The Khaudum Omuramba snaking east towards the Okavango Delta.

Chapter 2

FOUNDATIONS

Millions of years to build
As an administrative region with clearly defined borders, Kavango is very new, especially so in relation to the hundreds, thousands and millions of years over which this area has existed. What is to be seen today is largely a product of events and developments over all these years. Indeed, the region’s natural features have been millions of years in the making.

Several features dominate Kavango’s landscape: its flatness, the mantle of windblown sand, the Okavango River, dry omuramba valleys (dry rivers are known as omurambas in Namibia) and the remains of old sand dunes. One way or another, all of these are associated with the fact that Kavango is part of the Kalahari Basin, a vast depression stretching from the northern Cape in South Africa upwards to close to the Congo River (Figure 4). But what formed this huge Basin, how did the region come to be covered by windblown sands, and when did the Okavango River first flow?

Time on Earth goes back to the formation of the planet some 4,600 million years ago, but what Kavango looked like for much of that time is not known. The best place to begin is with the formation of the basement to Kavango, a foundation of rock produced over a period lasting about 350 million years. All of this started some 900 million years ago when an ancient landmass began to split apart into several continental plates. Deep rift valleys formed between the splitting plates, and sediments washed down into lakes lying in the bottoms of the valleys. The splits later widened much further to form distinct continents separated by oceans. One of these is known as the Khomas Ocean, and thick layers of sediments were deposited on its seabed.

The continents then started moving closer about 700 million years ago. Sediments that first accumulated in the rift valley lakes and those later deposited on the ocean floors were squeezed upwards, the great forces of compression heating and moulding them into metamorphic rocks: limestones, quartzites, schists and dolomites. The name of the new landmass created about 550 million years ago by these and other colliding continents was Gondwana, and those metamorphic rocks formed the basement of what is now Kavango. However, the rocks lie at very different depths below the current surface of the region. Those in the south (near Mangetti) and in the east (around Bagani) are closest to the ground because this is where mountain belts had formed when the colliding continents pushed the seabed sediments higher. One belt now forms the hills near Grootfontein, Tsumeb and Otavi while another remains as the hills of the Khomas Hochland, which we now see around Windhoek. The Khomas Hochland belt actually extends in a north-easterly direction, through Botswana and up into Zambia, but most of the original belt in those north-eastern areas was later eroded away. All that remains visible today are small hills, such as the Aha Hills near Tsumkwe and the Tsodilo Hills to the east in Botswana, and rock outcrops in the south-east of Kavango and near Bagani, including those that form the Popa Falls (Figure 5). In actual fact, the surface rocks at Bagani and in south-eastern Kavango are thought to have been produced from the earliest deposits of rift valley sediments. They are called Nosib Group rocks, while Damara Supergroup is the name given to the whole assortment of rocks formed from sediments pushed up by the colliding continents.

Basement rocks lie much deeper in western Kavango, and in some places drill rigs must penetrate
Although Kavango appears very flat, elevations drop gradually from west to east and from south to north.

Old sand dunes formed during drier episodes over the past two million years. The last dry period during which dunes were actively formed probably lasted until about 10,000 years ago. The alignment of the dunes reflects the easterly direction from which prevailing winds blew when the dunes were formed. Dunes to the west of the Omatako were formed from sands carried down this oromamba, while those west of the Okavango Delta were likewise formed from sediments brought down into the Delta by the Okavango River. The satellite images show how old dunes cut across the main road between Mururani and Katjinkatji.
and in south-eastern Kavango. Large areas of these volcanic rocks lie hidden beneath the sands, probably as fairly thin layers less than 50 metres in thickness. One small outcrop of basaltic flows has been seen just south of the region at Klein Dobe, north of Tsukwe. These initial raptures caused Antarctica and South Africa to part ways, but it was about 132 million years ago that new breaks formed between Namibia and South America. The movements of the earth's crust continue today as South America and Africa drift further apart.

Another important event followed the break-up of Gondwana. The margins of what remained as southern Africa began to lift up, producing a rim of mountains and hills encircling the landmass but also leaving a vast and shallow bowl in its centre. Much of this depression now forms the Kalahari Basin (Figures 2 and 6). The predominance of windblown sand in these layers reflects the generally arid conditions that have persisted over the past two million years, although isolated deposits of clays have been laid down by water flowing along the omurambas and in inter-dune valleys during periodic wetter cycles.

The Okavango River is thought to be about 65 million years old, but it could have had its beginnings as far back as 180 million years ago when Gondwana first started to break apart. It is also possible that the Okavango flowed much further south, and one theory suggests that it could have fed into what is now the Orange River. A different hypothesis suggests the Okavango could have flowed all the way into the Limpopo River (Figure 9). The cycle in which the last two million years were generally drier than the previous 63 million years was part of a long-term change in climate. There have also been many other medium-term changes, such as those occurring in about 23,000 year cycles over the past 200,000 years (Figure 10). Rainfall during the wettest of these more recent cycles was often several times higher than the averages of today, and many other rivers must have flowed in the region. This is when water would have carved the Omatako, Ndonga, Khaudum and other omurambas into the Kalahari...