The rainfall has been recently increasing, and its level in 2003 is similar to that in 1950.

Climate change has brought about the following conditions;

- Desertification has advanced by 6km per year for the past ten years, and a large movement of population has occurred in the areas influenced by serious droughts.
- Wind in Mauritania is mainly from the north. It scatters much sand and dust, and causes various problems.
- The wind accumulates sand in some places, which erodes very many green areas, even though no quantitative survey has defined the level of erosion. Another reason of erosions is the rainfall on the sand dunes in the southern districts.
- The dry hot wind from inland is intensely evapo-transpirable.
- The aquifer in the Sahara areas consists of fossil water, which has limited replenishment resources.
- The only perennial river is the Senegal.
- Much exploration work is now being actively carried out in the northern desert areas where the water supply may be a bottleneck for mine development.
- There is a development project for a phosphate mine adjacent to Bogue and Kaedi cities near the Senegal River in the southern district.

The climate condition in Mauritania is severe, especially in the northern desert area. Desertification is still advancing from the north to the south, and people have been moving in the same direction. Mining excavation is currently done mainly in the northern area. It is not densely populated in the area, therefore the environmental impact to the inhabitants is comparatively low. On the other hand, in the southern part, where phosphorus is under study for development, the environmental impact is higher because there are more inhabitants near the Senegal River basin.

1.2 Geography and Geology

Mauritanian is generally flat, and has the following three basic geographical features:

- Sand rock plateau (in the south central and central parts as well as the northern end).
- Sand dune areas (in the southern, central and eastern parts).
- Eroded flat zones (the entire northern territory and some foothills of Inchiri, north of Akjoujt City).

The inland makes a slight slope down to the coast and Senegal River. There are the Adrar Plateau and Majabat Al-koubra in the central part. Fig. 1.2 shows Mauritanian geography.

Mauritanie

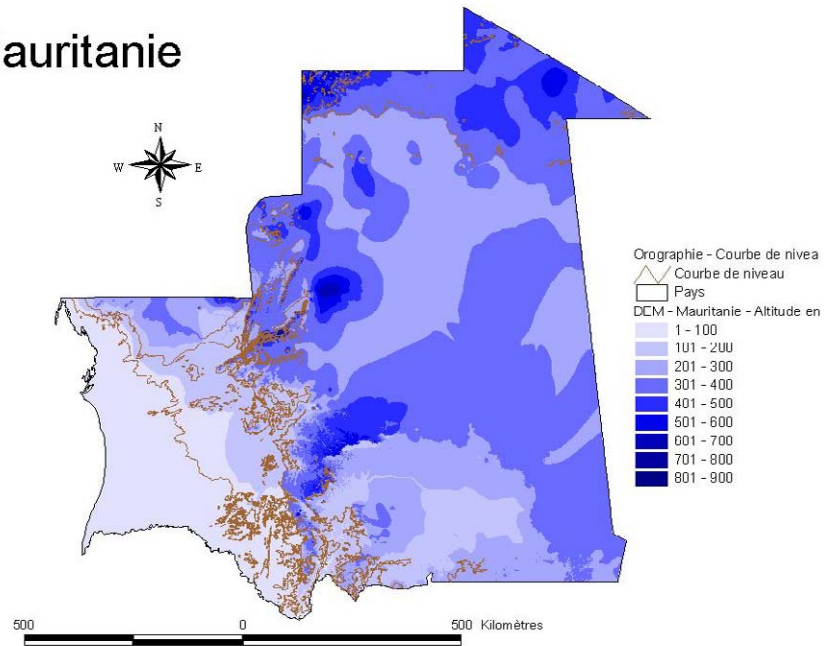


Fig. 1.2 Mauritanian Geography

Mauritanian geology is shown in Fig. 1.3. It can be divided in four different parts; Reguibat Shield in the north, Taoudeni Basin in the east, Atlantic Basin in the west and Mauritanides Chain in the central part.

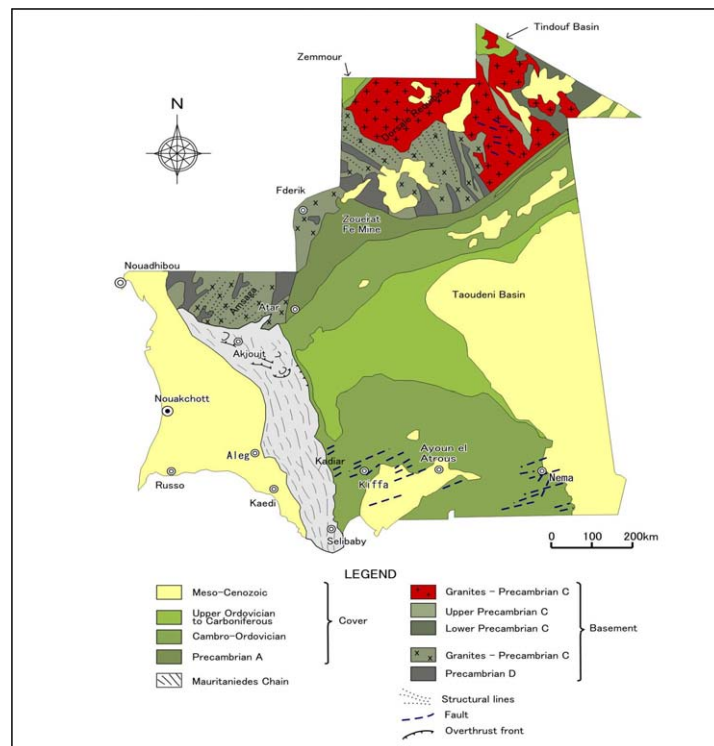


Fig. 1.3 Mauritanian Geology

1.3 Water

Water resources are related to the geographical and rainfall characteristics of the. Fig. 1.4 shows the four principal resources in Mauritania.

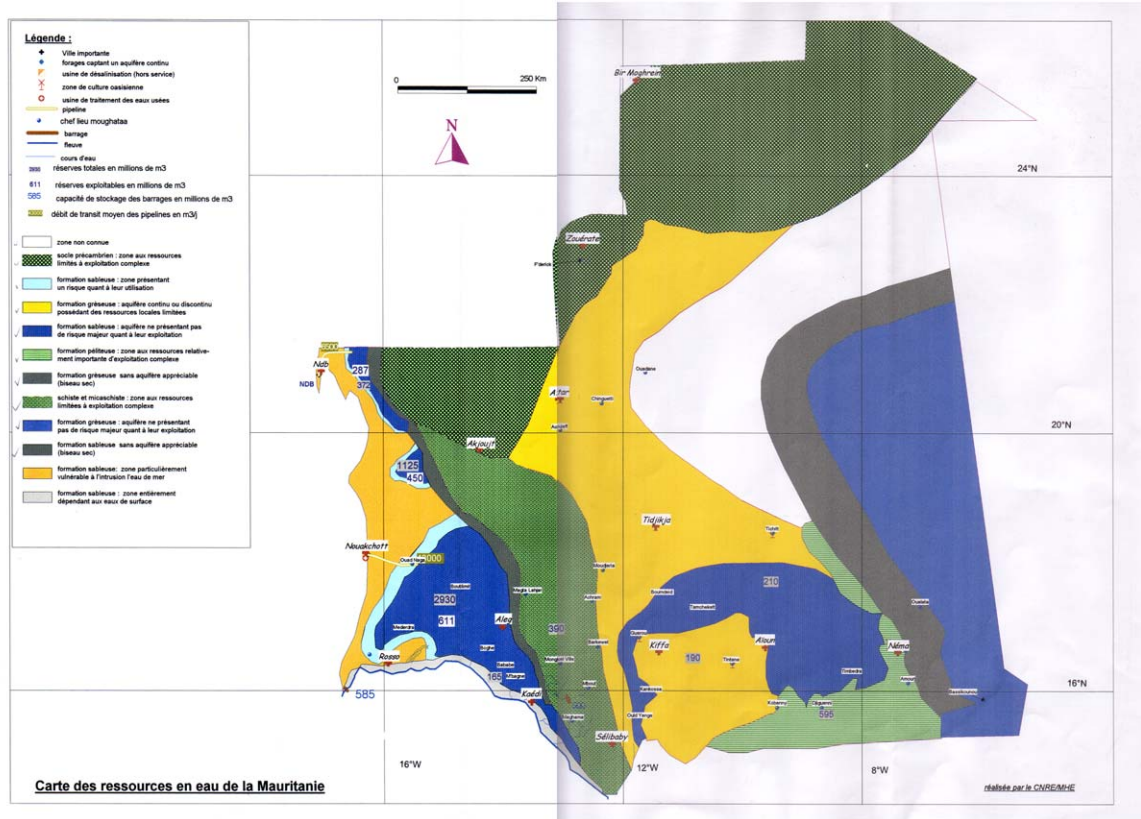


Fig. 1.4 Water Resources Map in Mauritania

Principal water resources are explained in Table 1.1.

Table 1.1 Principal Water Resources in Mauritania

Colors on the Map	Characteristics for Resources
Yellow (Central Part)	Sandstone formation having a continuous or discontinuous water table with limited local reserve
Dark Blue (Four separated parts)	Sand formation water tables with adequate amount for their utilization.
Blue (Southeastern Part)	Sandstone formation water tables with adequate amount for its utilization
Light Gray (Around Senegal River)	Sand formation zone completely dependent on surface water

Water resources over the Sahara and Sehel areas are limited, and the total amount of rainfall in the Mauritania is small. There is a streamway in the Senegal River in the southeastern part of Mauritania. Data on the potential water reserve whose validity was proved scientifically, is not available, and the data on aquifer is both incomprehensive and limited. Therefore, it must be surveyed scientifically.

The rain in areas with frequent rainfalls creates some water ponds with different lifetimes depending on the local conditions like the intensity or frequency of the rainfalls. Heavy rainfall areas

are located to the north of Adrar, but the areas with most precipitation are located in the south and the southeast between 15° and 18° in the latitude. From the viewpoint of water potential, these heavy rainfall areas are the principal water sources. According to the World Union for Nature Conservation (UICN), there are 250 to 320 places where it rains a lot in Mauritania. The principal surface water are listed in Table 1.2. All of them are located in the southern Mauritania.

Table 1.2 Principal Surface Waters in Mauritania

Name	Brief explanation
Lake Aleg	Located near Aleg City (Brakna) with a maximum area of 5,000ha.
Lake Maal	Located southeast of Aleg City with a maximum area of 5,000ha.
Slough Tamourt en Naaj	Located in the Maritanide in Gorgol with an area of 1,600km ² .
Lake R' kiz	Arable basin covered with water from Senegal River in Trarza. 5km (W),35km (L)
Slough Gouraya	Located south of Selibaby (Guidimaka).
Lake Fom Gleita	Artificial lake in Gorgol.
Slough Kankossa	Located in the Karakoro river basin (Assaba).

Most of Mauritania's groundwater is represented by fossil water. It was supplied about 5,000 years ago. Water balance in each aquifer is not known. Most of Mauritania is dry on the surface, but has a large groundwater reserve. Water distribution and quality vary by regions. Generally water quality is good except some mine sites. Some aquifers are not potable because of their salt content. (for instance, the orange colored zone in Fig. 1.4 along the Atlantic coast and around the Zouerate districts). Some wells may be contaminated by nitrates or fecal bacteria due to improper management.

The following problems are related to water;

- Aquatic trees called Tifa have grown thickly in Senegal River and changed its ecosystem since the river flow hampered by the St. Louis Agriculture Dam constructed by OMVS (Organization for the Development of Senegal River Valley)
- Excess utilization of free groundwater for cultivation of corn and vegetables.
- Water from the Senegal is only available around Rosso City. Groundwater is used as potable water for inhabitants, domestic livestock and economic activities in most regions of Mauritania.
- Alluvial aquifer in the Senegal River basin is supplied periodically by water from the river overflow, and natural sloughs or reservoir. Its capacity is limited, but it is the only renewable aquifer in Mauritania. Therefore, it is tolerable for excess utilization, but easily contaminated.
- Other alluvial aquifers except the Senegal basin are only replenished by temporary rainfalls. These aquifers are very sensitive to both excess utilization and contamination.
- Water is indispensable for mine development, and water supply is a lifeline for mining operation. Under the circumstances, water needed for operations must be transported from a long distance.
- Contamination risk for water resources is comparatively large in mine development. It is necessary to pay attention especially to the heavy metal produced as a result of mining operations as well as oil, reagents and acid used in the development of mines. Water

contamination in Mauritania may have a more serious impact than that in other countries due to the limited water resources.

1.4 Soil

Mauritanian soil is represented by five types shown in Table 1.3.

Table 1.3 Mauritanian Soils

Type of Soil	Existing Areas	Characteristics of Soil
Desert Soil	Desert Areas	Classified as alluvial and abrasion soil. Soil in northern dune areas is not solidified, while that in southern areas is solidified by rain. Its quality is poor and is not good from an agricultural viewpoint.
Yellow Soil	Semi Desert Areas Coastal Areas	Density is higher than that of desert soil, but does not contain humus. Soil formed on sandy soil moved by wind or coastal sand.
Soil containing humus (isohumic)	Semi-dry Areas	High content of decomposed animals & vegetation. Humus content decreases according to depth. Contains much red iron.
Soil containing moisture (hydromorph)	Senegal Riverside	Formed on alluvial layer or clay soil. Very high density. Suitable for cultivation of foxtail millet or rice due to its impermeability.
Sodium Soil (halmorphe)	Coastal Areas Riverside Areas	Extremely high density. Contains sodium, calcium or soluble compounds. Unsuitable for cultivation due to its impermeability.

Soil resources located in the southern parts have been deteriorated by wind erosion.

- Important soils to inhabitants are humic (soil with humus content) and hydromorphic (soil containing moisture), which are available for vegetation. Both soils are located in the Senegal River basin.
- Development of the phosphorous mine could have certain serious impact on the rich soil in the southern regions. Therefore, much attention should be paid to this issue.

1.5 Flora (Vegetation)

Vegetation is distributed in four areas, which are Senegal River, Sahel, Saltcat and Sahara areas. Vegetation grows in clusters in those areas according to soil characteristics like structure, impoundment or salinity. Table 1.4 shows common kinds of vegetation.

Table 1.4 Vegetation in Mauritania

Areas	Types of Trees and Grass (g)
Senegal Area	Acacia nilotica, Acacia sieberiana, Acacia seyal, Zizyphus Mauritania, Bauhinia rufescens, Crataeva religiosa, Vetiveria Nigritana
Sahel Area	Combretum glutinosum, Adansonia digitata, Sclerocarya birrea, Acacia senegal, Andropogon gayanus (g), Balanties aegyptiaca, Leptadenia pyrotechnica, Chloris prieuri (g), Cenchrus biflorus (g), cram cram (g), Commiphora africana, Boscia senegalensis, Capparis decidua, date, Zizyphus mauritania, Acacia seyal
Saltcat	Tamarix senegalensis, Salsola baryosma, Salicornia senegalensis
Sahara Area	Stipagrostis pungens (g), Acacia Ttortilis ss. Raddiana, Panicum turgidum (g)

Distribution areas for classified forests investigated by UNSO (UN Sudan-Sahel Office: office to fight against desertification and drought) in 1991 are listed in Table 1.5 and their location is shown in Fig. 1.5.

Table 1.5 Classified Forests

WILAYA	Total forest area	Name of classified forests
TRARZA (VI)	8,553 ha	Foret de Bou Hajra, Keur Mour, Gani, M' Barwadji, Dioldi, Koundi
BRAKNA (V)	8,425 ha	Tessem, Mboyo, Dar el Barka, Olo Ologo, Silbe, Afnia, Toueidieri, Lpel, Ganki
GORGOL (IV)	4,462 ha	Diorbivol, Dinde, Dao, Yame N' Diaye, N' Goye
GUIDIMAKA (X)	2,251 ha	Melgue, Seydou, Bouli, Kalinioro, Oued Jrid,
ASSABA (III)	16,105 ha	Nehame, Marai Seder
TAGANT (IX)	5,995 ha	El Mechra, Legdeim, Teintane
HODH EL GHARBI (II)	1,650 ha	Tamount de Tamchekket

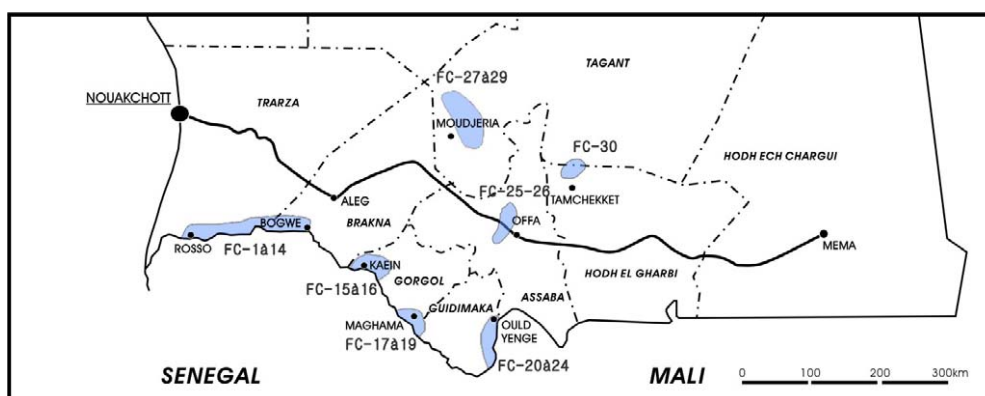


Fig. 1.5 Location of Classified Forests (hatches in the figure)

Special categories are set up for some species; 14 endangered species, 9 indigenous species and 22 protected species in the protected zones. All these species are listed in Table 1.6.

Table 1.6 Special Vegetation Species in Mauritania

Endangered Species	
• <i>Adansonia digitata</i>	• <i>Mimosa pigra</i>
• <i>Commiphora Africana</i>	• <i>Pterocarpus erinaceus</i>
• <i>Tamarindus indica</i>	• <i>Sterculia setigera</i>
• <i>Grewia bicolor</i>	• <i>Raphia soudanica</i>
• <i>Ceiba pentandra</i>	• <i>Ficus abutilifolia</i>
• <i>Dalbergia melanoxylon</i>	• <i>Sclerocarya birrea</i>
• <i>Anogeissus leiocarpus</i>	• <i>Euphorbia soudanica</i>
Indigenous Species	
• <i>Ziziphus mauritiana</i>	• <i>Acacia raddiana</i>
• <i>Balanites aegyptiaca</i>	• <i>Boscia senegalensis</i>
• <i>Acacia Senegal</i>	• <i>Panicum turgidum</i>
• <i>Maerua crassifolia</i>	• <i>Aristidal pungens</i>
• <i>Capparis deciduas</i>	
Protected Species in the Protective Zones	
• <i>Adansonia digitata</i>	• <i>Hyphaene thebaica</i>
• <i>Acacia albida</i>	• <i>Khaya senegalensis</i>
• <i>Acacia Senegal</i>	• <i>Combretum micaranthum</i>
• <i>Acacia nilotica</i>	• <i>Pterocarpus erinaceus</i>
• <i>Borassus flabellifer</i>	• <i>Raphia soudanica</i>
• <i>Boscia senegalensis</i>	• <i>Tamarindus indica</i>

• Ceiba pentandra	• Sclerocarya birrea
• Commiphora africana	• Sterculia setigera
• Dalbergia melanoxylon	• Ziziphus mauritiana
• Grewia bicolor	• Panicum turgidum
• Grewia tenax	• Aristida pungens

- Gold exploration works are currently being carried out in the northern parts of the country whose vegetation is very poor. Therefore, the impact of the mining activities is not so serious to vegetation. Special species listed in Table 7, however, must be carefully considered.
- Mining activities like the phosphorous development in the Senegal basin or Sahel area seem to seriously impact on surface vegetation. Careful action should be taken to avoid diminishing the precious Mauritanian flora.

1.6 Fauna (Animal)

Fauna's characteristics in the same four areas as vegetation are shown in Table 1.7.

Table 1.7 Mauritanian Fauna

Area	Fauna
Senegal River	Crocodile, Python, Warthog, Monkey (Patas & Cynocephales) and other many migratory birds like Mange-mil.
Sahel	Small elephant (<i>Loxodonta africana</i>), <i>Gazella dama</i> , <i>Gazella dorcas</i> , <i>Oryx algazel</i> , Lion, Leopard, Wildcat, Hyena, Cheetah, Turtledove, Duck, Wild duck, Ostrich
Saltcat	Many fishes and birds (108 species like Pink framingo, Egret, Blue heron, Pelican are identified in the national parks)
Sahara	<i>Addax nasomaculatus</i> , <i>Oryx alegazel</i> , <i>Ammotragus lervia</i> , <i>Fennecus zerda</i> , <i>Monachus monachus</i>

Fully protected 20 species (category 1) and partially protected 22 species (category 2) are indicated in the Hunting and Nature Protection Code. Those species are listed in Table 1.8.

Table 1.8 Protective Fauna Species in Mauritania

Fully Protected Species (Category 1)	
1. <i>Loxodonta Africana</i>	11. <i>Hippotragus</i>
2. <i>Addax Nasomaculatus</i>	12. <i>Giraffa camelopardalis</i>
3. <i>Oryx gazelle</i>	13. <i>Otis arabs</i>
4. <i>Gazella Dama</i>	14. <i>Nestis Nuba</i>
5. <i>Gazella dorcas</i>	15. <i>Neotis denhami</i>
6. <i>Gazella ruffrons</i>	16. <i>Eupodotis ruficrista</i>
7. <i>Ammotragus lervia</i>	17. <i>Struthio camalus</i>
8. <i>Orycteropus afer</i>	18. <i>Trichechus senegalensis</i>
9. <i>Bubalis bubalis</i>	19. <i>Monachus monachus</i>
10. <i>Damalicus</i>	20. <i>Testudo gracca gracca</i>
Partially Protective Species (Category 2)	
1. <i>Phacochoerus aethiopicus</i>	12. <i>Alopochen aegyptiaca</i>
2. <i>Anas querquedula</i>	13. <i>Lepus sp</i>
3. <i>Anas clypeata</i>	14. <i>Tringa sp</i>
4. <i>Anas acuta</i>	15. <i>Streptopelia sp</i>
5. <i>Anas penelope</i>	16. <i>Eupodotis senegalensis</i>
6. <i>Anas platyrhunchos</i>	17. <i>Coturnix coturnix</i>
7. <i>Sarkidiornis melanota</i>	18. <i>Columba livia</i>
8. <i>Numida meleagris</i>	19. <i>Dendrocygna bicolor</i>

9. <i>Plerocles exustus</i>	20. <i>Dendrocygna vidnata</i>
10. <i>Francolinus</i> sp	21. <i>Ptilopachus petrosus</i>
11. <i>Plectropterus gambensis</i>	22. <i>Flucia</i> sp

- Various faunas are seen in the southern Senegal River and Sahel areas. Comparatively poorer fauna is found in the northern areas where gold and diamond exploration works are actively being carried out.
- However, some “fully protected species” like *Addax nasomaculatus*, *Ammotragus lervia* or *Monachus monachus* are making their habitats in the northern areas so their habitat should be carefully protected.

Enough consideration to fauna should be taken for mining development like phosphorous in the southern areas.

1.7 Coast and Sea

Mauritania has a coastal zonation with an average width of 50 km and 720 km in total length from Port Nouadhibou in the north to Ndiago in the south. The coast and sea are partially contaminated by industrial wastewater, sanitary drainage, marine transportation and SNIM’s iron ore. Banc d’Arguin National Park and small-scale fishery have been influenced by the marine pollution. And oil tankers from the Middle East to EU carry the potential threats for marine contamination. Following from the expansion of social activities, Banc D’Arguin National Park suffers from a lot of garbage, especially used plastic bags damage the beautiful landscape.

On the other hand, collection of much sand and shells from the coast for civil construction causes the devastation of the coast. Erosion is especially accelerated by wind at these sites. Also a strong erosion by water at Port Nouakchott becomes an issue for the sandy coast.

The fishery resources, second largest exporting item, have been decreased by overfishing.

- A specialized port will be needed if export of base metal concentrate starts after mines are opened. Environmental consideration should be given to its construction and concentrate dispersion from the open concentrate depot.

2. Human Environment

2.1 Population

Mauritania’s population was estimated to be 2.83 millions in 2002. Population density in Mauritania is 2.6 persons per km², which is much smaller in African countries with a population of more than 2 million. Average population density in Africa is 26 persons per km², which is ten times larger than Mauritania. Table 2.1 shows the population for the past 37 years.

Table 2.1 Population in Mauritania (in million)

Year	1965	1977	1988	1993	2002
Rural Population	1.00	1.04	1.10	1.23	1.20
Urban Population	0.10	0.30	0.76	0.92	1.63

Total Population	1.10	1.34	1.86	2.15	2.83
Annual Growth Rate	n/a	1.8%	3.5%	3.1%	3.5%

Nomads made up 12.8% of the population in 1988, however this share dropped sharply to 4.8% in 2000. In 2002, urban population (57.6 %) was larger than rural population (42.4 %), which has decreased to half of 1965. These figures indicate a clear tendency of domiciling nomads and urban migration of inhabitants since the 1970s' droughts. Interestingly, according to an investigation in 2000, agricultural percentage of Mauritania is lower than other African countries.

There is a comparatively higher proportion of young people with age of less than 15 years old, 48.9 % in rural communities and 41.4 % in urban. Therefore, the demand for education, healthcare and job training is large. However, the proportion for the younger people is decreasing gradually due to the decrease in the pregnancy rate. Number of children born per woman decreased to 4.7 in 2001 from 6.2 in 1980 according to WHO statistics.

The most dense population area is around the Senegal River, which occupies 36.4% of the population. Nouakchott has the highest growth rate of population with 3.75 %, from 1988 to 2000.

By WHO statistics of 1997, total migration between wilayas was 128,000 in 1993. It means that 6% of total population moved to other wilaya and stayed there for a long time. Migration is one characteristic of Mauritanian population. The 42,300 migrants to Nouakchott make the major part of total migration, accounting for 40% of total amount. Migration to Nouadhibou is also large. In other words, migration has occurred in the high potential areas for production in the coast. Unregulated urbanization, however, gave a serious impact to the life infrastructure and social, hygiene, cultural, economical and political fields.

Mauritania gives a clear tendency in the habitation. Urbanization is advanced in the northern part (69.8 % of the northern population) and most of the inhabitants' living in the river side and central parts is based on agriculture.

Average family members consist of 6.5 in Mauritania. According to environmental data, more than 29 % of Mauritanian households depend on female, due to many male migrants and high divorce rate.

- Mine development in the northern area will involve moving people to this area because it has a very small population. Therefore, it is expected to have a large impact to the human environment. If a new mining town is built, several influential factors to inhabitants like the wind direction should be taken into account from a long-term viewpoint.
- Traditional nomads must be considered as well as new inhabitants for the mine operation to coexist with them by offering them a new route and some conveniences.

2.2 Socioeconomical Activities

Various economic reforms have been attempted in Mauritania, but not all of them have been successfully implemented. After repeated droughts, Mauritania suffered from large unemployment,

government debt and lack of transparency in government. It still retains its status as one of the least developed countries in the world. The Mauritania GNP in 2000 was US\$ 495, which was much less than the African average, US\$ 749.

Mauritania was recognized as a heavily indebted poor country (HIPC) by initiatives of the IMF and the World Bank to attain debt relief. Mauritania could reduce US\$ 1.1 billion from debt service since February 2000. In December 2001, many financing countries gave strong support to Mauritania in the Advisory Committee, which is held every three years.

In Mauritania, tertiary industry (commerce, transportation, telecommunication etc.) is a main sector that occupies 38% of total GDP. Industrial sector occupies 33% and agriculture 28%. Principal activities in the industrial sector are production of iron ore and large-scale fishery, which occupy about 95% of the total exports. Accordingly, the Mauritanian economy is affected by the international price fluctuation of these products because its economic activities are concentrated on them.

Constraints in Mauritanian economy have been considerably reduced since the beginning of the 1980's. The World Bank evaluates Mauritania as follows: "Economical structure has a sharp contrast between comparatively smaller modernized fields and traditional self-sufficient fields".

Industrial base in Mauritania is restricted to iron mining and large-scale fishery, which obtain most of the foreign currency as mentioned above, but 64% of the labor force is engaged in rural agriculture. Economic details are described in "Chapter 3" of the report.

- Mine development can be a powerful solution for the poverty problem. If other mineral resources are excavated in addition to iron ore, which is currently playing a big part in exports, the economical effect is expected to be very large. If a new mine opens, other industries related to mining will be activated as well. This secondary effect would be also large according to its production scale.
- Development of a new mine should be accompanied by a new mining town equipped with infrastructure, roads, water supply, electrical supply and schools, which improve the quality of life for the inhabitants.

2.3 Education

Average illiteracy rate was 59.98 % in 1988 and the difference between men (67.95 %) and women (52.08 %) was about 16 %. Mauritanian illiteracy rate has been almost the same since 1988. Mauritanian illiteracy was 58% in 2000 which is a very high index, considering that global illiteracy in Africa is 38 %. The government expects it to decrease to 20 % as one of the medium-term goals in the strategy for poverty reduction. Educational issues are within the authority of the central administration. Specific issues are; lack of clarity in goal and management, weakness in human resources, lack of information and inadequate budget.

The Mauritanian education system consists of elementary school (6 years), junior high school (3 years), high school (3 years) and university (4 years). As for higher education, there is a national university established in 1981, Nouakchott University in the capital. Another private university, Moroccanhas University, was just opened in 2004 to instruct business studies. International scholarship systems have been introduced. Many bright students successful at a qualification test have studied in foreign universities. Except for public schools, there are several academies for foreign languages, electrical skills and mechanical or computer skills.

- The education system does not cover mining field in Mauritania.

2.4 Healthcare

Health care is one of the serious issues in Mauritania. Some mortality rates are listed below.

Table 2.2 Mortality Rates

Item	Mortality rate
Infants less than 1 year old	118 deaths per 1,000 infants
Children more than 1 year old	182 deaths per 1,000 children
Pregnant women	930 deaths per 100,000 babies

Average life span for a newborn baby is estimated to be 51.3 years. Three major sicknesses for medical examination are acute respiratory dysfunction (14 %), malaria (12 %) and diarrhea (8 %). Immunization rates for vaccine are 93 % for BCG, 67 % for measles, 56 % for DTC5, 27.5 % for VAT2. Number of inhabitants per each medical expert is as follows: 9,425 for a doctor, 65,188 for a dentist, 167,635 for a pharmacist, 10,915 for a maternity nurse and 4,806 for a registered nurse. Epidemic and verminous diseases are on the increase. The current situation is understandable by the fact that share of healthcare expenditures of in the GNP is 1.4%, which is less than half of the African average,

- In Nouakchott there is the National Central hospital, comparatively well-equipped, with about 400 beds, the National Neuropsychosis Hospital, the only psychiatric and neurological medical center in Mauritania, with 60 beds and the National Orthopedic and Rehabilitation Center with orthopedic surgery and kinesiology.
- In local communities there are ten hospitals, 224 small medical clinic offices and two semiofficial organizations. There are SNIM hospitals with most medical courses in Nouadhibou and Zouerat.
- According to domestic nutrition data for the past ten years, malnutrition amounts to about 40 %.
- As far as there is no collection system for garbage and no waste water treatment system in the cities, the new inhabitants' daily life is very bad because they cannot keep the sanitary condition.
- In case of medical emergencies in the outmost mine sites, preventive care should be taken at the mine sites, while intensive care must be sought for in Nouakchott or Nouadhibou where medical facilities are satisfactory.

2.5 Cultural Heritage, Protected Zones and Tourist Resorts

Various cultural heritages, protected zones and tourist resorts are important areas to be kept as sanctuaries in Mauritania. Table 2.3 shows a list of them. Each zone has accommodations like hotel or/and tents.

Table 2.3 Main Sanctuaries in Mauritania

Zone	Wilaya	Category	Note
Oualata	Hodh el Chargui	World Heritage	Old city in 10 th Century
Tichit	Tagant	World Heritage	Old city in 10 th Century
Chinguetty	Adrar	World Heritage	Old city in 10 th Century
Oudane	Adrar	World Heritage	Old city in 10 th Century
Ban d'Arguin	Inchiri	World Heritage, National Park	Wild birds & fishes, Ramsar Convention
Diawling	Trarza	National Park	Wild birds, Ramsar Convention
Chatt Boul	Trarza	Natural Protective Area	Wild birds, Ramsar Convention
Liverier	Inchiri	National Protective Zone	The largest seal breeding area
Ayoun	Hodh el Gharbi	Tourist Resort	Oasis , landscape
Keur Massene	Trarza	Tourist Resort	Hunting area
Rachid-Tidjikja	Tagant	Tourist Resort	Oasis
Atar	Adrar	Tourist Resort	Oasis

The precious cultural heritages and tourist resources must be protected as a top priority and most carefully considered in the development including mining in Mauritania whose territory is almost occupied by the desert. Fig. 2.1 shows the locations of main sanctuaries.

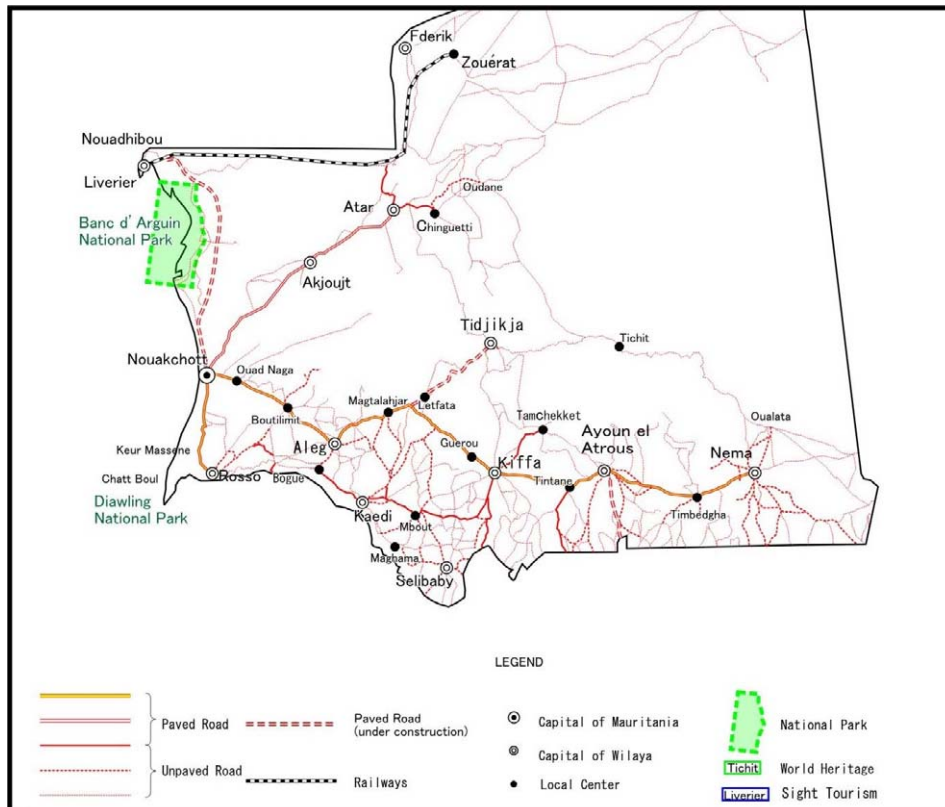


Fig. 2.1 Main Protected Areas in Mauritania

5.2 Environmental Standards in Japan

In Japan, desirable environmental standards are must be maintained on environmental conditions in air contamination, water pollution, soil contamination and ambient noise in order to protect human health and preserve daily lives. Environmental standards are shown bellows;

1. Environmental Standards Concerning Air Pollution

material	SO2	NO2	Photochemical Oxidant	CO	SPM
Environmental Conditions	Daily average of hour values: less than 0.04 ppm and hour value: less than 0.1 ppm.	Average of hour values: 0.04 ppm to 0.06 ppm or less than 0.06 ppm.	Hour value: less than 0.06 ppm	Daily average of hour values: less than 10 ppm and eight-hour average: less than 20 ppm.	Daily average of hour values: less than 0.1mg/m ³ and hour value: less than 0.2mg/m ³ .

2. Environmental Standards Concerning Water Pollution

(1) Environmental Standards for Protection of Human Health and Underground Water

Item	Standards	Item	Standards
Cadmium	Less than 0.01mg/l	Total Cyanide	Undetectable
Lead	Less than 0.01mg/l	Sexivalent Chrome	Less than 0.05mg
Arsenic	Less than 0.01mg/l	Total Mercury	Less than 0.0005mg/l
Alkyl Mercury	Undetectable	PCB	Undetectable
Dichloromethane	Less than 0.02mg/l	Carbon Tetrachloride	Less than 0.002mg/l
1,2-Dichloroethane	Less than 0.004mg/l	1,1-Dichloroethylen	Less than 0.02mg/l
cis-1,2-Dichloroethylen	Less than 0.04mg/l	1,1,1-Trichloroethane	Less than 1mg/l
1,1,2-Trichloethane	Less than 0.006mg/l	Trichloroethylene	0.03mg/l 以下
Tetrachloroethylene	Less than 0.01mg/l	1,3-Dichloropropene	Less than 0.002mg/l
Thiuram	Less than 0.006mg/l	Simazine	Less than 0.003mg/l
Thiobencarb	Less than 0.02mg/l	Benzine	Less than 0.01mg/l
Selenium	Less than 0.01mg/l	Nitrate Nitrogen	Less than 10mg/l
Fluorine	Less than 0.8mg/l	Boron	Less than 1mg/l

(2) Environmental Standards Concerning Daily Lives Protection

• Rivers (excluding lakes and ponds)

Type	pH	BOD	SS	DO	Coliform counting
AA	More than 6.5 and less than 8.5	Less than 1mg/l	Less than 25mg/l	More than 7.5mg/l	Less than 50/100ml
A	More than 6.5 and less than 8.5	Less than 2mg/l	Less than 25mg/l	More than 7.5mg/l	Less than 1,000/100ml
B	More than 6.5 and less than 8.5	Less than 3mg/l	Less than 25mg/l	More than 5mg/l	Less than 5,000/100ml
C	More than 6.5 and less than 8.5	Less than 5mg/l	Less than 50mg/l	More than 5mg/l	—
D	More than 6.0 and less than 8.5	Less than 8mg/l	Less than 100mg/l	More than 2mg/l	—
E	More than 6.0 and less than 8.5	Less than 10mg/l	No floating materials	More than 2mg/l	—

• Lakes and ponds (natural lakes, ponds and artificial ponds with capacity of over 10 million m³)

Type	pH	BOD	SS	DO	Coliform counting
AA	More than 6.5 and less than 8.5	Less than 1mg/l	Less than 1mg/l	More than 7.5mg/l	Less than 50/100ml
A	More than 6.5 and less than 8.5	Less than 3mg/l	Less than 5mg/l	More than 7.5mg/l	Less than 1,000/100ml
B	More than 6.5 and less than 8.5	Less than 5mg/l	Less than 15mg/l	More than 5mg/l	—
C	More than 6.0 and less than 8.5	Less than 8mg/l	No floating materials	More than 2mg/l	—

• Sea Area

Type	pH	COD	DO	Coliform counting	n-hexane materials
A	More than 7.8 and less than 8.3	Less than 2mg/l	More than 7.5mg/l	Less than 1,000/100ml	Undetectable
B	More than 7.8 and less than 8.3	Less than 3mg/l	More than 5mg/l	—	Undetectable
C	More than 7.0 and less than 8.3	Less than 8mg/l	More than 2mg/l	—	—

3. Environmental Standards Concerning Soil Contamination

Item	Standards	Item	Standards
Cadmium	Less than 0.01mg/l	Total Cyanide	Undetectable
Lead	Less than 0.01mg/l	Sesivalent Chrome	Less than 0.05mg
Arsenic	Less than 0.01mg/l	Total Mercury	Less than 0.0005mg/l
Alkyl Mercury	Undetectable	PCB	Undetectable
Dichloromethane	Less than 0.02mg/l	Carbon Tetrachloride	Less than 0.002mg/l
1,2-Dichloroethane	Less than 0.004mg/l	1,1-Dichloroethylen	Less than 0.02mg/l
cis-1,2-Dichloroethylen	Less than 0.04mg/l	1,1,1-Trichloroethane	Less than 1mg/l
1,1,2-Trichloethane	Less than 0.006mg/l	Trichloroethylene	0.03mg/l 以下
Tetrachloroethylene	Less than 0.01mg/l	1,3-Dichloropropene	Less than 0.002mg/l
Thiuram	Less than 0.006mg/l	Simazine	Less than 0.003mg/l
Thiobencarb	Less than 0.02mg/l	Benzine	Less than 0.01mg/l
Selenium	Less than 0.01mg/l	Nitrate Nitrogen	Less than 10mg/l
Fluorine	Less than 0.8mg/l	Boron	Less than 1mg/l

4. Environmental Standards Concerning Ambient Noise

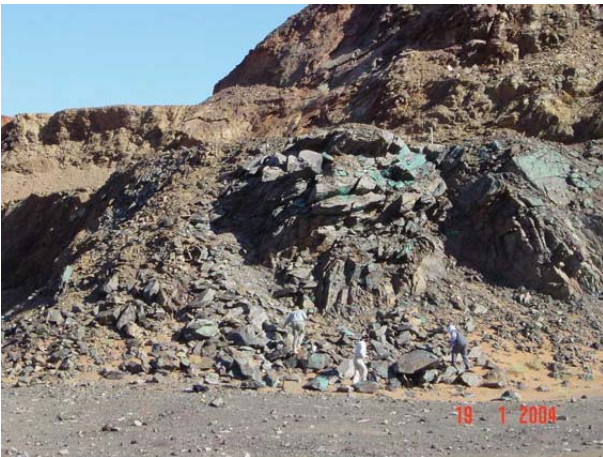
Area type	daytime	Night time
AA	Less than 50db	Less than 40db
A and B	Less than 55db	Less than 45db
C	Less than 60db	Less than 50db

6. Photos of the Supplementary Geological Survey

6.1 Akjoujt Area



1. Open Pit of Akjoujt Mine (Guelb Moghreïn deposit). NS – 400m (right-left on the photo), EW – 500m. Mining activity lasted until 1978.



2. The Vein Type Ore with Malachite, Azurite & Cu Sulfate (the part in light blue color) in Chlorite Schist



3. Study of the Ore Outcrops



4. Tabrinkout Manifestation (W)



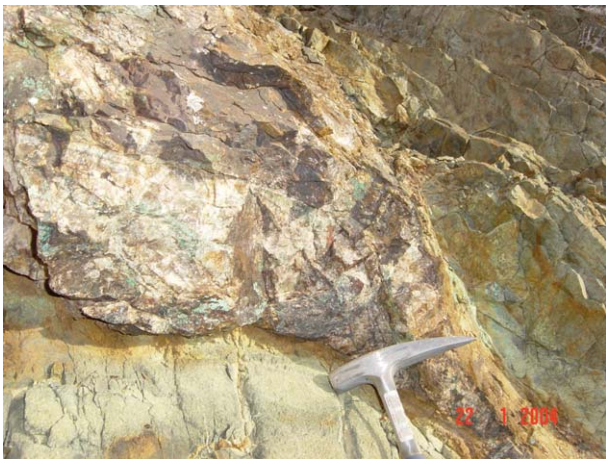
5. Technical Transfer of Simplified Measuring



6. Cu Ore Zone in Guelb Moghreïn



7. Quartz vein (AKM013) with Malachite in Chl. Schist on footwall of Guelb Moghreïn
W=10cm, Strike N25W, Dip 42° SW



8. Footwall of Guelb Moghreïn. The boundary between Chl. Schist and Carbonate ore is clear. The of boundary face shows strike N85° E, dip 30° S. A 3 cm Epidote rim is observed in Chl. Schist



9. Talc vein in Carbonate Ore (AKM018).
W=2~6cm strike N48°, dip 90°
The abundant anthophyllite is confirmed by X-ray diffraction analysis.

6.2 Zouerate Area



1. Open Pit of Tazadit T01 deposit.
Length: 700m (E-W), maximum width 500m (N-S),
Depth: 500m



2. Tazadit T014 Deposit. The volume of mining is 19 million tons per year. The ore is composed of hematite with the Fe grade of 45%.



3. Drilling Work in El Rhein Mine (Depth: 18m)
3,000 tons of ore are broken by blasting of 1 tons of ANFO in each hole.



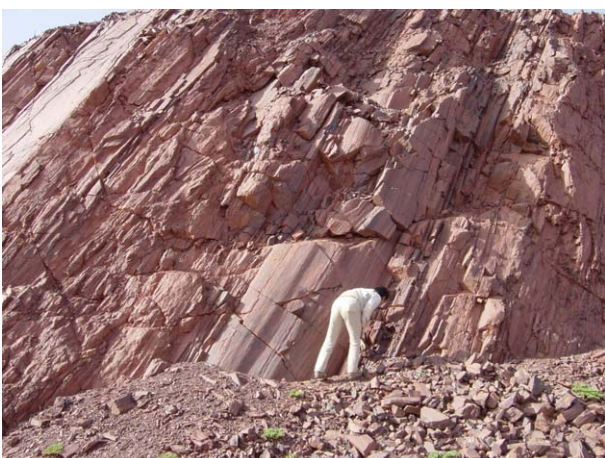
4. Technical Transfer of POSAM
(Portable Spectroradiometer for Mineral Identification)



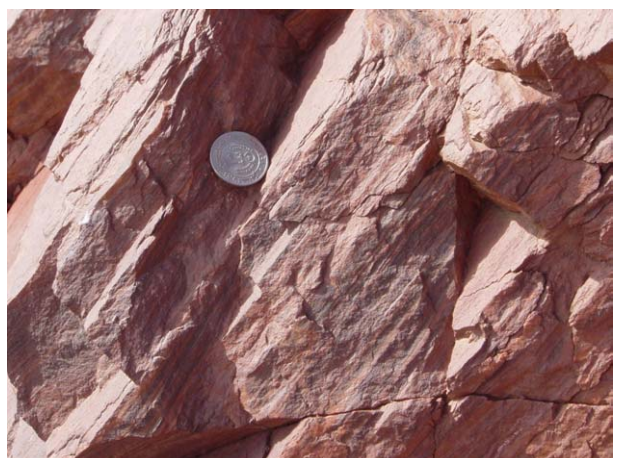
5. Transportation of iron ore by threefold locos of SNIM Railway



6. It takes 24hours to transport iron ore from Zouerate to Nouadhibou Port (650km)



7. Showing Itabrite layer with a low grade of TOI ore body (altitude 680m). Strike 60° W, Dip 55° W



8. BIF(Bandit Iron Formation) clearly shows bandit structure.