HERITAGE SURVEY OF THE PROPOSED COAL MINE AT KOUDELAGER, VRYHEID, KWAZULU-NATAL

FOR KEATON ENERGY / LEEUW MINING & EXPLORATION (PTY) LTD.

DATE: 28 NOVEMBER 2013

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INTRODUCTION

The Koudelager Reserve is located in the Vryheid coal field some 50 Km east of Vryheid in Northern KwaZulu Natal ... The deposit occurs on Portion 1 of the farm Koudelager 115. The farm forms part of a larger deposit which was prospected by Natal Anthracite Colliery in the late 1970's. The reserve block extends onto the adjacent Remainder of Koudelager 115 and Leeuw Mining & Exploration (Pty.) Ltd. has a current mining licence on the property.

In the past very small scale mining has taken place on farms surrounding Koudelager from adits along the seam outcrop, while slightly larger operations have been sustained on Spitzkop. Mining activity on Koudelager itself is confined to prospecting adits that have been rehabilitated.

The area is well served by provincial and district roads with the main Vryheid - Nongoma road passing about 3Km to the north of the reserve. The district road joins the reserve to this road. The surface rights of the property are held by the Kewulane Community Trust and certain areas have been leased to Mondi for forestry operations. The property is extensively used for Wattle and Blue Gum plantations.

Keaton Energy / LME own and operate the Leeuw Vaalkrantz Colliery (LVC) which is situated approximately 34Km by road from the Koudelager reserve and the coal that is mined at Koudelager will transported by road to the washing plant at LVC for processing.

It is envisaged that a conventional drill and blast bord and pillar mining method will be employed, and, due to the seam thickness, the reserves will be mined with scrapers. Access to the underground workings on each of the two seams that are to be mined will be via 4 adits into a highwall established from each seam outcrop. New access roads will be constructed to each of the two adit platforms from the nearby district road.

Minimal surface infrastructure will be developed on the mine, it will be limited to portable, container size, structures adapted as offices, store, workshop, lamp-room, and ablution block. A stacker conveyor will be erected to temporarily stockpile coal conveyed from underground on the adit platform, from where it will be loaded into road trucks for haulage to the processing plant at LVC.

The only other surface infrastructure will involve the excavation of clean surface water cut-off drains up-grade of the adit platforms and two, small, lined pollution control dams as part of the pollution control measures on the mine.

The study area is shown in figures 1 – 3.

The study area will thus have the following impacts:

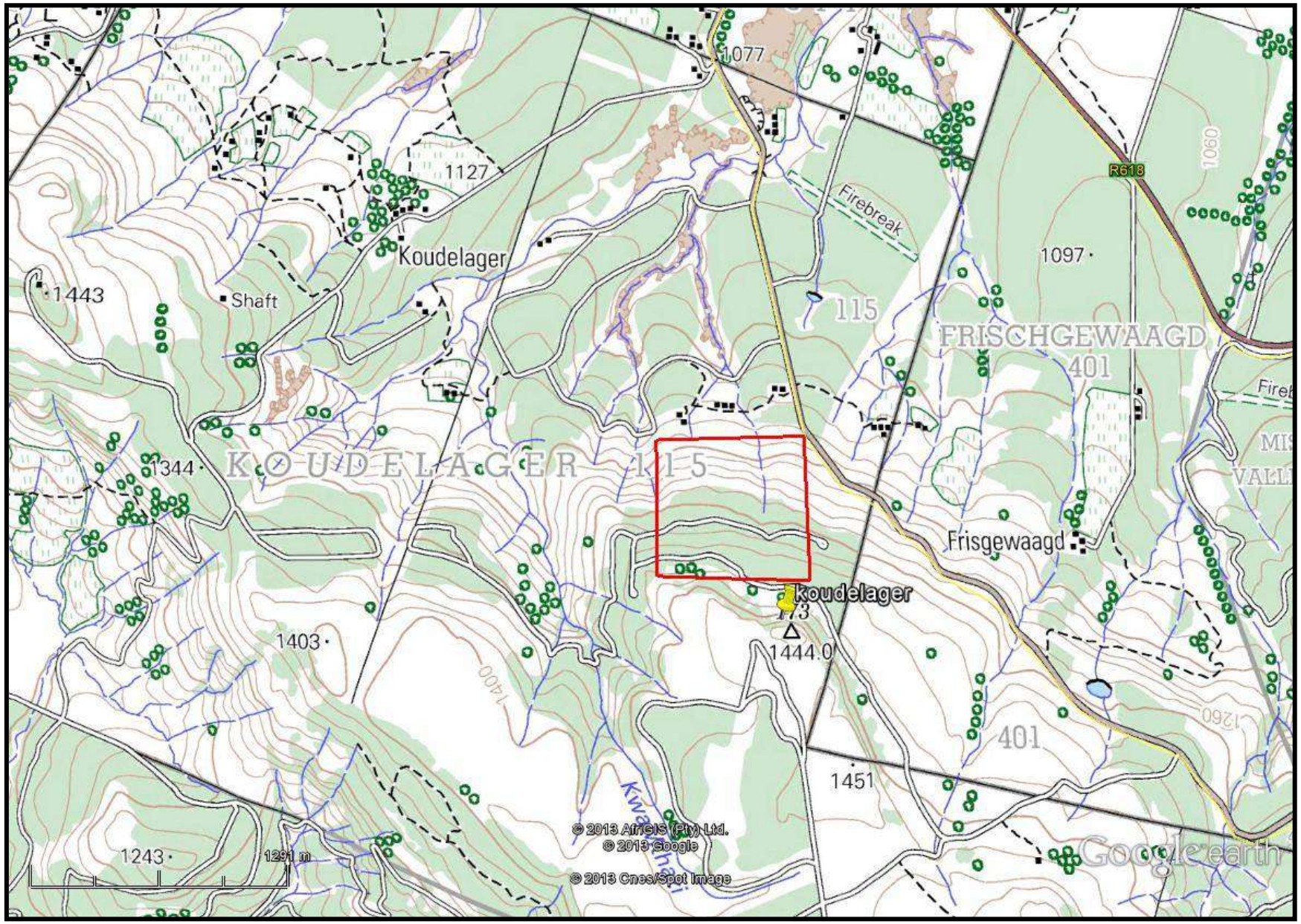
1. Two mining platforms that will extract the coal
2. Access roads to the platforms.
3. The locations of offices are not known.

There are two main concerns for the Heritage Impact Assessment. The first main concern is the occurrence of human graves within the study area. These graves should not be affected and may require a social impact assessment. The second area of concern is the palaeontology. Coal deposits are by default palaeontological features, and are thus protected by the heritage legislation. Both will require management plans.

FIG. 1 GENERAL LOCATION OF THE STUDY AREA

FIG. 2: AERIAL OVERVIEW OF THE STUDY AREA

FIG. 3: TOPOGRAPHICAL MAP OF THE STUDY AREA



KWAZULU-NATAL HERITAGE ACT NO. 4 OF 2008

"General protection: Structures.—

- No structure which is, or which may reasonably be expected to be older than 60 years, may be demolished, altered or added to without the prior written approval of the Council having been obtained on written application to the Council.
- Where the Council does not grant approval, the Council must consider special protection in terms of sections 38, 39, 40, 41 and 43 of Chapter 9.
- The Council may, by notice in the *Gazette*, exempt—
- A defined geographical area; or
- defined categories of sites within a defined geographical area, from the provisions of subsection where the Council is satisfied that heritage resources falling in the defined geographical area or category have been identified and are adequately protected in terms of sections 38, 39, 40, 41 and 43 of Chapter 9.
- A notice referred to in subsection (2) may, by notice in the *Gazette*, be amended or withdrawn by the Council.

General protection: Graves of victims of conflict.—No person may damage, alter, exhume, or remove from its original position—

- the grave of a victim of conflict;
- a cemetery made up of such graves; or
- any part of a cemetery containing such graves, without the prior written approval of the Council having been obtained on written application to the Council.
- General protection: Traditional burial places.—
- No grave—
- not otherwise protected by this Act; and
- not located in a formal cemetery managed or administered by a local authority, may be damaged, altered, exhumed, removed from its original position, or otherwise disturbed without the prior written approval of the Council having been obtained on written application to the Council.

The Council may only issue written approval once the Council is satisfied that—

- the applicant has made a concerted effort to consult with communities and individuals who by tradition may have an interest in the grave; and
- the applicant and the relevant communities or individuals have reached agreement regarding the grave.

General protection: Battlefield sites, archaeological sites, rock art sites, palaeontological sites, historic fortifications, meteorite or meteorite impact sites.—

- No person may destroy, damage, excavate, alter, write or draw upon, or otherwise disturb any battlefield site, archaeological site, rock art site, palaeontological site, historic fortification, meteorite or meteorite impact site without the prior written approval of the Council having been obtained on written application to the Council.
- Upon discovery of archaeological or palaeontological material or a meteorite by any person, all activity or operations in the general vicinity of such material or meteorite must cease forthwith and a person who made the discovery must submit a written report to the Council without delay.
- The Council may, after consultation with an owner or controlling authority, by way of written notice served on the owner or controlling authority, prohibit any activity considered by the Council to be inappropriate within 50 metres of a rock art site.
- No person may exhume, remove from its original position or otherwise disturb, damage, destroy, own or collect any object or material associated with any battlefield site, archaeological site, rock art site, palaeontological site, historic fortification, meteorite or meteorite impact site without the prior written approval of the Council having been obtained on written application to the Council.
- No person may bring any equipment which assists in the detection of metals and archaeological and palaeontological objects and material, or excavation equipment onto any battlefield site, archaeological site, rock art site, palaeontological site, historic fortification, or meteorite impact site, or

use similar detection or excavation equipment for the recovery of meteorites, without the prior written approval of the Council having been obtained on written application to the Council.

- The ownership of any object or material associated with any battlefield site, archaeological site, rock art site, palaeontological site, historic fortification, meteorite or meteorite impact site, on discovery, vest in the Provincial Government and the Council is regarded as the custodian on behalf of the Provincial Government." (KZN Heritage Act of 2008)

METHOD

The method for Heritage assessment consists of several steps.

The first step forms part of the desktop assessment. Here we would consult the database that has been collated by Umlando. This databases contains archaeological site locations and basic information from several provinces (information from Umlando surveys and some colleagues), most of the national and provincial monuments and battlefields in Southern Africa (http://www.vuvuzela.com/googleearth/monuments.html) and cemeteries in southern Africa (information supplied by the Genealogical Society of Southern Africa). We use 1st and 2nd edition 1:50 000 topographical and 1937 aerial photographs where available, to assist in general location and dating of buildings and/or graves. The database is in Google Earth format and thus used as a quick reference when undertaking desktop studies. Where required we would consult with a local data recording centre, however these tend to be fragmented between different institutions and areas and thus difficult to access at times. We also consult with an historical architect, palaeontologist, and an historian where necessary.

The survey results will define the significance of each recorded site, as well as a management plan.

All sites are grouped according to low, medium, and high significance for the purpose of this report. Sites of low significance have no diagnostic artefacts or features. Sites of medium significance have diagnostic artefacts or features and these sites tend to be sampled. Sampling includes the collection of artefacts for future analysis. All diagnostic pottery, such as rims, lips, and decorated sherds are sampled, while bone, stone, and shell are mostly noted. Sampling usually occurs on most sites. Sites of high significance are excavated and/or extensively sampled. Those sites that are extensively sampled have high research potential, yet poor preservation of features.

Defining significance

Heritage sites vary according to significance and several different criteria relate to each type of site. However, there are several criteria that allow for a general significance rating of archaeological sites.

These criteria are:

1. State of preservation of:

1.1. Organic remains:

1.1.1. Faunal

1.1.2. Botanical

1.2. Rock art

1.3. Walling

1.4. Presence of a cultural deposit

1.5. Features:

1.5.1. Ash Features

1.5.2. Graves

1.5.3. Middens

1.5.4. Cattle byres

1.5.5. Bedding and ash complexes

2. Spatial arrangements:

2.1. Internal housing arrangements

2.2. Intra-site settlement patterns

2.3. Inter-site settlement patterns

3. Features of the site:

3.1. Are there any unusual, unique or rare artefacts or images at the site?

3.2. Is it a type site?

3.3. Does the site have a very good example of a specific time period, feature, or artefact?

4. Research:

4.1. Providing information on current research projects

4.2. Salvaging information for potential future research projects

5. Inter- and intra-site variability

5.1. Can this particular site yield information regarding intra-site variability, i.e. spatial relationships between various features and artefacts?

5.2. Can this particular site yield information about a community's social relationships within itself, or between other communities?

6. Archaeological Experience:

6.1. The personal experience and expertise of the CRM practitioner should not be ignored. Experience can indicate sites that have potentially significant aspects, but need to be tested prior to any conclusions.

7. Educational:

7.1. Does the site have the potential to be used as an educational instrument?

7.2. Does the site have the potential to become a tourist attraction?

7.3. The educational value of a site can only be fully determined after initial test-pit excavations and/or full excavations.

8. Other Heritage Significance:

8.1. Palaeontological sites

8.2. Historical buildings

8.3. Battlefields and general Anglo-Zulu and Anglo-Boer sites

8.4. Graves and/or community cemeteries

8.5. Living Heritage Sites

8.6. Cultural Landscapes, that includes old trees, hills, mountains, rivers, etc related to cultural or historical experiences.

The more a site can fulfill the above criteria, the more significant it becomes. Test-pit excavations are used to test the full potential of an archaeological deposit. This occurs in Phase 2. These test-pit excavations may require further excavations if the site is of significance (Phase 3). Sites may also be mapped and/or have artefacts sampled as a form of mitigation. Sampling normally occurs when the artefacts may be good examples of their type, but are not in a primary archaeological context. Mapping records the spatial relationship between features and artefacts.

RESULTS

DESKTOP STUDY

The desktop study consisted of analysing various maps for evidence of prior habitation in the study area, as well as for previous archaeological surveys. The archaeological database indicates that there are archaeological sites in the general area (fig. 4). There are several archaeological sites outside of the study area. These sites date to the Early, Middle and Late Stone Age (including Rock Art), and Late Iron Age. There are no known national monuments, battlefields, or historical cemeteries in the study area.

The first available map for the area dates to 1969. The 1969 topographical map indicates that there are two settlements in the study area (fig. 4). The 1973 aerial photographs indicate that there are five settlements in the study area of

which two are from 1969 (fig. 5). The locations of these settlements are given in Table 1.

TABLE 1: LOCATION OF MIDDLE 20TH CENTURY SETTLEMENTS

NAME	LATITUDE	LONGITUDE	DESCRIPTION
B1	-27.797356873	31.220397916	1969
B2	-27.796544960	31.218578556	1969
1	-27.797194384	31.214690971	1973
2	-27.797146885	31.220329047	1973
3	-27.798244251	31.220652098	1973
4	-27.798265227	31.219686684	1973
5	-27.799426801	31.215016817	1973

FIELD SURVEY

Several heritage sites were observed during the survey. These are listed in Table 2 and illustrated in Figure 6. Most of the sites are human burials dating to the 20th and 21st century. The location are summarised in Table 2, and illustrated in Figure 7.

TABLE: 2: LOCATION OF HERITAGE SITES FROM THE SURVEY

NAME	LATITUDE	LONGITUDE	ALTITUDE (M)	DESC
KOU01	-27.797684000	31.220290000	1164.2	Grave
KOU02A	-27.797462000	31.220079000	1161.0	Grave
KOU2B	-27.797436000	31.220180000	1160.3	Grave
KOU03	-27.797708000	31.219691000	1165.6	Grave
KOU04	-27.797688000	31.219406000	1166.2	Grave
KOU05	-27.797815000	31.219050000	1169.4	Grave
KOU06	-27.797905000	31.218952000	1170.7	Grave
KOU07	-27.797995000	31.218782000	1172.8	Grave
GOU08	-27.796437000	31.220071000	1138.8	Grave
KOU09A	-27.796934000	31.218972000	1150.4	Grave - east
KOU09B	-27.796867000	31.218702000	1148.0	Grave western
KOU09C	-27.796774000	31.218565000	1148.5	Grave
KOU010	-27.796862000	31.218060000	1146.2	Grave
KOU011	-27.797251000	31.218237000	1153.9	Grave
LSA	-27.797725000	31.214932000	1186.0	Stone tools
KOU012	-27.797234000	31.214302000	1168.8	Grave
KOU013	-27.797321000	31.214530000	1171.9	Grave
KOU13A	-27.797019000	31.214815000	1166.5	Grave
KOU014	-27.797147000	31.215375000	1169.3	Grave
KOU015B	-27.797248000	31.215884000	1171.5	Grave
KOU015C	-27.797253000	31.215949000	1170.8	Grave
KOU016	-27.797210000	31.214559000	1169.8	Grave
TERRACE	-27.800542000	31.220755000	1251.9	Terracing

FIG. 4: LOCATION OF KNOWN HERITAGE SITES NEAR THE STUDY AREA

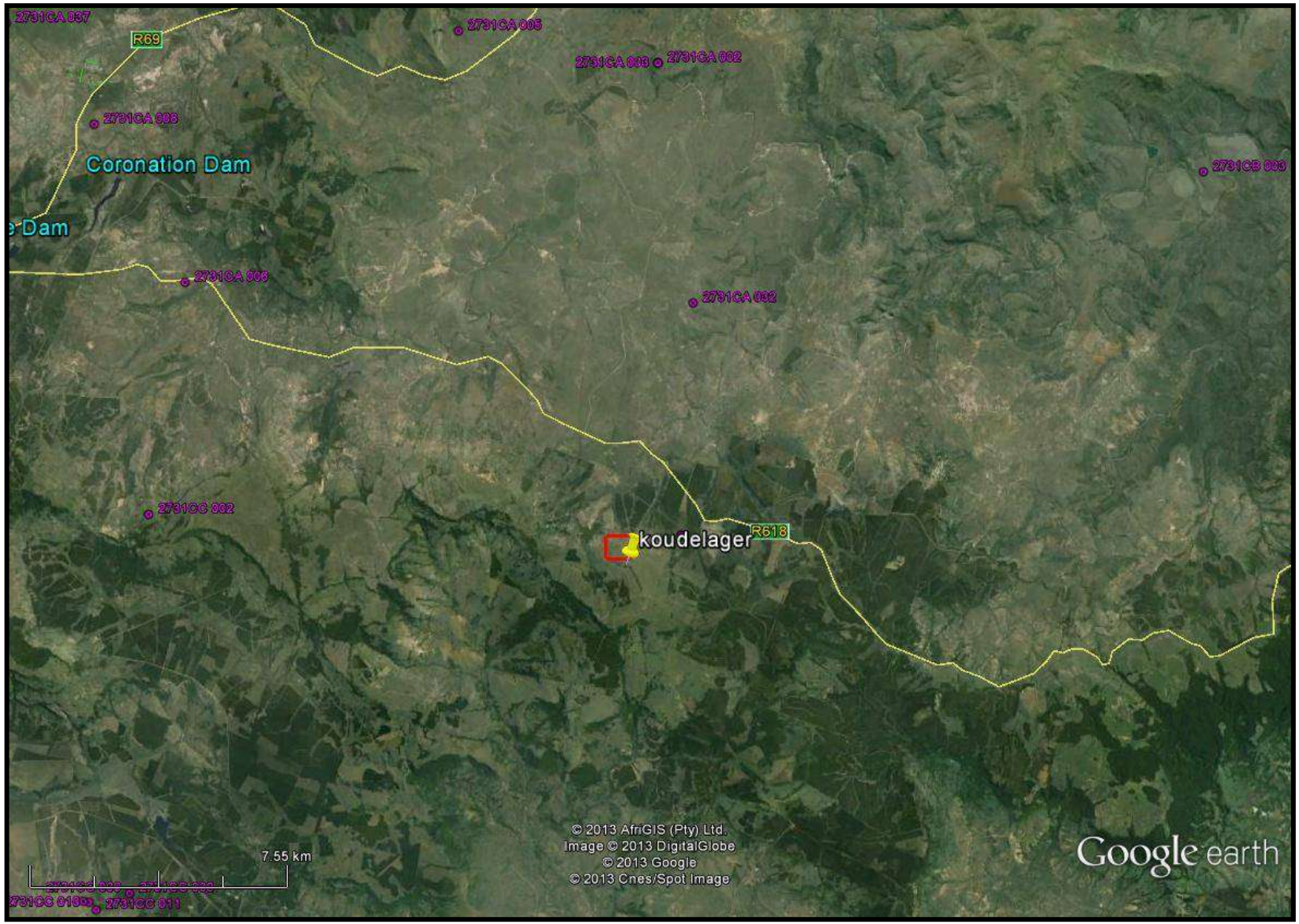


FIG. 5: THE STUDY AREA IN 1937

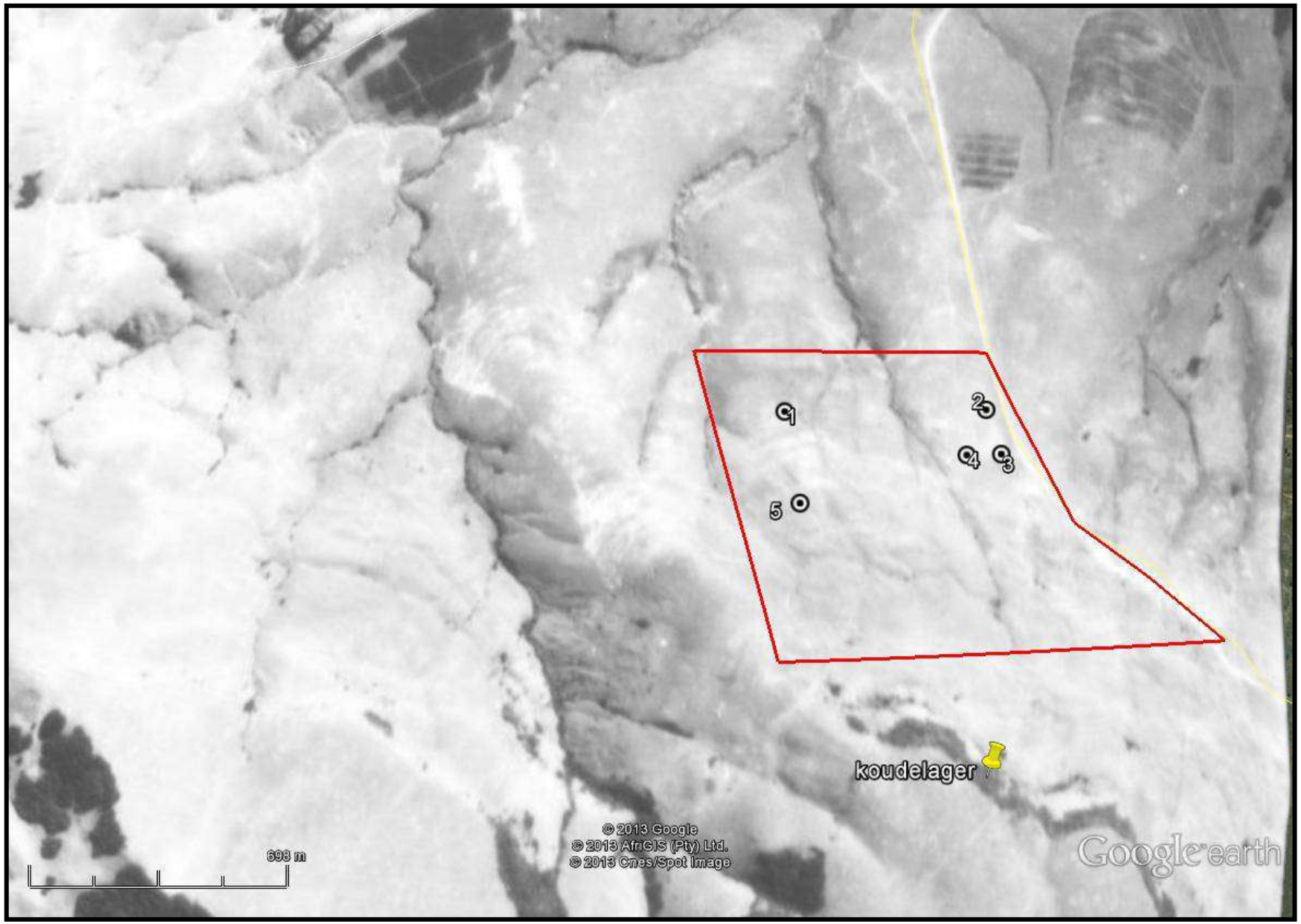


FIG. 6: THE STUDY AREA IN 1969

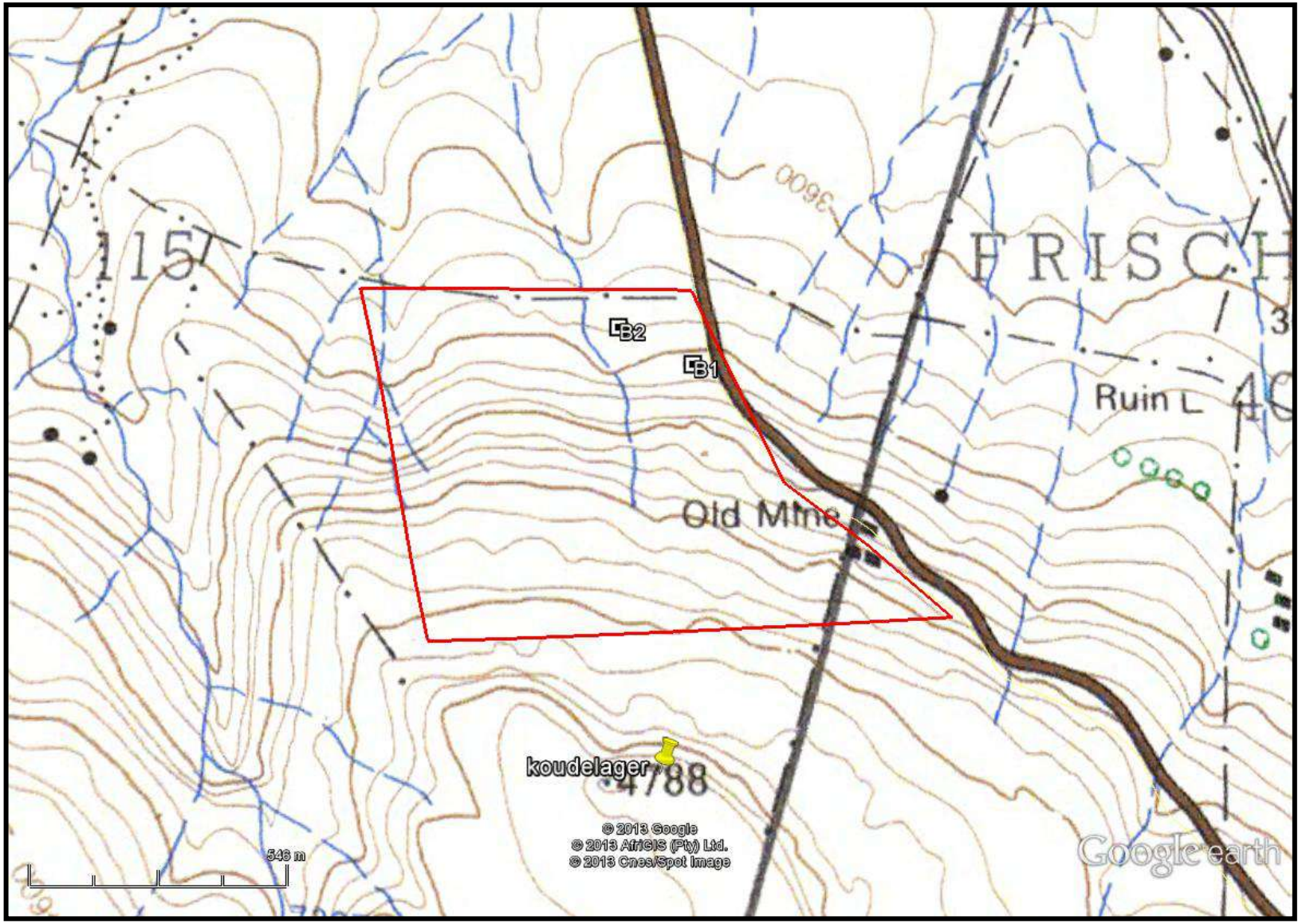
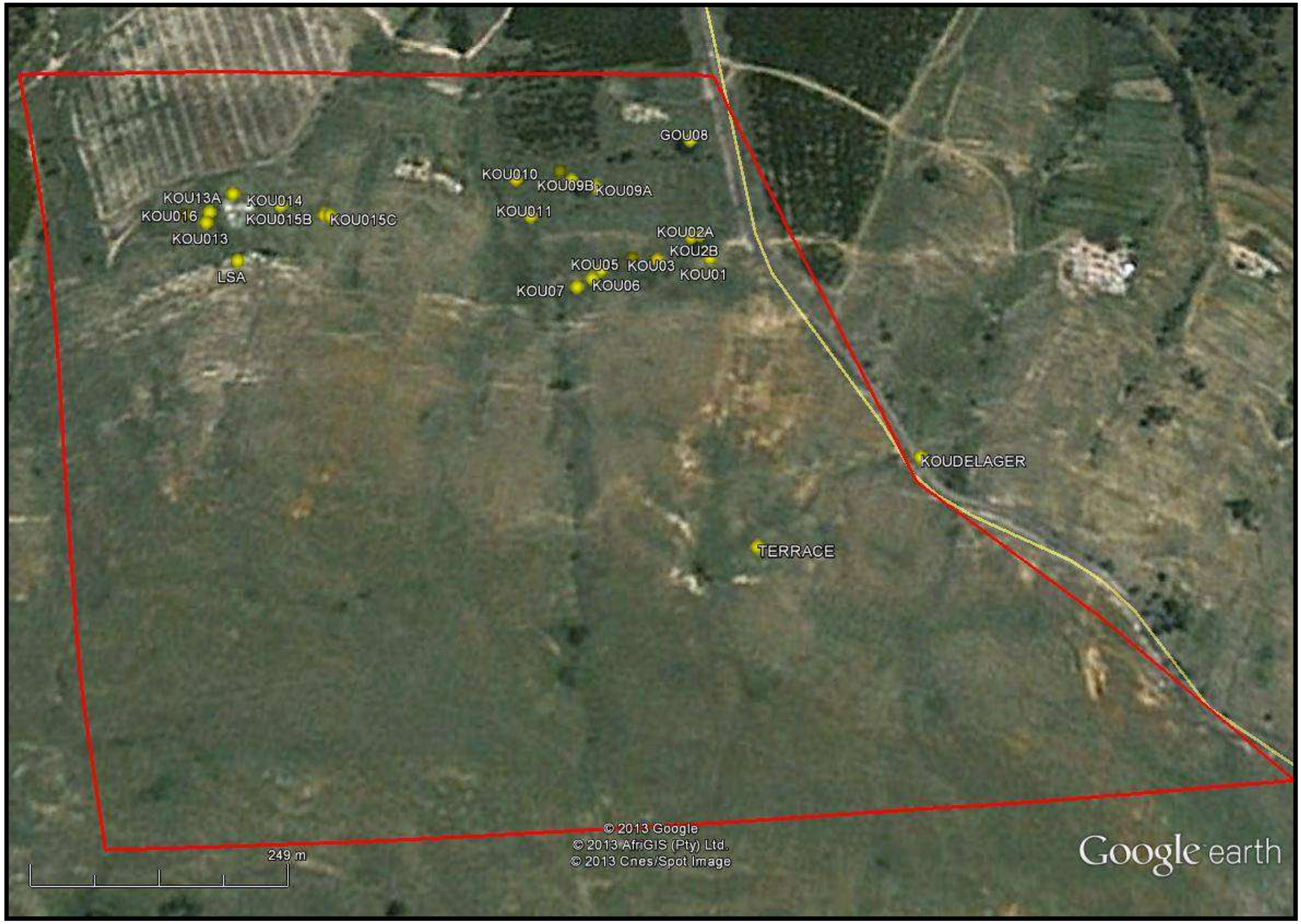


FIG. 7: THE LOCATION OF SURVEYED SITES



Most of the sites recorded during the survey are graves that belong to a few settlements that appear to date to 1969 – 1973, while a few are more recent. Individual graves, or clusters, were recorded during the survey. By a cluster, I refer to graves that are within a few meters of each other. All graves occurring within 50m of any development, including roads, require automatic mitigation. Mitigation requires that the grave(s) be clearly demarcated, normally with fencing. The demarcation needs to occur 5m from the edge of the grave or cemetery. There also needs to be a 20m buffer between the grave and the development. There are a few clusters of graves that appear to be related to the same family. Normally these graves are in a group, near each other and related to a single settlement. These graves are probably form one family. The clusters are as follows:

- KOU2a – KOU02b: settlement of two houses
- KOU03 - KOU04: No visible settlement
- KOU05 – KOU07: settlement of four houses
- KOU09: A cemetery
- KOU12 – KOU016: settlement of eleven houses

The rest of the graves appear t0 be isolated graves and not clearly related to any specific settlement or cluster. These are as follows:

- KOU01
- KOU06
- KOU08
- KOU010
- KOU011

KOU01

KOU01 is a single grave on the slope of the hill. The grave is a stone cairn in a north-south orientation, i.e. downhill facing (fig. 7). There are no settlements directly associated with the grave.

Significance: The grave is of high significance

Mitigation: The grave needs to be demarcated. This grave may be affected by the proposed access road in that it will occur near a proposed access road.

SAHRA Rating: 3A

FIG. 7: GRAVE AT KOU01

KOU02

KOU02 is located 25m downhill from KOU01. The site consists of two graves each demarcated with a tree (fig. 8). The trees, and their boundaries, form the edge of the cemetery, and were once demarcated with metal poles. The eastern grave is a stone cairn in a north-south orientation. The second grave is “wedged” between two trees and is in an east-west orientation. An informant stated the graves were related to the Mtjali family who currently live further downhill. The graves probably relate to settlement 2

Significance: The grave is of high significance

Mitigation: The area surrounding the trees, and thus graves, needs to be demarcated. The tree is a heritage resource directly related to the graves.

SAHRA Rating: 3A

FIG. 8: GRAVES AT KOU02

KOU03

KOU03 is an oval circle of stones that appears to be an old sunken grave. A small stream nearby would have caused the sunken appearance through increased natural decay. The grave is in an east-west orientation. There is no settlement directly related to this grave.

Significance: The grave is of high significance

Mitigation: The grave needs to be demarcated.

SAHRA Rating: 3A

FIG. 9: GRAVE AT KOU03

KOU04

KOU04 is a single grave in a north-south orientation. The grave is a semi-circle of stones with the interior partially sunken. The grave may be related to settlement 4 from the 1975 map. The grave may also be related to the graves at KOU05, KOU06, and KOU07.

Significance: The grave is of high significance

Mitigation: The grave needs to be demarcated.

SAHRA Rating: 3A

FIG. 10: GRAVE AT KOU04

KOU05

KOU05 is a group of four graves each on an east-west access. The graves are stone cairns and are probably related to a row of settlements downhill from them. The graves may be related to the graves at KOU04, KOU06, and KOU07. One grave is a juvenile

Significance: The grave is of high significance

Mitigation: The grave needs to be demarcated.

SAHRA Rating: 3A

FIG. 11: GRAVES AT KOU06

KOU06

KOU06 consists of three graves in a north-south orientation. The graves are small stone cairns, suggesting these are the graves for juveniles. The graves may be related to the graves at KOU04, KOU05, KOU07, as well as with the settlement in front of it. This settlement is probably settlement 4 on the 1975 map. There are one square and three circular (from east to west) house foundations in front of the graves of KOU05, KOU06, KOU07.

Significance: The graves are of high significance

Mitigation: The graves need to be demarcated.

SAHRA Rating: 3A

FIG. 12: GRAVES AT KOU06

KOU07

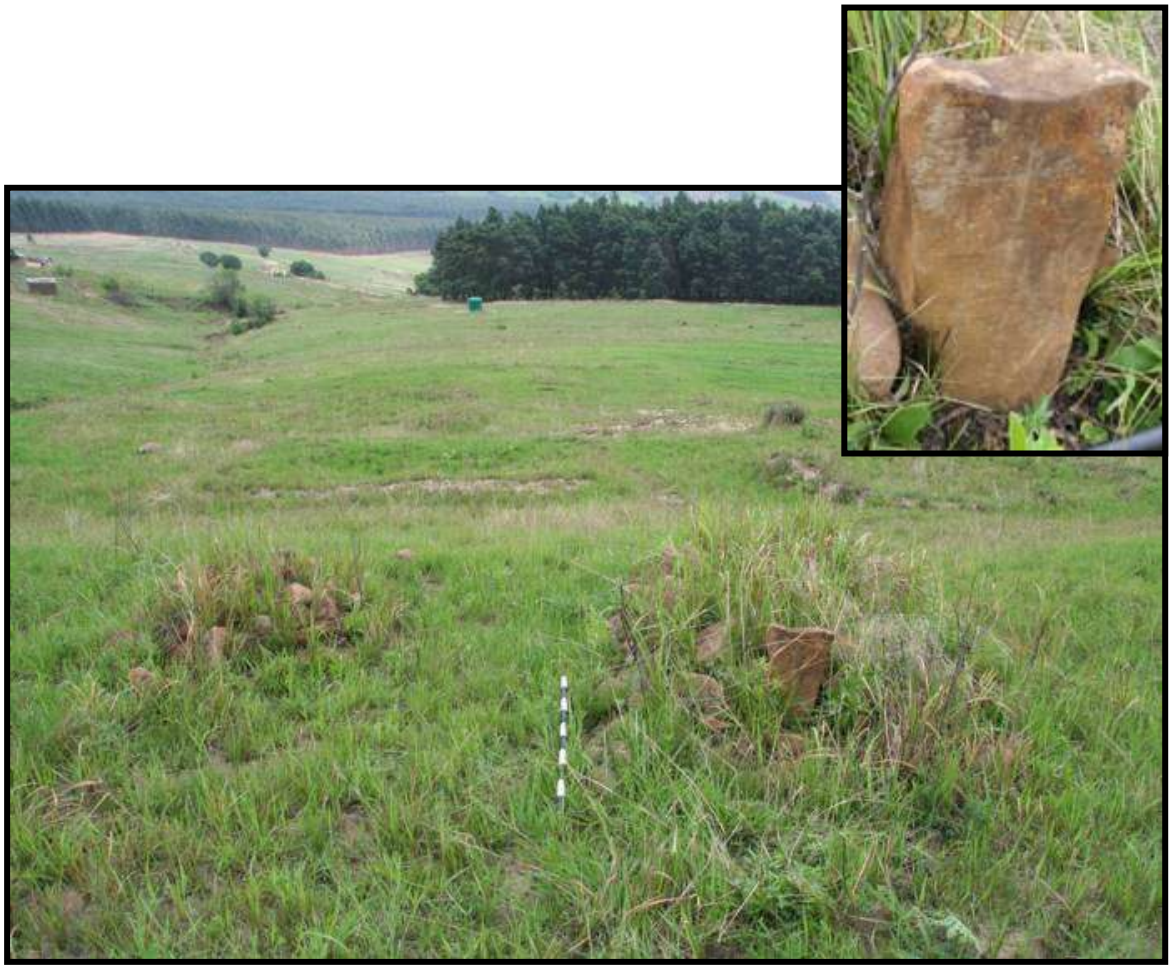
KOU07 consists of two graves in a north-south orientation. The western grave is of a juvenile, while the eastern grave is of an adult. The eastern grave has an inscribed headstone. The date on the headstone is faded but dates to the 20th century (possibly 1981). Both graves are stone cairns.

Significance: The graves are of high significance

Mitigation: The graves need to be demarcated.

SAHRA Rating: 3A

FIG. 13: GRAVES AT KOU07



KOU08

KOU08 is a grove with two graves (fig. 14). The eastern grave (yellow arrow) is at the base of the main tree and has an undated headstone with a name. There is no cairn directly associated with this grave. The western grave is a stone cairn (green arrow) that has been placed between the main tree and a smaller tree.

Significance: The grave is of high significance

Mitigation: The grave needs to be demarcated. The tree itself should be viewed as a heritage resource directly related to the graves.

SAHRA Rating: 3A

FIG. 14: GRAVES AT KOU08

KOU09

KOU09 is a cemetery of ~20 graves (fig. 15). The graves are mostly in a north-south orientation. The upper row of graves is more recent while the older graves under the tree appear to be much older. I was informed that these graves belong to the Mtjali family who reside nearby. The GPS readings are taken from the most eastern and western sides, while KOU9c (fig. 15 bottom) is just outside of the cemetery.

Significance: The grave is of high significance

Mitigation: The grave needs to be demarcated. The tree itself should be viewed as a heritage resource directly related to the graves.

SAHRA Rating: 3A

FIG. 15: CEMETERY AT KOU09

KOU010

KOU010 is a single grave in a northeast-southwest orientation. The grave is a stone cairn. There are no visible settlements related to this grave.

Significance: The grave is of high significance

Mitigation: The grave needs to be demarcated.

SAHRA Rating: 3A

FIG. 16: GRAVE AT KOU010

KOU011

KOU011 is a single grave in a northeast-southwest orientation. The grave is a stone cairn that has sunken in the centre. There are no visible settlements related to this grave.

Significance: The grave is of high significance

Mitigation: The grave needs to be demarcated.

SAHRA Rating: 3A

FIG. 17: GRAVE AT KOU011

KOU012

KOU012 is a single grave in a northeast-southwest orientation. The grave is a stone cairn and the northern side of the grave is slightly eroded. The grave is probably related to Settlement 1 from the 1975 map.

Significance: The grave is of high significance

Mitigation: The grave needs to be demarcated.

SAHRA Rating: 3A

FIG. 18: GRAVE AT KOU012

KOU013

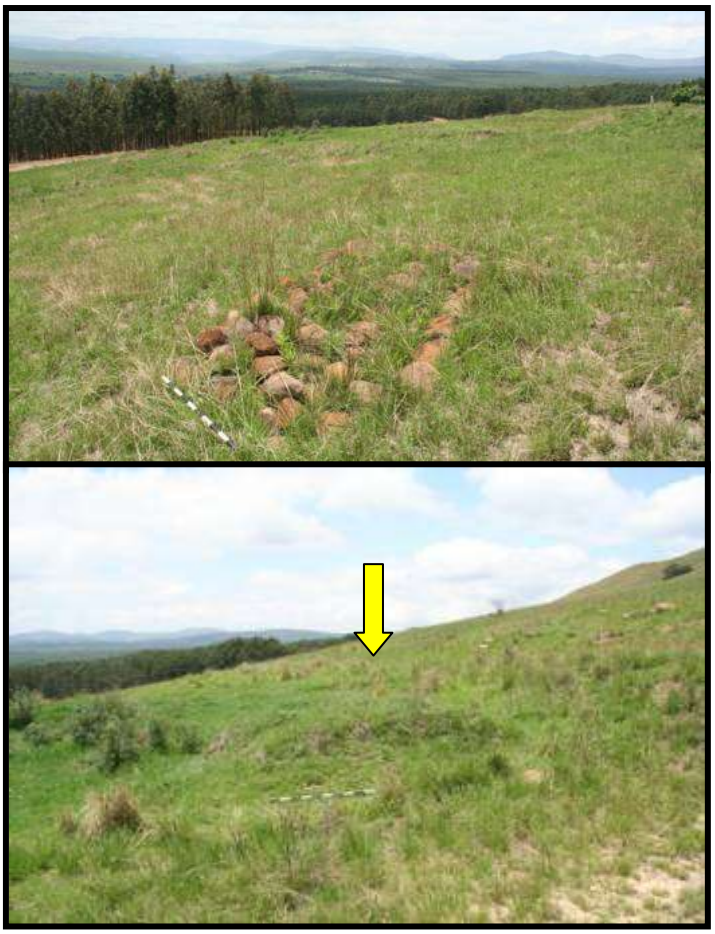
KOU013 is a single grave in an east-west orientation. The grave is a stone cairn that has sunken in the middle. KOU013A is a mound of sand in the centre of the cattle byre (yellow arrow). This may not be a grave; however, it is not uncommon for the head of a household to be buried in the centre of a cattle byre. I suggest it is treated as a grave. These graves are probably related to Settlement 1 from the 1975 map.

Significance: The grave is of high significance

Mitigation: The grave needs to be demarcated.

SAHRA Rating: 3A

FIG. 19: GRAVE AT KOU013



KOU014

KOU04 is a single grave in a northeast-southwest orientation. The grave is a stacked stone cairn and appears to be more recent than the rest of the graves at this cluster. The grave is probably related to Settlement 1 from the 1975 map.

Significance: The grave is of high significance

Mitigation: The grave needs to be demarcated.

SAHRA Rating: 3A

FIG. 20: GRAVE AT KOU014

KOU015

KOU015 is a group of three graves ion an east-west orientations. All of the graves are stone cairns... The two western graves appear to be of adults, while the eastern grave appears to be that of a juvenile. The grave is probably related to Settlement 1 from the 1975 map.

Significance: The grave is of high significance

Mitigation: The grave needs to be demarcated.

SAHRA Rating: 3A

FIG. 21: GRAVES AT KOU015

KOU016

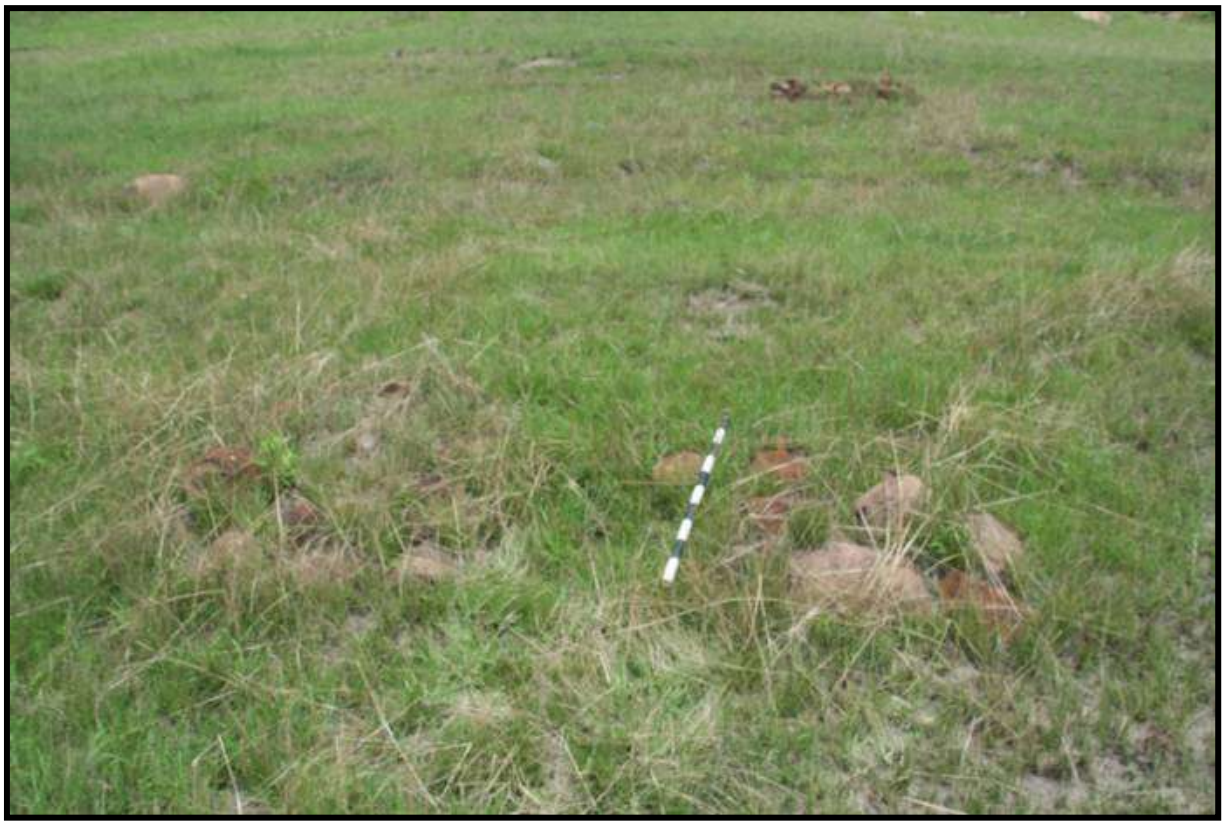
KOU016 are two graves near KOU013. The graves are in a north-south orientation. Both graves are of juveniles. The graves are probably related to Settlement 1 from the 1975 map.

Significance: The grave is of high significance

Mitigation: The grave needs to be demarcated.

SAHRA Rating: 3A

FIG. 22: GRAVES AT KOU016



STONE TOOLS

There were no definite stone tool sites, rather isolated occurrences. These were more common above the sandstone overhangs where the stones had rolled down from above the hill. Only six tools were noted. Five of these were standard LSA flakes (fig. 23), and one was a weathered MSA flake.

Significance: The tools are of low significance

Mitigation: No further mitigation is required.

SAHRA Rating: 3C

FIG. 23: STONE TOOLS KOUDELAGER

TERRACING

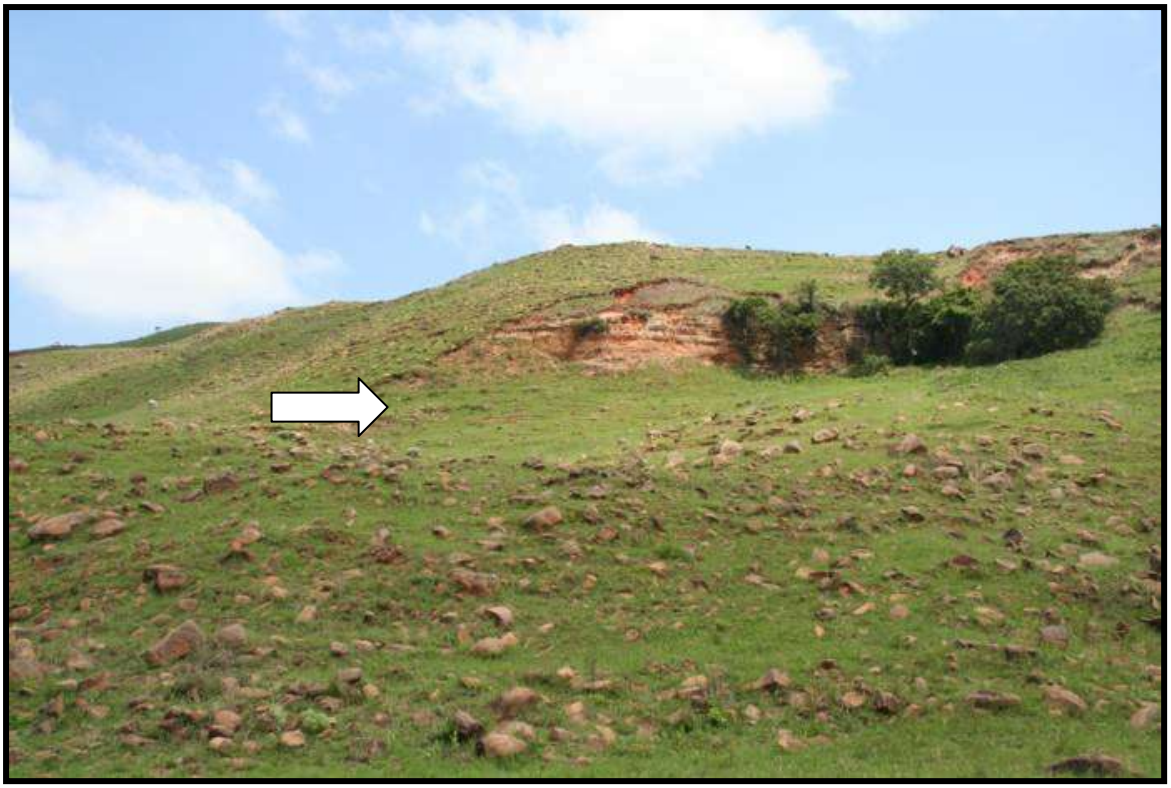
The southern section of the study area relates to the proposed upper access road and platform. There is a cleared area ~5m wide from the existing dirt road to the terraces. To the west of the terrace is a sandstone cliff face. The cleared area is probably related to the old mine offices shown on figure 6. I believe the cliff face is part of an old mining operation with the cleared area being an access road. The terracing would have been an anti-erosion terrace.

Significance: The terracing is of low significance

Mitigation: The grave needs to be demarcated.

SAHRA Rating: 3C

FIG. 24: TERRACING AT KOUDELAGER



PALAEONTOLGOCIAL DESKTOP ASSESSEMENT

Dr Gideon Groenewald (see appendix A) undertook a desktop PIA. “The Vryheid Formation is well-known for the occurrence of coal beds that resulted from the accumulation of plant material over long periods of time. Plant fossils described by Bamford (2011) from the Vryheid Formation are; *Azaniodendron fertile, Cyclodendron leslii, Sphenophyllum hammanskraalensis*, *Annularia* sp., *Raniganjia* sp., *Asterotheca* spp., *Liknopetalon enigmata*, *Glossopteris* > 20 species*, Hirsutum* 4 spp., *Scutum* 4 spp., *Ottokaria* 3 spp., *Estcourtia* sp., *Arberia* 4 spp., *Lidgetonnia* sp., *Noeggerathiopsis* sp. and *Podocarpidites* sp.

According to Bamford (2011), “Little data has been published on these potentially fossiliferous deposits. Around the coalmines, there is most likely to be good material and yet in other areas the exposures may be too poor to be of interest. When they do occur, fossil plants are usually abundant, it would not be feasible to preserve and maintain all the sites, however, in the interests of heritage, science such sites should be well recorded, sampled, and the fossils kept in a suitable institution.

Although no vertebrate fossils have been recorded from the Vryheid Formation, Mason and Christie, (1985) have described invertebrate trace fossils in some detail. It should be noted, however, that the aquatic reptile, Mesosaurus, which is the earliest known reptile from the Karoo Basin, as well as fish (*Palaeoniscus capensis*), have been recorded in equivalent-aged strata in the Whitehill Formation in the southern part of the basin (MacRae, 1999; Modesto, 2006). Indications are that the Whitehill Formation in the main basin might be correlated with the mid-Vryheid Formation. If this assumption proves correct, there is a possibility that Mesosaurus could be found in the Vryheid Formation.

The late Carboniferous to early Jurassic Karoo Supergroup of South Africa includes economically important coal deposits within the Vryheid Formation of

Natal. The Karoo sediments are almost entirely lacking in body fossils but ichnofossils (trace fossils) are locally abundant. Modern sedimentological and ichnofaunal studies suggest that the north-eastern part of the Karoo basin was marine. In KwaZulu-Natal, a shallow basin margin accommodated a prograding fluviodeltaic complex forming a broad sandy platform on which coal-bearing sediments were deposited. Ichnofossils include U-burrows (formerly *Corophioides*) which are assigned to ichnogenus *Diplocraterion* (Mason and Christie, 1985)" (PIA – Appendix A).

Significance: The study area in general is not sensitive for palaeontological remains; however, the coal beds are of medium significance.

Mitigation: The coal beds will only be exposed after they have been extracted. These deposits will need to be periodically assessed and sampled. Leeuw Braakfontein Colliery will need to liaise with Amafa KZN and a palaeontologist as to the best method of obtaining these samples.

MANAGEMENT PLAN

The main management plan for this area is that regarding the human graves. The access road(s) and platforms should not affect the graves in any manner. There will need to be consultation with the living descendants related to the graves, in addition to the general management plan. A wider social consultation may be needed for any graves not claimed by the people living nearby.

All graves within 50m of any development will need to be protected. Protection should be in the form of clear demarcations during the construction phase. In addition to this there will need to be a fence with access gate for each grave, cemetery, cluster of graves, or those area that have used trees to demarcate the boundary of the grave(s). The fencing will need to be placed 5m from the edge of the grave, tree outline, or cemetery. There will be an additional 15m buffer zone between the fence and any infrastructure. No construction and

mining activity may occur within this buffer zone. Approval of these demarcations and buffer zones must be obtained from the living descendants.

The main problem with the lower access road is its restricted working area. IN terms of environmental legislation, the road may not go directly up a slope. Zigzag access roads are thus used to minimise erosion. Due to the topography of the area, such a zigzag road is not feasible as it would affect several graves and would be spatially constricted in terms of turning points. It would affect the people living in the area as well. Figure 25 shows these two options in pink. The second alternative is to use an access road above KOU01, KOU06 and KOU07. This is shown as a yellow line in figure 25. This would be the most direct route with minimal environmental and social impact. The only issue would be the proximity of the road to the graves. A 20m buffer zone will need to be placed from these graves. A monitor will be required to stand at the graves during construction to ensure that the graves are not affected. A barrier should be placed on the northern side of the road after construction to ensure that the graves are not inadvertently affected during the operational phase.

The EAP and ECO of the project must be informed of the fact that plant fossils will, by definition, be mined and that it will be important to record and collect well-preserved fossils of plants for further study.

Arrangements must be made to have a qualified palaeontologist on standby during mining operations. When well-preserved fossils are recorded, the palaeontologist must be appointed to apply for collection and destruction permits from AMAFA and SAHRA and to record well preserved fossils for further study at an institute such as the Bernard Price Institute for Palaeontology at WITS University. The client will also require a permit to destroy palaeontological material.

FIG. 25: POSSIBLE ACCESS ROADS

CONCLUSION

An HIA was undertaken for the proposed Leeuw Braakfontein Colliery, KwaZulu-Natal. The colliery will consist of two staging platforms and two access roads. The access roads may affect existing graves, as there are limited options for the location of road. The roads may not occur within 20m of a grave, and each grave within 50m of the road needs to be clearly demarcated. Community consultation should occur with any graves occurring within 50m of the road. The palaeontology of the coal seems are of medium significance and would require mitigation during the operational phase.

There are no other heritage issues relating to the proposed colliery.

APPENDIX A

SITE RECORD FORMS

UMLANDO ARCHAEOLOGICAL SITE RECORD FORM

SITE CATEGORY: (X where applicable)
Palaeontology: X
Stone Age: X
Iron Age:
Historical Period: X

Recorder's Site No.: KOU 1-16
Official Name:
Local Name:
Map Sheet: 2731CC Gluckstadt
GPS reading: S27 47 51.6 E31 13 13.1 100 m

DIRECTIONS TO SITE: SKETCH OR DESCRIPTION.

Follow South Street out of Vryheid. South Street becomes the R69. Follow the R69 for 20.1km then turn Right onto the R618. Turn Right onto the P219 after 21.5km. KOU 1-16 is located 2.8km from here.

SITE DESCRIPTION:

Type of Site: Graves and fossils
Merits conservation: Yes
Threats: Yes
What threats: Colliery

RECORDING:
Graphic record: Yes
Digital pictures: x Tracings : Re-drawings:

Recorder/Informant: Name: Gavin Anderson
Address: PO Box 102532, Meerensee, 3901
Date: November 2013

Description of site and artefactual content.

Site consists of many graves in various locations. Refer to report for detail locations. Coal beds have medium significant fossils. Isolated stone tools occur in the area and are MSA and LSA

APPENDIX B

PALAEONTOLGOICAL DESKTOP IMPACT ASSESSMENT

DESKTOP PALAEONTOLOGICAL ASSESSMENT OF THE KOUDELAGER STUDY AREA, KWA-ZULU NATAL

FOR

Umlando

DATE: 24 November 2013

By

Gideon Groenewald

Cell: 082 339 9202

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EXECUTIVE SUMMARY

Gideon Groenewald was appointed to undertake a desktop survey, assessing the potential palaeontological impact of the development of a Staging platform and road at the Koudelager Coal Mine located approximately 42km East of Vryheid, Kwa-Zulu Natal Province.

The key assumption for this desktop study is that the existing geological maps and datasets used to assess site sensitivity are correct and reliable. However, the geological maps used were not intended for fine scale planning work and are largely based on aerial photographs alone, without ground-truthing.

The study area is underlain by a Jurassic aged dolerite sill, which is in turn underlain by Permian aged sediments of the Vryheid Formation. The Vryheid Formation is well-known for the occurrence of coal beds that resulted from the accumulation of plant material over long periods of time. Mining for coal or development of infrastructure that cut into the Vryheid Formation, will expose sediments of the Vryheid Formation and it will expose plant fossils. The study area is allocated a Medium palaeontological sensitivity due to the fact that dolerite is an igneous rock, and will thus not contain any fossils, but the underlying sediments of the Vryheid Formation will have fossils, which will be exposed during the mining operations or during the development of infrastructure.

Recommendations:

1. The EAP and ECO of the project must be informed of the fact that plant fossils will, by definition, be mined and that it will be important to record and collect well preserved fossils of plants for further study.
2. Arrangements must be made to have a qualified palaeontologist on standby during mining operations. When well-preserved fossils are recorded, the palaeontologist must be appointed to apply for collection and destruction permits from AMAFA and SAHRA and to record well preserved fossils for further study at an institute such as the Bernard Price Institute for Palaeontology at WITS University.

INTRODUCTION

Gideon Groenewald was appointed to undertake a desktop survey, assessing the potential palaeontological impact of the development of a Staging platform and road at the Koudelager Coal Mine located approximately 42km East of Vryheid, Kwa-Zulu Natal Province.

Figure 1 Locality of the Koudelager study area

SOUTH AFRICAN NATIONAL HERITAGE RESOURCE ACT NO 25/1999

This Palaeontological Assessment forms part of the Heritage Impact Assessment (HIA) and complies with the requirements of the South African National Heritage Resource Act No 25 of 1999. In accordance with Section 38 (Heritage Resources Management), a HIA is required to assess any potential impacts to palaeontological heritage within the development footprint.

Categories of heritage resources recognised as part of the National Estate in Section 3 of the Heritage Resources Act, and which therefore fall under its protection, include:

geological sites of scientific or cultural importance;

objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens;

objects with the potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage.

METHODOLOGY

Following the "SAHRA APM Guidelines: Minimum Standards for the Archaeological & Palaeontological Components of Impact Assessment Reports" the aims of the palaeontological impact assessment are:

to identify exposed and subsurface rock formations that are considered to be palaeontologically significant;
to assess the level of palaeontological significance of these formations;
to comment on the impact of the development on these exposed and/or potential fossil resources and
to make recommendations as to how the developer should conserve or mitigate damage to these resources.

In preparing a palaeontological desktop study the potential fossiliferous rock units (groups, formations etc) represented within the study area are determined from geological maps and Google Earth imagery. The known fossil heritage within each rock unit is inventoried from the published scientific literature, previous palaeontological impact studies in the same region and the author's field experience.

The likely impact of the proposed development on local fossil heritage is determined on the basis of the palaeontological sensitivity of the rock units concerned and the nature and scale of the development itself, most notably the extent of fresh bedrock excavation envisaged. The different sensitivity classes used are explained in Table 1 below.

Table 1 Palaeontological sensitivity analysis outcome classification

Sensitivity	Description
Low Sensitivity	Areas where there is likely to be a negligible impact on the fossil heritage. This category is reserved largely for areas underlain by igneous rocks. However, development in fossil bearing strata with shallow excavations or with deep soils or weathered bedrock can also form part of this category.
Moderate Sensitivity	Areas where fossil bearing rock units are present but fossil finds are localised or within thin or scattered sub-units. Pending the nature and scale of the proposed development the chances of finding fossils are moderate. A field-based assessment by a professional palaeontologist is usually warranted.
High Sensitivity	Areas where fossil bearing rock units are present with a very high possibility of finding fossils of a specific assemblage zone. Fossils will most probably be present in all outcrops and the chances of finding fossils during a field-based assessment by a professional palaeontologist are very high. Palaeontological mitigation measures need to be incorporated into the Environmental Management Plan

When rock units of moderate to high palaeontological sensitivity are present within the development footprint, a field-based assessment by a professional palaeontologist is usually warranted.

The key assumption for this desktop study is that the existing geological maps and datasets used to assess site sensitivity are correct and reliable. However, the geological maps used were not intended for fine scale planning work and are largely based on aerial photographs alone, without ground-truthing.

These factors may have a major influence on the assessment of the fossil heritage significance of a given development and, without supporting field assessments, may lead to either:

an underestimation of the palaeontological significance of a given study area due to ignorance of significant recorded or unrecorded fossils preserved there, or

an overestimation of the palaeontological sensitivity of a study area, for example when originally rich fossil assemblages inferred from geological maps have in fact been destroyed by weathering, or are buried beneath a thick mantle of unfossiliferous “drift” (soil, alluvium etc).

GEOLOGY

The Study area is underlain by Permian aged sedimentary rocks of the Vryheid Formation and a Jurassic aged Dolerite sill.

Vryheid Formation (Pv)

The mine is operating in the Permian aged sedimentary rocks of the Vryheid Formation of the Ecca Group, Karoo Supergroup that underlies the dolerite, with outcrops occurring just North of the study area. The Vryheid Formation consists of a sequence of coarse-grained sandstone and carbonaceous shales, interpreted as deltaic sedimentary deposits in localised Graben-induced basins in this part of Kwa-Zulu Natal (Johnson et al, 2006).

Dolerite (Jd)

The Jurassic aged dolerite is present as a sill that overlies the Vryheid Formation.

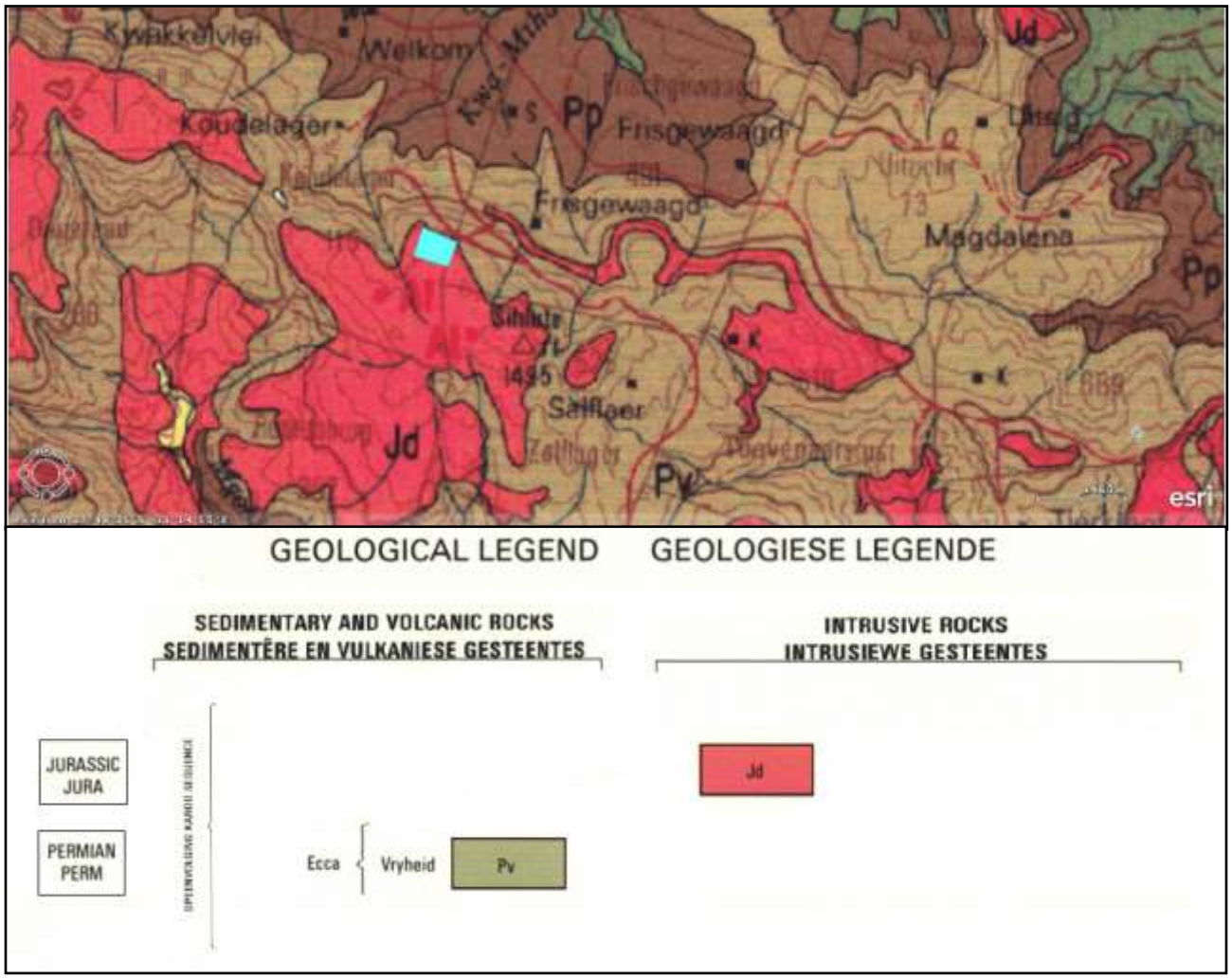

Figure 2 Geology of the Study Area

PALAEONTOLOGY

Vryheid Formation (Pv)

The Vryheid Formation is well-known for the occurrence of coal beds that resulted from the accumulation of plant material over long periods of time. Plant fossils described by Bamford (2011) from the Vryheid Formation are; *Azaniodendron fertile, Cyclodendron leslii, Sphenophyllum hammanskraalensis*, *Annularia* sp., *Raniganjia* sp., *Asterotheca* spp., *Liknopetalon enigmata*, *Glossopteris* > 20 species, *Hirsutum* 4 spp., *Scutum* 4 spp., *Ottokaria* 3 spp., *Estcourtia* sp., *Arberia* 4 spp., *Lidgetonnia* sp., *Noeggerathiopsis* sp. and *Podocarpidites* sp.

According to Bamford (2011) “Little data has been published on these potentially fossiliferous deposits. Around the coalmines there is most likely to be good material and yet in other areas the exposures may be too poor to be of

interest. When they do occur fossil plants are usually abundant and it would not be feasible to preserve and maintain all the sites, however, in the interests of heritage and science such sites should be well recorded, sampled and the fossils kept in a suitable institution.

Although no vertebrate fossils have been recorded from the Vryheid Formation, invertebrate trace fossils have been described in some detail by Mason and Christie (1985). It should be noted, however, that the aquatic reptile, Mesosaurus, which is the earliest known reptile from the Karoo Basin, as well as fish (*Palaeoniscus capensis*), have been recorded in equivalent-aged strata in the Whitehill Formation in the southern part of the basin (MacRae, 1999; Modesto, 2006). Indications are that the Whitehill Formation in the main basin might be correlated with the mid-Vryheid Formation. If this assumption proves correct, there is a possibility that Mesosaurus could be found in the Vryheid Formation.

The late Carboniferous to early Jurassic Karoo Supergroup of South Africa includes economically important coal deposits within the Vryheid Formation of Natal. The Karoo sediments are almost entirely lacking in body fossils but ichnofossils (trace fossils) are locally abundant. Modern sedimentological and ichnofaunal studies suggest that the north-eastern part of the Karoo basin was marine. In KwaZulu-Natal a shallow basin margin accommodated a prograding fluviodeltaic complex forming a broad sandy platform on which coal-bearing sediments were deposited. Ichnofossils include U-burrows (formerly *Corophioides*) which are assigned to ichnogenus *Diplocraterion* (Mason and Christie, 1985).

Dolerite (Jd)

Due to its igneous nature, no fossils will occur in dolerite.

DISCUSSION

The predicted palaeontological impact of the development is based on the initial mapping assessment and literature reviews.

Following this desktop survey, the entire study area is underlain by a dolerite sill (Figure 2) and it is unlikely that any fossils will be present in the areas with dolerite outcrop. Mining for coal will however, by definition, mean that the mining operation will expose plant fossils in the sediments of the Vryheid Formation that underlies the dolerite sill. Depending on the method of mining, the fossils will only be exposed during the actual mining of the coal beds. This implies that, although the palaeontological significance of the present outcrops in the study

area is low, the potential for finding fossils during the mining operation, or during development of infrastructure that cuts into the Vryheid Formation, is very high. It is therefore important that fossils from the Vryheid Formation is recorded during the mining operations as well as during the development of infrastructure and a rating of Medium Palaeontological significance is allocated to the site. The palaeontological significance is summarised in Table 2.

Table 2 Palaeontological significance of geological units on site

Geological Unit	Rock Type and Age	Fossil Heritage	Vertebrate Biozone	Palaeontological Sensitivity
Dolerite	Dolerite JURASSIC	None	None	Low sensitivity
Vryheid Formation	Light grey, coarse-grained sandstone and carbonaceous mudstone PERMIAN	*Azaniodendron fertile, Cyclodendron leslii, Sphenophyllum hammanskraalensis*, *Annularia* sp., *Raniganjia* sp., *Asterotheca* spp., *Liknopetalon enigmata*, *Glossopteris* > 20 species, *Hirsutum* 4 spp., *Scutum* 4 spp., *Ottokaria* 3 spp., *Estcourtia* sp., *Arberia* 4 spp., *Lidgetonnia* sp., *Noeggerathiopsis* sp. and *Podocarpidites* sp. *Diplocraterion* burows	None	Medium sensitivity

MANAGEMENT PLAN

The likely impact of the proposed development on local fossil heritage is determined on the basis of the palaeontological sensitivity of the rock units concerned and the nature and scale of the development itself, most notably the extent of fresh bedrock excavation envisaged. The different sensitivity classes used are explained in Table 1 above.

The palaeontological sensitivity of the development is related to the specific geology that underlies the development footprints. While the Vryheid Formation is rich in fossils, the study area is underlain by a dolerite sill that intruded during the Jurassic Period. Dolerite will not contain any fossils, but mining for coal will, by definition, be the mining of fossil plant material. Depending on the method of mining, either open cast or underground, fossil material will be exposed during the mining operation and a Medium Palaeontological Sensitivity is therefore allocated to the study area (Figure 3). This will ensure that careful monitoring of the palaeontological heritage is part of the Management Plan of the mine.

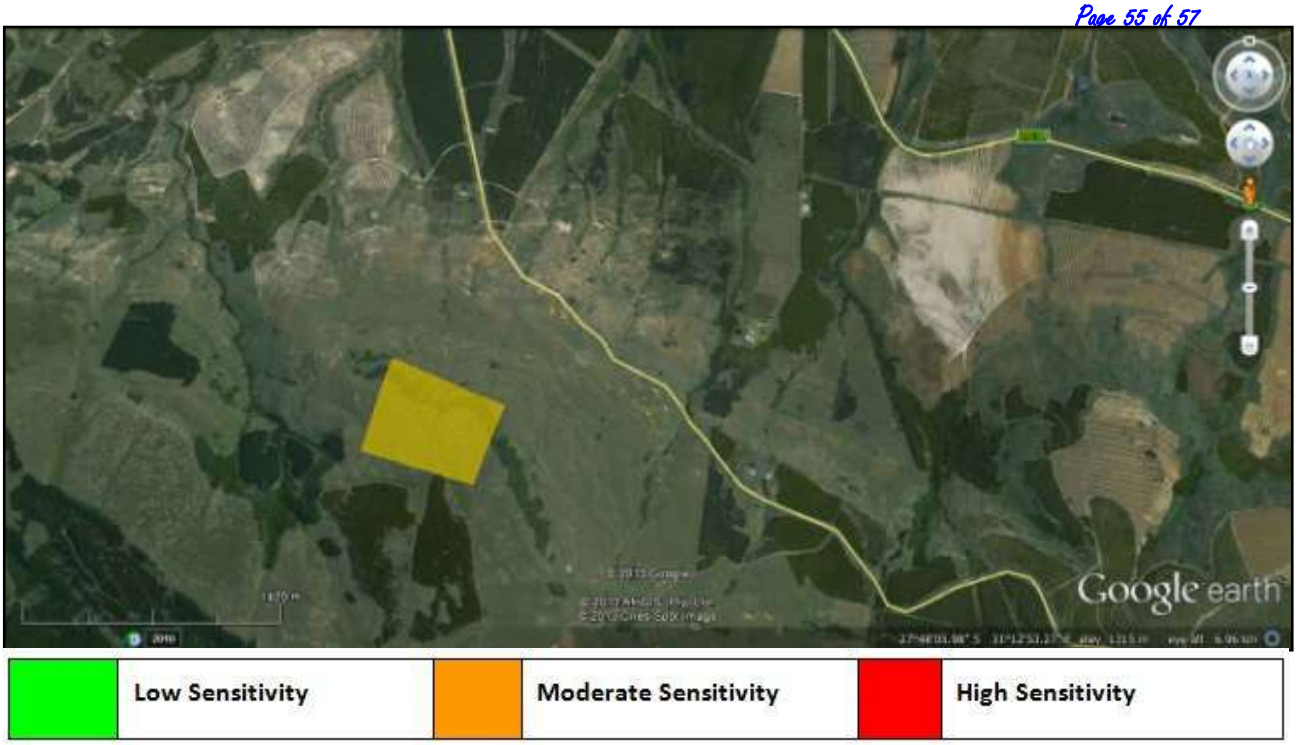

Figure 3 Palaeontological sensitivity of the study area

CONCLUSION

The study area is underlain by Jurassic aged dolerite, which is in turn underlain by Permian aged sediments of the Vryheid Formation. Mining for coal will expose sediments of the Vryheid Formation and it will expose plant fossils. The study area is allocated a Medium palaeontological sensitivity due to the fact that dolerite is an igneous rock, and will thus not contain any fossils, but the underlying sediments of the Vryheid Formation will have fossils, which will be exposed during the mining operation.

Recommendations:

1. The EAP and ECO of the project must be informed of the fact that plant fossils will, by definition, be mined and that it will be important to record and collect well preserved fossils of plants for further study.
2. Arrangements must be made to have a qualified palaeontologist on standby during mining operations. When well-preserved fossils are recorded, the palaeontologist must be appointed to apply for collection and destruction permits from AMAFA and SAHRA and to record well preserved fossils for further study at an institute such as the Bernard Price Institute for Palaeontology at WITS University.

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QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR

Dr Gideon Groenewald has a PhD in Geology from the University of Port Elizabeth (Nelson Mandela Metropolitan University) (1996) and the National Diploma in Nature Conservation from Technicon RSA (the University of South Africa) (1989). He specialises in research on South African Permian and Triassic sedimentology and macrofossils with an interest in biostratigraphy, and palaeo-ecological aspects. He has extensive experience in the locating of fossil material in the Karoo Supergroup and has more than 20 years of experience in locating, collecting and curating fossils, including exploration field trips in search of new localities in the southern, western, eastern and north-eastern parts of the country. His publication record includes multiple articles in internationally recognized journals. Dr Groenewald is accredited by the Palaeontological Society of Southern Africa (society member for 25 years).

DECLARATION OF INDEPENDENCE

I, Gideon Groenewald, declare that I am an independent specialist consultant and have no financial, personal or other interest in the proposed development, nor the developers or any of their subsidiaries, apart from fair remuneration for work performed in the delivery of palaeontological heritage assessment services. There are no circumstances that compromise the objectivity of my performing such work.

Dr Gideon Groenewald
Geologist