CHAPTER VIII.

STRUCTURE

A. GEOPHYSICAL PROSPECTING.

The original drilling program was already far advanced when an aeromagnetic survey was carried out. The survey was designed to provide structural information which could be used in conjunction with the information obtained from completed bore-holes. It was hoped that bore-holes could then be located to the best advantage.

Except for a well-defined linear anomaly striking west from the old Kaalvallei Diamond Mine and indicating the position of a Kimberlite "fissure", the variations in the magnetic intensity gave only the broadest outline of the structure by indicating on a regional scale where beds of the Lower Division of the Witwatersrand System lie close to the base of the Karroo System.

A gravimetric survey was carried out after the drilling program had been completed. The purpose of this survey was to trace the strike of faults, which were intersected in bore-holes and to determine whether faults, which were not intersected in bore-holes could be traced by this means.

Unfortunately, the results of the gravimetric survey did not come to expectations. There were too many variable factors that could cause gravimetric anomalies or obscure them. Firstly, there is the variable depth of the covering Karroo System, for which corrections had to be made. (The depth of the Karroo system on the Virginia and Merriespruit mines ranges from approximately 700 feet to over 2,000 feet. See Cousins, 1950, plate XXXVII). Secondly, near-surface sheets of dolerite that have a thickness approximating 100 feet caused anomalies which could have been interpreted as being the result of faulting in the Witwatersrand System. The variable proportion of dolerite in the Karroo System is another difficulty that had to be accounted for. In addition the anomaly due to increase in the thickness of Ventersdorp lava on one side of a fault tends to be compensated by shallow heavier rocks of the Lower Witwatersrand System. Even the presence of the de Bron fault was obscured by the occurence of Ventersdorp Upper Sediments in the western block. These sediments are comparable in density with the quartzite of the Upper Division of the Witwatersrand System, with the result that the expected high density anomaly usually characteristic of the Ventersdorp System did not exist over the western block. On the other hand, the strike of a fault east of No. 2 Shaft on the Virginia Mine was correctly predicted after having first been intersected in a bore-hole drilled horizontally in the direction in which the crosscut was advancing.

B. STRUCTURAL INTERPRETATION.

On the average, only one bore-hole per square mile was drilled on the Virginia and Merriespruit mines. Only generalised structural maps could, therefore, be drawn from bore-hole information alone, yet these had to be as accurate as possible so that the positions of shafts could be planned to the best advantage. Structure contour maps were revised and kept up to date as underground development exposed greater detail. Plate I is the latest structure contour map of the Basal and Leader-Basal Reefs.

In order to obtain very reliable structural information from bore-hole drilled from the surface, the more recent bore-holes were surveyed by an Eastman directional survey instrument for deviation from the vertical. Radiometric logging was also done by the Union Geological Survey soon after completion of each of the recent bore-holes.

In the case of bore-hole K.A.2 an attempt was made to determine the dip and strike of the Basal Reef by means of two deflections, each of which were accurately surveyed by the Eastman directional survey instrument. The deduced strike is almost at right angles to the average strike of the Basal Reef in the drive nearest to the bore-hole (see plate I). The reason for this discrepancy presumably is that the points of intersection of the Basal Reef are too close together, the largest distance between points being less than 12 feet, coupled with the fact that the margin of error in measuring the depth of the reef intersections is too great.

It is a well-known fact that bore-holes penetrating low-dipping strata tend to deviate in such a way as to penetrate the strata perpendicularly. (Garrett W.S.,1952,p.p.510-513.)

Other mechanical factors also influence the deviation of a hole. The direction of deviation can, therefore, be used only as a guide to the strike and dip in the vicinity of a bore-hole, when other more precise information is lacking. In steeply dipping holes, the hole seems to deviate parallel to the bedding.

The dips of the strata can be measured on the core and should then be corrected for the deviation of the hole. Dips measured on cores of quartzite differ somewhat from the true dip because false dips in current-bedded strata cannot always be distinguished from true bedding-planes.

The structure contour map (plate I) and the block diagram of Virginia Mine (plate J), show that faulting in this part of the Orange Free State Gold-field is much less intense than in the Odendaalsrus area. Large, relatively unfaulted blocks are bounded by a few faults of considerable throw. Adjustments in the fault blocks are achieved by folding and by minor faults with displacements of only a few feet.

The change in strike of the Upper Witwatersrand sediments in the Merriespruit Mine takes place on the nose of a large north-plunging syncline.

Because of the vast thickness of competent brittle quartzite involved in the folding, the fold is open, and the dip of its limbs seldom exceed 20 degrees. The western limb

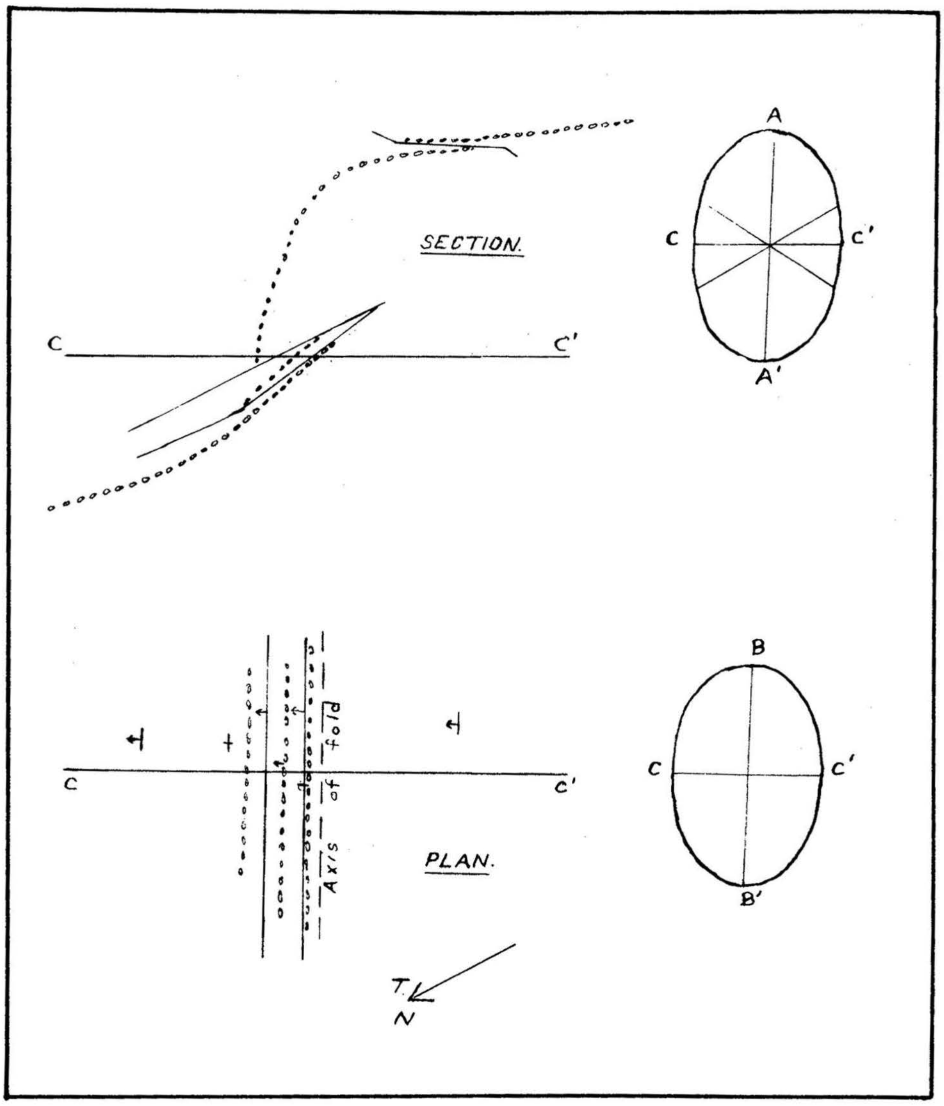

Fig. 11.

Faulted monoclinal fold in 33-3E Raise,

Merriespruit.

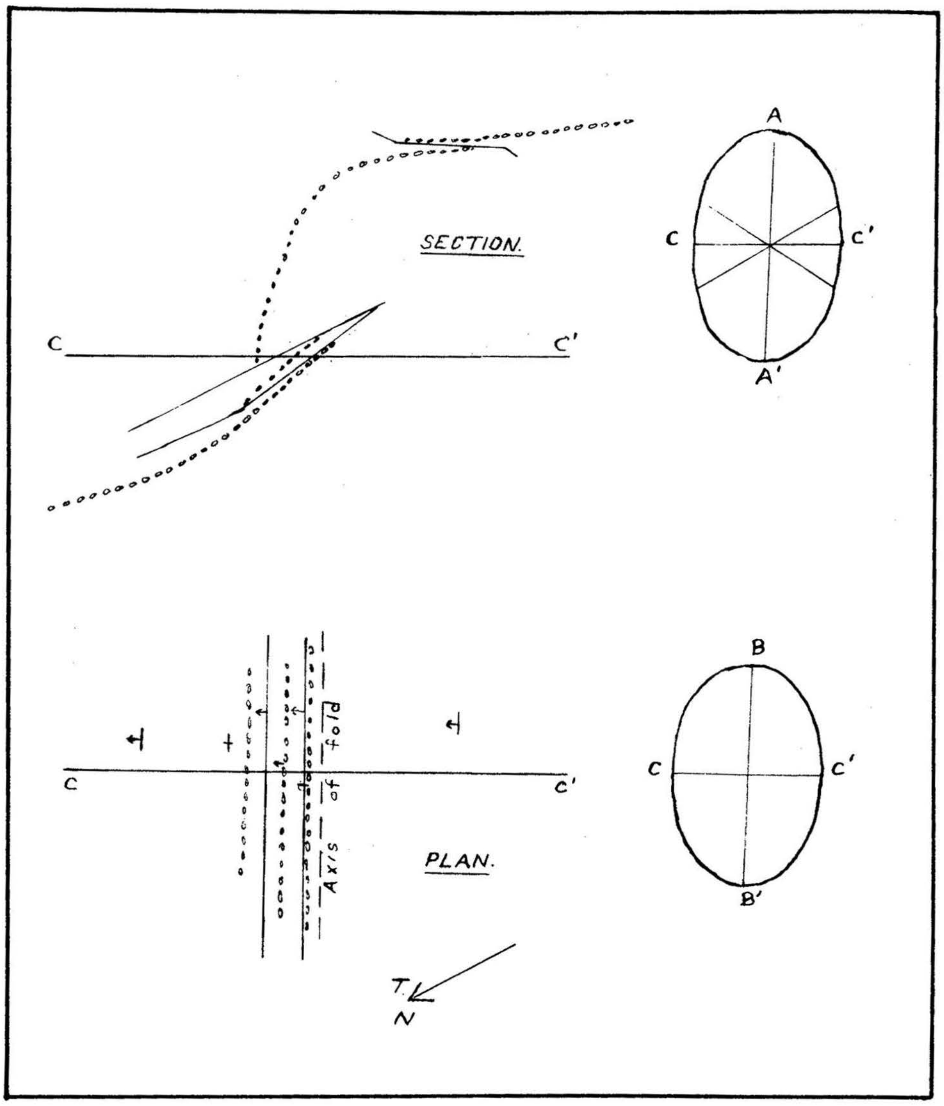

Fig. 11.

Faulted monoclinal fold in 33-3E Raise,
Merriespruit.

in bore-hole M.O.2 indicates that the dip in the western block is either reversed, or that further intense faulting complicates the downthrow block. The latter possibility has been assumed in plate I.

A detailed structural and stratigraphical analysis of the core of bore-hole M.O.3 shows that this bore-hole has penetrated a steep, faulted monoclinal structure (plate I, section A.-A.) As the depth of the Basal Reef in bore-holes to the west of the Merriespruit Mine agree more closely with the upper intersection of the reef and as the hole followed the dip of the strata for a considerable extent, the faulted monocline can be considered as the other wall of a trough or graben. The faulted monocline is considered to meet the de Bron fault at an oblige angle north of the Merriespruit Mine, with the result that bore-hole L.R.I is situated on the shallow side of this structure. The faulted monocline parallels the Homestead fault and may represent the southerly extension of this fault after trailing the de Bron fault for some six miles.

In bore-holes S.E.3 and M.U.I., duplication of strata indicates the presence of a reverse or thrust fault, which has a throw of approximately 2,000 feet in the vicinity of these bore-holes. The difference in the type of quartzite forming the footwall of the two intersections of Leader-Basal Reef in bore-hole S.E.3, shown in plate F, indicate that considerable compression took place perpendicular to the strike of the fault, which favours the belief that this is a thrust fault. (Billings M.P, 1942, p.172). For the sake of conservatism, the dip of this fault in the structure contour map has been taken at 45°, although the dip may in reality be much smaller.

Local steepening of the beds occurs on the limbs of the syncline and forms minor monoclinal folds, some of which are associated with thrust and other faults. (See fig.11) These are prominent in the Merriespruit Mine around the nose of the syncline, but does not seem to be related to that feature. The orientation of the ellipsoid of deformation is similar to that of the Merriespruit thrust fault and it may be assumed that they are of the same age.

A normal fault with a down-throw of approximately 350 feet towards the west has been encountered in the course of underground development between No. 2 and No. 3 Shafts of the Virginia Mine. The strike of this fault is parallel to that of the large Virginia or Railway fault, to the east of which the so-called G.F. Block of Upper Witwatersrand sediments has been thrown down. To the west of the fault near No. 2 Shaft, there is local folding and intense minor faulting. The folds trend north-east towards the south-west the faults decrease in intensity.

Some of the intrusions followed fault-planes. Mostof these are Ventersdorp type intrusions which exhibit a structure similar to the flow-structure of viscous lava.

Fault-planes along which the tensional movement has been up or down commonly dip at angles between 55° and 70° and these along which horizontal movement predominated are usually steeper than 80°. The latter have a mullion structure pitching at low angles.

The low-angle thrust faults associated with minor folds have variable ,curved strikes.

The thrust faults are displaced by most of the other types. The age relation between the strike-slip faults and the tensional faults is less certain. Small, water-bearing strike-slip faults south of Merriespruit No. 1 Shaft appears to have been subjected to a later vertical movement, which has partly shattered the mullion structure, leaving openings up to 6 inches in thickness in which water has accumulated.

The displacement of the de Bron fault took place during the deposition of the Upper Ventersdorp sediments. A great thickness of agglomerate, tuff and quartzite accumulated in the trough that developed to the west of this fault. The age relation between this fault and the others is not known.

CHAPTER IX.

STRATIGRAPHICAL ANALYSIS AND INVIRONMENTAL RECONSTRUCTION.

A. INTRODUCTION.

The study of sedimentary rocks should always be directed towards the unravelling of the environmental conditions under which the sediments were deposited. The alternation of strata representing a succession of lithotopes or areas of uniform sedimentary environment provides the key to the geological history or conditions prevailing during deposition of the sediments. A careful study has, therefore, been made of the characteristics and variations of each sedimentary unit for the purpose of determining the environmental pattern of that unit.

Sharpe (1949, p.266-279) has shown that the concept of cyclical sedimentation can be applied to sediments of the Witwatersrand System. The study of sedimentary tectonics in sedimentary analysis is being increasingly realised as of major importance and it is felt that diastrophism is a major factor in sedimentation. The theory of a geosynclinal origin of the Witwatersrand System is now generally accepted. B.B. Brock ("A view of faulting in the Orange Free State"), has given a vivid picture of the main stages in the growth of the geosyncline.

A number of features, which Pettijohn has mentioned as being typical of the geosynclinal facies are also characteristic of the Witwatersrand Beds: (Pettijohn,1949, p.444-446).

(1) The great thickness of the Witwatersrand is comparable with thicknesses of sediments in geosynclinal basins.

(2) Arenaceous and argillaceous materials are intimately mingled.

(3) The coarseness of grain and the abundance of sand increases upwards.

(4) Rhythmic and graded bedding is common in the Lower Witwatersrand System.

(5) Carbonate rocks are absent or very rare and other chemical sediments are rare, but bedded chert is common near the base.

It must be borne in mind that the proximal facies of a geosyncline is the one most often found in outcrops, so that the following features of Pettijohn must be added: (See also Krumbein and Sloss, p.22).

(6) The rocks are very thick, coarse-grained and polymictic in composition.

(7) They contain material of earlier deposited strata of the margins of the same geosyncline.

In the chapter on disconformities, we have come to the conclusion that a considerable thickness of sediment had been removed from the marginal areas subsequent to deposition. If the Witwatersrand System was formed in a geosynclinal basin, where else could these sediments have gone to but further into the basin, where the depth of water was below the base-level of erosion. It must be stressed that the area covered by this treatise is not the proximal facies of the geosyncline, but is presumably near one of the extremities of its axis, with the result that the environment bears many of the characteristics of an unstable shelf. The tectonic framework of the Far East Rand, on the other extremity, resembles that of this area.

B. GEOLOGICAL HISTORY.

During the closing phases of deposition of the Lower Division of the Witwatersrand System, coarse sediments began to preponderate, as the surface of deposition approached the base-level and also as a result of isostatic adjustment whereby the distributive province was elevated. It must be assumed that the great thickness of material comprising the sediments of the Lower Division must have definitely disturbed the balance of load on the substratum. In the Free State, submergence kept pace with the influx of detritus although the presence of pebble bands in the Lower Footwall beds indicate that the base-level was approached and perhaps actually reached for short intervals. On the Central Rand, the base level was not only reached, but erosion of newly-formed sediments occurred and a strand line was present with its concomitant environments of beach, lagoon, estuary and dune. Transgressive seas over newly-formed sediments of these environments left auriferous conglomerate beds as their basal deposit.

Throughout the time preceding he deposition of the Basal Reef, normal marine (neritic) sedimentation is postulated to have taken place in the Orange Free State area. Owing to isostatic adjustments the sedimentary basin was periodically depressed and the distributive province elevated, resulting in periodical rejuvenation which in turn affected the composition, volume and coarseness of the sediments being deposited. The resulting sedimentation was cyclical, the sands ranging from argillaceous to pebbly. The conglomeratic units in the Lower Footwall beds and the Intermediate Reefs represent culminations in diastrophism or crests in the cycles of sedimentation (Sharpe, 1949, p.270.)

Dr. D.J. Simpson has noticed that the uranium content of the sediments also increase and decrease rhythmically as the coarseness of the sediments increases or decreases.(1951, p.106).

During the interval of time immediately prior to the deposition of the Basal Reef, there was no coarsening of the sediments deposited, not even in other parts of the Orange Free State. The sedimentation during that interval must have taken place in a shallow-water environment where currents could have been strong enough to form current-bedding and ripple-marks. Extensive drilling has proved that the Lower Footwall beds exist far beyond the limits of the Basal Reef The sedimentary basin, after the formation of the Basal Reef, was,therefore, much smaller than previously. The tectonical zone between the area of subsidence and the positive area, or the zone of uplift, must, therefore, have moved towards the axis of the geosyncline during that time.

Let us review some of the facts concerning the Basal Reef. In the Welkom area, marker beds occurring in the Upper Footwall beds are progressively overlapped by the Basal Reef in directions radiating from the Welkom Mine. In the Virginia-Merriespruit area, the Basal Reef directly overlies quartzite that is some 200 feet below the reef in the Welkom area. One would, therefore, expect that the Basal Reef would lie on a sharply demarcated plane, a disconformity. This is not the case. We have seen that the sediments of zone E.L.1 is separated from the Basal Reef by a disconformity and that the lenticular quartzite intercalated with the conglomerate of the Basal Reef is almost impossible to distinguish from the quartzite immediately underlying the reef.

One can attempt to explain these facts by assuming a sudden influx of coarse sediments from a rejuvenated distributive province. Such an event would have been heralded by a somewhat progressive increase in coarseness of the detritus, for which there is no evidence. In fact, the gradation from large to small pebbles in the Basal Reef is upward.

Should one assume that the coarse sediments had been eroded prior to the enplacement of the Basal Reef, one would also have to assume the elevation of almost the entire Orange Free State section of the geosynclinal basin above the base level. The assumption is contrary to the tectonic framework of sedimentation in a subsiding geosynclinal basin.

The sequence of events to be described below seems to explain the facts most satisfactorily.Prior to the deposition of the Basal Reef, sedimentation took place in shallow water where currents and waves could wash away the finer-grained clayey material and leave a fairly pure sandy deposit. The subsidence of the basin was so slow that the base level was eventually reached, with the result that most of the incoming detritus of sand-dimensions were swept deeper into the basin. The surface then became covered with the coarse materials which the waters were not competent to carry away. "These would be a part of the underlying unit and would be the last sediments deposited before the beginning of the new cycle". (W.H. Twenhofel, 1939, p.27, see also p.30). The Basal Reef is, therefore, petrologically not a basal conglomerate, but a marginal or terminal conglomerate.

Coupled with the slow subsidence of the basin at the time of the deposition the Basal Reef, was an uplift at the margin. This took place at such a rate that wave action and currents were able to preserve the base level by removing the sand elevated above this level and transporting it to areas further into the basin, where the bottom of the sea was below the base level. Throughout this interval, which was long enough to have eroded about 300 feet of sediment from near the margin, heavy minerals and material of pebble dimensions were concentrated on the base level. At the same time, material from the distributive province was also received and sorted. The pebbles of soft material were ground away and the hard pebbles were rounded and comminuted. The majority of pebbles remained close to the shore-line,forming a thicker body of conglomerate than deeper into the basin.

The mapping of the Basal Reef on the Merriespruit Mine revealed that it contained elongated lenticular patches where the reef is of uniform appearance. (plate D.) Their longest axes lie in a north-easterly direction. Krumbein and Sloss, (1953, p.194) has called such individual patches lithotopes. Together they form the environmental pattern of the Basal Reef. We have shown previously that the distribution of gold in the reef is closely related to the sedimentary features and that "pay shoots" exist in lithotopes where the reef is well-developed. A knowledge of the environmental pattern of the Basal Reef may, therefore, assist in predicting the distribution of "pay shoots".

The writer tentatively submits the following explanation for the environmental pattern encountered in the

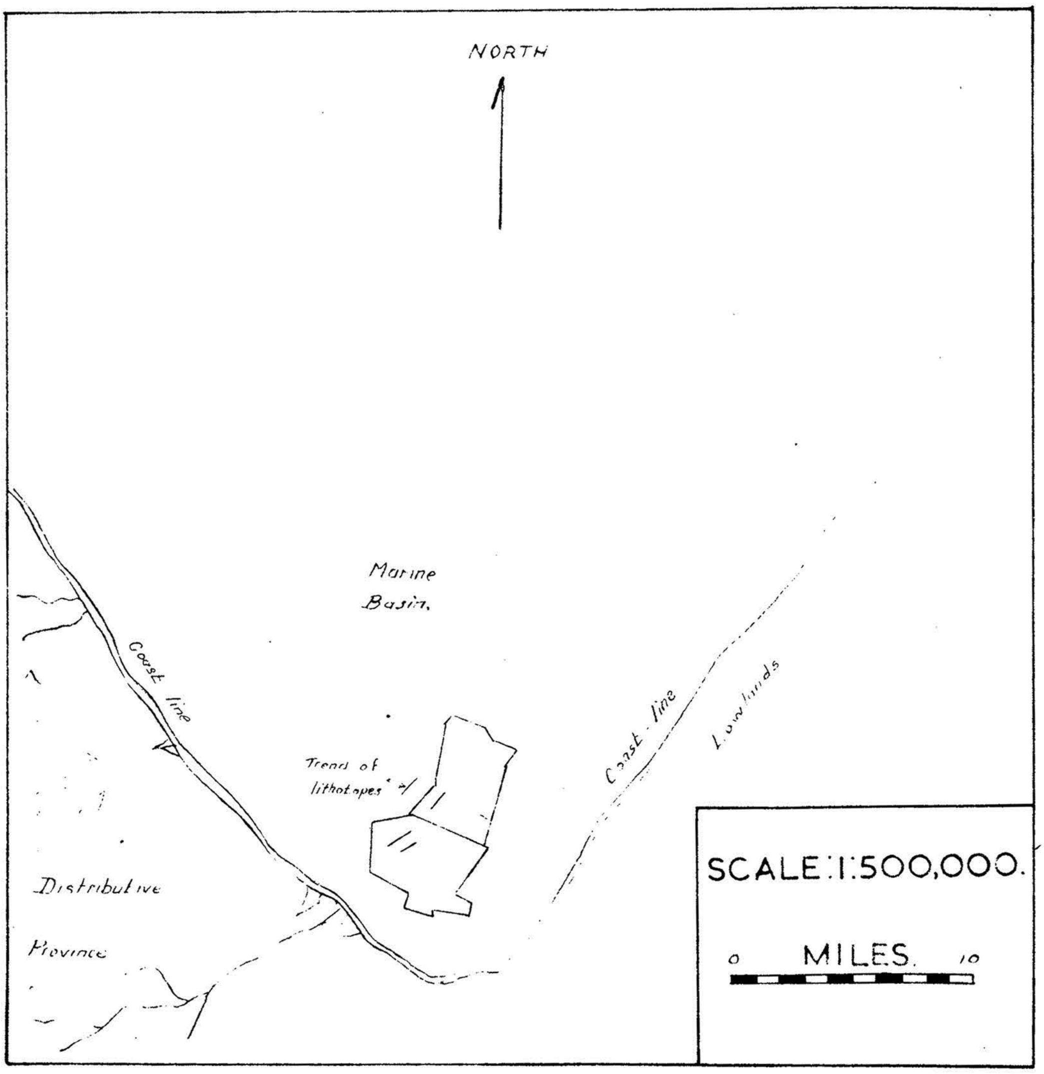

Fig. 12.

Paleogeographic map of the Basal Reef.

Virginia-Merriespruit area.

It is common knowledge that there are areas on any beach where the undertow is stronger than elsewhere. These areas are depressed relative to the rest of the shore-line. The elevated areas are the so-called beach cusps, and may be as much as 3 feet higher than the surroundings. The undertow results in the formation of off-shore currents. It is reasonable to assume that sediments subjected to the additional energy of these off-shore currents would be coarser and better sorted than those in bordering areas.

The presence of long-shore currents would modify the lithotope thus formed if the strength of the current at the bottom of the sea is comparable with that of the off-shore currents. At this stage, we do not yet have sufficient information to state definitely whether these currents had a marked effect on the environmental pattern of the Basal Reef.

The direction of elongation of lithotopes in the Basal Reef, as well as the direction of flow of currents displayed in the Footwall beds are north-east. From the paleogeographic map, fig. 12, it is not clear whether off-shore currents or long-shore currents played the longest roll in the formation of pay-shoots, as the coast-line curves from south-east to north-west near the Merriespruit Mine, but the writer considers that the portion of the coast-line opposite the distributive province had been the most effective in determining the shapes of the lithotopes.

Only a slight amount of marginal uplift would have been necessary for the high-lying portions of the Basal Reef to have become exposed to erosion. With the environmental pattern as shown in plate D, the portions where the Basal Reef were removed would be elongated in a north-easterly direction. The material of the Basal Reef that was removed, was washed into the initial sediments that formed during the ensuing period of subsidence. The basin must then have subsided rapidly by about 70 feet, accompanied by further marginal uplift. The resulting deposit was unstratified, and contained numerous small channels and pot-holes that were filled up with pure, well-washed sand and pebble detritus originating from the higher-lying portions of the Basal Reef. The environment was probably deltaic or littoral. The erratic well-rounded pebbles and the poor sorting of the sand and clay detritus which gave rise to the "waxy" appearance of the quartzite point to rapid deposition in water, as if the detritus was dumped into the basin and covered up before stratification could have been imposed on it by the agency of sea currents. The surface of the delta or deltae might have been above sea-level, as numerous rapidly aggrading distributaries left their imprints in the deposit.

Some of the large streams actually scoured their channels through the Basal Reef. These channels were filled with coarse detritus mainly from the distributive province, as the varied pebble assemblage and the lack of economic concentration of gold and uraninite would attest.

During severe storms, spring tide or perhaps after dust storms, thin layers of pure sand either washed clean of clayey material by water, or sorted by aeolian agencies, were left on the surface of the deposit. As a result of marginal uplift, coarse material of the Basal Reef that had been deposited there in the previous cycle of sedimentation was removed and this material was re-deposited in the distributories of the deltaic deposit, together with fresh material from the distributive province. This hypothesis would explain the existence of lenses of auriferous and uraniferous conglomerate as much as 40 feet above the base of the E.L.1 sediments. Such conglomerates were intersected in bore-holes K.A.2 and K.A.3 south of No.1 Shaft on the Merriespruit Mine. It appears as if these isolated conglomerate bodies were concentrated near the margins of the basin as it existed during E.L.1 times and that only the southern area was

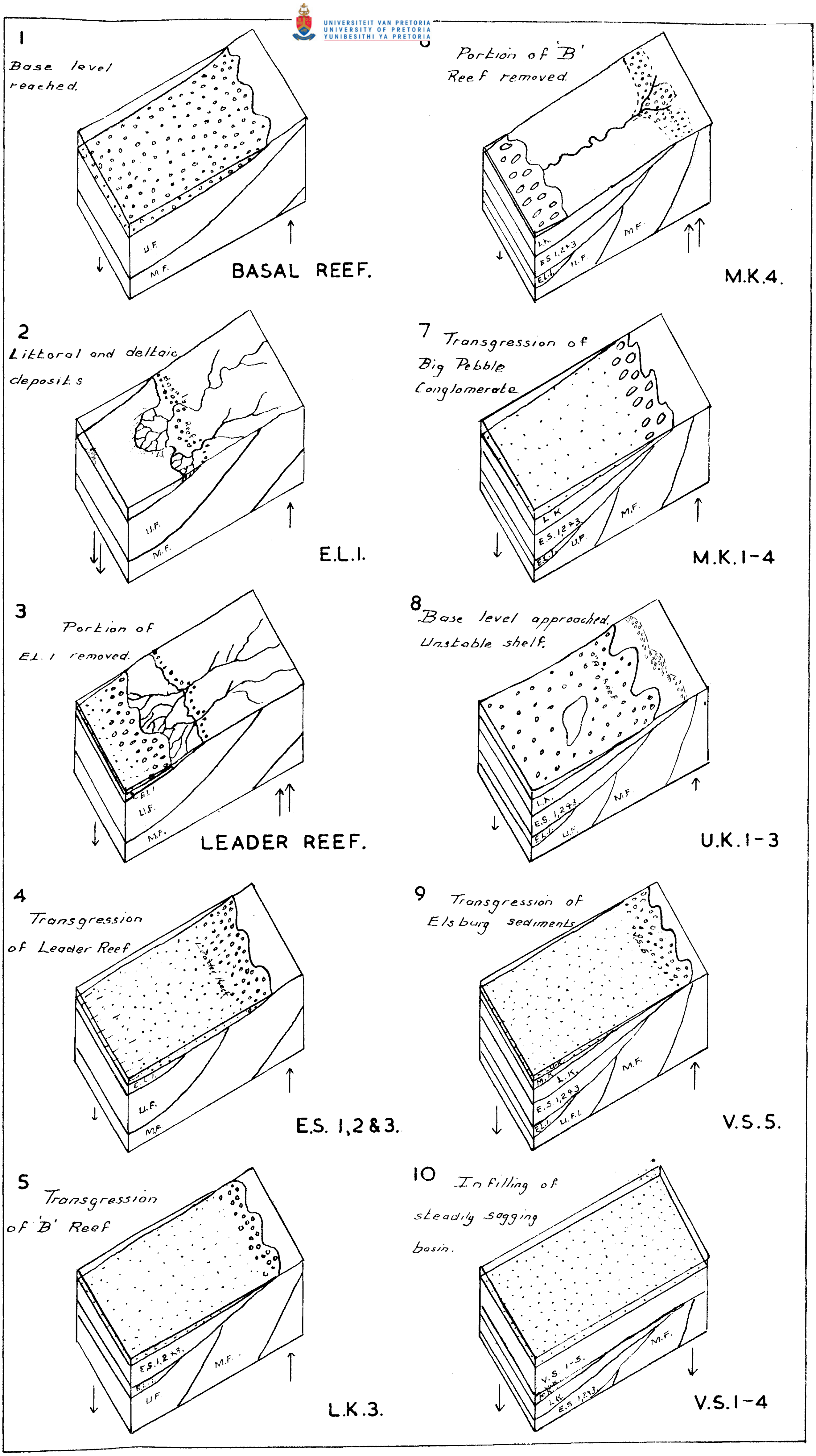

Fig. 13, Stages in the evolution of the Upper Division of the Witwatersran
System in the Virginia-Merriespruit area. ---- Schematic.

subsequently preserved from denudation.

The suspension load of the distributaries, consisting mainly of very small particles of clay, slowly settled beyond the confines of the delta and formed a bed of shale, the well-known Khaki Shale. As the deltae extended, the bottomset beds were covered with deltaic material. The deltaic facies of zone E.L.1 interfingers with stratified quartzite of neritic environment further into the basin and consists almost entirely of the neritic facies towards the Odendaalsrus area. (fig.3).

Current ripple-marks, formed on the upper surface of an outlier of the Khaki Shale, possess a wave-length averaging 3 inches and an amplitude of ¼ inch. This gives a ripple index of 12, which is close to the range of 4 to 10 given by Twenhofel (1939, p.521) for aqueous wave ripple-marks. As aeolian ripples have indices ranging from 20 to 50 one can be fairly certain that these ripple-marks were not formed by wind. The schematic block diagrams in fig. 13 depict stages in the evolution of the Upper Division of the Witwatersrand System from the time that the Basal Reef started to form until the end of the Witwatersrand period. The arrows below the blocks indicate the relative movements which took place and the length and number of arrows the intensity of diastrophism.

The Leader Reef, with its different assemblage of pebbles to that the Basal Reef and zone E.L.1, has probably received a great amount of its material from the distributive province. The coarse basal beds of zone E.S.3 were subject to wave and current action and an environmental pattern probably similar to that of the Basal Reef was evolved. The direction of elongation of the lithotopes have not yet been firmly established, but the meagre evidence available indicates an elongation in a similar direction to that of the Basal Reef. Distributories on the surface of the delta were filled with material of sand and pebble dimensions.

The Leader Reef, transgressing the E.L.1 quartzite, merged with the Basal Reef and a zone was formed in which the constituents of both reefs were mixed. This brought about a definite enrichment in the mineral content of the reef, which was, therefore, called the Leader-Basal Reef. As the transgression of the Leader-Basal Reef proceeded towards the edge of the basin, and progressively onto older sediments, sand was simultaneously being deposited off-shore on top of the newly-formed conglomerate. The coarseness of the sediments dimished somewhat progressively away from the shore-line with the result that fairly argillaceous sediments of zone E.S.1 formed deeper in the basin at the time that beds of pebble dimensions were being formed near the shore.

The Leader Reef, according to its method of formation, is petrologically a basal conglomerate. It rests upon a disconformity, the base level, and the overlying sediments diminish somewhat progressively in coarseness as one proceeds upwards in the column. We also find, that, whereas the material of the Basal Reef had been subjected to wave and current action for a long time over a considerable area, sorting and concentration of the Leader Reef took place over a narrow zone that advanced into the land with the shore-line. The Basal Reef was, therefore, more nearly contemporaneously developed over the whole area and subjected to a much longer period of sorting and concentration than the Leader Reef.

A similar cycle to the previous one was repeated with the "B" Reef as the basal conglomerate, but this cycle had hardly begun when a fresh upheaval of the source area brought on the very coarse sediments of the Big Pebble Reef.

The lenticular conglomerates, minor disconformities and diastems frequently found in the Upper Kimberley Stage indicate that sedimentation took place close to the base level. The high sphericity of the pebbles and the oligomictic character of the conglomerate bodies indicate that they had repeatedly or for a considerable time been subjected to wave and current action.

It was during this period that a large river, flowing either eastwards or westwards, scoured its valley out of the semi-compacted sediments. Soundings at river mouths have shown that rivers scour out their channels for considerable distances from the shoreline. It is, therefore, not even necessary to assume that sub-aerial erosion of the adjacent sediments had taken place, as indicated in fig. 5.
The evolution of a valley formed seawards of the shoreline would differ from the diagrams only in that tributories would be absent, and that the sea-level would be higher than shown.

The period of marginal uplift in the Virginia-Merriespruit area ended with the transgression of the Elsburg sediments. The "Gold Estates Leader", which formed in restricted favourable areas on the disconformity has a wider distribution in the marginal area where the newly-formed Upper Kimberley conglomerate beds supplied the coarse material. The contention that the "Gold Estates Leader" has derived is material from the re-working of underlying sediments (Feringa,1954, p.58) seems logical when one remembers how closely this reef resembles the "A" Reef and how completely different the other Elsburg conglomerate beds are from Kimberley conglomerates.

The V.S.5 conglomerate is a widespread bed of poorly rounded and sorted pebbles of a variety totally different from the underlying conglomerate and typical of the Elsburg Stage. This conglomerate was derived from the coarse constituents of the distributive province and was formed while wave and current action was still strong. The basin was very large at that time. Bore-holes as far south as Monstari 1798,10 miles south of the Sand River, drilled through as much as 1100 feet of the Elsburg Stage. It is possible that the distributive province also moved further away from the axis of the geosyncline, thus accounting for the different composition of the sediments discharged into the basin. Sedimentation more or less kept pace with subsidence in the basin throughout the

Elsburg Age. In the final stages there was an influx of coarse material, which formed the polymictic fanglomerate against fault - scarps in the St. Helena area. Coarse material was even spread out as far as the Virginia-Merriespruit area. According to Brock, (1954, p.8) the basin west of St. Helena ruptured as a result of an overload of accumulated sediments. The elevated block west of the fault supplied the coarse material that was dumped into the basin east of the scarp.

A bed of conglomerate immediately preceeding the first flow of lava resembles other Elsburg conglomerates and is apparently conformable with the Elsburg sediments. Its position with respect to the lava, however, indicates that the conglomerate is the correlate of the Ventersdorp Contact Reef, which is the basal conglomerate of the Ventersdorp System. In the Virginia-Merriespruit area, therefore, the Ventersdorp System follows upon the Witwatersrand System apparently without a break in the sedimentation.

CHAPTER X

THE RELATION BETWEEN THE ORIGIN OF THE BANKET AND ITS MINERAL CONTENT.

In the course of the petrographical investigation, it became clear that the conglomerate beds that possess a particular set of characteristics are more likely to contain gold and uraninite in economic concentration than others. These characteristics are, as previously mentioned, a high proportion of resistant pebbles, a high co-efficient of sorting and degree of roundness and sphericity, close packing, and a minimum of intercalations of quartzite. These characteristics are caused by the action of aqueous currents and waves. The fact that the majority of gold-bearing conglomerates are connected with disconformities suggest that the selective action of waves and currents took place on a profile of equilibrium. The sedimentary environments in which the bankets of the Witwatersrand System originated favoured concentration of heavy minerals with the coarse light constituents. The gold and uraninite in the bankets can therefore be explained as concentrations of heavy minerals in ancient placer deposits.

The theory of post-depositional infiltration of mineralising solutions can hardly account for the high concentrations of gold and uraninite in isolated bodies of conglomerate lying in zone E.L.1. Neither can it account for the barren channel conglomerate that locally replace the mineralised Basal Reef.

It may be argued that either gold or uraninite or both of these minerals have replaced other heavy minerals, or that these minerals were precipitated by certain heavy minerals. If that were the case, the distribution of gold and uraninite would be controlled by the distribution of these heavy minerals. Environmental conditions that would concentrate heavy minerals would still control the distribution of gold and uraninite.

The writer finds that in this area, at least, a terminal conglomerate is likely to be of greater economic importance than a basal conglomerate.

CHAPTER XI

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