

# The history of the Geological Survey of Namibia

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While the first, albeit short-lived Mining Commissioner's Office was opened in Otjimbingwe as early as 1889, the roots of the Geological Survey of Namibia go back to 1903 when the first Government Geologist, FW Voit, took up his duties in Windhoek. H Lotz, who joined him in 1904, was succeeded in 1906 by P Range. Since the discovery of diamonds fell within his period of service for the then Colonial Government, Range mapped extensively in the southern parts of Namibia. The outbreak of the First World War brought geological activities of the Government to a standstill but the activities of company geologists continued after the surrender of the German troops. Only in 1926 did the Administration of South West Africa request assistance from the Government of the Union of South Africa which exercised a mandate over the region at the time. Subsequently, a branch of the Geological Survey of South Africa headed by SH Haughton was opened in Windhoek. Mapping of the territory was the main task of this branch. In 1932, the branch was also given the duty of administering mining legislation and WP de Kock was appointed Inspector of Mines and Mining Authority. During the Second World War, the branch played an important role in the exploration for strategic minerals under the leadership of CEM Schweltnus.

After the Second World War, when South Africa continued to administer the territory, the search for water became the foremost task in Namibia's arid environment. H Martin and H Korn were consequently appointed in 1945 as hydrogeologists. In 1947, Martin was appointed head of the branch and work concentrated mainly on mapping and hydrogeology. In 1963, the branch was upgraded to a sub-office of the Geological Survey of South Africa under WL van Wyk and in 1965 the first 1:1 million geological map of Namibia, compiled by Martin, was published. By the late 1960s a draft of the handbook on the mineral resources had been completed. Under LNJ Engelbrecht and PJ Hugo, who followed WL van Wyk, a coal drilling programme was carried out in the Ovambo Basin, offshore petroleum exploration began and a revised issue of the 1:1 million geological map of Namibia was initiated. In 1979, the Geological Survey became an independent Directorate in the Department of Economic Affairs of the Administration of South West Africa. While hydrogeology was transferred from the Geological Survey to the Department of Water Affairs, the activities of the Geological Survey centred on mapping, particularly in the complex Damara Orogen. Descriptions of the stratigraphy of Namibia were published and a new inventory of the mineral resources of the country was compiled. The revised 1:1 million geological map was published in 1980. In 1981, RMcG Miller was appointed Director. Several 1:250 000 maps followed, cooperative projects with universities greatly expanded, and the flow of publications on regional geology significantly increased. The draft of the Mineral Resources Handbook was revised but permission for publication was withheld, as before, for political reasons.

Following Namibian Independence, the Geological Survey of Namibia was made a Directorate within the Ministry of Mines and Energy. Restructuring in 1993 resulted in the establishment of the three divisions of Regional Geoscience, Applied Geoscience and Geotechnology. Numerous cooperative projects with foreign countries were initiated. The totally revised, restructured and updated Mineral Resources Handbook was finally published and planning of the present Geological Survey building started. From 1992 to 1996, BG Hoal served as Director. Today, the Geological Survey of Namibia is a modern research institution with excellent facilities. Tasks include mapping, geophysics, remote sensing, cartography, economic geology, geochemistry, engineering geology and environmental geology. Research data are accessible through data bases and disseminated in digital as well as conventional formats. The Geological Survey of Namibia also operates the National Earth Science Museum and the National Energy and Earth Science Information Centre.

## Introduction

The Geological Survey of Namibia, a Directorate within the Namibian Ministry of Mines and Energy, is the National Institution for Earth Sciences and Geological Resources. It is entrusted with management and research of an important asset of Namibia: the country's surface and subsurface. The Geological Survey's mission is to enhance the knowledge and awareness of Namibia's geological resources which include mineral resources (land-based and marine), energy resources (fossil and nuclear fuels), building materials, land resources, as well as groundwater and soil resources. Through scientific investigation, and application and dissemination of high quality research data, the Geological Survey of Namibia facilitates the search for and the assessment of mineral resources, geological engineering, land-use planning and sustainable development with due regard to the environment.

The roots of this institution, which has served the people of Namibia in the field of earth sciences for almost a century, go back to 1903, when the first Government geologist took up duty in Windhoek. Most of the work reported on in this paper is recorded in publications listed in the volumes on the earth science bibliography of Namibia (Hugo, *et al.*, 1983; Schalk and Hegenberger,

1991) and in open file and archival reports at the Geological Survey of Namibia in Windhoek.

## The early days

As early as 1888, when the German Emperor passed a decree on 25 March concerning the exploitation of gold and precious stones in the then Protectorate of South West Africa, a mining commission was established in Otjimbingwe, the "capital city" of the Protectorate at the time. This mining commission operated under the auspices of the *Deutsche Kolonial-Gesellschaft für Südwest Afrika*, at that stage the owner of all mineral



**Figure 1:** Kommissariatshaus, Windhoek

rights in the country. The first officials were mining engineer Bauer from Annaberg/Erzgebirge and his technical assistant Eberhard Grimm from Hannover. Due to the fact that the *Deutsche Kolonial-Gesellschaft für Südwest Afrika* did not actively participate in exploration because of a lack of funding, the activities of the mining commission were very limited.

In 1889, the German government changed the legislation and all mineral rights were vested in the colonial government as representative of the State. The first head of this new commission was *Bergassessor* Frielinghaus. The officials were now government employees and not representatives of the *Deutsche Kolonial-Gesellschaft für Südwest Afrika* any more. Frielinghaus shared an office with other imperial officials at the Reichskommissariatsgebäude. With the move of the imperial governor to Windhoek in 1892, the mining commission also moved there and was subsequently based at the *Kommissariatshaus* (Fig 1). Frielinghaus was followed in August 1892 by Gustav Bernhard Duft, *Königlich Preussischer Bergreferendar und Kaiserlicher Bergrat* from *Clausthal*, after whom the secondary copper mineral from Tsumeb, duftite, is named. Duft headed the office for 12 years until 1904, during which time important discoveries, such as the Tsumeb ore body, were made. Duft also served as District Commissioner of Windhoek at the same time, a fact which earned him the criticism of the imperial government in Berlin, since he was suspected of neglecting his duties at the mining commission. As early as 1899, the need for a geological laboratory arose and a building company was commissioned to establish a small facility that same year.

Up to 1903, personnel at the mining commission were comprised exclusively of mining-related technical professionals such as engineers and surveyors and their technical assistants. Nevertheless, the German imperial government recognised the importance of scientific geological research in the Protectorate and tasked the mining commission by decree 420 of 30 May 1903 with the relevant duties, such as the compilation of geological profiles and palaeontological research on behalf of the Prussian Geological Survey (*Preußische Geologische Landesanstalt*). However, the mining commission was not equipped for this in terms of personnel. When engineer Gathmann left the services of the commission in 1903 to take up employment with the *Otavi Minen- und Eisenbahngesellschaft*, *Erzherzog* Johann Albrecht zu Mecklenburg suggested during a meeting of the Colonial Board in Berlin on 18 May 1903, that he be replaced by an experienced geologist.

This suggestion was not readily supported by the mining commission in Windhoek where it was felt that the geological research could be done as a sideline by the mining engineers when they were travelling to inspect the mining operations. Duft, however, realised in the end that the appointment of a proper geologist was necessary and started negotiations with a Dr FW Voit who was involved in exploration work in Dama-



Figure 2: Mining Commission, Lüderitz

raland for the company of A Goertz u. Co. Ltd. from London. Voit joined the commission that same year. His first assignment was to study the then so-called Nama Formation and its possible correlation with the Karoo Sequence, and hence possible coal-bearing horizons, or alternatively with the so-called Cape Formation.

Voit was joined in February 1904 by Dr H Lotz from *Hersfeld* who remained in the territory until mid 1906. Since this was the time of the Herero War, geological work remained somewhat limited, and Lotz concentrated on the search for groundwater. Voit and Lotz also published on the general geology of the country during that time.

After Duft left the commission in 1904, *Bergassessor* Pasel took over in an acting capacity. He suggested in 1906 the establishment of a second office in Gibeon with responsibility for the south of the country. That

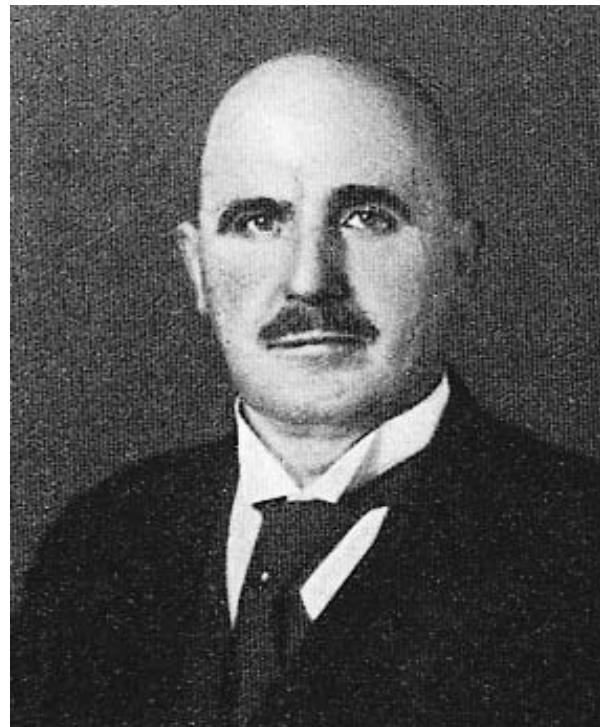


Figure 3: Dr Paul Range.

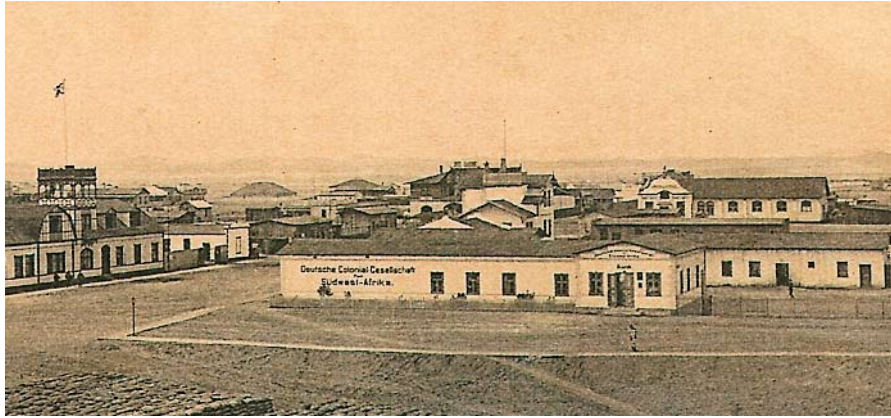


Figure 4: Laboratory of the “Südwest-Afrikanische Minen Syndikat”, Swakopmund.

same year, a branch of the mining commission was opened, not in Gibeon, but in Lüderitz (Fig. 2) and Lotz was seconded there as geologist for the southern region. The official boundary between the southern and northern areas was declared to be the Tropic of Capricorn. On 18 September 1906, Dr P Range (Fig. 3) assumed duty in Lüderitz as Lotz’s successor. Range continued to be mainly occupied with the search for groundwater. He did, however, also continue with the study of the relationship between the Nama and Karoo sediments and recognised the Dwyka Tillite. He discovered the Ediacaran fauna in the Nama sediments and the Gibeon meteorites and became famous for confirming the first diamond find in Namibia in 1908.

Voit remained the official geologist for the northern region and was made responsible for regulating the mining activities in the Swakopmund district. He was therefore stationed in Swakopmund where he operated from the laboratories of the *Südwest-Afrikanische Minen Syndikat*, housed in the buildings of the *Deutsche Kolonial-Gesellschaft für Südwest-Afrika* (Fig. 4). Voit was able to do limited research on the copper deposits of the Otavi Mountainland and the diamond occurrences between Meob and Conception Bays. He felt, however, that his administrative tasks concerning the growing mining industry were keeping him from conducting proper geological research, and therefore submitted a memorandum in 1911 proposing to the imperial government the foundation of a Geological Survey. He emphasized in particular that the use of the laboratory of a private company constituted a conflict of interest, and that the imperial government needed to have an independent geological laboratory which should also be more competent than the small and limited facility at the mining commission in Windhoek. He proposed Swakopmund as the place where a Geological Survey should be established. Since Pasel agreed to that suggestion, negotiations with the *Südwest-Afrikanische Minen Syndikat* started, and on 31 December 1911 the laboratory in Swakopmund was handed over to the imperial government (Fig. 4). Nevertheless, for administrative reasons, the laboratory moved to Windhoek in

1912. Voit continued with his research on copper deposits in the country.

With politics becoming tense in Europe, the imperial government consolidated offices and, on 30 September, the mining commission in Lüderitz closed and the activities were taken over by the commission in Windhoek. At the outbreak of World War I in 1914, all officials, including the above-named geologists were enlisted. German troops surrendered in Namibia in May, 1915. The offices of the imperial government, including the geological laboratory, remained closed.

#### The Period between the two World Wars and during World War II

Following the Treaty of Versailles in 1920 which made Namibia a South African mandate, it took as long as 6 years before the South African administration for South West Africa realised that there was a need for geologi-



Figure 5: Dr Sydney Haughton.

**Table 1:** Mapping undertaken between 1928 and 1945

Year	Area
1928	Eastern part of the Omaruru sheet
1929	Southern extension of the Omaruru sheet
1930	Western part of Rehoboth sheet, Aranos, Koes, Warmbad sheets,
1931	Windhoek, Rehoboth sheets
1932	Windhoek sheet
1933	-
1934	-
1935	-
1936	Karas Mountains
1937	Karas Mountains
1938	Omaruru, Karibib sheets, Karas Mountains
1939	Karibib, Okahandja sheets
1940	-
1941	Karibib, Okahandka sheets
1942	Karibib sheet
1943	-
1944	Southern Namibia
1945	Southern Namibia

cal surveying in the country. Two junior geologists of the Geological Survey of South Africa were delegated responsibility for Namibia but were stationed in Cape Town, mainly because of the availability of laboratory and library services. However, it soon became apparent that, because of the distance, this was not a satisfactory arrangement, and a branch of the Geological Survey of South Africa was opened in Windhoek. The two geologists from Cape Town and an analytical chemist moved to Windhoek, where they joined the offices of the Mining Authority of the South West African Administration. The branch was subsequently headed by Dr SH Haughton (Fig. 5), a great uncle of a later Director of the Geological Survey of Namibia, Dr BG Hoal.

Haughton started the first systematic mapping in Namibia, and Table 1 gives an overview of mapping undertaken between 1928 and 1945. In 1929, one geologist was involved full-time in the exploration for water in the Stampriet Artesian Basin. A survey in the Warmbad area also started and sheets Aranos and Koes were surveyed and investigated for their mineral potential. The interest of the international geological community focussed on Namibia when participants of the XV International Geological Congress, which was held in South Africa, visited the country. A laboratory capable of handling geological samples was established in the building of the Mining Authority for South West Africa. In 1930, the survey of the Stampriet Artesian Basin had been completed, but geologists continued to assist in groundwater exploration elsewhere in the country. Economic geology reports focused on coal near Berseba, salt near Swakopmund, lead-silver at Ai-Ais and lithium in the Erongo region. The first proof of the Warmbad sheet was completed.

In 1931, one of the geologists, WP de Kock, was also appointed as Inspector of Mines and Mining Authority. The involvement in groundwater exploration continued. By 1932 mapping in the Windhoek area was completed. However, due to financial constraints, no further

fieldwork was carried out and the geologists were confined to their offices working on maps for which field data already existed. Assistance to prospectors was also given. The situation was even worse in 1933 when no fieldwork at all was undertaken. Nevertheless, due to the extensive gold exploration during this time in the Rehoboth area, a map was prepared and published the following year with a detailed memoir entitled "The Geology of the Western Rehoboth". Also in 1934, geological maps of the three southern-most degree sheets Amib, Umeis and Nakop were printed in Southampton, UK. Notwithstanding the above progress, staff had to be retrenched because of the continuing lack of financial support. Haughton moved to Pretoria to become the Director of the Geological Survey of South Africa. A memoir on the work in the Warmbad area was compiled by the remaining office-bound staff and published in 1936. Over the years, a number of geologists had resigned. Eventually only Dr WP de Kock was left and when he resigned in 1935, operations were brought to a standstill.

In 1936, Pretoria appointed Dr CEM Schweltnus as regional geologist for the country to head the Windhoek office and the work gained new impetus. He revised earlier work on the tin deposits of central Namibia and commenced a geological and topographical survey of the Karas Mountains. This survey, including an aerial photographic survey, was continued throughout 1937 but, due to lack of funds, no other research was carried out. In 1938, the Karas Mountain survey was almost completed. The Omaruru map sheet was subsequently published with explanations in 1939. The importance of geological surveying in Namibia was once more recognised in 1940 when Pretoria seconded two more geologists to Windhoek to swell total staff numbers to four. During this year they concentrated on economic geology, in particular uranium near Swakopmund, the Berg Aukas zinc-lead deposit, the Hohewarte copper-lead deposit and the Karibib lithium deposits.

A detailed investigation into the mineral potential of the Tantalite Valley area started in 1941 and continued until 1943. The fluorite on Aukam, the graphite at Okanjande and the water supply in the southern rural areas also received attention. The Karibib map sheet was published in 1942. In the same year, a pollution problem was investigated in Klein Windhoek. This was the first occasion that the Geological Survey was involved in environmental matters. Furthermore, a reconnaissance survey for tin in Kaokoland was carried out and an occurrence of quartz crystals suitable for piezoelectric purposes was investigated near Rehoboth. The old Natas Mine was also revisited due to the intensified demand for Tungsten. In 1944, an appraisal of the Abenab Mine was carried out. While mapping continued in 1945 in the southern part of the country, the additional duty of finding groundwater for various railway stations throughout the country was added.



Figure 6: From left to right, Drs. Jack Otto, Henno Martin, A. Giesecke and F.C. Truter in the Kaokoveld, 1954.

### The Period 1946 to 1978

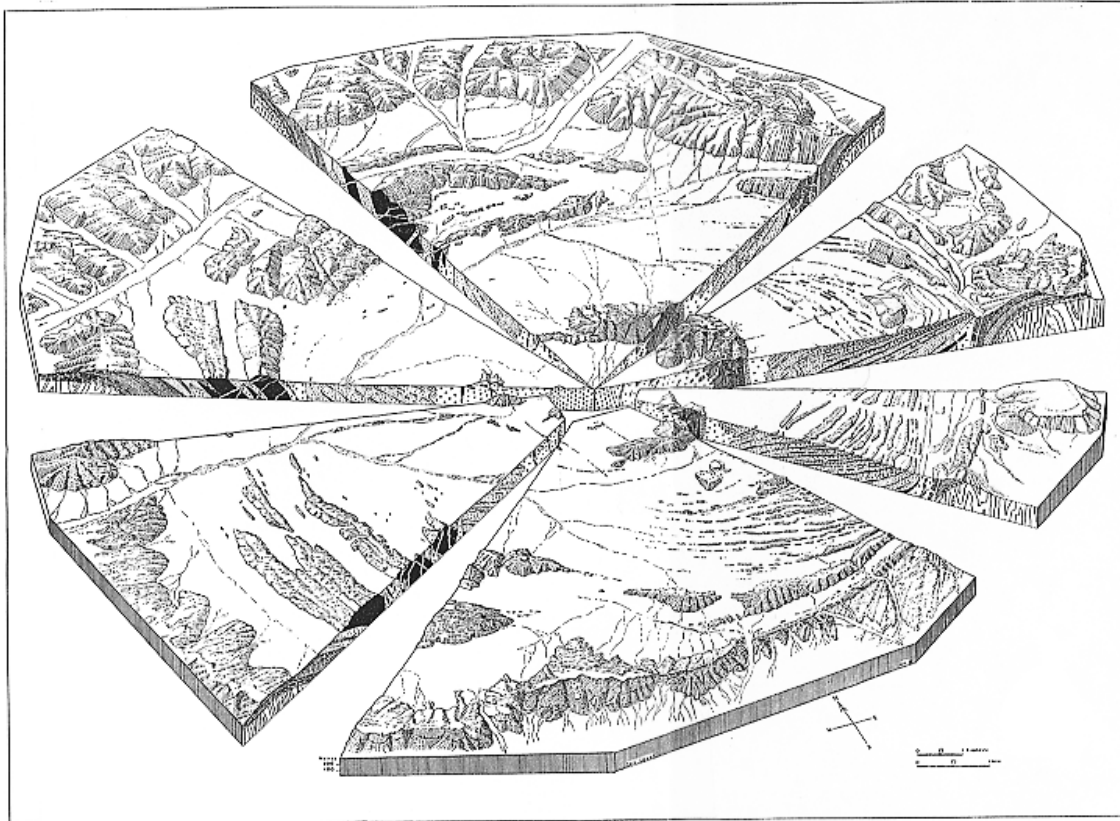
After the Second World War, the Union of South Africa continued to administer Namibia after refusing to place the country under a United Nations trusteeship in 1946. Consequently, geological surveying continued to be conducted under the supervision of the Geological Survey of South Africa. As the growing importance of groundwater exploration became apparent, two new posts were created for that purpose. Between 1945 and 1946, groundwater exploration had been carried out on a temporary basis by two geologists employed by the South African Administration for South West Africa, Drs Henno Martin and Herman Korn. Both had become famous for their sojourn in the Namib Desert during World War II, where they hid for more than two years. Their story was published in a book entitled “The Sheltering Desert”, also well-known under its original German title “*Wenn es Krieg gibt, gehen wir in die Wüste*” (Martin, 1956). Martin and Korn were to be retained until such time as the two new posts could be filled. However, Korn died in a car accident in 1946.

In 1947 an investigation of the Aris phonolite and other rocks for railroad ballast was carried out, groundwater exploration continued throughout the country and a report on vanadium in the country was compiled. Later that same year, Martin (Fig. 6) was appointed to head the Windhoek branch of the Geological Survey of South Africa. Initially, a small office was made available by the

Table 2: Mapping carried out between 1947 and 1978

Year	km <sup>2</sup>	Area
1947		Otavi Mountainland
1948		Karasburg
1949		Karasburg
1950		-
1951		-
1952		-
1953		Kaokoveld
1954		Kaokoveld
1955		-
1956		-
1957		Windhoek and Rehoboth sheets, Karasburg
1958		-
1959		Windhoek and Rehoboth sheets, Otavi Mountainland
1960		Omaruru, Windhoek and Rehoboth sheets, Kaokoveld
1961		Southern Damara Orogen
1963	5 965	Gobabis and Rehoboth sheets
1964	1 920	Gobabis, Leonardville, Aranos and Koes sheets
1965		Fransfontein, Rehoboth, Gibeon and Keetmanshoop sheets
1966		Swartbooisdrift, Rietfontein and Rehoboth sheets, Otjohorong area
1967		Swartbooisdrift, Sesfontein, Fransfontein, Gobabis, Rehoboth and Ai-Ais sheets
1968-69	38 400	Kunene Complex, Baines Mountains, Doros, Brandberg, Central Damara
1970	23 250	Epupa Complex, Summas Mountains, Opuwo, Fransfontein and Meob Bay sheets
1971-72	13 500	Fransfontein, Omaruru, Gobabis, Rehoboth, Meob Bay, Mariental, Keetmanshoop, Grünau and Warmbad sheets
1973	16 000	Kamajab, Cape Cross, Omaruru, Gobabis, Rehoboth, Mariental, Grünau and Warmbad sheets
1974	17 240	Kamajab, Fransfontein, Windhoek, Gobabis, Kuiseb, Rehoboth and Mariental sheets
1975	10 720	Kamajab, Walvis Bay, Windhoek, Kuiseb, Keetmanshoop and Grünau sheets
1976	3 400	Kamajab and Omaruru sheets
1977	4 925	Omaruru, Walvis Bay, Kuiseb and Rehoboth sheets
1978	8 500	Omaruru, Walvis Bay, Windhoek and Rehoboth sheets

administration in the southern wing of the “Tintenpalast” building next to the old archives but subsequently the Geological Survey shared an office with the Weather Bureau in today’s Independence Avenue and from 1958 on occupied a small, pre-fabricated home next to the Tintenpalast. Later, the Geological Survey moved to an office in a small house in No. 11 John Meinert Street adjacent to the building of the National Museum. While Martin’s first focus was hydrogeology and the location of water boreholes, he maintained a keen interest in nation-wide geological mapping which he and Herman Korn had started using their own resources when they came to South West Africa in 1935. Their early work on the Messum Igneous Complex (Korn and Martin, 1954) (Fig. 7) and the Naukluft Nappe Complex (Korn and Martin, 1959) (Fig. 8), although published many years later, are still classics. When he was joined by TS Kok, who took over the responsibility for groundwater, Martin dedicated himself fully to the compilation of the

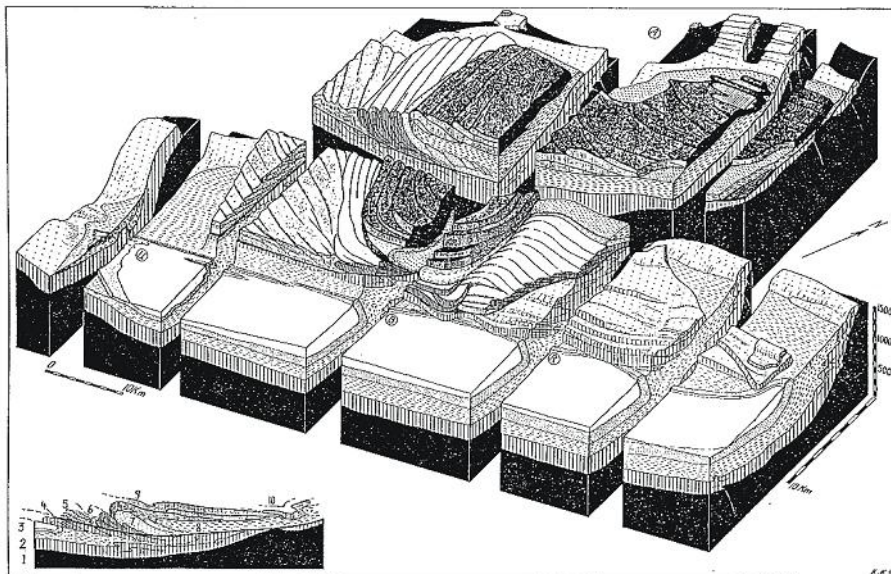


**Figure 7:** The Messum Igneous Complex (from Korn & Martin, 1954) with kind permission of the Geological Society of South Africa.

first geological map of Namibia at a scale of 1:1 000 000, an enormous undertaking in a country of some 824 000 square kilometers and limited previous mapping. A resume of regional mapping between 1947 and 1978 is given in Table 2.

In 1948, research concentrated on the Karasburg

map sheet as well as on the pegmatite occurrences near Karibib. The emphasis on groundwater exploration increased and became a major responsibility of the Geological Survey for the next 30 years. Statistics on boreholes selected and drilled between 1948 and 1977 are given in Table 3. Of the holes drilled, an average of



**Figure 8:** The Naukluft Nappe Complex (from Korn & Martin, 1959) with kind permission of the Geological Society of America.

**Table 3: Boreholes selected by the Geological Survey of Namibia 1948-1977**

Year	Number	Localities	Drilled	Percentage success boreholes (>450 lh)
1948	21	7		
1949	87	83		
1950	85	76		
1951	122			
1952	164	91		60%
1953	177	96		59%
1954	215	105		67%
1955	308	176	127	51%
1956	202	117	110	65%
1957	318			
1958	425		153	68%
1959	460		165	75%
1960	133			81%
1961	102			
1962	171		115	90%
1963			55	77%
1964	184		66	83%
1965	166		64	58%
1966	171		84	67%
1967	144		94	77%
1968/69	148		109	74%
1970	133		92	69%
1971/72	508		449	59%
1973	250	223	183	62%
1974	268	179	218	55%
1975	317	228	167	53%
1976	241	139	218	50%
1977	373	104	160	68%

64% were successful. From 1949 onwards, two geologists were employed on a full-time basis in the search for water. Manganese and tantalite occurrences were also investigated. Radioactive minerals as well as a large number of samples from prospectors were studied in 1950 and the laboratory at the Geological Survey of South Africa actually minuted that the promotion of exploration in Namibia worked so well that by 1950 10% of all samples submitted to the laboratory were from this country. Martin also investigated the palaeontology of the Dwyka Formation in the Mariental region. The

first gravity survey of the country was undertaken that same year by NC Harding of the University of Wisconsin, USA.

With the world-wide shortage of steel experienced in 1951, a survey of the iron deposits of Namibia became necessary during that year. Likewise, the manganese deposits of Otjosondu were researched and a study of the distribution of salt water and fresh water in the bed of the Kuiseb River east of Walvis Bay was undertaken. Titanium, zirconium, rare earth element and cerium occurrences in Namibia were investigated during 1952. In 1953, quarry sites for the railway and harbour administration were identified, and Martin collated the results of the geological mapping done by Bethlehem Steel in the Kaokoveld. An excavation was made in the Phillips Cave for French archaeologist Prof Abbe Breuil in order to obtain charcoal samples for age determinations of the rock paintings present in the cave. Martin also studied methods for interpretation of changes of ground water levels, while two other hydrogeologists tested the applicability of EM and other geophysical methods for the search for water. A gravity survey was undertaken in the south of the country.

In 1954, geologist numbers in the Geological Survey increased to nine. Geological research was carried out in the Kaokoveld. Martin investigated the gypsum and salt deposits of the west coast. In 1955, a map and a report on Otjosondu was completed and Martin contributed to a publication on artificial recharge of groundwater published by the United States Geological Survey. Despite the fact that there was an acute shortage of geologists in South Africa at the time, Pretoria seconded two more geologists to Windhoek since groundwater exploration was growing ever more important. Consequently, in 1956 all staff were involved exclusively in the search for water. In 1957, work was carried out to determine the southernmost extent of the Damara Sequence south of Windhoek and to address geological correlation problems in the Kaokoveld. The search for water, however, remained the most important activity



**Figure 9:** The old German, then English, hospital in Windhoek which housed the Geological Survey from 1961 to 1994 (drawing by Sandra Kazandjian).

involving 5 geologists full-time. A special geohydrological study was conducted in the Steinhausen area, borehole sites were selected in the Windhoek municipal area and the hot springs at Gross Barmen. The water resources of the Swakop River were investigated and four airborne photographic surveys were undertaken over water-bearing structures to assist in the siting of boreholes. The first EM instrument was purchased for groundwater investigations. Sites for a possible dam on the Okavango River as well as dam sites and quarries in the Windhoek area were investigated.

In 1958, a branch of the Geological Survey with one geologist was opened in Otjiwarongo. The demand for groundwater grew to such an extent that the Windhoek office sited more holes in that year than the entire Geological Survey of South Africa. Aerial photography and EM survey were used extensively to find water-bearing horizons. The Benioff seismograph of the Pretoria Station was installed in Windhoek. This therefore became the fifth seismic station in the southern African network. Survey geologists further investigated uranium occurrences in Namibia, the Kalkfeld carbonatite, pegmatites in the Warmbad district and the sodalite occurrence near Swartbooisdrif. They searched for occurrences of suitable road aggregates and investigated foundations for houses to be built on mica schist of the Kuiseb Formation in Windhoek. A gravimetric survey was conducted by the Otjiwarongo office. In 1958, Martin was appointed visiting professor at the University of Sao Paulo where he lectured and conducted research into the the Karoo and Nama equivalents in Brazil.

In 1959, investigations included 296 magnetic observations as a contribution to the International Geophysical Year, mapping and testing of the terrain at three dam sites and research on the beryl occurrences of the Keetmanshoop and Warmbad Districts. A geological section was put up in the Government Museum in Windhoek, representing the first geological display in Namibia. Groundwater investigations remained a major task. Martin returned in 1960. Most of the mapping in that year was undertaken to solve stratigraphic correlation problems for the compilation of the geological map of Namibia. Advice was given in the construction of the Hardap and Swakopoort dams. In 1961, the Geological Survey moved to the premises of the old German hospital, later the English hospital, in today's Robert Mugabe Avenue (Fig. 9). A mineral map for the country was completed and economic geology research addressed, amongst other topics, the amazonite occurrences in the Maltahöhe District, potentially diamondiferous gravels south of Walvis Bay and the coal deposits of Namibia. The Nama fossils were re-visited.

Up to this stage, the Geological Survey had fallen under the jurisdiction of the Director of Works who was also responsible for the supply of water. In 1962, however, the Geological Survey, with 8 members of staff in Windhoek and one in Otjiwarongo, was placed directly under the Geological Survey in Pretoria. A new seis-

mograph, donated by the United States of America was installed in Windhoek. Records were sent to the Coast and Geodetic Survey of the USA. The Nainais Tin Mine was investigated and reconnaissance work in the Kaokoveld and studies of the Kunene Complex and kimberlites as well as Dwyka tillites in the Gibeon District were carried out. Martin concentrated on the compilation of the geological map of Namibia. A manuscript for a handbook on the mineral resources of Namibia was compiled but publication prevented for political reasons. The fresh water supply for Henties Bay was addressed by sinking boreholes in the bed of the Omaruru River. Investigations for water supply from the sandy beds of the Swakop, Khan and Oanob Rivers were also undertaken. Work in the Stampriet Artesian Basin and in the Epukiro area continued. A total of 320 new measurements were taken for the gravity survey, and the first Bouguer anomaly map was virtually completed. Age determinations of Namibian rocks were carried out by the Geological Survey of South Africa in Pretoria.

In 1963, Martin left the Geological Survey to become the Director of the Precambrian Research Unit at the University of Cape Town. He was succeeded in Windhoek by Dr WL van Wyk. That year saw the first compilation of a tectonic map of Namibia. The western part of the Rehoboth sheet was being mapped by SA De Waal who was to become Deputy Permanent Secretary of the Ministry of Mines and Energy in independent Namibia. A survey for underground water in the Bondelswarts Reserve in the Warmbad District, as well as new underground water research in the Kombat and Berg Aukas Mine areas was conducted, and research on the water resource potential of the Omaruru River continued. The gravimetric survey of Namibia was completed and a handbook on that subject was prepared for publication. In 1964, the handbook on the carbonatites of South Africa and South West Africa was completed. Dwyka rocks in the Gibeon and Keetmanshoop Districts were investigated and the physical properties of the Auob and Nossob sandstones were studied for their artesian potential. The Damara rocks in the Hakos Mountains

**Table 4: Airborne geophysical surveys 1968-1978**

Year	Survey	Area	Total line km	Flight ground clearance (m)	Line spacing (km)
1968	S1/68	Rössing	24 000	120	1
1971	S2/71	Cape Cross	22 000	150	1
1972	S3/72	Hereroland		150	5
1974	S4/73	Swakopmund	8 500	150	1
	S5/73		940	150	1
	S6/74	Omaruru	38 880	125	1
1975	S7/75	Okahandja	3 780	100	1
1976	S8/76	Walvis Bay	6 629	100	1
	S9/76	Gibeon/ Mariental	1 174	100	1
1977	S10/77	Okahandja	12 407	100	1
1978	S11/78	Rehoboth	39 000	100	1



were studied. Copper occurrences in the Swakopmund District were investigated and the marine terraces between Walvis Bay and the Ugab River mouth were studied for their possible diamond content. Research on the gypsum and limestone occurrences of Namibia was initiated and a comprehensive report on the coastal salt pans was completed. In search for beryllium, the granites of Gross and Klein Spitzkoppe, the carbonatites of Etaneno and Okorusu, the old Krantzberg Mine, the fluospar deposits of Omburo and the Paresis Igneous Complex were investigated. The search for fossil fuels culminated in the drilling of the 6000 foot-deep Vreda borehole in the Gibeon District and a more than 6163 foot-deep borehole in the Etosha Basin. Both holes were unsuccessful but provided invaluable stratigraphic information. A map showing all boreholes in the area between Windhoek and Gobabis was completed to delineate water-bearing strata underneath the Kalahari sands. A total of 150 sites were investigated for engineering geology purposes.

In 1965, Martin's efforts throughout the country since his arrival 30 years earlier culminated in the publication of the first 1:1 000 000 Geological Map of Namibia and his book on the Precambrian Geology of South West Africa and Namaqualand. The layered complex on Alberta 175 in the Rehoboth District was discovered and mapping of the Huab Complex began. The areas west of Fransfontein and south of Rehoboth and the southern boundary of the Damara Sequence were mapped in detail. Extensive areas in the Gibeon and Keetmanshoop Districts were also mapped. An apatite occurrence near Epembe in Kaokoveld, the gold deposits of Ondundu, the semi-precious stone occurrences in the Karibib District and the salt potential of Ovamboland were investigated. The Aranos aquifer received renewed attention and surveys of the underground water resources near Gobabis, Keetmanshoop and Karibib, as well as the groundwater in Tertiary fluvial sediments along the west coast were undertaken. The engineering geologist investigated 133 sites.

1966 saw an emphasis on igneous complexes such as the Cape Cross, Etaneno, Okonjeje and Kunene Complexes. Mapping in the Otjohorongo area started. A memoir on "The geology of the area around Windhoek, Rehoboth and Dordabis" was completed, as well as a map and report on the Mariental, Aranos, Gibeon and Koes areas. The copper occurrences of the Rehoboth District were promoted for development, and limestone for a possible indigenous limestone industry was investigated for the first time near Karibib. Marbles as dimension stone were the subject of another study. Groundwater was studied at Anichab near Lüderitz where it is stored in the Tsondab aeolian sandstone. On the 29th of April 1966, the seismological station recorded a small earthquake with an epicenter some 400 km from Windhoek. Some 144 sites were investigated for engineering geology purposes, and 12 proposed dam sites on the Kunene River and one on the Swakop Riv-

er, including detailed foundation tests were carried out. Recommendations for the siting of a grave yard as well as a possible quarry at Ruacana were made. A site for a new Geological Survey building between the present State Museum and National Theatre was investigated. However, the site was condemned for high-rise buildings because it was located directly on the Pahl Fault.

In 1967, the Wlotzkas Bakon troctolite was mapped, and a memoir and map of the marble occurrences of the Karibib area was completed. The copper mineralisation of the Klein Aub area was investigated, as well as the pegmatites in the Karibib area. Following seismological work at Kiochab Pan, 18 successful holes were drilled for the water supply of Lüderitz. Other holes were drilled in the Omaruru River, and possible sites were investigated in the Caprivi Strip. Some 114 sites were investigated by the engineering geologist. Drilling was carried out for the Ruacana Diversion weir and the Swakoppoort dam site. Three alternative sites for Ruacana, another dam site near Matchless Mine as well as a quarry near Okahandja to supply aggregate for the Swakoppoort dam were investigated. The proposed tunnel at Ruacana for water supply to an underground power station was also studied.

Van Wyk was followed by Dr LNJ Engelbrecht in 1968. Between 1968 and 1969, the granites on the Fransfontein sheet were studied, and the Damara Orogen of central Namibia received particular attention. The cave guano on Arnhem and heavy minerals in beach sands near Swakop were investigated, a report on the marble occurrences in the Karibib District was completed and the phosphate potential of the Epembe carbonatite, and pegmatites at Etiro, Kaliombo, Helicon, Rubicon, Donkerhuk, as well as Dassiesfontein and others in the south were investigated. Drilling for coal in the Owamboland Basin, which had started in 1967, intersected seams at depths of 335 to 360 m. Radiometric surveys were carried out in the Rehoboth area and at Epembe. The first airborne magnetic and radiometric survey by the Geological Survey was carried out in 1968 east of Rössing, and an anomaly was investigated at Cape Cross. Table 4 gives a summary of airborne geophysical surveys conducted between 1968 and 1978 (Eberle and Hutchins, 1996). A seismic survey was conducted in Ovamboland as well as a gravity and seismic survey in Kaokoland, and another seismic survey for groundwater at Aus. Individual surveys for water supply were undertaken at Torra Bay for a new fishing harbour, at Windhoek, where drilling depths of 600 meters were recommended, Otjiwarongo, Tsumkwe, Henties Bay, Tsumeb and Usakos.

In 1970, gravity surveys were conducted in Hereroland, at the Omaruru Delta, in the dunes south of the lower Kuiseb River and in the karst region north of Tsumeb. Seismic surveys for groundwater were carried out in Hereroland and at the Khan and Swakop Rivers. The Stampriet aquifer also received attention again. During 1971 and 1972, the ring complex on

farm Bremen was studied. Support was given to staff from the Geological Survey of South Africa for palaeontological studies on the Omingonde Formation in the Otjiwarongo area, where spectacular specimens of *Kannemeyeria* were discovered. Fossil fish and reptiles were found at Doros Crater. An aerial radiometric survey in the Spitzkoppe area detected an anomaly at Okombahe, as well as at Trekkopie and Rössing. Engineering geology research was undertaken for possible dams at Düsternbrook, Dreihuk and Spes Bona, as well as on the proposed dams on the Omatako and at Ruakana and Calueque in southern Angola. A total of some 10 600 gravity, magnetometer and EM measurements were taken in Hereroland, northwest of Tsumeb and in the Omaruru delta area. The groundwater potential of the Omaruru River, the Stampriet area, Damaraland, Namaland, the municipalities of Grootfontein, Kamanjab, Aus, Bethanie, Gochas, Otjiwarongo, Karasburg and the Oamites mine area was tested.

In 1973, the Fransfontein granites, the Khoabendus Formation, the Otavi Group and the Karoo Sequence received further attention and a photogeological study was carried out on sheet Windhoek. Detailed mapping took place in the Naukluft with emphasis on the sole dolomite. Geological Survey of South Africa staff were again supported in their study of microfossils from Etosha for age determinations and the Omingonde Formation, where 2 new genera and species of *Dicynodontia* and one new genus and species of *Cynodontia* were described. A borehole was drilled in marbles near Karibib in cooperation with the National Building Research Institute. The exploration results of Etosha Petroleum Co were evaluated. Test boreholes were drilled at Okaputa and the water supply of Gochas, Rehoboth and various places in Damaraland was investigated. The position of boreholes in Bushmanland and the Kavango were mapped and an aeromagnetic survey was conducted in Hereroland. The first start was made for a geohydrological map of the country. Gravity data from the lower Kuiseb valley were processed to develop the underground water resources. Investigations in the Omaruru delta and the Stampriet area were continued and electrical resistivity work was carried out at two dam sites in the Khan River valley. A gravity base station was established at Windhoek International Airport. A comprehensive report was compiled on the Ruacana diversion weir and 8 other dam sites were mapped and evaluated.

In 1974, samples from Etosha as well as from the Whitehill Formation, an equivalent of the oil-prone Irati Shale of South America, were investigated for oil. The Stampriet aquifer received more attention and a borehole survey was carried out in Damaraland and Namaland. Electromagnetic and resistivity surveys were conducted in Hereroland. Other surveys concentrated on the Omaruru area, the Omaruru delta, the proposed von Bach dam, Owamboland, Bushmanland, Rooibank, Seeis, the Tsumeb karst area, Windhoek, Witvlei and

Gobabis. On the 27th of April 1974, a seismic event with epicenter in Namibia and a magnitude of 3.8 on the Richter scale was measured by the Windhoek seismic station. Investigations on the tunnel at Ruacana, the dam wall at Calueque, as well as seven other dam sites were continued. Construction material for roads was tested near the Swakoppoort and von Bach dam sites. The Pahl Fault in Windhoek as well as flood damage next to the main road to Tsumeb were investigated.

The National Geodynamics Project on the Damara Orogen started in 1975 with detailed mapping of the Windhoek sheet. Reconnaissance mapping was carried out with an emphasis on areas with economic potential as well as the revision of the 1:1 million geological map. The hand-coloured 1:250 000 sheets Rehoboth, Keetmanshoop and Grünau were completed in readiness for scribing and publication while compilation of the Cape Cross sheet started. The fossil *Cloudina* was discovered in the upper Buschmannsklippe Formation indicating its equivalence with the lower Nama Group. Cuttings from 368 water boreholes logged and the viability of hydro-geochemical prospecting in the Otavi Mountainland was tested. Extensive groundwater research was carried out at Grootfontein, Stampriet, the Omaruru delta, along the Kuiseb River west of Gobabeb, the White Nossob, Khan, Swakop and Seeis Rivers and in the Kavango and western Caprivi. A recommendation was made for groundwater control in the Otavi triangle. A geophysical survey was undertaken in Namaland, supplementary hydrogeological studies took place in Hereroland, Ovamboland and the Rehoboth region and a water canal between Grootfontein and the Omatako dam site was investigated. Cooperation with the palaeomagnetic laboratory in Pretoria took place for research on the Nama Group. The construction of the Ruacana diversion weir received further attention and advice was given during the construction of the Swakoppoort and Dreihuk dams.

In 1976, Dr PJ Hugo succeeded Engelbrecht as head

**Table 5: Airborne geophysical surveys 1979-1989**

Year	Survey	Area	Total line km	Flight ground clearance (m)	Line spacing (km)
1979	S12/79	Windhoek	34 669	100	1
	S13/79	Omatako		100	1
	S14/79	Summerdown		100	1
1980	S15/80	Damaraland	56 935	100	1
1981	S16/81	Tsumeb/ Sesfontein	43 057	100	1
1982	S17/82	Tsumkwe	60 338	100	1
1983	S18/83	Helmeringhausen	22 676	100	1
1984	S19/84	Ai-Ais	25 667	100	1
1985	S20/85	Karasburg	21 502	100	1
1986	S21/86	Opuwa	24 678	150	1
			6 527	100	1
1987	S22/87	Mariental	23 896	100	1
1989	S23/89	Bethanien	13 056	100	1

of the Geological Survey. Work on the revised 1:1 million map continued including 94 400 km<sup>2</sup> of photo-interpretation and reconnaissance mapping. The serpentinites of the southern Damara Orogen were studied, and marine phosphates and glauconite were addressed. Further investigations at Koichab Pan for the water supply of Lüderitz were undertaken. Detailed pump-tests were carried out on the Auas quartzites and associated Tertiary faults of the Windhoek aquifer. The hydrological map of Namibia was almost completed and hydrogeological work was carried out in all rural areas. Palaeomagnetic samples were taken from rocks of the Damara Sequence. There was a large demand for information from prospectors and exploration companies.

Much of 1977 was devoted to the compilation of the revised 1:1million geological map. Mapping included work on the basal contact of the Damara Sequence south of Windhoek, serpentinites and Salem-type granites. The serpentinites and the Alberta Complex were tested for their nickel potential. The water supply of several towns and the Windhoek aquifer, in particular, were investigated and hydrogeological maps were completed for several rural areas. A special study was undertaken on the Grootfontein karst area. Another earthquake with a magnitude of 4.6 on the Richter scale and centered at Rosh Pinah was measured on the 25th of January 1977. The first in a new series of 1:250 000 map sheets, the Gibeon sheet, was released. In October 1977 the hydrogeology section was transferred from the Geological Survey to the Department of Water Affairs.

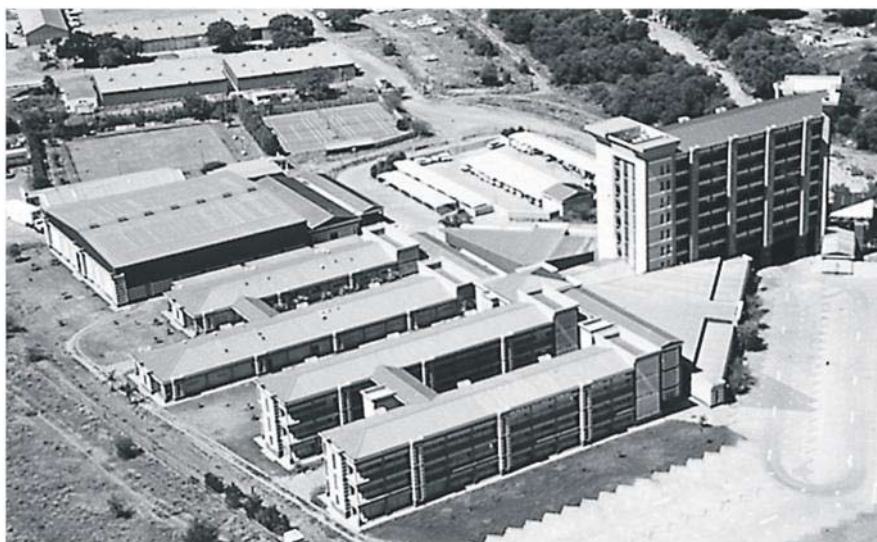
In 1978, continued palaeontological research in the Omingonde Formation by staff of the Geological Survey of South Africa uncovered one nearly complete skeleton of Titanogomphodon and two incomplete skulls of Scalenodon. Reports on the mineral potential of 24 areas were written and two radiometric calibration platforms were established in Windhoek. Potential dam sites were inspected near Rehoboth and 25 dam

sites were investigated in connection with the Central Namib Water Scheme.

### **The Period 1979 to 1989**

Following the installation of an Interim Government for South West Africa in 1977, the Geological Survey became an independent Directorate in the Department of Economic Affairs in 1979. Mapping, map preparation and engineering geology investigations continued. Hugo returned to Pretoria at the end of 1979, and Dr RMcG Miller became Acting Director. He was appointed Director of the Geological Survey of South West Africa/Namibia in 1981. The new structure consisted of two divisions, namely Regional and Economic Geology.

The intensive work on the revision of the 1:1 million geological map culminated in the publication of a new map, with a separate gravity edition, in 1980. Two more new 1:250 000 maps, the Mariental and Gobabis sheets, were printed. In the same year, descriptions of all stratigraphic units in Namibia were published (SACS, 1980). The acquisition of airborne geophysical data continued. Table 5 gives an overview of surveys flown between 1979 and 1989 (Eberle and Hutchins, 1996). In 1981, the first memoir in the new series “Memoirs of the Geological Survey of Namibia” appeared as a continuation of the old “South West Africa Series” of memoirs of the Geological Survey of South Africa. Research concentrated on the area south-east of Walvis Bay and the serpentinites of central Namibia. The Keetmanshoop 1:250 000 sheet was released in 1982, the first to be prepared entirely in Windhoek by staff of a newly established Cartographic Office within the Regional Geology Division. In 1983, the first Bibliography of South West African/Namibian Earth Sciences was published, covering all publications in the field of earth sciences up to 1980. A major achievement in 1983 was the pub-



**Figure 10:** The four wings and coreshed of the present, tailor-designed building of the Geological Survey of Namibia adjoining the 8-story high-rise building of the Ministry of Mines and Energy.

lication through the Geological Society of South Africa, of the book "Evolution of the Damara Orogen of South West Africa/Namibia" which contained the results of the National Geodynamics Project on the orogen from 1973 to 1980. This remains the single most important reference book for researchers working on the Damara Orogen. The first X-ray diffractometer was acquired in the early 1980s. Since the Council for Scientific and Industrial Research of South Africa stopped funding university research projects in Namibia in the early 1980s, the Interim Government took over this function and the Geological Survey obtained funding to continue extensive support of Namibian research projects by universities.

While the Geological Survey continued to be housed in quite inadequate facilities, staffing levels steadily increased, reaching 15 geologists and 25 support staff by 1985. Mapping was carried out on the Omaruru, Windhoek, Kuiseb, Rehoboth, Meob Bay, Mariental and Spencer Bay sheets. During general renovations of the Geological Survey's facilities a new sample preparation facility was commissioned. Modern Logitech equipment resulted in automatised production of thin sections for the first time. The drawing office facilities were upgraded to include a cartographic darkroom. The Cape Cross-Uis tin belt, the copper occurrences of the Ovitoto area and the tungsten occurrences of the central zone of the Damara Orogen, as well as the Cenozoic succession of the Kuiseb Valley of the central Namib were studied. The establishment of a study collection of rocks and minerals was initiated with the transfer of the collections in the National Museum of the Geological Survey. Geotechnical investigations were undertaken for the Oanob Dam water scheme near Rehoboth. In total, 16 cooperative projects with seven different universities were under way by the mid-1980s. These increased levels of activity necessitated a new approach to rapid data dissemination and the publication series "Communications of the Geological Survey of Namibia" was initiated with Volume 1 appearing in 1985.

Between 1986 and 1989, mapping was undertaken on sheets Omaruru, Walvis Bay, Windhoek, Rehoboth and Spencer Bay. The jawbone of the giant thecodont *Erythrosuchus africanus*, a forerunner of the dinosaurs, was found during that mapping. The drilling of two boreholes on the offshore Kudu Gas Field was monitored. An Atomic Absorption Spectrophotometer (AAS) was obtained from the Department of Agriculture in 1987, and a small AAS laboratory equipped, enabling the Geological Survey for the first time to conduct quantitative analysis. The wet chemistry laboratory was completely refurbished and transformed into a functional facility. The microscopic laboratory was upgraded through the purchase of a modern research microscope for transmitted and reflected light, including a reflectivity meter and state-of-the-art photographic equipment, as well as a fluid inclusion stage. The research microscope was later upgraded with thermo-luminescence equipment,

and a Wilfley table was built in-house. Mapping was carried out on the Brandberg Complex, the Awasiib Mountain terrain, the turbidites of the Ugab River, the Nama Group, the Rubicon Pegmatite, the Klein Aub Mine and the Toscanini coal occurrence. A number of engineering geology projects were carried out on the coastal erosion and dune encroachment at Henties Bay, and on several dams and urban developments. The long awaited 1:500 000 map of the Damara Orogen, again prepared for publication entirely in Windhoek by the Cartographic Office of the Geological Survey, was published in 1988.

The planned implementation of UN Resolution 435 to facilitate Namibian Independence for 1 April 1989 drew the interest of numerous international investors to Namibia from 1988 onwards. It soon became apparent that with political obstacles removed, the need for a handbook on the mineral resources of Namibia was more essential than ever before in order to accommodate the enormous numbers of requests for information. On the basis of the older compilations, new information on all mineral commodities available in Namibia was collected and compiled in a new format to cater better for the needs of potential investors. To avoid delays, individual commodity chapters were put on open file as soon as they became available, rather than waiting until the entire handbook would be complete. By 1990, 27 chapters had been completed and released in the Open File "Mineral Resource Series" which is still the best selling series of the Geological Survey's open file system. During the same period the Geological Survey was also computerised in order to establish in-house facilities for both electronic publishing as well as data processing.

### **The period since Independence**

Following Namibian Independence on 21 March 1990, the Geological Survey of Namibia became a Directorate in the newly established Ministry of Mines and Energy under the leadership of the Hon Minister Dr hc Andimba Toivo ya Toivo. Geologists Dr Leake Hangala and Dr Sybrand de Waal were the first Permanent Secretary and Deputy Permanent Secretary respectively of this Ministry.

International development aid organisations showed great interest in assisting the Geological Survey and soon a number of projects commenced. In 1991, the Finnish-Namibian Mapping and Maps Project started and was aimed at establishing a digital geological and cartographic database for the country. It has enabled the Geological Survey to streamline the process of map publishing and produce digital formats of map products which greatly enhanced efficiency and flexibility. The German-Namibian Mineral Prospecting Promotion Project commenced in 1992 and initially focused on the integration of data of 25 years of airborne magnetic and radiometric surveys in order to provide a single

compatible data set. This was released in 1994. Subsequent interpretation of the geophysical data resulted in valuable information for mineral exploration and for the Metallogenetic Map of Namibia which was being compiled by the Economic Geology Division of the Geological Survey at the time. Since 1993, cooperation with the Japanese International Cooperation Agency in the field of base metal and rare earth element exploration has taken place. The work of French palaeontologists in cooperation with the Geological Survey led to the discovery of the 13 million-year-old hominoid *Otaviipithecus namibiensis* at Berg Aukas. This represents the first fossil evidence of a pre-australopithecine south of the equator.

During 1992 and 1993, the Namibian Government Service underwent a restructuring process. The Geological Survey emerged from this exercise strengthened and with three Divisions, namely Regional Geoscience, Applied Geoscience and Geotechnology, with a total staff establishment of 78 positions. Miller left the Geological Survey in 1992 to become the first Technical Manager of the Namibian Petroleum Corporation (Namcor). Dr BG Hoal, great-nephew of Haughton who headed the Geological Survey in Windhoek between 1926 and 1934, took over from him until 1996. The author became his successor as Director.

The new structure and the new possibilities offered through the cooperative projects made the need for new facilities for the Geological Survey overwhelming. Through the support of Hangala at the political level, funds could be secured and in 1994, the Geological Survey moved into its new premises on the southern outskirts of Windhoek after a three-year planning and construction period. The Taylor-designed complex houses offices, an extensive laboratory wing, a cartographic office, the National Energy and Earth Sciences Information Centre, the National Geological Museum with extensive curation facilities, the National Core Shed and an auditorium (Fig. 10).

By 1994, the final chapters of the Mineral Resource Series were completed and the special publication "The Mineral Resources of Namibia" was released in a file format to allow for updating. It has become the standard reference volume on the subject and is now also available in digital format. Subsequently, a comprehensive database on the Namibian mineral occurrences, NamDat, was established and is constantly updated. A large conference to attract international investors in the mining sector to Namibia was also held in 1994. An ambitious program to acquire high-resolution airborne geophysical data started that same year. Funding has been obtained from the Namibian Government as well as from the European Union's Sysmin Fund. To date, about 50% of the country have been flown. This program has proved to be a most effective tool for attracting investment in the Namibian exploration sector. Cooperation with the United States Geological Survey and the Iris Consortium has resulted in these organisations

using the Geological Survey's Tsumeb seismic station as part of the Global Seismic Network since 1994.

The laboratory has been equipped with modern analytical apparatus, such as an Induced Coupled Plasma Spectrophotometer (ICP) in 1996, an X-Ray Fluorescence Spectrometer (XRF) in 1998 and a new X-Ray Diffractometer (XRD) in 1999. Specialised laboratories for industrial minerals, as well as soil and rock mechanics have been commissioned. Today, the laboratory is one of the finest facilities of its kind on the African continent. In the museum section, displays on Namibian palaeontology, including a large replica of *Massospondylus*, the excavated *Erythrosuchus* with an artist's reconstruction of the animal and an exhibit on hominoid and human evolution, including *Otaviipithecus namibiensis* and the recently discovered Orange River Man, have been compiled. There are displays on all major Namibian mining operations, as well as educational exhibits on themes like "The use of minerals in cars". Some Gibeon meteorites as well as the World's largest vanadinite crystal are also on display.

The digital map coverage has increased tremendously. Mineral reports are compiled on the basis of the metallogenetic map and the minerals database, comprising 1:250 000 scale mineral maps with explanations. The Engineering Geology Subdivision is concentrating on waste management and rehabilitation of old mine sites. The Tsumeb seismic station assists with the monitoring for the International Nuclear Test Ban Treaty. Namibia, represented by the Geological Survey, became a full member of the International Union of Geological Sciences in 1999.

From modest beginnings, the Geological Survey of Namibia has become the country's leading earth science research institution. It is acknowledged that today's success of the organisation would not have been possible without the pioneering work carried out by many devoted members of staff during the early days. Despite the modern research techniques available today, large parts of Namibia still remain frontier territory and the Geological Survey of Namibia has entered the 21st century with the huge task of ensuring that Namibia's geological resources are utilised for the benefit of all Namibians and future generations.

### **Acknowledgements**

A number of people rendered enormous assistance in the tracing of old documents and photographs, as well as in sharing their memories with me. Without their assistance I would not have been able to document the history of the Geological Survey of Namibia with the necessary detail. My special thanks go to Mr R Gevers; Prof. I Hälbich; Ms G Keding; Ms M Kreutzberger of the Society for Scientific Development, Swakopmund; Mr J Kutzner of the National Archives of Namibia; Ms Meier; Ms L Niebuhr of the library of the Council for Geosciences, Pretoria; Ms A Otto-Reiner of the Na-

mibia Scientific Society; Mr Rusch and Prof K Weber of the Geological Institute of Göttingen University. I am also indebted to Drs RMcG Miller and BG Hoal for their useful comments on the manuscript.

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