Phase 1 Heritage Impact Assessment for a proposed new mining area on the farm Sandfontein 356, Niekerkshoop, NC Province.

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Executive Summary

A Phase 1 Heritage Impact Assessment was carried out on the farm Sandfontein 356 near Niekerkshoop in the Northern Cape Province, as part of a mining application for the removal of crocidolite. The field assessment was conducted on relatively flat terrain at two separate zones where intended development will involve the mining of micro-banded tiger eye (crocidolite) within iron-rich Kuruman Formation outcrop. The basement rocks at Sandfontein 356 are covered in places by superficial deposits that are made up of variable clasts of surface gravels, reworked calcretes, Quaternary sands and sandy soils. Results from a foot survey of the study area show evidence of widespread but small-scale modern mining activities. A relatively low density of stone tools was recorded as isolated surface occurrences (ratio of 1-5: $1m^2$), but no above-ground evidence was found of *in situ* Stone Age archaeological sites. There are also no indications of rock art, prehistoric structures, graves or historically significant structures older than 60 years within the areas that were surveyed. Except for the lower valley fills where rock art localities are likely to occur, the upland areas are characterized by flat terrain and are not considered palaeontologically or archaeologically vulnerable. The survey area is assigned a rating of Generally Protected C (GP.C).

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Introduction

A Phase 1 Heritage Impact Assessment was carried out on the farm Sandfontein 356 near Niekerkshoop in the Northern Cape Province, as part of a mining application for the removal of crocidolite. The region's unique and non-renewable archaeological and palaeontological heritage sites are 'Generally' protected in terms of the National Heritage Resources Act (Act No 25 of 1999, section 35) and may not be disturbed at all without a permit from the relevant heritage resources authority. As many such heritage sites are threatened daily by development, both the environmental and heritage legislation require impact assessment reports that identify all heritage resources including archaeological and palaeontological sites in the area to be developed, and that make recommendations for protection or mitigation of the impact of the sites. Archaeological Impact Assessments (AIAs) and Palaeontological Impact Assessments (PIAs), or overarching Heritage Impact Assessments (HIAs) are most often specialist reports that form part of the wider heritage component of Environmental Impact Assessments (EIAs) required in terms of the National Environmental Management Act or of the Environment Conservation Act by the provincial Department of Environment Affairs; or Environmental Management Plans (EMPs) required by the Department of Minerals and Energy.

Legislative framework

The primary legal trigger for identifying when heritage specialist involvement is required in the Environmental Impact Assessment process is the National Heritage Resources (NHR) Act (Act No 25 of 1999). The NHR Act requires that all heritage resources, that is, all places or objects of aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance are protected. Thus any assessment should make provision for the protection of all these heritage components, including archaeology, shipwrecks, battlefields, graves, and structures over 60 years of age, living heritage and the collection of oral histories, historical settlements, landscapes, geological sites, palaeontological sites and objects.

The Act identifies what is defined as a heritage resource, the criteria for establishing its significance and lists specific activities for which a heritage specialist study may be required. In this regard, categories of development listed in Section 38 (1) of the NHR Act are:

- The construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;
- The construction of a bridge or similar structure exceeding 50m in length;
- Any development or other activity which will change the character of the site;
- Exceeding 5000 m² in extent;
- Involving three or more existing erven or subdivisions thereof;
- Involving three or more subdivisions thereof which have been consolidated within the past five years;
- Costs of which will exceed a sum set in terms of regulations by the South African Heritage Resources Agency (SAHRA).
- The rezoning of a site exceeding 10 000 m².
- Any other category of development provided for in regulations by the South African Heritage Resources Agency (SAHRA).

If a heritage resource is likely to be impacted by a development listed in Section 38 (1) of the NHR Act, a heritage assessment will be required either as a separate HIA or as the heritage specialist component (AIA or PIA) of an EIA.

The significance or sensitivity of heritage resources within a particular area or region can inform the EIA process on potential impacts and whether or not the expertise of a heritage specialist is required. A range of contexts can be identified which typically have high or potential cultural significance and which would require some form of heritage specialist involvement (**Table 1**). This may include formally protected heritage sites or unprotected, but potentially significant sites or landscapes (**Table 2**). The involvement of the heritage specialist in such a process is usually necessary when a proposed development may affect a heritage resource, whether it is formally protected or unprotected, known or unknown. In many cases, the nature and degree of heritage significance is largely unknown pending further investigation (e.g. capped sites, assemblages or subsurface fossil remains). On the other hand, it is also possible that a site may contain heritage resources (e.g. structures older than 60 years), with little or no conservation value. In most cases it will be necessary to engage the professional opinion of a heritage specialist in determining whether or not further heritage specialist input in an EIA process is required. This may involve site-significance classification standards as prescribed by SAHRA (**Table 3**).

Alternatively, useful sources of information on heritage resources in South Africa can also be obtained through SAHRA's national database of heritage resources, including existing heritage survey information as well as other published or secondary source material on the overall history of a particular area or site.

Methodology

The significance of the affected area was evaluated through a desktop study and carried out on the basis of existing field data, database information and published literature. This was followed by a field assessment by means of a pedestrian survey of the power line route. A Garmin Etrex Vista GPS hand model (set to the WGS 84 map datum) and a digital camera were used for recording purposes. Relevant archaeological and palaeontological information, maps, Google Earth images and site records were consulted and integrated with data acquired during the on-site inspection.

The task also involved identification and assessment of possible palaeontological and archaeological heritage within the proposed project area, in accordance with section 9(8) and appendix 6 ("Specialist reports") of the NEMA EIA Regulations, 2014 , whereby the specialist report takes into account the following terms of reference:

- Identify and map possible heritage sites and occurrences using available resources.
- Determine and assess the potential impacts of the proposed development on potential heritage resources;
- Recommend mitigation measures to minimize potential impacts associated with the proposed development.

Description of the Affected Area

Locality data

1 : 50 000 scale topographic map 2922BD Niekerkshoop

1 : 250 000 scale geological map 2922 Prieska

Sandfontein 356 is located on high ground within the Asbesberge mountain range, approximately 30 km north of Prieska and 10 km south of Niekerkshoop (**Fig. 2**). The site coordinates of the survey area are as follows:

A) 29°25'44.89"S 22°47'49.39"E

B) 29°26'42.14"S 22°46'55.56"E

C) 29°26'47.56"S 22°47'23.76"E

D) 29°25'50.95"S 22°48'1.77"E

E) 29°24'27.36"S 22°48'46.74"E

F) 29°24'26.58"S 22°49'35.48"E

G) 29°25'47.05"S 22°50'1.98"E

H) 29°26'10.21"S 22°49'48.99"E

I) 29°25'56.65"S 22°49'7.84"E

J) 29°26'18.87"S 22°48'55.54"E

The field assessment was conducted on relatively flat terrain at two separate zones where intended development will involve the mining of micro-banded tiger eye (crocidolite) within iron-rich Kuruman Formation outcrop (**Fig. 3**).

Geology

Sandfontein 356 is primarily underlain by banded ironstone, haematite, crocidolite and chert layers located in the basinal facies of the Ghaap Group (Asbestos Hills Subgroup, Transvaal Supergroup) (**Fig. 4**). Older strata lower down in the facies (e.g. Cambell Rand Subgroup) are exposed along the Orange River south and west of the study area and consist of stromatolite- and microfossil-bearing dolomite, dolomitic limestone and chert members, that were formed by the precipitation of carbonate rocks when colonies of stromatolites thrived in shallow, tropical marine environments towards the end of the Archaean Eon, 2.6 billion years ago. Localized outcrops of by Dwyka Group tillites (Karoo Supergroup, Mbizane Formation) are located to the south and southeast of the study area and represent valley and inlet fill deposits left behind on Ventersdorp basement rocks by retreating glaciers about 300 million years ago. The Dwyka-aged palaeovalleys bear evidence of glaciated pavements, consisting of well-preserved polished surfaces striations on basement rocks, which are found throughout the region. Late Cenozoic surface calcretes occur extensively to the east of the Asbesberge. The basement rocks at Sandfontein 356 are covered in places by superficial deposits that are made up of variable clasts of surface gravels, reworked calcretes, Quaternary sands and sandy soils (**Fig. 5**).

Background

The banded iron formations (BIF) at Sandfontein 356 possibly reflect Early Proterozoic environmental conditions following iron deposition as a result of the build-up of free oxygen in the oceans by cyanobacterial photosynthesis. Paleogene fossil assemblages are known from a crater lake deposit within a volcanic pipe at Stompoor near Prieska and include a diversity of fish, frogs, reptiles, insects, and palynological remains (Smith 1988). Fluvial deposits from the ancient Koa Valley northwest of Prieska and south of Pofadder, has yielded fossil vertebrate bone as well as fossil wood (Partridge and Maud 2000). No Quaternary fossils have been explicitly reported from the vicinity of Prieska, but a fossilized horn core of an extinct alcelaphine has been retrieved from alluvial sediments along the Ongers River near Britstown, while Florisian type faunal remains have been excavated from an archaeological site at Bundu Farm Pan near Copperton (Brink *et al*. 1995; Kiberd 2006).

The archaeological footprint in the area are primarily represented by Stone Age archaeology, rock art localities, structural remnants dating back to the Anglo Boer War and its aftermath, as well as graveyards and other historical structures dating more than 60 years ago. The Stone Age archaeological footprint in the region is represented by Early, Middle and Later Stone Age sites associated with pans, while the landscape in general is characterized by low density surface scatters (Beaumont 1995; Kiberd 2006). MSA surface scatters have also been recorded at Elswater, Brakfontein and Nuwejaarskraal near Douglas. Rock engravings have been recorded in the younger valley fills along the steeper slopes located near the eastern and south-eastern margins of Sandfontein 356 (van Riet Low 19). In addition, rock art sites have been recorded on a number of farms around Prieska, including Kleindoring, Wonderdraai and Omdraaisvlei. Historical ruins and graveyards associated with the asbestos mining industry during the first half of the 20th century are located at Kliphuis and Engeldewilgeboomfontein north of Prieska. Further away, stone pipes and LSA artefacts have been recorded on the farm Doornkuil near Britstown, while prehistoric graves and clay pottery have been recorded along the Orange River in the vicinity of Douglas.

Field Assessment

The proposed development footprint and existing access roads are located on banded ironstone , haematite and crocidolite outcrop covered by surface gravels and modest sandy soils. Results from a foot survey of the study area show evidence of widespread but small-scale modern mining activities (**Fig. 6 & 7; Table 4**) A relatively low density of stone tools was recorded as isolated surface occurrences (ratio of 1-5: $1m^2$), but no above-ground evidence was found of *in situ* Stone Age archaeological sites. There are also no indications of rock art, prehistoric structures, graves or historically significant structures older than 60 years within the areas that were surveyed.

Impact Statement and Recommendation

Potential impacts are summarized in **Table 5**.The geology of area reflects Early Proterozoic environmental conditions while the farm itself is located near the lower Orange River basin, which has previously yielded ample archaeological evidence of prehistoric human occupation. Isolated surface scatters of Stone Age lithics are present but sparsely distributed and highly weathered. Except for the lower valley fills where rock art localities are likely to occur, the upland areas are characterized by flat terrain and are not considered palaeontologically or archaeologically vulnerable. The survey area is assigned a rating of Generally Protected C (GP.C). However, the potential occurrence of isolated and unmarked graves or intact subsurface archaeological finds not recorded during this survey can never be excluded, so it is advised that SAHRA and a qualified archaeologist are informed immediately in the event of potential exposure.

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Tables and Figures

Table 1: Relationship between different heritage contexts, heritage resources likely to occur within these contexts, and likely sources of heritage impacts in the central interior of South Africa.

Heritage Context	Heritage Resources	Impact
Palaeontology	Precambrian shallow marine and lacustrine stromatolites, organic-walled microfossils, Ghaap Plateau (Transvaal Supergroup) Palaeozoic and Mesozoic fossil remains, e.g. Karoo Supergroup Neogene regolith	Road cuttings Quarry excavation Bridge and pipeline construction (Quaternary alluvial deposits)
Archaeology Early Stone Age Middle Stone Age LSA - Herder Historical	Types of sites that could occur in the Free State include: Localized Stone Age sites containing lithic artifacts, animal and human remains found near *inter alia* the following: River courses/springs Stone tool making sites Cave sites and rock shelters Freshwater shell middens Ancient, kraals and stonewalled complexes Abandoned areas of past human settlement Burials over 100 years old Historical middens Structural remains Objects including industrial machinery and aircraft	Subsurface excavations including ground levelling, landscaping, foundation preparation, road building, bridge building, pipeline construction, construction of electrical infrastructure and alternative energy facilities, township development.
History	Historical townscapes, e.g. Kimberley Historical structures, i.e. older than 60 years Historical burial sites Places associated with social identity/displacement, e.g. Witsieshoek Cave, Oppermansgronde Historical mission settlements, e.g. Bethulie, Beersheba, Moffat Mission	Demolition or alteration work. New development.
Natural Landscapes	Formally proclaimed nature reserves Evidence of pre-colonial occupation Scenic resources, e.g. view corridors, viewing sites, Historical structures/settlements older than 60 years Geological sites of cultural significance.	Demolition or alteration work. New development.
Relic Landscape Context	Battle and military sites, e.g Magersfontein Precolonial settlement and burial sites Historical graves (marked or unmarked, known or unknown) Human remains (older than 100 years) Associated burial goods (older than 100 years) Burial architecture (older than 60 years)	Demolition or alteration work. New development.

Table 2. Examples of heritage resources located in the central interior of South Africa.

Historically, archaeologically and palaeontologically significant heritage sites & landscapes	**Examples**
Landscapes with unique geological or palaeontological history	Karoo Basin Beaufort Group sedimentary strata Glacial striations on Ventersdorp andesites Vredefort Dome World Heritage Site. Taung World Heritage Site
Landscapes characterised by certain geomorphological attributes where a range of archaeological and palaeontological sites could be located.	Vaal, Modder and Riet River valleys Pans, pandunes and natural springs of the Free State panveld. Ghaap Plateau
Relic landscapes with evidence of past, now discontinued human activities	Wonderwerk Cave Stone Age deposits Cave sites and rock shelters in the Maluti Drakensberg region (rock art) Southern Highveld pre-colonial settlement complexes. Dithakong settlement complexes Rock engravings on Ventersdorp andesites
Landscapes containing concentrations of historical structures.	Concentration camps & cemeteries from the South African War.
Historical towns, historically significant farmsteads, settlements & routes	Batho historical township area in Mangaung (Bloemfontein). Kimberley
Battlefield Sites, burial grounds and grave sites older than 60 years.	Sannaspos Magersfontein

Table 3. Field rating categories as prescribed by SAHRA.

Field Rating	**Grade**	**Significance**	**Mitigation**
National Significance (NS)	Grade 1	-	Conservation; national site nomination
Provincial Significance (PS)	Grade 2	-	Conservation; provincial site nomination
Local Significance (LS)	Grade 3A	High significance	Conservation; mitigation not advised
Local Significance (LS)	Grade 3B	High significance	Mitigation (part of site should be retained)
Generally Protected A (GP.A)	-	High/medium significance	Mitigation before destruction
Generally Protected B (GP.B)	-	Medium significance	Recording before destruction
Generally Protected C (GP.C)	-	Low significance	Destruction

Table 4. Features recorded during the foot survey.

Feature	Coordinates	
Informal flakes / chunks (banded ironstone)	29°24'45.77"S	22°48'58.08"E
Stone tool chunks (ironstone)	29°25'14.66"S	22°48'56.71"E
Weathered stone tool scatter (banded ironstone)	29°25'53.54"S	22°49'19.65"E
Weathered stone tool scatter (banded ironstone)	29°26'3.65"S	22°47'48.97"E
Weathered stone tool scatter (banded ironstone)	29°26'22.32"S	22°47'19.33"E
Modern Farm Structure	29°24'33.40"S	22°49'25.13"E
Modern Farm Structure/s	29°24'57.21"S	22°49'18.94"E
Modern Farm Structure	29°25'59.95"S	22°49'37.47"E
Borrow Pit	29°26'19.91"S	22°48'31.14"E
Borrow Pit	29°26'7.86"S	22°47'25.19"E
Borrow Pit	29°26'12.22"S	22°47'27.41"E
Borrow Pit	29°26'34.45"S	22°47'0.32"E
Borrow Pit	29°26'32.47"S	22°47'9.98"E
Borrow Pit	29°26'26.75"S	22°47'11.24"E
Borrow Pit	29°26'21.77"S	22°47'12.42"E
Borrow Pit	29°26'11.67"S	22°47'28.74"E
Borrow Pit	29°26'12.41"S	22°47'27.40"E
Borrow Pit	29°26'13.62"S	22°47'26.26"E
Borrow Pit	29°26'16.93"S	22°47'26.79"E
Borrow Pit	29°26'21.17"S	22°47'25.45"E
Borrow Pit	29°26'22.72"S	22°47'24.96"E
Borrow Pit	29°26'24.50"S	22°47'25.37"E

Table 5. Summary of impact on the survey area in terms of Extent (the size of the area that will be affected by the impact), Intensity (the anticipated severity of the impact), Duration (the timeframe during which the impact will be experienced), Probability, Confidence, Mitigation and Site Rating.

Impact	Extent	Intensity	Duration	Probability of impact	Confidence	Mitigation	Rating
Impact of proposed development on palaeontological heritage	Local	Moderate - High	Permanent	Low; Banded ironstone and crocidilite outcrop; Sterile and weakly developed superficial deposits	High	None	Generally Protected C (GP.C)
Impact of proposed development on archaeological heritage	Local	Moderate-High	Permanent	Low: No aboveground evidence of *in situ* archaeological features, graves or structures older than 60 years on flat upland terrain	High	None	Generally Protected C (GP.C)

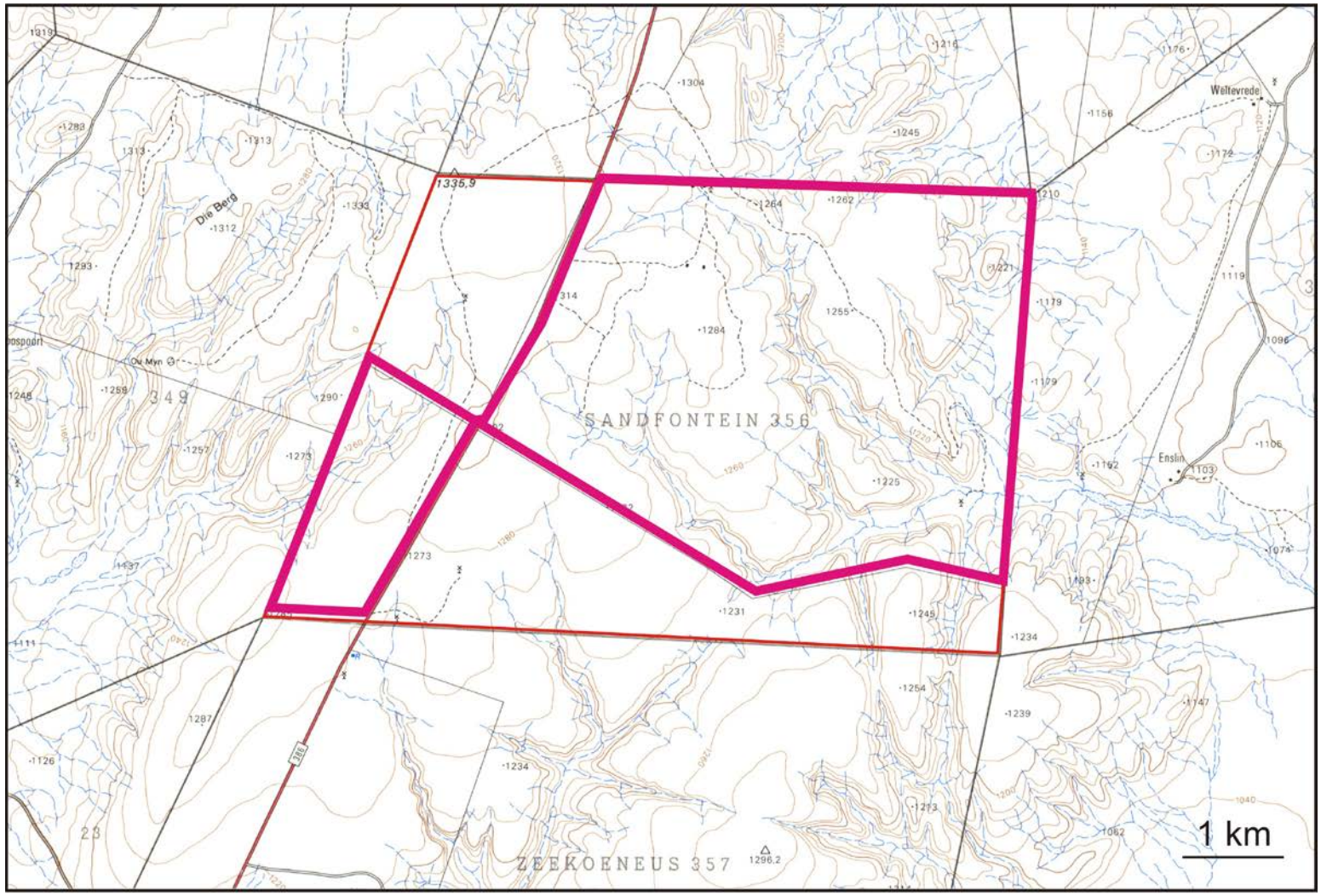

Figure 1. The study area at Sandfontein 356 (portion of 1:50 000 scale topographic map 2922BD Niekerkshoop).

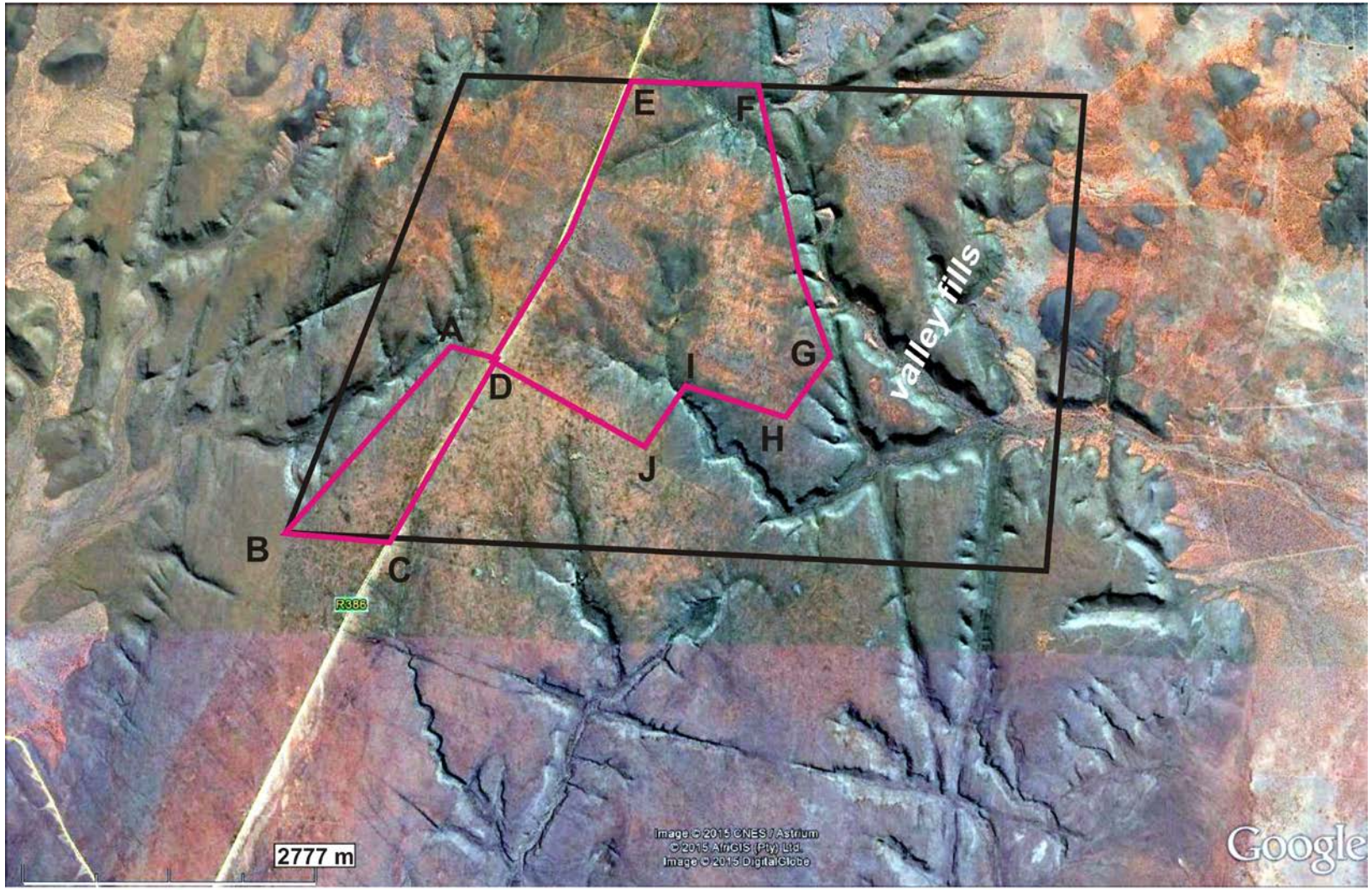

Figure 2. Arial view of the flat, upland terrain surveyed.

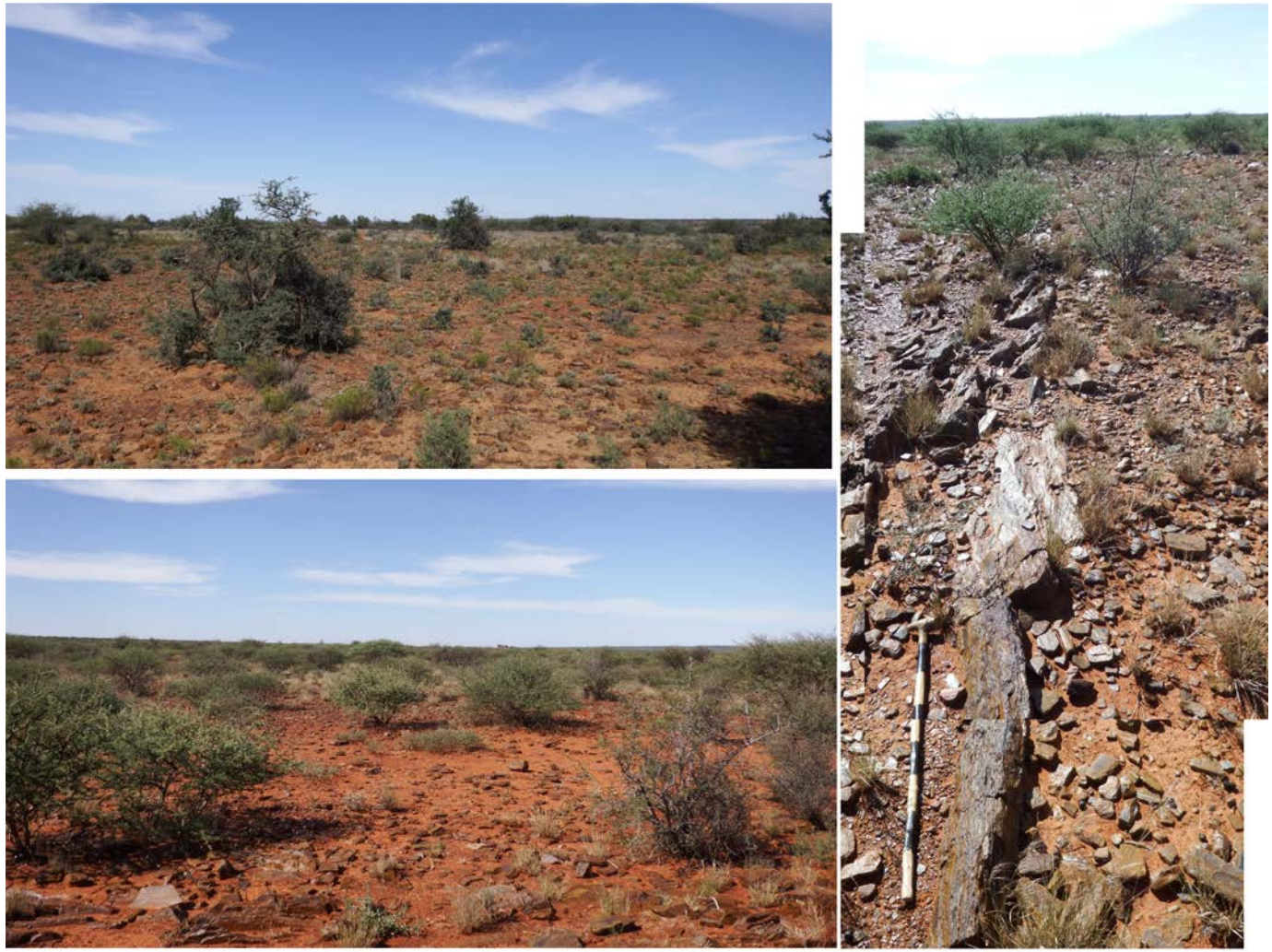

Figure 3. General view of the terrain (above and below left). The development footprint and existing access roads are located on banded ironstone and crocidolite outcrop (right), covered by surface gravels and modest sandy soils.

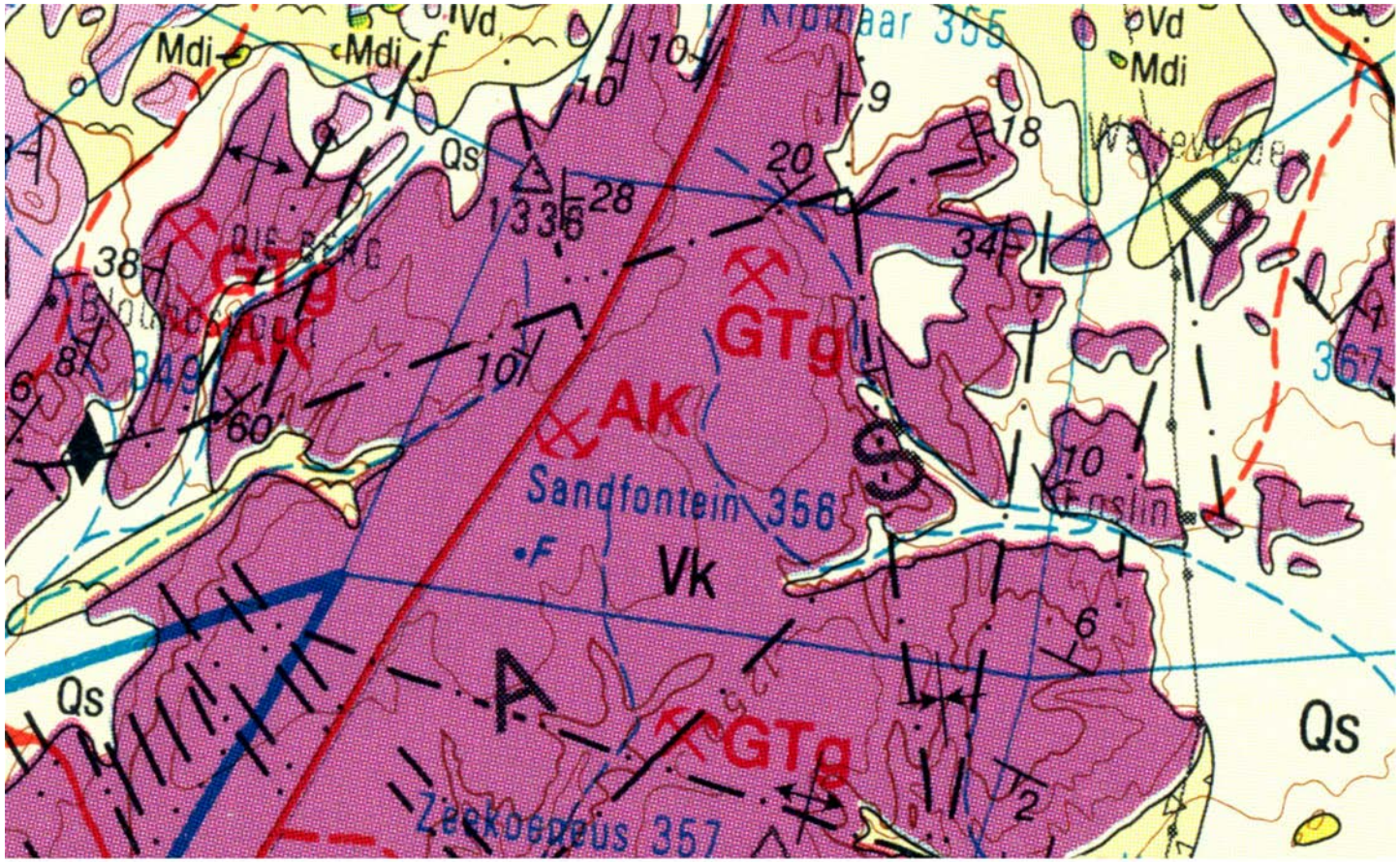

Figure 4. Sandfontein 356 is primarily underlain by banded ironstone, haematite, crocidolite and chert layers located in the basinal facies of the iron-rich Ghaap Group (*Vk,* Transvaal Supergroup) as shown by a portion of the 1:250 000 scale geological map 2922 Prieska.

Figure 5. The basement rocks at Sandfontein 356 are covered in places by superficial deposits made up of variable clasts of surface gravels, reworked calcretes, Quaternary sands, sandy soils and isolated surface scatters of weathered and informal stone tools.

Figure 6. General view of an existing borrow pit following the excavation of a crocidilite seam.

Figure 7. Existing mining activities (top) and excavated material (center and bottom).