A few days before the *bodika* commences the inner council of the chief will nominate a master (*rabadia*) and a deputy-master (*moditiana)* for the school. These men will control and direct the activities of the session. The previous initiates (*mediti*) are largely responsible for the initiation of the boys under the direction of the *rabadia*. A *thipana* (witch-doctor) is also appointed to perform the circumcision. After the functionaries were appointed the chief will provide then with a bag with the foreskins of the boys of the previous initiation school. These will be roasted and mixed with *tshidi* – the usual preventative medicine against witchcraft. This medicine will be used to treat the site where the new initiation lodge will be built.

The chief will announce the day of the commencement of the *bodika* and will invite neighbouring chiefs to attend the opening ceremony. The boy's hair will be shaven by their mothers and they will cast off their old clothes. Their fathers will provide them with new loin skins.

The boys will then gather in the *kgorong* and be instructed to go into the veldt for the day to collect fire wood for the chief and bark from the trees which are fashioned into small rings to be used the following day to tie up their genitals after circumcision to protect their wounds.

That night the initiates sleep in the *kgorong* with all the men of the tribe. Men are not allowed to have relationships with women during this period. The *mediti* engage in sham fights. One of the most important ceremonies of the whole initiation is performed this night and will be regularly repeated throughout this session of the initiation school.

During the night of the opening ceremony the initiates will line up in a single file with the *kgosana ya mphahto* in front. He is followed in descending order (rank) by the other boys of the royal *kgoro*. These are again followed in a similar fashion by the boys of the next *kgoro* in seniority and so on down to the lowest boy in

rank of the most inferior *kgoro*. The boys are made to bend over and each is lashed twice with a *moretlwa* switch by the *rabadia* starting with the *kgosana ya mphahto* and ending with the boy lowest in rank.

The purpose of this act is to indicate that status and rank (birth and social superiority) will henceforth be the factor that determines leadership and not strength and ability as the case was when leadership was determined by means of stick fights between boys. This ceremony, as many others during initiation, underlines the fact that initiation is not merely an educative institution, but that it is largely and institution of, and introduction of the candidates into the social and political structure and organisation of the tribe.

Before daybreak the following day the war horn (*phalaphala*) will be blown whereupon the boys, accompanied by the chief in front, *mediti* and all the tribesmen, in rank and file, will move to the river while singing to conduct the circumcision ceremony. The boys will be circumcised according to rank although a boy of low status (*molobi*) will be used as a model, in case of witchcraft, and be circumcised before the *kgosana ya mphatho*. The *molobi* will also proceed in all other activities during the initiation.

After circumcision all the boys are made to laid down in the shade of a tree for the rest of the day. During the night and the latter part of the *bodika* the boys remained naked. Each son is given a specially prepared leather skirt (*motshabelo*) by his father. Formerly, the wounds would remain unattended to, to heal of their own accord.

After the circumcision the boys return home to rest while the *mediti* are busy building the initiation lodge (*mphatho*) where the boys spend the nights for the duration of the ceremony. The lodges of successive *bodika* sessions are always built on more or less the same site. This place is taboo for all women and children.

When the lodge is completed and the fires burning the boys will march into the *mphatho*. Their march will be in the same rank and file in which they were lashed. They may only enter the lodge through their own entrance leaving their skirts outsides. Here they will gather every night for the duration of the ceremony which lasts approximately three months. During this period they may not be seen or come into contact with any women or uninitiated children.

For the first few days after circumcision they remain in the lodge to allow their wounds to heal. As soon as scabs have formed they start their daily routine. The fact that they are now in a dangerous and transitional phase is emphasised by various customs. They have to whiten their bodies with ash and chalk. They are taught a peculiar secret language. All the utensils they use and orders that are given have special names during this ceremony.

Excessive care is taken against witchcraft as can be seen in all the precautionary measures that are taken with their meals. Women from the village prepare their food which is left at a safe distance from the lodge.

The daily routine during the whole session changes very little. Most of the day-time activity is taken up by hunting and practising the crafts of men such as wood working and leather making.

Early and late afternoons as well as evenings are devoted to formal instructions and the singing of initiation songs. They are taught the essential manly qualities of cowage and endurance. They are also taught to be obedient to their fathers and disobedient to their mothers. Much stressed is laid on the essential attitude of deference towards and respect of the chief. They are taught the tribal history and the genealogies of the royal family. They are instructed in tribal law and in sex education. The aim of the formal instruction is to prepare the boy as a

potential adult for the social, political, jural and economic roles that will be expected from him as a man.

This formal instruction is done by teaching the boys traditional formulae which has to be learnt by heart in an archaic form of language. Boys of each *kgoro* are instructed by the *mediti* of their own group while sitting around their own fire in the *mphahto*.

Throughout the session the boys are subjected to various tests of endurance. The lashing according to rank continues daily. When they forget their formulae they are harshly beaten by the *mediti*. It occasionally does happen that boys may die during the initiation. Such incidents are accepted as a boy 'has been eaten by the *koma*'.

Shortly before the end of the session each age group will receive a regimental name as the group become a regiment (*mphatho*). The name of the regiment depends on the name of the leader.

As soon as the regiment has been formed the tribe will be informed of the closing of the session. Preparations are made for a feast with the chief inviting neighbouring chiefs for the homecoming of the boys.

> 'During these last days the boys will be shown how to break up a rock into smaller pieces by heating it with fire and subsequently cooling it with water. Every boy has to prepare a few of the slabs which break off in this manner by smoothing their surfaces. These flat slabs are then given to the *mediti*. On their last day, the boys are sent out to collect fire-wood, which they have to take to the chief on their return. In their absence, the *mediti* erect some cairns with the stones near the men's entrance to the lodge. They usually built three cairns, slightly conical in shape, one large, approximately three feet high, called *phiri* (hyena), and two smaller ones

about half the size of the previous one, called *phiŝana* (hyena cub). In these cairns are placed some of the ashes of the *bodika* fires, those of the royal and principal groups in the *phiri*, and of the subordinate groups in the *phiŝana*. When the boys return to the lodge they will be shown the cairns, which will remain as a visible monument to their regiment.' (Mönnig 1978: 120)

Early the next day all the men of the tribe will again gather at the lodge. The boys will bath to wash off the white colouring. Each father will cut his son's hair and clothes him in a new loin-skin. Their bodies will be rubbed with a mixture of fat and red-ochre.

While the boys are being prepared the remaining men will break up the lodge. The boys are lined up according to rank and file and will be lashed for the last time. As they proceed towards the village in rank and file, not looking back, the *rabadia* will set the *mphatho* to fire.

On arrival in the village the boys are joyously greeted and a great tribal feast held in their honour. A short period of fasting is now observed by the boys, all mothers whose first sons are candidates and the girls of corresponding age group. This is ended when the boys are ritually bathed to clean themselves from the red ochre. The boys remain at the chief's place for ten days where they are lavishly entertained. After this they are reminded of their duties and responsibilities before they return to tribal life.

6.3 Mining heritage remains

Two main types of mining heritage remains occur in the Modikwa Platinum project area, namely (Figure 2):

- The remnants of the abandoned Onverwacht Platinum Mine's open cast pit on Onverwacht 292KT; and
- A series of incline shafts sunk along the lower eastern slope of part of the Leolo Mountains on Onverwacht 292KT.

Only the shafts along the lower slope of the Leolo Mountains occur in the present Modikwa project area. However, a brief description of the Onverwacht Platinum Mine is also provided below.

The descriptions of the historical mining activities in the Steelpoort below is given in the English metric system, namely feet and inches as this was the measurement system used during the early 20th century.

6.3.1 The abandoned Onverwacht Platinum Ltd

The Onverwacht Platinum Mine is located along the western slope of a long, low bush clad ridge situated across a wide valley to the east of the Leolo Mountain and the shafts on Onverwacht 292KT. Both the shafts and the Onverwacht Platinum Mine date from the early decades of the 20th century when the exploration for and mining of platinum commenced in the Steelpoort (Figure 2).

The Onverwacht Platinum Mine originated from a vertical pipe which originally appeared as an outcrop, a small knoll or a platform of hortonolite-dunite on the western slope of a long, low bush clad ridge that rose 250 to 350ft above the plains surrounding the ridge.

By 1929 the amazing ore body that formed the basis of the Onverwacht Platinum Mine was exposed by means of shafts, tunnels and stopes to a vertical depth of nearly 800ft although a practically barren zone of some 250ft had to be passed to attain this depth which still carried platinum values.

Exposure of the ore body proved that it is an irregular parsnip-shaped segregation of hortonolite-dunite and hortonolite-wehrlite within a much larger body of olivine-dunite that exhibits a transgressive or discordant relation towards the rocks surrounding it. The Onverwacht platinum pipe had the character of a steeply inclined pipe as the hortonolite-dunite body was inclined at an average angle of 78° 30' in a direction S 28° E.

The diagrammatic geological section of the Onverwacht platinum pipe revealed the following geological features (Figure 10):

- 1-2: The ridge which is built of bronzite forming part of a huge sheet of that rock dipping to the west at about 13 degrees. It encloses at least two seams of chromite.
- 3: The olivine-dunite enclosing the hortonolite-dunite 'pipe' exhibits near the surface fairly advanced serpentinisation and is traversed by veins and seams of dense magnesite. The dunite exposed on the walls of the open mine is thus seen to be traversed by a roughly rectangular network of magnesite veins up to 9" in thickness which resent a striking contrast to the surrounding dark rock. The contrast between the hortonolite-dunite and olivine-dunite, while well defined, was extremely irregular. The main body of hortonolite-dunite created wedge-shaped, carrot-shaped and irregular ore shoots in the surrounding olivine-dunite.
- 4: The main body of hortonolite-dunite was roughly circular in plan at the outcrop and measured roughly 60ft by 60ft. The hortonolite-dunite was regularly jointed and in consequence weathered in big rectangular slabs.

- 4a & 5: Horizontal and steeply-inclined vuggy seams and veins of quartz, chalcedony and opal up to 4" thick, or of a dense compact dull-white mixture of magnesite and opal occupying joints in the dunite were much in evidence between the surface and the 50ft level. Some extended to a depth of 100ft but below that depth there was no sign of them.

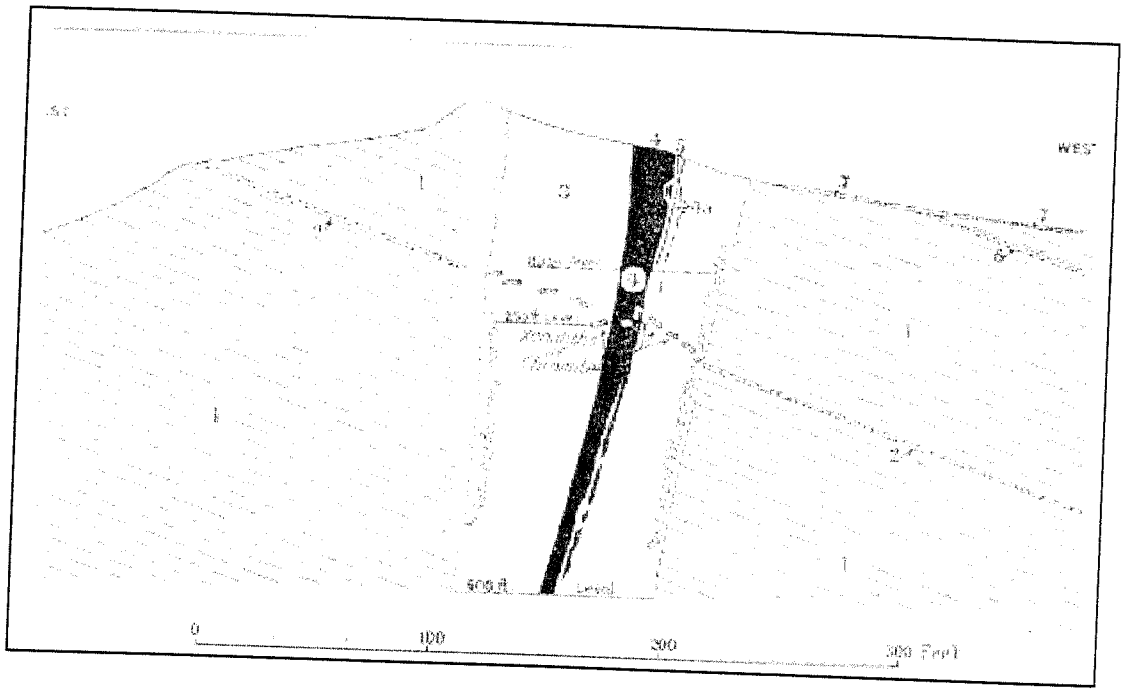


Figure 10- The Onverwacht platinum 'pipe' in vertical section (above) (Wagner 1973:65). The geological deposit associated with the 'pipe' is described in the text.

The Onverwacht platinum 'pipe' changed in shape as its depth increased. On the 100ft level the area of the pipe measured 2 925ft². Below this level it decreased steadily. The 'pipe' area now measured 2 270ft². Below the 350ft level the main body split into three smaller branches or roots. The biggest of these persisted below the level in a continuous body to the greatest depth attained and still had an area of approximately 420ft² on the 750ft level. The other roots was replaced below the 450ft level by irregular patches and seems of hortonolite-dunite which were located roughly parallel to the main root.

The platinum content of the hortonolite-dunite ranges from nil to 1 213 dwts per short ton. In the upper levels of the central part of the 'pipe' it averaged well over 1oz of platinum to the ton. The richest platinum was to be found between the 200ft and 250ft levels. The best average values were encountered on the 250ft level which showed an average of 18,4dwts over a pay area of 2 270ft. Below the 250ft level there was a steadily falling off in values and between 550ft and 700ft the pipe was practically barren. At 700ft good values were again struck. The pay averaged 11dwts over 420ft. These good values persisted to the 750ft level which averages 9,5dwts over a pay area of 420ft². On the 800ft level much lower values were again encountered.

The mining methods that were followed in the Onverwacht Platinum Mine were determined by the types of deposits that were encountered in this mine. Various types of platinum deposits such as the almost vertical dunite 'pipes' (Lydenburg district); big, irregular steeply-inclined lenses (Mokopane) and relatively narrow but very extensive tabular ore bodies with low moderate dips (Rustenburg and Lydenburg) usually determined the mining methods that were used to mine platinum in the early 20th century.

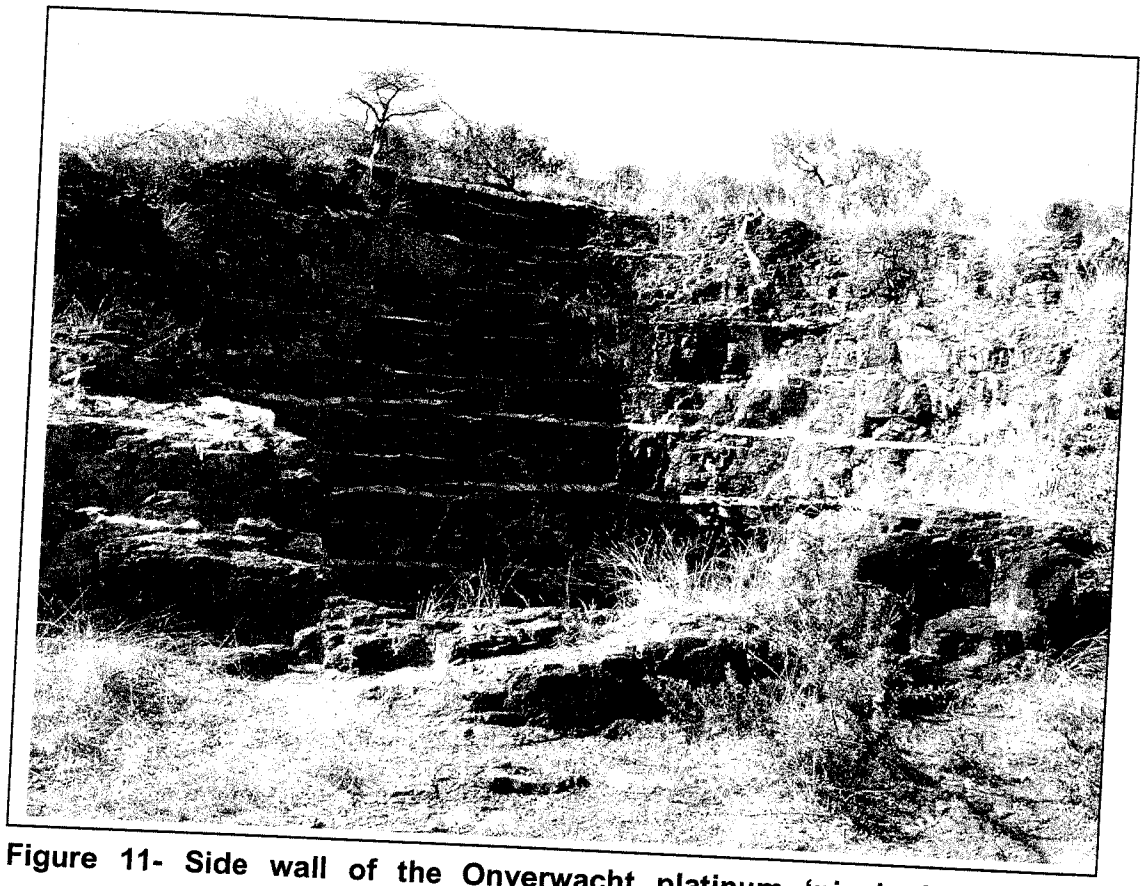


Figure 11- Side wall of the Onverwacht platinum 'pipe' showing the hortonolite-dunite walls of the open mine which is traversed by a roughly rectangular network of magnesite veins up to 9" in thickness. These white veins strike a sharp contrast against the surrounding dark rock.

The dunite occurrences at the Onverwacht Platinum Mine presented rather novel features to South African mining engineers. From the surface to depths ranging from 30-80ft the platinum-bearing dunite was broken in open quarries. The ore below this depth was attacked by three compartment shafts sunk well outside the area of enrichment. From these shafts cross-cuts were driven at intervals of 100ft to intersect the 'pipes'. From the cross-cuts levels were opened up and these in turn were connected by vertical development winzes sunk either within the 'pipes' or just outside them.

For the extraction of the great cylindrical bodies of ore thus blocked out the Onverwacht Mine employed the following. Thin concrete 'mats' or platforms' were built across the 'pipe' at intervals of 50ft and the hortonolite-dunite between removed slice by slice by overhand stoping. As each 'lift' or slice of the ore body was stoped out the excavated area was filled with waste rock tipped from the development winze from the level above.

As stoping proceeded, a timbered ore-pass was constructed through the filled area. Down this the broken ore was sent to the level below to be trammed to the main shaft and hoisted to the surface.

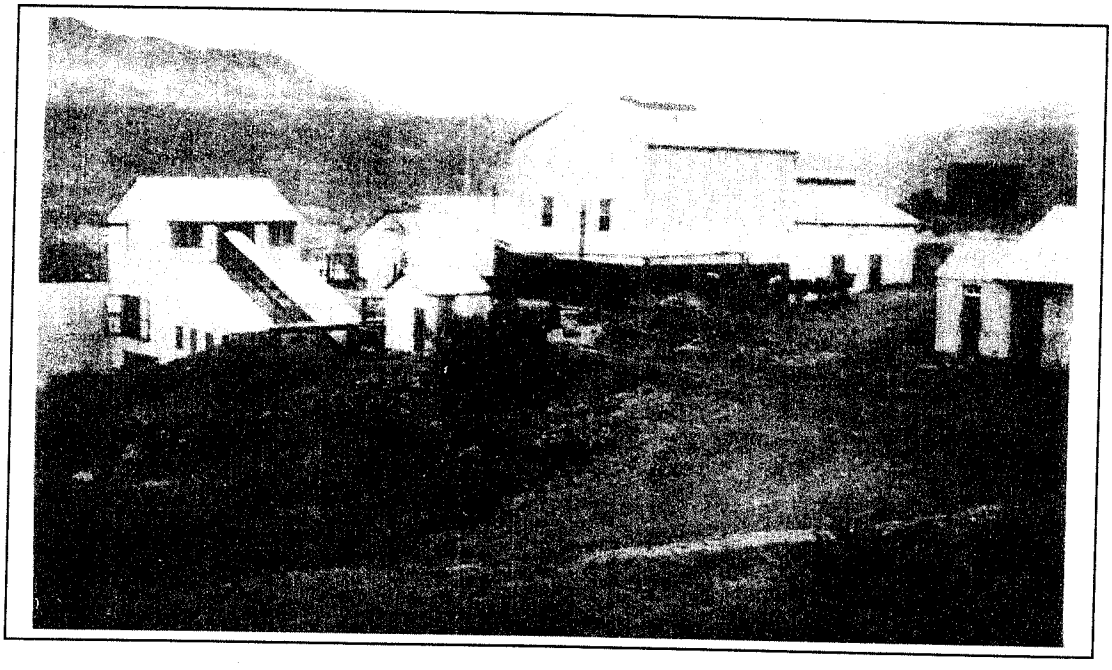


Figure 12- Infrastructure that used to be associated with the Onverwacht Platinum Mine (above). Important plants included treatment plants, power plants as well as mills. Other conspicuous structures were the towering headgear of vertical shafts (Wagner 1973:78, 96).

6.3.2 Shafts along Leolo Mountain

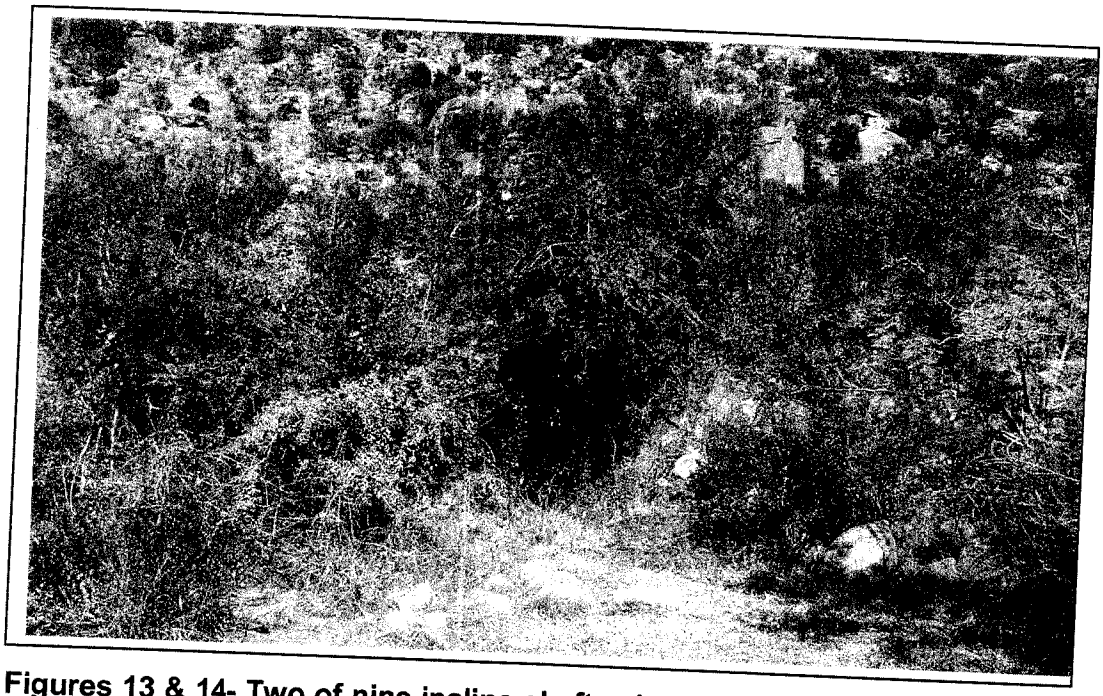
Up the lower slope of the Leolo Mountain range, above Site LIA01, a series of nine prospecting shafts are located from the north to the south along the base of the Leolo Mountain range on Onverwacht 292KT. At least three of these adits occur near Site LIA01 while the remaining six are situated further to the south along the base of the Leolo Mountains, outside the perimeters of Site LIA01 (Figure 2)

These shafts along the lower eastern foot slope of the Leolo Mountain range can be traced back to the search for the Merensky Horizon in the Lydenburg and Pietersburg districts during the early 20th century. A great deal of explanatory work consisting of putting down a number of inclines, several of which attained considerable depths and from which, in the sulphide zone, tunnels were driven on Umkoanestad, Maandagshoek, Forset Hill, Zeekoegat and Middelpunt were done in the years 1925, 1926 and 1927. The operation was finally suspended on 11 August 1927.

The Merensky Horizon was traced at intervals from Rooiboschbult 1965 on the Springbok Flats to Sterkfontein 221 in the southern part of Pietersburg, roughly for a distance of 100 miles.

On Rooiboschbult, the easternmost locality where the horizon was found, the strike was apparently east and west. The horizon did not outcrop but was located by means of prospecting beneath a considerable thick surface limestone deposit. Between Rooiboschbult and Doornvlei 612 where the horizon was next found a gap of some miles occurred. The horizon next appeared at Zeekoegat 312 from where it was traced, almost without a break, as far as Eestergeluk 348, a distance of 40 miles.

The horizon was opened up in this stretch on the following farms: Zeekoegat 312; Middelpunt 20; Umkoanestad 28; Brakfontein 84; Klipfontein 119; Pashashoek 126; Twickenham 336; Hackney 337; Forest Hill 342; Winnarshoek 349; Driekop 170; Maandagshoek 148; Onverwacht 330; Winterveld 424 and Eerstegeluk 348.



Figures 13 & 14- Two of nine incline shafts along the lower base of the Leolo Mountain range. These shafts were sunk during the second decade of the 20th century in search of the Merensky Horizon (above and below).

Figure 15- An incline shaft in operation on the Merensky Horizon during the early 20th century (Wagner 1973:151) (above). The shafts on Onverwacht 292KT had similar appearances and were used to penetrate the Merensky Reef in order to obtain platinum bearing deposits from this horizon (above).

The dip in the Zeekoegat-Eerstegeluk section ranged from 5 degrees to 25 degrees and in places, as far instance on Forest Hill 342, the horizon is disposed in gentle undulations.

A considerable amount of work was done on the horizon in the northern half of Eerstegeluk. The horizon in its normal development was again found in the southern part of Tweefontein 221, a distance of 21 miles, there is an almost continuous outcrop.

Three main facies were distinguished in the Merensky Horison, namely:

- The Maandagshoek facies was developed in the central part of the field. Here the layer consists of a comparatively thick layer of 'Merensky Reef' rather coarse grained in its upper portion which is platinum bearing and a lower portion which is barren of platinum.
- The Zeekoegat facies developed in the northern and north-western part of the fields where the horizon is made up of three layers of 'Merenky Reef' separated by two thin 'chrome bands'.
- The Helena facies as developed in the southern part of the fields in which an inconsiderable layer of coarse pegmatitic norite or feltspathic pyroxinite and thin 'chrome bands' are developed in the uppermost part of a thick body of 'Merensky Reef' – the platinum metals being concentrated here too in the uppermost part of the horizon.

It was found that the platinum horizon in the Maandagshoek facies, on Maandagshoek 148 and adjoining farms such as Onverwacht 292, consisted of a thick tabular body of pseudoporphyrithic pyroxinite diallage-norite carrying platinum in its uppermost portion. The platinum bearing reef (no 3) is variable as to grade and composition and in place encloses patches of coarse-grained pegmatitic norite. Only the uppermost 2 or 3 feet of the horizon carried platinum and, as elsewhere in this part of the Lydenburg district, the average platinum metals content of even this portion of the horizon did not exceed 2 dwts.

7 CONCLUSION AND RECOMMENDATIONS

Modikwa Platinum intends to expand its mining activities on part of the farm Onverwacht 292KT in the Steelpoort Valley in the Mpumalanga and Limpopo Provinces of South Africa. The development project will include the establishment of a new (decline) shaft, a mobile office, roads and a compression. Consequently, A Phase I Heritage Impact Assessment (HIA) study was done for Modikwa Platinum during April 2004. The Phase I report recommended that certain Phase II work be undertaken as the development project may impact on some of the heritage resources.

This report described the Late Iron Age site (Site LIA01), including initiation sites, and the mining heritage remains on Onverwact 292KT and provided, where possible, explanations for the meaning and the significance of these remains. As Modikwa Platinum is located in the heartland of the pre-historical and the historical Pedi chiefdom the description and explanation of Site LIA01 and the inisiation sites was done by using oral tradition and ethnographic information with regard to the historical origins and past life-ways of the Pedi. However, Modikwa Platinum is also associated with a rich mining heritage. Consequently, historical information was used to explain the significance of the mining heritage remains on Onverwacht 292KT.

Site LIA01 is marked by stone walled terraces that serve as retaining walls to create a stepped site located against the lower eastern slope of the Leolo Mountain Range. The site, however, is severely damaged in places as it was re-occupied in more recent times when a local community established their village on top of the older remains. It seems as if the terraces may have contained dwellings, such as huts, and that small enclosures may have been used to keep small stock. No large enclosures for cattle occur near the site. The presence of metal slag that is possibly derived from the smelting of iron may suggest that limited iron working was done in

certain parts of Site LIA01. Archaeological remains such as pot shards occur in limited numbers on the terraces. No grinding stones were observed although these could have been robbed by the inhabitants of the village that is superimposed on Site LIA01.

Site LIA01 seems to have been occupied during at least two periods, namely during the Late Iron Age (c. AD1700 onwards) into the historical period (c. AD1840 onwards, until the last few decades of the 20tth century). The second, recent occupational period explains the presence of tin plate, pieces of glass and the foundations of square mud dwellings on the High Upper Part (HUP).

The large terraces in the HUP of the site followed by the smaller, less complicated and spacious terraces in the Central Part (CP) and in the Lower Part (LP) of the site, suggests some form of social stratification of the site with the royalty (high status community members) living in the higher part of the village and the commoners down below.

At least two initiation sites, each with at least two stone cairns were mapped in the project area. It seems as if the initiation cairns can either be associated with the people who occupied Site LIA01 or with descendants of the people who lived in the stone walled site and who already have abandoned the site but who erected these cairns in close proximity of Site LIA01. These sites can be linked with the initiation school for boys (*bodika*) and were used to keep the ashes from the initiation lodge (*mephatho*). The larger initiation cairn was called the hyena (*phiri*) and the smaller cairn the hyena cub (*phiŝana*) and respectively kept the ashes from the fire places of the boys that were part of the royalty and the boys that were from common rank.

Two main types of mining heritage remains occur in the Modikwa Platinum project area, namely the remnants of the abandoned Onverwacht Platinum Mine's open cast pit and a series of incline shafts sunk along the lower eastern

slope of part of the Leolo Mountains. Both the incline shafts and the Onverwacht Platinum Mine date from the early decades of the 20th century when the exploration for and mining of platinum commenced in the Steelpoort. The Onverwacht Platinum Mine (Ltd) was the third most important role player in the platinum industry in South Africa during the first half of the 20th century. After the collapse of the platinum industry in the 1930's, only two companies remained and amalgamated namely Rustenburg Platinums Ltd.

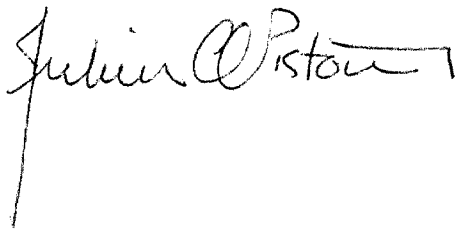
Since the Phase II investigation was undertaken Modikwa Platinum has altered their expansion programme to such an extent that no heritage resources will be affected by the new development project in the near future. Only one of the adits (shafts) along the side of the Leolo Mountain will be re-utilised as this shaft will be used to gain access into the platinum bearing deposits in the mountain range.

The graveyard [GY01] will also not be affected by Modikwa Platinum's proposed expansion activities. This feature will be left undisturbed in its present location where it will be accessible to family members and friends of the deceased to make pre-arranged visits to the graveyard. Modikwa Platinum should consider demarcating the graveyard with a fence in order to prevent that any accidental damage occur to this site.

The exceptionally deep Onverwacht open pit has been demarcated by Modikwa Platinum as part of the mine's safety regulations. This measures will simultaneously contribute to the conservation of this unique heritage site.

No specific mitigation measures are proposed for the heritage resources in the Modikwa Platinum Mine. However, it is recommended that Modikwa Platinum consider monitoring all heritage sites in the mine lease area by means of completing a checklist drawn up for each type/range of heritage resource. This checklist must be updated annually. New heritage sites that are discovered must

be added to this checklist which must serve as the basis of a cultural heritage register, which must be kept by reputed mines. This task must be undertaken by an archaeologist accredited with the Association for Southern African Professional Archaeologists (ASAPA).



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Appendix D:

Geotechnical Survey

ANGLO PLATINUM

Mining Technical Services

To:	H. Griesel
Cc:	P. De Garis J Bihl G. Hungwe B van Rhyn J Corry R. Johnson D. van Rensburg
From:	K. Akermann
Date:	24 April 2008
Ref:	MOD-05-2008
Subject:	**Preliminary Design for S2 Portal Based on Geotechnical Evaluation of Core from OV 758**

1. Introduction

The core from Geotechnical Borehole OV 758; drilled at the proposed new site for 2S Decline (further up the hill) was evaluated on 23 April 2008. Point Load Index Tests (5 tests / m) and RQD were calculated for the first 15m of core. The results of the geotechnical evaluation and a preliminary design for the portal are presented in this report.

2. Point Load Index Tests

- Approximately 5 point load index tests were conducted / m of core.
- Point Load Index tests were converted to UCS; using an established empirical formula

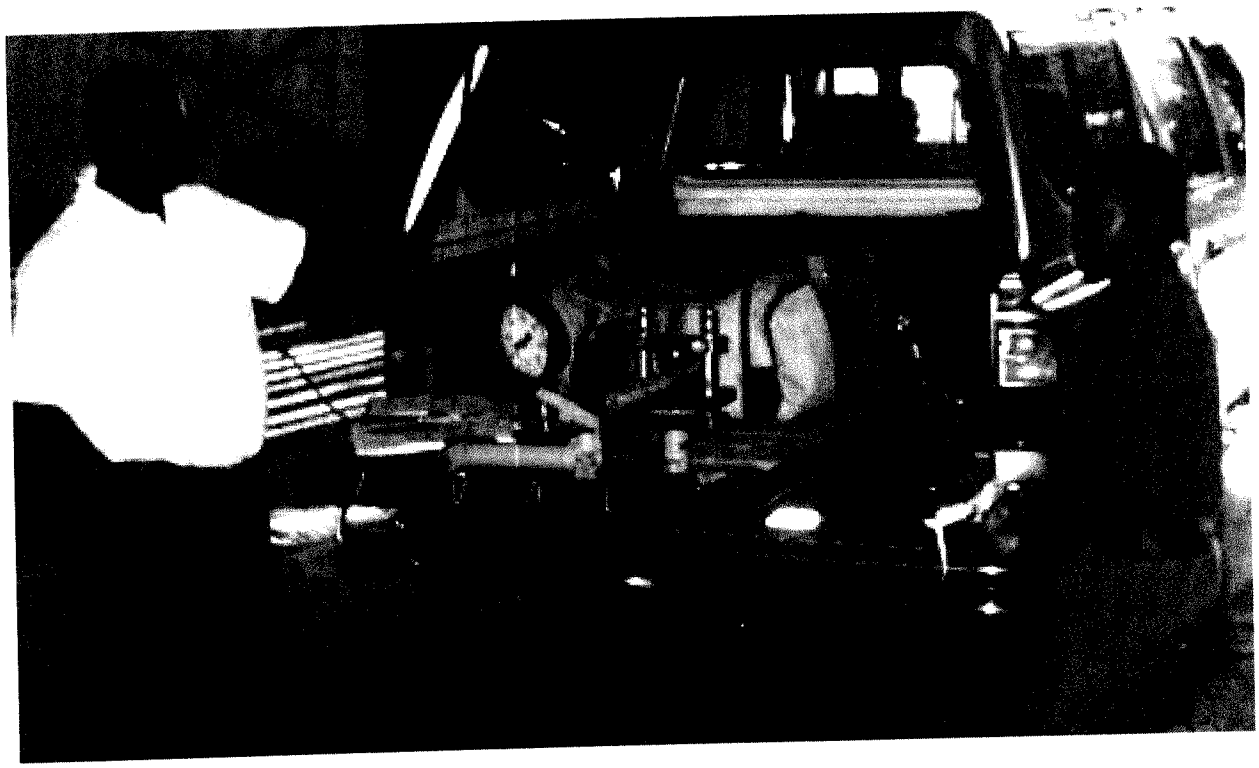

Figure 1: Point Load Index Tests conducted on core from OV758

The point load method of testing provides a quick and easy estimate of Uniaxial Compressive Strength (UCS) of the rock material, and can be used to estimate rock mass strength by downgrading the UCS in accordance with rock mass rating or RQD. In this test the core is loaded between two hardened steel points of the point load test apparatus. The force, P, at which the core breaks is recorded on the pressure gauge, and the point load index is calculated as:

$$Is = \frac{P}{D2} \quad \text{.....} \quad (1)$$

Where P is the load in kN and D is the diameter.

Broch and Franklin (1972) found that Is could be correlated with UCS, and Bieniawski (1975) suggested the following approximate relationship between UCS, Is and the core diameter, D, measured in millimetres:

$$UCS = (14 + 0.175D) \,.\, Is \quad \text{.....} (2)$$

A high degree of scatter is a general feature of point load index tests, and a large number of tests are generally required to give a reliable estimate of UCS. An average of 5 tests per m of core was therefore conducted.

3. Rock Quality Designation (RQD)

RQD is a measure of the natural degree of jointing or fracturing and is expressed as a percentage of intact core with length > 10cm / m length. A RQD of 100% implies that joints are spaced > 100mm and all intact pieces of core are therefore > 100mm in length.

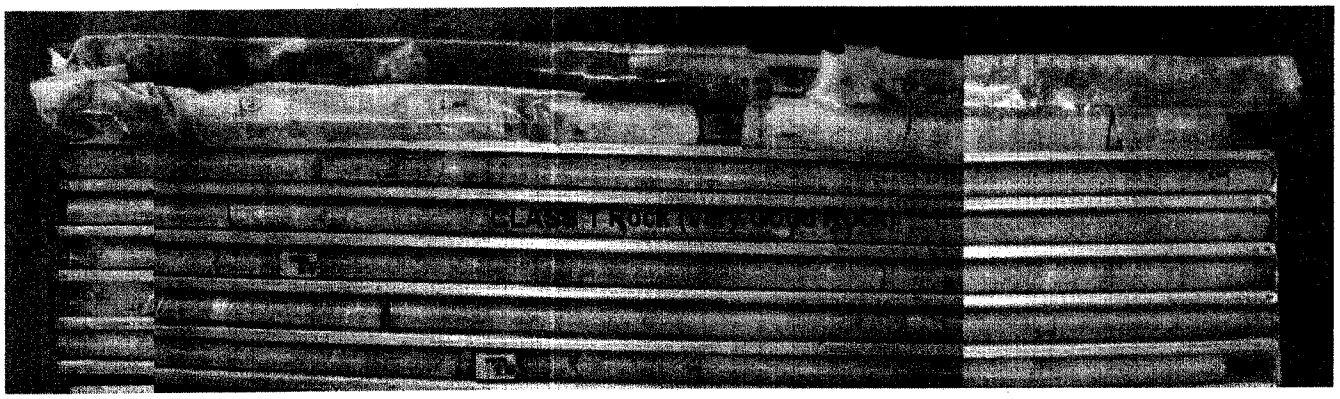

Figure 2: Very good quality rock from geotechnical borehole OV758 (RQD ~ 100% at Depth > 4m)

4. Conclusions and Recommendations

RQD and PIoint Load Index Test results (converted to UCS) are illustrated in Figure 3 over-leaf

A total of 4m of overburden is immediately followed by intact rock with a UCS of 120 MPa and an RQD of 100%

It is estimated that a 3m beam (CLASS 1 Rock) will be sufficient to ensure the stability of S2 portal.

The preliminary design is illustrated in Figure 3 over-leaf

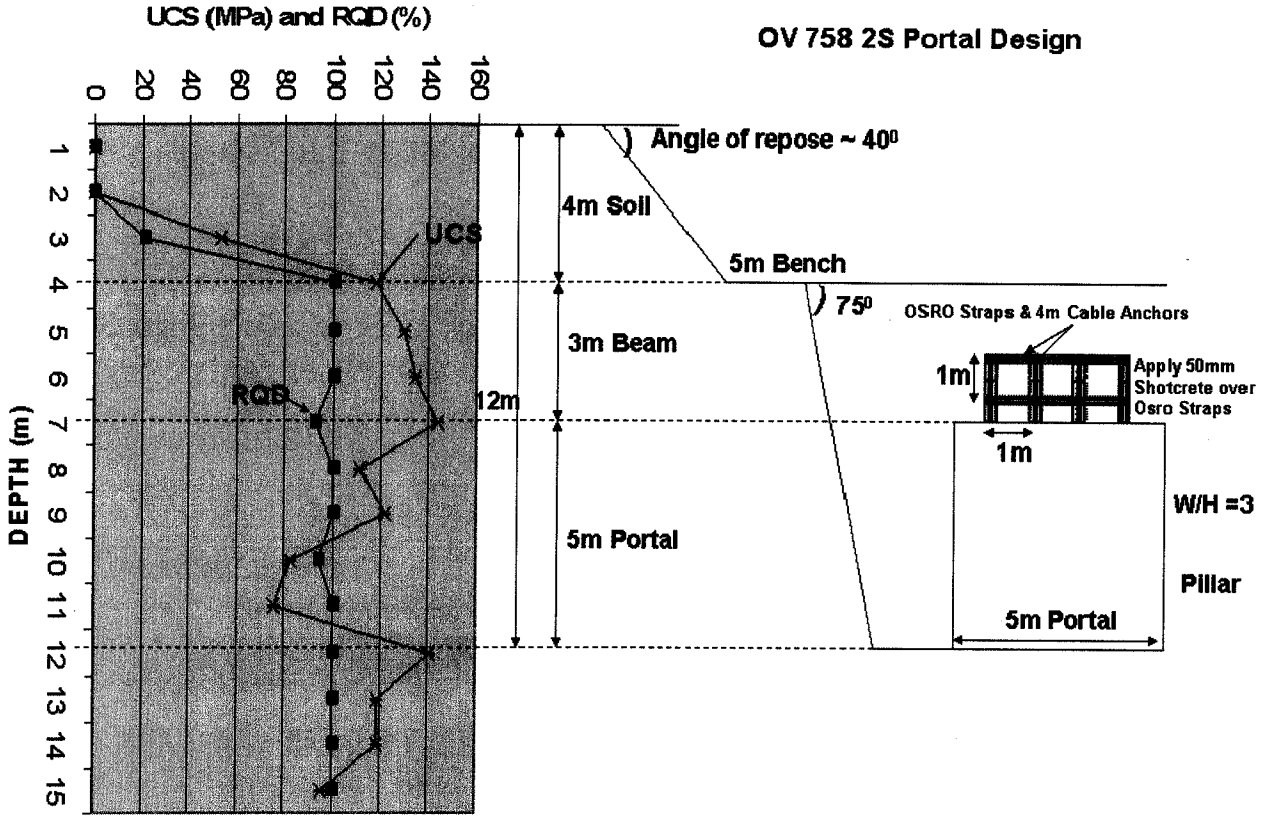

Figure 3: Preliminary Design for 2S Portal

The final design will be formulated as excavation proceeds and the degree and orientation of vertical jointing can be assessed (not generally visible in vertical boreholes).

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