

2021-22, Spring water Management Plan in the Above: Scenic view of the steep **Territory of Simono Petra Monastery Client:** M. Athos Republic, Greece (Hydronova srl) Reference/Partners: eng. Dimitrios Kottas, Tsimas Panaiotis, Andrea Cattarossi (a. comprises several small springs Cattarossi@hydronova.tech) **Position:** hydrogeologist (team leader)

The Republic of M. Athos supports itself almost Below: one of the old spring catchment in the forested area entirely, with crop production. Water is a major source for its living and is used for drinking, irrigation hydropower and a reserve to combat seasonal fires. Source of water derives from small surface basins and the many natural springs. Due to adverse climatic changes the entire territory has been exposed to scattered water shortage in the last years. Moreover the poor design of the catchments, some dating back to hundreds of years, do not allow clean and



south west slope and the Monastery. The study area goes from sea level to 800 m (asl) and seeping out from the fractured granitic rock. Right: position of M. Athos in Greece.





constant supply. The received assignment aims to prepare a detailed inventory of all spring points and to assess a groundwater budget to evaluate the potential for development alternatives ensuring sustainability of the resources.

Left: Map of the study area with location of the investigated points. For the planning of the rehabilitation of the the existing springs the geophysical surveys enabled to find the bedrock depth facilitating the project design of the new catchments.

2020-21, Ground Water Management Plan (GWMP) for farm Harasib (Otavi, Namibia)

Client: Harasib Trust, Tsumeb (Namibia)

Reference/Partners: eng. Sarel Lacante lacante.engineering@gmail.com

Position: principal hydrogeologist

The Trust is expanding its irrigation scheme on a 20 km^{2} area and the Department of Water Affairs (Geogydrology Division) has requested the assessmento of a GWMP. The purpose of the investigations is to make sure that suitable procedure are in place to monitor and evaluate the response of the aquifer and the surrounding environment to the abstraction process and to quantify any effects of recharge. The study procedures encompass a set of more specific tests to perform, with a detail compared to the amount of the abstraction points and their rates, like:

- > Water point inventory and pump tests
- >Water level monitoring
- >Groundwater quality
- > Water balance/aquifer sustainability evaluation



The average rainfall is 550-600 mm/a (above) with potential evaporation close to 3000 mm/a. The farm is located in the Otavi Mountainland, a scarcely populated area covered by scrub savannah (main property below)







Despite the low precipitation rate the entire region hosts a fractured aquifer that can support agricolture and livestock farming. The average depth of the water table is 30-50 m (above).



Above: The groundwater in the Dolomite Aquifer belongs to the Ca-Mg-HCO3 facies with a high degree of total hardness. Below: A total number of 10 water wells were drilled, and tested to evaluate the hydrogeologic properties and define a reliable value of safe yield.



2020-21, Hydrogeological conceptual model of Sofia plain aquifer, World Bank funded

Client: Hydro Nova srl, Italy

Reference/Partners: eng. Paolo Mastrocola (p.mastrocola@hydronova.tech)

Position: lead hydrogeologist

The objective of the consulting assignment was to propose a detailed groundwater conceptual model for the aquifer system in Sofia valley. The results of this exercise were then used as a framework to assess a steady state numerical model. The main outcomes were an updated evaluation of the bulk aquifer potential and its water chemical status. Based on this preliminary reconstruction it was then finalized a general water balance highlighting the interactions between groundwater and surface water. The aquifer quantity and quality risks for the planning of future developments, were described according to the bulgarian national methodology and the EU standards.

Below: rest water level map for the unconfined aquifer. The average depth of the water table is 5-6 m, on the plain. At the date of the survey the annual water abstraction was estimated as $48 \times 10^6 \text{ m}^3/a$.





Above: This map was obtained from the processing of various stratigraphic logs and used to calculate the net to gross thickness ratio over the plain. The values were then correlated to some scattered measurements of porosity and permeability and eventually incorporated in the model cells.



Above: Piper diagram illustrating the chemical facies of the aquifer water (magnesium bicarbonate type) **Below:** digital elevation model of Sofia plain. The aquifer is surrounded by a continuous range of mountains. The main river Iskar enters the plain near German and exits at Novi Iskar.



Alessio Fileccia dr

Rehabilitation and aquifer 2018 to present, modeling of Arbaat well field, World Bank, financed

Client:Hydro Nova srl, eng. Andrea Cattarossi, www.hydronova.tech

Position: hydrogeologist

Area: Red Sea State, Port Sudan

The primary sources of drinking water supply for the city of Port Sudan are under critical decline. The reservoir dam along khor Arbaat is under threat of siltation and Arbaat well field is failing. In march *Project area location and* 2018 the World Bank contracted Hydro Nova to position of water wells perform an investigation into the possible causes for the low performance of Arbaat well field. A detailed some 40 km north west of Port assessment of the alluvial valley aquifer and inspection of almost 100 boreholes proved that the actual exploitable water volume is less than 35 l/s. The study has also shown that the majority of the wells, are very poorly built with high skin factors, inefficient screens and design. Two piezometric maps, a set of aquifer tests and a monitoring campaign, with a final numerical groundwater model allowed to recommend some preferred solutions like a partial rehabilitation of the existing boreholes and a subsurface dam.

Right: the figure provides a sketch of the proposed wells, following International Standards. The existing boreholes suffer from clogging and wrong position of the pumps, that become dry in some periods of the year.

Below: Geologic profile along Arbaat valley. The vertical scale is greatly exaggerated. The water table is the blu dotted line. The lower aquifer bed is either metamorphic or granitic, while the upper is alluvial. At present it is not clear if the aquifer bottom is highly fractured and how deep extend the fractures until finding the compact rock. On a general note the groundwater potential restricted to the fractured zone can reasonably considered poor and able to deliver only a few m³ /hr. We must anyway stress the importance of such deepest zone in the recharge process. The two aquifers are clearly in contact and there is no evidence of an aquitard between the two.



(circles). The vallev is sited Sudan and the Red Sea coast. The well field occupies a flat plain, 10 km long and 2 km wide.









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2018-19, Groundwater assesment and 3D numerical model in the Bissidirou plain (Obock region, Djibouti), Share Eau project, EEC funded

Client/Partner: Lottiassociati spa, Rome

Reference/Partners: eng. Francesco Fusco f.fusco@lottiassociati.com ; dr Giulio Cattolica g.cattolica@lottiassociati.com; eng. Paolo Polo (HydroNova p.polo@hydronova.tech)

Position: hydrogeologist, groundwater modeler

As in many african countries, the vast majority of the population has no access to safe drinking water. To partly overcome this situation, the EU has recently launched the project SHARE Eau in the Horn of Africa, for improve local infrastructures and water pipe construction. In the republic of Djibouti the coastal region close to the boarder with Eritrea has been selected for a future development. The area is known as Bissidirou plain and located 40 km inland along the river Weima. The region has a relative abundance of groundwater of good quality. The valley can be described as an elongated graben with basaltic basement overlaid by a thick alluvial deposit interfingered with lava flows. The preliminary tests have shown a fairly good potential aquifer with average yield 1-3 l/s per borehole. The numerical model (Modflow) has unfortunately shown that this rate of abstraction could lead to brackish water intrusion in the long term. Compared to the general aquifer potentials of Djibouti, the area deserves



anyway, further attention, therofore requesting a careful water management policy.



Above: hydrogeological parameters for the 8 main boreholes in the Weima valley

Below: Numerical simulation after 10 years of pumping of the semiconfined aquifer. The contour lines give the expected drawdown (m) after 10 years at 900 m³/d. The highest values, are likely to give rise to salt water invasion from the adjacent aquifer.



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2016-17, Groundwater Mapping of Sierra Leone; Client: African Development Bank, supervision Sierra Leone Water Company (Salwaco)

Referees: dr Casey Walther, Hydronova (USA); Mrs. Cecilia Greenwood, Edal Drill. Company (SL)

Position: lead hydrogeologist **Area:** Sierra Leone

The overall objective of the project was to develop a new knowledge-base of groundwater resources in Sierra Leone and establish capacities for sustainable management of national groundwater resources.

The project lasted from july 2016 to september 2017. My role was lead hydrogeologist during all phases of the research, working at close contact with a team of international experts.

The flagship product of this study was the Hydrogeologic Atlas of Sierra Leone, a series of maps and related report, published in official digital and hardcopy formats following IAH standards. The maps were prepared for Sierra Leone by using a geographic information system (GIS) format and were also implemented through a complete collection of all existing data and a period of field surveys. Main thematic maps: Lithology, Main trends, faults and fractures, Hydrogeology, Groundwater contours, Depth to water, Aquifer Vulnerability, Surface Permeability, Recharge and discharge areas,



The Estimated Depth-to-Groundwater depicts an estimate of the distance (m) from the land surface to the surface of the water table, known as the unsaturated zone. The method of analysis relied on water-level readings from shallow boreholes, hand-dug wells and other representative surface-water features. The procedure is based on a preliminary research and classification of main water points on the field, followed by the measurement of their position, elevation and depth to water table.

Water points (boreholes/hand dug wells), Aquifer productivity, Specific Capacity, Depth to basement.





Specific Capacity (SC) contour lines for Freetown Western Area. The map shows the distribution of SC derived from 74 drilling reports. Main values, corresponding to higher aquifer potential, are near Cline town, Wellington and Waterloo.

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2015-17, Groundwater resources in Iraq (ASHRI project), phase 2

Client: Unesco, EEC;

Referee: dr Andreas Lueck, Partners: Hydronova (USA), SGI (Italy), RGI (France);

Position: hydrogeologist;

Area: Iraq country

Unesco and EEC are currently operating in Iraq to improve life conditions after the recent war. One of the main goal is the implementation of water supply works and the assessment of new and safe aquifers. Due to the uncontrolled post war activity thousands of unauthorised wells

were drilled causing severe drawbacks in water quality and potential.

Attention was then paid to deep groundwater reservoirs. During the implementation of ASHRI-2 project, five main aquifers were identified as priority systems over which focusing groundwater exploration and exploitation, and located at several hundreds meters of depth. Further more to raise the general awareness among the governmental personnel in charge of water management, a comprehensive manual was prepared, focused on the country hydrogeology. The Manual, defined generally as a Drilling Handbook, was intended as a document for well drillers and groundwater field technicians operating in Iraq. The rationale behind was to serve both, as an inventory of groundwater resources and to populate the wells and database system. As a final task a training course was held in Amman to 20 Iraqi staff, on basic hydrogeology, water well drilling and completion and aquifer tests.



During the last phases of the project a hands on course was held in Amman to describe the main topics of the Drilling Manual and to visit some monitoring stations.



Screen selection (from the Drilling Manual)







Hydrogeological cross section of the Umm er Radhumaand Dammam Aquifer System (North) across the Kuwait-Saudi border

2005 in progress, hydrogeology and karst extension in Otavi mountainland

Clients/Partners: Namgrows, Harasib farm (LF Pretorius Trust), STS-Italia

Otavi mountainland is located in the northern part of Namibia at an elevation of 1300-1900 m asl. On a wide region of 5000 sq km, made essentially of limestone terranes of 750 million years, some of the biggest underground lakes have been discovered recently. Among them Dragon's Breath and Harasib are the best known. Their waters could be connected to the big Etosha pan, some 150 km farther to the north. The extension of the first, where we focused our researches, varies during the years due to precipitation. It was 26000 sqm in 1991 and 18000 sqm in 2011. One of the aims was to set up a plan to protect this fragile environment from overexploitation also finding alternative places where pump out water for local farming. At the time a well is delivering water to kettle at a low rate.

The lake was surveyed again and explored underwater down to 105m (J. Martinez, P. Marti) without reaching the bottom. To check the hydraulic connections piezometric maps and a monitoring program were set up. These investigations allowed us to locate new positions for drillings that came out to be succesfull after a geophysical campaign.



The Otavi triangle, in north Namibia. The groundwater is flowing radially to the north, east and west.





Dragon's Breath: The underground lake, one of the biggest on the world, had an extension of 170 x 140 m in june 2011, but was much bigger in 1991, due to its lower level. The recharge rate is very rapid allowing a rising of the surface as much as 8 m during a 5 months time.

Below: water level readings at three water points 5-7 km apart at one hour interval; the curves show a very good hydraulic connection and quick response of the aquifer after the rains



Below: The topographic profile shows where The chamber is located compared to the ground surface. The roof is gently sloping on either side and lake extension is bigger when water level is lower.



2008, feasability study for flood prevention on Mekerra river basin

Client: Europaid (Safege, Bruxelles); **Referees:** Mn. E. De Clermont-Tonnerre; **Position:** hydrogeologist (ECT); **Area:** west side of the country, Atlas mountains, south of Sidi Bel Abbes

In the framework of a project financed by Europaid, a geological and hydrogeological study has been carried out on the south part of the Mekerra river basin between Ras el Ma and Sidi Bel Abbes. Aim of the study was the reduction of the destructive floods that annually take place along the upper part of the river flow. Thanks to the aerial and satellite photos available it was possible to combine geological and hydrogeological data with filed trips and to prepare a Permeability map for the upper part of the river basin. The project was conducted in cooperation with a group of EEC experts in hydraulics and GIS and allowed to map the hazard areas and those with infiltration basins to slow the river floods.



2008, feasability study for the exploitation of submarine springs

Client: Europaid (Safege, Bruxelles)

Referees: Mn. E. De Clermont-Tonnerre (CE)

Position: consultant in charge of the project (ECT)

Area: Algeria, mediterranean coast (1200 km)

EEC is currently present in Algeria with a number of project in the field of groundwater resources.

The present study aimed to investigate the natural discharge along the coast. It is well known that limestone outcrops are potentially good sites for submarine springs. This is particularly true in many places along tha Mediterranean sea (Lebanon, south of Italy, Sardinia, Croatia etc.).

Investigations were carried out with local experts from ANRH (Agence Nationale Resources Hydrauliques) by means of aerial and satellite photos. This first approach allowed us to prepare a list of feasible places to visit and map more in detail. A general evaluation of the karst extension and aquifer potential was finally prepared together with an inventory of the most important submarine springs.

The study was able to ascertain that no important outflows are present along the 1200 km to account for further projects.

Below: one possible solution proposed for the exploitation of a submarine spring taken from the italian institute CNR 1969 (G. Stefanon). The system prevents mixing between fresh and salt water during low regimes.



The study area of 1200 km under investigation is greyed. Along the algerian coast porous and karst aquifers can be encountered; the last being the focus of our researches; sub marine springs are known to be located preferably on limestone terranes.





Above: the use of satellite photos modified to show differences in water temperature are extremely useful to detect underwater springs. The picture shows an elaboration: red colour reveals warmer temperatures while blue the cooler.

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1991-92, hydrogeological 2d model of the Dogon plateau

Client/Partner: Caritas Swiss branch, Luzern, dr Claudio Cavedon

Reference: Dr H. Staubli

Position: consultant in charge of the project;

Area: Dogon Plateau

The evaluation of groundwater resources is considered a preliminary phase for the exploitation of aquifers.

This is particularly important in arid and semiarid areas.. The Dogon plateau is currently overexploited due to extensive farming. Its average extension is 80 x 60 km with large outcrops of quartzitic sandstone and interbedded layers of conglomerate and argillite. General permeability is low and depending on fracture concentration. The aquifer is unconfined everywhere and only locally confined, while precipitation accounts for 450-500 mm/yr. Due to high evaporation (3000 mm/yr) recharge is very low and concentrated during storms. The need for irrigation is high exposing to risk of lowering the water table thus compromising the water balance. The present study was conducted to establish real dangers and evaluate the aquifer potential and sustainability.

A number of 400 wells were inventored which allowed us to dress up several piezometric maps and a 2D numerical model. The simulated water table helped to better understand recharge and discharge The study allowed to position future boreholes and to calculate the amount of renewal of ground water resources.

Bottom page: Numerical simulation of the semiconfined aquifer. The overexploited area of Bandiagara is well visible; arrows show flow directions



Above: geological sketch of Dogon plateau. Vertical exaggeration is 10 times. The most striking morphological element is the Bandiagara cliff; contour interval is 20 m.

Task performed:

Water point inventory Piezometric maps Water balance assessment Pumping tests Chemical analysis Numerical model



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1987, hydrogeological and geophysical researches for Water Work Authorithies

Client: Studio Lotti e Ass. s.p.a., Roma

Reference: dr L. Zoppis

Position: consultant

Area: north and south of the country

The project was financed by the italian Ministry of Foreign Affairs and aimed to renovate the allocation of water resources in 9 provincial towns scattered in the country.

Due to extensive precipitation most of potable water is withdrawn from rivers with less investment but highly dependent on precipitation and with higher risk of bacterial pollution.

Field researches aimed to evaluate ground water as an alternative supply to surface water.

The bottom figure shows a geologic profile close to the city of Kanchanabury along the left bank of the river Kway. The area is located on a wide valley filled with loose sediments.

After a geophysical campaign and aquifer tests the proposed solution was the drilling of infiltration wells between 20 and 30 m depth, along the right river bank.



This suggestion coupled with the existing aqueduct, made it possible to overcome major sanitary problems due to bacterial pollution.

Task performed:

Water point inventory

Pumping and aquifer tests

Vertical electircal soundings

Below: The research area west of Kanchanabury and close to the border with Myanmar (former Birmania)



Left: A vertical electrical sounding (Schlumbérgér arrangment, with AB line of 500 m and average depth of penetration of 40-60 m.

Below: electrostratigraphic profile along right bank of river Kway. The area where we focused our researches is located between VES K11 and the right bank, where the higher resistivity values have been encountered (50 - 150 ohm.m). The exploratory drillings confirmed the presence of a 10-15 m thick layer of sandy gravel.



Period: 1985-86

(Sudan)

Drilling operations in the Darfur region

Client: Montedison Servizio Agricoltura s.p.a., Ref. Dr. A. Avellino

Position: consultant

The project was financed from the U.N.D.P. in the framework of the Water Sector Program and aimed to improve farming and sanitary conditions in Darfur rural areas.

The project area has an extension of 300 x 400 km between Jebel Marra and north Kordofan. Seventytwo new boreholes were drilled and 22 rehabilitated during the operations.

The most important aquifer is located in the Nubian sandstones a common continental formation spread throughout Sahara.

Less important aquifers are in the surficial deposits and in the weathered material of the crystalline basement.

The pumping tests performed allowed to caluclate a safe extraction rate between 0.5 - 6 l/s, quite a normal figure for the region.

Period: 1989

(Sudan)

Geophysical researches in Dongola state

Client: Geoexpert Int. s.r.l., Trento Ref.: Prof. A. Fuganti

Position: consultant

An extensive geophysical campaign covering an area along the river Nile, north of Dongola was carried out for a ground water study. The project was financed by the Sudanese Ministry of Energy.

The two phases were made up of 150 vertical electrical soundings with AB arrangements of 1500 - 2000 m.

The soundings aimed to reconstruct the morphology of the crystalline basement, made of precambrian granite and gneiss at 250 - 400 m depth.

The geoelectrical soundings allowed us to calculate also the average thickness of the aquifer made of the Nubian sandstones and hence served as a program for the new water boreholes.

Contours (isobaths) show the depth of the rock basement. They derive from the electrical surveys and some drilling log interpretation. The figure shows the maximum depth of the basement at 600 m below surface and making up the bottom of the underground water reservoir. (Contour interval is 100 m)





Measuring the pump discharge with a container during a pumping test





dr Alessio Fileccia

1985, rural water supply

Client/Partner: E.E.C, Geoscience, Florence

Reference: dr. C. Smith

Position: consultant

Area: atlantic coast between Buchanan and Sasstown

financed by the European The project was Econimic Community and completed during 6 months in four different counties: Gran Bassa, Sinoe, River Cess, Grand Kru located along the atlantic coast of Liberia. The project was addressed to improve the living conditions and development of infrastructures. As consultant I was in charge for the assessment of the groundwater potential and part of a team with an hydraulic engineer and two sociologists. At the end of the field trips a Master Plan for the management of surface and underground water was established. The four counties had an extension of 27000 sq km and a population of 310000. Topographic relief is characterised by gently rolling hills covered by dense tropical vegetation on a lateritic soil. Average rainfall is high and between 2000 and 5000 mm/yr. The tar roads are few and main villages are connected by gravel roads that become muddy during rainy season, slowing down every kind of communication. Several area have been visited for the project where hydrogeological and geophysical reconnaissance was made.

On the basis of this preliminary investigations a list of feasible sites where to drill new boreholes was prepared. The aquifers have low potential due to lack of large alluvial plains but nevertheless they are adequate for the local living standards. Along the coast there is a belt of loose alluvial deposits hosting interesting water reservoirs. Further inland the outcrops of the Guinean shield are present. These are made of granite dating back to 2,5 billion years with surficial aquifers of very low porosity and high iron content. The drilling program has prevued jet/driven wells along the shore and rotary or hand dug wells inland.

Work performed:

- geoelectical soundings
- water points inventory/piezometric maps
- field chemical analysis
- hydrogeological reports on 25 areas

Below: the four counties where the project has been carried out in Liberia. The investigated area has an extension of 27000 sq km



Below: stratigraphic log of well Gb25, near Buchanan, on St John's river estuary. The log was drawn using gamma and resistivity logs. Water well screens were positioned between 20 an 24 m of depth. High values of counts per second (c.p.s.) means clay content, while high resistivity correspond to coarse grains and hence a water bearing layer.



1979-83, hydrogeological investigations on the karst aquifer of Cyrenaica

Client: Hydrogeo s.p.a., Pisa;

Reference: Dr geol. Giuseppe Ghezzi

Position: consultant

The project was financed by the Lybian Ministry of Agricolture and was addressed to the improvement of the existing water supply and the ground water assessment of the entire region. Under this last issue, 100 new deep wells were prevued. The first phase began east of Benghazi (Bayda-Bayyadah area) and went on to the east during the following three years up to Jebel el Akhdar at 600 m of elevation, near Cyrene. The area had an extension of 3000 sq km. Cyrenaica has an average rainfall of 400 - 500 mm/yr but today's recharge is reserved to surficial aquifers. Deep reservoirs had been replenished during humid interglacial periods. Rock formations are made of limestone with layers of marl and clay. Deep drillings to 250 m have shown confined aquifers on the west side while karstic aquifers are present on the east, sometimes mixed with salty water. To evaluate the problem of sea intrusion due to overexploitation, aquifer tests have been performed on site. Between Bayda and Cyrene tracer and pumping tests, water point inventory and the survey of several caves allowed us to reconstruct different hydrogeological basins and the feasability of use of karst springs.

Work performed:

- -photogeology
- vertical electrical soundings (40)
- -Water points inventory/piezometric maps
- drilling/pumping tests assistance (50)
- -Electrical well logs
- underground surveys
- final reports

Uranium ore prospecting (Kufra desert)

Client: Centro Ricerche Geologiche s.p.a., Florence

Reference: Dr Alberto Pistolesi

The desert south of Kufra is considered a former sedimentary basin today covered by dune ridges made of coarse quartz grains. These eolian deposits derive from the erosion of intrusive rocks of precambrian age. Few outcrops are present and made of granite (J. Uweinat, 1900 m) and flat hills of sandstone and siltstone (cretaceous).

The task was performed by prospecting on the field with scintillometer and drilling with percussion hammer. The ore is embedded in sandstones, sienites and carbonatites outcropping on vast areas from Kufra oasis to the border with Egypt.

Work performed:

- geological surveys
- -photogeology
- drilling assistance
- -welllogs

Below: geologic assistance during drilling in the limestone formations at 200 m depth (Jebel el Akhdar)

Below: map showing two project areas: Cyrenaica to the north, for the ground water researches on the karstic aquifer, kufra desert to the south where uranium ore prospecting was carried out.



dr Alessio Fileccia Consulting geologist

Period: 1977

(Nigeria)

Hydrogeological researches in NE State

Client: Centro Ricerche Geologiche spa, Florence

Reference: dr Alberto Pistolesi

Position: consultant

In the framework of the economic cooperation between the Italian Ministry of Foreign Affairs and the Nigerian Government, a project dealing with the improvement of the water supply system in NES was carried out. Issues of concern were the ground water resources between lake Chad and river Benue. Important aquifers are located to the north along the south shore of the big lake where loose continental deposits outcrop, namely sand and silt. The overall thickness is more than 2000 m with three main water reservoirs wich deliver on average 10 - 15 l/s per well. To the south the basement complex and the hard quartz sandstones give poor yields (1 - 5 l/s). Several water wells were drilled at a maximum

depth of 260 m following the rotary drilling method with direct or reverse circulation.

Task performed:

- well site positioning
- geologic assistance during drilling
- electrical well logs

Below: simplified geological map of Nigeria.

The project area is located south of lake Chad were several boreholes have been drilled in the loose deposits of the "Chad Basin" and the fractured sandstones of Gombe and Bima (Yola)

Niger Lake Chad ;0KOto Dahomey Maiduguri o Chad basin Nigeria Jos plateau Yola Bamarda mountains Western african shield □Tertiary Cretaceous Basin Gulf of Basament of Niger Oban mountains Guinea delta 200 400 ∃ km

Period: 1975-1976

(Algeria)

Geotechnical study for a railway project

Client: Laboratoire Nationale des Travaux Publics, L.N.T.P.B., Algeri;

Reference: Ing. Paul Brossier

Position: long term contract

Directly employed from the National Agency and in charge of the field surveys and drilling campaign for a commercial railroad of 1500 km between Tindouf (Gara Djebilet) and Oran (La Macta). The railway had to connect a big iron mine close to the border with Mauritania to the Mediterranean sea. The field team had experts from the american company Ford Bacon and Davis inc. that made the feasability study. During field works 5 drilling rigs for the geotechnical investigations were operating. They performed 250 bores from Bechar to Oran mainly close to the proposed river crossings and tunnel entrances across Atlas mountains.

Task performed:

- in charge of 5 drilling rigs along 600 km of the line
- geological surveys for the ballast
- geotechnical tests (permeability, packer etc.)



Above: the grey line shows the proposed commercial railway, on the west side of the country. After completion the train had to transport the iron ore from the big mine of Gara Djebilet to the sea. For security reasons and due to the bad political situation the project was definetly stopped in Bechar.