The Dr H.M.E. Schürmann collection: Precambrian and other crystalline rocks and minerals

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The Dr H.M.E. Schürmann collection is stored at the National Museum of Natural History in Leiden, The Netherlands. It mainly consists of Precambrian rocks, but also includes other crystalline rocks and minerals, which were collected from all over the world. In order to provide a quick reference to localities of interest, an overview of the most important geographical locations is given.
During his life and particularly after his retirement, Schürmann spent much of his time studying the Precambrian in North Africa. As a result, he gathered an extensive and well-documented collection of Precambrian rocks and minerals from Egypt and an irreplaceable collection of Precambrian rocks from drill-cores of deep wells situated in Libya. Both collections are discussed in this paper. Subsequently, the collection of xenolith-bearing basalts from Finkenberg, Germany, and collections of glaucophane-bearing rocks, ophiolites and ores from various countries are highlighted.
The Schürmann collection has been reorganised and made better accessible; the catalogues that were produced are listed.

Contents

Introduction

In the 1970's the collection of the late Dr H.M.E. Schürmann (1891-1979) has been included in the geological collections of the former Rijksmuseum van Geologie en Mineralogie (National Museum of Geology and Mineralogy: RGM), now incorporated in the Nationaal Natuurhistorisch Museum (National Museum of Natural History), situated in Leiden, The Netherlands.

The Schürmann collection mainly consists of Precambrian rocks and comprises approximately 16,000 specimens, 5,300 thin-sections and hundreds of relevant documents and articles.

Mr G. van der Wegen, M.Sc., former curator at the museum, worked on the collection for many years. Recently his work has been updated by the author, within the framework of the 'Delta-plan of Culture Preservation', launched by the Dutch Ministry of Welfare, Public Health and Culture, and financed by the Foundation 'Stichting Dr. Schürmannfonds'. The collection has been reorganised, thin-sections and documentation have been made accessible, the registration has been further automatised and new catalogues have been produced.

As a result, the Schürmann collection as a whole will be easily accessible for future scientific reference.

Historical background

Dr H.M.E. Schürmann already started to compile his collections when he went to secondary school. He collected samples in the area near his home in Düsseldorf, Germany. Later, as a geology student, he collected rocks under the guidance of Dr G. Steinmann in Germany, Switzerland and northern Italy (van der Wegen, 1980).

After gaining his Doctor's degree at the Rheinischen Friedrich-Wilhelms University, Bonn, Germany, he joined the 'Bataafsche Petroleum Maatschappij' in 1913 and started his career as a geologist in Egypt with Anglo-Egyptian Oil Fields Ltd. From 1914 to 1930 he worked in Indonesia (at that time the Netherlands East Indies), first in South Sumatra, later as chief geologist in Java and as manager in Borneo (now: Kalimantan) and North Sumatra. In 1930 he became Head of the Royal Dutch Shell Geological Division in The Hague, The Netherlands.

Under his leadership new geophysical methods for exploration were developed and valuable contributions were made towards research into the genesis of oil (Krol, 1972).

Besides his services to the oil industry, Dr Schürmann spent much of his spare time studying the Precambrian, particularly of North Africa and Saudi Arabia.

This study already began in 1913, when Dr Schürmann became acquainted with the Precambrian of Egypt, during regional studies in the Ras Zeit range and the Esh-Melaha range, both close to the shore of the Gulf of Suez, and the Red Sea Hills, the watershed between the river Nile and the Gulf of Suez/Red Sea (Fig. 1). At the end of 1914 Schürmann left Egypt, but during his stays in Europe he took every opportunity to investigate the samples of Precambrian rocks collected in previous years. The most important work started, however, after his retirement in 1951, when he had the opportunity to make several field-trips to Egypt.

The collected data were published in a special series called 'Massengesteine aus Aegypten I-XX' (N. Jb. Miner.) between 1937 and 1961. More field-trips were made to the Sinai, Saudi Arabia, Jordan, Algeria, and Morocco, but also to western Europe, Scandinavia and India in order to compare the various Precambrian terranes. The huge compilation work finally led to the publication of 'The Pre-Cambrian along the Gulf of Suez and the northern part of the Red Sea' (Schürmann, 1966) and 'The Pre-Cambrian in North Africa' (Schürmann, 1974).

Shortly after the Second World War, partly as a result of these activities, Dr Schürmann recognised the possibilities of isotope-geochronology, a new branch of science at that time (Krol, 1972). In this field he carried out pioneering work during the fifties, including geochronological research on Precambrian rocks from Libya and Mesozoic tin-bearing granites from Indonesia.

Schürmann carefully managed his valuable collection of Precambrian rocks, of glaucophane schists from various countries and of xenoliths from the Finkenberg basalt and other volcanic rocks in western Germany.

In 1949 he established the Dr Schürmannfonds Foundation, in order to ensure the maintenance of the Schürmann collection and to guarantee the continuation of his work, not only in the Precambrian of Egypt, but also in other Precambrian areas.

Provenance of the collected material

All rock and mineral samples that are present in the Schürmann collection are stored according to country. Countries and main areas are listed below, in alphabetical order. A few collections of minor importance (with only 1 or 2 specimens from one particular country) are excluded from this list.

Country	main areas
Algeria	Hoggar, Polignac Basin
Australia	Sidney, Melbourne, Queensland
Austria	Carinthia, Tirol
Canada	Alberta: Waterton
Chile	Atacama Huasco, Tierra del Fuego
Cuba	Matanzas, Sta Clara
Czechia	Egerland
Egypt	Eastern Desert, Sinai
Finland	Kalvola, Kisko, Mustio, Outokumpu
Germany	Eifel, Harz, Nordrhein-Westfalen, Odenwald, Siebengebirge, Thüringen, Westerwald
India	Assam, Bihar, Maharashstra Nagpur, Rajasthan
Indonesia	Sumatra: Atjeh, Bataklanden, Benkulu, Palembang; western Java: Sumedang; West Irian
Iran	Eastern Iran, Elburz Mountains, Hamadan/Bisitun, Kuh-I-Anguru
Iraq	Kurdistan
Ireland	Rosses Ring complex, Donegal, Milford
Italy	Campania, Liguria, Lombardy, Piemonte, Sicily
Japan	Hokkaido, Honshu, Ryukyu Islands, Shikoku: Besshi area
Jordan	Amman, Aqaba
Libya	Sirte Basin, Gargaf, Tibesti
Malaysia	Sarawak
Mauritania	Requibat
Mexico	Querrero, San Felipe
Morocco	Anti-Atlas
New Caledonia	
Norway	Telemark
Pakistan	Beluchistan

Rumania	Carpati Orientali, Dobrogea, Muntii Banatului, Walachia
Saudi Arabia	Jiddah (road to Mecca)
Somalia	Somali
Sudan	Northwest Sudan
Sweden	Dalarna, Dalsland, Lapland, Norrbotten, Stockholm, Småland
Switzerland	Val de Bagnes
Turkey	Ankara, Eskisehir, Taurus Mountains
United Kingdom	Cornwall, Devonshire, Wales: Anglesey, Shropshire; Scotland
U.S.A.	California, Montana, Wyoming
Venezuela	Antimano, Caracas, Mara District, Merida, San Juan de los Morros, Tachira, Trujillo, Zamora

Highlights

Egypt

The largest part of the collection comes from Egypt where Schürmann started his activities as early as 1913. Rocks were collected in the Eastern Desert and the Sinai, where Precambrian is exposed (Fig. 1). Schürmann (1966) combined the results obtained during his field trips with those from previous workers and proposed a very general and schematic stratigraphic table, which, in this paper, will be used as a frame of reference for descriptions of the collections (Table 1).

The construction of the stratigraphic column is based on field relations and detailed studies of conglomerates and breccias. The column represents rocks of Proterozoic age: the youngest consolidated rim of the old African cratonic shield (600-1000 Ma) equal to the Riphean (Schürmann, 1961). Schürmann came to the conclusion that the younger Precambrian includes several conglomerates of different ages and that the younger granite intrusions caused various contact metamorphic effects in the sedimentary rocks. Additionally, the orogenic history caused large variations in the degree of metamorphism and deformation of both sedimentary rocks and plutonic masses (Schürmann, 1966).

Radiometric age determinations appeared to be of little value in checking the validity of the stratigraphic column. K/Ar and Rb/Sr determinations showed a younger radiometric age than expected; rocks considerably older according to field geology, showed about the same age as the youngest plutonic intrusions, i.e. 500-550 Ma. These young ages are probably due to an early Palaeozoic rejuvenation of the Precambrian rocks (Schürmann, 1964). This corresponds with the age of the thermotectonic event (550 ± 100 Ma) which formed the Pan-African belts. Those belts contain metamorphosed and deformed supracrustal rocks (e.g. the Western Congo System), as well as prominent areas of partially reactivated basement, for example the Mozambique belts and Nigeria (Windley, 1977).

A rather complete section of the lower part of the Precambrian of Egypt (Table 1) can be found in the Mitiq area, Central Eastern Desert (south of Fig. 1, Lat. 26°05′ Long. 33°40′). The collection contains samples of the Mitiq Series, mainly paragneisses with granitic intrusions. Thin-banded gneisses from Wadi Feiran (Sinai), which belong to the same series, still show perfect graded bedding; the original rock probably represented a volcanic tuff (Schürmann, 1966).

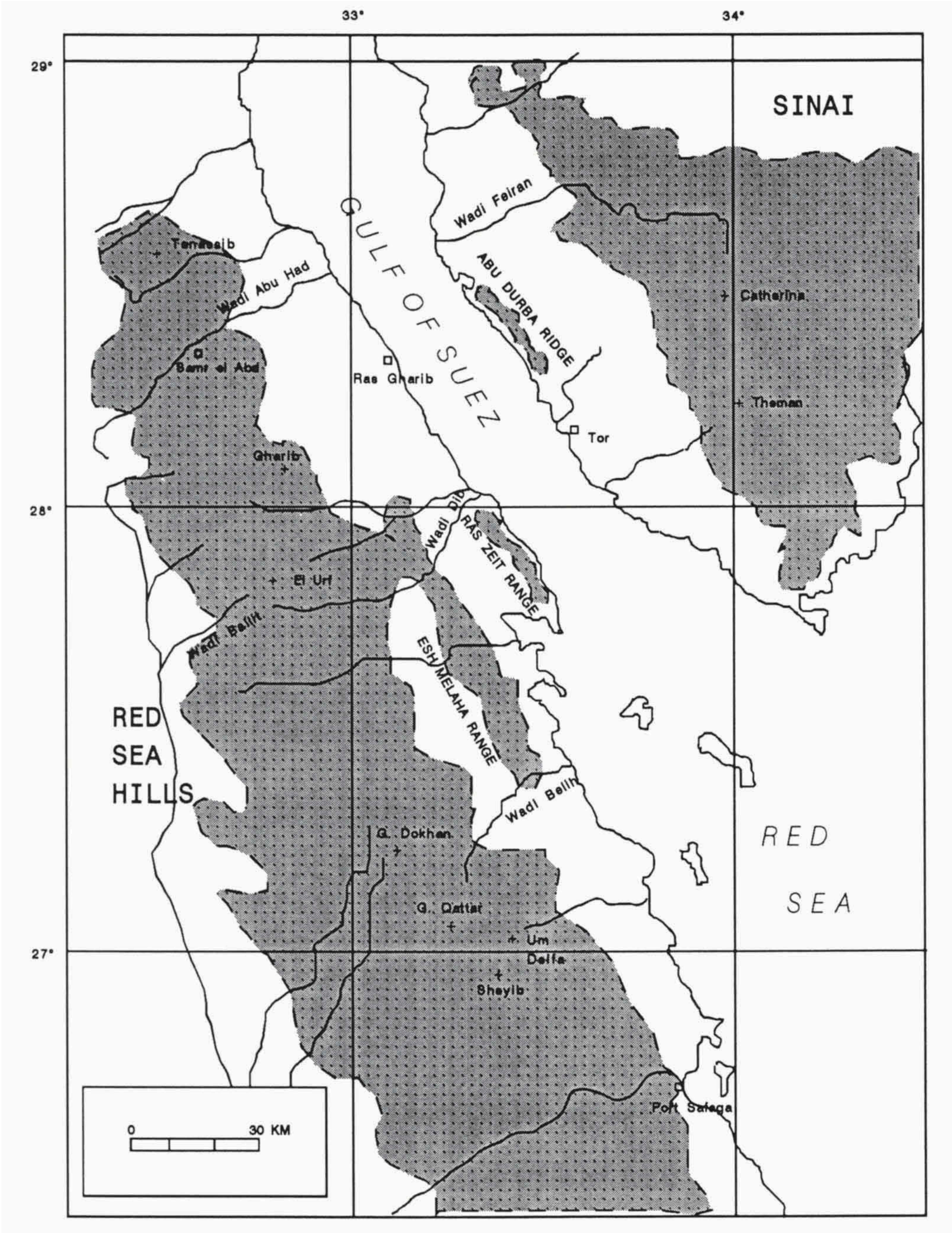

Fig. 1. Locality map of Red Sea Hills and Sinai (based on the maps of Schürmann, 1966 and Schürmann, 1974).

 Exposed Precambrian + mountain □ town/village

Table 1. Schematic stratigraphic column of the Praecambrian of Egypt, after Schürmann (1966).

	Upper Gattarian	alkaline, partly red granites cut through Hammamat Series
	Taphrogeny	
P	Hammamat Series	terrestrial and littoral sediments: conglomerates, breccias, greywackes, slates
R	*Unconformity*	
O	Lower Gattarian	pink and porphyric granites: Shaib type; grey granodiorite
T	*Main Orogeny*	
E		
R	Dokhan Series	ultrabasics, including serpentinite; volcanic rocks and ashes
O	Shadli	green schists with rare conglomerates or dispersed pebbles of granite and gneiss; injection paragneiss
Z	Wadi Abu Had Breccia	breccia with 'hälleflinta' and Shait granite fragments
O	*Unconformity*	
I	Shaitan	Shaitan plutonism: mainly granodiorites
C	Atalla Series	basic and acid volcanics, greywackes, schists and paragneisses
	Mitiq Series Gneiss	Mitiq and Feiran gneisses, partly injection paragneiss, partly orthogneiss; Ereier Complex

The collection contains relatively many samples of the Atalla, Shaitian and Abu Had breccia formations, considering the fact that those formations constitute less than 1% of the total Precambrian surface. Rocks of the Atalla Series were collected at one of the few outcrops, Samr el Abd in the northern Red Sea Hills, East Egypt (Fig. 1). Hälleflinta, various types of tectonised felsites, metaquartzites, phyllitic and chloritic rocks occur in the Atalla Series [Schürmann (1966) defined hälleflinta as derived from very acidic alkaline magma and sometimes grading from real volcanics via tuffs into sediments which have undergone metamorphism under high stress].

Many samples of the Wadi Abu Had Breccia are present. The breccia contains hälleflinta fragments from the Atalla Series, bright red rhyolite fragments and many pink alkali-granitic components probably from the Shaitan. There is only one outcrop known, in Wadi Abu Had, Northern Red Sea Hills.

Shadli Schists are not only found in the Eastern Desert but also in the south-eastern part of the Sinai. The formation consists of calcareous greenish slates, greenschists and andalusite schists and marbles originated by granite contact metamorphism (Schürmann, 1966). Contact metamorphism also changed greenish slates into various types of hornfels. Some conglomeratic layers contain igneous pebbles and greywacke pebbles of pre-Shadli age.

The Dokhan Series is widely present in the northern part of the Eastern Desert and samples have been collected at the type locality, Gebel Dokhan (Fig. 1). Pyroclastics and volcanics form the bulk of this mountain and specimens of the Imperial Porphyry or 'porfido rosso antico' are present in the collection (Fig. 2). This rock, widely known and exploited by the Romans, is a reddish brown quartz andesite with plagioclase feldspar phenocrysts, containing traces of piedmontite and veins of epidote (Schürmann, 1966).

In the Central and southern Eastern Desert basic rocks of Dokhan age, such as gabbros, diorites, and serpentinites, were collected. Serpentinites, already known and exploited since Pharaonic times, also occur on Zeberget Island in the Red Sea. The collection contains platy peridot crystals of gem quality, which grew in druses of these serpentinites. It has been found that the Zeberget peridot is almost pure forsterite with Fo 98.5% (Schürmann, 1974).

The final acid phase of the Dokhan volcanics is represented by ignimbritic, well-layered rhyolites (Schürmann, 1966). Samples have been taken from many different localities which are scattered over a distance of c. 220 km from north to south throughout the Red Sea Hills.

Rocks from the Hammamat Series form a large part of the collection. The series consists of thick sedimentary deposits of red sandy clay-slates, calcareous slates, greywackes, conglomerates, breccias, tuffs and other pyroclastics together with volcanic flows. The deposits have a widespread occurrence in the Eastern Desert and the Sinai, and are believed to be of torrential fluviatile origin, deposited under desert

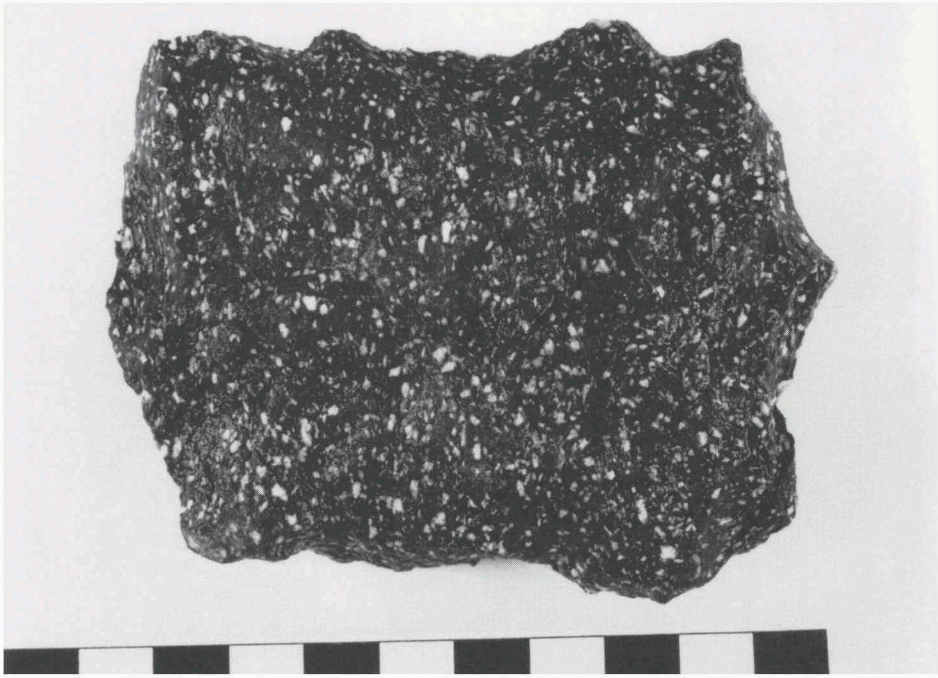

Fig. 2. Porfido rosso antico (Dokhan Series), Gebel Dokhan, Red Sea Hills, Egypt; RGM 316 844 (scale bar in cm).

conditions near mountain ridges not far from a shoreline (Schürmann, 1966).

Remarkable features like prints of fossil raindrop and graded bedding can be observed in some samples (Figs. 3-4). In many conglomerates typical 'porfido rosso antico' pebbles can be found, which prove that the Dokhan Series was in an erosion stage when the Hammamat Beds were deposited. Boulders of an older conglomerate are also found in the Hammamat Series (Fig. 5); this conglomerate is probably of Shadli age.

The Gattarian Granites occur as discordant stocks in the Shadli and younger series, and are widespread in the Eastern Desert and the Sinai. Especially the Lower Gattarian Granites occur in batholiths. The collection contains many samples of Lower Gattarian pink granites and Upper Gattarian red alkali-granites, riebeckite granites and pegmatites. In addition, a few examples of alaskite, a coarse grained white granite of Late Gattarian age, are present.

Hornblende-hornfels, plagioclase-hornblende-hornfels and pyroxene-hornblende-hornfels can also be found in the collection. Those rocks were collected in the northern part of the Eastern Desert, close to Gattarian intrusions which caused high-grade contact-metamorphism.

Although the Precambrian in the Red Sea area is not rich in mineral resources of economic importance, the collection contains quite a few iron- and copper-ore minerals from Wadi Dib, northern Red Sea Hills. Barite comes from the same area and has been found in vein deposits in the Hammamat Series. Malachite ore comes from Wadi Ballit, northern Red Sea Hills, molybdenum from quartz-veins in Gattar Gran-

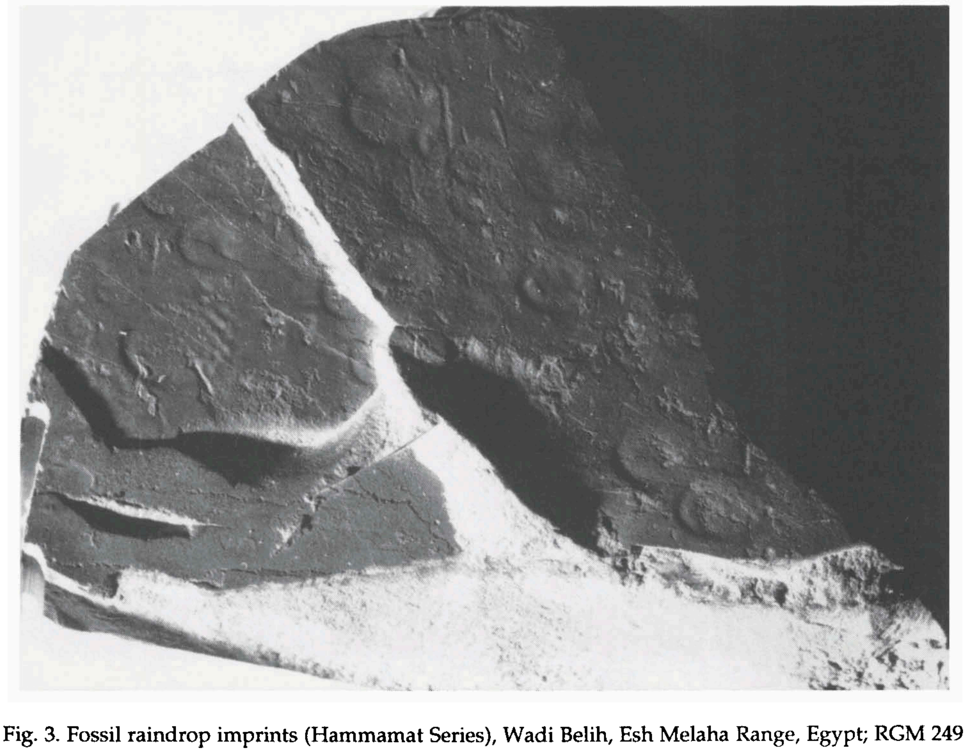

Fig. 3. Fossil raindrop imprints (Hammamat Series), Wadi Belih, Esh Melaha Range, Egypt; RGM 249 200 (scale bar in cm).

Fig. 4. Arenaceous rock with graded bedding (Hammamat Series), SW Sinai, Egypt; RGM 317 929 (scale bar in cm).

ites at Gebel Qattar, Red Sea Hills (Fig. 6), and steatite from contact metamorphosed serpentinites in the central Eastern Desert. Finally, samples of quartz veins containing wolframite were collected in the Central Eastern Desert, Wadi Mia.

Libya

Schürmann has made an attempt to compare and correlate the Gulf of Suez-Red Sea area with Precambrian areas in the Western Desert of Egypt, Libya, Algeria, and South Morocco. In Libya the Precambrian is exposed in Tibesti, Uweinat and Gargaf (Fig. 7). From these areas only a few samples are present in the collection, however. Accordingly, the bulk of the material from Libya consists of Precambrian rocks from cores of deep wells, most of which was provided by Shell, BP and Mobil oil companies. The cores were obtained from over a hundred wells, situated in the Sirte Basin (Fig. 7), which has a N-S length of c. 500 km and a width of 400 km. Depending on

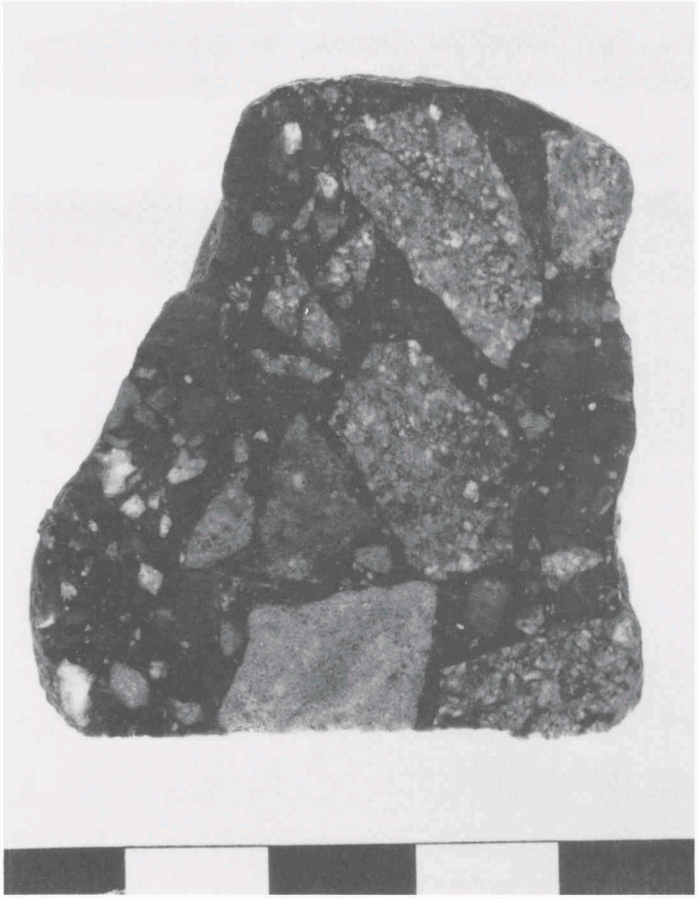

Fig. 5. Conglomeratic component: older conglomerate in Hammamat conglomerate: aplitic granite and pink felsite in dark coloured matrix. Wadi Dib, Esh Melaha Range, Egypt; RGM 314 675 (scale bar in cm).

the position of the well, Precambrian basement was reached at subsea depths varying from 800 to 4000 m; various samples show the contact between Palaeozoic or Mesozoic sediments and Precambrian igneous rocks. The great differences in depth are caused by NW-NNW striking horsts and grabens and E-W running faults (Schürmann, 1974).

The collection contains many Precambrian sediments: pelitic schists, phyllites and sandy shales are identified as equivalents of the Shadli Series (Table 1), whereas some greywackes, conglomerates and breccias are recognised as Hammamat equivalents. Although some rocks are contact-metamorphosed, others still show sedimentary structures like graded bedding, lamination, and also contorted layering, probably due to subaquatic movements. Metavolcanics of the Dokhan Series and Lower Gattarian Granites, granodiorites and diorites can also be found in Libyan sections.

Over 100 radiometric age determinations were made from cores of Precambrian age. Most determinations were done by the K/Ar method with confirmatory checks

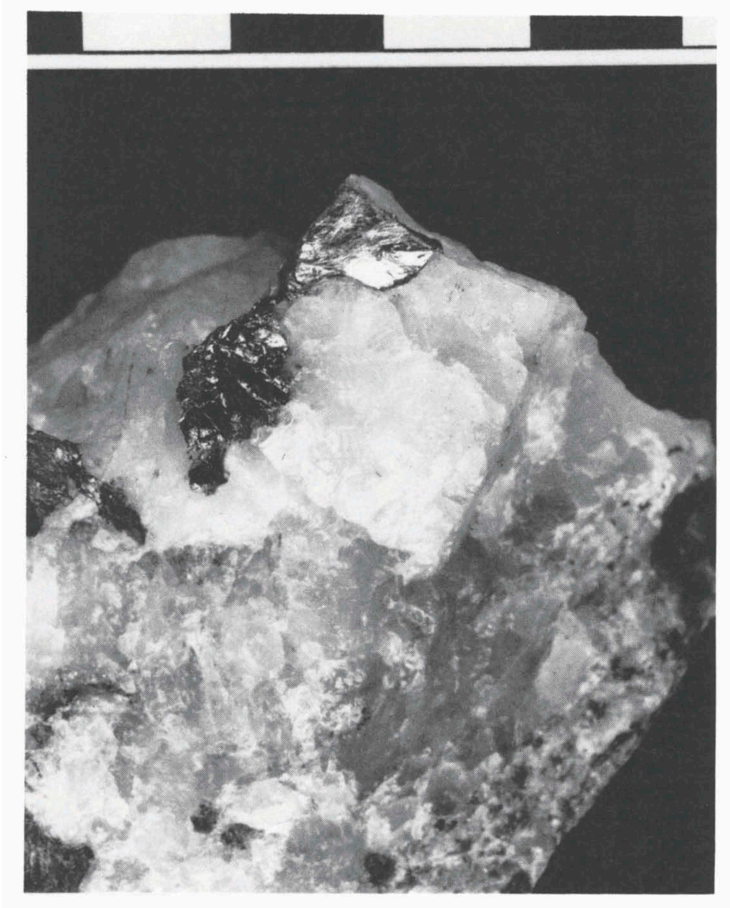

Fig. 6. Molybdenite in quartz-vein (in red granite). Gebel Qattar, molybdenum-mine, Red Sea Hills, Egypt; RGM 316 860 (scale bar in cm).

by the Rb/Sr method (whole rock as well as isolated muscovite and biotite analyses), and showed the same age as found for the rocks in Egypt, i.e. c. 550 Ma. As for Egypt, this age could also be explained by rejuvenation of the Precambrian by younger thermotectonic events (Schürmann, 1974).

Germany

Schürmann gained his Doctor's degree on a study of sedimentary inclusions in basalts from the Finkenberg in the Siebengebirge, Germany (Schürmann, 1913). During fieldwork he collected over 500 xenolith-bearing basalts of Tertiary age in this area. The collection contains alkali-basalts with olivine and clinopyroxene phenocrysts, olivine xenocrysts, ultramafic xenoliths, inclusions of opal, jasper, quartz, sillimanite, pyrrhotite, and infilled vugs with calcite. In some basalts, vesicles filled with zeolites can be found.

A recent study of the collection showed that the mantle-derived ultramafic xeno-

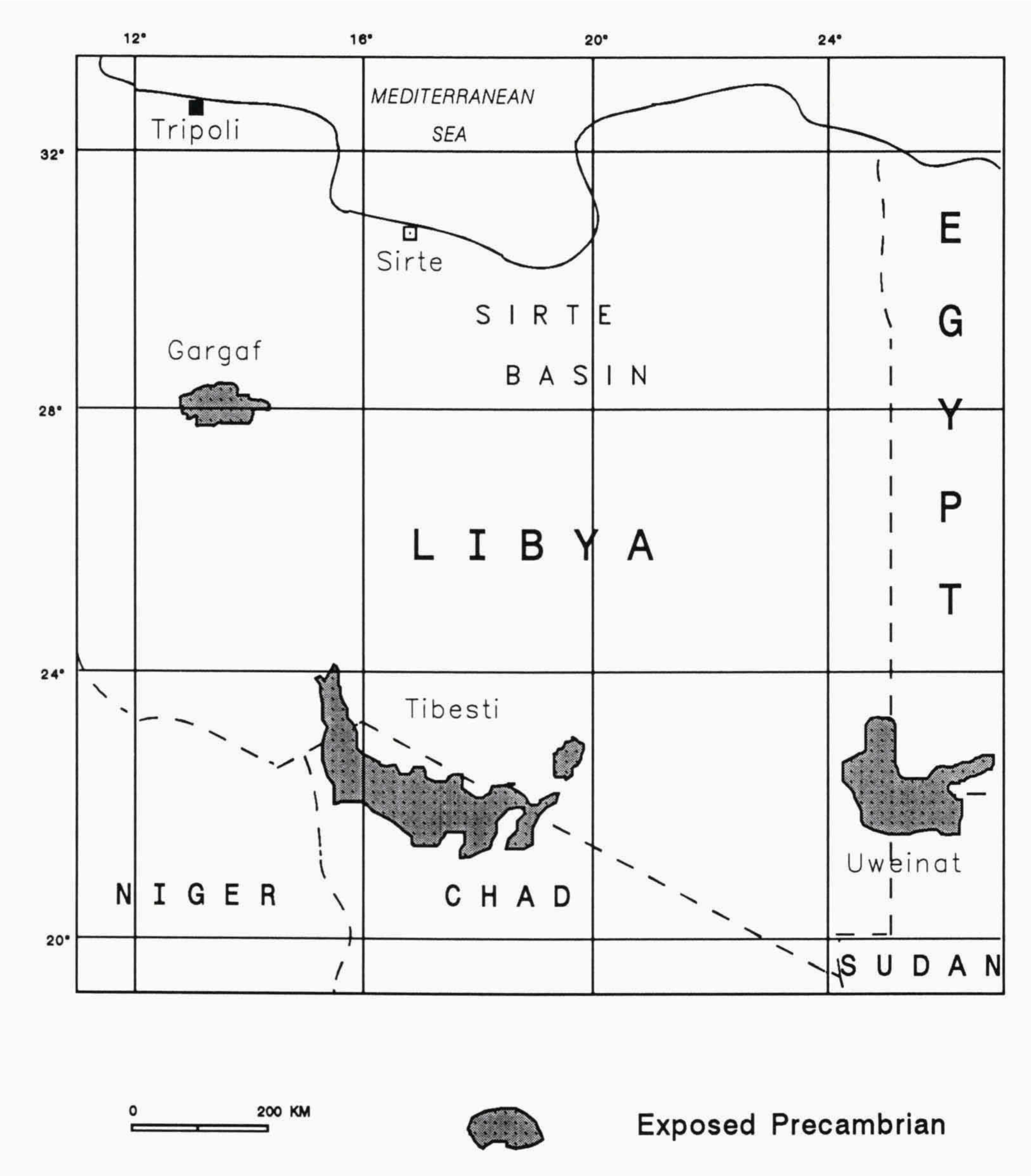

Fig. 7. Locality map of Lybia.

liths mainly belong to the lherzolite and wehrlite series; the xenoliths underwent respectively processes of deformation, partial recrystallization, and metasomatism. The variety of xenolith types indicates that the upper mantle beneath this volcanic region must have been heterogeneous (Moreva-Perekalina, 1985).

It must be emphasised that this collection has become very valuable and irreplaceable since the quarries of Finkenberg were abandoned and filled with water, shortly after the second World War. At present, the area is completely cultivated and built-on.

An important supplement of the collection consists of volcanic rocks from the Eifel. Basalts, trachytes, sanidinites, nosean and leucite bearing phonolites, augite and hauyn bearing lavas, and carbonatites from various localities are present. This collection also became more valuable since many places in the Eifel are no longer accessible.

Miscellaneous

In connection with his work in the Precambrian of North Africa, Schürmann was convinced that the study of polymict conglomerates is of great assistance in defining the relative age of tectonic units (Fig 4.) For comparison he not only collected conglomerates from Egypt, Morocco, Algeria, and Saudi Arabia, but also from Precambrian terranes in India, Scotland and Scandinavia.

One of the topics that Schürmann was particularly interested in, was the occurrence of glaucophane schists and their origin. He collected glaucophane-bearing rocks and related ophiolites from many countries. The most extensive collection of glaucophane schists comes from the Alpine orogenic belt of western Europe, especially from Val de Bagnes, Switzerland. Additionally, the collection contains glaucophane schists, serpentinites, spilites, and eclogites from localites in Piemonte and Liguria, Italy, glaucophane-bearing rocks and serpentinites from Eskisehir in Central Anatolia, Turkey, serpentinites, peridotites and radiolarites from the Hamadan/Bisitun area, Iran, and serpentinites and spilites from Kurdistan, Iraq. Along the Circum-Pacific belt, glaucophane schists have been collected in New Caledonia and Japan (Ryu Kyu Islands, Hokkaido and Shikoku, Besshi area). Finally, glaucophane-bearing rocks from Anglesey (U.K.), California (U.S.A.), and Caracas (Venezuela) can be found in the collection.

A modest part of the Schürmann collection consists of minerals, especially ores. Gold ores and gold nuggets from Sumatra, and native platina from Borneo (Kalimantan), Indonesia, are present. Furthermore, the collection contains manganese ores, like psilomelane and pyrolusite, but also Mn-bearing minerals like tirodite and Mn-bearing aegirine-augite (Zwaan & van der Plas, 1958) from Nagpur, central India. Cassiterite, wolframite and chalcopyrite have been collected in the Ashio mine, Honshu, Japan. Iron ores consisting of magnetite and hematite, come from the well-known igneous iron deposit at Kiruna, northern Sweden (Guilbert & Park, 1986). Various arsenides and sulfides like niccolite, arsenopyrite, pyrrhotite, and chalcopyrite were collected in the same province, called Norrbotten, northern Sweden.

Catalogues

As a result of the work on the Schürmann collection the following catalogues have been produced:

Basic catalogue — Contains all available data of each sample and is listed in numerical order.

Subcatalogue of countries — All material that is present in the Schürmann collection is listed according to country and locality.

Subcatalogue of igneous rocks — All igneous rocks are listed alphabetically, and are subsequently sorted according to country and locality.

Subcatalogue of metamorphic rocks — All metamorphic rocks are listed alphabetically, and are subsequently sorted according to country and locality.

Subcatalogue of sedimentary rocks — All sedimentary rocks are listed alphabetically, and are subsequently sorted according to country and locality.

Subcatalogue of minerals, ores and fossils — All minerals, ores and fossils are listed alphabetically, and subsequently sorted according to locality.

Subcatalogue of thin-sections — All thin-sections of rocks present in the collection are listed according to country and locality.

Catalogue of documentation — Publications and other relevant documentation regarding the collections, including photographs, maps, journals of fieldtrips, etc. are listed. The documents are listed according to country of interest, and are subsequently sorted according to author and title.

The mentioned catalogues are present at the National Museum of Natural History, Leiden, The Netherlands, and can be consulted upon request.

Acknowledgements

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