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THE GEOLOGY
OF THE
AREA AROUND EAST LONDON, CAPE PROVINCE

AN EXPLANATION OF SHEET MAP 3227D (EAST LONDON), 3228C (KEI MOUTH)

by

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Met 'n opsomming in Afrikaans onder die opskrif

DIE GEOLOGIE VAN OOS-LONDEN EN OMGEWING

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GEOLOGICAL MAP IN COLOUR ON A SCALE OF 1:125 000 OBTAINABLE SEPARATELY AT 60c, FOREIGN 75c

GEDRUK DEUR EN VERKRYBAAR VAN DIE STAATSDRUKKER, BOSMANSTRAAT, PRIVAATSAK X85, PRETORIA

GEOLOGIESE KAART IN KLEUR OP 'N SKAAL VAN 1:125 000 APART VERKRYBAAR TEEN 60c, BUITELANDS 75c

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ABSTRACT

The area is bounded by 32°30'S, 27°30'E and the coast, with East London near the mid-point of the coast-line. The surface is a coastal plain rising from near sea-level to 916 m at the north-west corner and dissected by a number of rivers, chief of which are the Kei and the Buffalo.

The geological formations range in age from Beaufort Series to Recent but most of the area consists of Beaufort Series invaded by Karoo dolerite. Most interesting is the recognition of the Middle Beaufort Stage at Kidd's Beach, Kwelera River, Qolora River and near Stutterheim as a characteristic sandstone sequence 900 m thick. The Beaufort rocks dip at small angles inland but more steeply eastwards near the coast.

Ore deposits are negligible.

I. TOPOGRAPHY

The area mapped lies south of the 32°30'S parallel and east of the 27°30'E meridian and is terminated by the Indian Ocean to the south-east. It covers some 4 891 km^2 of which 4 139 km^2 lie north of latitude 33°S and the remaining 752 km^2 lie to the south. The city of East London is situated at 33°01'S and 27°55'E on the boundary between the two old sheets 129 and 130 into which the whole survey area is divided, while the town of Stutterheim at 32°35'S and 27°29'E lies just outside the area near its north-west corner. The coast-line, a fairly straight line, extends from the Keiskamma River mouth in the south-west to a little short of Mazeppa Bay in the north-east, a direct distance of 135 km in a direction E 38° N.

Administratively the area is divided into two by the Great Kei River. That part north-east of the Kei is a portion of the Transkei which is reserved for Bantu occupation. The remainder of the area is part of what is commonly known as the Border which extends along the coast as far as the Great Fish River and as far inland as Aliwal North on the Orange River. Within this area there are various enclaves reserved for Bantu and these are collectively known as the Ciskeian Native Territories, but the term Ciskei is sometimes applied to both European and Bantu areas in the Border region. The area is further subdivided into magisterial divisions and includes the greater part of the Division of East London, almost the whole of Komga, part of Stutterheim and a smaller portion of King William's Town, while that part in the Transkei belongs to the Divisions of Kentani and Butterworth.

Some idea of the general topography may be obtained by reference to the map of South Africa 1:500 000 topographical edition, Queenstown (1949) and Port Elizabeth (1950) sheets. The city of East London (population 136 757) lies near the mid-point of the coast-line, while the town of Komga (2 274) lies due north of East London near the northern margin of the area. Other smaller centres are Berlin (2 086) west-north-west of East London on the main road to King William's Town, Kei Road (500) north of Berlin, and Macleantown (610). Kentani at 32°30'S and 28°21'E is the only centre beyond the Kei.

The railway system is poor and simple. A main line runs from East London to Stutterheim which is situated just outside the north-west corner of the area, with an important branch to King William's Town from Blaney and another branch from Amabele through Komga to Kei Bridge (the Umtata line).

A primary network of tarred roads radiates from East London with the coast road to Peddie, the main road to King William's Town branching at Berlin to Stutterheim, and the main Transkei road to Kei Bridge via Komga. The whole area is reasonably accessible by secondary roads which generally follow the watersheds and by farm roads, except for some of the deeper valleys in which case a fair amount of walking is necessary for geological mapping. The whole coast is, however, studded with holiday resorts which can be reached by car.

The area is drained by a large number of rivers flowing roughly at right angles to the coast. The following figures give the percentage of the whole land surface falling within the drainage basins of each of the principal rivers: Great Kei 24, Gqunube 16, Nahoon 13, Buffalo 9, Kwelera 9, Quku 4, Chalumna 4, Kobonqaba 3, Kwenurha 3, Ncera 2, Nxaxo 1, Qolora and others 11. Half of the rivers mentioned — Chalumna, Buffalo, Great Kei, Qolora, Kobonqaba and Nxaxo — rise outside the area, while the others rise within it. None of these rivers is navigable under natural conditions.

II. PHYSIOGRAPHY

The relationships of the area to the main physiographic provinces of the Republic seem to be a matter of opinion and every new author contributes to the confusion. It is certain that the area is from any point of view transitional, and the boundaries between the physiographical subdivisions are, to a large extent, arbitrary. There is general agreement that the Cape Fold Belt ceases to be recognizable topographically near Grahamstown and certainly to the west of the Great Fish River, although a considerable amount of folding can be traced far to the east of this river. Here, however, peneplanation has produced a relatively smooth plain cut across a variety of geological formations.

Perhaps the best known classification of physiographical regions is that of John H. Wellington who designated the Southern Cape as region II with subregion IIE wrapped around the eastern end of the Cape Folded Belt. This subregion he calls the Southern Coastal Foreland and it extends to the north as far as Somerset East. The word foreland is not defined but is presumably used to indicate simply the country immediately at the foot of the mountains.

According to Wellington's map this Foreland extends some 24 km beyond East London and appears to terminate about half-way between East London and the Great Kei River where its northern boundary runs inland to the foot of the Amatole Mountains. In the present area this boundary would run inland to the north-west corner of the map roughly in a straight line.

Apart from a strip at the coast the rest of the area falls into Wellington's subregion 9D, called by him the Eastern Cape Uplands and stretching inland to the Great Escarpment. The coastal strip, which in our area is about 24 km wide, according to his map, is subregion 9E and named the South-eastern Coastal Belt. According to Wellington, this Coastal Belt in the southern Transkei and the Eastern Province varies in character from a low plateau rising gently from coastal cliffs up to 50 m high to a sandy dune-covered area backed by a gentle ascent to the interior. It is, however, not very clear what features distinguish the two subregions.

It should be mentioned here that Alex. L. du Toit had employed the term Coastal Belt in very much the same sense farther up the Pondoland Coast, while he referred to the area immediately inland of it as the Coastal Plateau. Here the Coastal Belt, again about 24 km wide, rises from sea-level to an escarpment at about 450 m. Moreover, in Pondoland Du Toit recognized yet another surface farther inland called by him the Inland Plateau and rising inland from about 1 000 m. It is, however, doubtful whether these subdivisions can be traced into the southern Transkei or into the Border.

In the first edition of his "South African Scenery" (1942, fig. 257), Lester King shows the Southern Folded Belt continuing to the coast from Port Alfred to East London, presumably influenced by Rogers' map of physical divisions published in the Union Year Book No. 10 (1927-8). In the second edition (1951) the eastern end of the fold belt was withdrawn to its proper place near Grahamstown. Beyond East London there appears in the first edition what is called the Eastern Coastal Belt only 5 km wide at first but widening towards the Transkei, while the remainder of our area is labelled Eastern Midlands. In the second edition there is a continuous coastal belt, about 32 km wide at East London, but it changes its name from Eastern Coastal Belt to Southern Coast at the Great Fish River mouth. Now the boundary between the Eastern Coastal Belt and the Eastern Midlands is located according to King by the scarped front of the "African" erosional surface, or so he wrote in 1951.

Subsequently King decided that the surface just referred to is not part of the "African" surface, but this does not mean that the boundary falls away. Indeed in his "Morphology of the Earth" the morphologic map of Africa retains the boundary, so that presumably his arrangement of the Geomorphic Provinces is still valid.

In 1955 the Tomlinson Report on the Bantu Areas of South Africa presented a map of the Transkei and Ciskei (map 34) in considerably greater detail than anything of earlier date. According to the text it was the work of Deryck E. Nel and taken from his unpublished Ph.D. thesis. It depicts a Coastal Area running the length of the coast of the Border and Transkei and terminated inland by the First Escarpment, a discontinuous feature broken by the main river valleys. Within our area it has a maximum width of 24 km in the south-west and diminishes to the north-east to a minimum of 8 km around Cintsa River mouth, but increases again to about 16 km in the Transkei. The First Escarpment itself is shown up to 5 km wide and is followed inland by the Inland Step over the remainder of our area. In the Border this Inland Step is about 300 m above sea-level but in the southern Transkei it is more like 500 m in the neighbourhood of Kentani.

The Inland Step then stretches inland to the Second Escarpment just beyond the confines of our area. It is a winding feature including the Amatole Mountains and in the Transkei passes through Cofimvaba and Engcobo and runs about 30 km inland of Umtata, corresponding to the escarpment between Du Toit's Coastal Plateau and his Inland Plateau. Farther inland is the Inland Highveld corresponding to Du Toit's Inland Plateau.

Some years later (1962) a report was published on natural environment and land use of the Border Region by Christopher Board. The term Border Region was taken to mean the divisions of King William's Town and East London, and those parts of these two divisions occurring in our area account for nearly a half of the whole region. A chapter (p. 25-40) is devoted to physiography and a map (No. 3) shows the distribution of the physiographic regions recognized by Board. In so far as this system is ap-

plicable to our area, the latter is divided into two belts, an Outer Coastal Belt and an Inner Coastal Belt separated by a boundary line approximately at 250 m above sea-level but continued across the main river valleys.

The Outer Coastal Belt, next to the sea, is characterized by the following features:-

(a) its inland margin corresponds to the line where the general land slope of the Inner Coastal Belt first steepens appreciably towards the sea; the width of this belt on average is said to be some 10 km and as the drop is 250 m, the average slope is 25 m per km;

(b) the surface is planed off by shelves having a lower slope locally; they are up to 2 km in width and occur especially at about 60 m above sea-level but also at 120 m and at 200 m;

(c) hills locally rise above the general surface by as much as 150 m;

(d) rivers crossing the Outer Belt emerge from deep valleys and are straight without tributaries;

(e) other rivers rising near the inner margin do not join the main rivers.

It will be seen that this Outer Coastal Belt corresponds roughly with Nel's Coastal Area although no reference is made to Nel's work by Board.

The Inner Coastal Belt occupies the rest of our area and in fact continues inland as far as the Amatole Mountains. In the adjoining Peddie District these coastal belts together have been called the coastal plain and the term can be used here also. The whole area around East London is in fact a dissected coastal plain modified at the coast by sedimentary deposits resting upon its surface. This is using the term "coastal plain" not in any genetic sense but for a surface that rises continuously from sea-level. On this basis Board (on his map 3) has divided the Inner Coastal Belt into remnants of an original coastal plain and the various drainage basins that have appreciably modified it by erosion, and it is clear that these units have been generalized to a considerable extent.

This system of classification seems to have advantages over the others and for the purpose of this survey it has been extended so as to include the whole area. This includes the generalized coastal plain contour at 610 m which has also been extended through the area (fig. 1). However, in our area the margin between the Inner and Outer Coastal Belts cannot generally be recognized as an escarpment.

The highest point in the area is situated at the north-west corner with a beacon at 916 m and this point is only 10 km east of Dohne Peak at 1 456 m, which may be regarded as the eastern extremity of the Amatole Mountains. This beacon lies in the drainage basin of the Toise River which is tributary to the Kubusi, itself a tributary of the Kei, and is not regarded as a point on the coastal plain but is probably not far below coastal plain level.

In the Kei Road area the distance on the coastal plain between the 610 and 915 m contours is about 16 km so that the average slope is 19 m per km which, as Board says, is about the same as that of the average for the whole coastal plain measured in a direction at right angles to the coastline. Between the 305 and 610 m contours the slope is much less with only 12 m per km.

The Great Kei River is in some ways the most important river in the

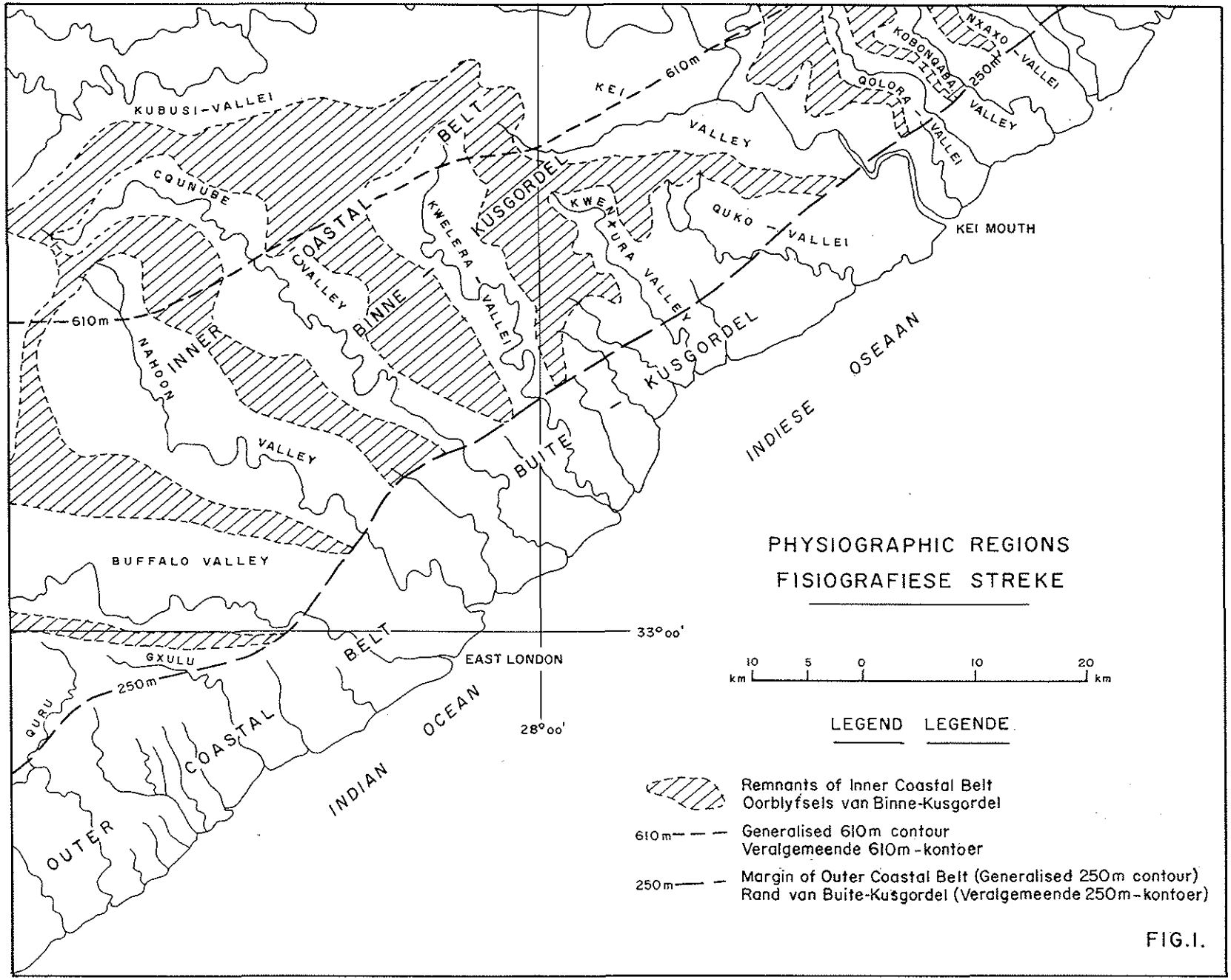
KUBUSI-VALLEI
KEI
610m
VALLEY
KOBONQABA
NXAXO
VALLEI
250m
VALLEY
QOLORA
VALLEI
CQUNUBE
BELT
COASTAL
KUSGORDEL
KWENTURA VALLEY
QUKO
VALLEI
KEI MOUTH
610m
NAHOON
INNER
CVALLEY
BINNE
KWELERA
VALLEI
KUSGORDEL
INDIESE
OSEAAN
VALLEY
BUITE
BUFFALO VALLEY
33°00'
GXULU
BELT
EAST LONDON
250m
QURU
COASTAL
OCEAN
28°00'
INDIAN
OUTER
PHYSIOGRAPHIC REGIONS
FISIOGRAFIESE STREKE
10 5 0 10 20
km km
LEGEND LEGENDE
Remnants of Inner Coastal Belt
Oorblyfsels van Binne-Kusgordel
610m
Generalised 610m contour
Veralgemeende 610m-kontoer
250m
Margin of Outer Coastal Belt (Generalised 250m contour)
Rand van Buite-Kusgordel (Veralgemeende 250m-kontoer)

FIG.1.

area if only because it has the effect of dividing the area into two separate portions, Transkei and Border. This is all the more so because there is no road crossing the river anywhere near its mouth. In fact to take a car from Kei Mouth on the west bank to the opposite Transkei bank would involve a road journey via Kei Bridge, Butterworth and Kentani of almost 160 km. The Great Kei River, as the White Kei, rises in the Stormberg and is joined by the Swart Kei near Cathcart whence it follows a meandering course in a south-easterly direction and enters the area at Kei Bridge near the mid-point of the northern margin.

From here it continues to follow a meandering course, at first towards the east, and therefore along the northern margin, for a direct distance of some 16 km, finally to swing to a south-easterly direction, and therefore roughly at right angles to the coast, for about 32 km direct. The river continues to meander almost to its mouth, the final straightening being not more than two and a half kilometres from the sea. The direct distance from Kei Bridge to Kei Mouth is 43 km while the river travels 72 river kilometres.

While the Great Kei River itself enters the area at Kei Bridge, an upper part of the Kei River basin can be followed all along the northern part of the area to the west and this part has been carved by a large tributary, the Kubusi and, in turn, by its tributary the Toise. The Kubusi River rises some 21 km west of the area in the Amatoles and follows a meandering course, passing only a couple of kilometres south of Stutterheim. On entering the area it flows roughly eastwards with a highly meandering course about 8 km from the northern boundary for some 24 km, where it is joined by the Toise (Gqolonci) River which rises behind Dohne Peak about 16 km west of the north-west corner of the area. The enlarged Kubusi then produces some of the most striking scenery of the whole area before it leaves the area on the northern margin some 7 km farther on. This is just north of the beacon Matollokop (789 m) where the floor of the Kubusi is at 396 m and both north and south slopes are steep. Moreover, this point is easily accessible by the road running north from Bleakmoor, which itself is situated on the watershed between the Kei River drainage and the rivers flowing south such as the Gqunube.

After leaving the area the Kubusi River continues to meander just outside the area, and at a distance of a further 10 kilometres eastwards the river just loops into the area where it is joined by the Gwahoo (Zimbane) River, again with spectacular scenery and easily reached from Komga. This is only 5 km short of the infall into the Great Kei River which enters the area about 10 km farther along the boundary.

Kei Bridge crosses the river 2 or 3 km farther down the river and is well known as a landmark on the main coastal road from East London to the Transkei and Natal. Only a few years ago there was, at the road bridge, a customs office controlling the introduction of strong drink and firearms into the Transkei. Nearly a kilometre up the river is the railway bridge on the railway from Komga to Umtata, built in 1949. The river here is at 166 m above sea-level and the line of the road is called the Kei Cuttings. Along the road the valley is broad and gradually drops from the southern shoulder at a little over 600 m in a direct distance of $6\frac{1}{2}$ km. This is not steep for a road but the railway at the siding called Spiral, in order to reduce height, actually loops itself at 350 m with a diameter of about 640 m. However, quite close to Kei Bridge the rise on the south bank is very steep and, where the Kei enters the area, it rises from less than 167 m to over 600 m in a kilometre. This is the well known landmark Moordenaars Kop, the beacon of which is just north of the 32°30' parallel, and parts of its slopes are vertical.

From here right to the mouth the river follows a broadly meandering course with very little flood plain so that the meanders are incised in varying degree. Commonly only one bank is very steep, usually the outer bank, so that the river is not generally very confined. Nevertheless the river throughout this section can be said to flow in a gorge. Relative to the coastal plain and general level of the country, the depth of incision becomes progressively less as one approaches the coast but over the last 10 km or so the river emerges particularly rapidly.

About 24 km up-river direct the main course is joined by a tributary on its left bank, the Gcua River, which also follows a highly meandering course with the production of more striking scenery, and about 5 km farther down it is joined by another tributary, the Tyityaba River, on its other bank. Apart from these, there is a surprising lack of any significant tributaries below Kei Bridge and below these two tributaries the valley is particularly confined.

The flow is perennial and consequently the mouth is always open. There is, however, a sandbar which is quite shallow. It is tidal for about 16 km, as described by the survivors of the Grosvenor shipwreck in 1782. Within the area the direct distance from point of entry to the mouth is 46 km, while the distance along the river bed is 72 km with an average river gradient of 2,3 m per km.

The Buffalo River with East London at its mouth is even more important than the Kei from many points of view. It and some of its tributaries rise outside the area on the southern slopes of the Pirie Range, a southerly offshoot of the Amatoles and, after passing through King William's Town, it enters the area some 40 km west of East London at the Laing Dam, one of East London's water supplies. It follows a meandering course except for the last 6 km in a general easterly direction, a feature which distinguishes it from the other rivers of the area, which flow rather in a direction perpendicular to the coast-line. Moreover, within the area of the map the river flows close to its southern watershed, with the result that there are virtually no right bank tributaries. Board regarded this as being due to greater ease of headward erosion down-dip of the sediments, but it may well be due rather to the presence of the large dolerite sheet running along the right bank. Within the area the direct distance from entry to the mouth is 40 km, while the distance along the watercourse is 60 km with an average river gradient of 4,5 m per km.

The river is tidal for a distance of only 10 km, where the first rock outcrops occur across the bed in the vicinity of Buffalo Pass. Within the harbour region the depth of water was originally such that at low spring tide it was possible to cross the river dryshod. In fact in 1827 the Rev. W.R. Thomson crossed by ox-wagon at the mouth of the Quigney River where the harbour now exists and where the depth of water is now controlled by dredging.

Reference to the map of physiographic regions will show that, at the Laing Dam where the Buffalo enters the area, the width of the valley is some 4 km with the northern shoulder at about 490 m and the river-bed at about 280 m. This gives a depth to the valley of about 210 m, a figure which diminishes only slightly down the river. The gradient of the bed is fairly uniform with the exception of the section immediately below Bridle Drift Dam, where the river-bed drops from 122 m to 91 m in 1,6 km along the river.

It follows a meandering course with ingrown meanders such that cliffs occur only on the outer banks but, in the stretch just mentioned and also in the stretch immediately below the Laing Dam, the river flows in a gorge

steep on both sides with banks rising to a height of some 120 m. A good idea of the sort of scenery involved can be seen looking up the valley from the Buffalo Bridge at East London.

The Buffalo River forms an important barrier to communications but unlike the Kei River, there is a main road bridge at about one and a half kilometres from the mouth and another good road crossing at the tidal limit about 10 km from the mouth, known as Buffalo Pass. There was another minor road crossing at Bridle Drift about half way down the valley but this is now submerged in the Bridle Drift reservoir.

Of the other important rivers rising outside the area, the Tyolumnqa (Chalumna) has its source some 21 km to the west; the Qolora rises just outside the area near Kentani, the Kobonqaba some 16 km to the north of this and the Nxaxo, just to the east, has its origin some 8 km to the north. Of those rising within the area, the Nahoon, Gqunube (Gonubie) and Kwelera follow meandering courses across the greater part of the area, while the remainder are relatively short.

On the whole the river valleys run perpendicular to the coast-line and are strikingly parallel to each other, being separated by elongated strips of coastal plain and possessing a dendritic pattern only near their sources.

As has been mentioned, the coast-line is rather straight, the only significant departure being a broad embayment some 24 km across between Kwelera Point and Haga-Haga. Only in one short section of the coast-line are there appreciably high coastal cliffs and that is for about a kilometre just south-west of Morgan Bay. Otherwise the coast tends to be rather sandy but without high bare sand-dunes. On the other hand, over the last 12 km approaching the sea there is a steepening of the profile more marked than in the area to the west. This corresponds to Board's Outer Coastal Belt with an average slope of about 25 m per km, and it is modified in different places by terraces locally developed at various heights, especially at 60 and 200 m respectively. These shelves have a smaller than average slope and possess a landward scarp, and may be up to 1,5 km wide.

III. VEGETATION

The distribution of the broad veld types can be taken from "The Veld Types of South Africa" 1953 by J.P.H. Acocks, while a more detailed study has been made in "The Border Region" by C. Board (1962).

The map by Acocks on a scale of 1:1,5 M shows a simple pattern closely related to topography and in the first place divides the area into three strips running roughly parallel to the coast. Nearest to the sea is coastal forest and thornveld, a belt about 23 km wide and narrowing slightly towards the Transkei. This includes our Outer Coastal Belt but is considerably wider and rises inland to a maximum of 450 m on the coastal plain. This is followed inland by a second belt, called Eastern Province Thornveld, about the same width as the previous one and tapering slightly more towards the Transkei. The inland margin of this belt lies well inside the 610 m contour of the coastal plain and it is followed by the Dohne Sourveld in the north-west corner of the area.

Modifying this pattern very considerably is the vegetation of the larger river valleys, known as Valley Bushveld. This covers appreciable areas in the valleys of the Buffalo, Nahoon, Gqunube, Kwelera, Kei and Kobonqaba.

The coastal type is largely thornveld, distinguished with difficulty

from the Eastern Province Thornveld farther inland by the actual species of plants occurring there, and it is generally considered that the vegetation of the coastal type was all originally some kind of forest. The residual forest areas are not extensive today and are not shown separately on Acocks' map. In the other direction, where bush has been removed, the vegetation approximates to grassveld but is not regarded as true grassveld. In "The Border Region" the vegetation was subdivided in much more detail by D.M. Comins and an area of coastal dune bush is shown separately.

The Eastern Province Thornveld of Acocks occupies the intermediate belt and may have been forest to some extent in the past, but it is now almost entirely thornveld with Acacia karroo and in places tends to grade into grassland.

In the north-west corner of the area up to the highest point the vegetation type is called Dohne Sourveld and is largely grassveld with forest relics and scrub. Dohne itself with its agricultural experimental station is situated at the corner of the map.

The Valley Bushveld occupying the major valleys approximates to forest and may be rather impenetrable. It shows up sharply on airphotos separated from the thornveld of the coastal plain remnants. In particular it covers an appreciable area in the valleys of the Kei and its tributaries. Comins groups this type under the heading woodland, which includes gully bush and riverine bush.

In the course of time the natural vegetation has been appreciably modified by the various activities of man. Perhaps the most important effect has been the removal of forest and the development of scrub and even grassland in its place. This is difficult to assess and different opinions are held as to the original extent of forest. Natural pastures have undoubtedly been affected by grazing and in particular by overgrazing, with the destruction of much pasturage and a modification of its composition. In the last few decades a very important factor has been the growth of the pineapple industry, especially in the Kidd's Beach area. Vast quantities of natural bush have been cleared as can be seen from the earliest airphotos of 1939. Tree plantations have also changed the landscape locally, beginnig with pine and gum plantations at Fort Grey as far back as 1884.

IV. STRATIGRAPHY

A. PREVIOUS WORK

The first systematic mapping within the area was that of the Division of Kentani by A.W. Rogers and E.H.L. Schwarz, published in 1902 together with a description of the geology as Appendix III to the Annual Report of the Geological Commission of the Cape of Good Hope for 1901 (1902b). The area shown on their map includes that part of the present survey within the Transkei as far up the Kei River as the Gcua River which is the boundary between the Divisions of Kentani and Butterworth. The description should be read in conjunction with the preceding Appendix II which deals more generally with the southern Transkei (1902a). The scale of the published map is 1 inch to 500 Cape roods or 1:74 376, while the map itself is described as a map of the Karoo dolerite. Consequently no dip arrows are given for the sediments.

Between 1938 and 1940 three geologists of the Geological Survey, J. de Villiers, J.J. Spies and A. Strauss mapped the greater part of the area bounded by 32°30'S, 27°30'E and the coast, that is to say the area of the

with the word diamond. Diamonds of mixed origin were shown by experts to have been salted in the river sand of the left bank of the Kei River.

E. GOLD

About 1950 gold was reported to occur in weathered dolerite at Mhala's Kop (B2) near Macleantown. No more than traces had been found, as is liable to happen with mineralized dolerite, but at the time it was regarded as news.

F. LIMESTONE

Sandy limestone is widespread within a few kilometres of the coast, forming long hills of material resting on the coastal plain. Most of this is probably consolidated dune and much too sandy to be of any value as limestone. One very small occurrence of good quality limestone is that of the Needs Camp upper quarry and this has been worked for years in a desultory manner. Wybergh describes a limestone at Needs Camp as a first class limestone and gives an analysis but there is a little doubt about the locality.

G. SAND

Foundry sand is used by the Railways from Nahoon River mouth, according to the Mineral Resources handbook.

H. TITANIUM

Ilmenite is common in sand derived from weathered dolerite and is encountered in varying amount all along the coast-line. It is often accompanied by concentrates of rutile and zircon derived from the Beaufort sediments. Attempts to work these residues for titanium have mostly centred on Cape Morgan where a wide exposure of poor grade sand rests on dolerite, but the geographical position is also against successful exploitation. Attention has recently been paid to the Nxaxo River mouth where, on its right bank, an even greater expanse of sand occurs. The percentage of heavy minerals is apparently comparable with that of Cape Morgan and access is even more difficult.

I. UNDERGROUND WATER

A summary of the occurrence of underground water accompanied the account of the geology of the Border Region (Mountain, 1962 p. 22) and much of this applies to the present area. Owing to the average rainfall of 760 mm, there is a good surface flow although it is seasonal, and underground resources might be expected to be good. For the East London District, however, the percentage of failures is rather high at 49, while the percentage of successful yields which are brackish is also rather high at 35. Results for Komga have not been analyzed, while the Transkei has very few boreholes within the area of the map. Kentani, the only town, is well supplied with fairly shallow holes.

No artesian supplies are known.