

Report: lithostratigraphy of the area between the Swakop, Khan and lower Omaruru Rivers, Namib Desert

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The study area, situated between the Khan, Swakop and lower Omaruru Rivers, comprises rocks of the Abbabis Metamorphic Complex overlain by the Damara Sequence, as well as a variety of Cambrian and Mesozoic intrusives. Field studies assisted by LANDSAT image interpretation have led to a revision of the stratigraphy of the Central Zone of the Damara Orogen, which has been subject to controversy. A schist - calc silicate rock - marble sequence present between the Chuos and Karibib Formations is introduced into the stratigraphic nomenclature as the Arandis Formation, and correlated with the Oberwasser, Okawayo and Spes Bona Formations of the Karibib area. However, distinct lithostratigraphic successions are recognised in the northern and southern parts of the Central Zone, separated by the Omaruru Lineament.

Introduction

The study area is situated along the central coast of Namibia between the towns of Swakopmund and Henties Bay, and extends inland to the Khan River (Fig. 1, inset). Tectonically it lies within the western Central Zone of the Damara orogenic belt. The oldest rocks present comprise highly metamorphosed and deformed gneisses of the Mokolian Abbabis Metamorphic Complex, which outcrop in domal and anticlinal cores along the Khan River (Fig. 1). They are unconformably overlain by folded and metamorphosed sediments of the Neoproterozoic coarse to fine clastic Nosib Group and the carbonates and fine-grained clastics of the Swakop Group (Damara Sequence). The Nosib and Swakop Groups are separated by a paraconformable contact (Henry, 1992). On the plains northwest of the Omaruru Lineament extensive sand and calcrete cover prevails and outcrops are scarce.

Both the Abbabis Metamorphic Complex and the overlying Damara Sequence exhibit complex small and large scale fabrics, while on a regional scale northeast striking folds are the predominant deformational features in the mapped area (Brandt, 1985). The northeast striking Omaruru Lineament transects the area (Fig. 1) and separates the southern and northern Central Zone of the Damara Orogen. Facies changes across it and the preservation of higher stratigraphic levels in the northern Central Zone are ascribed to vertical movement along this lineament (Klein, 1980). The style of folding appears to be tighter in the southern Central Zone.

Widespread granitic to granodioritic melts intruded the sedimentary sequence during the Neoproterozoic (late Namibian) and Cambrian in association with the various deformational events of the Damara Orogeny. In the study area porphyritic biotite "Salem" granites and red granites are common, while leucocratic granites are relatively scarce. Pegmatites are associated with all of these suites. Younger intrusions comprise the Cretaceous Henties Bay Syenite (Fig. 1), as well as numer-

ous northeast trending dolerites and subordinate acidic dykes of Jurassic and Cretaceous age.

Parts of the area were previously mapped and studied by Smith (1965), Jacob (1974), Marlow (1981) and Brandt (1985). The present mapping was undertaken within the framework of the Finnish-Namibian Geological Mapping and Maps Project with the aim of providing a more detailed lithostratigraphic description of a previously poorly known area, and thus contribute towards clarifying the ambiguous stratigraphy of the Central Zone of the Damara Orogen (Table 1). In accordance with the recognition of a schist and marble unit below the Karibib Formation in the study area, the subdivision of the middle Swakop Group, established by Botha (1978) along the lower Omaruru River and by Badenhorst (1987, 1992) in the Karibib area, has been revised. The newly introduced Arandis Formation (Table 1) conformably overlies the Chuos Formation mixtites and comprises the Oberwasser, Okawayo, Spes Bona and Karub Members, of which the first three are correlatives of the Oberwasser, Okawayo and Spes Bona Formations of the Karibib District (Badenhorst, 1992). The basal marble layer (Karub Member) appears to be restricted to the area between the Khan River and the Omaruru Lineament. The Arandis Formation is exposed south of Rössing Mountain and in narrow belts surrounding the domes and anticlines along the Khan River. Isolated outcrops are also found among the largely sand covered areas north of the lower Swakop River and east of Henties Bay.

Lithostratigraphy of the area mapped

Abbabis Metamorphic Complex

The highly metamorphosed rocks of the pre-Damara Abbabis Complex outcrop in the cores of domes and anticlines adjacent to the Khan River (Fig. 1). This heterogeneous sequence, in which primary features have been almost entirely obliterated, comprises augen, migmatit-

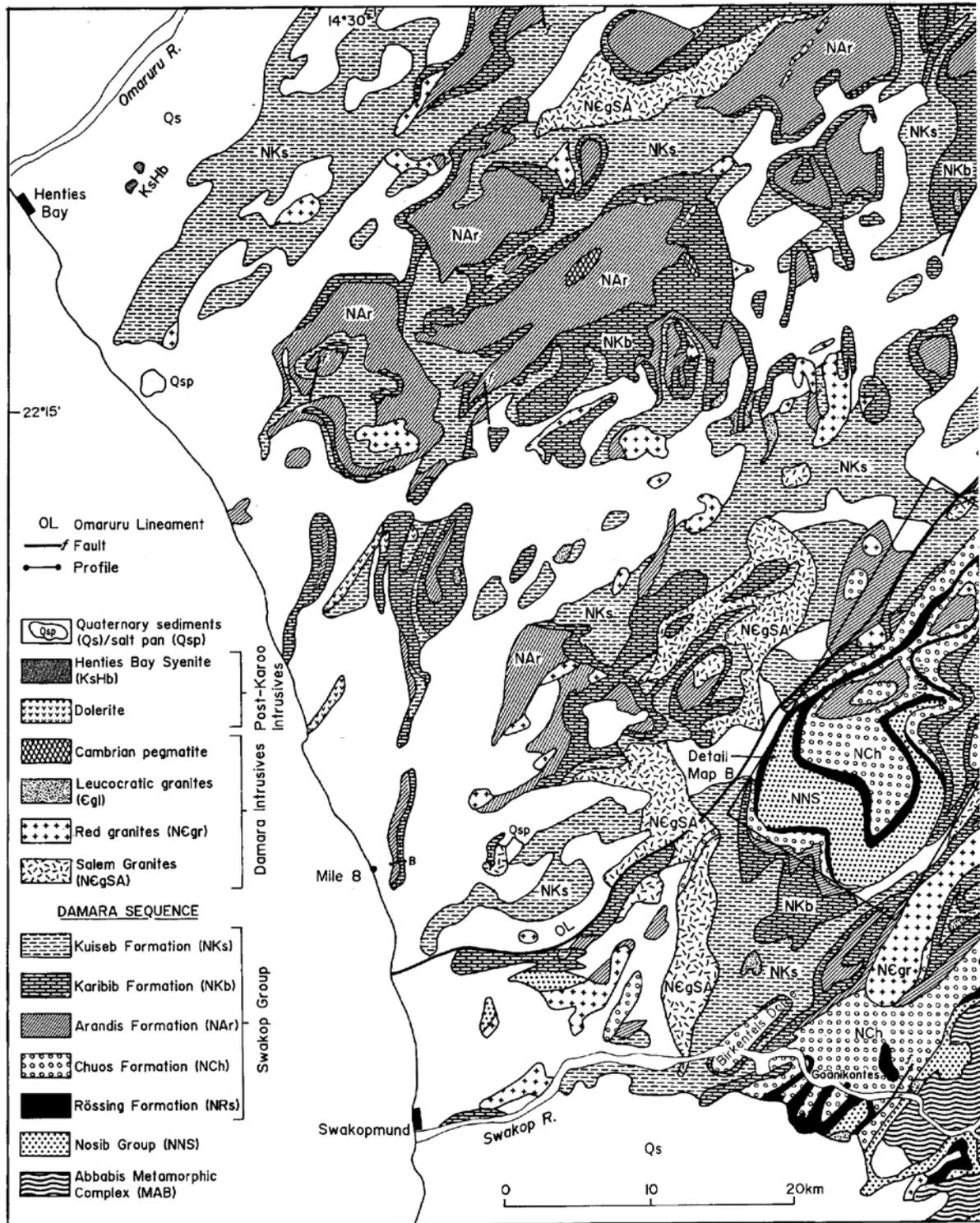
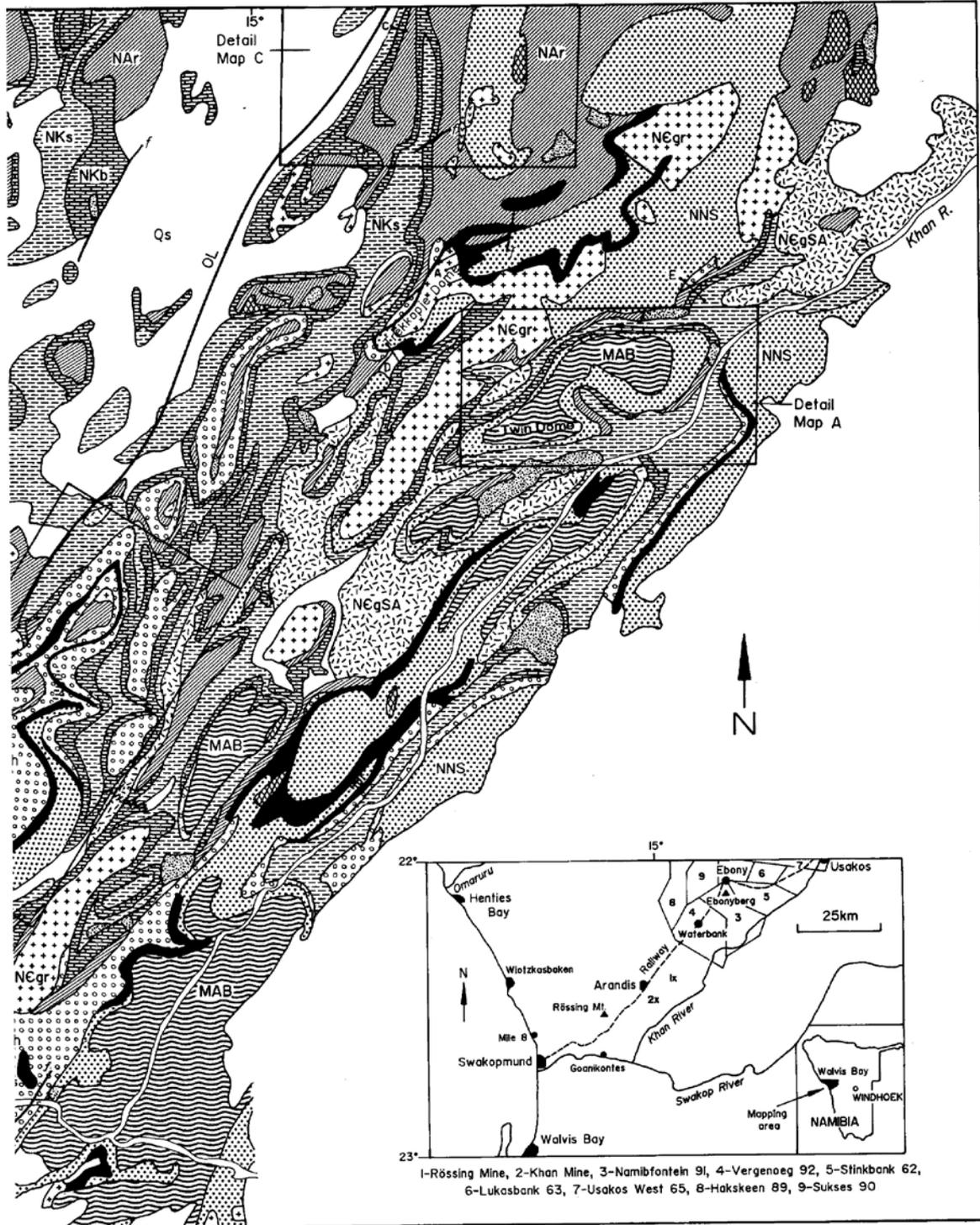


Figure 1: Generalised geological map and location of the study area (inset). The areas covered by detailed maps in figures 2, 4 and 6 are shown and labelled as Maps A, B and C, respectively.



ic, biotite sillimanite and granitic gneisses, biotite schist and amphibolite. The predominant augen gneiss consists of large (5 to 20 mm) microcline porphyroblasts in a foliated quartz-biotite-feldspar matrix. Local granitic bodies and pegmatite dykes probably were generated at various stages in the Damara Orogeny. Amphibolite inclusions in granitic gneisses in the Khan River area are up to tens of metres in thickness. They represent either boudinaged pre-Damara basic dykes or volcanic flows similar to metabasalts of the Naob Formation in the Abbabis Inlier (Marlow, 1981; Brandt, 1987). Dark magnetite and sillimanite bearing quartzofeldspathic gneisses around the western part of the "Twin Dome" (Kröner, 1984) possibly can be correlated with the biotite sillimanite gneisses and dark biotite schists of the lower Naob Formation (Smith, 1965; Brandt, 1987).

Damara Sequence

Nosib Group

Etusis Formation The up to 3500 m thick Etusis Formation commonly grades down into the increasingly metamorphosed rocks of the Abbabis Complex. Recognition of the contact between the units is further complicated by the general conformity of the foliation. The arkosic and micaceous gneisses and feldspathic quartzites of the Etusis Formation outcrop in narrow zones around the granitic or gneissic cores of domes and anticlines (Fig. 2). Red syntectonic granites present in some dome cores (Fig. 1) were possibly derived from these rocks and the underlying gneisses during orogenic events. Commonly characterised by low relief and poor exposure in the mapping area, the Etusis Formation

forms hills and ranges east of the Khan River. Contrary to previous mapping, the Rössing Dome (Fig. 1) is now thought to consist entirely of Etusis gneisses and quartzites exhibiting various stages of metamorphism and deformation (Oliver and Kinnaird, 1996).

The predominant, light-brown to pink, fine- to medium-grained quartzites and meta-arkoses vary in appearance according to metamorphic grade. Parallel bedding and low angle crossbedding are well preserved in the Khan River area (e.g. on the farm Namibfontein 91), where the grade is comparatively low. Within the more intensely deformed and metamorphosed domes parallel bedding and cross-laminae are defined by thin heavy mineral layers. The microscopic texture of the feldspathic quartzites is predominantly blastoclastic (recognisable relict lithic clasts) to granoblastic. The rare rocks in which primary clastic grains remain recognisable consist of rounded to subangular quartz and feldspar, the latter commonly exhibiting perthitic and microperthitic intergrowths. Garnet is usually present as an accessory.

A 10 to 15 m thick intraformational conglomerate, consisting of 5 to 15 cm deformed quartz and quartzite pebbles in an arkosic matrix, is present on the farm Stinkbank 62 (Fig. 1, inset). On the farm Sukkes 90, one to 3 m thick graded beds of quartz pebble conglomerate, fining upward into medium grained meta-arkose, occur in the upper third of the Etusis Formation. Elsewhere, the uppermost part of the formation often consists of a some tens of metres thick red arkosic gneiss with oriented white quartz sillimanite nodules. Mica schist and calc silicate quartzite are encountered within the unit at various stratigraphic levels.

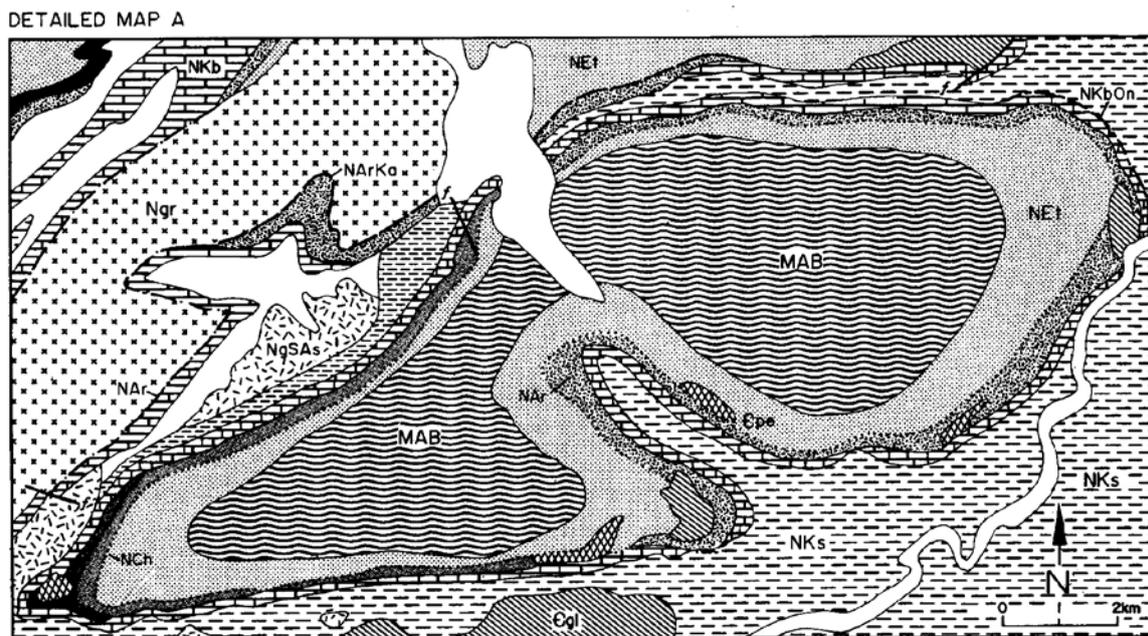


Figure 2: Detailed geological map (marked A in Fig. 1) of the "Twin Dome" area, Farms Vergenoeg 92 and Namibfontein 91 (legend on facing page).

Khan Formation Generally the pyroxene-, amphibole- and feldspar-bearing quartzites and gneisses of the Khan Formation form a sharp contact with the underlying Etusis Formation. In places, however (e.g. on the farms Namibfontein 91 and Vergenoeg 92), the Khan Formation is represented by a calc silicate-rich interlayer of variable thickness within the upper part of the Etusis quartzites, indicating an interfingering relationship. The prominent inselberg of Rössing Mountain consists of greenish-grey scapolite-bearing calc-silicate quartzites of the Khan Formation, which in the west of the area reach up to 1000 m in thickness (Fig. 4). At Rössing Mountain they are thickly bedded, whereas thin bedding, emphasised by alternating light-coloured arkosic and greenish pyroxene-amphibole-bearing layers, is predominant in the Khan River area. Intraformational conglomerates, consisting of rounded quartzite pebbles (< 10 cm) in a coarse-clastic matrix, are exposed southeast of Ebonyberg, at Rössing Mountain,

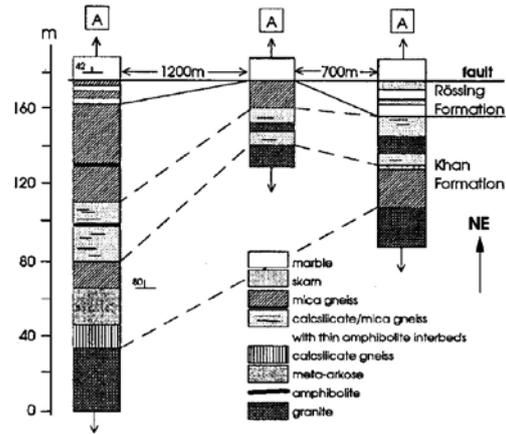


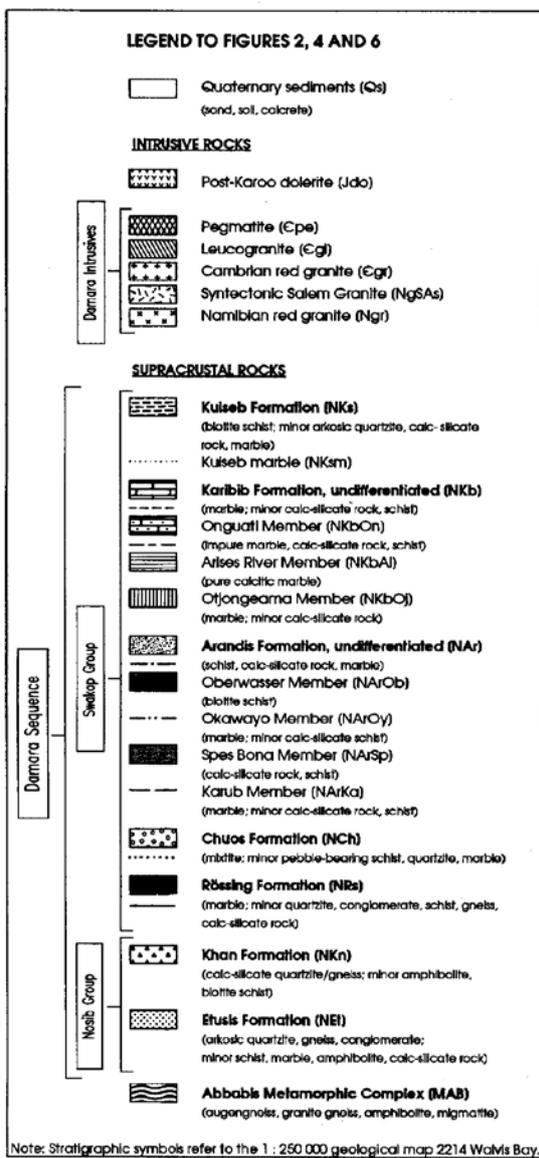
Figure 3: Lithostratigraphic profiles for the upper part of the Khan and lower part of the Rössing Formation, Farm Vergenoeg 92 (profiles A in Fig. 1).

on the farm Namibfontein 91 (Fig. 1, inset), and in the lower Swakop gorge, near Goanikontes, where they resemble the mixtites of the overlying Chuos Formation. An up to 20 m thick dark biotite - amphibole schist or amphibolite layer forms the uppermost part of the Khan Formation near the Rössing Uranium Mine, in the Trekopje Dome (Fig. 3) and in the Goanikontes area (P. Nex, pers. comm.).

Swakop Group

Rössing Formation The Rössing Formation is lithologically heterogeneous and paraconformably (Henry, 1992) overlies the Nosib Group (Fig. 3). At the mouth of the Khan Mine gorge and around Rössing Dome it reaches ca. 200 m in thickness (Jacob, 1974) and consists of impure dolomitic marble, calc-silicate gneiss, quartzite, conglomerate and biotite-cordierite schist. From the Rössing Dome it thins rapidly to the northeast, where it is represented by a thin schist or marble layer. Towards the coast it is characterised by light-grey to buff marble forming prominent, continuous ridges. At Mile 8, the Rössing Formation is represented by a clastic meta-arkose displaying graded bedding, whilst in one locality, northeast of Swakopmund, a 10 to 30 m thick massive serpentine-bearing (up to 35 modal per cent) marble surrounds a dome of red granite and Khan Formation gneisses. Northeast of Rössing Mountain the same marble horizon locally forms sharp-crested anticlines. On the Swakop River, near Goanikontes, the formation comprises predominant arkosic quartzite, with interbedded conglomerate and biotite schist.

West of the Omaruru Lineament the Rössing Formation is exposed only in the core of a northeast plunging anticline situated some 15 km north of Swakopmund. Here, it is characterised by light-grey marble and laminated quartzite. The latter contains sulphide and sillimanite and is locally stained dark grey by disseminated graphite.



Note: Stratigraphic symbols refer to the 1 : 250 000 geological map 2214 Walvis Bay.



Figure 4: Detailed geological map (marked B in Fig. 1) of the area around Rössing Mountain, northeast of Swakopmund.

Chuosi Formation The Chuosi Formation rests unconformably on the Rössing Formation and outcrops extensively between the Khan River and the Omaruru Lineament (Fig. 1). The up to 700 m thick massive mixtite typically consists of deformed clasts in a dark grey to greenish-grey gritty, foliated quartz-biotite-feldspar matrix. The clast-size decreases from angular to subrounded boulders and cobbles in the Khan River gorge to rounded pebbles and minor cobbles further to the west. Concomitant with size, the predominantly meta-sedimentary and granitic clasts which are derived from underlying units decrease in abundance. Epidotised marble clasts are found northeast of Rössing Mountain.

A thin layer of pebbly schist is present in the "Twin Dome" (Fig. 2). Subordinate rock types within the Chuosi Formation are thin marble beds in the Goanikontes area, and iron formation at Mile 8 (Fig. 5, profile B) and in the Khan River area (Henry *et al.*, 1986). Along the northwestern limb of the Trekkopje Dome (Fig. 1) a lateral lithological change from grey massive fragment-bearing rock in the southwest to atypical greyish light-brown gritty meta-arkose in the northeast is observed. The meta-arkose, which underlies the Karub Member of the Arandis Formation, shows a blastoclastic texture with angular to subrounded quartz grains. It contains sericitised andesine, as well as accessory biotite, sphene and apatite.

Arandis Formation Since the first published refer-

ence to the schist layer between the Chuosi mixtite and the Karibib marble (Gevers, 1931), the nature and stratigraphic status of this unit has been subject to controversy. It has been correlated with either the underlying Chuosi or the overlying Karibib Formation (e.g. Jacob, 1974; Bunting, 1977; Marlow, 1981; Miller, 1983; Henry, 1992). Table 1 gives an overview of the stratigraphic nomenclature and correlations used by previous authors. Botha (1978) named the schist unit below the Karibib marble Oberwasser Formation (after the farm Oberwasser 118 in the lower Omaruru River area), while Brandt (1983, 1985) assigned this name to a calc-silicate rock in the same stratigraphic position between Henties Bay and the farm Sukses 90 (Fig. 1, inset). However, the exact stratigraphic position of the Oberwasser Formation remained unresolved due to the absence of the Chuosi mixtites in these areas. Watson (1982) and Miller (1983) correlated the marble and mixed calc silicate/schist units underlying the Oberwasser schist with the Rössing and Khan Formations, respectively (Table 1). In the Karibib area, Badenhorst (1987,1992) subdivided the up to 3500 m thick sequence below the Karibib marble into three formations. Reserving the name Oberwasser for the upper schist, he named the underlying impure marble Okawayo Formation and the lower schist Spes Bona Formation. The Spes Bona schist which rests directly upon Chuosi mixtites defines the stratigraphic position of the sequence in this area.

No lithostratigraphic unit corresponding to the Ober-

Table 1 Stratigraphic nomenclature and correlations of the Central Zone of the Damara Orogen

Botha 1978 (lower Omaruru River)	Klein 1980 (upper Omaruru River)	Watson 1982 (Karibib area)	Brandt 1985 (Henties Bay and Karibib areas)	Miller 1983 (summary)		Badenhorst 1992 (Karibib area)	This study	Lithology	
Rietkuil Formation	Kuiseb Formation	Kuiseb Formation	Kuiseb Formation	Kuiseb Formation		Kuiseb Formation	Kuiseb Formation	schist; calc-silicate rock, marble, quartzite	
Junmon and Hoopverloor Formations	Onguati Member	not developed	Karibib Formation	Onguati Member	(a)	Onguati Formation	Arandis Formation	Onguati Member	marble, calc-silicate rock, schist
	Arises River Member	Arises River Member		Arises River Member		calcareous marble			
	Otjongeama Member	Otjongeama Member		Otjongeama Member		marble, calc-silicate rock			
	Harmonie Member	Harmonie Member		Harmonie Member		not developed		marble, calc-silicate rock, schist	
Oberwasser Formation	Chuosi Formation*	Oberwasser Formation	Oberwasser Formation	Oberwasser Formation		Oberwasser Formation	Oberwasser Member	schist	
Geluk Formation	Rössing Formation	Rössing Formation		Rössing Formation		Okawayo Formation	Okawayo Member	marble, schist, calc-silicate rock	
Tsaun Formation	Khan Formation	Khan Formation		Khan Formation		Spes Bona Formation	Spes Bona Member	schist, calc-silicate rock	
		Etusis Formation		Etusis Formation		not developed	Karub Member	marble, calc-silicate rock, schist	
						Chuosi Formation	Chuosi Formation	mixtite, pebbly schist	
						Rössing Formation	Rössing Formation	marble, quartzite, schist, calc-silicate rock	
						Khan Formation	Khan Formation	calc-silicate rock, biotite schist, amphibolite	
						Etusis Formation	Etusis Formation	arkosic quartzite, gneiss, biotite schist	

(a) --- Correlation after Botha, Klein, Watson, Brandt and Miller

(b) ——— Correlation after Badenhorst and this study

* no correlates of the Oberwasser Formation recognized

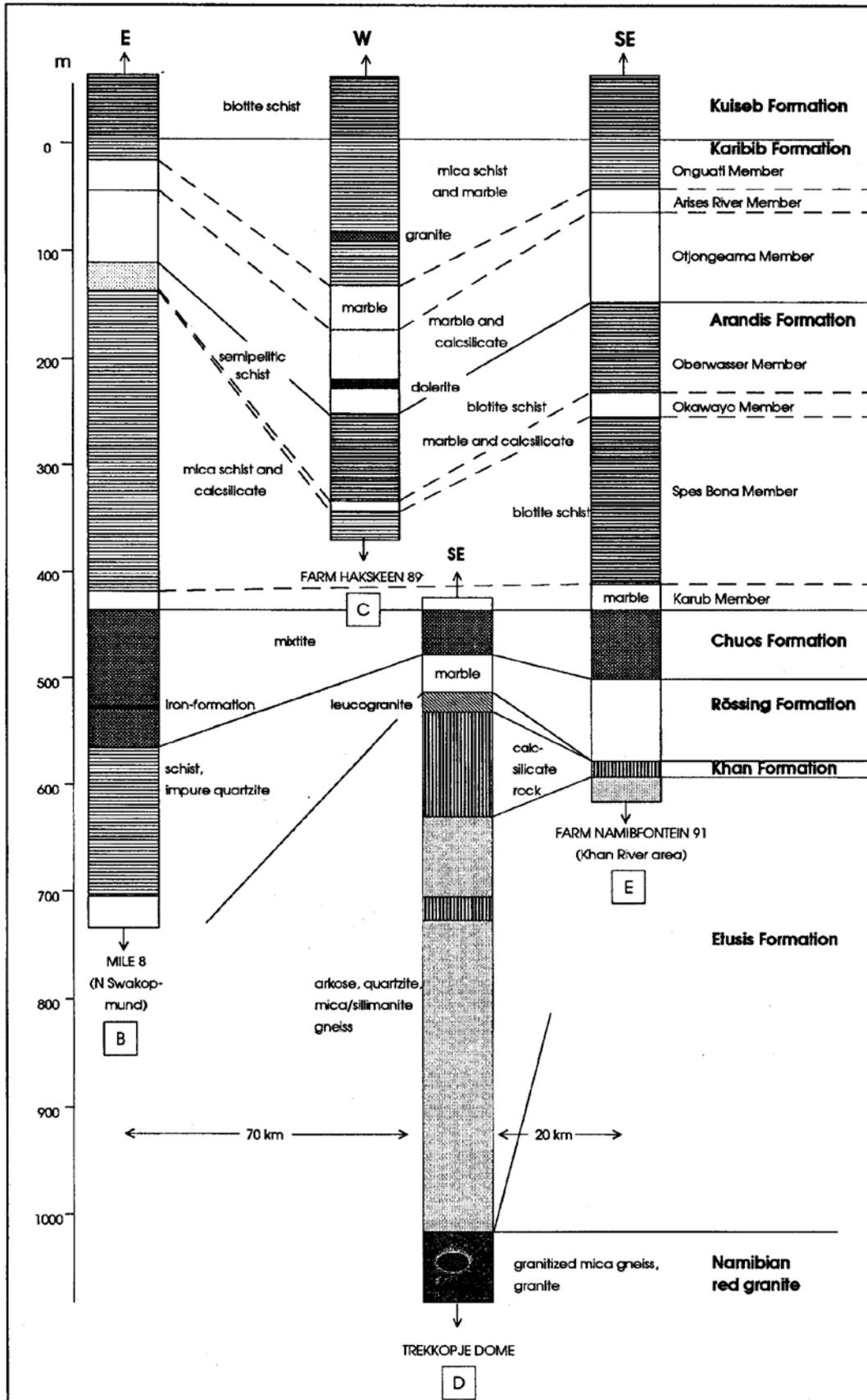


Figure 5: Lithostratigraphic profiles through the Damara Sequence between the coast and the Khan River area (profiles B, C, D and E in Fig. 1).

wasser, Okawayo and Spes Bona Formations was previously recognised in the Khan - Swakop area. In the course of the present mapping an up to 650 m thick schist, calc silicate rock and marble sequence was encountered between the lower Khan River and the coast. This horizon, which forms a conformable unit between the Chuos and the Karibib Formations, is continuous throughout the study area. It is extensively exposed south of Rössing Mountain and east of Henties Bay

(Fig. 1). Due to the similarity of the rocks, identification of the lower and upper schist units, however, may be difficult in areas of intense deformation and metamorphism or poor exposure. Therefore, and because of the greatly reduced thickness of the schists and the interlayered marble in the mapping area, they are re-assigned lithostratigraphic member status by the current authors, and the name Arandis Formation is introduced for the undifferentiated schist/calc-silicate rock

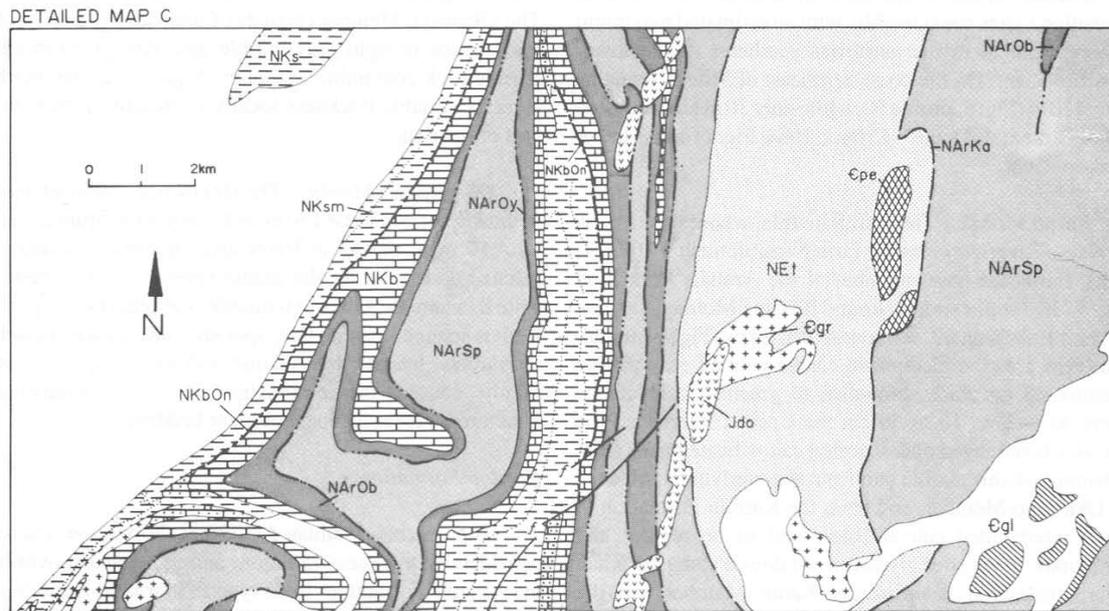


Figure 6: Detailed geological map (marked C in Fig. 1) of Farms Hakskeen 89 and Sukses 90, southwest of Usakos.

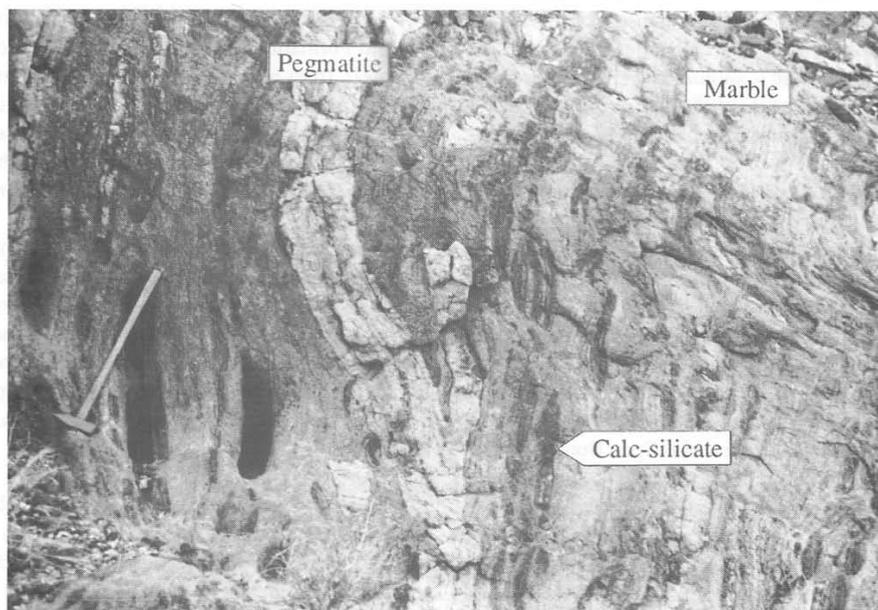


Figure 7: The Karub Member in a tributary of the Khan River: greyish marble with boudinaged calc silicate interlayers (pegmatite dyke in the centre).

sequence present between the Chuos mixtite and the Karibib marble within the tight anticlines of the Khan River area and on the sand covered plains southeast of the lower Omaruru River (Fig. 1).

The newly recognised formation is best exposed in the region centering on the town of Arandis (Fig. 1, inset). Where it is completely developed, it can be subdivided into the Oberwasser, Okawayo, Spes Bona and Karub Members. The latter underlies the Spes Bona schists between the Khan River and the Omaruru Lineament, but has not been encountered further to the east. In thickness the Arandis Formation varies considerably, with an estimated maximum of about 650 m in the antiforms southeast of the lower Omaruru River. On the coast, northeast of Mile 8, it attains some 420 m (Fig. 5, profile B), while only 30 m are measured in the "Birkenfels Dome" (Kröner, 1984; Fig. 1) on the lower Swakop River.

Karub Member The Karub marble, whose type area is the Karub River gorge on the farm Namibfontein 91 (Fig. 1, inset), forms the basal member of the Arandis Formation (Fig. 5). It is well exposed around Rössing Mountain and on the farm Hakskeen 89, southwest of Usakos (Figs. 4 and 6). In its type area the medium- to coarse-grained grey marble contains <5 cm thick, brownish to greenish calc-silicate layers, as well as 10 to 50 cm thick schist interbeds. The typically boudinaged and distorted calc-silicate bands (Fig. 7) distinguish this marble unit from the overlying marbles of the Okawayo Member, and from the Karibib Formation in which interbedded calc-silicates tend to be regular and continuous. In the strongly deformed domes along the Khan River, distinction between the Karub Member and the Rössing Formation marble is problematic where the intervening Chuos Formation is not exposed.

The Karub Member thins from 40 to 60 m near the Khan River to less than 40 m in the tight domal structures west of the Khan River. West of the railway (Fig. 1, inset) it is represented by a 2 to 5 m thick bluish, dense, skarnlike rock, which forms a narrow ridge. This calc-silicate rock contains major pyroxene, biotite and scapolite, as well as subordinate plagioclase. The upper contact of the Karub Member is gradational, with the number of schist interbeds increasing upwards.

Spes Bona Member The calc-silicate bearing schists of the Spes Bona Member dominate the Arandis Formation. They decrease in thickness from 280 m north of Swakopmund to between 30 and 120 m in the Khan River area. At Mile 8 the well preserved, dark greenish, bedded schists consist of 1 to 50 mm thick alternating biotite- and calc silicate-bearing layers, showing graded lamination only in thin section. In contrast, in the highly deformed and metamorphosed Khan River area, the Spes Bona Member comprises dark grey, foliated biotite schist (Fig. 5, profile E), resembling the overlying Oberwasser Member and Kuiseb Formation.

The biotite and calc-silicate schists of the Spes Bona Member have a granoblastic to porphyroblastic texture and contain accessory garnet, sphene, apatite, zircon, chlorite, tourmaline and carbonate. Atypical, fine- to medium-grained dark grey quartzite, present on the farms Lukasbank 63 and Usakos West 65 (Fig. 1, inset), contains scapolite and is blastoclastic to granoblastic.

Okawayo Member Separating the Oberwasser and Spes Bona Members, which are commonly lithologically indistinguishable schists due to strong deformation and metamorphism, this 2 to 25 m thick marble is an important marker horizon (Fig. 5). It forms characteristic low ridges and hogbacks, which are readily discernible on aerial photographs and satellite images. The contacts of the Okawayo Member with the underlying and overlying schist units are gradational, with 1 to 2 m thick transition zones. The Okawayo Member consists of intercalated 5 to 20 mm thick bands of light grey marble and dark greenish calc-silicate rock containing scapolite. A grey, massive marble layer of variable thickness locally is present in the central part of the unit.

Oberwasser Member The Oberwasser Member varies in thickness from some 150 m on the lower Omaruru River to 10 - 50 m in the Khan River area. It consists mainly of foliated dark grey, locally garnet-bearing biotite schist. At Mile 8, where the Okawayo marble is absent (Fig. 5, profile B), it is semipelitic with thin, sporadic calc silicate or marble interlayers. Intense deformation and metamorphism commonly caused the elimination of most sedimentary structures, except for local obscure bedding.

Karibib Formation

The marble-dominated Karibib Formation exhibits considerable thickness variations and conformably overlies the Arandis Formation. In its type area around Karibib it is divided into four subunits (Klein, 1980). During the present mapping the Otjongeama, Arises River and Onguati Members were also recognised in the Khan - Swakop area, while the basal Harmonie Member appears to be absent.

Otjongeama Member The lower most member of the Karibib Formation present in the mapped area increases in thickness from about 40 m along the Omaruru and Khan Rivers towards the centre of the study area. In the Swakop River gorge it exceeds 200 m in thickness, whereas at Mile 8 (Fig. 5) it measures only 50 m. Within the domes and anticlines of the Khan River area this unit is represented by marble bands less than 10m thick.

The light-grey to yellowish-brown Otjongeama marble is characterised by 1 to 5 cm thick, green to dark brown calc silicate interlayers. They are commonly

continuous, but polyphase folding locally caused distortion and boudinage. The contact with the pure marble of the overlying Arises River Member tends to be sharp, except where the distinguishing calc silicate bands decrease in abundance or are absent.

Arises River Member The Arises River Member averages some tens of metres in thickness (Fig. 5), but between the Omaruru Lineament and the Omaruru River reaches 200 m locally. Due to its weathering resistance the pure, calcitic marble tends to form topographic highs. It is predominantly white to light or bluish grey, with a subordinate dark grey, sulphide-bearing variety. One to 2 mm graphite flakes locally make up as much as 5 modal percent of the light-coloured rock, imparting a speckled appearance. The marble is commonly very coarse-grained with fist-sized calcite crystals and massive, but in some outcrops a distinct regular lamination or colour-banding can be observed.

Onguati Member The Onguati Member forms the transition zone between the calcitic Karibib and the pelitic

Kuiseb Formations (Badenhorst, 1992). It consists of thinly interlayered calc-silicate and marble beds with minor schist. Commonly less than 10 m thick, it attains 100 to 150 m in the Swakop River gorge west of Goanikontes, and on the farm Hakskeen 89 (Fig. 6). A well-developed sequence of alternating calc-silicate, marble and schist is exposed in a tributary gorge of the Khan River east of the "Twin Dome" (Fig. 2).

Kuiseb Formation The youngest lithostratigraphic unit of the Damara Sequence is exposed in most synclines between the domes and anticlines of the Swakop-Khan area (Figs. 2 and 4), and underlies the sand-covered plains west of the Omaruru Lineament (Fig. 1). However, due to the poor weathering resistance of the highly deformed and metamorphosed schists good outcrops are scarce. Along the Khan River, cross-bedding and graded bedding are locally preserved, but to the west most sedimentary structures have been obliterated by deformation and metamorphism. Boudinaged calc silicate interlayers and concretions are frequent within the Kuiseb schists, and several metres thick marble interbeds occur on the farm Hakskeen 89 (Fig. 6).

The predominant dark grey quartz-biotite schists commonly contain garnet and cordierite, while local greenish-grey calc-silicate rocks carry pyroxene, scapolite, epidote, carbonate and sphene. Near the Omaruru River, the Kuiseb Formation is more feldspathic, and alternating quartz-feldspar-rich and biotite-rich layers are discernible in spite of the intense metamorphism. The feldspathic composition of the Kuiseb Formation in this area led Botha (1978) to associate it erroneously with the Nosib Group (Tsaun Formation).

Summary

During the course of the present mapping, a lithostratigraphic succession corresponding to the Oberwasser, Okawayo and Spes Bona Formations of the Karibib region has been recognised in the Khan - Swakop - lower Omaruru River area. Due to the reduced combined and individual thickness of these units (total 650 m as opposed to 3500 m around Karibib), as well as to the difficulty of distinguishing the schists of the Oberwasser and Spes Bona Formations in highly tectonised and metamorphosed or poorly exposed country, they are relegated to member status in the study area, and the name Arandis Formation is introduced for undifferentiated schists and calc-silicate rocks between the Chuos mixtite and the Karibib marbles. The name Karub Member is proposed for the marble horizon underlying the Spes Bona schist between the Khan River and the Omaruru Lineament.

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