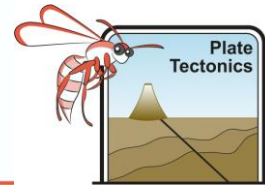


Beaconsfield Disaster – Teacher Notes



Western Australia is our most seismically prone state. It also relies heavily on mining for income. Mining both causes and is affected by seismicity. Gold mineralisation often follows tectonic structures such as faults.

Miners tell of the rocks “talking” to them. Rock creaks, groans and spits as it adjusts to stress on mining cavity boundaries.

Incompetent (soft) rock such as that you find in coalmines makes constant small adjustments.

Competent “hard rock” found in some gold, silver and copper mines build up stress until it explodes with the sound of gunfire and earthquakes can be felt.

Dangers increase with depth.

Removing rock to form a cavity causes stress to the walls of adits, drives, shafts and stopes.

Broken wall and roof rock is usually supported by pit props, weld mesh, concrete and bolts to guard against collapse.

Controlled explosions (blasting) to break up rock will compound the pressure by overcoming limiting friction.



Pit props supporting a stope in the old Hannan’s gold mine in Kalgoorlie

The deeper the mine the greater this pressure from overburden becomes. This increase may be demonstrated by cutting holes into a large clear plastic cool drink bottle and filling with water as demonstrated in the picture below.



*The **Pascal (Pa)** is named after the French philosopher and scientist Blaise Pascal. It is a measurement of force per unit area. One Pa is the pressure one newton exerts on one square meter.*

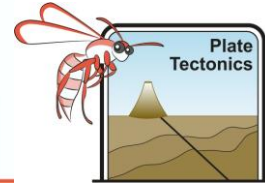
Standard atmospheric pressure at the surface of the earth is 101325 Pa.

A mega Pascal MPa is 1,000,000Pa.

Pressure at the foot of a 3km mine can be 80MPa (9x greater than at surface)

Pressure at the foot of a 4km mine can be 110MPa (108.6x greater than at surface)

Beaconsfield Disaster – Teacher Notes



When I was in my twenties working on the west coast of Tasmania, I accompanied an eighty-year-old miner exploring an adit (horizontal drive) in “hard rock” near Dundas. He had terrible rheumatism from years of hard physical work and only moved with difficulty. We were about a hundred metres from the mouth of the opening when the mine suddenly started “talking”. The old miner was out and in the sunshine well before I realised what was happening and I had only just started after him as the adit started collapsing behind me!

The Beaconsfield Mining Disaster

The Tasmanian Beaconsfield goldmine collapse on the 25th April 2006 resulted in one death. Fourteen men working at 890m escaped after sheltering in safety chambers and two men spent fourteen days trapped in a small metal cage until they were rescued. Although the rock fall was originally reported as being due to an earthquake the Coroner’s report suggests that the earthquake was the result of mining practices at that time.

http://www.magistratescourt.tas.gov.au/_data/assets/pdf_file/0005/120884/alx.016.002.0002_001.pdf

“As mining activity had progressed beyond a depth of 800m the pressure on the ore body in some locations commenced to exceed the inherent rock strength. In other areas of the mine, the removal of ore unclamped geological features...This caused an increase in seismic activity throughout the mine and also increased the number of rock falls, especially adjacent to firing times.”

www.theage.com.au/flash/miners/rescue.htm provides a good introduction (but it does contain one expletive spoken by the rescued miner).

Materials per student or group

- Metre rulers or measuring tape (or the long edge of an A4 page is 30cm)
- Access to the Internet

Measure out a 1.2m X1.2m square on the ground. If possible add student backpacks to represent rocks. Fit two students into it and ask them how comfortable they would be if they had to spend twelve days trapped in that area.

Select at least two sources to ensure you have the most correct answer.

What problems would they have?

Muscle cramps, back pain and cuts, no light, no water, no food, cold, no waste product disposal, close contact, general frustration (including in this case differing football and car make allegiances).

Where is the Beaconsfield mine?

40kms north west of Launceston in Tasmania.

What did the earthquake measure?

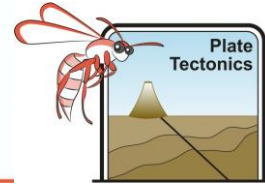
2.1 on the Richter scale.

Did the earthquake itself trap the miners?

No the earthquake triggered a rock fall which trapped the miners.

How many miners were underground at the time?

Beaconsfield Disaster – Teacher Notes



Seventeen.

How many were trapped underground?

Three, one died.

Did the rescue party enter the mine immediately?

No they sent in a heavy loader with cameras first.

After they found the body of Larry Knight, what did the rescue miners intend to do?

They planned a horizontal tunnel towards where they thought the remaining two miners might be trapped in the rock fall.

What evidence did the rescuers have that two miners had survived?

They sound of their voices from a microphone that had been pushed into the area according to one source. Another source gave that two fellow miners breached safety protocol and crept in through dangerous passages. When they called out the trapped miners replied.

How had the miners avoided being crushed in the rock fall?

They had sheltered in a 1.2m X 1.2m cherry picker cage. Initially it was thought that they were protected by a large slab of rock above but the men said this was not so. The “ceiling” was made of many small rocks wedged together. They were partly buried by rocks and one had been knocked unconscious. They were able to free themselves by cutting through their trapped clothes and boots using Stanley knives.

How many days after the rock fall did food and water to the trapped miners?

Six. They shared one muesli bar in half to last for three days. One miner lost most of his half when it fell from his pocket as he slept.

How did the rescuers manage to get the food to the miners?

Through PVC pipe casing a drilled hole.

When the hole was expanded to 90mm what else was sent to the miners?

Vitamins, space blankets, fresh clothing, plastic bags and glo-sticks.

Why would the miners need plastic bags?

Waste (including human waste) disposal.

Finding drilling and blasting too dangerous, what novel technique do the rescuers decide to use?

A raise borer that literally grinds rock into powder

Did they start drilling the rescue bore immediately?

No they first drove a 16m pilot tunnel to initially break the rock, in much the same way that you drill a small hole in hard wood before expanding it.

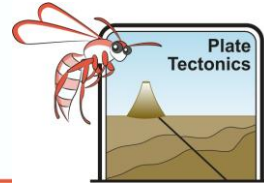
Did they drive the pilot tunnel through to the miners?

No this would have been too dangerous. They realised that causing a cavity in the unconsolidated rock surrounding the miners might cause a collapse. They stopped before breaking through. They hoped to use jackhammers to penetrate the last part.

Why did the rate of penetration slow down again?

The rock is too hard (quartzite). One observer said that it was like trying to break steel with a paper

Beaconsfield Disaster – Teacher Notes



hankie!

What was the next technique the rescuers tried?

Low impact PCF explosives.

How long had the miners spent underground before the rescuers broke through?

Two weeks.

When did the two trapped miners walk into the light at last?

Tuesday May 9th

How was Science directly employed in the rescue?

The rescuers collected information from many sources across the world to plan their work

They regularly assessed the risks inherent with each new challenge.

As the situation changed they employed new technologies to overcome these problems.

The health of the men was monitored and food and support was changed as larger holes were created and their health needs changed.

Why do you think they sent iPods to the men?

The trapped miners' problems were not just physical but psychological also. The iPod would "isolate" them for a short while and provide entertainment suited to their own tastes.

What, to date is the longest time miners have been trapped underground and survived?

32 Chilean miners were trapped 688m underground for 69 days on the 5th August 2010

Lessons learned at Beaconsfield and the drilling expert from Beaconsfield were used to bring the miners to the surface in a rescue pod

If you were trapped underground in a confined space for two weeks what have you learned from this research that might help you during the ordeal? Is there anything else you recommend that might be of help?

Any reasoned response.

The 2010 Boulder Earthquake

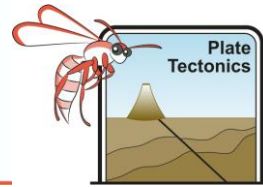
On the 20th April 2010 an earthquake registering 5 on the Richter scale hit the Western Australian gold mining centres of Kalgoorlie and Boulder. Many of the older buildings in Boulder were damaged and local gold mines and the Mt Charlotte Super pit were closed. Kevin McCue the president of the Australian Earthquake Engineering Society suggested that the absence of aftershocks inferred the quake was caused by mining activities.

"Mining can be a dangerous occupation. Gold can be used to make jewellery. Underground gold mining should be banned in Australia because mining is dangerous and gold is used frivolously."

Consider these statements above and give a scientifically reasoned response to it below.

The worksheet suggests first establishing key words, Main ideas and writing a bibliography.

Beaconsfield Disaster – Teacher Notes



Visiting www.safeworkaustralia.gov.au/sites/swa/statistics/work-related-fatalities/pages/worker-fatalities may be of use.

Data/statistics show that working in the transport industry or even in Art and recreation is much more liable to kill you than mining.

Gold has many uses other than those that support vanity.