PROJECT PROPOSAL: INSTALLATION OF SITE SAFETY INFRASTRUCTURE AT "COOPER'S B" AT THE COOPERS'S CAVE NATIONAL HERITAGE SITE, CRADLE OF HUMANKIND WORLD HERITAGE SITE, GAUTENG PROVINCE

Introduction:

The Cradle of Humankind World Heritage Site, situated in the north western quadrant of the Gauteng Province, is home to 14 palaeontological and archaeological sites proclaimed as National Heritage Sites in terms of the National Heritage Resources Act, 1999.

Of these 14 National Heritage Sites, the Cooper's Cave Palaeoanthropological Site (SAHRIS reference **9/3/233/0024**), has been quite extensively excavated by Dr Christine Steininger of the University of the Witwatersrand since 2010, with a particular focus on the locality known as "Cooper's D". In 2012, the Cooper's research team has also given consideration to starting excavations in the underground locality known as "Cooper's B. The team is expected to start excavations at Cooper's B in 2014.

Over the past few years, the monitoring and inspection programme jointly conducted by the South African Heritage Resources Agency (SAHRA) and the Cradle of Humankind World Heritage Site Management Authority (COHWHS MA), has recommended that an in-depth site safety analysis be conducted for the palaeontological sites located within the Cradle of Humankind World Heritage Site.

In 2012, the COHWHS MA appointed SRK Consulting Engineers and Scientists (Pty) Ltd as the Fossil Site Safety Inspector for the COH WHS, and carried out site safety inspections at selected sites, particularly those sites that are currently under excavation and / or where tourism is taking place. On the basis that both excavation and tourism is taking place at Cooper's Cave, it was included in the safety inspections. The purpose behind such an inspection process was to:

- identify areas of safety concern, and areas of instability; and
- identify appropriate methods of stabilisation that will not only ensure the safety of the researchers and visitors alike, but also ensure that the scientific research potential and overall site significance of the sites is protected and conserved.

The subsequent reports were provided to SAHRA by the COHWHS MA in November 2012.

At the latest round of joint inspections held in July 2013, it was agreed between the COH WHS MA, SAHRA, the landowner and Dr Christine Steininger that the COH WHS MA would attend to obtaining the necessary SAHRA permit for the installation of site safety infrastructure at "Cooper's B", as detailed more fully below.

Site Safety Inspection Findings: Cooper's Cave

The site safety assessment identified the following safety hazards at Cooper's Cave:

- Highwall collapse
- Falling into excavations
- Slipping and falling

- Failure at cave entrance
- Failure of cave roof during excavation of laminated material
- Falling into cavern below
- Rolling rocks

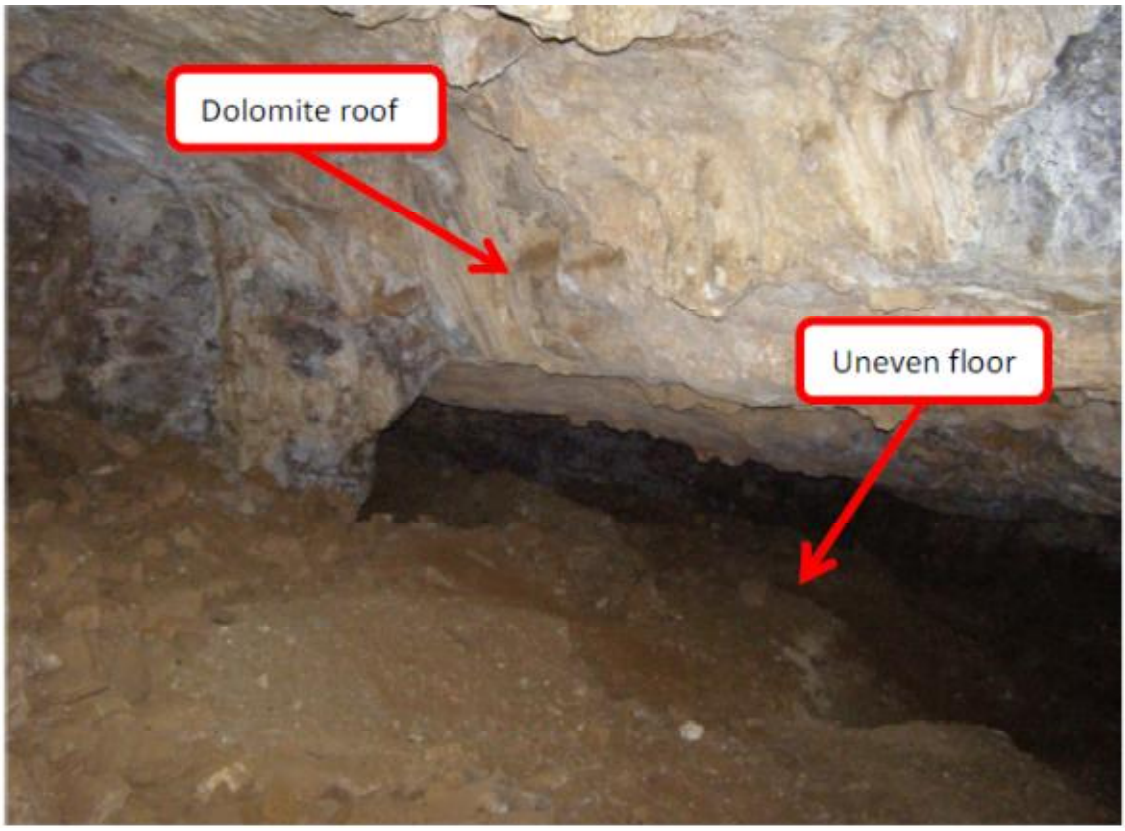
Utilising the risk assessment protocol designed for this project, the following two hazards were rated as the highest risks for the Cooper's site, requiring attention:

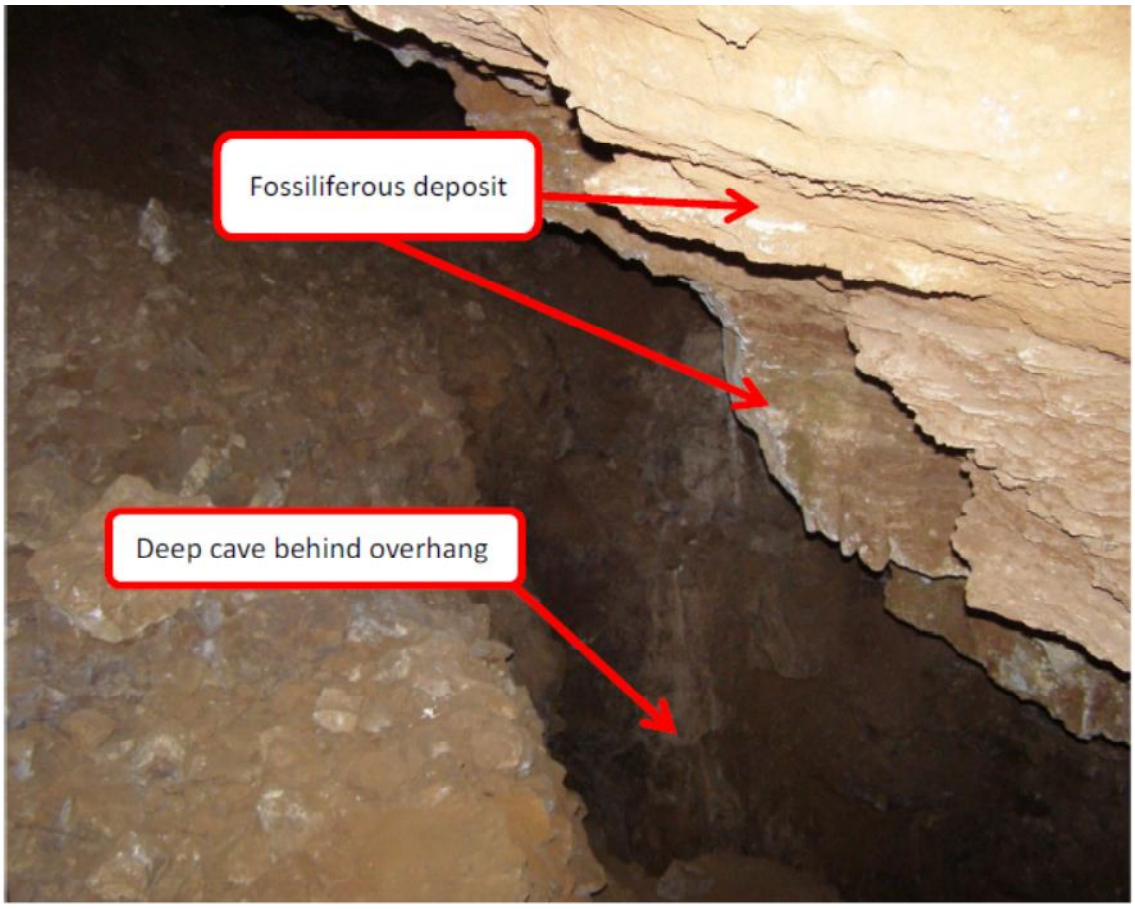
- Failure of cave roof during excavation of laminated material; and
- Falling into cavern below

Both of these hazards occur within the "Cooper's B" locality. Furthermore, the identified hazard of rolling rocks is also applicable to "Cooper's B", and the proposed site safety infrastructure is also aimed at reducing this hazard.

1. Failure of Cave Roof During Excavation:

The roof of Cooper's cave comprises hard rock dolomite, which forms overhang at the base of the talus cone as shown in the first photograph below. The dolomite however is capped at the bottom of the overhang by laminated material which hosts fossils deposits of scientific significance. This, together with the sharp drop off into the cavern below is shown in the second photograph.





Excavation of laminated material covering a pillar at the base of the talus cone, as well as a small portion of the overhanging laminated material is being considered by the Cooper's Cave research team, and in fact, a small amount of excavation has already taken place.

However, as per the site safety inspection report, there are 3 hazards associated with the proposed excavation of the laminated material in this locality:

- Firstly, the excavation of laminated material covering the pillar may result in destabilization of the roof above it. The most severe risk would be collapse of the cave roof, which would result in severe injury or fatality to anyone working within the cave. However, no obvious joints were observed that could result in failure, so it is considered unlikely.
- Secondly, the laminated material and deposits are located in a series of overhangs beyond which the cave continues and becomes very deep as shown in the photograph above. This steep drop off is hazardous as it could result in scientists and staff falling into the cavern during excavation, or while walking down the unstable slope to excavation area This could result in serious injury and could be potentially fatal.
- Thirdly, rocks may be disturbed, while people walking down the uneven slope, which could injure people working at the base.

Excavating the laminated overhang may result in the loosening of large blocks of laminated material and if they fall off during excavation, may result in serious injury, possibly fatal, to anyone working beneath it.

1.1 Recommended stabilisation methods and materials:

The site safety inspection report recommended that for all three identified hazards, the best option would be the installation of a safety barrier to prevent people and valuable fossiliferous material falling to depth, as well as acting as an early warning system to indicate a potential collapse.

SRK has further suggested the following preventative measures be followed at all times when excavating overhangs:

- Excavate from the top down to prevent destabilization of material above area of excavation
- Avoid working directly below the laminated material
- Ensure that all laminated material is removed and no potentially destabilized material remains
- Use of hard hats

As to what would constitute a simple, yet very effective warning system, the site safety inspection report recommends the installation of a line of timber mine poles, which will deform and crack if the cave roof begins to move. They will slow down the failure, giving time for people to be evacuated.

The site safety inspection report recommends the following:

- The installation of a row of large diameter (>200mm) wooden mine poles, at the base of the talus cone (beyond the drop off).
- Spacing the poles approximately 1m apart.
- A load spreading headboard must be placed at the base of each mine pole to prevent bearing or sliding failure in the soft material
- A board / netting should be placed between the mine poles to stop rolling rocks.

As part of the site safety inspections, SRK approached several companies to discuss the appropriate materials and costing for the Cooper's Cave site. One of the companies contact by SRK, New Concept Mining (Pty) Ltd, has very kindly agreed to donate the necessary site safety infrastructure and to install the infrastructure for free.

On 26 June 2013, a site visit of Cooper's Cave was conducted by an official of the COH WHS MA, together with representatives of New Concept Mining (Pty) Ltd, Mr Riaan Lotz, the landowner of the Cooper's Cave site, and Dr Christine Steininger of the Cooper's Cave research team. At this inspection, Mr. Lotz signed a landowner consent document prepared by the COH WHS MA, allowing for the installation of the site safety infrastructure at Cooper's B. This consent form is attached as part of the permit application.

The engineers from New Concept Mining (Pty) Ltd have been provided with a copy of the site safety recommendations for Cooper's Cave, and largely agree with the findings of SRK, save for the possible

additional installation of a row of smaller, close set poles parallel to an area beyond the overhang where the scientists will commence with excavations.

When the cave roof and floor where examined by the engineers of New Concept Mining, it was found that the roof and floor material in the area indicated by the site safety inspections for the installation of the mine poles are composed of very soft sedimentary layers that are not suitable for pre-stressing. Because of the softness of the rock, installing compressed headboards will cause the roof to crumble and increase the likelihood of a collapse. More suitable cave roof formation will have to be determined to install the headboards. The cave floor is also problematic – there are areas where it is stable, however these identified areas are covered in mining debris and rubble that are of potential scientific value. These areas will have to be cleared by the Cooper's Cave research team before the installation.

Other than that, the installation at Cooper's Cave will be much more simple than that at the Swartkrans site. A row of poles will be installed parallel to the area being excavated to prevent any rocks rolling off from the steep slope and hitting the excavation area. There will also be poles further along the edge to act as a barrier to prevent people falling off the ledge.

1.2 Proposed Installation:

In summary, a line of approximately 10 220mm diameter mine poles and pre-stressed headboards will be installed in a row parallel to the talus cone, just beyond the edge of the drop-off, for a distance of approximately 10 meters to ensure that the length of the drop off up to the excavation area is protected. A further row of smaller, more closely packed poles will also possibly be installed in the excavation area to act as a further barrier against falling rocks. Netting or boarding will also be placed between the larger poles to catch any rolling rocks. The exact placement of the poles will only be agreed upon on the day of installation.

As mentioned above, before the New Concept Mining team can commence with the installation, the Cooper's Cave research team will have to clear the floor just beyond the drop-off of all rubble and debris for analysis. Prior to commencing with the installation, New Concept Mining, together with the research team will determine:

- the placement and exact height of each mine pole, this includes the possible installation of the smaller set of poles in the excavation area;
- the distance between the poles (and thus the exact number of poles to be installed);
- the extent to which the headboards will have to be pre-stressed (particularly those that might be placed against the cave roof).

As mentioned above, there will also possibly be the installation of a high strength wire mesh or boarding between the larger mine poles to act as barrier against rolling rocks.

It is also a possibility that a rock motion detector, such as the "Rock Robot" will be installed to allow for the long term monitoring of the impact of the excavations on the cave roof.

The mine poles will be cut to the appropriate size on site, but all cutting, pre-stressing etc, will be done on the surface in a pre-agreed area, away from any excavations, dumps, sensitive areas, etc.

All waste material and left over equipment will be removed from the site once the installation has been completed, and the site will be left in the manner it was found (save for the new installation).

1.3 Monitoring of installation activities:

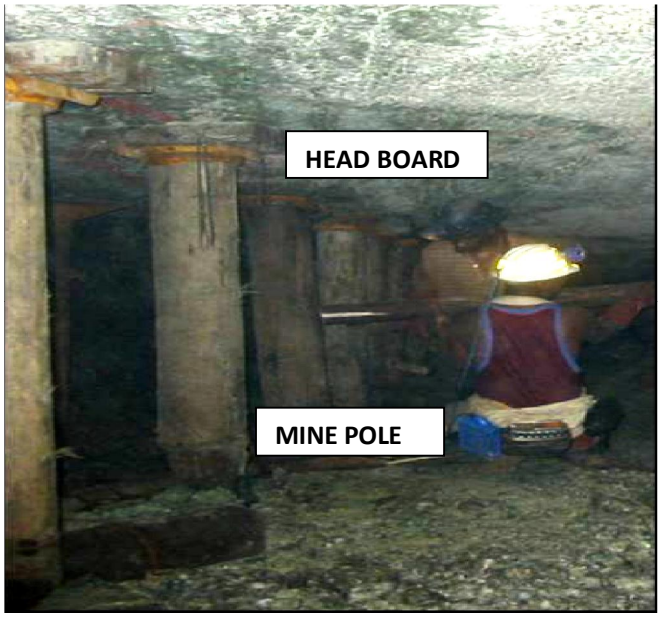
An official of the COH WHS MA, together with a representative of the Cooper's Cave research team (most likely Dr Christine Steininger) will be on site for the duration of the installation.

The COH WHS MA will photograph the affected area prior to the installation, and again after the installation has been completed. These photographs, together with a report on the installation, will be provided to SAHRA, should it be required.

Below are some photographs of examples of the headboards and mine poles suggested for the Cooper's Cave site safety infrastructure installation.

LOAD SPREADING HEAD BOARDS

MINE POLES



INSTALLED LOAD SPREADING HEAD BOARDS AND MINE POLES (these poles are thicker than those proposed for the Cooper's Cave installation)