Palaeontological Impact Assessment of the cave above Mostert Adit, Thabazimbi Mountain

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SUMMARY

The cave was visited by Prof Marion Bamford and Mrs Cynthia Kemp on 20 February 2012 under the guidance of Mr Gawie Goss and four Phoenix employees. The solution cavity which has been naturally enlarged by roof fall has extremely delicate and beautiful aragonite and calcite crystal formations covering much of the floor, walls and ceilings. There is only a very small opening to the outside through which air passes thus maintaining a near constant temperature and humidity but allowing for some evaporation. There is no evidence of fossil or living creatures in the cave. It is strongly recommended that this cave is preserved and protected from the outside elements. Changing the atmosphere (airflow, moisture, light) will destroy the pristine aragonite and calcite crystals. Access to the cave will have to be strictly controlled at all times.

INTRODUCTION

Details of the geology and formation of the cave have been provided by J Martini (1986) and will be updated by Prof Bruce Cairncross in 2011/2012 but a brief summary is provided here for background.

Thabazimbi is in the northern part of the Transvaal Basin and the rocks here are old and potentially non-fossiliferous although some evidence of early bacteria could possibly be found in the dolomites (Tayloe et al., 2009). Considering the oldest to the youngest rocks, exposed in the area are the Penge Formation banded ironstone (BIF) and Black Reef Formation of the Chuniespoort Group (approx 2500 – 2420 million years old. This group is overlain by the Pretoria Group but only three formations are present in the Thabazimbi area: the Rooihoogte Formation, Magaliesberg Formation and Steenkampsberg Formation which have various combinations of sandstone, shale and quartzite (see Figure 1 and Table). In parts the whole sequence is overlain by Quaternary alluvium, sand and calcrete.

Banded Iron formations are considered to be very early evidence of life on earth because oxygen released into the atmosphere by photosynthesizing micro-organisms such as blue green algae/bacteria and green algae was captured by iron and formed layers of iron oxides. There is some debate whether the process of iron formation was purely abiotic or biotic as there are other sediments included such as silica or chert bands (Beukes and Klein, 1990). Unlike in various stromatolites deposits there are no micro-organisms preserved in BIF. It is highly unlikely, therefore, that there would be any fossils in this area.

The cave was discovered in the 1950's when miners broke through into the cavern from the Mostert adit. In 1985 and 1986 members of the South African Speleological Association visited the cave, described the formations and recommended a management plan (Martini, 1986). With collapse of the roof the cave is up to 37m in height in places and approximately 70m long. The floor is very uneven and is covered with numerous large and small blocks. A demarcated pathway has rock chips added to infill some cavities and make it easier to walk along, and rope handrails. According to Mr Goss the accessible area is only one third of the cave. In this area most of the walls and roof and much of the floor are covered with delicate aragonite crystals of the coral, tray and popcorn types (Martini, 1986).

Access to the mining area is controlled by Kumba / Anglo American security. Access to the cave is restricted. There is a locked iron gate at the entrance of the Mostert adit, and another locked iron gate at the base of the chimney. A metal-clad wooden trapdoor seals the first chimney from the second, which opens out into the floor of the cave. Photography in the cave was prohibited.

OBSERVATIONS

Aragonite-calcite crystals were seen in abundance but no flowstone, stalacmites or stalactites. The four informal types of aragonite-calcite formations were seen; the clouds, trays and coral and popcorn. We could see patches on the walls and roof where there had been recent rockfalls and the dark red ironstone, grey dolomite and pale chert bands, all bare of white crystals, were visible. Crystals were re-growing on "newly" exposed surfaces but from one visit it is not possible to determine a timeframe. In a closed environment I assume it is a slow process for the crystals to form.

Near the trapdoor entrance to the cave there is some red dust covering the white aragonite crystals; farther away the surfaces are much cleaner. No algal growth was visible. Some cables for lights were visible but since some of the cabling has been stolen (Goss pers. comm.) no lights are left on in the cave.

We could find no evidence of an opening into the cave, past or present, other than the very slight draught of air. There was no evidence of bats in the cave. There were no fossils in the cave either, as was expected as there is no natural opening that is large enough to permit the entrance of living or dead plant or animal matter.

RECOMMENDATION

Although there is no palaeontological material in the cave I strongly recommend the <u>preservation and protection</u> of the cave for the following reasons:

1. By any standards the cave has incredibly beautiful aragonite and calcite crystal formations. These are extremely fragile.
2. To protect the contents of the cave the atmosphere must be maintained. The temperature and humidity should be kept at their natural level and not fluctuate. No new openings should be made and access by visitors should be kept to an absolute minimum. Human breath and air movement caused by moving bodies can upset the cave atmosphere.
3. The cave should be kept dark and sealed to prevent algal growth and dust being introduced.
4. Visitors should be carefully monitored so they do not wander off the designated path or touch or remove any crystals.

5. Access to the cave should be strictly controlled, firstly to limit the number of visitors and secondly from a safety point of view. Roof falls have occurred and no doubt will continue to occur naturally, and perhaps will increase from future mining activities in the area.

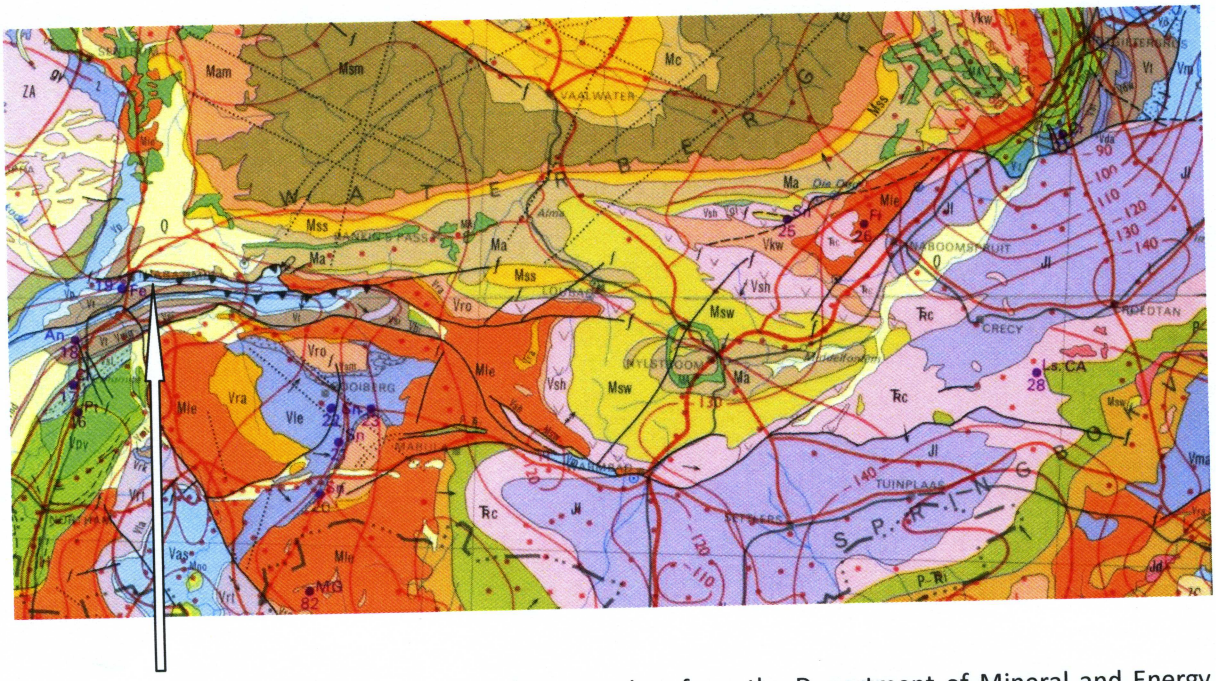

Figure 1: Geological map of the Thabazimbi Area taken from the Department of Mineral and Energy Affairs, Pretoria. Key for symbols in table below taken from the map and ages from Eriksson et al. 2006. Note that the sequence is not complete and only the relevant formations are listed. Arrow points to the mine.

Group	Symbol	Formation	Lithology	Approx Age (Ma)
Pretoria	Vst	Steenkampberg	quartzite	
	Vmg	Magaliesberg	quartzite	
	Vt	Rooihoogte	Shale, conglomerate, breccias, diamictite	2420
	Vb	Buffelsfontein	Volcanic rocks, sandstone	
Chuniespoort	Vp	Penge	BIF , shale	2500 - 2430
	Vbr	Black Reef	Quartzite, conglomerate, shale, basalt	2650
	Q	Quaternary	Alluvium, sand, calcrete	1.8 - 0

Table 1: legend for Figure 1.

References

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