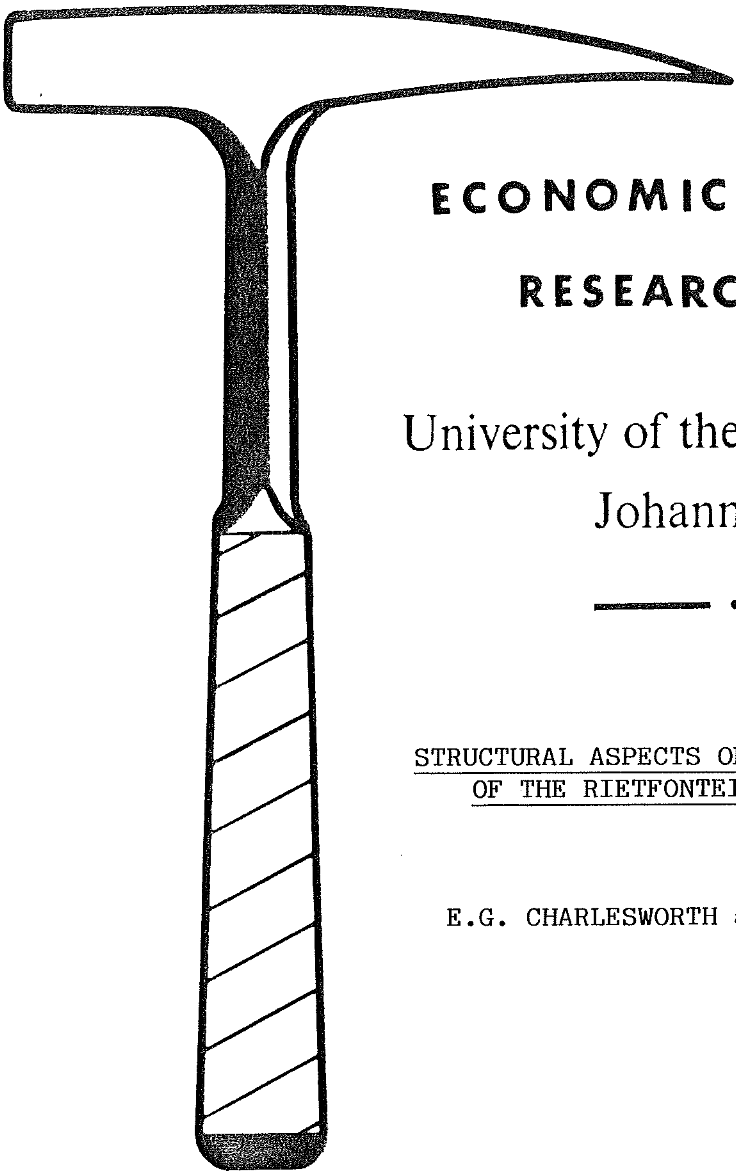

ECONOMIC GEOLOGY RESEARCH UNIT

University of the Witwatersrand
Johannesburg

STRUCTURAL ASPECTS OF THE EASTERN PART OF THE RIETFONTEIN FAULT SYSTEM

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INFORMATION CIRCULAR No. 213

UNIVERSITY OF THE WITWATERSRAND
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by

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1. INTRODUCTION

The Rietfontein Fault System occurs as a major, narrow east-west trending zone along the northern margin of the presently preserved Witwatersrand basin (Figure 1). It forms a curvilinear trace over a strike distance of some 60km where it is exposed in an erosional window through rocks of the Transvaal Sequence. From the Central Rand area, this fault system can be traced westwards where it cuts across the northern margin of the major West Rand Syncline and where it splays into several major southerly trending faults. Eastwards from the Central Rand area, the Rietfontein Fault System forms the southern margin of the Bezuidenhout Valley graben and comprises an anastomosing set of faults which bound blocks of basement and Witwatersrand lithologies. At its eastern end, the fault system splays, and the faults curve into a northerly orientation but are largely obscured by Karoo cover rocks.

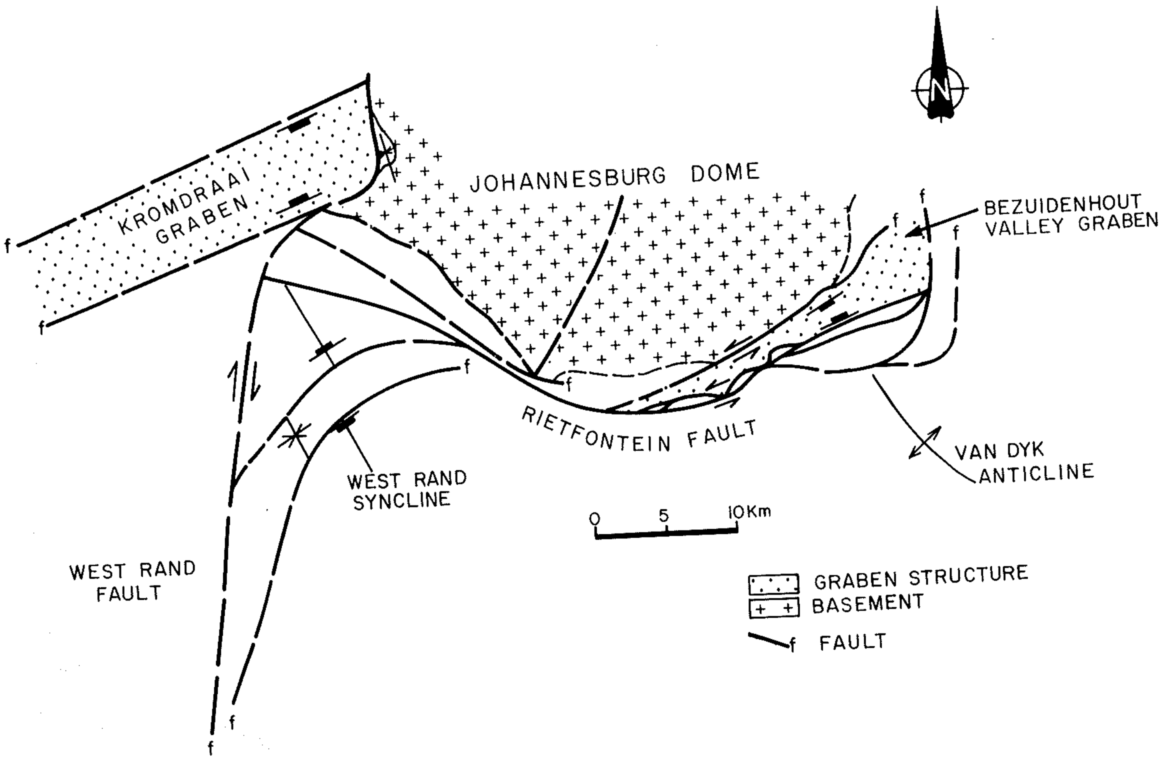

Figure 1: Rietfontein Fault System and associated structural features along the northern margin of the Witwatersrand basin. Cover rocks removed.

Mellor (1911 a, b; 1913) originally described the Rietfontein Fault and proposed that it was an extensive strike fault with a northerly downthrow duplicating Central Rand Group strata. Pretorius (1964) and Brock and Pretorius (1964) recognised Mellor's Rietfontein Fault with its northerly inclination as being of post-Ventersdorp, pre-Transvaal age. However, they pointed out that there were several instances along the strike of this fault where fault movements appeared to be inconsistent, with both apparent normal and reverse components of movement occurring on the northern side of the fault. In an attempt to reconcile the apparent displacements along this fault zone, Brock and Pretorius (1964) distinguished between the Rietfontein Fault of Mellor (op. cit.) and what they considered to be an earlier formed fault which they named the 'Central Rand Fault'. It was this latter fault which they regarded as either occurring subparallel and to the south of the Rietfontein Fault or merging with it. In addition, these authors regarded this fault as being of pre-Ventersdorp age and forming the peripheral fault to the Witwatersrand basin as a steep southerly dipping normal fault along which Witwatersrand strata were downthrown to the south. Unfortunately, these aspects have frequently been confused and the Rietfontein Fault has been inferred to be a southerly dipping normal fault.

McCarthy *et al.* (1982) described southerly verging thrusts associated with overturning of strata in a fault-bounded block at Langerman's Kop, in the Central Rand area (Figure 2 and inset), associated with the Rietfontein Fault system. More recently, Stanistreet *et al.* (1986) in evaluating the pre-Transvaal deformation along the northern margin of the Witwatersrand basin, drew attention to the role of strike-slip faulting.

Despite the fact that the Rietfontein Fault System contains structural features indicative of reactivation in post-Transvaal times (McCarthy *et al.* 1986), nevertheless a re-appraisal of known pre-Transvaal sedimentary and volcanic relationships in conjunction with the geometry of the fault system indicates that the Rietfontein Fault System has had a long history. Stanistreet and McCarthy (1986), McCarthy *et al.* (1987) and McCarthy *et al.* (1989) have suggested that the Rietfontein Fault was active as an oblique reverse fault with southerly movement developed by left-lateral transpression during lower Central Rand Group sedimentation. It has also been suggested that the extrusion of the Crown and Bird lavas were associated with transtensional zones along penecontemporaneous wrench or strike-slip faults (Clendenin *et al.* 1988). The Rietfontein Fault System has been interpreted as a major strike slip fault with the development of the Platberg age Bezuidenhout Valley Graben as a pull-apart graben developed along this fault system (Stanistreet *et al.* 1986). More recently McCarthy *et al.* (1989) view the Rietfontein Fault as a strike slip fault with a major normal component of movement to the north during the development of the Platberg.

The Rietfontein Fault zone and its associated monocline have been recognized as the dominant structural feature of the Central Rand since Mellor's (1911a) pioneering work. Brock and Pretorius (1964) identified its fundamental role in the development of the Witwatersrand Basin (terming it a "principal declivity"). Myers *et al.* (1989) accord it similar

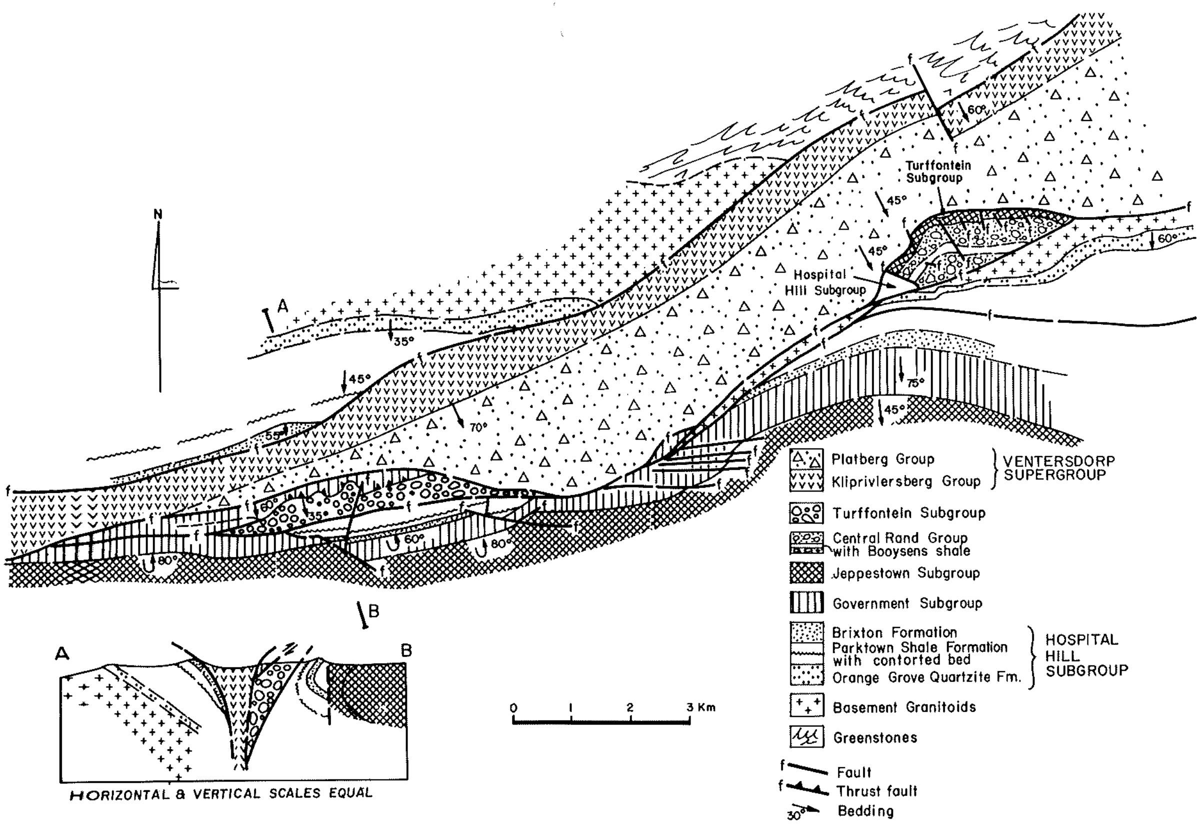

Figure 2: *Detailed geology of the Rietfontein Fault System in the Central Rand area. Compiled from mapping by the authors and that of Mellor (1917) and Engelbrecht (1957). Inset shows a profile along the line A-B.*

importance. In view of this, we have collected available data on the fault and in this paper the regional characteristics are reviewed and details of the better known eastern part of Rietfontein Fault System are presented.

2. CHARACTERISTICS OF THE FAULT SYSTEM

The regional context of the Rietfontein Fault System has recently been examined by Stanistreet *et al.* (1986). The fault system is characterized by the occurrence of the following major features:- (1) evidence of stratigraphic thinning of Central Rand Group sediments from the main Witwatersrand basin northwards across the fault zone; (2) an associated en echelon set of north-west striking folds across the northern part of the basin; (3) the deep, narrow, fault-bounded Bezuidenhout Valley graben of Ventersdorp (Platberg) age along the fault zone; (4) narrow fault-bounded slices of basement, upper and lower Witwatersrand Supergroup lithologies juxtaposed along the fault zone; (5) terminal fault-splays at the western and eastern ends of the fault system; and (6) along most of its length through the Central and East Rand, strata to the south are steeply dipping to overturned.

(i) Stratigraphic thinning

Engelbrecht (1957) noted a significant decrease in the Johannesburg Subgroup strata between the Witwatersrand Deep Gold Mine and the Rietfontein gold mine situated within the Rietfontein Fault System, over a north-south distance of some 5km. Similar lithological attenuation has been recorded by Cousins (1965) along the eastern limb of the West Rand syncline. These aspects indicate that the Rietfontein Fault System was active during Witwatersrand sedimentation and have been explained in terms of an oblique reverse fault with southerly downthrow acting under left-lateral transpression (McCarthy *et al.* 1989).

(ii) Folding

Stanistreet *et al.*(1986) drew attention to northwesterly striking folds that occur across the northern part of the Witwatersrand basin. A set of en echelon northwesterly striking folds and associated strike-slip faults are particularly well-developed in the East Rand Basin (Antrobus and Whiteside, 1964, Whiteside, 1964, De Jager, 1964, Stanistreet *et al.* 1986). In addition, pay shoots and erosional channels parallel the trend of fold axes and thickness variations of stratigraphic units are spatially related to this fold set implying that folds developed during sedimentation (Stanistreet *et al.* 1986). In addition, NW-SE trending en echelon perianticlines which control the distribution of Main Reef conglomerates have been documented at E.R.P.M. at the boundary between the East Rand and Central Rand goldfield (Camden-Smith and Stear, 1986). Also in this vicinity, the northwest trending Springs Monocline is suggested to have been active during Witwatersrand sedimentation (Antrobus and Whiteside, 1964). On a regional scale, the Rietfontein Fault System is discordant to this north-west striking en echelon fold set. It also cuts across two major north-west striking fold structures namely: in the west, the West Rand Syncline and in the east, the Van Dyk anticline (Figure 1), the latter feature being closely associated with the Springs Monoclinal structure mentioned previously.

(iii) The Bezuidenhout Valley graben

The central to eastern section of the fault system is dominated by the Bezuidenhout Valley Graben (Figure 2), which trends east-north-easterly over a distance in excess of 30km. At its present level of exposure, the graben ranges from approximately 0,5km in width at its western end to some 3km in width at its eastern extremity. Details of the geology of the graben have been presented by McCarthy and Cadle (1984), and McCarthy *et al.* 1989). These authors noted that the graben contains an attenuated sequence of Klipriviersberg lavas overlain by in excess of 2km of rapidly deposited litharenites and diamictites derived from erosion of Ventersdorp basaltic lavas. Lithologies within the graben vary from moderate dip in the east (45°S), but steepen westwards to high angles (80°S) (Figure 2).

(iv) Fault breccias

The Rietfontein Fault zone is rarely exposed. However, it may be examined at two localities in the Germiston area. The first is at the Jaybee quarries adjacent to A.G. de Wit Drive, and secondly in a recently-developed parking lot behind the Makro Store off North Reef Road. At the Jaybee quarries the Rietfontein Fault is exposed in the southwestern end of the quarry. At this locality, Platberg sediments, the weathered form of which were quarried for brick manufacture, are juxtaposed against an attenuated fault-bound slice of basement granitoids. Southwards the granitoids are, in turn, faulted against both southerly dipping Hospital Hill and Government Subgroup sediments (Figure 2). The Rietfontein Fault zone is at least 20m wide and comprises a close-spaced penetrative wavy schistosity which dips steeply to both the south and to the north (Figure 3). This fault-fabric envelopes small clasts of sheared granitoids and Platberg sediments. Northwards from the fault zone within Platberg sediments, curvi-planar fractures are commonly developed and generally dip steeply northwards with a strong, moderate to steeply plunging lineation. Southwards from the fault zone, a steep northerly dipping schistosity with a persistent sub-horizontal lineation is prominently developed in the granitoids.

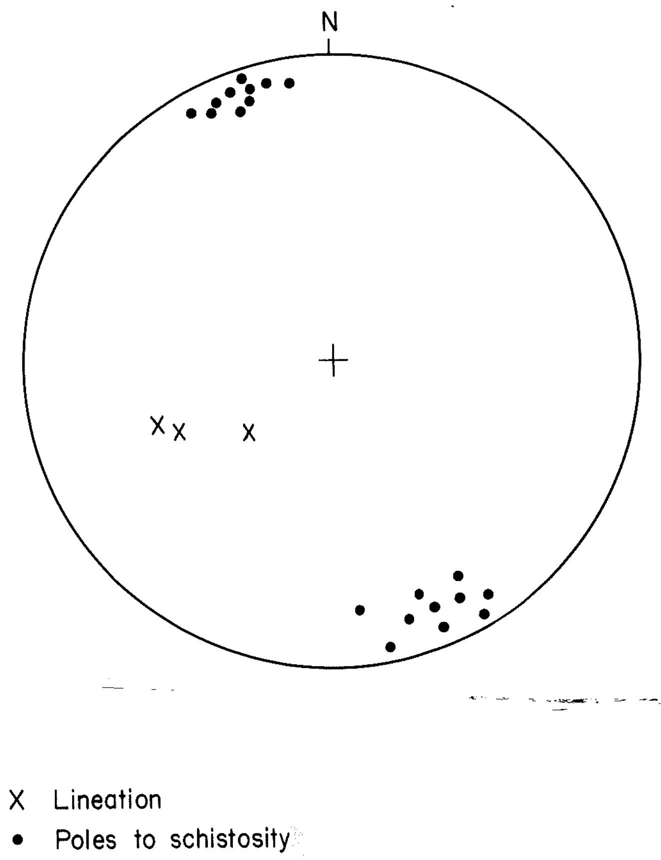

Figure 3: *Stereographic plot of fabrics within the Rietfontein Fault zone, Jaybee quarry, Germiston (Lower hemisphere, equal area projection).*

At the Makro locality, the fault zone is partially exposed over a distance of 30 m. Its northern contact is not observed but it separates Platberg sediments to the north from a fault-bounded slice of basement granitoids (Figure 2). The fault zone consists of phacoidal blocks of basement granitoids and brecciated quartzites together with deformed and lenticular ironstones and ferruginous shales set in a highly schistose matrix. In detail, the southern margin of the fault zone against weathered and schistose granitoid is well-exposed and dips 70° to the northwest. A prominent schistosity is developed within the fault zone parallel to the fault contact over a distance of some 3 m in quartz-mica schists. Proceeding northwards into the fault zone this fabric maintains a similar strike but varies in dip about the vertical. In places this fabric appears to enclose and wrap around phacoidal blocks of brecciated quartzite. Northwards, the quartz-mica schist fault-matrix grades into, and alternates with, finely laminated mauve argillaceous chloritic schists containing lenses of quartzite at a metre-scale, thin lenticular quartz veins, and folded and lenticular blocks and lenses of magnetic banded iron formation which may have been derived from the Contorted Bed. Most of the lenses and blocks are aligned in the pervasive schistosity which strikes east-west with steep (75-85°) southerly and northerly dips and which appears to be discordant to the prominent schistosity developed at the southern margin of the fault zone.

(v) Fault-bounded slices

Along the southern margin of the Bezuidenhout Valley Graben the Rietfontein Fault System is braided and fault-bounded slices comprise a variety of lithologies in the narrow fault zone. These slices attain length to width aspect ratios of up to 9:1. From west to east, major fault blocks, spaced along the fault zone, are exposed at Langerman's Kop, comprising Government and Turfontein Subgroup strata; Bedfordview, consisting of basement granitoids and lower Witwatersrand strata, and at Rietfontein Gold Mine, consisting of elements of Hospital Hill and Jeppestown Subgroup Strata and Central Rand Group lithologies (Figure 2).

(a) Langerman's Kop The geology of Langerman's Kop has been examined in detail by Mellor (1911 a; b) and McCarthy *et al.* (1982). This fault slice is bounded to the south by the Rietfontein Fault and along its northern margin a fault which splays from the Rietfontein Fault juxtaposes Ventersdorp (Platberg) lithologies against Turffontein and Government Subgroup strata which form the outlier (Figure 2). Within this fault-slice, McCarthy *et al.* (1982) identified a northerly dipping thrust fault where Government Subgroup strata are thrust over Mondeor Formation quartzites and interlayered coarse conglomerates of the Turffontein Subgroup (Figure 2). Jeppestown Subgroup strata are not present. In association with this southerly verging thrust, strata steepen and are locally overturned. McCarthy *et al.* (1982) also recognized that the Mondeor Formation is deformed into an upright anticlinal fold which plunges shallowly to the east.

The northern contact of this fault-slice is not well-exposed. However, it has been examined in some detail by A.B.A. Brink in an unpublished site investigation at Darras Centre near the intersection of Juno Street and Kitchener Avenue, Kensington (Figure 4a). At this locality, the fault zone, at least 45m wide, strikes east-west and comprises highly deformed shale and silicified, brecciated quartzites of the Government Subgroup. Diamond drilling has confirmed that this fault zone separates Ventersdorp lithologies to the north from locally northerly dipping Mondeor Formation rocks to the south which are well-exposed on Langerman's Kop (McCarthy *et al.* 1982). The investigation clearly indicates that the Government Subgroup strata occur in a fault-bounded slice that structurally overlies the Mondeor lithologies along a northerly dipping fault-contact (Figure 4b). The Government Subgroup at this site is no more than 50m wide, and is, in turn, juxtaposed against Platberg sediments to the north, indicating complex inter-slicing of diverse stratigraphy.

(b) Rietfontein fault-slice The geology of the Rietfontein Gold Mine was originally described by Mellor (1911 a, b). Engelbrecht (1957) correlated the lithologies at Rietfontein Gold Mine with similar occurrences at the Witwatersrand Gold Mine within the main Witwatersrand Basin to the south. The now-defunct Rietfontein Gold Mine was developed in a fault-bounded slice of Witwatersrand strata (Figure 2), and information presented here has largely been extracted from mine plans and shaft sections in the custody of the office of the Government Mining Engineer.

In plan, this fault-bounded slice has a semi-ovoid shape with maximum dimensions of 3,5km x 1km. It is bounded to the south by the Rietfontein Fault and its northern contact is an arcuate fault splay to this fault where lower Witwatersrand strata are faulted against Platberg lithologies.

The fault slice comprises Jeppestown Subgroup shales and quartzites, Johannesburg Subgroup quartzites and conglomerates including the North, Main and South Reefs (Mellor, 1911 a, b) of the Main Conglomerate Formation (SACS, 1980), the Booysens Formation and the lower Turffontein Subgroup. In the central and eastern part of the fault slice, strata dip moderately (60°) to the south at surface, but flatten with depth (Figures 5, 6 and 7). In a north-south section through No. 2 Shaft, the North Reef clearly oversteps successively older southerly dipping Jeppestown strata (Figure 6). In contrast, within the western section of the fault slice, strata maintain a moderate to steep attitude (40-60°S) with depth (Figure 7) and along the western and northwestern limits of the fault slice pronounced overturning of strata occurs. This is evident both from limited outcrop and from examination of structural contours established for the Main Reef, especially at its western extremity (Figure 8). At the western extremity, the complexly folded Central Rand Group is structurally overlain by a wedge-shaped, fault-bounded segment of Hospital Hill Subgroup strata, including a quartzite and magnetic shale.

The Rietfontein Fault can clearly be delineated from mine data and borehole information (Figure 9). In the east the fault dips at 25° to the north (Figure 5), increases in attitude to a dip of 60°N in the central area (Figures 6 and 7) and continues westward along strike at dips of 60-70° to the north (Figure 8). Notably, overturning of both basement granitoids and Hospital Hill Subgroup strata occur along the southern flank of the Rietfontin Fault as is evident in a section through No. 2 Sub-incline Shaft (Figure 5). In this profile, Hospital Hill Subgroup strata dip at 70-75° to the north. The close association of overturning with this major fault implies southerly movement along the steep northerly inclined Rietfontein Fault.

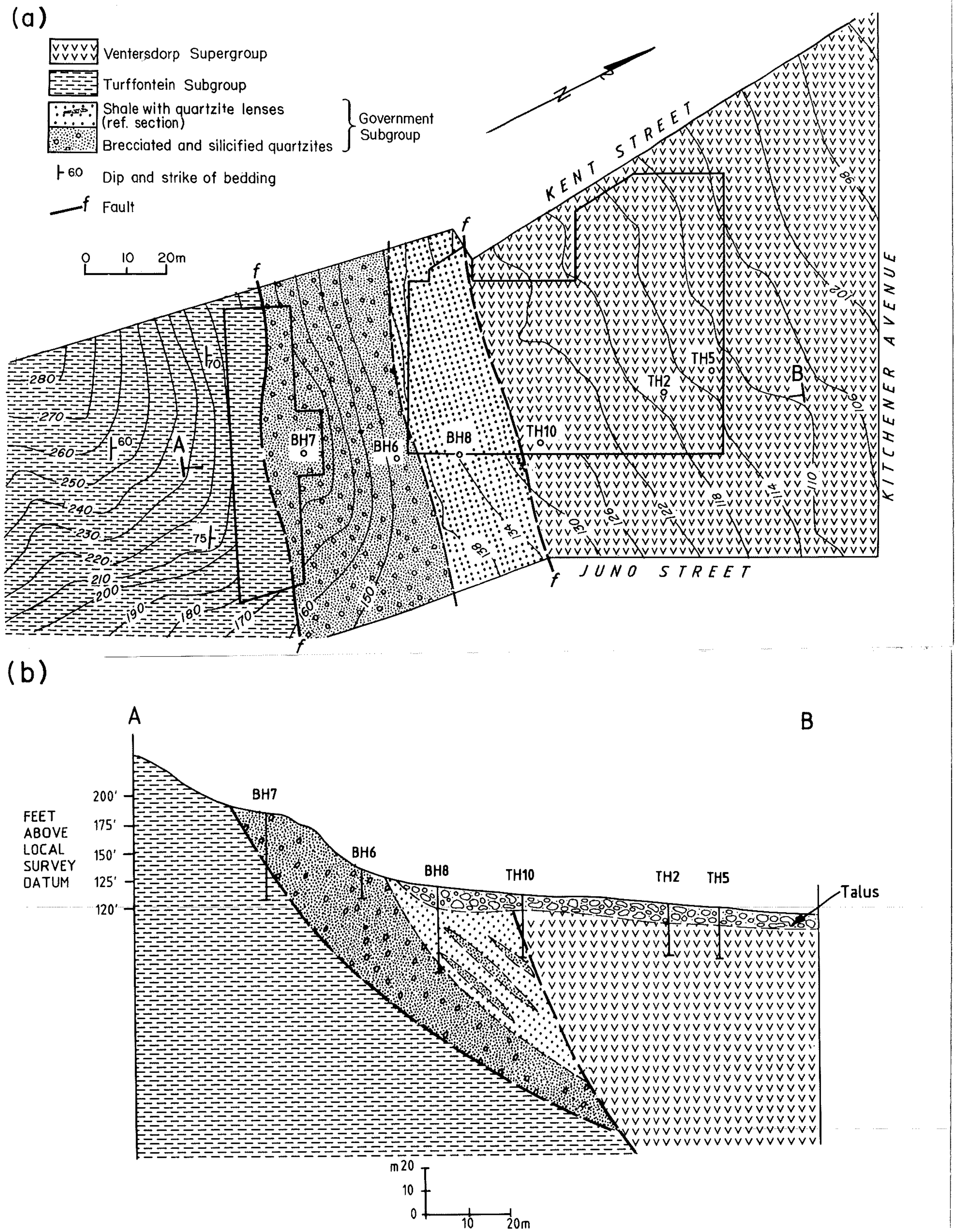

Figure 4. (a) *Geological map across the northern margin of the Langerman's Kop fault-slice at Darras Centre, Kensington. Talus and other surficial deposits removed. Compiled from unpublished data from a site investigation by A. Brink. Contours in feet, based on original site survey. Selected borehole positions indicated.*

(b) *Geological profile along line A-B. Refer to Figure 4 (a) for geological key.*

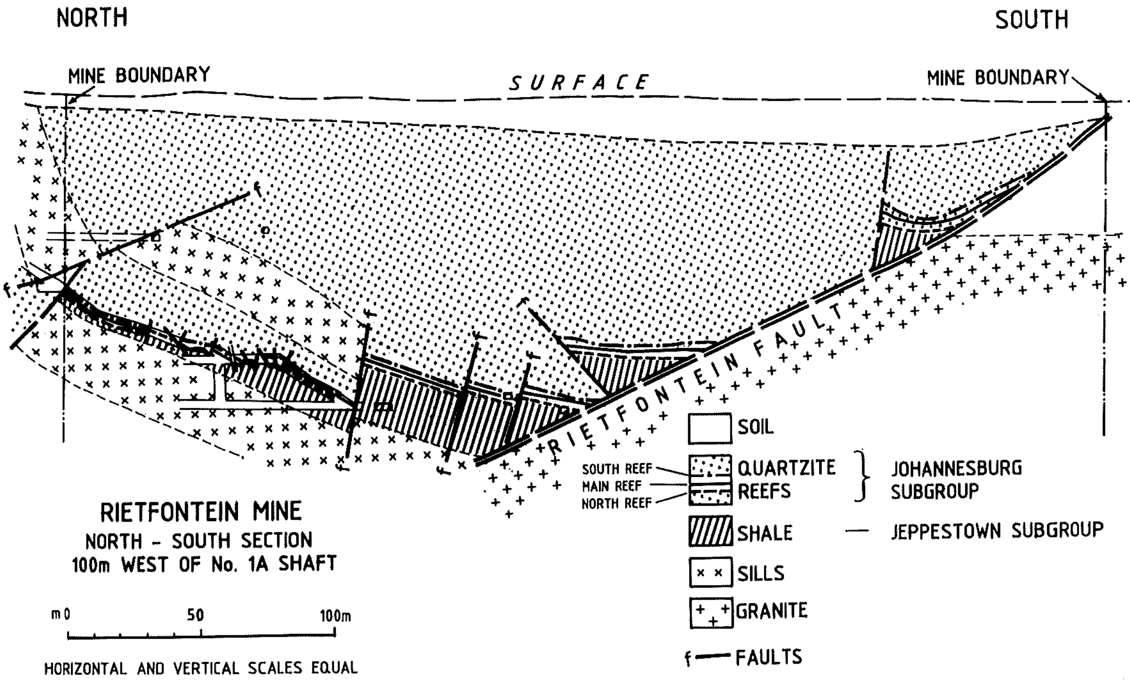

Figure 5. North-south geological section, Rietfontein Gold Mine, located 100m west of No. 1A Shaft. Refer to Figure 9 A-A' for locality. Based on information compiled by Engelbrecht (1957) and geological data in custody with the Government Mining Engineer, Johannesburg.

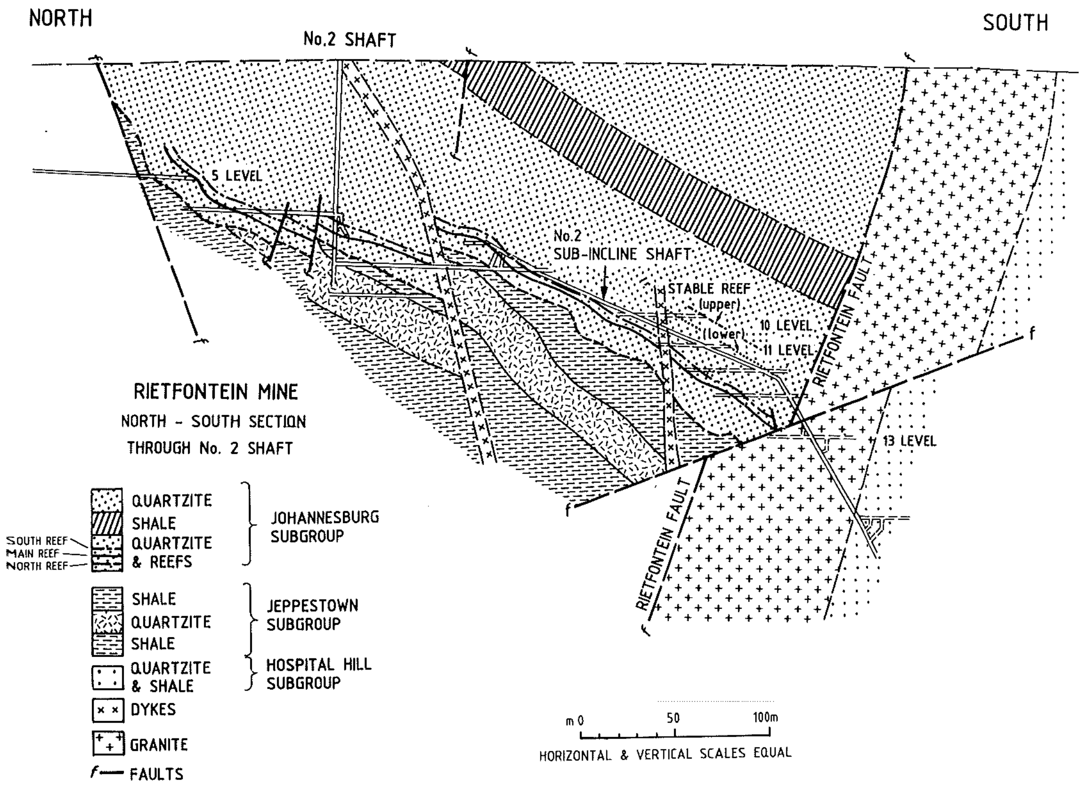

Figure 6. North-south geological section Rietfontein Gold Mine, through No. 2 Shaft system. Refer to Figure 9 B-B' for locality. Compiled from geological data in custody with the Government Mining Engineer, Johannesburg.

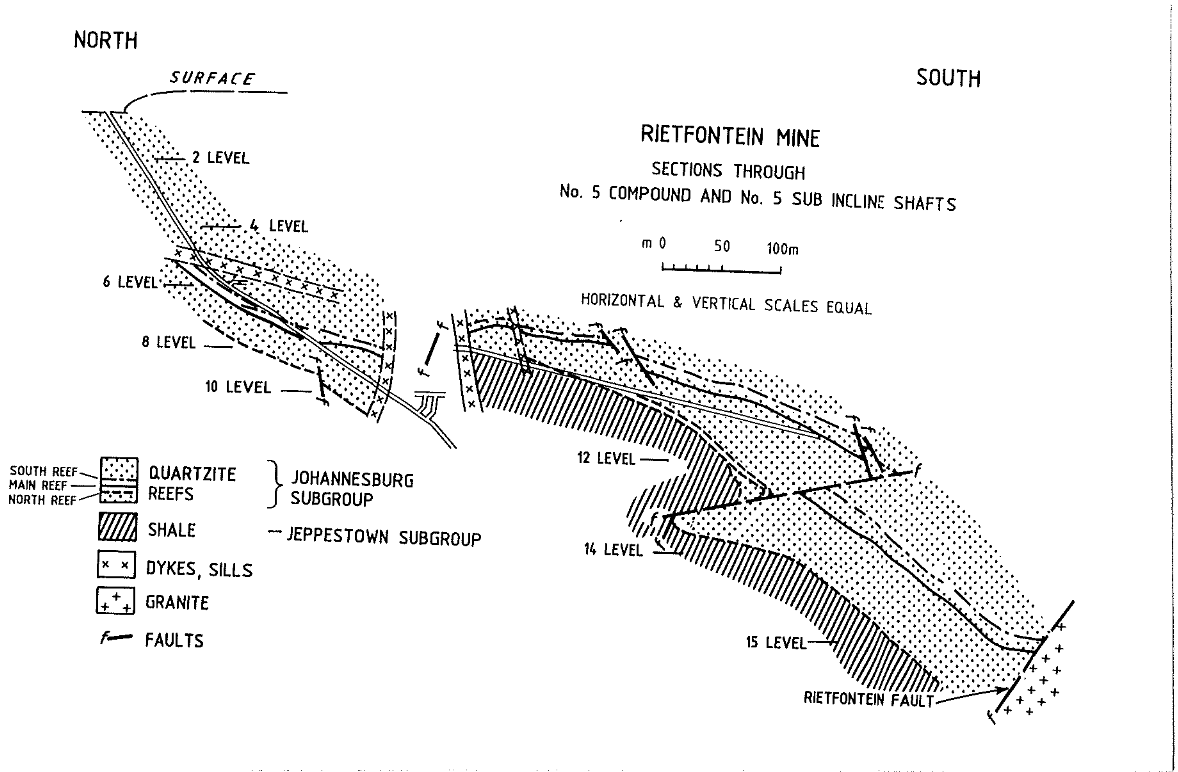

Figure 7. *Geological sections through No. 5 compound and No. 5 sub-incline shafts, Rietfontein Gold Mine. Refer to Figure 9 C-C' for locality. Compiled from geological data in custody with the Government Mining Engineer, Johannesburg.*

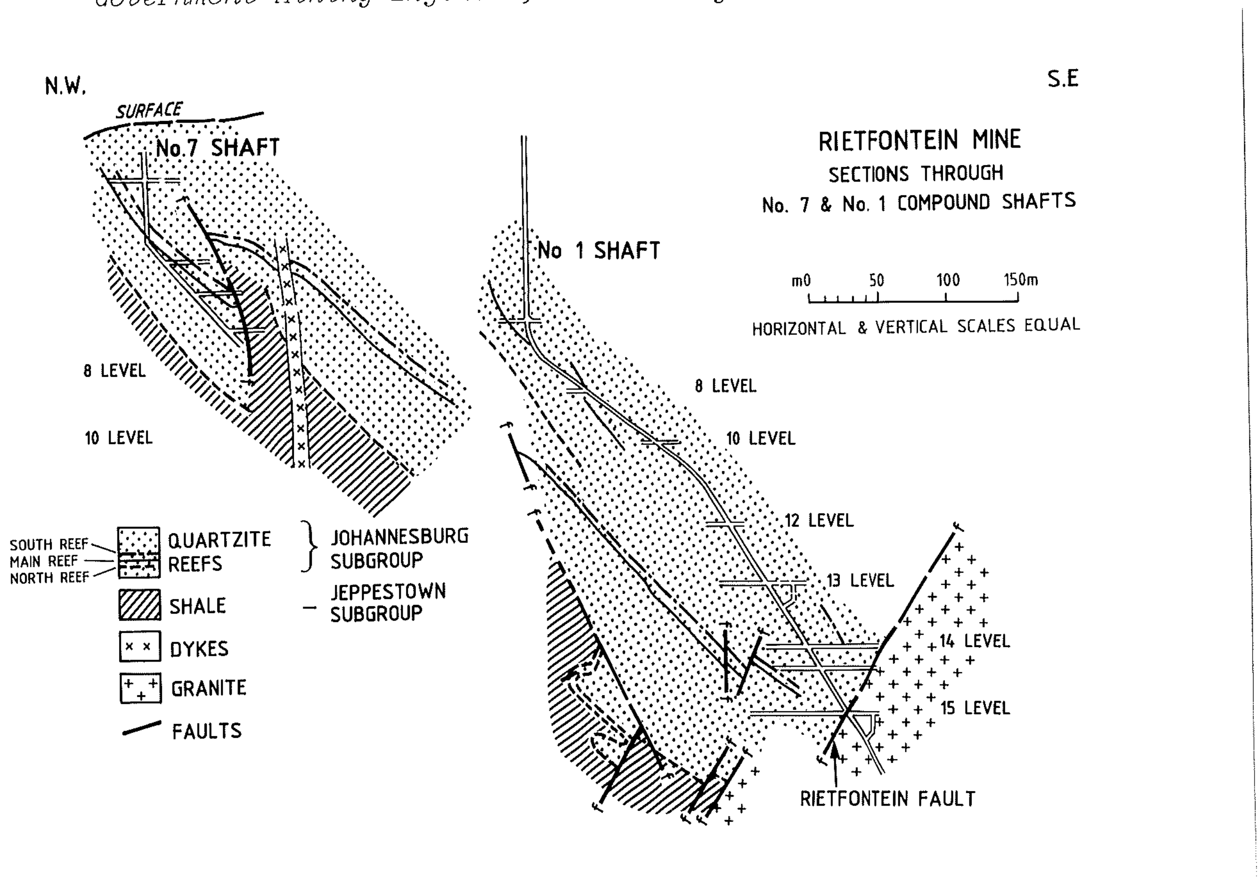

Figure 8. *Geological sections through No. 7 and No. 1 compound shafts, Rietfontein Gold Mine. Refer to Figure 9 D-D' for locality. Compiled from geological data in custody with the Government Mining Engineer, Johannesburg.*

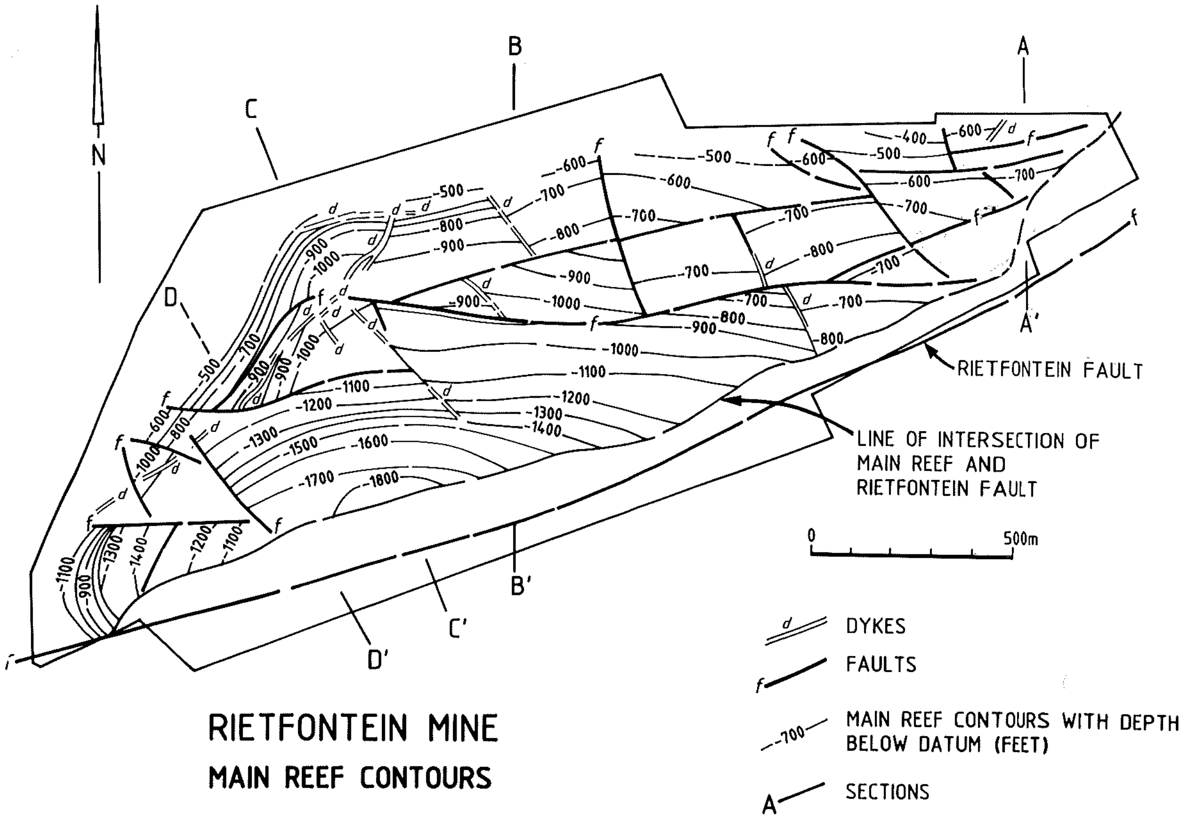

Figure 9: *Map showing Main Reef contours at Rietfontein Gold Mine. Contour interval of 100 feet below mine datum, which is 6000 ft above sea level.*

The northern bounding-fault to the Rietfontein Fault slice is largely inferred from borehole data. Along most of this fault, Ventersdorp (Platberg) lithologies, are juxtaposed against Jeppestown and Hospital Hill Subgroup strata (Figure 2). Nevertheless, there is some complexity in this fault zone as can be gauged from a section through the northern margin of the fault slice (Figure 10). At this locality a fault-bounded slice of Turffontein Subgroup lithologies is structurally interleaved between Ventersdorp strata. Three faults are exposed in underground workings, all of which dip moderately to the north over a short lateral distance (Figure 10). Mapping by Engelbrecht (1957) indicated that the two southerly faults appear to be cut-off along strike by the most northern fault, although exact fault logic cannot be ascertained because of poor surface outcrop. From south to north, the first fault juxtaposes Ventersdorp lithologies against Jeppestown Subgroup strata, the second fault juxtaposes Turffontein Subgroup against Ventersdorp strata, and along the third and most northerly recognised fault, Ventersdorp lavas overlain by Platberg sediments are juxtaposed against Turffontein Subgroup strata (Figure 10).

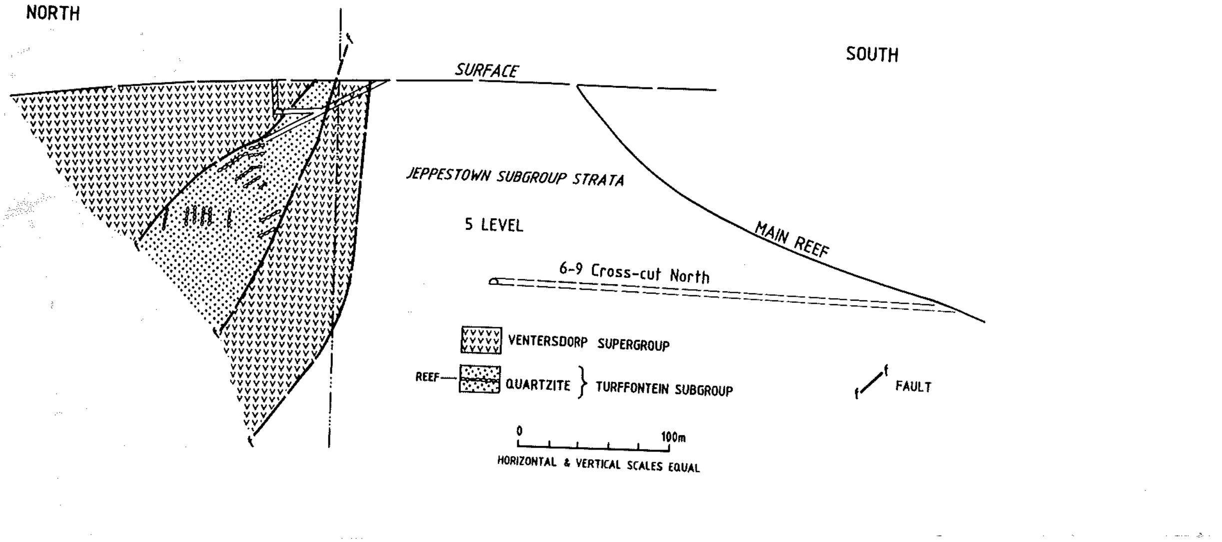

Figure 10: *Section through the northern margin of the Rietfontein fault-slice. Based on Engelbrecht (1957).*

At surface, the fault-bounded slice of Turffontein Subgroup strata is approximately 250 m in length and some 20 m in width, although the slice widens with depth forming an upward-tapering wedge. Engelbrecht (1957), in his study on the correlation of the conglomerate reefs and lithologies at Rietfontein Gold Mine, drew attention to the lithologies in this fault slice. At surface the conglomerate reefs and associated quartzite lithologies dip at 50° to the north, as a consequence of which, these have been referred to as the "north-dipping reefs" (Engelbrecht, 1957). Whilst Engelbrecht (1957) pointed out the robust nature of these conglomerates and alluded to the fact that they may represent basal conglomerates of the V.C.R., they probably represent Mondeor or Kimberley Formation conglomerates. Mine data clearly indicates a northerly attitude for the conglomeratic reefs near surface and within the vicinity of the northerly inclined shaft. However, on the elevation of 5 level, two occurrences of reefs have been intersected in diamond drilling. The southerly reef occurrence dips moderately to the north but the northerly occurrences are sub-vertical in attitude. This aspect indicates that these lithologies may be deformed into a tight synclinal fold. Unfortunately, access to the defunct mine workings is not possible to test this possibility.

In addition to the major bounding faults, the lithologies at Rietfontein Gold Mine have been affected by several periods of faulting and the intrusion of dykes and sills. Whilst field evidence for age relationships is not tightly constrained, some of the salient features are outlined here. The earliest phase of faulting appears to be a series of block faults, with both apparent normal and reverse movement, which have affected Johannesburg and Jeppestown Subgroup lithologies (Figure 5). These faults generally strike to the north-east sub-parallel to the trend of the Rietfontein Fault. In underground exposures no offset of the Rietfontein Fault is noted, neither do these faults appear in lithologies south of the Rietfontein Fault (Figure 5). Engelbrecht (1957) mapped a series of steeply inclined north-westerly striking faults, many of which have an apparent normal movement, but may also involve a component of right-lateral strike-slip motion. These faults are prominently developed along the northern margin of the Rietfontein Fault block (Figures 2 and 9). They frequently displace sills and dykes within the fault-block (Figure 9) and cut across the northern boundary-fault of the Rietfontein Fault slice and Platberg lithologies to the north (Figure 2). A set of faults with a similar attitude is known to occur along the northern margin of the Bezuidenhout Valley Graben (Figure 2). At the Rietfontein Gold Mine, there is no evidence that these northwesterly striking faults offset the Rietfontein Fault, although it is possible that they do elsewhere.

In the deeper sections of the mine (Figures 6 and 7), a thrust fault dipping 20° north displaces the Rietfontein Fault. The lateral extent and age of this fault is unknown, but it is probably a relatively late structural feature, based on the fact that it displaces dykes of probable Ventersdorp age (Figure 6). A minimum of 50m displacement is indicated with a southerly sense of vergence.

In an attempt to assess the deformation and movement of the Rietfontein Fault slice, the disposition of the lithologies within the fault-bounded slice were examined. In this regard, structural contours of the Main Reef were established (Figure 9) and clearly illustrate the deformed aspect of the formation which is also partly reflected in outcrop pattern (Figure 2). Southerly dipping strata occur in eastern and central parts of the fault slice, but towards the western end show a marked change of strike to the southwest and, adjacent to the Rietfontein Fault, curve to the south and southeast (Figure 2). Whilst over much of the western end of the slice strata dip to the southeast, pronounced overturning occurs along the northwestern and western margin. A block diagram illustrating the overall form of the fault slice is presented as Figure 11. The contrasting deformation of the conglomerate horizons of the eastern and western margins evident in this figure is of note. In the east, the strata flatten towards the Rietfontein Fault, while in the west, they are deformed into a steeply plunging fold-like structure with axial plane sub-parallel to the fault. This contrasting deformation is consistent with left-lateral strike-slip movement.

(vi) Terminal fault splays

At the western end of the Rietfontein Fault System, pronounced splaying to the southwest is evident, across the West Rand Syncline (Stanistreet *et al.*, 1986). In contrast, at the eastern end of the fault system, faults change from an east-northeasterly orientation and bend northwards.

Some of the main features of this eastern splay-system are: (1) the noted discordancy produced where faults cut across the Van Dyk Anticline (Figure 12); (2) the indication of reverse movement across the fault splays with an east-southeasterly sense of vergence, based on the distribution of lithologies and fault curvature; and (3) the marked overturning of strata along the eastern flank of the north-striking fault splay, north of the Van Ryn Estate Gold Mine.

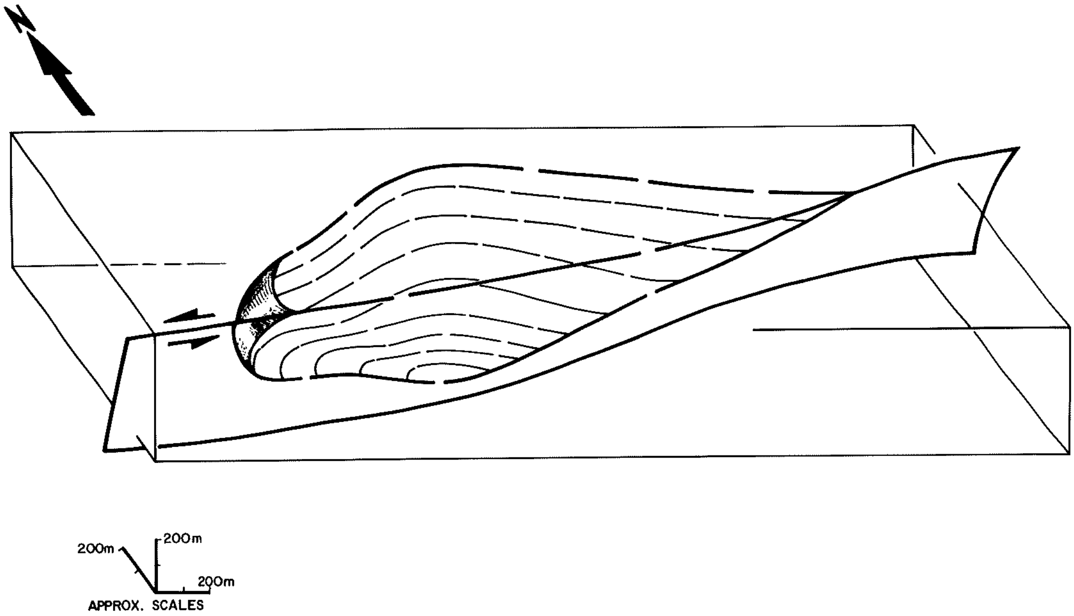

Figure 11. *Section through the northern margin of the Rietfontein fault-slice. Based on Engelbrecht (1957).*

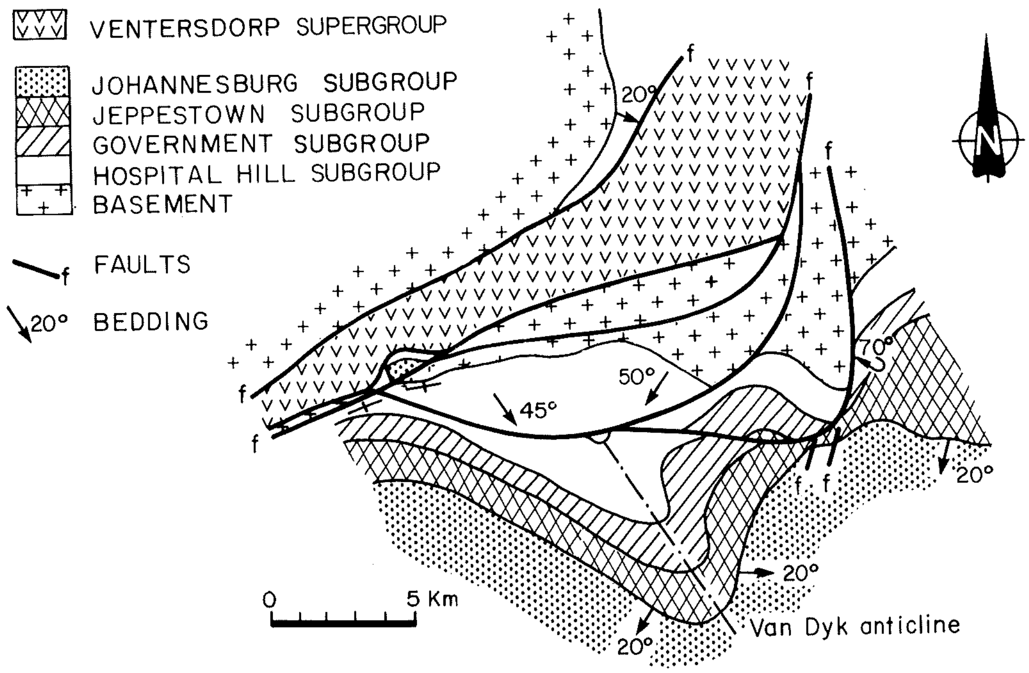

Figure 12. *Geological map of the exposed eastern extremity of the Rietfontein Fault System. Compiled from Mellor (1917) and mapping by the authors.*

3. EFFECTS OF POST TRANSVAAL DEFORMATION

Salient features of this phase of deformation have been presented by McCarthy *et al.* (1986). In particular, these authors recognised northward verging folds and thrusts together with an associated regional penetrative cleavage along the northern margin of the Witwatersrand Basin. In addition, the emplacement of the Johannesburg granitoid dome has not only up-domed the Transvaal lithologies, but has locally affected the regional cleavage and caused some reactivation of the Rietfontein Fault System (McCarthy *et al.* 1986). These authors further point out that the penetrative east-west-striking cleavage not only cuts across the West Rand Syncline but across the early overturning occurring along the southern flank of the Rietfontein Fault.

Although the full effects of the post-Transvaal reactivation of the Rietfontein Fault are difficult to assess equivocally, the rotation and restoration of Transvaal strata to the horizontal could imply that the Rietfontein Fault was initially sub-vertical in attitude with a steep northerly dip.

4. DISCUSSION

The occurrence of fault-bound slices along the Rietfontein Fault forms one of the most significant aspects of this part of the Rietfontein Fault System. They occur in a relatively narrow zone of deformation and are bounded to the south by the Rietfontein Fault. The Langerman's Kop and Rietfontein Fault slices represent the best documented of the larger (kilometre-scale) bodies. The slice of basement granitoids at Bedfordview and other smaller fault slices are less well-exposed and hence not well documented. These fault-bound slices represent fragments of displaced stratigraphy and frequently cannot be matched with lithologies on their immediate flanks. Although they are often allochthonous or exotic, internally slices preserve important lithological and structural relationships.

The Rietfontein Fault slice, comprising mainly Central Rand Group strata, is juxtaposed against basement granitoids across the Rietfontein Fault and also shows an apparent downthrow to the north of at least 2km as it lies juxtaposed against Platberg Group sediments. In contrast, the fault-bounded slice of basement granitoids which occurs immediately to the west of the Rietfontein Gold Mine shows an apparent upthrow across the Rietfontein Fault. Further westwards, the Langerman's Kop fault slice contains Government Subgroup strata thrusted over Turffontein Subgroup strata with a southerly vergence. This fault slice shows complex relationships along its northern margin, where a narrow sliver of Government Subgroup strata lies interposed between Platberg Group strata to the north and Mondeor Formation to the south (Figure 2), while along the southern margin of Langerman's Kop, Mondeor Formation strata lie juxtaposed against Hospital Hill Subgroup across the Rietfontein Fault (Figure 2).

Despite these apparent conflicting fault displacements, field evidence also clearly indicates that the Rietfontein Fault dips northwards and, associated with this fault, extensive overturning of strata along its southern flank implies reverse movement with a southern vergence. This complex pattern of intersliced lithologies is reminiscent of strike-slip duplexing, as described by Woodcock and Fischer (1986).

5. STRUCTURAL HISTORY

The Rietfontein Fault System has had a long structural history involving several periods of fault reactivation. The earliest recognised period of activity of the Rietfontein Fault is attributed to marginal uplift with a southerly directed reverse sense of movement along the northerly inclined fault. Such movement is indicated by the associated overturning of strata along the southern flank of the fault as well as stratigraphic evidence, namely lithological attenuation and unconformity elationships (Stanistreet *et al.*, 1986; McCarthy *et al.*, 1989) which show that this marginal uplift occurred during Central Rand sedimentation. In addition, regional studies (Stanistreet *et al.*, 1986; McCarthy *et al.*, 1987; Clendenin *et al.*, 1988) indicate that the Central Rand Group was influenced by in plane compression, as suggested by oblique reverse faulting associated with left-lateral strike-slip movement along the northern margin of the Witwatersrand Basin. Fragmentary evidence of this deformation is also preserved within the Langerman's Kop fault slice where Government Subgroup lithologies are overthrust on Turffontein strata and may represent a segment of a positive palm-tree structure. Within the Rietfontein Gold Mine slice the faulted segment of Hospital Hill Subgroup strata which occurs at its western extremity, may also represent a segment of a positive palm-tree structure. Furthermore, the fault-bounded slice of basement granitoids at Bedfordview indicate upward and southerly movement, probably at this time. The northward attenuation of Klipriviersberg lavas across the Rietfontein Fault suggests that this style of deformation continued into Klipriviersberg times (Stanistreet *et al.*1986, McCarthy *et al.* 1989). These authors, however, have pointed out that the development of the Bezuidenhout Valley Graben was caused by extension. This is evident from the downfaulting along the northern side of the Rietfontein Fault. The preserved fault-bound slices of Langerman's Kop and Rietfontein both attest to this movement which was probably in the order of 2-3km. However, the strongly asymmetric form and overall structure of the Rietfontein Fault slice and the faulted contact with Platberg lithologies is evidence that this fault slice was emplaced with a component of left-lateral movement along the Rietfontein Fault. In particular, the steeply plunging fold-closure at the western end of the Rietfontein Fault slice (Figures 9 and 11) clearly attests to this left-lateral movement and contrasts with the steeply dipping to overturned Hospital Hill Subgroup strata along the southern flank of the Rietfontein Fault. The net effect is that this period of deformation can be characterised by oblique fault movement comprising northward normal displacement together with left-lateral strike-slip motion. The amount of lateral strike-slip displacement is difficult to assess equivocally. The east-west orientation of the Rietfontein Fault is orthogonal or trends at a high angle to the orientation of the main Ventersdorp trough to the west and, in terms of its regional context, Clendenin *et al.* (1988) have suggested that it probably acted as a transfer fault during Platberg Group time.

The fault slices are clearly allochthonous and, with the recorded strike-slip displacement recorded from the Rietfontein Fault slice, are probably analogous to the strike-slip isolated fault lozenges and duplexes described by Woodcock and Fischer (1986). Strike-slip duplexes and fault lozenges may be shunted or move along the fault system parallel to the regional slip vector. However, these authors also point out that duplexes or individual horses will usually also move up or down perpendicular to the slip vector because of the unconstrained upper surface to the fault system.

Woodcock and Fischer (1986) proposed that movement of a strike-slip duplex or fault lozenge is achieved by its attachment or 'docking' to one flanking fault with the main strike-slip switching to a fault on its other flank. Continued movement leads to an exotic fault-slice isolated from its original stratigraphic and structural position (Woodcock and Fischer (1986). These authors, furthermore, suggested that the process of strike-slip duplexing can take place at fault bends, offsets and along straights which involve fault-bound slices delineated by early formed shears and fractures. In the case of the emplacement of the fault-slices along the Rietfontein Fault, however, it appears to be a more complex situation. A probable scenario is that the early period of fault activity was characterised by transpression in which positive flower structures were generated during Central Rand Group time. This was then succeeded by transtensional deformation in which the already structurally prepared ground was sliced through to produce the allochthonous fault-bound slices. This is borne out by the fact that the slices contain lithologies that range from basement granitoids through to Turffontein Subgroup strata and in cases may be structurally interleaved with Ventersdorp lavas (north margin of Rietfontein Fault slice).

It is important to note that structural cross-sections established across the Rietfontein Fault zone and Bezuidenhout Valley Graben cannot be balanced. Because of the movement of rock material in and out of the section planes it becomes an almost impossible task to achieve (Woodcock and Fischer, 1986) and this inability to balance such sections is a major criterion for the recognition of strike-slip faulting (Sylvester and Smith, 1976; Sylvester, 1988).

6. CONCLUSIONS

The geometry of the Rietfontein Fault System precludes simple basin-edge subsidence with associated normal down-to-the-south faulting. The fault system preserves evidence that it has had a protracted structural history that has involved reactivation. Its earliest activity can be traced from Central Rand times when it acted as an oblique-slip fault under transpression to subsequent reactivation as an oblique-slip fault under transtension during the Ventersdorp and Platberg times. The occurrences of fault-bounded slices along the Rietfontein Fault are interpreted as allochthonous strike-slip duplexes and lozenges. The overall form of the Rietfontein Fault slice suggests that it was emplaced along the Rietfontein Fault by left-lateral strike-slip movement.

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