DANMARKS OG GRØNLANDS GEOLOGISKE UNDERSØGELSE RAPPORT 2005/75

Final Inception Report November 2005
Mining Sector Support Programme

Technical Assistance to the Geological Survey Department, Ghana
EU Project 8 ACP GH 027

Per Kalvig

GEOLOGICAL SURVEY OF DENMARK AND GREENLAND
MINISTRY OF THE ENVIRONMENT

GEUS

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LIST OF ABBREVIATIONS

BEAK	Beak Consultants GmbH, Germany
BRGM	Geological Survey of France
CSPIP	Civil Service Performance Improvement Programme
EDF	European Development Fund
EPA	Environmental Protection Agency
FS	Field Sheet
GGMPP	Ghanaian-German Mineral Prospecting Project
GEUS	Geological Survey of Denmark and Greenland
GGS	Ghana Geological Survey (this name applied for the future semi-autonomous Geological Survey agency)
GIMPA	Ghana Institute of Management and Public Administration
GMODB	Ghana Mineral Occurrence Database
GSD	Geological Survey Department, Ghana
HRD	Human Resource Development
IMS	Information Management System; Project under the MSSP
LAN	Local Area Network
MC	Minerals Commission
Ministry	Ministry of Lands, Forestry and Mines
MSSP	Mining Sector Support Programme
NDF	Nordic Development Fund
PMU	Project Management Unit, for the EU sponsored MSSP, Accra, Ghana
Survey	Geological Survey Department, GSD
TA	Technical Assistance
WB/NDF-Project	Mining Sector Development and Environment Project
WB	World Bank

PREFACE

The Inception Report has been prepared in accordance with the contract between the Government of the Republic of Ghana, represented by the National Authorising Officer for the EDF, Ministry of Finance, and the Geological Survey of Denmark and Greenland (GEUS). The contract states that,

- the inception phase will start up immediately,
- the inception report will be delivered within one month
- the Consultant will review relevant background information such as policies, strategies, the functions of GSD and regional offices
- the Consultant will prepare a detailed work-plan for the implementation of the project, and
- discuss the plan with the counterpart

The GEUS Project Manager, Dr. Per Kalvig, arrived to GSD, Accra on September 7th, 2005, and commenced work on September 8th.

A work-plan proposal encompassing the project approach, the staffing, the timing and the areas of focus have been discussed with the Client at an Inception Report Workshop held in Ghana on October 5th, 2005.

The Draft Inception Report was submitted at the GSD Director on 19 October 2005, and subsequently discussed by GSD and GEUS in a meeting held at the GSD, on 5 November 2005. On this basis amendments were made for the Final Inception Report.

In the MSSP/TA Project GEUS is acting adviser to the GSD Director. In this capacity GEUS is free to present ideas and suggestions and recommendations. The management of GSD is not bound by the advise given by GEUS.

The delay on the completion of the Inception Report is not expected to impact the implementation of the project programme.

EXECUTIVE SUMMARY

Background

In accordance with the service contract No. SVC/05/05/EDF (Project no. EDF 8 ACP GH 27) under the Mining Sector Support Programme (MSSP) for Technical Assistance to the Geological Survey Department, GEUS provides one long-term expert for a period of 27 man-months and a number of short-term experts for a total of six man-months. The total length of the project amounts to 30 months. The Project commenced on 1 September 2005 and shall be completed not later than 29 February 2008.

The Technical Assistance Project will exploit the results of the previous WB/NDF Project (2001-2003) contracted by GEUS.

General findings

The present financial situation of the Geological Survey Department (GSD) does not permit the Survey to carry out its core business activities. The irregular and insufficient financing prevents proper planning and execution of the activities.

The GSD is a department under the Ministry of Lands, Forestry and Mines, and thus operates under the Civil Service Code, setting strict limits as to staff set-up. The total GSD staff is c. 320 of which c. 135 are based in Accra, with the remaining in the six Regional Offices. Only about twenty of the geoscientists have a formal specialisation at MSc or PhD level. Given the financial funding the Survey is presently considered overstaffed, and a mismatch occurs between the number of professionals and admin./technical staff. The solution to this problem is depending on an organisational reconstruction of the Survey into a semi-autonomous agency under the Ministry.

Task A

The Mission and Visions statements for the Survey have been amended in 2002. The present project will undertake an assessment to ensure that the statements are still relevant and appropriate, also for a future semi-autonomous agency.

Task B

A provisional structure of the Survey was established in 2003, comprising a directorship (one Director and two Deputy Directors), six geo-scientific divisions, and one division for administration and finance. A Divisional Head manages each division, except two managed by a Deputy Director (Div. for Admin. & Finance; Div. for Geophysics). In general the specialisation within the divisions requires enhancement to cope with its scope of work. Use of available in-house specialisation can be optimised. Enhancement of the knowledge base could be achieved by training and by addressing the pool of specialities available within the Survey. Training of all groups appears to be seriously needed

both at employee and management level. A plan to reorganise the structure is being prepared, which will address some of these shortcomings.

Task C

A detailed HRD Plan was developed in 1999 but appears as yet not implemented, except for the training provided under the WB/NDF Project. As pointed out by the WB/NDF Project a good number of the junior geologists lack elementary skills, which prevent them from undertaking independent field work and reporting. A short-term and a long-term Human Resource Development Plan will be developed in this project, addressing such shortcomings and encourage enhancement of more general skills among the professionals. The development of the HRD plans will take training provided under other MSSP projects into account.

Besides, detailed plans will be developed for the secondment of GSD staff going for specialised training at the Copenhagen Geocenter - funded by the DANIDA Fellowship. It is proposed that part of this training is converted to training in Accra, to meet the training needs among a larger group of geologists.

It is observed that both vertical and horizontal flow of information needs improvement, in order to enhance efficiency and activities. A HRDP, in addition to short-course training, will address the needs for enhanced administrative, managerial and leadership capacities/capabilities of the management group.

Task D

In the course of the WB/NDF-Project an interim plan of reorganisation of the GSD was developed. The current interim status hampers the implementation of the reorganisation, and the Heads of Divisions do not at present have the responsibility with respect to planning and execution, staffing, budgets and costs for their division's activities. However, the Project will assist the Divisional Heads in their endeavours to develop action plans for the strengthening of their divisions, addressing topics such as various shortcomings, human resources, capabilities, budgets, and potential focus areas to be developed – or abandoned. The training needs are to be detailed in the HRDP (Task C1 and C2).

Task E

The WB/NDF Adviser did not regard it possible to enhance the capabilities of the GSD under the present set-up. The present Adviser supports this view. For the past three years efforts have been made to transform the Survey to a semi-autonomous agency under the Ministry; these efforts have as yet proven unsuccessful. We recommend that a brief strategy plan be written, explaining to stakeholders and decision-makers that the development of a sustainable mining industry, environmental- and geohazards problems, land use planning, water resources, and energy all

require the availability of knowledge-based geo-scientific data. This in turn calls for an efficient, up-to-date geological survey organisation.

Task F

As a consequence of the inadequate funding of the GSD over the past many years, only limited geological mapping activities have been undertaken, with the consequence that a large number of potential map areas have as yet not been mapped, and many junior geologist therefore are inadequately trained. Very limited training has been provided since the WB/NDF Project, though a number of senior/principal geologists are well qualified to do so. It appears that the junior geologists seconded to the upcoming MSSP-Geological Mapping Project in general are in need of training. In close co-operation with the contractor of the MSSP Mapping Project, a training programme will be organised to provide the junior geologists some basic skills prior to the implementation of the MSSP field-work.

Task G

Geological mapping of the Voltaian Basin has been given low priority over the past many years, because of the scarce outcrops and low ranking of its mineral potential. However, increasing demand for water resources and hydrocarbons have changed the priorities. Efforts are therefore now being made towards the developing of a stratigraphic model for the Voltaian Basin, e.g. geological mapping of the FS 1001D under the MSSP Mapping Project. The Adviser will assist the GSD in developing the stratigraphical concepts of the basin, on the basis of information and data provided by the GSD. Given the time limits for this task, the Adviser foresees that only an overall framework for the concept can be developed. Training in modern stratigraphical principles will be provided in the course of this task, and a manual for geological mapping of sedimentary terrains will be developed.

Task H

In the WB/NDF Project a Ghana Mineral Occurrence Database (GMODB) was developed in MS Access, and training in database construction and maintenance was provided. The GMODB has since then not been further developed due to other commitments. A new Information Management System will be developed under the MSSP, encompassing a new database platform and a LAN installation, connecting all agencies in the Ministry. Given these circumstances it is recommended to liase with stakeholders, prior to further development of the database. The Client is advised to revitalise the GSD Management Database Group for overseeing the development of the new information system, hereunder the implementation of the GMODB and its possible transformation into a database as a part of the new system.

Task I

The needs for additional databases was also discussed in the WB/NDF Project, but in the interim no attempts towards developing new databases have been made, except for data related the Ghana-

Germany Environmental and Engineering Geology Project. The IMS Contractor (BEAK) concluded most spatial data is in bad condition, and rectification is a prerequisite before further use. The Management Database Group is advised to address these requests as they are deciding on the priorities to the new databases being developed. The Adviser will assist the Director and the Management Database Group in this, liasing closely with other MSSP projects in order to incorporate their database requirements.

Task J

The stratigraphical division of the Birimian Supergroup as applied by the GSD differs from that being used by the Geological Surveys in the neighbouring francophone countries. The Ghanaian-German Mineral Prospecting Project (GGMPP) suggested that volcanic and sedimentary rocks were formed simultaneously over a period of few million years. The solution of this problem will require a major scientific effort, which is deemed beyond what is possible within the limits the project. GEUS will after discussions with the GSD design a research programme to focus this problem; implementation will have to wait until the necessary funding can be found.

INCEPTION REPORT

1. Background

The mineral sector in Ghana has grown significantly over the past decades. However, the known resource-base is depleting and only few new deposits are being discovered. Furthermore, the regulatory institutions and geological support organisations are weak and exploration activities have declined. To mitigate these adverse conditions and to create a favourable atmosphere for future mining activities, the EU has provided funding to the Government of Ghana, under the Mining Sector Support Programme (MSSP).

Institutional reinforcement and capacity-building activities are part of the Agreement, and include among other activities 'Technical Assistance to the Geological Survey Department (GSD)'. The Agreement also includes programme activities that will provide modern geological and geophysical information through (a) geological mapping of selected areas, (b) acquisition of airborne magnetic survey in the Volta and Keta Basins, (c) quality control of airborne geophysical survey data, (d) an airborne gravity survey, and (e) establishment of a modern information management system,

The current contract under the Mining Sector Support Programme (MSSP), is signed between the Government of the Republic of Ghana, represented by the National Authorising Officer for the EDF, Ministry of Finance, and GEUS, to the effect that GEUS should provide one long-term expert and a number of short-term experts for technical assistance to advise and assist the Director in restructuring the GSD into a more efficient organisation.

Under the Mining Sector Development and Environmental Project (WB/NDF-Project), GEUS provided an adviser to the Director of the Geological Survey Department (GSD) during 2001–2003, to assist in restructuring the GSD into a more effective organisation. The main aim was to re-construct GSD sequentially and to focus on the main components of providing the 'basic geological infrastructure'.

The findings, achievements and conclusions made by GEUS were as follows,

- Lack of sufficient funding of the Survey, poor remuneration of its personnel, and low level of training of junior geoscientific staff are obstacles to the desired development;
- Transformation of GSD to a semi-autonomous organisation under the Ministry should be given high priority, enabling the new organisation to adjust its scope of work and to address the present problem of overstaffing;

- A draft Act for the new organisation – Ghana Geological Survey (GSS) – has been presented to the Ministry.
- New GSD Mission and Vision statements have been formulated;
- The GSD' potential for producing new geological maps was enhanced, and the following achievements were made;
  - Three geological maps a 1:100.000 were produced in GIS
  - A Geological Mapping Manual, setting standards for further field activities and for instructions in proper mapping techniques were produced and implementation was initiated
  - Thin sections were provided
- Because of financial constraints it has not been possible to set up a new thin section laboratory.
- The acquired XRF Spectrometer was at the end of the Project still awaiting installation.
- A group of the GSD profession staff was trained in GIS applications.
- GEUS analysed which databases would be most needed, in order to enable GSD to present its data to the public. A Minerals Occurrence Database was established.
- Contributions to the 'Archive Rehabilitation Unit' by proof reading, editorial advice etc.
- In the field of Human Resources Development, training courses were provided in geological mapping procedures, GIS, and database issues. Some GSD staff visited GEUS to get training in various fields of data management and in geochemical analytical techniques.

It is in this context that the present Technical Assistance to GSD must help the re-structuring of the GSD. As stated by GEUS (WB/NDF project) this is a difficult task - perhaps hardly achievable - given the present organisation set-up and financial constraints.

The funding now available via EU grants for a number of issues of great importance for GSD and Ghana should be absorbed and put to the best possible use. The future co-operation between GSD and GEUS will be aimed at this goal.

2. General conditions

2.1 Finance

The WB/NDF Inception Report stated that it would only be possible to significantly improve the efficiency of the GSD provided that necessary funding from the Government of Ghana is allocated *and* that GSD changes status into a semi-autonomous institution, enabling the organisation to adjust its tasks and personnel accordingly.

As indicated in the Table 1, the financial constraints have not changed to the better. The table also indicates the problems created by the discrepancies between the approved budget and the released funding. It is the view of the Adviser, that management of a modern geological survey requires strict compliance between budgets and released funding, in order to enable the survey implement necessary long-term research and work plans.

GSD has not yet achieved the status of a semi-autonomous organisation, although much effort has been spent on this task.

***Table 1**: Funding of Service and Investments released to GSD, 1997- 2004*

		1997	***1998***	***1999***	***2000***	***2001***	***2002***	***2003***	***2004***
Service (Mio. Cedis)	Approved	n.a.	n.a.	1,853	6,083	1,296	609	1,341	3,000
	Released	331	465	909	1,196	605	424	1,164	2,036
Investment (Mio. Cedis)	Approved	n.a.	n.a.	1,853	3,391	3,109	410	264	1,200
	Released	408	1,008	635	1,507	2,241	110	151	1,066
Salaries (Mio. Cedis)	Approved	478	544	862	961	1,202	2,137	4,264	3,080
	Released	478	544	862	961	1,202	2,137	3,097	3,080
Administration (Mio. Cedis)	Approved	60	46	350	509	1,006	702	1,309	1,100
	Released	60	46	350	509	1,006	702	817	606

(Figures partly from WB/NDF-PROJECT Final Inception Report 2001, and partly provided by GSD, 2005)

With regard to the financial constraints under which GSD must operate, it is not only the inadequate funding that poses a problem. In addition, discrepancies between approved budget and released funds as well as untimely release of the necessary funds severely hamper planning and the possibility to improve the productivity of the Survey. For example, the scheduled mapping activities – which are one of the core activities of a Geological Survey – have in reality been put on hold because the necessary funds are not available. Consequently, the much needed field training of assistant geologists cannot be undertaken due to non-availability of funding.

2.2 Personnel

The GSD total staff amounts to about 310, of which about 135 are based in the GSD Head Quarters in Accra; the remaining work out of the six Regional Offices in Takoradi, Saltpond, Ho, Koforidua, Kumasi and Tamale. The WB/NDF Final Report has pointed to the fact that the GSD, under the current financial scheme, is overstaffed, and a mismatch was observed between the numbers of geoscientists and administrative and technical staff. This problem still occurs. Besides, less than half of the geoscientists are formally trained at MSc-level or above. In essence, critical fields of specialisations are either not available or just represented by one or two persons. These problems can not be addressed under the present circumstances, in which the Survey operates under the Civil Service Code.

***Table 2**: Annual recruitment of geoscientists.*

	YEARS			
Degrees	**2002**	**2003**	**2004**	**2005 (to date)**
BSc	2	0	7	4
MSc	0	0	1	3
PhD	0	0	0	0
Total	**2**	**0**	**8**	**7**

***Table 3:** Training background and position for geoscientists. Figures are provisional.*

Position	**Diploma**	**BSc**	**MSc**	**PhD**	**Total**
Directorship			3		3
Divisional Head		1	3	1	5
Principal Geoscientist		2	4	3	9
Senior Geoscientist		3			3
Geoscientist		6	1		7
Assistant Geoscientist		17	6		23
Total		**29**	**17**	**4**	**50**

Table 4: *The staffing and formal specialisation of divisions and Regional Offices. Provisional figures.*

	Head Office						Regional Offices				
	Info. Man.	**Gen. Geol.**	**Geo-chem**	**Envir. Geol.**	**Geo-phys.**	**Econ Geol.**	**W/R**	**N/R**	**E/R**	**V/R**	**ASH**
Geophysics	1 MSc	1 MSc			1 MSc 1 PhD						
Seismology					1 MSc						
Hydrology		1 MSc			1 MSc						
Envir. Sanitation					1 MSc						
Geochemistry			1 PhD								
Mineral Exploration			1 MSc				1PhD	1MSc	1MSc		
Environmental geology		1 MSc		1 BSc							
Engineering geology											
Petrology				1 MSc							
Gen. geology		1 MSc								1 BSc	
Sedimentology											1MSc
Ceramics						2 BSc					
Bachelors	3	5	1	3	3		2	0	1	1	1

The WB/NDF Final Report has also pointed to problems related to the very low remuneration of GSD's personnel. Geologists and other staff groups are leaving for better paid jobs in the minerals industry; sometimes after money have been spent on their training overseas. Though this may not be bad for the country, it does make it difficult to develop the GSD.

The Director has over the past couple of years stressed the necessity of enhancement of the management staff, encompassing recruitment of e.g. one Administration and Finance Officer; one HR Officer; one Legal Officer; one Policy and Planning Officer. The Adviser will in the course of Task B and Task C2 provide his recommendations as to the administrative set-up.

2.3 Hardware / software equipment

In September 2005 the MSSP/IMS Project reviewed the status of the GSD, and found that presently the Survey is not very well equipped with modern hardware and software. In addition to these shortcomings the Survey has presently no functioning photocopier, and the numbers of printers are very limited.

The IMS operator made in September 2005 the following observations: *'At the GSD 46 computers exist. About 30 of them have an acceptable processor speed and disc space. 10 computers (with a disk capacity of 40 GB) are used explicitly for an environmental project with the BGR, and 4 computers are linked in small network at the geophysical section.*

A connection to the Internet is established via dial up on demand.'

The IMS operator records a complete list of software licenses applied by the Survey.

The IMS operator made the following statement as to the data storage system: '*Currently, no central data storage systems exist at the GSD, neither for digitally stored information nor for analogous stored information. The data storage is related to different divisions and responsible people. Often digital data is stored on one computer only. Due to limitations of the disk capacity, data has been transferred to CD-ROMs for external storage and back up'.*

2.4 Organisation - status

The GSD is presently a department under the Ministry of Lands, Forestry and Mines. This means that the Survey operates under the Civil Service code, and thus has to comply with a certain set of rules regarding staff. Under this code GSD is neither in control of recruitment nor staff notice. Furthermore, the remuneration schemes are also defined by the Civil Service code. As a semi-autonomous agency the Survey would be able to adapt the number of staff to its actual needs and provide better wages for its remaining personnel. Thereby job satisfaction would be improved and fewer qualified staff would leave the Survey for better paid jobs in the private sector. A more autonomous status would thus enable the Survey to better undertake commercial contracts to improve the funding of activities.

Over the past four years considerable efforts have been spent reorganising the Survey. In addition to a large number of documents and recommendations, a draft Act was provided under the WB/NDF project. But so far these efforts have not been proven successful.

During the WB/NDF Project a provisional structure of the Survey was established in 2002, and some adjustments were made in 2003. No changes have been made since then. The GSD organisational structure is further discussed in chapter 3.2. Divisions and their responsibilities are given in Table 5 (p. 18).

3. INSTITUTIONAL CAPACITY BUILDING

3.1 Task A – Review of GSD's Mission and Vision Statements

Findings

The first GSD Mission statement was formulated in 1998. In the WB/NDF-Project it was revealed that some clarification was required. In a workshop held in 2002, the following Mission statement was adopted:

> **'***The Ghana Geological Survey, as the principal curator of all national geoscientific data, has the main task to continuously generate, collect, store and archive geoscientific data, and to disseminate data and information in a user-friendly way to the government, industry and the public at large. Generation of geoscientific data is done through geological mapping, research and investigation. The Survey has the responsibility to advise the State to make informed decisions on geoscientific issues concerning mineral resources, environment, groundwater management, land use planning and geohazards.'*

A set of visions were developed under the WB/NDF project, to express the ideals, which the development of GSD and its daily activities should be aimed at, such as:

' The Ghana Geological Survey endeavours;

- *To develop into a Geological Survey which is highly recognised internationally and which has a competitive reputation world-wide*
- *To create an attractive and inspiring working environment, based on ethical and social values, and thereby maintain a skilled work force*
- *To produce up-to-date geological maps, based on the integration of geological, geophysical, geochemical and remote sensing data in a GIS environment*
- *To re-establish a national digital seismic network in order to define earthquake-prone zones in the country as input for effective land-use planning*
- *To contribute to the continuous exploration and sustainable exploration of rocks, minerals, hydrocarbons, and underground water resources*
- *To establish and maintain a national geological information system consisting of reports, maps and other data in an easily accessible manner for end-users. This should include all bore-hole information such as reports, logs and cores*
- *To continuously publish its new geological findings nationally and internationally*
- *To be pro-active in promoting the public understanding of the relevance of geo-sciences to key issues for society and the importance of the Survey for the sustainable development '*

Suggestions

As a first step we will examine the Mission and Vision statements to ensure that they are still appropriate and relevant and can guide the organisation, also in the event that GSD is transformed to a semi-autonomous agency. The review will include interviews with the management of the GSD and selected key stakeholders. In the event amendments seem required the necessary actions will be taken to assist the GSD management in this.

As a second step, we propose to focus on the implementation of both the Mission and Vision statements within the organisation itself, to strengthen the identity and to emphasise their importance among the staff.

Deliverables

A brief report on the findings and proposals

Assisting in implementing the Mission and Vision statements in the organisation

Time frame

The Findings Report will be presented to the GSD management not later than the end of fourth quarter 2005.

3.2 Task B – Preparation of detailed plan of re-organisation

Findings

The WB/NDF-Project found that the most important aspects of reconstructing the GSD are related to create a more independent organisation with a Governing Board, which ultimately also will have the responsibility, in cooperation with the Director, to reconstruct the Survey.

In order to introduce a step-by-step reconstruction of the Survey, the WB/NDF Project assisted the Director in organising a temporary structure of the Survey. Formally the original organisational structure thus still exists but has a dormant status, but an operational structure was put in place in 2003. The new structure includes a directorship (comprising one Director and two Deputy Directors – an Administrative and a Technical), one division for Administration and Finance, and six geo-scientific divisions. The divisional responsibilities stated in the GSD-organogram are listed in Table 5.

Table 5: *The operational GSD structure - Divisions and divisional responsibilities*

Division	**Responsibilities**
Division for Administration & Finance	Policy & Planning Budget Human Resource/Personnel/Public relations Legal affairs Secretariat General services (security, cleaning, car fleet etc.)
Division for Information Management	Data management (GIS and digital data) Records office (physical reports & data) Library Core repository Geological map production
Environmental Geology Division	Environmental geochemistry Hydrogeology Engineering geology Site investigations Drilling
Geophysical Division	Ground geophysics/petrophysics Airborne geophysics Seismology
General Geology Division	Geological mapping Stratigraphy Remote sensing Thin-section laboratory Regional offices (six in total)
Geochemistry Division	Regional geochemistry Analytical laboratory
Economic Geology Division	Mineral resource assessments Industrial minerals, ceramics and dimension stone

A Deputy Director heads the Division for Administration & Finance.

The importance of close co-operation between the different Divisions and between Divisional Heads and the Director was pointed to by the WB/NDF-Project. However, it appears that management meetings are held irregularly, which is an impediment to the development of the new organisational structure. The flow of information from management to the staff can be improved.

Inadequate financial funding of some of the core activities for the Survey hampers the implementation of the new organisation. The current status of GSD as a department under the Ministry means that the Survey is not in control of staffing and remuneration, and this is a serious problem for the implementation of a modern Geological Survey.

It is observed that in some cases the geoscientific specialisation of a division is not appropriate with respect to the fulfilment of its scope of work. For example: (a) the Environmental Geology Division has no geoscientists formally trained in the field of hydrogeology, and no strong experience within this field is available, although hydrogeology and water resource management are meant to be new key areas. (b) The Economic Geology Division has no geologist formally trained in economic geology; (c) The General Geology Division has no expertise in stratigraphy without which mapping of sedimentary terrains is hardly possible. Except for Division of Geophysics, the divisions do not possess a specific pool of specialists within its field of specialisation.

However, some of these expertise's are available in-house but currently assigned to other tasks; e.g. none of the specialists in economic geology are assigned to work in the Division of Economic Geology; the Survey's sole specialised sedimentologist is mainly working on the Birimian System. It is recommended to consider a reorganisation of the in-house pool of expertise in order to enhance the required specialisation of each division.

It is understood that apparently no budget is allocated to each division under the responsibility of its divisional head. This and the irregular and inadequate funding of activities make it almost impossible for the heads to plan and carry out relevant activities. Several heads request training on management matters.

Implementation of the new organisation is a corporate matter, and should therefore be led by the directorship and the divisional heads. It appears, however, that it has been difficult for the management to keep the pace of the implementation.

Suggestions

It is important that the organisation and management structure reflects the goals set out according to the Act, the Mission Statement, and the Strategy Plan. At the same time the organisational structure shall allow flexible and efficient execution of management directives. The organisational structure shall also ensure efficient interfaces with stakeholders, including national and international programmes. To address such needs we will analyse the current structure, and put it into the contexts of Task C1 – Human Resource Development Programme, Task C2 – Development of the Administrative, Managerial and Leadership Capacities, and Task D – Execution of Plans to Strengthen the Divisions.

We recommend that a review of each division should be undertaken in the light of the Mission, the Vision statements and any other strategic documents, prior to any changes of the present organisation. We will support a concept in which each division constitutes a pool of relevant geoscientific specialisations lead by a divisional head with a proven record as a geoscientist and manager. The organisation shall reflect the current areas of focus, rather than would-be focus-areas.

Also the organisation of the Records Office and the Library will be addressed.

In the course of this task the Adviser will assess the various capabilities in terms of staff specialisation and equipment within each division, and proposals for amendments will be provided. An optimisation of the human resource capabilities of each division is strongly required, addressing also the issue of overstaffing. This may include informal staff interviews of geoscientists.

Deliverables

A detailed plan of re-organisation addressing the organisation of each Division, Regional Offices, the Records Office and the Library, the Central Drill Core Repository, the Petrographical Laboratory and the Central Seismic Station and National Network.

Time frame

We find it of outmost importance that a full insight is achieved by all before any recommendations are made, and therefore propose to commence this task during the second quarter of 2006. We anticipate a completion of the review before the end of the third quarter, 2006, enabling the amendments to be put in place and monitored during 2007.

3.3 Task C1 – Prepare a long-term and short-term Human Resource Development Programme (HRDP)

Findings

A detailed plan for HRD was made in 1999, (‘Draft Training Policy for the Geological Survey Department’), providing a firm basis for further work. However, it appears the policy was not implemented. In the period since the WB/NDF-Project to now has hardly any in-house training been provided by GSD staff specialists aimed at various GSD staff groups. The conclusions made by the WB/NDF-Project are therefore still valid. This study concluded that the senior geologists are well qualified. The assistant geologists and geologists, however, lack many elementary skills such as ability to correctly identify minerals, rocks and structures in the field; many of them can only carry out mapping projects under close supervision. GSD was advised on various types of necessary training

in elementary skills, such as simple mineralogy and rock classification. The following in-house training was given under the WB/NDF-Project:

- Field training to mapping geologists
- General aspects of mapping and map production
- A geological mapping manual was developed and comprehensive instructions given
- Course in basic petrology (microscopy of thin sections) and rock classification
- GIS On-the-Job Training
- Basic training in database development and management
- Some senior staff were seconded for advanced training in Copenhagen in database development and rock geochemical analysis
- Two senior staff were seconded for field mapping projects in Greenland
- A geological excursion for a group of mapping geologists was organised to study rock units in the Western and Central Regions of Ghana.

In addition to these courses training has been provided to a group of geologists by the GSD-BGR Environmental Geology Project, on topics encompassing GIS, engineering geology, and geohazards.

Training in petrography and geological mapping techniques has only been undertaken rarely, and junior geologists recruited in the interim after the WB/NDF project have not as yet been trained.

The Ten-Year Strategic Plan (2004–2013) provides a useful frame of the Humane Resource Development Plan.

Apparently, the technicians and administrative staff have for the past couple of years received very little training and some staff none at all. It appears that enhancements of basic and specialised skills for these groups are needed, in order to transform the GSD into an efficient semi-autonomous agency. This calls for a comprehensive Human Resource Development Programme. The programme should specifically keep focus on sustainability on the training, ensuring that qualifications of all staff groups are maintained on a regular basis.

Suggestions

A modern Geological Survey requires a thorough and dynamic training policy – including management directives for its implementation – in order to cope with the activities a geological survey must handle. This policy shall encounter the needs for training of recruited staff, and continued training in new skills or new technology should be implemented. The training policy shall of course reflect the requirements stated in the Geological Survey Act, the Mission Statement, and the Strategic Document.

Initially, we will review the Draft Training Policy of May 1999, within the perspective of the Ten-Years-Strategic Document, and based on that propose amendments to bring it up-to-date. An implementation plan will be developed in-close co-operation with the management. Importantly, the implementation plan will consider sustainability of the training plan beyond the conclusion of this project.

In order to identify the training needs, an assessment of each Division/Regional Office will be carried out. On this basis both a short-term and a long-term Human Resource Development Plan (HRDP) will be presented. The details of these plans will also take into account the additional training that will be provided by other projects under the MSSP-umbrella, in order to co-ordinate and optimise the overall training programmes.

The short-term HRDP shall try to ensure that the seconded geologists to the MSS projects possess sufficient skills to participate in the activities, such as basic mapping geology disciplines, petrography, economic geology, sedimentology and stratigraphy. A ‘quick start’ training course for junior geologist may be considered, after consultations with the Client and the MSSP Mapping Project Contractor. It is recommended that training efforts be provided jointly by senior GSD staff and the Adviser.

The long-term HRDP will cover the geoscientific staff as well as the technical and administrative staff. The long-term HRDP will be developed jointly with other contractors under the MMS Programme, such as CGS/Geoman/BRGM for the training related to geological mapping; Fugro/BGS for the airborne geophysical survey; and BEAK for the Information Management System. Specific training courses for geologists – in-house and in the field will be arranged on subjects in relation to geological mapping, stratigraphy, economic geology and databases. A strong demand for training on subjects with regard to presentation of geoscientific data was expressed at the Inception Report Workshop (Minutes of the Workshop, Appendix B). This will be addressed in the development of the HRDP.

The development of a detailed training plan will await discussions with the operators in the MSSP projects.

The long-term HRDP will also lay out a strategy for undertaking the training of the geoscientific staff in cooperation with relevant institutions or universities.

The Adviser will head the training programme, and some Survey specialists will be involved in providing training, so as to ensure sustainability after the conclusion of this project.

The Danish Ministry of Foreign Affairs, the Business Cooperation & Technical Assistance, has confirmed that the Ministry will support training programmes (the so called DANIDA Fellowship) in Denmark within a maximum amount of 10 percent of the Danish share of the total contract, equivalent to approximately 60,000 EUR. The Adviser recommends that this funding be spent partly on additional training in Ghana, with the aim to train a larger group of staff and partly on training for seconded staff at Geocenter Copenhagen, thus boosting the very limited amount of man-months available for short-term experts in Ghana. Any outcome of the training discussions with the Client needs an approval by DANIDA (the Business Cooperation & Technical Assistance) prior to the execution of the programme.

In view of the vast mapping challenges the Survey is facing over the next many years, we propose two topics for this training:

(a) Precambrian geology and rock geochemistry, age determination etc. and/or
(b) Advanced stratigraphical methods and sedimentary basin analysis.

A detailed proposal will be presented by the Supervisor including a budget break-down.
The DANIDA Fellowship shall commence not later than two years from the date of pre-approval.

The training needs of technicians and administrative staff in basic skills will be dealt with in the HRDP.

Deliverables

- Interviews with all geoscientists mapping their career projections and training needs
- A detailed Human Resource Development Plan will include both a short-term plan and a long-term plan, comprising (a) Review of and amendments to the Draft Training Policy document; (b) Assessment of the training needs of the geoscientists; (c) Assessments of the training needs of the administrative and technical staff
- DANIDA Fellowship – a detailed proposal
- Implementation: On-the-Job Training and formal in-house short course training.

Time frame

Since it may be required that the seconded junior geologists undertake some immediate training this component of the training programme will be given priority, and scheduled for the fourth quarter of 2005. It is considered possible to deliver the HRDP at the end of the first quarter 2006.

3.4 Task C2 – Development of the administrative and managerial leadership capacities

Findings

The success of a semi-autonomous Geological Survey agency is based not only on the expertise and knowledge of its geoscientists, but also on efficient management and administrative procedures clearly focused on the objectives defined in Mission and Visions.

The temporary and informal organisation of the Survey comprises a directorship, consisting of a Director and two Deputy Directors, one Administrative and one Technical, and a number of divisions. Principal geologists are appointed as Divisional Heads, except for the Geophysical Division and Division for Administration & Finance which both are headed by a Deputy Director.

A number of policy papers have been developed to guide the management on how to operate under the current structure. However, it is observed that further improvement of both vertical and horizontal flow of information is needed. We find it of prime importance that the management group is briefed regularly on general affair matters; lack of information will prevent the heads to organise the work of the divisions efficiently. It appears that the awareness about information flows among Divisional Heads needs improvement. It is also equally important that the Heads of Divisions and their divisional staffs hold regular information meetings. Further training in management, leadership and a disciplined company spirit will help alleviate this.

Several divisional heads have expressed a need for training within the fields of work planning, budgeting, reporting of financial results, use of performance indicators and staff management.

It can be observed that certain staff groups among administrative and service personnel are organised in a very inflexible structure, in which services beyond a few fixed tasks are neither expected nor offered. This rigid structure most likely is inherited from a past system. It can be thought of as a reflection of the culture of an organisation, and this can be developed into something more suitable. Such development requires both a thorough understanding of the activities – and responsibilities - of the Survey, which probably necessitates a top-down approach involving information and general training. We therefore recommend that training of these groups should be considered.

Suggestions

The Human Resource Development Plan will address the development of the administrative, managerial and leadership capacities of selected employees of the GSD. The training programme will comprise elements such as e.g. goals and framework, strategic management plans, delegation

of responsibilities, personnel management, and motivation of personnel. Training will also be provided in methods for budgeting and reporting financial results.

The training will include On-the-Job Training and formal short courses in-house training provided during the project period. The training will include topics such as e.g. budgeting, staff management, work planning/implementation/monitoring; development and use of performance indicators; reporting; development of commercial activity contracts; and public relation activities and stakeholder contact. It may as well be considered to draw on the expertise provided by GIMPA, provided funding can be arranged.

Deliverables

- A detailed plan of HRDP focusing managerial and administrative training
- Short courses and On-the-Job Training

Time frame

We regard it as possible to submit a HRDP for training of management skills not later than end of January 2006, enabling the implementation of training to commence at the end of the first quarter of 2006.

3.5 Task D – Assistance in the execution of the plans to strengthening the newly created divisions of the GSD

Findings

In the course of the WB/NDF-Project an interim plan of re-organisation of the GSD was developed. Divisions were established aimed at enhancements of the management of the Survey. The arrangement was suggested to bridge the gap until a semi-autonomous status can be approved. The organisational structure now operates with five data collecting divisions and two divisions that are more general, one for Data Information Management and one for Finance and Administration. Acting divisional heads have been appointed. The current structure of GSD does not allow formal appointments of Divisional Heads, and in consequence no inducements can be given to this new group of staff. Besides the heads have no independent charge with respect to activity planning and execution, staff, budgets and costs. In effect the divisions are not yet fully implemented, and in reality the role of the divisional heads is comparable to a Team Leader. It appears that this group would benefit substantially from management training and from sharpening of delegation and responsibilities.

In general, the divisions only undertake tasks given by the Director. If no tasks are given, or when the activity is completed, the level of activity decreases sharply. It appears that such 'free' periods are not utilised to enhance skills nor to undertake improvement of the divisional knowledge base. It is recommended to encourage 'teach-your-self' training in such vacant periods, in order to bridge the gap between staff specialisation and the specialisation in the divisions. The present mismatch not only hampers staff motivation but also impacts on quality of work in each division. It is recommended to pay special attention to this issue in combination with the activities carried out under Task B.

A number of strategic documents and training policy papers spell out the need for regular training. However, a need for enhanced implementation of plans and specific training programmes seems justified. Presently training is provided on ad-hoc basis only.

Suggestions

The overall objective of the Project is to support the reinforcement and reorganisation of the GSD into and effective, customer oriented organisation. The Survey must become customer oriented, and provide high quality services and products to the Government, the public stakeholders, the mining sector's institutions and to the private sector. This goal is only achievable if the professional capacity is specialised, focused and meets international standards. The recommendations to be made will be based on the review undertaken in Task B. The Adviser will assist the divisional heads in their endeavours to develop action plans for the strengthening of their divisions, addressing topics such as various shortcomings, human resources, capabilities, budgets, and potential focus areas to be developed – or, if necessary, abandoned.

We recommend that the training needs be detailed in the HRDP (see Task C1 and C2). The training plan must be two-folded: (a) to address the professional enhancements of the division and (b) to address the managerial aspects. We recommend that the Adviser assists the divisional heads in implementing management routines. Besides the Adviser will advise the divisional heads on potential areas of business which – in the time to come - could generate an income to the GGS. The plan of strengthening will be developed jointly by the divisional heads and the Adviser; key stakeholders will be consulted.

Deliverables

- Assistance to the divisional heads in their endeavours to develop and implement a divisional plan of strengthening. Progress reports will be reported on a quarterly basis.

Time frame

The activities are supposed to be ongoing throughout the course of the Project, and initial activities are anticipated to take place in the first quarter of 2006.

3.6 Task E – Advice on and assistance to the GSD to become a semi-autonomous institution under the Ministry

Findings

The WB/NDF-Project assisted the Director in his efforts to transform GSD to a semi-autonomous agency. Such status will enable the Survey to better adapt the number of staff to its actual needs and provide better wages for its remaining personnel; in consequence, job satisfaction will increase and HR turn-around will decrease. As a semi-autonomous organisation the Survey will also be able to generate income to cover parts of the running costs, and thus be less dependable on the inadequate and irregular financial appropriations from the Government.

A large number of documents have been produced in order to facilitate this change e.g.:

- The Amendment of the Geological Survey Act. The draft has been presented to the Ministry of Lands, Forestry & Mines, and is now awaiting presentation to the Parliament. It is the view of the Adviser that some minor amendments to the Draft Act would make the tasks of the GGS more clear.
- 'Memorandum to the Cabinet' (of April 2005) is made on behalf of the Ministry in which the Minister supports the new concept and presents the GGS to the Government. The Memo also explains the market prospects of the Survey. The Adviser recommends that a thorough review of the budget should be carried out to ensure that realistic estimates are made of the potential revenues from external clients.
- A Strategic Plan (2004-2013) for the Ghana Geological Survey has been developed, presenting a detailed run-down of all division programmes and plans. The Adviser finds it difficult to grasp which areas are in focus and which are not – and why. It is therefore recommended to develop a brief version designed to enhance stakeholder's and decision-maker's awareness of the importance of having a National Geological Survey of high international standard.
- The Annual Report (2004) presents a run-down of the finances, administration and the geological activities. Besides each division presents their annual work. However the results are not put into the perspective of the objectives/scope of work/budget and the achievements made, nor are any constraints/ shortcomings in regard to the execution of the geological activities reported. It is the Adviser's view that such documents do not provide the decision-maker with the information required ascertaining if the financial funding is sufficient or not. Besides the report does not explain if targets are met or not.

We would like to point to the fact, that a transformation into a semi-autonomous agency does not imply that all problems are solved. Most likely this new status will generate some new fields of problems to be addressed. Of these generating supplementary income to fund the running costs of

GGS will be critical. Implementation of commercial activities becomes a necessity, and the execution of such activities shall go hand in hand with the execution of compulsory GGS activities. It is recommended to develop a policy outlining to which extent and the type of commercial activities being acceptable.

Suggestions

The efforts made to date and the many convincing documents produced to support the transformation into a semi-autonomous organisation, is acknowledged. Apparently the Minister and key stakeholders support the concept. It is therefore not clear to the Adviser why this matter is still pending.

We agree that the need for this transformation is critical. Without this, GSD will not receive the full benefit of the majority of the efforts being put into this project. To geo-scientists it is a well known fact that knowledge based geo-scientific data is a prerequisite for the development of the society, with respect to mineral resources, building materials, energy, water, land-use, environment and geo-hazards. However this is not the case for the majority of stakeholders and decision-makers. Consequently, we recommend undertaking the following actions to further the process:

- To develop a condensed and brief strategic plan with the aim to explain and illustrate this relationship to decision-makers and stakeholders.
- To develop a chain-of-command process for documents between the Minister and the GGS (in effect its Board of Directors), encompassing such documents as:
  - GGS Strategy Document (preferably 8 years period),
  - GGS Performance Contract between the Minister and the GGS (preferably 4 years period) (to be the tactical plan developed on the basis of the Strategy Document).
  - GGS Annual Work Programme (2007) (to be the operational plan detailing the GGS Performance Contract)
  - GGS Annual Budget (2007) (detailing the budget framework provided by the GGS Performance Contract).
  - GGS Annual Financial Report (2007). (To be developed at the beginning of year 2008, reporting the 2007 books, put into perspective of the GGS Annual Budget (2007)).
  - GGS Annual Activity Report (2007). (To be developed at the beginning of the 2008, reporting the 2007 activities and achievements made, put into perspective of the GGS Annual Work Programme (2007))

Such documents make all achievements apparent to the public, stakeholders and decision-makers enabling them to assess if there is a good match between the funds spent and the results achieved. Such documents are indispensable management tools not only for the Board of Directors and for the senior management of GGS, but also for the Ministry.

The management is recommended to second one geoscientist acquainted with the Survey policy and strategic documents – on a full time basis - to be in charge of the development of such documents.

Deliverables

- To supervise and oversee the development of the above mentioned documents
- To supervise and assist in any such activities deemed necessary by the Director in his endeavours to achieve a semi-autonomous status for the Survey.

Time frame

We recommend commencing these activities not later than second quarter of 2006, in order to ensure that approved documents are available at the very beginning of year 2007. Not later than at the end of January 2008, the reporting activities shall be in place.

4. ASSISTANCE IN TECHNICAL SUPPORT ACTIVITIES

4.1 Task F- Assistance in implementing applied methodology to guarantee mapping consistency and uniformity in underlying concepts

Findings

In consequence of inadequate funding to the Geological Survey Department over the past many years, geological mapping activities have only been undertaken to a limited extent. From this follows that many of the geologists – especially among the assistant geologists and geologists - have gained insufficient mapping experience to ensure consistency and uniformity in the underlying concepts to geological mapping.

At Head Office, the Division of General Geology does not possess any geologist trained in the fields of sedimentology, palaeontology and stratigraphy; one trained sedimentologist is based at the Regional Office in Kumasi. In consequence mapping of complex sedimentary terrains such as the Voltaian and Buem Systems is hardly possible with the current staffing.

These shortcomings were of a major concern to the WB/NDF-Project, and a large number of activities were initiated to enhance the geological mapping capabilities, among others:

- A geological mapping manual was developed
- Field excursions were arranged on both introductory level and advanced level

- Assistant geologists and geologists were trained in elementary mapping techniques
- Petrographical training was given and a teach-yourself thin-sections kit was provided
- Short courses for assistant geologists and geologists were given in topics such as rocks and minerals identification, structural geology, and stratigraphy
- All mapping teams were assisted in the field

The thin section lab is dysfunctional, and no thin sections have been made since the WB/NDP project. A new lab will be established under the MSS Project. Skilled and experienced staff is reported available. Since they have not been active for some time limited training or brush-up will most likely be required.

The WB/NDF Project recommended that a geological maps database should be developed, but this has not as yet been worked upon.

Currently systematic geological mapping activities are undertaken in Upper East Region (FS 1003B2); Upper West (1001A2); Western Region (FS 0502C1; FS 0502C2); and Volta Region (0700A4 (Worawora)). The target areas either are in close proximity to known gold mineralised districts or fall within major aero-geophysical anomalies. However the funding is inadequate to finance the geological fieldwork and logistics. In consequence - and despite the fact that geological mapping is one of the core businesses of any Geological Survey – these field activities have in reality been put on hold. This in turn impedes the training of the assistant geologists and the consistency of the geological maps.

Geological mapping Status for geological mapping of the 1:100,000 field sheets over the past four years are as follows:

- F.S. 1003A2,4; B1,2, Upper West Region: Geological map completed and available
- F.S. 1001A4, Upper East Region: Geological map completed and available
- F.S. 1001A2, Upper East Region: Geological mapping in progress; almost completed (*).
- F.S. 0700A4, Volta Region: Mapping reportedly completed; compilation and description in progress
- F.S. 0502C2, Western Region: Geological mapping in progress; about half way through (*)
- F.S. 0502C1, Western Region: Geological mapping in very early stage (*)
- F.S. 0501B3,4, Greater Accra Region: Geological map completed and printed

(*) No activity due to inadequate funding.

The WP/NDF-Project observed some problems mapping the FS 0700A4, overlaying the Buem formation and provided assistance in mapping sedimentary units. It is not clear if a trained sedimentologist has been involved in the compilation and quality control of this field sheet.

A Ghana Stratigraphic Committee has been established, with the objective (a) to develop accurate and precise nationally acceptable terminology and procedures tailored to international practice, (b) to prepare national/international agreement on principles of stratigraphic classification for effective communication. A standard legend for the Birimian and part of the Voltaian has been suggested under the WB/NDF-Project, based on mapping done under the Ghanaian-German mapping project (GGMPP). The colour index standard legend covering all subsurface units requires revision and will be reviewed considering the above mentioned efforts.

As part of the MSSP activities a geological mapping campaign is being undertaken. The project includes the following field sheets:
FS 0903B – Birimian System dominating
FS 0903D – Birimian System dominating
FS 0803B – Birimian System dominating
FS 0503B – Birimian System dominating
FS 1001D – Voltaian System dominating
Parts of FS 0800C,D and 0700A,B – Togo/Buem Systems dominating

The programme includes a training component of the GSD geologists seconded to the project. It is again strongly recommended to co-ordinate all efforts on training being provided by the various projects under the MSSP.

Suggestions

It is imperative that new geological maps of Ghana are based on the state-of-the-art scientific concepts of Precambrian geological evolution, and it is important to ensure that the applied methodology guarantees mapping consistency and uniformity in underlying terminology. Consequently the Geological Mapping Manual prepared in the WB/NDF-PROJECT project will be reviewed and amended if deemed necessary. Hard copies of the final version will be made. In addition, a Mapping Manual for mapping sedimentary terrains will be developed under this project (see task G). Strict implementation by the MSSP mapping teams will be ensured.

About fourteen GSD geologists will be involved in the MSSP mapping project. Thus only a very small number of geologists are left to undertake the duties of the General Geology Division, including the completion of the Field Sheets which are currently in production. GSD is recommended to allocate as much financial resources as possible to proceed the systematic geological mapping projects. The possibility of additional external funding should be considered as well.

It is important to continue the digitising process of old maps, along the concept agreed to in the WB/NDF-Project. For this purpose training of geologists in reading geological reports with insight and extracting information from ‘Archive Reports’ is essential, and should be sustained.

A prerequisite for undertaking the activities which fall under this task, is that the relevant staff group is available to participate in the training programme. We understand that the Survey will take the necessary steps to make this happen.

The revision of the colour index standard legend covering all subsurface rock units should be undertaken in close co-operation with the National Stratigraphic Committee. The Advisor will follow the work undertaken by the National Stratigraphic Committee closely, and advise the Director on this matter.

Deliverables

- Geological Mapping Manual (Final Version); digital version and 30 hard-copies
- Training in the use and implementation of the Geological Mapping Manual
- Various short courses in topics backing the geological mapping (to be further detailed in cooperation with GSD and the MSSP mapping project contractor)
- Assistance in the revision of the colour index standard legend

Time frame

The training of junior geologists in the application of the Geological Mapping Manual will commence in the fourth quarter of 2005; the training will continue on ad-hoc basis throughout the project period. Short courses on related topics will be provided during the second quarter of 2006 and onwards on ad hoc basis. The assistance in the revision of the colour index standard legend will be provided on ad-hoc basis.

4.2 Task G – Assistance in developing a stratigraphic model for the Voltaian Platform and establishing a standard manual guide for mapping in the Voltaian

Findings

The sediments of the inland Voltaian Basin, covering more than 100,000 sq. km forming one of the three major geotectonic units of Ghana, include sandstones, mudstones, conglomerates, carbonates and locally volcanic rocks and are considered to be of Upper Proterozoic to Palaeozoic age. The Voltaian System has a total thickness of 3,000 – 4,000 meters and rests unconformably on the Early Proterozoic Birimian System and related granitoids as well as on the Early Proterozoic Tarkwaian System.

In consequence of the scarcity of outcrops and limited potential for high-valued mineral occurrences – except for possible hydrocarbons – limited geological mapping has been undertaken in the Voltaian Basin. The Soviet Geological Survey Team undertook the most comprehensive work in the 1960s, dividing the System into three main divisions (a Lower, Middle and an Upper) on the basis of lithology. The Buem Formation of eastern Ghana was correlated with the Middle and Upper Voltaian Formations. Eleven key wells and a number of mapping wells were drilled; it is reported that the majority of the well logs are captured and translated into English. For political reasons the team left abruptly and only some of the reports and maps are presently available; to which extent data is available is not explored. In 1977, Shell Exploration and Production Company (Ghana) Ltd. completed one well in the southern part of the basin. The well was drilled to a depth of about 1167 metres. Anan-Yorke (A new classification proposal for the Voltaian sediments. GSD, Annual Report 1980) and Affaton *et al* (The tectono-stratigraphic relationships between the Upper Precambrian and Lower Palaeozoic Volta Basin and the Pan-African Dahomeyide orogenic belt. Amer. J. Science. 280, 224-248, 1980), appear to be the latest published work. No fossil remains are reported except for some rare algae growths and sponge spicules,[1].

However, an ever-increasing demand for ground water resources and hydrocarbons calls for an up-to-date stratigraphic model for the Voltaian System. On this background geological mapping on the FS 1001D map is included in the MSSP Mapping Project activities.

The revision of the stratigraphic model for the Voltaian System will be undertaken on basis of archive data, including data to be gathered from teams previously involved in work on the Voltaian, new information from the MSSP mapping project if possible, and from field excursions to selected areas. All relevant data are being gathered and organised by GSD. Provided the necessary data is provided the Adviser shall assess and compile the data, as well as recommend further investigations where deemed relevant.

To undertake sustained activities in relation to this task the Survey's capability in mapping sedimentary rocks needs to be enhanced. Training in relevant topics will be included in the training plan.

Suggestions

Considering the time limits given for short-term experts this task will only be possible if the Survey provides all relevant data for the compilation. We therefore strongly recommend a Voltaian Stratigraphic Model Task Force to be established at the Survey. The objective of the task force is to organise the work – including the gathering of relevant data – and to compile the data supervised by the Adviser. The task force will be responsible for providing data to the Adviser. We also recommend

[1] G.O. Kesse (1985): The Mineral and Rock Resources of Ghana

that data from water wells, satellite imagery, and airborne geophysical surveys be included. In addition the information gained from mapping the FS 1001D map sheet shall be included in the compilation if possible.

To develop a stratigraphic model for the Voltaian is not a straightforward task. We therefore do not anticipate a conclusion to be reached before the time limits given. In order to achieve the goals set out all possible efforts should therefore be made to ensure ongoing activities at the conclusion of this project.

Deliverables

- Geological mapping manual for mapping sedimentary terrains
- Assistance in developing a stratigraphic model for the Voltaian Platform. Interim model to be provided.

Time frame

The success of the task is related to the data input. Acquiring the data may be very time consuming. We therefore recommend calling upon the short-term experts for their first assessments in either the 4th quarter of 2006 or the 1st quarter of 2007. In this period also training in sedimentology and stratigraphy will be provided, and a mapping manual for mapping sedimentary terrains will be developed. A second visit by the short-term experts is suggested to take place in the 4th quarter of 2007.

4.3 Task H – Assistance in the continuous development and improvement of the existing mineral database with inputs or feedback from the industry as to the shape and format of the database

Findings

In the course of the WB/NDF Project it was decided to develop a Ghana Mineral Occurrence Database (GMODB). GEUS short-term experts trained a small group of staff on how to develop a database; a number of short-courses were provided at the Surveys headquarter, and Mr. Kwame O. Boamah, Head, Division for Information Management, was seconded for additional data-base training at GEUS, Copenhagen.

Prior to the development of the GMODB GEUS emphasised that development of databases is a corporate matter. Thus it is a management responsibility to develop and direct strict procedures regarding for example:

- the sources for data

- how to extract information from reports in a systematic way;
- how to code the information into the database;
- how to undertake quality control;
- how to make data available; and
- how to solve confidentiality issues.

To address these issues a Management Database Group was established. Further, it was stressed that the necessary manpower resources should be assigned to develop and maintain the database. It appears that the Management Database Group as yet has not been active, and neither have the human resources been allocated to undertake this task related to the development of the database. The development and maintenance of the GMODB is left with the Head of Division for Information Management. The Head has been focused on tasks related to GIS applications, and in consequence the GMODB has not been further developed since the WB/NDF Project came to an end. Some key issues related to the development of the GMODB are thus still pending. It is recommended to revitalise the Management Database Group.

As part of the MSSP a comprehensive Information Management System (IMS) is being implemented in the Ministry of Lands, Forestry and Mines, inclusive all its agencies. The project comprises the following three components,

- Intranet system (LAN), encompassing design, procurement and commissioning;
- Web sites, encompassing design and implementation;
- Geological and mining records databases inclusive the processing software development.

The complete IMS Project components are planned to be in place not later than June 2006. A training package is part of the project. It is understood that the current GMODB structure is adaptable by the new IMS set-up. The implementation of this advanced information management system is going to make a tremendous step forward for the work at the GSD and for the work on databases in particular. It is however recommended to ensure that the information and concepts of the GMODB be fully imported into the new database structure.

It should also be kept in mind that no system is better than the human resources behind it, and thus most likely recruitment of specialised staff will be required.

Suggestions

The management is urged to revitalise the Management Database Group in order to address the outstanding issues with respect to manning and instructions for the development of the GMODB in its new version. The Management Database Group should also liase with the IMS Contractor ensuring that compatibility between the GMODB and the new platform is established. Finally, the training being provided by the IMS contractor and GEUS should be co-ordinated.

The GMODB or its future replacement is meant to be a national database, and thus it is important to make sure that all stakeholder views and comments are being considered. It is therefore recommended to organise a GMODB-workshop for stakeholders, prior to further development of the database is made. The PMU should be applied for financial funding of such a work-shop.

Deliverables

- Presentations in GMODB-workshop
- Liaison with the IMS Contractor with regard to the GMODB and training
- Advise as to the further development of the database
- Advise the Management Database Group
- Short courses in database development and maintenance

Time frame

Both the GMODB-workshop and the co-ordination of activities are considered urgent, and should preferably be undertaken not later than the 4th quarter of 2005. The additional tasks will be attended to on ad-hoc basis in course of the project.

4.4 Task I – Assistance in constructing other databases like geological and geochemical databases

Findings

In the WB/NDF-Project a need for the following databases was registered:

- Geochemical database with analytical results from GSD's new XRF-instrument
- Clay deposits database
- Seismic database
- Mineral occurrence database (work in progress)
- Environmental geology database
- Geological maps database
- Geological samples database
- Water well database

Though divisional heads expressed the needs in 2003, none of the above databases are developed further as yet, except for the environmental geology database. The Ghana Mineral Occurrence Database is dealt with in chapter 4.3.

The Information Management System Project (IMF) recently recorded the various types of data being of potential relevance for the new database system. The following statement was reported: '*Currently, no central data storage systems exist at the GSD, neither for digitally stored information nor for analogous stored information. The data storage is related to different divisions and responsible people. Often digital data is stored on one computer only. Due to limitations of the disk capacity, data has been transferred to CD-ROMs for external storage and back up.*

Generally, all spatial data (except that of the Ghanaian-BGR environmental project) is in a bad condition. All data has to be reviewed, the rectification checked and corrected, and catalogued in a metadata database. This is the prerequisite for its use in the GDGIMS. '

The BEAK record does not include the 'clay deposit database', and this information is therefore added to the table. Besides a bibliographic database is not included, but further details are not as yet available. No sample-database has been developed.

Table 6: *Important relevant digital data of the GSD is listed in the table below (Data gathered by BEAK, the IMS Project contractor).*

Data set name	**Format and file name (if applicable)**	**Size**	**Owner/ storage location**	**Remarks**
Airborne geophysical data	Oasis Montaj formats, tiff, ASCII	More than 50 GB	Geophysical Division	The data is organised according to the project areas. Beside the primary and processed data many interim files exist. The primary data (ASCII) and the processed data (images) are of interest for import into the IMS.
Mineral occurrence database	ACCESS GMODB_Beta_version_4_b .mdb	5 MB	Division for Information Management	The database contains 878 records on mineral deposits of Ghana. The coordinates are in the geographical system.
Reports metadata database	ACCESS MetaLite.MDB	0.3 MB	Division for Information Management	The database contains 39 records on reports, issued by the GSD over a period starting from 1928 till 1997
Data of the BGR Ghanaian environmental project with	Mainly ARCINFO 9.x data sets: images, geodatabase, shape-files	5.2 GB	GSD-BGR project group	The data set contains very complex topographical and geo-scientific data on the Greater Accra region: topographical map sheets, geological maps, maps of hazards, elevation models etc.
Map margins of geo-scientific maps	ARCINFO 9.x data		Division for Information Management	Metadata to the scanned geological maps of Ghana: surrounding polygons
Scanned	TIFF	9 GB	Division for	The resolution varies, the

geological maps, Scale 1:50,000, 1:62,500; altogether 63 sheets			Information Management	rectification has to be checked and corrected. The reference file is missing for some of the maps.
Scanned maps with seismic information, Accra region, different scales	TIFF	0.1	Division for Information Management	The resolution varies, the rectification has to be checked and corrected. The reference file is missing for some of the maps.
Scanned geological maps, Scale 1:100,000; altogether 12 sheets	TIFF	9 GB	Division for Information Management	The resolution varies, the rectification has to be checked and corrected. The reference file is missing for some of the maps.
Maps with the historical coastline	TIFF and BMP	2 GB	Division for Information Management	The resolution varies, the rectification has to be checked and corrected. The reference file is missing for some of the maps.
Ceramic raw materials database	Excel	<0,1 GB	Economic Geology Division	Clay raw materials specifications. C. 100 sites. Coordinates not complete
Recovered reports (about 100 reports)	.doc	??	Division for Information Management	Old reports were retyped and stored on hard discs. The information covers text and figures. Maps, etc are contained in the originals only.

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***Table 7**: Important analogous data-sets of the GSD (data gathered by BEAK, the IMS Project contractor)*

Data set name	**Format and file name (if applicable)**	**Size/ amount**	**Owner/ storage location**	**Remarks**
Different geoscientific maps	Paper	??	General Geology Division	The maps are stored in steel cabinets. The maps are partly in a bad situation. The maps have to be scanned, rectified and catalogued.
Different topographical base maps	Paper	??	General Geology Division	The maps are stored in steel cabinets. The maps are partly in a bad situation. The maps have to be scanned, rectified and catalogued.
Bulletins and reports (published)	Paper	??	Division for Information Management	Bulletins and reports describing different activities/ issues of the GSD/ geology of Ghana. The materials can be purchased in the

				GSD. The materials have to be scanned and catalogued (document management system).
Library	Paper	??	Library	The library contains published and un-published literature. A project of reorganisation of the library has been launched. The data has to be verified, the catalogue has to be transferred to a computerised system. It is recommended, to integrate it into the GDG IMS.
Non-published reports	Paper	??	Directors office	Confidential reports of the mining and prospecting companies.

Suggestions

The tables 6 and 7 illustrate some of the options for new databases. However despite databases being important tools for any Geological Survey, development and maintenance are resource demanding, and all aspects should be considered thoroughly prior to any decision. For instance issues related to definition of responsibilities, organisational set-up, sources of data, requirements for the outputs etc. should be addressed by the management.

We recommend that no new database be developed unless approved by the Management Database Group. The responsibility for development and maintenance of databases should be delegated to the Division for Information Management; provision of data being the responsibility of the 'sector' divisions.

Prior to any new database development, the Management Database Group is recommended to reanalyse the needs, addressing issues such as:

- What type of need do we have?/ Why do we need this database? Who else needs such data?
- What type of data is available and what is the quality/accuracy of the data?
- Does a national database already exist providing almost the same information?
- Who are the stakeholders/users?
- Should confidentiality be considered?
- How many resources are required to develop the database and how many resources are required to maintain it? Can we afford that?
- What type of software and hardware is required – and can we afford that?
- Should data be provided free of charge to external users or fee-based?

The Adviser will assist the Director and the Management Database Group in their endeavours to develop new databases. The Adviser shall liase with the MSSP contractors undertaking geological mapping and airborne geophysics as well as stakeholders exploring any new database requirements; such information should be reported to the Management Database Group.

In the event new databases are considered stakeholder workshops should be organised to focus on the stakeholder needs. Potential stakeholders would be e.g. the Minerals Commission, Mines Department, EPA; research institutes; universities; and the industry. PMU should be approached for funding of the workshop.

The architecture of relevant databases applied by GEUS will be presented to the Management Database Group.

Short courses will be arranged in cooperation with the Management Database Group and the IMS operator BEAK.

Deliverables

- Ad hoc assistance to the Management Database Group
- Liaison with MSSP contractors and stakeholders
- Short courses in database development and maintenance (to be coordinated with the IMS contractor BEAK).

Time frame

Activities on this task should commence not later than 1st quarter 2006, and shall proceed on ad-hoc basis in course of the project.

4.5 Task J – Assistance in developing state-of-the-art concepts on Precambrian and Lower Palaeozoic geology

Findings

This task refers to an old dispute between geologists in Ghana and Côte d'Ivoire on the relative ages of Birimian volcanic and sedimentary rocks. In Ghana the Birimian system was subdivided into a Lower Series consisting predominantly of metasedimentary rocks, and an Upper Series, mainly comprising metavolcanics. In Côte D'Ivoire the opposite relationship between metasediments and metavolcanics was proposed (see e.g. Kesse, 1985[2]). On the geological maps prepared during the Ghanaian-German Mineral Prospecting Project (GGMPP) terms like 'Lower Series' and 'Upper

[2] G.O. Kesse (1985). The Mineral and Rock Resources of Ghana

Series' or Lower and Upper Birimian are not employed (see e.g. Hirdes *et al.* 1993: Explanatory notes for the Geological Map of Southwest Ghana 1 : 100,000. Sheets Wiawso (0603D), Asafo (0603C), Kukuom (0603B), Goaso (0603A), Sunyani (0703D) and Berekum (0703C)). These authors suggest that volcanic and sedimentary rocks were formed simultaneously over a period of perhaps ten million years.

Suggestions

The solution of this problem will require a major scientific effort, involving (among other items) a large number of age determinations on the different rock types. New geochronological methods are now available, and it is suggested that the issue be discussed with the contractor of the MSSP Mapping Project and other relevant institutions. Such a study lies outside the scope of the present project. However, GEUS will perform a pilot project comprising a limited geochronological study with age determination of 10 rock samples. Further, GEUS will, after discussions with the GSD, investigate possibilities for a joint scientific project on this matter.

Deliverables

A summary of the status of the geochronological knowledge of the different lithological units in Ghana including the results of the pilot project. Further a plan for necessary fieldwork, geochronology, interpretation and necessary funding will be made.

Time frame

The plan should be completed not later than end of second quarter, 2006.

5 PROJECT TIMEFRAME

Tasks		2005			2006												2007												2008		
		4. Quart.			1. Quart.			2. Quart.			3. Quart.			4. Quart.			1. Quart.			2. Quart.			3. Quart.			4. Quart.			1. Quart.		
A	Review of proposed GSD Mission and Vision Statements																														
B	Detailed plan of reorganisation																														
C1	Prepare Human Resource Development Programme/Training																														
C2	Development of the administrative and managerial leadership capacities/Training																														
D	Strengthening the newly created Divisions of GSD																														
E	Assisting GSD to become a semi-autonomous institution																														
F	Implementing applied methodology guarantying mapping consistency and uniformity in underlying concepts																														
G	Developing a stratigraphical model for the Voltaian Platform and establishing standard manual guide in the Voltaian																														
H	Continued development and improvement of the existing mineral database																														
I	Constructing other databases																														
J	Developing state-of-the-art concepts on Precambrian and Lower Palaeozoic geology																														

Assigned experts on mission in Accra (indicating period only)	2005			2006												2007												2008		
	4. Quart.			1. Quart.			2. Quart.			3. Quart.			4. Quart.			1. Quart.			2. Quart.			3. Quart.			4. Quart.			1. Quart.		
Per Kalvig	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	
Christian Knudsen		X						X						X						X						X				
Feiko Kalsbeek		X						X						**X**						X						X				
Leif Thorning			X					X												X						X				
Martin Sønderholm														**X**												X				
Svend Stouge														**X**																
Marianne Thorsen								X																						
Jette Halskov					X																									

X : Visit to GSD
X : Visit to GSD - DANIDA Fellowship Training in Ghana (Awaiting approval by Danida)

Experts assigned	Approx. time assigned to Project (weeks)	Approx. time assigned to Danida Fellowship training in Ghana (weeks)
Per Kalvig	108	
Christian Knudsen	4	1
Feiko Kalsbeek	6	1
Leif Thorning	4	
Martin Sønderholm	5	1
Svend Stouge	3	1
Marianne Thorsen	1	
Jette Halskov	1	
Total	132	4

APPENDICES

Appendix A – Terms of Reference. Technical Assistance to the Geological Survey Department, Ghana (8 ACP GH 27)

Appendix B - Minutes of Inception Work-Shop

ANNEX-A

TERMS OF REFERENCE

Technical Assistance to the Geological Survey Department, Ghana
8 ACP GH 27

The mineral sector in Ghana has shown significant growth in the past decade, thanks to an investor-friendly environment created by the Government since the mid 1980s. However, the success of the sector, which represents 38% of the total export value and employs more than 36,000 people, is unlikely to be sustainable, due to both internal (weak regulatory institutions and geological support organisations) and external (limited exploration funds and fierce international competition) factors. The rapid depletion of known resources through recently introduced intensive mining methods and the lack of new deposits discovery implies that mineral output may decline substantially over the next 5 to 7 years. Private sector mining operations cannot be sustained, unless the mining institutions improve their operations, provide up-to-date geological and geophysical information to discover new resources and formulate and implement new policies.

The European Union has provided funding to the Government of Ghana, under the Mining Sector Support Programme (MSSP), to support these interventions.

The MSSP overall objectives are to sustain the country's mining sector economic performance, to alleviate poverty by increasing employment and to mitigate the mines' negative environmental impacts. Its specific purpose is to enhance institutional capacities to effectively promote and regulate the mineral resources sector in order to reverse the current trend of reduced private-sector mineral exploration, while facilitating the development of sustainable medium-term projects.

The main beneficiaries of the Programme are the institutions such as the Ministry of Mines (MOM), the Minerals Commission (MC), the Mines Department (MD) and the Geological Survey Department (GSD). MC is the Executing Agency of the programme and the finance is provided through the Ministry of Finance and the National Authorising Officer (NAO). The other stakeholders that will benefit from the programme implementation are the various mining communities, i.e. local population, mineworkers, mining and exploration companies and the country at large.

One of the important issues addressed in the mineral policy document is the recognition of the necessity of the Geological Survey Department (GSD) as a permanent, fully functional element in the mining sector's institutional framework, with an important role to play in the pursuance of goals outlined in the policy statement. Unfortunately, due to lack of funding, GSD has not performed up to expectations over the last years.

The MSS programme is continuing an ambitious program of GSD regeneration, started under the sponsorship of the World Bank namely, to reorganise GSD sequentially and to focus on the main components of providing the "basic geological infrastructure" namely:

- the production and publication of regional geological maps,
- the production of thematic maps, both for the specialised use and for the general public information,
- the compilation of mineral inventory with emphasis on the relation of mineral resources to the existing and envisaged land uses,
- the identification of geological hazards,
- the development and networking of a geological database with the mining sector information system (MSIS), and
- the interpretation of airborne geophysical, satellite imagery and seismic data for various users (customers) and purposes.
- The exploration of new mineral resources (deposits).

In order to commence GSD's make over, the Survey needs an overall assistance in the reorganisation process, including:

- the preparation of a detailed plan of the reorganisation
- the review and continuous organisation of the seven proposed Divisions (namely Administration and Finance, Geological Mapping, Environmental Geology, Geochemistry, Geophysics, Economic Geology, Data Management) and rebuilding their operational capability,
- the planning for training and for strengthening the professional capacity of employees, and
- the development of Survey's services to its outside customers and building up its consulting capacity.

This tender is to seek a highly qualified team of professionals, to serve as Advisors to the Director of GSD and assure a successful transformation of the Survey.

2. OBJECTIVES

The overall objective of the project is to support the reinforcement and reorganisation of the GSD into an effective service delivery organisation, customer oriented, providing high quality products and services to the Government, to the mining sector's institutions and to the private sector.

The highest priority in the modernisation scheme will be given to:

a) the development and motivation of GSD's human resources,

b) rebuilding of GSD's capacity in regional geological mapping,

c) developing GSD's capacity in the compilation of a mineral inventory.

3. CONTRACTING AUTHORITY OBLIGATIONS

The Contracting Authority shall provide all possible support to the Contractor, in particular:

- Two full time representatives of GSD shall be attached to the Contractor for the duration of its operation in Ghana. They shall report quarterly on their work and training to the management of GSD. They shall have appropriate academic background with a minimum of two years experience with the GSD.
- GSD shall provide the Contractor with a 20 m² office, fully furnished and equipped with a telephone line and a computer station with access to Internet. However, the operating costs of the office (supplies, phone, copying, etc.) are to be paid by the Contractor.
- The Contractor shall have free access to basic information, maps and documents relating to the mineral sector of Ghana.
- The Contracting Authority shall facilitate custom clearance and acquisition of visas and residence permits for the advisors and their dependants with the local authorities, but any cost arising thereof shall be borne by the Contractor.

4. OBLIGATIONS OF THE CONTRACTOR

- To provide the personnel with the required qualification and experience (see Annex C).
- To provide the Head Office back-up to provide assistance for solving any administrative, technical, financial or economic problem that may confront its agents in the performance of their duties.
- To provide on-the-job training to the Ghanaian seconded staff, as well as their participation to overseas formal training workshops.
- To supply one 4x4 vehicle to be used by the experts.

5. FUNCTIONS OF GSD

To be able to fulfil its Mission and achieve its set objectives, GSD carries out various functions that may be summarised as follows:

(a) Identification and provision of authentic maps and records on the country's geological resources to stimulate mineral exploration and for optimum land use, planning and development.

Geological resources may include:

(i) Rocks and mineral deposits.
(ii) Soils and potentially sound foundations
(iii) Sites suitable for various types of waste disposal and others of socio-cultural interest.

(b) Geo-hazard assessment including earthquake monitoring and microseismic zoning, dam site and mine site seismicity monitoring and analysis of risk and vulnerability indices in urban or populated areas.

(c) Research into geology (nature and structure of rocks, and their stratigraphic column), geophysics, geochemistry, seismology, etc

(d) Giving advice to the State and the general public on matters relating to geological implications in national development.

(e) Provision of baseline geological data to stimulate investor participation in exploration programmes and activities, leading eventually to exploitation or accumulation of useful geoscience data.

(f) Publish an annual bulletin to disseminate information to the public.

6. SCOPE OF WORK

The Contractor will advise and assist the GSD Director in the completion of the tasks outlined below:

- A careful review of proposed GSD's mission and vision statements – will be the first important task.

- The preparation of a detailed plan of reorganisation. The plan must be clear in purpose and direction, specifying steps to be taken, and identifying goals, benchmarks and measurable performance indicators. The specific components of the plan will address the review, reorganisation and build-up of the various Divisions, Records Office and Library (Under Data Management Division), Central Drill Core Repository, Mineralogical/Petrological Laboratory and Central Seismic Station and national Network.

- The review of training policy document and the Ten Year Strategic Document of the GSD and to prepare a more effective Human Resource Development program for both short and long term. The program will include but not be limited to "on-the-job" training, formal in-house training,

interdisciplinary training, retraining and other professional capacity strengthening of GSD employees at all levels. Special emphasis will be given to training in specialised fields such as sedimentology, paleontology, structural geology, satellite imagery interpretation.

A very important aspect of the training will be the development of the administrative, managerial and leadership capacities of selected professional employees. The training agenda should capture the long term recruitment policy of the GSD.

- Overall assistance in the execution of the plans to strengthen the newly created Divisions of the GSD.

- As the new geological maps of Ghana will have to serve the public for a long time, it is imperative that they are based on the state-of-the art scientific concepts of Precambrian geological evolution. It is also imperative that the applied methodology guarantees mapping consistency and uniformity in underlying concepts. The Advisor will therefore have to review the Geological Mapping Manual prepared previously and advise for its strict implementation by the MSS mapping groups. The Advisor shall assist in reviewing/preparing a colour index standard legend covering all subsurface units in Ghana. The standard legend for the Birimian and part of the Voltaian has been done under the WB/NDF programme.

- Assistance in developing a stratigraphic model for the Voltaian Platform and establishing standard manual guide for mapping in the Voltaian.

- Assistance in the continuous development and improvement of existing mineral database with inputs or feedback from industry as to the shape and format of the database.

  The Inventory should provide the GSD, the Minerals Commission, the Ministry, the Mining Industry and all stakeholders with a factual basis for rational estimation of Ghana's endowment with mineral resources, and thus facilitate the prognoses for the long-term development of the mining sector in Ghana.

  He or she should also assist in constructing other databases like geological and geochemical databases.

- Assistance in developing state-of-the-art concepts on Precambrian and Lower Paleozoic geology.

- Advise on and assist the GSD to become, a semi-autonomous Institution under the Ministry.

7. REPORTING AND INVOICING

The Contractor shall submit monthly progress reports and comprehensive quarterly reports to the supervisor. The quarterly report shall be distributed to all stakeholders, including the NAO, the EU Delegation, the Ministry of Mines and the PMU. It shall describe in detail the progress achieved in comparison with the objectives and give recommendations for improvements.

The Contractor shall also submit a final report to the supervisor, which shall analyse the achievements made and place them in the overall perspective and objectives of the project.

The original invoices, itemised statements and original supporting documents in accordance with Article 35 of the Special Conditions, addressed to the National Authorizing Officer (NAO), shall be submitted quarterly to the PMU for checking and transmission to the Contracting Authority and the EU Delegation.

8. VEHICLE

The Contractor will purchase and maintain a 4x4 vehicle for the use of the advisers. The vehicle must originate from an EU Member State or an ACP Country.

The vehicle will be suitable for rugged terrain and must comply with the following specifications:

- Ghana standard specifications
- Left hand drive
- 2.5 L minimum engine, turbo diesel
- Power assisted steering
- Bush protection bars
- Heavy duty tropicalised cooling system
- Air conditioning
- Minimum 5 passengers

At the end of the contract, the 4x4 vehicle will be turned over to the Government of Ghana in good working condition for the continuation of the project.

9. DURATION

The Contractor's assignment is expected to be completed over a period of 30 months, including leave. The assignment is estimated at 27 person-months for the long-term expert and 6 person-months for the short-term experts.

APPENDIX B

Workshop on Work Programme Proposal for the MSSP/TA

Held at Shai Hill Resort on October 5th, 2005

Timing
Wednesday 5th October, 2005

10:00 - Departure from GSD
11:00 - Arrival at Shai Hill Resort
12:10 - Opening prayer by the Director
12:15 – 13:15 Presentations of the WB/NDF Project findings – by the Director
14.10 – 14:30 Presentations of the MSSP – by Dr. Asabir, PMU
14:30 – 15:10 Lunch break
15:10 – 19:30 Presentations of Project Work Programme Proposal – by Dr. P. Kalvig, Adviser
19:30 - 20:30 Break for supper
20:30 – 21:30 Discussions

Thursday 6th October, 2005

07:00 – 08:00 Breakfast
11:00 Arrival at GSD

Attendants

Phillip Amoako, Director
Geoffrey Loh, Head, General Geology Div.
Kwame O. Boamah, Head, Division for Information Management
Dr. Kwasi Adu, Assistant Director, Takoradi Regional Office
Edmond Efa, Head, Environmental Geology Division
Lawrance Asare, Head, Economic Geology Division
Dr. John Asabir, PMU
Paul Amoako-Atta, Managing Dir., Terrex Ltd
Dr. Per Kalvig, Adviser, GEUS

Workshop agenda

1. Presentation of important findings in the WB/NDF Project – by P. Amoako, Dir.
2. Presentation of the Mining Sector Support Programme – by Dr. J. Asabir, PMU
3. Presentation of work programme proposal for the MSSP/TA - by Dr. P. Kalvig, Adviser, GEUS
4. Discussions

The presentations are attached in Annex C, D and E.

Ad. 3. Issues discussed

Task B:

- The Adviser proposed not to initiate this task before he has gained full insight in the present organisation.

- Rehabilitation of the Library was discussed. A library rehabilitation proposal has recently been prepared by an external consultant and is now under consideration; if the rehabilitation is to be carried out by the GSD management, external funding will be required. The Adviser aired the following views:
  - Any Geological Survey needs a well-organised and well-equipped library,
  - The present condition of the GSD library is nowhere near any acceptable standard and some rehabilitation is inevitable.
  - Keeping the fast moving IT-technology in mind (*and* the IMS Project) it is likely that most scientists in the near future mainly will visit virtual libraries, saving time and gaining more information.
  - The rehabilitation concept proposes annual running costs in the range of 38,000 USD.
  - The Adviser recommended reconsidering the library concept.
    No consensus was reached, and the matter deserves further and thorough assessment.

Task C

- Training in technical report writing and presentations is strongly required, and should be addressed in the HRDP. Several attendants recommended in-house workshops.
- DANIDA Scholarship: After presentation of two concepts, one in which a few staffs are seconded for training and one in which we spend one part of the funding on training at the Geocenter Copenhagen and the other part on training at the GSD. Prior to any decision being made, the Adviser shall detail the concepts further (in progress)

Task E

- The Director proposed that a brochure be prepared as an easy-readable extract of the Ten-Years Strategic Document, aimed to brief stakeholders and decision-makers about the need for an organisational change. The Director also recommended working on a package of GSD data and information for sale to external clients.

Task G

In the meeting it was made clear to the Adviser that this task is meant to develop a stratigraphic model for the Voltaian System based on existing data – which will be made available to him. The Adviser stressed that this was still an overwhelming task given the six man-months for <u>all</u> the short-term expert assignments, allowing *at the most* about two man-months for this task – inclusive development of a mapping manual. The Adviser expressed that he will have to consult Dr. Martin Soenderholm for his advice as to find an acceptable approach. In this task the Adviser will also liase with the Ghana Stratigraphic Committee.

Task H

- Ghana Mineral Occurrence Database (GMODB): Prior to further activities in this field a workshop was strongly recommended by the Director. A stakeholder meeting should be organised in 2005. Funding may be sponsored from the PMU surplus fund. An application will be submitted before end-of-year.

Task I

- The Director inquired if GEUS could make the architecture of a geological database available to GSD. The Adviser will forward this request.

Task J

The meeting confirmed that 'Developing state-of-the concepts on Precambrian and Lower Palaeozoic geology' refers to the discrepancies between the Ghanaian and the 'francophone' subdivisions of the Birimian System. The Adviser expressed that this task appears to be too complicated to be solved in this project, and that he would consult Dr. Feiko Kalsbeek and Dr. Christian Knudsen for their comments.

Stakeholder meetings

- Several participants raised the importance of stakeholder meetings. A list of relevant stakeholders is in progress; when completed, an action plan for enhanced contact to stakeholders will be prepared.

Performance indicators / achievements

Performance indicators versus project achievements were discussed. No common definitions and understanding was made in the meeting.