PALAEONTOLOGICAL MONITORING REPORT (JULY 2016) ON VAALBULT COLLIERY PIT LOCATED ON THE FARM VAALBULT 31T, MPUMALANGA PROVINCE

2 August 2016

Prepared for:
Vaalbult Mining Company (Pty)

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Prepared for:

Vaalbult Mining Company (Pty) Ltd

Prepared by:

Prof B Millsteed

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EXECUTIVE SUMMARY

Vaalbult Mining Company (Pty) Ltd owns and operates a colliery on the farm Vaalbult 31T, Gert Sibande District Municipality, located west of Carolina, Mpumalanga Province. The South African Heritage Resources Agency (SAHRA) has instructed Vaalbult Mining Company (Pty) Ltd [SAHRA document Ref: 16/5/1 Vaalbult Mining Project; dated 13 February 2014] that on-site checks for the occurrence of any fossils of the excavated pit and stockpiled material are required every six months by an experienced Karoo palaeobotanist. The frequency of these checks will be assessed after six months based on the findings and the planned mining programme. The Karoo palaeobotanist must submit a monitoring report to SAHRA on this work.

In compliance with the SAHRA instruction, this report documents the results of a palaeontological monitoring program site visit conducted by Prof B. Millsteed on the 15th of July 2016. Prof Millsteed was accompanied by Ms E. Nethavhani of Vaalbult Mining Company (Pty) Ltd (who facilitated the access to all those areas that were required) and Ms E. Denge of the University of Limpopo. Vaalbult Mining Company made no restrictions concerning the location of areas to be investigated and access was freely available to Prof Millsteed to inspect wherever he desired. During the site visit reported upon herein cuts 7, 36 and 62 were visited, these being the cuts that were being actively mined at the time. These three cuts are located on the western-most extent of the Mining Right area immediately proximal to and on either side of the sites examined in the preceding palaeontological monitoring visit in February 2016.

The site visit revealed that the Vaalbult Colliery mining operations impact directly upon strata of the Early Permian Vryheid Formation, Karoo Supergroup. This unit is known to be richly fossiliferous elsewhere in its extent; common fossils within the unit include plant macrofossils and trace fossils. The stratigraphic succession within in the Vaalbult Colliery consists of eight distinct lithofacies, named units A-H herein. The sequence is dominated by the two coal seams that are economically exploited by the colliery; these seams are the upper-most D Seam (unit E) and the underlying E Seam (unit A). The E seam constitutes the base of the colliery pit in all area observed and appears to be uniformly distributed throughout the pit. The sedimentary sequence separating the two seams varies between 11.5 m and 12.5 m in thickness (the thickness deceases towards the west). Immediately overlying the E Seam is a highly variable sandstone unit (unit B). In the earlier site visit unit B was observed to be a 30 cm thick, buff coloured uniform, massively bedded unit. However, in cut 36 the sandstone forms a 50 cm thick fining-upward sequence with granulestone at the base, grading upward into a flaser-bedded portion and an upper-most massive to planar-bedded sandstone portion. In cut 62 unit B is present as a <2 m thick laminated, micaceous sandstone (the individual mica flakes exceed several millimetres in size). Overlying unit B is approximately 2 m of black, thinly laminated, carbonaceous mudstone and then ca. 9-10 m of buff coloured sandstone (unit C). Overlying unit C is approximately 5-6 m of brown coloured, sandstones of unit D. The sandstone is variable in appearance, being parallel bedded in

cut 62 (Figure 6) and exhibiting well developed point bar cross-beds in cut 36. Similarly, the base of unit D is uniformly flat and parallel to bedding in cut 62 (Figure 6), but is extremely undulating in cut 26. The coals of Unit E (D seam) overly unit D and the maximum exposed thickness in the three cuts examined was ca. 40 cm. In the previous biannual site visit the unit overlying unit E was ca. 8 m of thinly laminated, black carbonaceous mudstones (termed unit F). In the current investigation, the rocks comprising unit F are sub dividable into three distinct lithological subunits (termed F1-F3 herein). Rock sequence F1 consists of ca. 2 m of massive and laminated dark grey mudstones, F2 consists of ca. 1 m of light grey, laminated mudstones and the upper part of unit F consists of ca. 3 m of black, carbonaceous mudstone (subunit F3). Within cut 7 unit H is not present and approximately 2 m of regolith (unit G) tops the sequence.

The strata examined to date within the mine pit and associated waste rock stockpiles are fossiliferous. During the present site visit a single unidentifiable carbonaceous compression of a woody stem segment was located within rocks attributed to unit B in cut 62. Several blocks of rock containing specimens of the ichnogenus *Skolithus* and a poorly preserved, unidentified, un-branching, horizontal, tubular were located in sediments ascribed to unit B in cut 62. None of the fossils (plant macrofossil or trace fossils) identified are palaeontologically significant and require special preservation or excavation.

The lithological succession of the Vaalbult Colliery is fossiliferous and due care needs to be exercised to ensure that the palaeontological heritage of the area is not diminished by the mining activities. That said, the strata being mined by the colliery occur beneath a uniformly thick regolith horizon and do not crop out. The absence of bedrock outcrop means that no fossils are observable at surface. As a result, it is only due to the ongoing mining activities that the fossiliferous strata are exposed and made available for scientific study. None of the fossils located during either the current or the preceding study are of sufficient palaeontological significance that their excavation by a palaeontologist or their preservation is required, but this may not always be the case. However, comparison of the stratigraphic successions studied in this and the preceding palaeontological monitoring reports indicates that several of the geological units present within the mine show significant sedimentological variation across the small area mined to date. It is interpreted, herein, that significant facies variations may be possible across the full extent of the Mining Right area. Changes within the abundance and type of fossil assemblages may be possible and that palaeontologically significant fossil assemblages may be present. The possibility of the presence of palaeontologically significant fossils within the rocks of the colliery therefore remains a strong possibility. The greatest potential for the presence of significant plant macrofossils is in the lower-energy lithofacies represented by units B, C and F.

It is accordingly recommended that:

- A member of staff (e.g., the Environment Officer) of the Vaalbult Mining Company (Pty) Ltd be trained to recognise the types of fossils that may be exposed via the mining operations. This officer should:
    - Make regular inspections of newly exposed rock material following blasting to identify if scientifically significant fossils have been exposed.
    - If significant fossils are present, they should be collected and placed in a safe, protected area for storage.
    - While the fossils are collected, precise notes of the location they were collected from must be collected, as well as the lithological unit containing the fossils.
- An experience Karoo palaeobotanist should be mandated by the colliery to inspect the fossils, ascertain their significance and to make any necessary recommendations concerning their preservation.
- Due to the low abundance and low scientific importance of the fossil assemblages identified within the mine excavations to date it is recommended that the examinations of the colliery cuts by an experience Karoo palaeobotanist should continue, but that the frequency of those inspections be decreased from six monthly to 12 monthly (subject to later review).

1 INTRODUCTION

Vaalbult Mining Company (Pty) Ltd owns and operates a colliery on the farm Vaalbult 31T, Gert Sibande District Municipality, located west of Carolina, Mpumalanga Province. The South African Heritage Resources Agency (SAHRA) has instructed Vaalbult Mining Company (Pty) Ltd [SAHRA document Ref: 16/5/1 Vaalbult Mining Project; dated 13 February 2014] that on-site checks for the occurrence of any fossils of the excavated pit and stockpiled material are required every six months by an experienced Karoo palaeobotanist. The frequency of these checks will be assessed after six months based on the findings and the planned mining programme. The Karoo palaeobotanist must submit a monitoring report to SAHRA on this work. In compliance with the SAHRA instruction, this report documents the results of a palaeontological monitoring program site visit conducted by Prof B. Millsteed on the 15th of July 2016.

2 LOCATION

Vaalbult Colliery is located on the farm Vaalbult 31T, Gert Sibande District Municipality, located west of Carolina, Mpumalanga Province. The Mining lease lies approximately 10 km west of the town of Carolina and 28 km northeast of Hendrina (Figure 1). The approximate corner points (see Figure 1) of the Mining Right area are provided in Table 1.

CORNER POINT	LATITUDE	LONGITUDE
A	-26.062385	30.008051
B	-26.091515	30.020978
C	-26.098911	30.999122
D	-26.093777	30.983943

Table 1: Approximate latitude and longitude of corner points of the Vaalbult Colliery Mining Right boundary. The coordinates are provided in geographic format, WGS84 datum.

3 RELEVENT EXPERIENCE

Prof Millsteed holds a PhD in palaeontology and has previously been employed as a professional palaeontologist with the Council for Geoscience in South Africa. He is the principle of BM Geological Services and has sufficient knowledge of palaeontology and the relevant legislation required to produce this Palaeontological Monitoring Report. Prof Millsteed is registered with the South African Council for Natural Scientific Professions (SACNASP; Reg. No. 400332/07), is a member of the Palaeontological Society of South African and is a fellow of the Geological Society of South Africa.

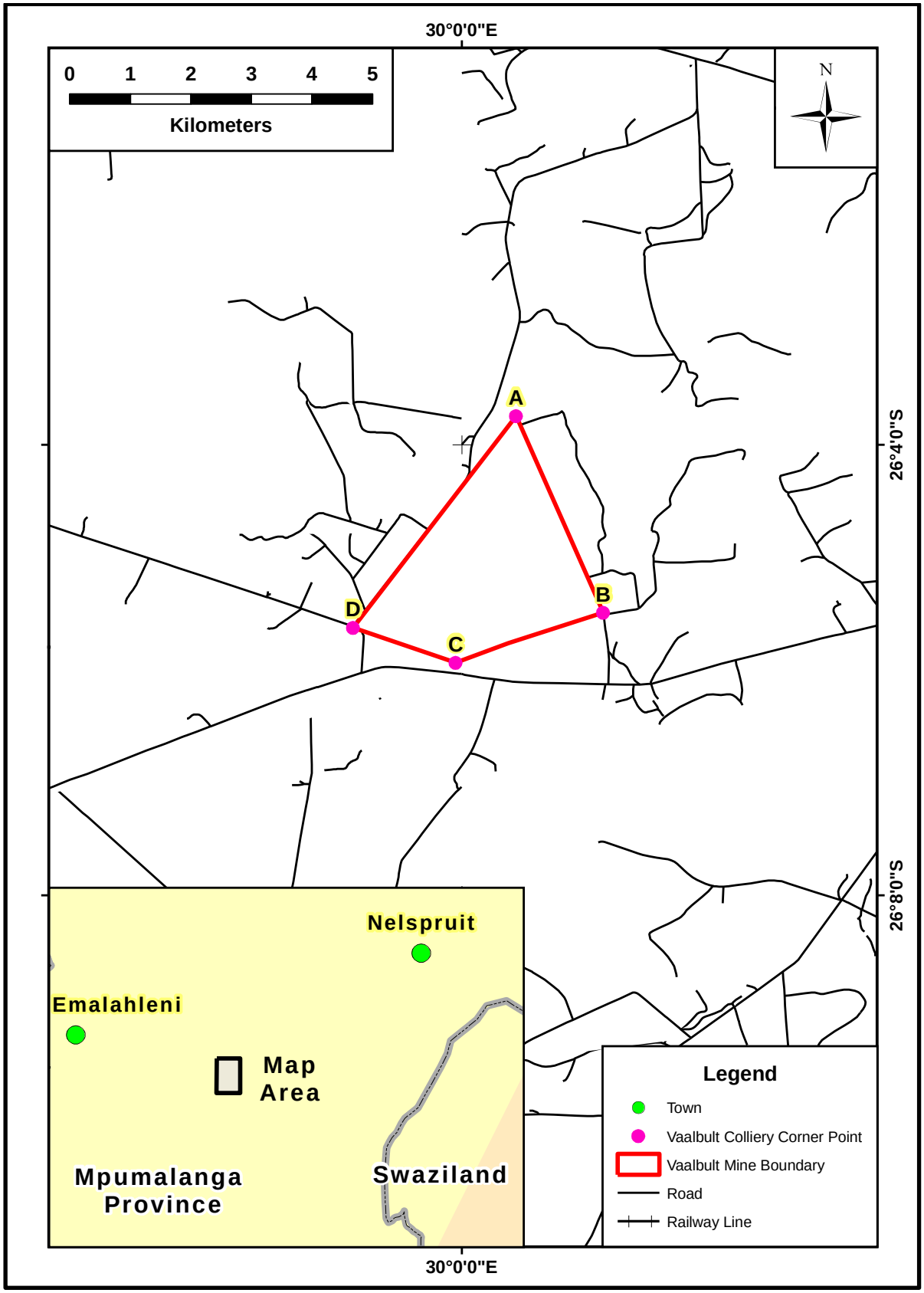

Figure 1: Location map of the Vaalbult Colliery. Shown, as the purple circles are the approximate corner points of the Mining Right area, the co-ordinates for the corner points are provided in Table1.

4 ACCESS AND INDEPENDENCE

Prof Millsteed was contracted as an independent consultant to conduct this palaeontological monitoring study and compile the present report and shall receive fair remuneration for these professional services. Neither Prof Millsteed nor BM Geological Services has any financial interest in the Vaalbult Colliery, the Vaalbult Mining Company (Pty) Ltd nor any companies or individuals associated with the project.

No restrictions concerning the location of areas to be investigated were made by Vaalbult Mining Company and access was freely available to Prof Millsteed to inspect wherever he desired. Vaalbult Mining Company (Pty) Ltd provided all support staff and made all safety and access arrangements required to inspect the areas selected by Prof Millsteed. A representative portion of the pit high walls were able be visited and documented in each of the mines working cuts visited.

5 METHODOLOGY

The Vaalbult Colliery was visited and inspected by Prof Millsteed on the 15th of July 2016. Prof Millsteed was accompanied by Ms E. Nethavhani of Vaalbult Mining Company (Pty) Ltd and Ms E. Denge of the University of Limpopo. Vaalbult Mining Company (Pty) Ltd imposed no restrictions concerning the location of areas to be investigated were made by; access was freely available for Prof Millsteed to inspect wherever he desired.

All sites inspected were visited on foot. The locations where detailed observations and photographs were made were recorded as waypoints using a hand-held GPS (Figure 2). The investigation was conducted within cuts 7 (waypoint Val3, Figure 2), 36 (waypoint waypoint Val4, Figure 2) and 62 (waypoints Val1 and Val2, Figure 2) of the colliery. These three cuts represent all cuts in which mining was occurring at the time of the inspection.

6 GEOLOGY

Figure 3 shows that the project area is completely underlain by rocks of the Early Permian Vryheid Formation. A summary of the characteristics of the Vryheid Formation in general, the strata present within the Vaalbult Colliery open pit, and their fossiliferous content and potential follows.

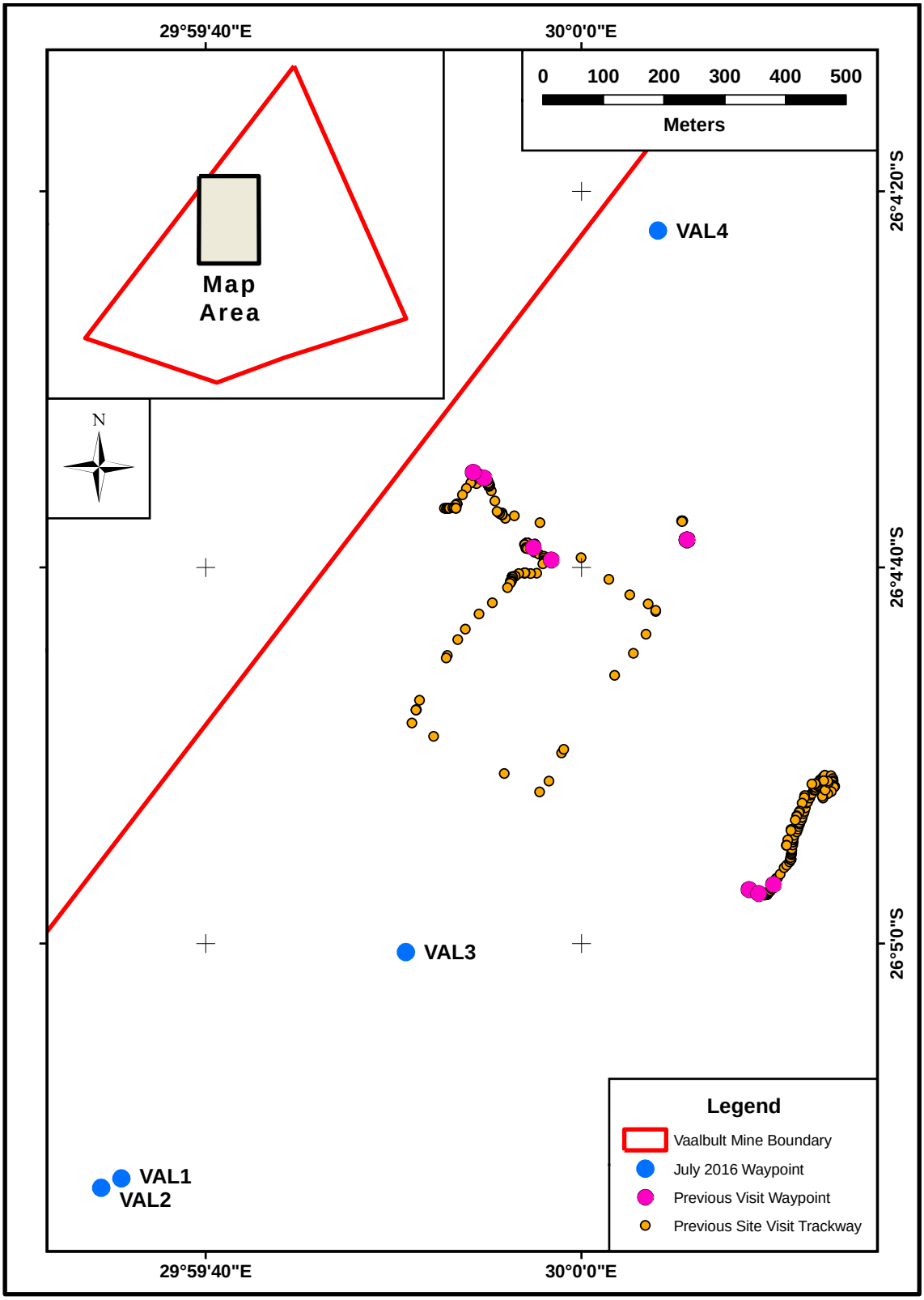

Figure 2: Map showing the location of the GPS waypoints showing the areas examined during the site visit on the 15th of July 2016 as well as those areas examined during the preceding site visit conducted six months previous. Val1 and Val2 are located in cut 62, Val3 is located in cut 7 and Val 4 is located in cut 36.

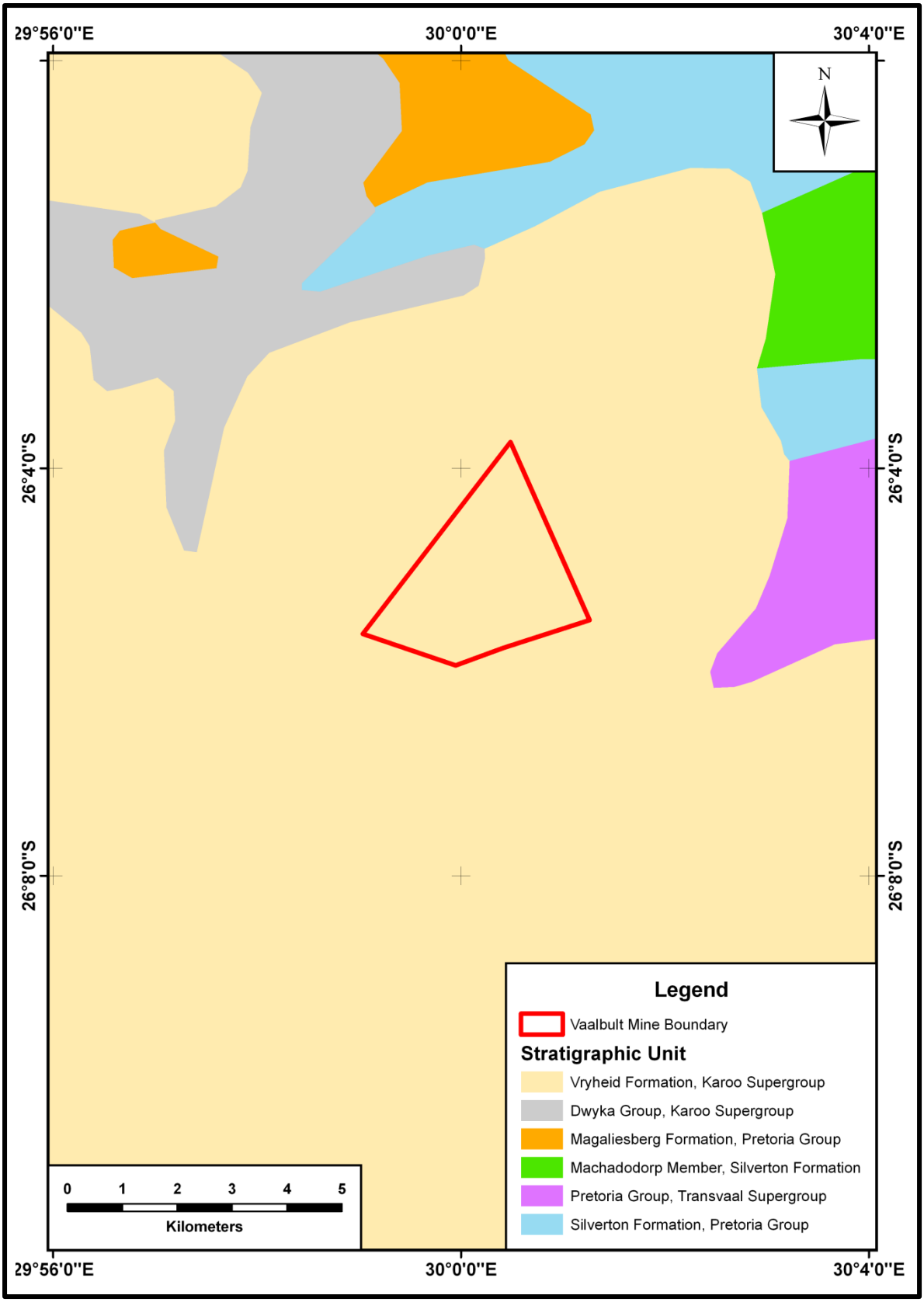

Figure 3: Geological map of the area underlying the Vaalbult Colliery Mining Right area and its immediate environs.

6.1 Vryheid Formation

The Main Karoo Basin consists of a retro-arc foreland basin filled with a lithological succession ranging in age from the Late Carboniferous to the Middle Jurassic (Johnson *et al*., 2006). The basin-fill sequence wedges out northwards over the adjacent Kaapvaal Craton.

In the Main Karoo Basin of South Africa the Vryheid Formation is a sandstone and coal-rich stratigraphic unit that interfingers with (i.e., is transitional with and partially time equivalent to) the overlying Volksrust and underlying Pietermaritzburg Formations; both of which are both are predominantly argillaceous (Figure 4). In terms of environment of deposition, the formation can be divided into lower fluvial-dominated deltaic interval, a middle fluvial interval (the coal-bearing zone) and an upper fluvial-dominated deltaic interval (Johnson *et al*., 2006). The thickness and frequency of the sandstone units increases from the base of the formation, reaching their maximum in the middle fluvial interval and then decrease again towards the overlying Volksrust Formation. To the south and southeast, the Vryheid Formation grades laterally into undifferentiated, deep-water argillites of the Ecca Group (Figure 4).

The Vryheid Formation is one of sixteen (16) recognised stratigraphic units that constitute the Permian Ecca Group. During the deposition of the Ecca Group the basin was dominated by a large sea (the salinity levels of this water body remain unresolved). The exception to this model was the deposition of the coal-bearing strata of the Vryheid Formation along the northern margin during an episode of deltaic progradation into the basin.

Deposition of the Vryheid Formation was terminated by a basin-wide transgression that drowned the Vryheid deltas and their coal swamps resulting in the deposition of the deep-water sediments of the Volksrust Formation. The investigation of the project area did not identify any outcrops of bedrock, the entire area being covered by Cenozoic Regolith.

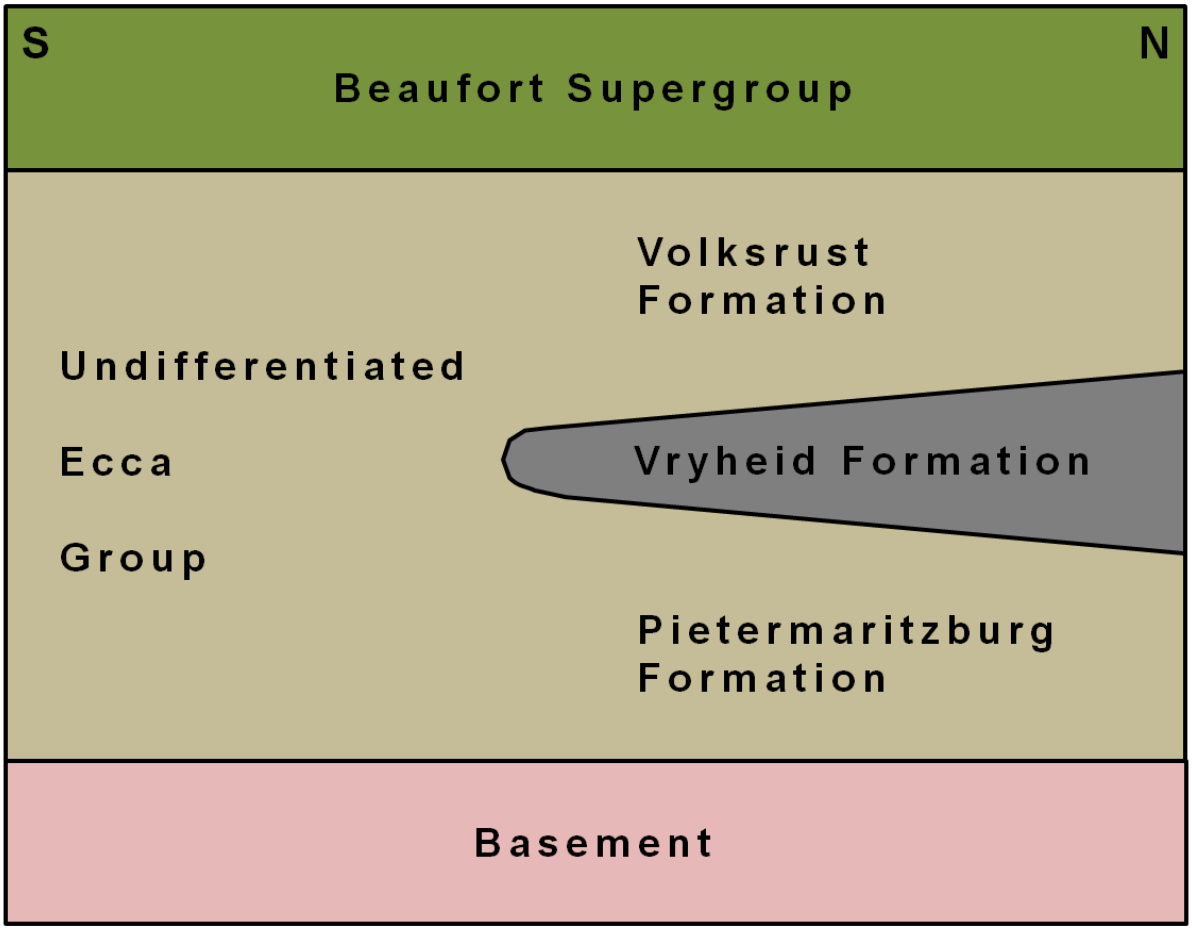

Figure 4: Schematic north-south oriented stratigraphic section of the Ecca Group in the northeast corner of the Karoo Basin. The Volksrust and Pietermaritzburg Formations can only be recognised when the Vryheid Formation forms part of the vertical sequence. In the north and north-western portions of the basin, the Pietermaritzburg Formation was not deposited and the coal-bearing strata of the Vryheid Formation rest directly upon the basement.

6.2 Geology of the Vaalbult Colliery

The lithological succession observed within the colliery pit is outlined below in Table 2.

Lithological Unit	Code
Regolith	H
Brown sandstone	G
Carbonaceous mudstone	F
D seam	E
Buff sandstone	D
Carbonaceous mudstone	C
Buff sandstone	B
E seam	A

Table 2: Lithological succession observed within the Vaalbult Colliery pit. The code indicated is the letter code used to identify the individual lithological units in this report.

The lithostratigraphic succession observed in cuts 7, 36 and 62 is illustrated in Figures 5-7). The stratigraphic sequence observed in the mine pit is dominated by the two coal seams that are economically exploited by Vaalbult Colliery (Figures 8 and 9). These two coal seams are the upper-most D Seam and the underlying E Seam (unit A). E seam constitutes the base of the colliery pit in all area observed and appears to be uniformly distributed throughout the colliery. During the preceding site unit E was observed to be a predominantly mudstone-rich horizon containing numerous thin, discontinuous coaly stringers. During the current study visit the seam was observed to be present as well developed coal seam exceeding 40 cm in thickness (Figure10). The sedimentary sequence separating the two seams varies between 11.5 m and 12.5 m in thickness (the thickness deceases towards the west; Figure 5).

The lithostratigraphic succession within the colliery is as follows. Immediately overlying the E Seam is a highly variable sandstone unit (unit B). In the earlier site visit unit B was observed to be a 30 cm thick, buff coloured uniform, massively bedded unit. However, in cut 36 the sandstone forms a 50 cm thick fining-upward sequence with granulestone at the base, grading upward into a flaser-bedded portion and an upper-most massive to planar-bedded sandstone portion (Figure 11). In cut 62 unit B is present as a <2 m thick laminated, micaceous sandstone (the individual mica flakes exceed several millimetres in size; Figure 12).

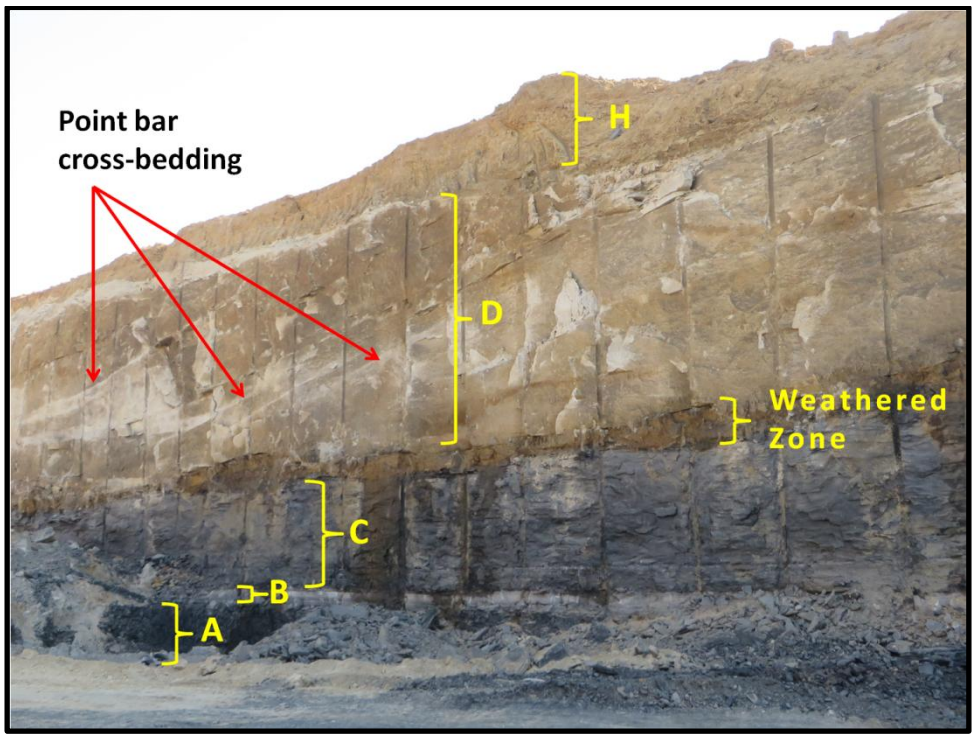

Figure 5: Photograph of the high wall in cut 36. The image shows the position and relative thickness of the various lithological units (Table 2) present. It is evident that the base of unit D is a highly undulating contact. An extremely weathered zone of variable thickness separates units C and D.

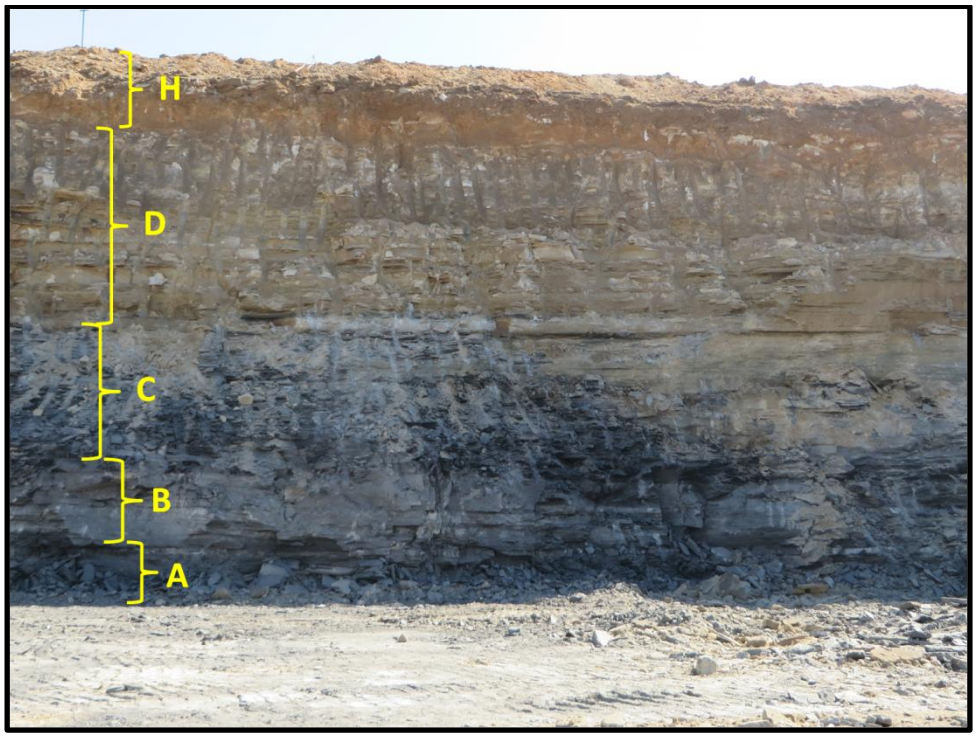

Figure 6: The lithological sequence present in cut 62 (see Table 2 for terminology).

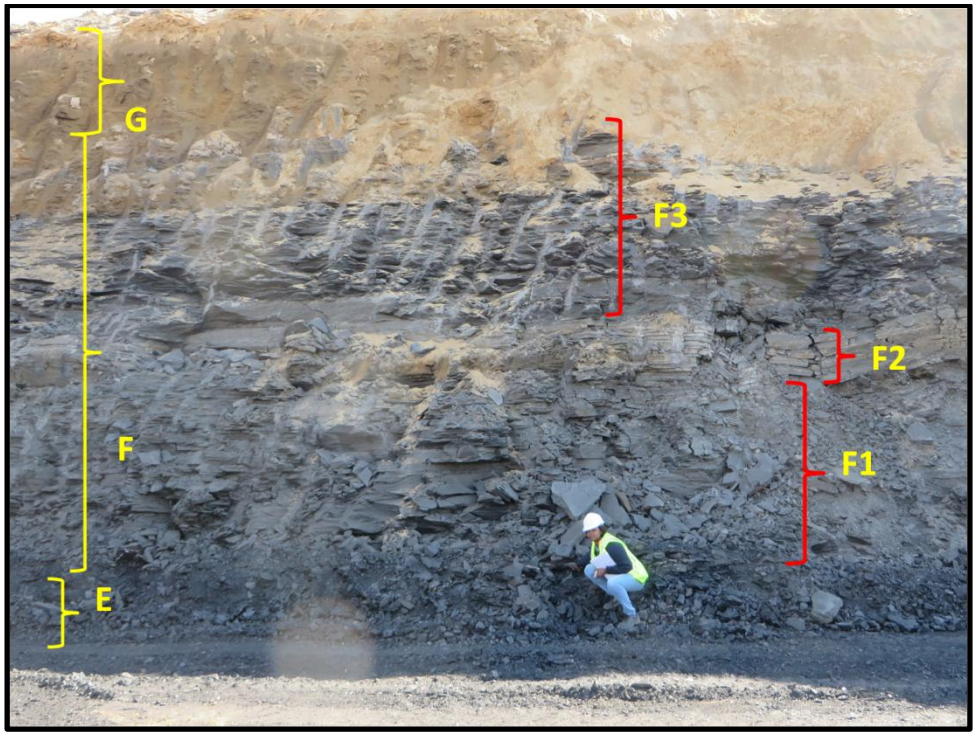

Figure 7: The lithological sequence present in cut 7 (see Table 2 for terminology). Ms E. Nethavhani of Vaalbult Mining Company (Pty) Ltd has her right hand located on the contact of unit E and unit F. Unit F is subdivided into three distinct lithological subunits. At the base is ca. 2 m of laminated to massive, grey mudstone (F1), which is overlain by ca. 1 m of thinly light grey mudstone (F2), and an upper-most ca. 2 m of black, carbonaceous mudstone (F3).

Overlying unit B is approximately 2 m of black, thinly laminated, carbonaceous mudstone and then ca. 9-10 m of buff coloured sandstone (unit C; Figure 13). Overlying unit C is approximately 5-6 m of brown coloured, sandstones of unit D (Figures 5 and 6). The sandstone is variable in appearance, being parallel bedded in cut 62 (Figure 6) and exhibiting well developed point bar cross-beds in cut 36 (Figure 5). Similarly, the base of unit D is uniformly flat and parallel to bedding in cut 62 (Figure 6), but is extremely undulating in cut 26 (Figure 5). The coals of Unit E (D seam) overly unit D and the maximum exposed thickness in the three cuts examined was ca. 40 cm. In the previous biannual site visit the unit overlying unit E was ca. 8 m of thinly laminated, black carbonaceous mudstones (termed unit F). In the current investigation, the rocks comprising unit F are sub dividable into three distinct lithological subunits (termed F1-F3 herein, Figure 7). Rock sequence F1 consists of ca. 2 m of massive and laminated dark grey mudstones, F2 consists of ca. 1 m of light grey, laminated mudstones and the upper part of unit F consists of ca. 3 m of black, carbonaceous mudstone (subunit F3). Within cut 7 unit H is not present and approximately 2 m of regolith (unit G) tops the sequence (Figure 7).

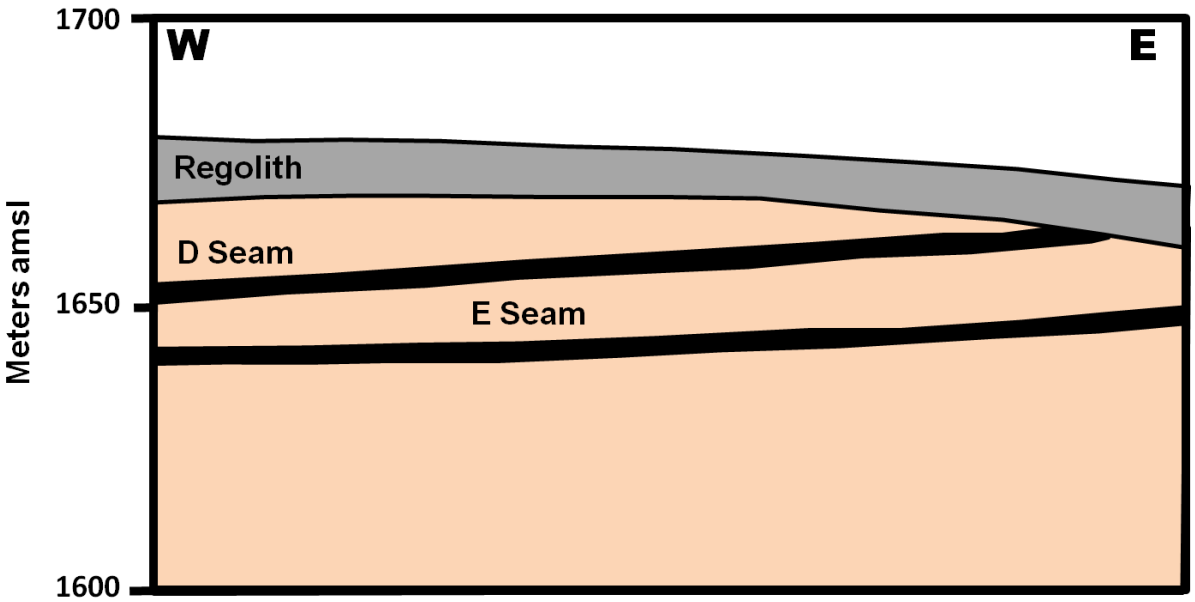

Figure 8: Schematic E-W oriented geological cross section across the central western section of the Mining Right area, and approximately in the same location as the mine pit (data obtained from the client). The location of the cross-section is provided in Figure 11.

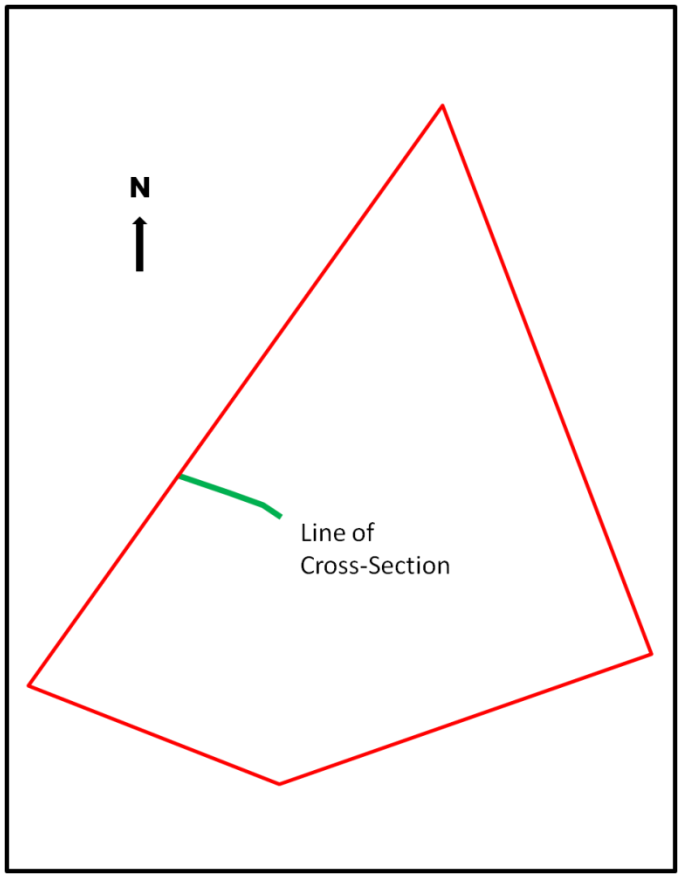

Figure 9: Map showing the location of the geological cross-section shown in Figure 10.

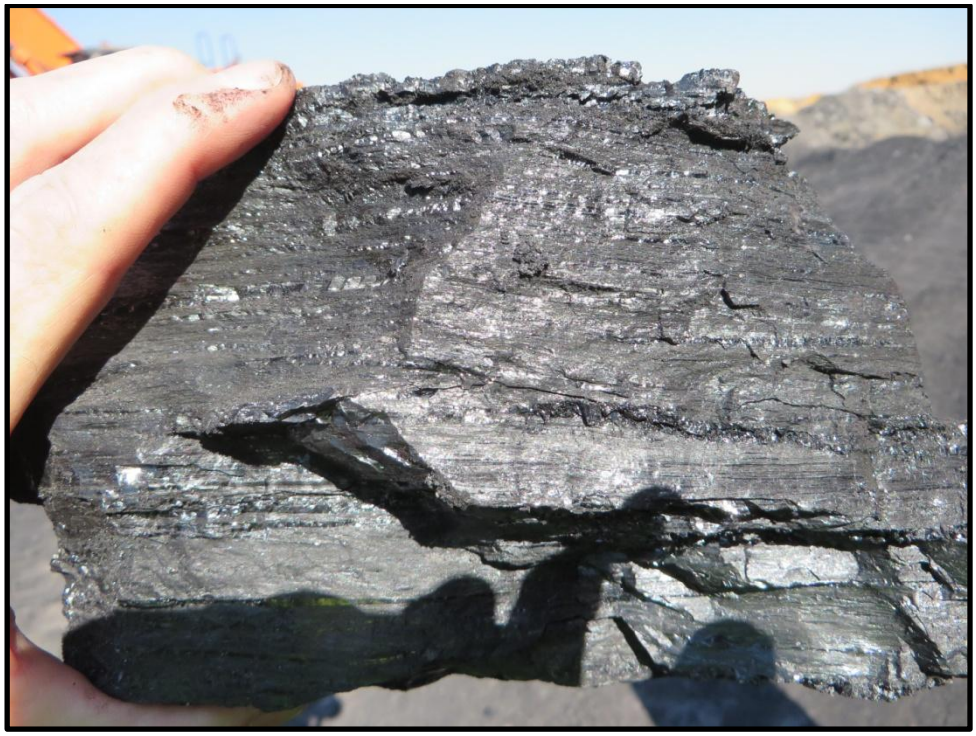

Figure 10: A hand specimen of the coal comprising the D seam (Unit E) in cut 7 (waypoint Val3, Figure 2). The coal is typified by thin bands of bright coal (vitrinite-rich) separated by thicker zones of dull (inertinite-rich) coal.

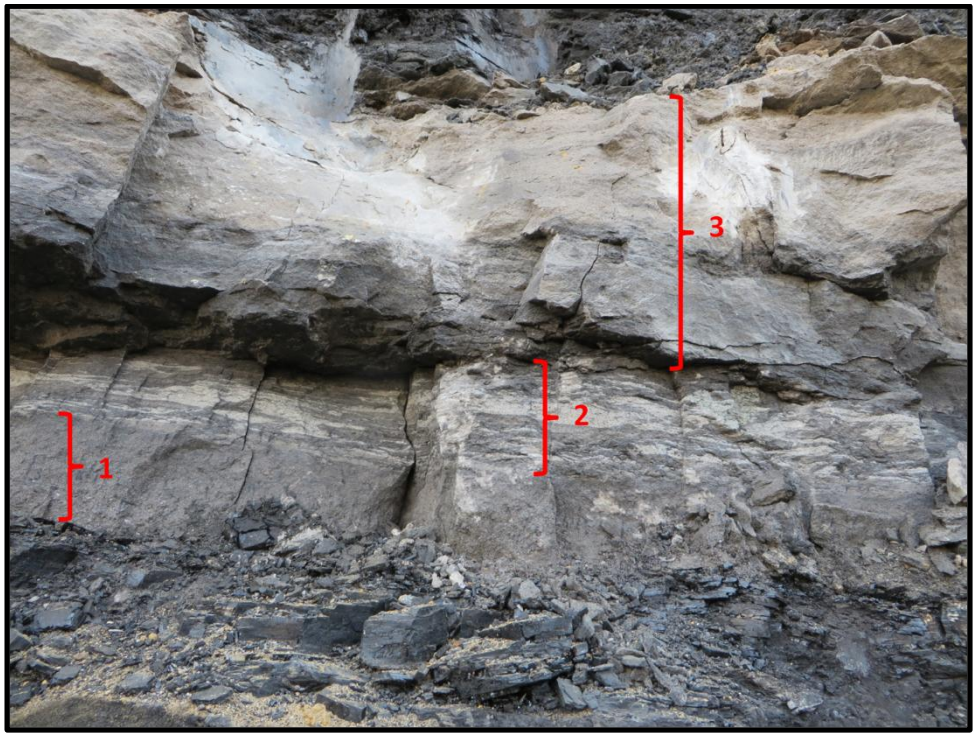

Figure 11: The internal sedimentology of Unit B in cut 36 (waypoint Val 4, Figure 2). The unit is composed of three lithozones (zones denoted in red). Zone 1 is composed of granulestone, zone B is finer-grained, flaser-bedded sandstone and zone 3 is massive to planar-bedded even finer-grained sandstone.

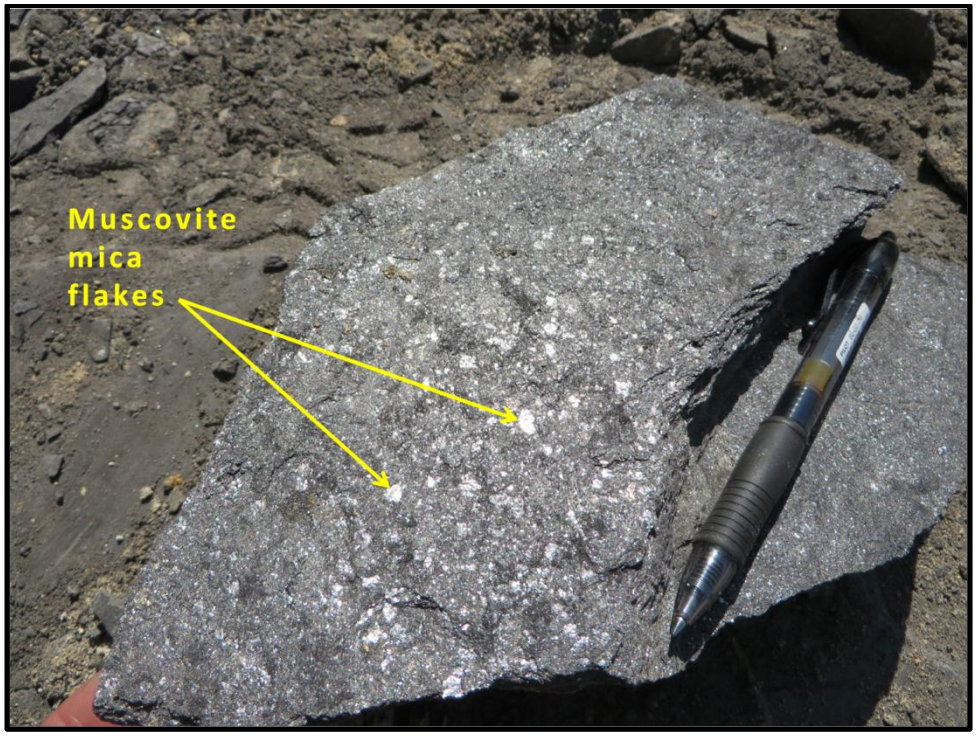

Figure 12: Unit B in cut 62 unit (waypoint Val1, Figure 2) is a carbonaceous sandstone typified by the presence of coarse-grained muscovite mica flakes up to half a centimetre in size.

Figure 13: Thinly laminated sandstones of Unit C in cut 62 (waypoint Val1, Figure 2).

Figure 14: Ms E. Denge of the University of Limpopo with her finger pointing to the boundary between unit C and unit D in cut 62 (waypoint Val1, Figure 2).

Figure 15: Ms E. Denge of the University of Limpopo with her finger pointing at the grey, massive mudstones of unit D cut 62 (waypoint Val1, Figure 2).

6.3 Palaeontological potential

6.3.1 Palaeontology of the Vryheid Formation

The most conspicuous and common components of the palaeontological record of the Ecca Group in general are the plant macrofossils of the *Glossopteris* flora. Two large and conspicuous leaf form taxa dominate the *Glossopteris* flora, these being *Glossopteris* and *Gangamopteris*. Within the upper Ecca (containing the Vryheid Formation) *Gangamopteris* has ceased to occur with only *Glossopteris* present (Anderson and McLauchlan, 1976). The palaeobotanical record of the Ecca Group is diverse and the literature describing it is voluminous (numerous papers having been published by E. Plumstead, H. Anderson, J. Anderson, E. Kovaks-Endrődy and M. Bamford amongst others). A comprehensive review of the flora in the Karoo Basin literature is, accordingly, beyond the scope of this study, but a thorough review of the palaeobotanical content of the Ecca Group in general and the Vryheid Formation in particular is presented in Bamford (2004). In that summary, it is indicated that the Vryheid Formation can be expected to contain the plant macrofossils *Buthelezia*, *Sphenophyllum*, *Rangia*, *Phyllotheca*, *Schizoneura*, *Sphenopteris*, *Noeggerathiopsis*, *Taeniopteris*, *Pagiophyllum* and *Benlightfootia* and the wood taxa *Australoxylon* and *Prototaxoxylon*. In addition to the above records can be added the observations of Tavener-Smith *et al*., (1988) where it was noted that both *Glossopteris* and *Vertebraria* occur within the palaeontological record of the formation.

In portions of the formation that are typified by low thermal alteration, abundant assemblages of palynomorph plant microfossils (including acritarchs) can be expected (Anderson, 1977).

Jubb and Gardiner (1975) report the presence of fragmentary fish fossils within the Ecca sequence of southern Africa, these being *Coelacanthus dendrites* from the Somkele coal-field of northern Natal and *Namaicthys digitata* from correlative strata in the Senge Coal-fields of Zimbabwe. While fish faunas are obviously rare and none have been reported from the Vryheid Formation the possibility remains that they may be present.

Animal body fossils are rare within the Ecca Group in general (excepting the time equivalent faunas of the Whitehill Formation). However, no reptile fossils have been identified within the Vryheid Formation.

Hobday and Tavener-Smith (1975) reviewed trace fossil assemblages identified within the Vryheid Formation. Within that fossil assemblage, they identified two forms (*Helminthiopsis* and *Taphrelminthopsis* within horizontally laminated siltstones and mudstones that represent part of the deep water *Nerites* community.

6.3.2 Palaeontology of the Vaalbult Colliery

Two district groups of fossils were identified within the sedimentary strata that comprise the Vaalbult Colliery highwalls exposed in cuts 7, 36 and 62. The fossil assemblages consist of plant macrofossils as well as a trace fossil assemblage.

6.3.2.1 Plant macrofossils

During the previous site visit (February 2016) numerous, scattered plant fossil macrofossils were identified in the waste rock stockpiles present within the mine area. Unfortunately, the stratigraphic provenance of many of these fossils could not be accurately determined, as they were located within rock material that had been mined; some material was clearly sourced from cut 24 (which was in operation at the time of the visit). The compressions occasionally bore an ornamentation of fine, narrowly spaced striations that run parallel to the long axis of the fossils. The presence of these striations suggests that the fossils belong to the Sphenophyta. No fossils attributable to leaves, fructifications or inflorescences were located. During the current site visit conducted in July 2016 a similar plant macrofossil was identified in cut 62 (Figure 16; waypoint Val2,). This was a single, fragmentary woody impression from lithological unit B (Table 2). The fossil is not palaeontologically significant due to their imprecise identification. It is evident that the distribution of plant macrofossils is highly patchy within the mine sequence.

6.3.2.2 Trace fossils

During the site visit conducted in February 2016 trace fossils representing burrows of two types were identified within the sedimentary rocks of the mine sequence. These fossils are a) closely spaced, unbranching, vertical, tubular burrows identified as the ichnogenus *Skolithus* and b) branching or bifurcating horizontal burrows tentatively identified as the ichnogenus cf. *Scolicia*. The fossils identified as the ichnogenus *Skolithus* were overwhelmingly the dominant ichnogenus recognised at the colliery.

During the conduct of the site visit reported upon, herein, ichnofossils were much less abundant. Isolated *Skolithus* burrows were identified in cut 62 (Figures 17-18; waypoint Val2, Figure 2) from the lower portions of lithological unit C (Table 2). Hobday and Tavener-Smith (1975) report the presence of this fossil type elsewhere in the Ecca Subgroup where they occur in sandstones associated with upward-coarsening regressive facies cycles attributed to delta progradation.

An unidentified fragment of an unbranching worm burrow oriented parallel to bedding was also identified in lithological unit B (Figure 119). The fragment is small (being only ca. 1 cm wide) which makes identification difficult. The fragment may represent an isolated fragment of the ichnogenus identified above as cf. *Scolicia* but this cannot be

Figure 16: Carbonaceous compression of a plant stem (cut 62, waypoint Val2, Figure 2).

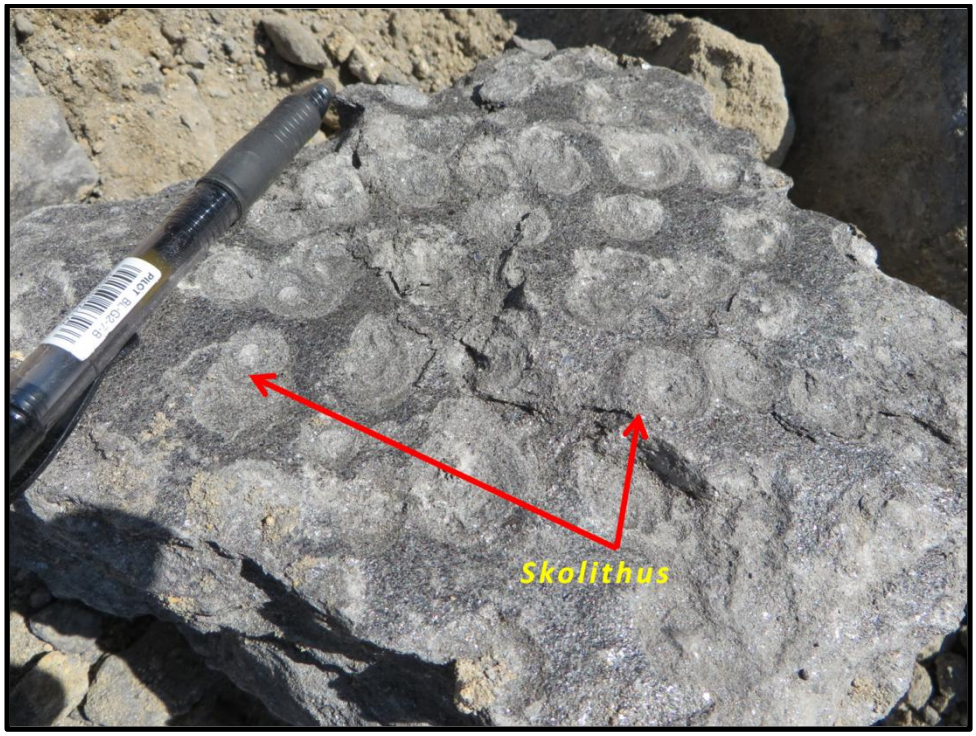

Figure 17: Specimens of *Skolithus* in carbonaceous sandstone from lithological unit B (cut 62, waypoint Val1, Figure 2).

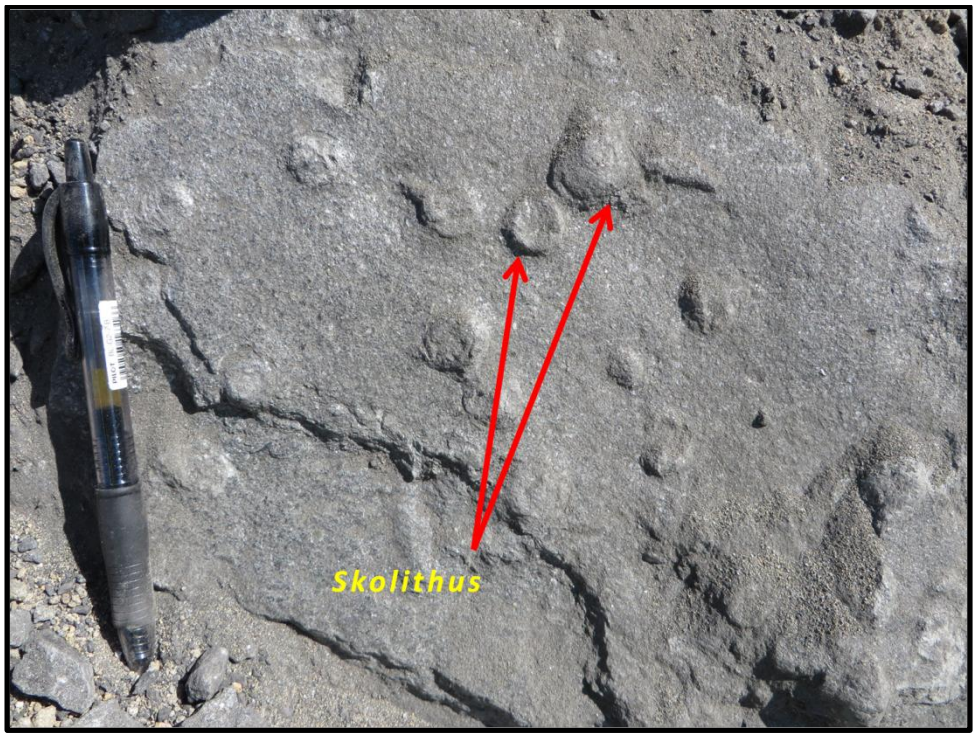

Figure 18: Specimens of *Skolithus* in carbonaceous sandstone from lithological unit B (cut 62, waypoint Val1, Figure 2).

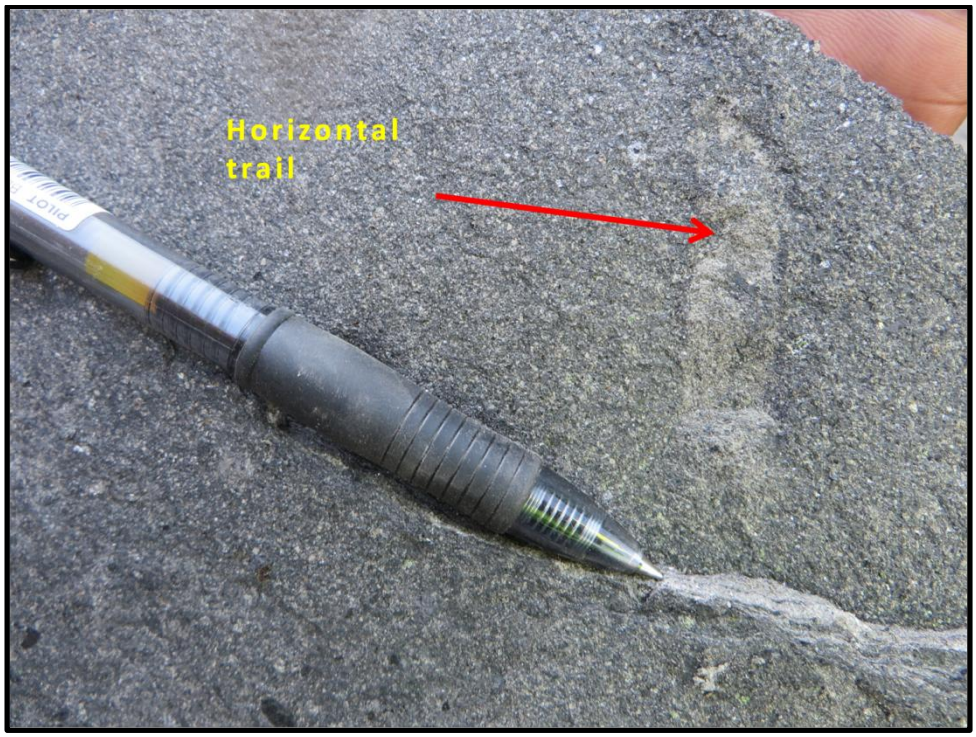

Figure 19: A fragment of a horizontal (bedding parallel), un-branched burrow within the micaceous sandstones of unit B in cut 62 (waypoint Val1, Figure 2). The burrow is approximately 1 cm wide.

determined with any certainty. This trace fossil are not palaeontologically significant at present. As with the plant macrofossils discussed in Section 6.3.2.1 above the ichnofossil assemblages are not uniformly distributed within the rocks of the coalmine sequence, but are instead markedly patchy in their occurrence.

7 SUMMARY

Prof B. Millsteed in the presence of Ms E. E. Nethavhani of Vaalbult Mining Company (Pty) Ltd and Ms E. Denge of the University of Limpopo conducted a site investigation of the open pit and associated waste rock stockpiles at the Vaalbult Colliery on the 15th of July 2016. The highwalls within cuts 7, 36 and 62 were inspected during the investigation. The site investigation confirmed the presence of the eight separate lithofacies (including an upper-most unconsolidated regolith horizon) which include two coal seams (the D Seam and the E Seam) that were identified during the preceding biannual palaeontological monitoring investigation. However, several of the lithological units displayed marked variation of their internal sedimentological features from those described in the preceding palaeontological monitoring report (dated February 2016). These differences are described above (Section 6.2).

Two distinct sets of fossil materials were identified within the rocks of the three cuts during this investigation. A single specimen of a carbonaceous compression of a woody stem fragment was located with the sandstones of unit B in pit 62. The fragment was not identifiable and is of particular scientific significance. It does however occur within the same stratigraphic unit as assemblages of large, striated, carbonaceous compressions of logs attributable to the Sphenophyta that were reported in the preceding site investigation report (dated February 2016). No fossils attributable to leaves, fructifications or inflorescences were located; but this is probably a reflection of the high-energy environment of deposition represented by the sandstones.

The second group of fossils are tube-like ichnofossils. The most abundant of the ichnogenera in the colliery succession are that vertical burrows attributed to *Skolithus*. The burrows of this type provided permanent shelter to animals that procured their food above the level of the sediment-water interface (Hobday and Tavener-Smith, 1975). Several small blocks of rock were located containing this ichnogenus in rocks of unit B in cut 62. A single specimen of an un-branching, horizontal, tubular burrow was located. The identification of this fossil was not possible due to the small size of this incomplete fragment. Both ichnogenera are associated with the sandstones of Unit B. Ichnogenera were also reported as occurring in the sandier basal portion of unit C and the base of unit F elsewhere in the colliery in the preceding palaeontological monitoring report (dated February 2016).

None of the fossils identified are palaeontologically significant and require special preservation or excavation.

8 RECOMENDATIONS

The lithological succession of the Vaalbult Colliery is fossiliferous and due care needs to be exercised to ensure that the palaeontological heritage of the area is not diminished by the mining activities. That said, the strata being mined by the colliery occur beneath a uniformly thick regolith horizon and do not crop out. The absence of bedrock outcrop means that no fossils are observable at surface. As a result, it is only due to the ongoing mining activities that the fossiliferous strata are exposed and made available for scientific study. None of the fossils located during this study or the preceding study are of sufficient palaeontological significance that their excavation by a palaeontologist or their preservation is required, but this may not always be the case. However, the area planed to be mined is large and, to date only the western-most margin of the Mining Right area has been disturbed by the mining activities. Comparison of the stratigraphic successions studied in this and the preceding palaeontological monitoring reports indicates that several of the geological units present within the mine show significant sedimentological variation across the small area mined to date. It is interpreted, herein, that significant facies variations may be possible across the full extent of the Mining Right area. Changes within the abundance and type of fossil assemblages may be possible and that palaeontologically significant fossil assemblages may be present. The possibility of the presence of palaeontologically significant fossils within the rocks of the colliery therefore remains a strong possibility. The greatest potential for the presence of significant plant macrofossils is in the lower-energy lithofacies represented by units C and F.

It is accordingly recommended that:

- A member of staff (e.g., the Environment Officer) of the Vaalbult Mining Company (Pty) Ltd be trained to recognise the types of fossils that may be exposed via the mining operations. This officer should:
    - Make regular inspections of newly exposed rock material following blasting to identify if scientifically significant fossils have been exposed.
    - If significant fossils are present, they should be collected and placed in a safe, protected area for storage.
    - While the fossils are collected, precise notes of the location they were collected from must be collected, as well as the lithological unit containing the fossils.
- An experience Karoo palaeobotanist should be mandated by the colliery to inspect the fossils, ascertain their significance and to make any necessary recommendations concerning their preservation.
- Due to the low abundance and low scientific importance of the fossil assemblages identified within the mine excavations to date it is recommended that the examinations of the colliery cuts by an experience Karoo palaeobotanist should continue, but that the frequency of those inspections be decreased from six monthly to 12 monthly (subject to later review).

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2 August 2016