

and research. In addition, the data need to become fully digital and easily accessible to the people of South Africa.

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## Mapping in Africa and beyond

Since 1994, a new dawn in African mapping has been emerging for the Council for Geoscience with a steady stream of geologists giving papers at international conferences and attending meetings and workshops in many African countries where friendships and research collaborations have been established, many of which continue to this day. At the same time as the geologists have been making these links, the efforts of Nok Frick to win commercial geological mapping projects in African countries, sometimes funded by the countries themselves or by agencies such as the World Bank, have been bearing fruit.

The first large African mapping contract that the Council for Geoscience secured was to produce new 1:1 million geological and metallogenic maps, with accompanying memoirs, of the Republic of Gabon in 1995/6. An initial compilation was made by Bob Thomas, Luc Chevallier and Jacques Martini from existing data. Much of the information was gleaned from long hours spent in a stiflingly hot hotel room in Libreville and leavened by a long reconnaissance field trip throughout the country, including the Ebola swamps of the northeast, with a host from the Ministry of Mines. The project delivered its products on time and within budget and marked a successful start to the great CGS African mapping adventures to come. In 1997, Bob moved from Pietermaritzburg to Bellville to join the main nucleus of the African mapping team (Chevallier, Pieter Gresse, Coenie de Beer and later Paul Macey). From here, the next major work was to produce 1:50 000 maps of the complex geology of the Precambrian Sirwa Inlier in the Anti-Atlas of Morocco. The first project (5 maps) took place under the leadership of Pieter Gresse, while Bob handled the second project

(2 maps). Staff of Pretoria, including Gerrit de Kock and Bernard Ingram, were also in the team. This project gave the team exposure to the geology of part of the Palaeoproterozoic West African Craton and the Neoproterozoic (Pan-African) of northern Gondwana, as well as of a Miocene volcano. The team acquired a good grounding in sorting out everyday logistical matters including vehicles, camping equipment and sample exportation in a foreign country and the patience needed to deal with the bureaucracy that can be encountered in parts of Africa. Nevertheless, the two projects were very successful and also resulted in articles in the geological literature, some of which became benchmark papers for Anti-Atlas geology.



First field camp at Askaoun in the Anti-Atlas of Morocco in 1997. Coenie de Beer, Piet Gresse, Luc Chevallier, Gerrit de Kock, Bob Thomas and the late George van Heerden.

Before the end of the Morocco projects, Nok Frick, ably assisted by Nols van Vuuren and Erik Hammerbeck, secured two more major mapping contracts — one of which was the first project outside of Africa — to map the Emirate of Fujairah in the United Arab Emirates (UAE). This project, mainly concerned with mapping the northern part of the Oman Ophiolite, was led by Geoff Grantham and again was highly successful, with all products (maps and memoirs) receiving good acclaim in the Emirates. It was also a valuable experience for all who participated and provided important expertise in ophiolite geology in one of the few geological settings not well represented in South Africa.

The Fujairah project was the only occasion, before or since, that was undertaken in conditions of relative luxury, with reliable air-conditioned four-wheel-drive vehicles, comfortable hotel rooms with hot showers and good food every night. At this time, in the early 2000s, Nok Frick was again taking the long view and busy behind the scenes dealing with funding organisations such as the World Bank

geological infrastructure projects often have geological mapping as a component and such a project was long in the planning in Mozambique, with mapping at a 1:250 000 scale. Consequently, in 2000, a CGS-DNG (Mozambique Survey) mapping area was secured in the Nampula Province of northeastern Mozambique, partly funded by the South African Department of Mineral and Energy Affairs. The first mapping expedition set off from Pretoria with six geologists in fully equipped CGS four-wheel-drive vehicles, under the leadership of the late Matt du Toit. This was a great adventure for everybody, driving up through Zimbabwe, across Tete Province, through Malawi and into Mozambique via the tea plantations of Mount Milanje. The first port of call was the civil-war-devastated town of Mocuba. This was the CGS mapping team's first taste of truly African conditions and everyone benefitted immeasurably from the experience. Over the years, the team gained the knowledge to make the working conditions as tolerable and efficient as possible. Another valuable lesson learned in northern Mozambique was the pace of mapping required to make meaningful geological maps of vast areas of highly complex geology at a large scale in a very short space of time, equating to mapping rates of more than 100 km<sup>2</sup> per day. One of the other major satisfactions of such projects is the passing on of knowledge to the local survey geologists who typically work as counterparts.

Bob moved to the United Kingdom in 2002 to take up a position with the (then)



The CGS mapping team traverses the High Atlas Mountains in Morocco, 1999.

international mapping group at the British Geological Survey (BGS). At about that time, the World Bank mapping project in Mozambique was starting. The Council for Geoscience secured a mapping area in the southern Nampula terrane while the BGS, working in a consortium with the Norwegian Geological Survey (NGU) mapped the adjoining area to the north between 2004 and 2006. During this time, BGS-NGU and CGS geologists worked in close collaboration over the boundary areas and there were a number of friendly workshops where ideas were discussed, chaired by the late Erik Hammerbeck and Erik Hartzler who acted as the World Bank supervisors. The same pattern emerged in 2005 with the major World Bank mapping project in Madagascar. The BGS, working with the United States Geological Survey, was in charge of an area north of that of the Council for Geoscience, led by Paul Macey. Many good collaborative workshops were held in various locations, with Hartzler, Chevallier and De Kock presiding as World Bank co-supervisors.

The Council for Geoscience and the British Geological Survey have a long record of friendly collaboration on international mapping projects. What does the future hold? It seems very positive. For example, for the recently launched bid for a major World Bank mapping project in Tanzania, the CGS and BGS will put in a joint proposal which, it is hoped, will lead to a cementation of the close ties between the two organisations. Last year, the BGS 'spun-out' a company known as 'BGS International', with Peter Zawada,

previously from the CGS, on its staff, to take up this type of project. Thus, the future for CGS overseas mapping, particularly in collaboration with the BGSi, looks secure with the possibility of plenty of geological mapping work in the pipeline. Some of this work is in the form of large World Bank projects proposed or planned, but smaller contract mapping projects for the private sector are becoming increasingly common. At present, the Council for Geoscience leads the field in this regard, such as, for example, Paul Macey's recent projects in Madagascar. Therefore, it is vital that Geological Surveys retain their still-needed skills in geological mapping. This requires the bringing through of a continuous stream of motivated, adventurous young geologists gaining wide geological knowledge and who are capable of mapping at all scales in all terrains and under all physical conditions.

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## Regional mapping in South Africa

The Council for Geoscience has participated in just over a century of national and international geoscience mapping through its six regional offices situated in South Africa. All the provinces in South Africa have been mapped at a scale of 1:250 000. The focus of mapping is now to update the geological maps at a scale of 1:50 000 for more detail. Beginning in 1912 with the establishment of the Geological Survey, now known as the Council for Geoscience, regional mapping has been the core function and the cornerstone of the organisation's scientific focus area. Although technology at the start was not as advanced as it is today, regional mapping saw a good record of the details of geological units in South Africa including the famous Witwatersrand gold basin, the Bushveld Complex, the Vredefort impact structure, the Karoo and the Cape Supergroups and the kimberlite diamond pipes, to name a few. With the advancement of technologies such as remote sensing and geophysical and geochemical techniques, used together with geological