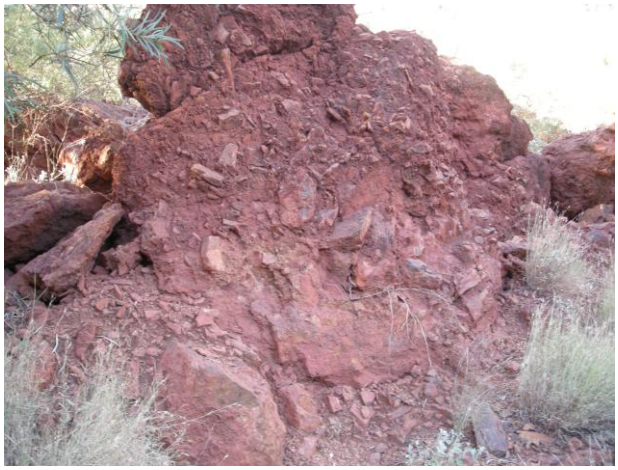
Knocking Off the Rough Edges – Teacher Notes

Angular talus of Banded Iron Formation



Talus compacted and cemented to form breccia

Weathered clasts carried along by a current of wind or water will collide and abrade. The longer they are carried the rounder and smaller they become.

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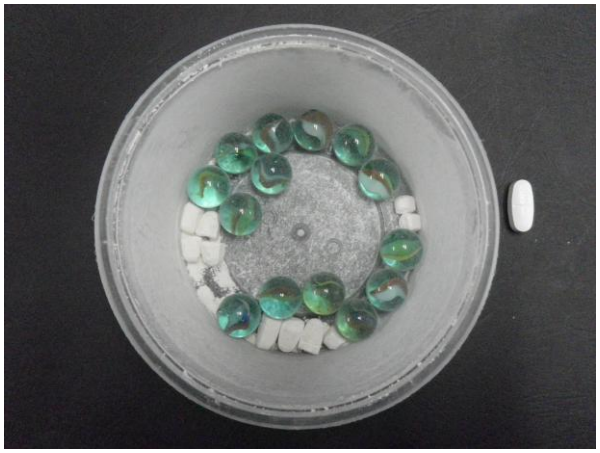
- Rock such as talc, limestone and chalk are made of soft minerals and therefor reduce and round rapidly. Please note classroom chalk is often reconstituted and cemented. It is often harder than natural chalk rock and the outer compacted edge resists abrasion.
- Igneous rocks such as dolerite (often used as road metal) and granite will take much longer to abrade.
- Heterogeneous rocks such as schists and fossiliferous mudstone will have some parts wearing down before the others.



Shaking relatively soft materials in jam jars or tins for varying periods of time can demonstrate this. Lumps of chalk or crayon can be shaken for varying periods of time and the results compared. If marbles are added to the clasts then rounding will occur faster.
This is the principle used in ball mills on mine sites where large lumps of rock are reduced in size to increase surface area for later chemical treatments.

NOTES

1. Internet sites may recommend shaking sweets such as M&Ms or Smarties. Their round shape and hardened exterior mean that it can take hours before noticeable change occurs.
2. Standard commercial chalk may be hardened by adding cement and compressed. Larger chalk sticks are softer. Break them to provide “rough edges”.

3. If no rocks are available locally, halve or quarter calcium (Caltrate) tablets, available from the medicine section of the supermarket or from a chemist. Enthusiastic shaking for 10 minutes produces noticeable results.
4. This activity is very noisy but good fun

A homogeneous rock: (Greek homo = same, genus = kind).

Materials per group

- Jam jar with lid, transparent take-away container or tin with lid
- Even sized pieces of blackboard chalk, crayon or limestone
- Six marbles
- Timer
- Hand lens

Students may need to be shown how to use a hand lens/magnifying glass before starting. Many students mistakenly move the lens back and forward between the object and their eye. More correctly the lens is kept close to the eye and the object is brought towards it until it comes into focus. Students may test by looking at their thumbnail, then at scars or sores on exposed parts of their bodies. Teachers with my sense of humour often then tell them that the final test is to look at the back of their elbows – IMPOSSIBLE!

1. Estimate the percentage of coarse, medium and fine clasts that are present after each shaking interval
2. Select a typical clast for each interval and sketch it into the space provided in the worksheet. Add a scale.
3. Estimate the percentage of angular particles at the end of each interval

Time	Shape	Scale	% coarse	% medium	% fine
0		1:1	100	0	0
5 minutes			95	3	2
10 minutes			80	0	10
15 minutes			70	0	30
20 minutes			65	0	35
25 minutes			60	0	40

Explain the change in the rate of breakdown Rate of breakdown decreases because broken fines cushion the impact of larger clasts on the walls of the container.

Option: Heterogeneous rock

Most weathered material is not homogeneous (Clasts would have come from a variety of sources and be weathered to different degrees). Some rocks also contain different minerals which weather at different rates and have different hardness.

Biscuits/cookies can represent heterogeneous rock. Chop chip cookies and sultana cookies can be shaken to demonstrate that some components break down faster than others.

Heavy minerals in Western Australia

Our ancient granites and gneisses only contain a very small amount of "rare earth" minerals such as ilmenite and monzanite. Some gneiss also contain garnets. These minerals are very resistant to weathering and are quite heavy. Rock is weathered releasing these hard resistant minerals and they are carried down to the sea by rivers.

In the sea they become concentrated by currents and are thrown up onto the beach. Wind can further concentrate deposits of heavy minerals. Many of our rare earth mineral deposits echo ancient beach lines.

Dark mineral rich layers of sand on the beach near Cape Leeuwin WA

Ball Mills

If rocks need to be finely ground then ball mills are used. Gold is often found finely distributed through other rocks. Crushing allows more surface area of gold bearing rock to be exposed for chemical treatment. Hard ceramic or steel balls are added to tumbling mills. They increase the rate of breakup. The balls are sent away for recycling regularly as they wear away and become less effective.

If the first activity is repeated with 5 glass marbles to represent the steel balls. The chalk pieces will be reduced to fine dust in five minutes.

Ball mills also produce flour, cement, pigments, ceramics, pyrotechnics and crush coal for coal fired power stations.