give way to zones of tremolite or talc. Most of the rocks making up the Komati Formation in the Jamestown Schist Belt comprise, however, a layered differentiated succession of ultramafic and mafic rocks, typified by the Handsup and Mundt's Concession differentiated bodies in the eastern part of the area, and which will be discussed in greater detail later in this thesis. The differentiated bodies consist essentially of serpentinized olivine and pyroxene peridotite, amphibolitized pyroxenite and meta-gabbro.

In addition to the rocks described above, and which form by far the bulk of the Komati Formation in the Schist Belt, there are zones consisting of dolomitized mafic and ultramafic material. This carbonation of the formations is prominent along zones of dislocation and shearing, particularly along the Albion Fault which slices through the southern part of the area, parallel to the general trend of the Schist Belt itself. The western extension of the Kaap River Fault is another zone along which considerable carbonation of the surrounding rocks has taken place.

The Komati Formation, as developed in the type-area in the Komati River Valley, is typified by the complete absence of any inter-layered siliceous sediment or chert horizons and is made up of a thick succession of regular, alternating, bands of mafic and ultramafic material (Viljoen and Viljoen, 1967). However, there are numerous bodies of quartz and felspar porphyry intrusive into the mafic and ultramafic horizons. These generally occur as elongated lenses lying parallel to the layering or schistosity of the formations.

This same relationship prevails in the Komati Formation of the Jamestown Schist Belt where numerous quartz and felspar porphyry bodies were found, particularly in the area separating the Mundt's Concession differentiated body from the Handsup differentiated body. A number of porphyry bodies also occur along, and adjacent to, the Albion Fault in the area southwest of the Handsup fold. In the Clutha Mine area, southeast of Noordkaap another long, narrow, quartz porphyry body, associated with carbonated greenschists and dolomitized meta-basalts, lies conformably between Fig Tree and Onverwacht Group rocks, parallel to the Lily Fault. A more comprehensive discussion of these porphyry bodies is to be given later in a section dealing essentially with the granitic rocks of the entire northwestern flank of the Barberton Mountain Land.

The essential elements of the Komati Formation, as defined in the type-area in the Komati River Valley are, therefore, present in the Jamestown Schist Belt. The major difference in the two areas, however, lies in the fact that the Komati Formation developed in the Komati Valley consists essentially of an extrusive sequence of pillow basalts together with alternating ultramafic horizons, some of which are also extrusive. Viljoen and Viljoen (verbal communication, 1968) have found pillow structures in these rocks and have amassed sufficient other information to suggest, quite conclusively, that some of these early ultramafic rocks flowed out on surface as lavas. In the Jamestown Schist Belt on the other hand, the Komati Formation, although similar in many respect is, nevertheless, comprised essentially of an intrusive sequence of mafic and ultramafic rocks. These, it would seem, were introduced into a pile of essentially basaltic lavas of the Onverwacht Group in the form of intrusive sill-like pods. Differentiation processes were able to take place, producing a layered succession of alternating olivine and pyroxene peridotites, pyroxenite, and gabbro. The relative abundance of the various rock-types involved in this event suggests that the parent magma was initially of ultramafic composition. There can be little doubt that the emplacement of the ultrabasic intrusive sills took place very early in the history of the development of the Onverwacht Group as the differentiated bodies have been fully involved in all the deformational phases that affected the area.

Despite the difference in character of these rocks, as displayed in the Komati River Valley and in the Jamestown Schist Belt, it is suggested that both types are intimately related to one another. Thus, it is contended that the differentiated rocks in the Jamestown Schist Belt are the igneous magmatic equivalents of the essentially volcanic mafic and ultramafic successions of the Komati River Valley. A test of this hypothesis would be a direct comparison of the bulk chemistry of the rocks from the two separate areas. Unfortunately no chemical data has yet been made available from the Komati Formation in the southern part of the Barberton Mountain Land.

(c) The Fig Tree Group

Rocks of the Fig Tree Group are only developed in the eastern part of the Jamestown Schist Belt where they form part of the western extension of the Lily Syncline. The Fig Tree assemblage is best developed in the area of the New Consort Gold Mine. Much detailed work has already been done in the mine area, notably by Hearn (1943), van der Berg et al, (1946), and Viljoen (1964), so that only a brief description will be given here and the new findings added.

At the base of the succession and in contact with the underlying Onverwacht Group schists there is invariably developed a hard, siliceous, chert-like rock known as the Consort "Bar". This notable horizon, along which most of the important gold mineralization has been located, was first mapped in detail around the Consort Mine by van der Berg et al,

(1946) and again later by Viljoen (1964). It became apparent that the area had been subjected to strong folding as well as granite and pegmatite invasion, the latter causing local disruption and elimination of the formations in the mine area.

Apart from the Consort "Bar", or Consort "Contact", as it is referred to locally, the Fig Tree rocks in the area consist of an alternating succession of shales, greywackes, and associated chert horizons. In addition, scattered-pebble conglomerates may be developed in places and the whole sequence is terminated by felspathic tuffaceous greywackes, and tuff conglomerates.

A complete account of the stratigraphy of the Fig Tree assemblage east of the Consort Mine was given by Viljoen (1964). In addition to the rock-types already mentioned he was able to distinguish several marker horizons within the pile of tuffaceous material comprising the upper part of the Fig Tree Group. One of these he called the "Lower Quartz-Bleb Marker". This occurs towards the top of the succession, within the so-called "autolith" zone of the Geological Survey (Visser, compiler, 1956), later termed the felspathic tuffaceous conglomerate zone by Anhaeusser (1964), and Viljoen (1964). The "quartz-bleb marker" constitutes a persistent laminated horizon, containing an abundance of highly sheared and flattened quartz lenses or "blebs". The second marker horizon Viljoen called the "Upper Pyroxene Marker". This occurs right at the top of the felspathic tuffaceous greywacke zone, immediately underlying the basal conglomerate of the Moodies Group (see Figure 5, in pocket) and consists essentially of coarsely crystalline diopsidic pyroxene together with lesser amounts of plagioclase, tremolite-actinolite, microcline, zoisite and quartz (Viljoen, 1964).

Practically the entire succession has undergone alteration and metamorphism with the result that the Fig Tree rocks in the area do not entirely resemble their equivalents in other parts of the Barberton Mountain Land. In fact, the Lily Syncline, between the Consort Mine and Louw's Creek, represent one of the few localities in the Barberton greenstone belt where rocks of the Fig Tree and Moodies Groups are sufficiently close to the granite contacts to have suffered thermal metamorphism.

The writer extended the mapping of the Consort Mine area further westwards where it was found that the Fig Tree Group sediments did not continue very far into the eastern part of the Jamestown Schist Belt. The Fig Tree rocks, in fact, terminated in a synclinal structure, known as the No. 3 Shaft Syncline, situated to the west and southwest of the Consort Mine offices and mill. The following descriptions of the Fig Tree assemblage therefore apply more specifically to the No. 3 Shaft Syncline area.

The Consort "Contact" or Consort "Bar" occurs at the contact between the underlying mafic and ultramafic schists of the Onverwacht Group and the overlying Fig Tree assemblage. In places the "Bar" is well-developed and forms a conspicuous cherty outcrop several feet wide. In the area west of Consort, the outcrops of the "Bar" are relatively poor, the best exposures being seen in some of the deeply incised gullies that drain into the North Kaap River. In most cases the "Bar" itself is only a few inches wide and its exact position is doubtful due to poor exposure. The schists underlying the Consort "Contact" are predominantly tremolite and talc-tremolite schists derived from serpentinites that build the low lying foothills of the Krokodilpoort Range. The Fig Tree rocks immediately overlying the "Bar" consist of metamorphosed shales and greywackes together with some thin chert bands. The grade of metamorphism here is not as high as that of the same sediments in the areas to the north and northeast of the Consort Mine where hornfelses are found. Some silicification of the shales has taken place resulting in the production of hard, brittle, strongly cleaved slaty rocks.

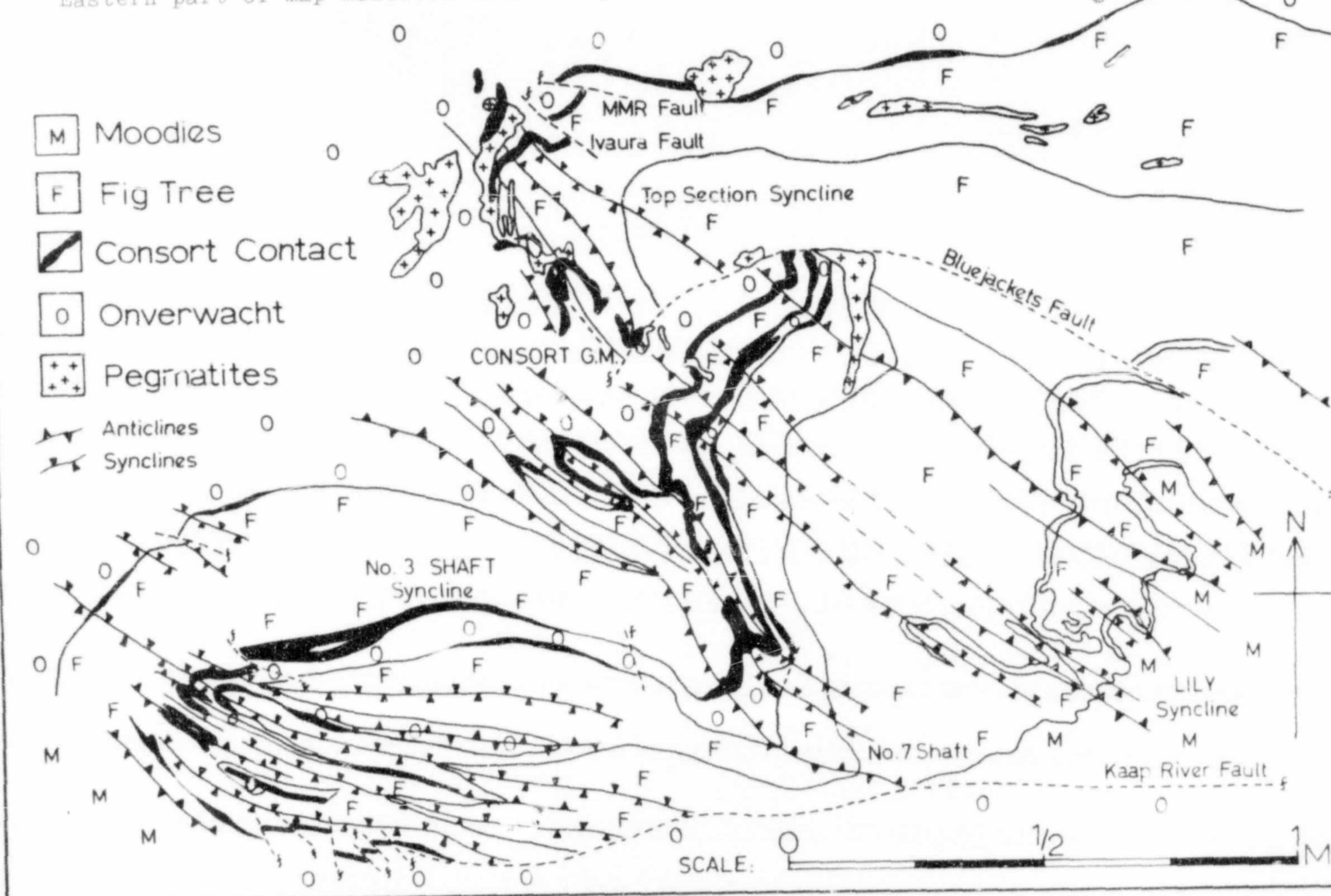
The origin of the "Bar" separating the competent Fig Tree rocks from the less competent Onverwacht schists has been explained by Hearn (1943), van der Berg (1946), and Viljoen (1964), as having resulted from the silicification of the intensely sheared zone at the junction of the two rock-groups. Hearn (1943) was of the opinion that the siliceous solutions, which made their way into the zone of shearing, were introduced subsequent to the pegmatite intrusions, and that the mineralization of the "Bar" took place after the silicification.

Van der Berg et al, (1946) considered that the succession at the base of the Fig Tree Group consisted of alternating cherts and greenschists similar to the Zwartkoppie rocks in the Sheba Gold Mine. The Geological Survey (Visser, compiler, 1956) on the other hand, contended that the various ultramafic schists separating the chert horizons in the mine area belonged to the intrusive suite of the Jamestown Complex. Gribnitz et al, (1961), and Viljoen (1964), placed the schists underlying the Consort "Contact" into the Onverwacht Group. The mapping in the No. 3 Shaft Syncline confirmed this view. From the Consort Mine eastwards the true nature of the stratigraphy can be demonstrated (see Figure 7, page 88, the eastern part of which is modified after Viljoen, 1964). Here only one chert horizon separates the Onverwacht schists from the Fig Tree shales. As no detailed regional mapping was available up until recently (Viljoen, 1964), the stratigraphic column as developed in the immediate mine area was thought to consist of three separate chert horizons with intercalated shales and schist.

STRUCTURE AND STRATIGRAPHY OF THE CONSORT MINE AREA

Fig. 7

Eastern part of map modified after Viljoen (1964)



Structural data presented by Viljoen (1964), and the writer (see Figure 8, page 90), show clearly that the main section of the Consort Mine as well as the No. 3 Shaft Syncline have been subjected to superimposed folding resulting in the production of a complex outcrop pattern and the duplication of stratigraphy. The Consort "Contact" in the No. 3 Shaft Syncline is followed by an alternating assemblage similar to that found in the area to the northeast of the Mine Offices. The succession is composed of isoclinally folded strata causing a repetition of the same beds to take place several times over a distance just exceeding half a mile.

In the synclinal cores of two of the fold structures felspathic tuffaceous greywackes are preserved, which appear to correspond with those of the upper part of the Fig Tree succession to the east, described by Viljoen (1964). In these rocks scattered-pebble conglomerates are developed in places and may correspond to the "quartz-bleb marker" horizon mentioned earlier. Flattened and folded chert pebbles from the No. 3 Shaft Syncline are shown in Plate 5B, page 91.

The shales and slates in the No. 3 Shaft Syncline are typically fine-grained, well-banded, and dark-brown in colour. In thin section the rocks consist of quartz, biotite, chlorite, some plagioclase, sericite, and carbonate at times. The greywackes are dark grey-brown or black on fresh surfaces but generally weather to a light grey-brown or reddish-brown colour. The rocks contain an abundance of angular quartz and chert fragments in a matrix composed predominantly of fine quartz, chlorite, biotite, sericite, iron oxides, carbonate and clay minerals. Plagioclase felspar is also a common constituent. The grain-size of the components is very variable. The tuffaceous greywackes of the upper part of the Fig Tree succession also contain angular to euhedral crystals of plagioclase, some grains of which show zoning. In outcrop the rock is distinctively different from the earlier mentioned greywackes in that the felspar shows up prominently as white flecks in a dark grey-black matrix. The weathered rock is generally a pale grey colour. The greywackes are poorly bedded but in places show a weak foliation or cleavage.

In the southwestern part of the No. 3 Shaft Syncline quartz-sericite schists of the underlying Onverwacht Group outcrop for a short distance. These rocks are associated with tremolite-actinolite schists and have been exposed as a result of folding and faulting in the area between the Fig Tree succession and a small block of Moodies sediments. The quartz-sericite schists are themselves intensely folded (see Plate 5 C and D, page 91).

STEREOGRAPHIC PLOTS OF STRUCTURAL PARAMETERS RECORDED FROM THE JAMESTOWN SCHIST BELT

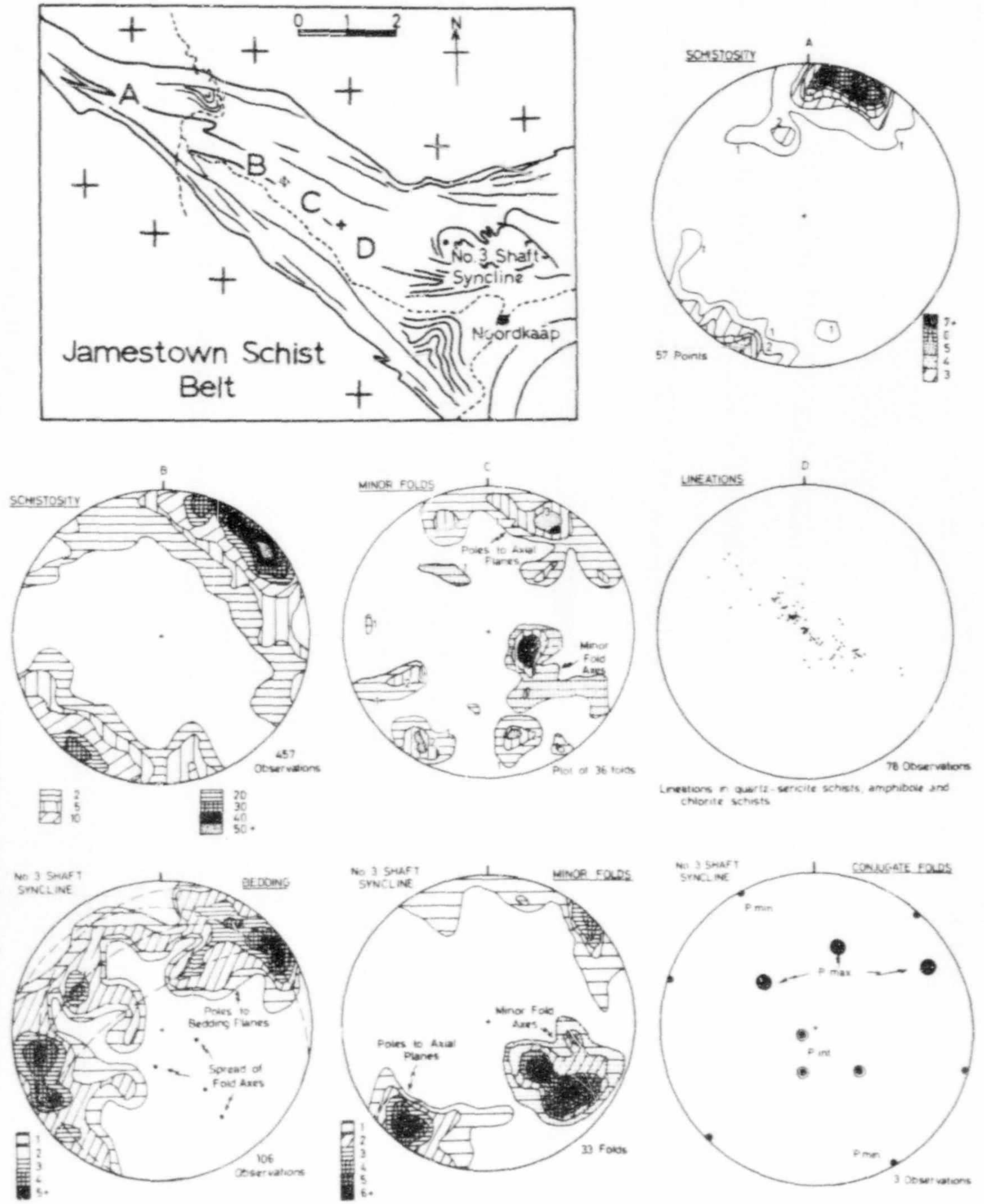
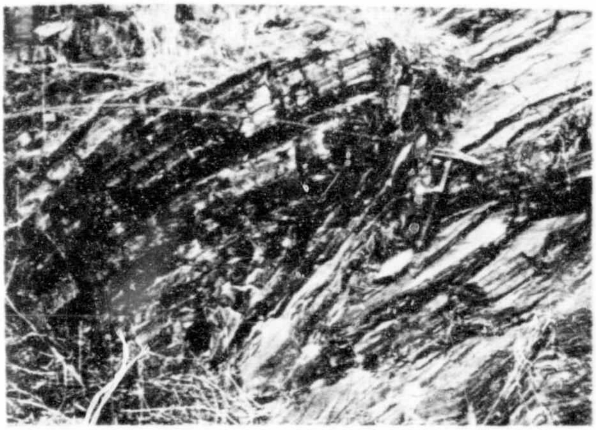


FIGURE 8 : Stereographic plots of : (i) steeply dipping schistosity (A and B), (ii) minor folds (C) and (iii) stretch lineations (D) recorded from Onverwacht assemblages in the eastern part of the Jamestown Schist Belt.
Bedding plane, minor fold, and conjugate fold data from Fig Tree sediments of the No. 3 Shaft Syncline of the Consort Mine is also presented.

PLATE 5

A



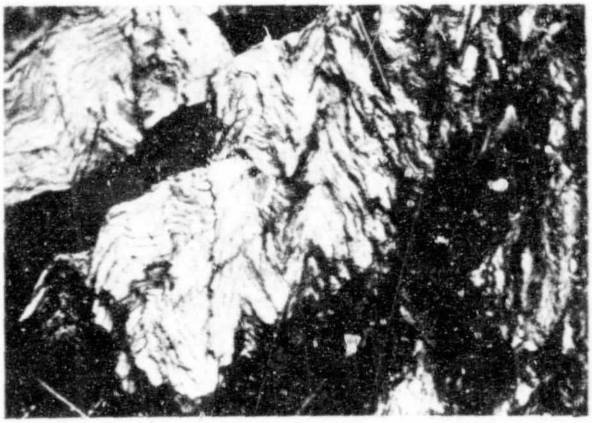
B

A. Large fold structure in metamorphosed Fig Tree shales and greywackes of the No. 3 Shaft Syncline - Consort Gold Mine. Fold axes plunge at intermediate to shallow angles to the southeast (Consort trend ± 135°). Axial plane of fold shown dips north at 53°.

B. Deformed conglomerate pebbles in the upper part of the Fig Tree assemblage of the No. 3 Shaft Syncline. Flattened chert pebbles can be seen with their long axes parallel to the bedding. To the right of the pen is a chert pebble folded by the Consort deformational trend.

C

D



C. Conjugate fold in quartz-sericite schists (Onverwacht) in the area immediately southwest of the No. 3 Shaft Syncline. The stress field calculated from this fold indicates a near horizontal P. max acting in a direction SW-NE.

D. Accordion folds in quartz-sericite schists associated with the conjugate fold shown in C. The fold axes plunge southeast and strike parallel to the minor folds in the No. 3 Shaft Syncline. The development of this phase of deformation was due to the influence of the Kaap Valley Granite diapiric pluton.

(d) The Moodies Group

Between the No. 3 Shaft Syncline in the Consort Mine area and the mafic and ultramafic schists of the Onverwacht Group in the eastern part of the Jamestown Syncline, a small arcuate ridge of Moodies sediments occurs as an isolated fault-bounded block. The sediments in this block strike roughly north-south, almost at right angles to the northwest trending schists which occur along the western and northern contacts.

Flowing through the centre of the block is the North Kaap River which has carved a gorge through the Moodies rocks, thereby creating a potentially favourable dam site (see Plate 3A, page 12). A weir, situated in the gorge, was used to divert water into a canal leading to a small hydro-electric plant, near Joe's Luck Siding, that generated power for the Consort Mine. This scheme was superceded by another diversion weir situated lower downstream in the Kaap River at the junction of the North and South Kaap Rivers where the volume of water was greatly increased.

The Moodies rocks are underlain in the east by a thin zone of felspathic tuffaceous greywackes, containing flattened chert fragments, and greywacke conglomerates. These pass conformably into Moodies rocks consisting, at the base, of a conglomerate horizon and is overlain by a calcareous felspathic quartzite horizon. The conglomerates and the quartzites probably represent part of the far western extension or closure of the Lily Syncline, the northern limb of which occurs approximately 1.75 miles to the east near the No. 7 Shaft Anticline. The conglomerate has all the characteristics of the typical basal conglomerate (MdB) of the Moodies Group and the quartzite horizon is similar to the calcareous quartzite horizon (MdCq) found in the Eureka Syncline to the southeast of Noordkaap.

The basal conglomerate does not consist of a single conglomerate layer but a zone of numerous pebble bands separated by quartzite material. The conglomerates and quartzites have suffered metamorphism and are mostly recrystallized and silicified. The pebbles are flattened, and aligned parallel to the bedding. Most of them consist of various types of banded chert, black chert, quartzite, granite and quartz porphyry. The quartzites are buff-coloured and when scratched with a pick leave a white carbonate stripe. The rocks are well-bedded and dip almost vertically or at steep angles to the east or northeast. They are thus slightly overturned in places. Minor folds such as intraformational drag folds and conjugate folds indicate compression in a horizontal plane in a north-south direction.

The Geological Survey map (Visser, compiler, 1956) shows the Moodies rocks swinging around in a broad arc and extending in a southeasterly direction ending at a bend in the North Kaap River. The writer could not locate this southeasterly trending limb but instead found the western extension of the Kaap River Fault, the fault plane of which is quartz filled for much of its length. The Kaap River Fault, which can be traced into the area to the east for several miles, is a large reverse or high-angled thrust fault with an upthrow to the south, exposing characteristic Onverwacht schists along much of its length. In the area to the east, the Kaap River Fault, previously known as the Main Southern Fault (Viljoen, 1964), truncates the fold trends of the Lily Syncline and eliminates entirely the southern half of this structure.

The western contact of the calcareous quartzites with the talc and tremolite schists of the Jamestown Schist Belt is nowhere clearly exposed but some of the schists adjacent to the Moodies rocks are also foliated in a north-south direction and probably form part of the fault zone extending along the western side of the block of sediments. Near the weir, and also probably in the fault zone, a quartz and felspar porphyry body outcrops.

D. STRUCTURE OF THE JAMESTOWN SCHIST BELT

(a) Introduction

The Jamestown Schist Belt consists of a number of large- and small-scale structures forming collectively a major synclinorium. Many of the structural features encountered in the area have already been mentioned or described in earlier sections of this chapter. It is intended here to present a more detailed and methodical statistical account of the various structural geological parameters that could be measured fairly consistently throughout the area. These results together with the findings in the Eureka Syncline (to be described later) will be used to explain the tectonic history of the area to the north of Barberton and will also be fitted into the regional structural pattern of the Barberton Mountain Land as a whole.

(b) Structural Parameters Observed and Measured

Besides the systematic measurement of strike and dip of schistosity in the Jamestown Schist Belt, and foliation in the Nelspruit and Kaap Valley granites, the typical small-scale structures recorded include the following :

(i) small-scale folds with amplitudes varying from a few mms. to several cms. in size. Where possible the attitude of the fold axial plane, fold axial trace, and plunge of the folds were measured. Many of these micro-folds are too small to measure accurately but the fold axes frequently result in a set of parallel crenulations which form measurable lineations.

(ii) fold axes, axial planes and plunges were recorded, wherever possible, in the large macro-fold structures.

(iii) minor crenulation, accordion, and conjugate folds were measured in order to ascertain the principal stress directions responsible for their development.

(iv) linear structures such as those produced by an alignment of micro-fold axes, elongation of rock particles, or mineral elongation and alignment.

In all cases, in the Jamestown Schist Belt, the schistosity is aligned parallel to the cleavage in the siliceous schist and cherty horizons and no distinction between the two parameters was made when plotting the data. Over 800 structural measurements were recorded and stereographic plots of the data were prepared using either the equal angle stereographic projection (Wulff net), or the equal area projection (Schmidt net).

It was found convenient for the purposes of description to divide the area into two parts, viz. the Schist Belt itself, extending from Noordkaap westwards, and the No. 3 Shaft Syncline area (see locality map, Figure 8, page 90).

(c) Major Structures

(i) Folds

Several major fold structures have been identified in the eastern half of the Jamestown Schist Belt. Possibly the most spectacular of these is the disharmonic fold on the farm Handsup 305 JU, immediately west of Noordkaap. This major structure, developed in differentiated mafic and ultramafic rocks correlated with the Komati Formation, was regarded by the Geological Survey (Visser, compiler, 1956) as "a shallow syncline with an axis pitching towards the southwest". The detailed mapping of the stratigraphy and structure of the fold could not verify this statement. The petrological investigations indicated that the rocks form a differentiated sequence younging in a direction away from the fold axial plane of the structure. In addition, where schists were found interlayered with the more massive ultramafic rocks they generally indicated a vertical, or near vertical, dip of the planes of schistosity.

It became evident that the fold, in fact, represented an anticlinal structure, plunging steeply to the northeast. Measurement of the strike of the schistosity proved doubtful due to the strong influence of the magnetic serpentinized ultramafic rocks on the Brunton compass. The formational trends, however, can clearly be seen on aerial photographs, particularly with the use of stereoscopic pairs (see Plate 6, page 96). The fold axis of the structure strikes approximately 33° N, but the dip of the fold axial plane could not be determined accurately. The writer suspects, however, that it is very steep, probably approaching vertical.

As mentioned earlier, the Handsup fold structure is an exceptionally fine example of a disharmonic fold, having a clearly defined detachment plane (the Albion Fault) parallel to the northwest trend of the Jamestown Schist Belt, on the southwestern side of the fold. On aerial photographs (see Plate 6, page 96) it can be seen that the actual detachment plane is low-lying with respect to the relief, and controls the local drainage. On the south side of the detachment plane the rock-types are virtually identical to those of the fold, consisting essentially of serpentinites and interlayered meta-gabbros as well as metamorphosed pillow basalts. It is in this area that the pillow structures, amygdales and spherulites shown in Plate 4, page 54 were photographed.

The Handsup fold appears to have been the result of late movements in the area north of Barberton and probably developed as a direct result of the inflection of the Eureka Syncline in the east. Ramsay (1963A) referred to the Handsup structure as being part of the Woodstock Anticline and classified it as an early fold (equivalent to his First Structures, F1). Roering (1965), in his attempt to synthesize the structural history of the main gold producing areas of the Barberton Mountain Land, argued in favour of younger movements having been responsible for the development of the fold. He maintained that "if the northwest folding (Ramsay's F3) was intense enough to produce the conspicuous fold pattern in the Consort locality, where Moodies as well as Fig Tree sediments were involved, then the more incompetent basic schists would have suffered even stronger deformation". The fact that the disharmonic fold is still prominent is more convincingly attributed to its having been superimposed on the Jamestown fabric, and not to its representing an undisturbed remnant of a very early structure.

The writer found evidence in the Jamestown Schist Belt indicating that the last apparent movement along the Albion Fault had been left

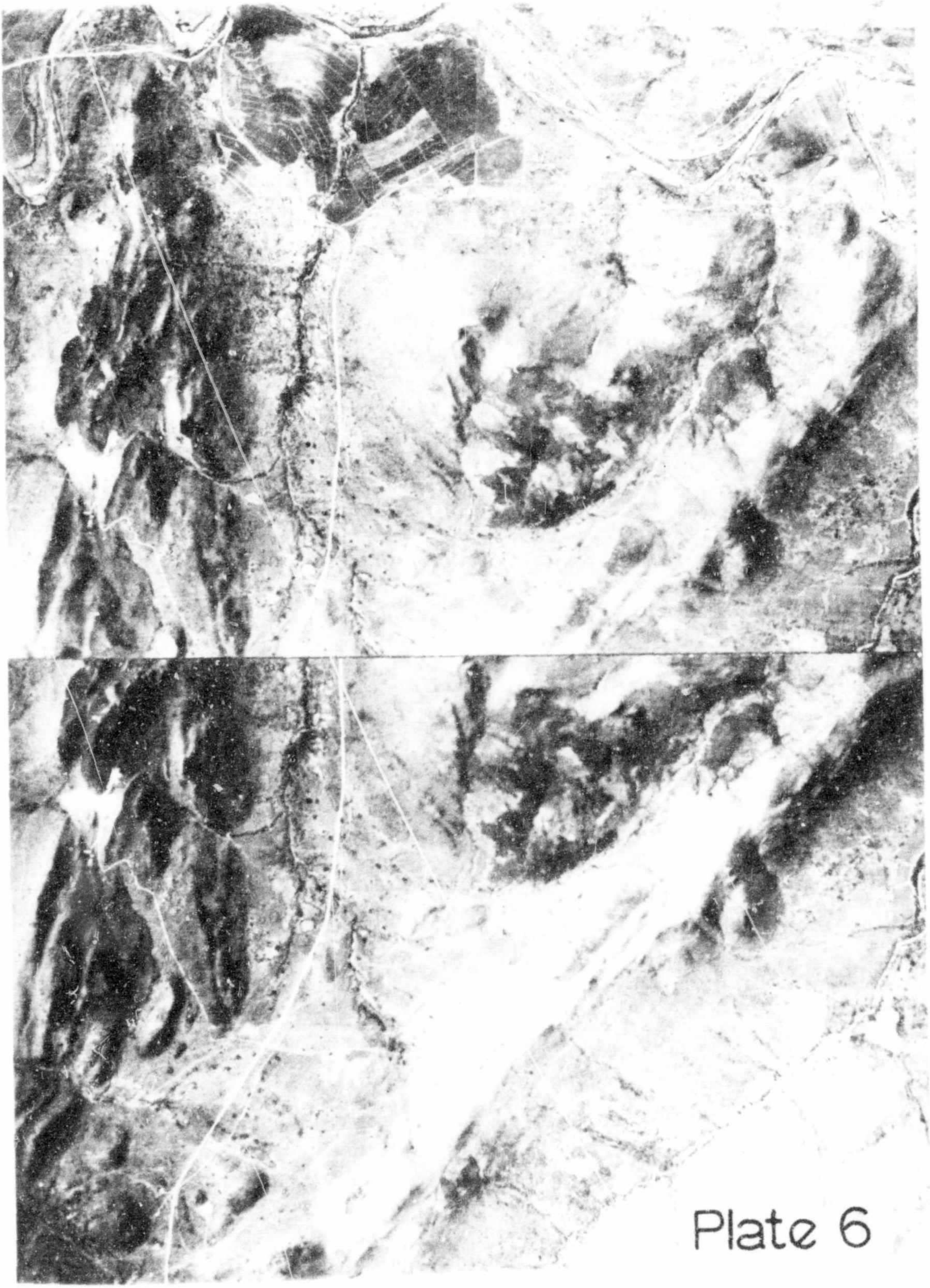


Plate 6

lateral transcurrent dislocation. The fold is envisaged as having been generated by a force from the southeast (i.e. from the direction of the Eureka Syncline). As the stress built up along the fault zone the rocks on the northern side of the dislocation were detached from those to the south and the formations swelled into a massive disharmonic structure. As the fold developed and grew larger, it forced the northwest linear trend of the Mundt's Concession fold to buckle, changing the strike to an east-southeast, and ultimately, to an almost east-west trend (see Figures 4 and 5 and Plate 6).

The second prominent structure in the Jamestown Schist Belt is that of the fold just mentioned above, viz. the Mundt's Concession differentiated ultramafic body, situated immediately north of the Handsup fold. Ramsay (1963A) considered this fold to be linked to the F3 period of fold generation, and he called the structure the Noordkaap Antiform. The initial work in the Jamestown Schist Belt (Anhaeusser, in : Pretorius, 1967) led the writer to believe that the rocks of the Komati Formation, which occupy the central portion of the Schist Belt, formed a boat-shaped, synclinal keel-structure. The Mundt's Concession fold in the area west of Noordkaap was, according to this interpretation, a syncline plunging west.

Continued work in the area, however, showed this explanation to be incorrect. It was the petrological study, and not the structural mapping however, that finally provided conclusive evidence to suggest that the fold was, in fact, an anticline. The differentiation trends of the mafic and ultramafic successions clearly showed the younging direction of the rocks to be away from the central core or fold axis of the structure, in a manner identical to the Handsup occurrence mentioned earlier. Accurate structural work in the area was impossible due to the magnetic character of the rocks, but once again, the trends could be clearly discerned on aerial photographs (see top half of Plate 6, page 96). There is no doubt in the writer's mind that the two differentiated bodies, forming the Mundt's Concession and Handsup folds, are part of the same formation. The intervening valley between the two structures marks the synclinal divide separating the exposed rock-types of the anticlines, which are identical in form, character, and composition, to one another.

The southern limb of the Mundt's Concession fold is strongly disturbed in the area southwest of the Marbestos Mine where the regular east-west trend of the formations becomes disrupted and obscure. Likewise, the regular, layered, trend of the formations on the northwest side of the Handsup fold become poorly exposed south of the road so that no direct connecting link can be made between the formations in the two structures. The disruption of the stratigraphy in this area appears to have been due to several factors, the most important of which, it would seem, was the drag or shearing movements caused by the Albion Fault which flanks the area to the south. As the fault is approached in the regions east of the Albion Gold Mine, and southeast of the Verdite Gold Mine, scattered blocks of the differentiated rock assemblage can be seen to swing around into the fault zone, where they are completely truncated.

The writer suspects too, that when the Handsup disharmonic fold was formed by a stress from the southeast, the rocks on the northwestern side of the structure suffered more intense compression and compaction, resulting in their complete loss of identity. The area is at present underlain by a variety of talc, talc-tremolite, tremolite-actinolite and carbonate bearing schists. In addition, the area is intruded by numerous disconnected and irregular quartz and felspar porphyry bodies, some of which are responsible, locally, for the production of small talc deposits. The valley separating the Mundt's Concession fold from that of the Handsup structure would thus appear to be the intervening syncline between two anticlines. There is evidence also, that considerable faulting took place in this valley. A prominent white quartz vein, representing the fault trace, can be followed for nearly two miles and occurs just north of the gulley. A sheared and brecciated zone, now strongly silicified, also occurs south of the main road near the turnoff to the Marbestos Mine.

What happens to these two major fold structures in the areas to the east is not at all clear. Poor exposure in the South Kaap River Valley, and the cover of the Fig Tree and Moodies sediments of the Eureka Syncline, do not allow many conclusions to be drawn. It is certain, however, that these Onverwacht formations continue southeastwards under the later successions. This is evidenced by the reappearance, in the underground workings of the Sheba and Fairview Gold Mines, in the southeast, of serpentinites and a variety of greenschists.

An interesting relationship exists in the area where the competent Fig Tree and Moodies formations of the Eureka Syncline overlie the less competent Onverwacht rocks of the eastern part of the Jamestown Schist Belt. The generation of the great arcuate structure of the Eureka Syncline, with a fold axis trending northwest, took place more-or-less synchronously with the development of the similar trending Jamestown Schist Belt. The sedimentary successions of the Eureka structure were subjected to deformation that resulted in the development of a 'concentric-type' fold structure, whereas the Schist Belt formations, wedged between the invading Kaap Valley Granite and the Nelspruit Granite, were drawn out into a long, narrow, tapering, 'similar-type' fold structure. The relatively incompetent serpentinites and mafic schists of the Onverwacht succession acted as a lubricating layer, permitting the sliding of the beds above, with the result that, as the Eureka inflection intensified, it was thrust in a northwesterly direction over the rocks of the eastern part of the Schist Belt. A zone of detachment, or décollement, resulted at the interface between the overriding competent rocks and the underlying incompetent varieties. The décollement, marked approximately by the trace of the Lily Fault southeast of Noordkaap, acted as a zone under severe tensional stress. Into the void, created by the deformation, streamed the long, narrow, quartz and felspar porphyry body referred to earlier. It is interesting to note that a similar décollement structure, also associated with small granitic bodies or bosses, intrusive into a zone of tension created by folding, has been recognized by Viljoen and Viljoen (verbal communication, 1968) in the Steynsdorp Anticline, on the south side of the Barberton Mountain Land (see Figure 3, page 51).

Another major fold structure, and one which probably forms the true axis of the entire Schist Belt, is that to the north of the Worcester Gold Mine. The fold is not very clearly exposed and is defined by the convergence of the uppermost cherty horizon of the Theespruit Formation, in the area just east of the Nelspruit-Barberton main road. Rocks of the Komati Formation, lying stratigraphically above the chert horizon do not show any fold closures, the area having instead a strong linear trend, marked by prominent schistosity in the metamorphosed mafic and ultramafic horizons. From stratigraphic and structural evidence the fold is a syncline plunging steeply to the southeast on a bearing of approximately 127°. Throughout the Schist Belt most of the minor folds measured gave relatively consistent values and these are plotted in Figure 8C, page 90. There is a spread of minor fold axes from about 0° - 80° but a maxima (±60°) indicates a fairly consistent plunge direction to the southeast. The axial planes of these minor folds are generally very steep, approaching vertical in most cases. A few folds were found plunging to the northwest. The spread of plunge directions in the area is considered to be due either, to differential compression of the folds, and hence, a variation of movement in the 'a' tectonic transport direction or, it may indicate the existence of an earlier tightly folded terrain, the presence of which has been entirely destroyed by superimposition of the strong linear Schist Belt trend.

To the west of the major fold described above, the reconnaissance mapping indicated the presence of further fold closures (see Figure 4, page 54). South of the trigonometrical beacon Hilltop (3770 feet), isoclinal folds were encountered, and N.D. Harte (personal communication, 1967) recognized an anticlinal structure, outlined by chert horizons of the Theespruit Formation, with a fold hinge closing in a southeasterly direction. The writer found that the synclinorial fold axis of the Schist Belt could be traced westwards, from the Worcester Mine area, through the central area, and on towards the escarpment. An additional fold-hinge of a synclinal structure was located on the farm Ridges 487 JT and Lot 159, approximately 5 miles from the escarpment near Kaapsehoop (for localities consult 1:50,000 map, Visser, compiler, 1956). The fold here plunges eastwards. On a regional scale it would appear that between the farms Waterfall 461 JT and Langrand (Lot 160) an elevated area developed, from which the Jamestown Schist Belt tapered in two directions. The area to the east is represented by most of the Schist Belt itself, while that to the west is obscured by the younger cover of the escarpment formations. Exposures of the far westerly continuation of the belt can, however, be seen in the Elands River Valley, 5 miles west of Kaapsehoop, where the Elands River has cut its way down through the Transvaal and Godwan rocks in the area. Evidence of the existence of the anticlinal, or elevated, zone extending through the far western part of the Jamestown Schist Belt was further strengthened by the gravity data (see the Bouguer Isogal Map, Figure 4, page 54). Low gravity values extend from Badplaas, in a north-easterly direction parallel to the escarpment, and traverse the western extension of the Schist Belt before swinging north towards Sabie.

Mapping in the area north of the Worcester Gold Mine, adjacent to the Nelspruit-Barberton main road, revealed the presence of two further large-scale fold structures. Immediately north of the North Kaap River in this area is a 'Z'-shaped drag fold, developed in a banded cherty horizon of the Theespruit Formation. Some of the sediments encountered in this horizon, between the Mary Hope gold workings and those of the Kaffir's Ltd., Mine (see Figure 4, page 54), are comprised of ferruginous shales and greywackes, chert, phyllites, and quartz-sericite schists. The rocks are all very steeply dipping and are strongly schistose parallel to the trend of the formations. The cherty horizon, outlined a drag fold, produced as a result of intraformational right-lateral transcurrent movement. The formations are intensely cleaved, almost all traces of the original bedding having been entirely obliterated. In the fold hinges the axial plane cleavage is particularly strongly developed with the result that it is only in the contrasting black and white banded cherts that the original layering can be seen, with the cleavage transgressing it at right angles. From the attitude of the steeply dipping drag fold it would appear that the northern part of the structure produces an anti-cline and the southern part a syncline, both plunging steeply to the east on a bearing of approximately 100°.

To the north of the 'Z' fold is another disharmonic fold with a detachment plane on the northern side of the structure, trending roughly parallel to the Nelspruit Granite contact, which occurs about half a mile to the north. The folded rocks consist of serpentinites, together with interlayered meta-gabbros, and form a succession very similar to that in the Handsup and Mundt's Concession folds. As mentioned before, the

Jamestown Schist Belt is comprised of a series of isoclinal folds, the exact number, and full development of which, are difficult to determine precisely. The great similarity of the rocks of the Handsup-Mundt's Concession bodies with those of this second disharmonic fold, and several other folds in the Schist Belt, leads one to consider whether or not the rocks might form part of one and the same stratigraphic succession. The isoclinal folding may have been sufficiently complex to account for the scattered remnants of differentiated mafic and ultramafic rocks which, in every case, seem to form separately definable, yet unconnected fold structures. An alternate explanation suggests that these assemblages represent separate intrusions of magma that were able to differentiate in much the same way as the bodies in the Komati Formation of the central core of the Jamestown Schist Belt. They would thus represent sill-like intrusions into the lower stratigraphic division of the Onverwacht Group, viz. the Theespruit Formation.

The disharmonic fold north of the Worcester Mine developed as a result of left lateral movement along the detachment plane to the north of the structure. The rocks south of the fault comprise the folded differentiated assemblage, while those to the north consist of poorly exposed sediments, meta-basalts and serpentinites. It appears that, as movement took place along the detachment plane, the rocks on the south side of the fault were prevented from moving to the east by a dome-like body of gneissic granite which occurs in the area to the northwest of the Kaffir Creek Talc Mines and which lies within the Schist Belt itself (see Figure 5, in pocket). The result was that the easterly displaced ultramafic and mafic assemblages were forced against the granitic buttress and were deformed, producing the fold structure.

Another major fold structure occurs to the north of the North Kaap River, in the region of the Kaffir Creek Talc Mines. Onverwacht rocks, forming part of the layered succession to the north of the Consort Gold Mine, continue westwards into the eastern part of the Jamestown Schist Belt where they eventually become involved in complex folding. The successions affected consist predominantly of a variety of metamorphosed mafic and ultramafic schists, serpentinite, and siliceous schist horizons. The latter rock-types, forming conspicuous outcrops, were used to establish the structure in the area. The rocks are strongly schistose and have been drawn out and attenuated by a combination of compression, at right angles to the formations, and shearing, in a direction parallel to the regional trend of the Schist Belt. The result is that numerous shredded, and discontinuous, lenses of siliceous schist appear to "float as rafts" in rocks comprised of talc, chlorite, tremolite, actinolite and carbonate schists. Lenses and irregular masses of serpentinite and talc-carbonate rocks also occur in the area.

The disconnected siliceous schist horizons converge, however, on Lots 135 and 137 and are not found again to the west. Reasons for suggesting that the quartz-sericite schists form part of a synclinal structure have already been given. Apart from the younging directions, deduced from the presence of chert cappings to the siliceous horizons, no other evidence as to the attitude of the structure was forthcoming from the area. In the nose of the fold the quartz-sericite schists are intensely folded on a small scale, with crenulation (kink-band) folds, accordion folds and conjugate folds particularly prominent. The development of these highly plicated rocks in the fold closure is analogous to the parasitic folding so frequently found in the cores of isoclinal folds. The approximate position of the fold axis of the synclinal structure can be seen in Figure 4, page 54, where it strikes east-southeast at approximately 110°. Once again the fold axial plane is near vertical.

Immediately south of this structure, and partly straddling the North Kaap River in the neighbourhood of the site of the old mining settlement of Jamestown, is another recognizable fold structure, the limits of which are indeterminable due to poor exposure on the northern and southeastern flanks. The structure once again consists of a differentiated assemblage of serpentinized ultramafic rocks, together with intercalated meta-gabbros and amphibolitized pyroxenites, identical to those found in the Handsup and Mundt's Concession bodies, described earlier. From the differentiation trend of the assemblages it would appear that the fold is an anticline with a fold closure in the southeast. The strike of the fold axis parallels the regional trend of the Schist Belt, i.e. approximately 130°. The axial plane and plunge of the fold cannot be measured accurately but the attitude of the former is probably near vertical, while the plunge is considered to be at a high angle to the south.

(ii) Minor Structural Data

Figure 8, page 90, summarizes the structural data for the eastern part of the Schist Belt. Measurements in the area west of the Nelspruit-Barberton main road (A), show poles to schistosity planes dipping generally in excess of 70°, with a maxima at 85°. The strike of the schistosity in this area is approximately 115°. Further east (B), the strike changes to between 120° and 130°. There is also a greater spread of the attitude of the schistosity from about 50° to vertical. As can be seen from the stereographic plots of the schistosity (A and B) there is a preferential southerly dip to most of the formations throughout the Schist Belt. Figure 8C, shows a plot of the attitude and plunge of minor folds in the area, while D is a plot of lineations, particularly in quartz-sericite schists and cherty horizons, but which are also present in many of the amphibole and chlorite schists found throughout the region. Many of the lineations are produced by folding on a microscopic scale. This variety is manifest in the brittle cherty horizons as well as in some of the mafic schists. The mafic schists, particularly near the granite contacts, also show a preferred mineral alignment or "stretch-lineations". All the lineations lie on a great circle and have a fairly wide spread, probably indicative of superposition on an irregular surface. The great circle that these points fall on is coincident with the axial plane cleavage and schistosity throughout the area.

(iii) Faults

The Jamestown Schist Belt is traversed by a number of longitudinal strike faults, some of which are clearly evident in the field. The Albion Fault, about which mention has already been made, can be traced from Caledonian Siding northwestwards for a distance of about 15 miles, adjacent and parallel to the Kaap Valley Granite contact. In the southeast the fault acts as the detachment plane for the Handsup disharmonic fold. Further northwest the fault is responsible for truncating obliquely the trends of the rocks of the Komati Formation, and near the Worcester Gold Mine it causes left-lateral transcurrent dislocation of the cherty horizons of the upper part of the Theespruit Formation.

The fault can be traced practically along its entire length, the fault plane usually being filled by white vein quartz. Near Kaffir Creek the fault zone is marked by a massive white quartz vein and areas of intense carbonation. Along some of its length, viz. in the area northwest of the Handsup fold, numerous quartz and felspar porphyry bodies intrude the fault plane. Elsewhere the rocks adjacent to the fault are strongly sheared and schistose with talc schists commonly developed.

A second major fault is the Kaap River Fault on the north side of the Mundt's Concession differentiated body, and separating the latter from the No. 3 Shaft Syncline of the Consort Mine area. This fault is best developed northeast of Noordkaap where a white quartz vein also marks the fault plane. The fault continues eastwards into the Jamestown Schist Belt, the rocks to the south of it being upthrown along its entire length. The fault dissipates itself westwards in the Schist Belt where it becomes part of an intraformational shear zone, strongly carbonated in places.

A third strike fault that can be traced for over 6 miles occurs along the northern side of the Schist Belt and, like the two other faults just described, appears to have suffered late left lateral transcurrent movement. The fault seems, furthermore, to have developed fairly late in the history of the Schist Belt. It can be traced from the northwest, where it forms the detachment plane for the small disharmonic fold north of the Worcester Mine, eastwards into the Nelspruit Granite north of the Kaffir Creek Talc Mines. In the granite terrain the fault builds a massive, resistant ridge of white vein quartz and the granites adjacent to it are strongly sheared.

Many other shear zones occur in the Jamestown Schist Belt and are frequently aligned parallel to the regional trend of the schists. Most of them occur as intraformational shear zones, their presence being marked by the numerous white quartz veins seen in the mafic schists of the area, as well as by the high degree of carbonation encountered.

To the northwest of the Consort Gold Mine, near the Nelspruit Granite contact, several faults occur that are aligned roughly parallel to the Consort Trend. The writer considers that these faults developed at the same time as the intense folding in the Consort Mine area. Rocks to the northwest of the mine were forced to accommodate themselves under compressional conditions. The serpentinites were able to "flow" easily and were squeezed into a number of irregular bodies, some of which invaded the sedimentary rocks of the Fig Tree Group. The siliceous-schist horizons, on the other hand, were thrust in a northwesterly direction and were aided in their movement by displacement along the faults that developed in the area.

Other faults occur in the Mundt's Concession body where they cut obliquely across the strike of the differentiated assemblages. In the synclinal valley separating the latter body from the Handsup fold a fault occurs parallel to the axial plane of this structure. Evidence is lacking, but the fault does trend towards the Woodstock fault, or mylonite zone, and the two may be part of one and the same dislocation. The region where the faults may join is, however, covered by arable farmlands.

E. THE STRUCTURE OF THE CONSORT MINE AREA

The Consort Mine area, approximately 2 miles north of Noordkaap at the eastern end of the Jamestown Schist Belt, comprises a number of isoclinal folds made up of a series of parallel anticlines and synclines (see Figure 7, page 88). As can be seen from this diagram the entire Consort Mine area consists basically of four major fold structures with which are associated many smaller folds. The folds all have axial plane traces striking roughly south-southeast and they plunge at variable angles in the same direction. From north to south these main folds are listed by Viljoen (1964) as follows :

(i) the Top Section Syncline

(ii) the Prince Consort Syncline

(iii) the No. 7 Shaft Anticline, and

(iv) the No. 3 Shaft Syncline.

The Top Section Syncline was found by Viljoen (1964) to consist of the east-west trending Consort "Contact" together with hanging wall hornfelses that swing south into a rather tight fold, the southeastern continuation of which is truncated by the Blue-jackets Fault. The writer, mapping the area to the west, found that the cherts and hornfelses of the Consort "Contact" were greatly disturbed by faulting and pegmatite intrusion in the hinge zone of the structure. Isolated blocks of Fig Tree sediments occurred scattered and twisted between irregular, very coarse-grained pegmatites associated with the mobilized border phase of the Nelspruit Granite to the north. In addition, masses of apparently intrusive serpentinite, in places altered to tremolite or talc-tremolite schist, further complicated the geology of the area.

The Prince Consort Syncline occurs in the area south of the Blue-jackets Fault and, according to Viljoen (1964), is the best exposed of the major folds. He found that the most striking feature of all the fold structures is the very regular orientation of their axial plane traces which have an average bearing of 145°. The vast majority of these folds were found to plunge at various angles to the south-southeast, the attitude of their axial planes often being nearly vertical or steeply southwest dipping, thus indicating slight overfolding to the northeast.

The No. 7 Shaft Anticline, southeast of the Mine offices consists of a series of synclines and anticlines, two anticlinal structures being known as the Hard Cash Anticline and Shires Anticline. These structures, like most of the other folds in the area, plunge to the south-southeast at variable angles. Surface exposure of these folds is poor and they have been delimited mainly by underground mapping.

The No. 3 Shaft Syncline, to the west of the No. 7 Shaft Anticline, was remapped by the writer. Most of the area underlain by the main fold structure comprises a number of isoclinal folds also making up a series of parallel trending synclines and anticlines (see Figure 7, page 88). Much of the structure lies in a wide meander plain of the

North Kaap River and is not well-exposed. At the time of mapping many of the trees, visible on aerial photographs, had been cut down making it difficult to locate accurately on a map, the exact position of the out-cropping chert horizons. Furthermore, part of the area had been covered by massive slimes dumps from the Consort Mine. However, sufficient evidence was forthcoming to show that the rocks in the area had behaved in a manner similar to those in the main body of the mine to the east and northeast.

Structural data pertaining to the No. 3 Shaft Syncline area is presented in Figure 8 (lower half of page 90). Small folds similar to that shown in Plate 5A, page 91, were plotted on a stereogram and indicate a spread of fold plunges ranging between 5° and 70° on a bearing averaging 115°. In the area to the east, Viljoen (1964) found a similar spread of fold plunges ranging between 20° and 80° to the southeast on a bearing averaging about 145°.

The plunges of the No. 3 Shaft Syncline folds show two maxima at about 30° and 50°, whereas Viljoen (1964) showed only one maxima at 50°. The axial planes of the folds in the No. 3 Shaft Syncline are generally very steep with most of them dipping south, again indicating slight overfolding to the northeast. The orientation of the fold axes has been confirmed by plotting the poles to the bedding surfaces on a stereogram (the pi-diagram method, Ramsay, 1962A), a method which is useful for detecting variations in fold plunge. As can be seen (Figure 8), the poles to bedding show a very irregular spread which is interpreted as indicating an original deformed surface. Had an original flat surface been in existence prior to the folding then the poles to the bedding planes would have formed a regular great circle, and the pole to this circle would have represented the fold axis. A number of great circles can be drawn through the bedding pole maxima in Figure 8 enabling at least 4 fold axes to be plotted. The poles to the numerous possible great circles all lie roughly in one plane but have variable plunges to the south-southeast.

The above evidence from the No. 3 Shaft Syncline, coupled with that of the other fold structures in the Consort Mine area clearly indicates that some type of irregular and deformed surface must have existed prior to the folding at present evident in the area. Ramsay (1963A) found two sets of folds developed underground in the Consort Mine. He stated that "early folds, probably F2 structures with intense mineral orientation parallel to their axes, are deformed by later, F3, structures". This F3 trend (a northwest-southeast trend) is so prominent throughout the northern part of the Barberton Mountain Land that Roering (1965) referred to it as "the Consort Trend".

The development of the Consort Trend, with a bearing of ± 135° in the Consort Mine area, is clearly due to a stress field acting in a southwest-northeast direction, thereby causing the superimposition of the NW-SE fold trend. Further evidence of the orientation of the stress field responsible for the Consort Trend is afforded by small-scale accordion and conjugate folds such as those shown in Plate 5, C and D, page 91. Pebbles flattened by an earlier deformation are also folded about NW-SE trending fold axes (Plate 5B, page 91). A plot of 3 conjugate folds in quartz-sericite schists (Figure 8, page 90) shows a somewhat variable spread of the P. max. stress direction. Two of the points, however, indicate a sub-horizontal maximum stress in a NNE-SSW and a ENE-WSW direction, and the P intermediate poles concentrate fairly consistently near the vertical plane.

F. MINERALIZATION IN THE JAMESTOWN SCHIST BELT

(a) Gold

Apart from the New Consort Gold Mine about which more will be mentioned later, several additional gold and base mineral deposits occur scattered throughout the length of the Jamestown Schist Belt between Caledonian Siding in the southeast and Kaapsehoop on the escarpment. The more significant of these deposits have been plotted on the reconnaissance map of the Schist Belt (Figure 4, page 54).

Most of the important gold ore bodies occur scattered along, or adjacent to, the Albion Fault. These include the Brian Boru, Albion, Olga, Jumbo, Bonny Dundee, Worcester, Lancaster, and Madelaine gold workings. However, only two of these mines, viz. the Worcester and the Albion Gold Mines, produced really significant quantities of gold. Apart from the gold workings along the Albion Fault, several other deposits are situated in the hard, brittle, more competent, cherty horizons that extend the length of the Schist Belt. Examples of this type are the Gem, Mary Hope, New Independence, and Kaffirs Ltd., ore bodies. Most of the remaining gold workings are situated along shear zones in the schists, where gold-quartz veins are generally developed parallel to the schistosity trends. The Dudley, Criterion, and Verdite workings are examples of this type. The Verdite Gold Mine is located northeast of the Albion Gold Mine, in rocks of the Mundt's Concession differentiated body and is plotted in Figure 5 (in pocket). A few small deposits were found in the Kaap Valley Granite, usually in shear zones very close to the contacts with the Schist Belt. Most of these occurrences are located just north of Kaapsehoop (Koffiekultuur, Maizie, Hester, Ophir) while the Caledonian workings are located in a shear zone in the granite near

Caledonian Siding. The quantity of gold recorded from the mineralized occurrences in the granites amount only to a few hundred ounces. Available production figures for workings in the Jamestown Schist Belt, including the Consort Mine will be given in a later section.

(b) Asbestos

Apart from the gold, chrysotile asbestos, talc, and magnesite, have been mined from time to time in the area. The Marbestos Mine on Mundt's Concession recovers mainly grade 7 fibre, the ore body itself, being situated in the core of the fold, approximately 2 miles northwest of Noordkaap. The asbestos occurs in a zone of serpentinized olivine peridotite that is sandwiched between meta-gabbros on the one side and serpentinized pyroxene peridotite on the other. There is fibre development in many other places where the serpentinized ultramafic rocks occur, but the quality and density of fibre is poor. Prospecting has been carried out further west of the Marbestos Mine in the same potential ore horizon, where cross-faulting has caused the local development of fibre seams. The quantity, as well as the quality, of this ore does not, however, appear to be of a high enough standard to warrant exploitation. Farther to the west, near Kaffir Creek, longer fibre than that recovered at the Marbestos Mine has been worked in the past on Lots 77 and 78, but no mining has taken place in the area for several years.

Other chrysotile asbestos workings occur in the far northwestern part of the Jamestown Schist Belt near the escarpment. Here the New Amianthus, and Star Mines are presently operating, while the Munnik Myburgh Mine has not produced for several years. The quality of the ore from these mines is generally very much better than other deposits on the northwestern side of the Barberton Mountain Land. The chrysotile ore deposits of this area are also located in differentiated ultramafic and mafic rocks similar in many respects to the Mundt's Concession body. However, only serpentinized pyroxene peridotite and pyroxenite act as host rocks to the fibre. These bodies have been discussed and described by van Biljon (1964).

(c) Talc

There are numerous talc workings scattered throughout the Schist Belt, the most prominent occurring in the area of the Kaffir Creek Talc Mines. Here, a number of widely separated talc occurrences have been mined up until recently. The talc is developed in highly altered serpentinites that have been caught up in the intense folding and shearing experienced by the formations in the area. Many of the deposits are located adjacent to blocks, or continuous bands, of quartz-sericite or quartzfuchsite schist. As mentioned earlier, the formations in the area of the talc mines have undergone isoclinal folding and metamorphism. The talc in the Kaffir Creek area developed as a result of the strong deformation, coupled with steatization processes associated with the intrusion of nearby granite magma. Carbon dioxide metasomatism of the serpentinites also took place, resulting in the production of dolomitic and talc-carbonate rocks. Isolated pods of high quality talc have been mined in the area but, in general, the talc has many impurities and is mainly of industrial grade.

Most of the remaining talc occurrences in the Schist Belt are situated either along faults or are adjacent to quartz and felspar porphyry intrusives. The Albion fault-zone has been responsible for the development of a great number of small talc deposits, a notable example being the Albion Mine, where both talc and gold have been worked. On the geological map of the Jamestown Schist Belt, the positions of most of the small talc deposits and quarries have been plotted (see Figure 5, in pocket). South of the Mundt's Concession differentiated body and in the area northeast of the Handsup fold are numerous talc workings associated with porphyry intrusives. These talc occurrences formed as a result of hydrothermal activity associated with the emplacement of the porphyry bodies. The talc developed as a result of the steatization of serpentinized peridotites.

(d) Magnesite

Only one magnesite deposit has been located in the Jamestown Schist Belt and this proved to be of poor quality, and never constituted a minable ore body. It occurs on Lot 70 in serpentinized ultramafic rocks forming part of the western extension of the Mundt's Concession differentiated ultramafic body. In many respects the magnesite has formed under the same geological conditions as the large deposits in the Kaapmuiden area, about 23 miles to the northeast. Here Viljoen and Viljoen (in : Pretorius, 1967), have established that the magnesite deposits occur in the lower magnesium-rich zone of a layered differentiated ultramafic body. The lower magnesium-rich zone is followed by iron-rich, blue-green serpentinite, and this in turn, by pyroxenite which, in every case, terminates an individual differentiated ultramafic cycle.

That the magnesite occurs generally in highly magnesian-rich rocks was shown to be the case by examining some of the ultramafic host rocks of the magnesite deposits. Thin section study showed that many olivine crystals have survived the alteration processes and occur as fresh, high birefringent cores, surrounded by antigorite, talc and magnesite. Although no suitable olivine grains could be extracted from the magnesite occurrence in the Jamestown Schist Belt, the writer was able to separate some large olivines from the Sugden Siding magnesite body 8 miles east of Noordkaap. This magnesite occurrence, like those near Kaapmuiden, and that in the Jamestown Schist Belt, is developed in a layered differentiated serpentinite body that has been described previously by van Zyl et al, (1942) and Anhaeusser (1964).

The forsterite contents of two samples from the Sugden Siding quarry were determined by the writer using X-ray methods of Yoder and Sahama (1957) and Jambor and Smith (1964) (see Table 5).

TABLE 5

FORSTERITE CONTENT OF OLIVINE : SUGDEN SIDING MAGNESITE MINE

Sample No.	Rock-type	Percentage Forsterite in Olivine d (130) method	d (174) method
HB 11a	serpentinized olivine peridotite	92.5	93.5
HB 2	serpentinized olivine peridotite	100.0	94.0

d (130) method of Yoder and Sahama (1957)

d (174) method of Jambor and Smith (1964)

In general the correspondence of values using the two methods was good indicating a very high Fo percentage of the olivine. The d (130) method did, however, tend to give values somewhat higher than the d (174) method. This tendency was confirmed by R.P. Viljoen (verbal communication, 1968) who also found that many of the olivines he had examined by this method in the Kaapmuiden differentiated bodies gave Fo values approaching 100 per cent.

The rocks in the layered ultramafic bodies on the northwestern flank of the Barberton Mountain Land, in which magnesite tends to form, are thus exceptionally rich in magnesia. It appears, that where the magnesian content diminishes there is more likelihood of the development of chrysotile asbestos in the serpentinites. This relationship can be demonstrated positively in the Kaapmuiden area where the later peridotitic products of the differentiation cycle give rise to chrysotile ore-bodies such as that of the Barberton Chrysotile Asbestos Míne, southwest of Malelane (Viljoen and Viljoen, in : Pretorius, 1967).

(e) Nickel

Nickel mineralization, apart from isolated occurrences such as the trevorite body in a shear-zone near Sheba Siding, east of Noordkaap, (Crosse,1921]; Partridge, 1943; Anhaeusser, 1964) is virtually unknown in the Barberton Mountain Land. However, samples of serpentinite, collected from various localities in the Jamestown Schist Belt, on assay, show concentrations of nickel above the normal background values associated with ultramafic rocks. The metal contents are, nevertheless, too low to constitute workable deposits. In the following table (Table 6) analyses indicating the average nickel content of ultramafic rocks from several parts of the world are given for comparison with some of the values obtained from serpentinites in the Jamestown Schist Belt (Table 7).

TABLE 6

NICKEL CONTENTS (IN PARTS PER MILLION) OF ULTRAMAFIC ROCKS FROM VARIOUS PARTS OF THE WORLD

Description of Rocks	and Reference	Nickel in ppm
Peridotite	(Rankama and Sahama, 1950)	3160
Ultrabasic rocks	(Goldschmidt, 1954)	up to 3600
Peridotite	(Average of 5 analyses, Clarke, 1924)	1600
Ultramafic rocks	(Turekian and Wedepohl, 1961)	2000
Ultramafic rocks	(Goles, 1967)	1500-2000

An average value of 3100 ppm Ni was obtained from the above 30 samples. From the table (Table 7) it can be seen that a number of samples gave nickel values in excess of the highest values listed in Table 6. The writer considers that these above-average background Ni values can be ascribed to slight concentration of the metal, consequent upon the thermal and dynamic metamorphism associated with the emplacement of the intrusive granites in the area north of Barberton. Several samples of mafic schists associated with the serpentinites gave values ranging between 400 and 1700 ppm Ni.

TABLE 7

NICKEL CONTENTS (IN PARTS PER MILLION) OF SERPENTINIZED ULTRAMAFIC ROCKS FROM THE JAMESTOWN SCHIST BELT

Sample No.	Nickel in ppm.	Sample No.	Nickel in ppm.
T 2	5700	T67	2700
T 3	2900	T72	3900
T 4	2900	T78	4200
T10	5200	T81	4100
T12	3300	T84	2700
T13	2500	T88	2200
T14	3500	K 9	3100
T26	4100	K16	2700
T33	2500	J 1	2500
T42	2300	J 3	4200
T46	2000	J8A	1700
T48	3600	J8B	2600
T55	2400	J12	3500
T56	3000	J16	1800
T65	2600	J17	3000

Analyses carried out by the National Institute for Metallurgy, Johannesburg.

Recent work in the area to the north of the Consort Gold Mine by Rand Mines Limited has exposed several shear zones in light yellow-green serpentinites. In some of these, nickeliferous magnetite occurs as irregular veins and patches but the quantity and grade of the ore found to date does not warrant exploitation (Macaulay, verbal communication, 1968). To the writer's knowledge the only other reported occurrence of nickel in the Barberton area is that mentioned by Hall (1924) in the New Amianthus asbestos mine. Here oval lumps of nickel sulphide were found embedded in slip-fibre bands of chrysotile asbestos.

(f) Verdite and Buddstone

In addition to the minerals already mentioned, a semi-precious variety of serpentine, known locally as verdite, has been mined from several localities in the Jamestown Schist Belt. It is an attractive dark-green rock that has been used for small ornaments as well as for the purpose of interior decorations in buildings. It has, in fact, been used in the interior of such prominent buildings as the Bank of England, and South Africa House in London.

True verdite is soft, and easily worked, but several occurrences of a hard, siliceous variety have been mined expressly for the manufacture of brooches, necklaces and bracelets. The verdite does not occur in large quantities and is frequently intergrown with grey or greyish-green talc. Some deposits of verdite are also associated with a highly colourful, green and white banded, and highly contorted rock known locally as "buddstone". This rock is also used as an ornamental stone or as semi-precious material for the manufacture of jewellery. As far as the writer is aware the occurrence of verdite and buddstone is entirely restricted to the Barberton Mountain Land, and in particular to the Jamestown Schist Belt and to the belt of the Onverwacht rocks flanking the Kaap Valley Granite southwest of Barberton. Neither verdite, nor buddstone are referred to by Dana and Ford (1958).

The verdite has been quarried from about six separate deposits, five of which are situated in the Jamestown Schist Belt. Two localities where buddstone is associated with the verdite, are known, the one being in the Jamestown Schist Belt north of the Worcester Mine, and the other occurring southwest of Barberton. Three verdite quarries are situated in approximately the same stratigraphic horizon around the Handsup fold west of Noordkaap. The Verdite Gold Mine on Mundt's Concession, besides producing gold, which occurred on shear surfaces in serpentinized ultramafic rock, also mined talc and verdite. A fifth locality, where verdite has been mined, is situated in the layered differentiated ultramafic rocks north of the Kaffirs Ltd., Gold Mine, west of the Barberton-Nelspruit main road.

The verdite occurrences are confined to the layered differentiated bodies and appear to have formed as a result of structural disturbance coupled, possibly, with some hydrothermal activity. The deposits are generally very small and pod-like, most of them being no larger than an average-sized room. The verdite is always found at the contact between pyroxene peridote layers and the overlying, tougher, more massive, metagabbroic layers. Generally there has been some shearing, or differential movement, along the contacts of these two rock-types resulting in the

Author Anhaeusser C R (Carl Robert)
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