

## Rapid Oxidation – Teacher Demonstrations

Many students confuse the processes of weathering and erosion.

1. ***Weathering is a destructive process.*** During the process of weathering large lumps of rock are broken into smaller lumps. Apart from falling downwards because of gravity, they do not move away from their original position. Weathering can be the result of heating and cooling, natural chemical reactions such as oxidising or breaking up because of acids and also because of the effect of living things, including humans.
2. ***During the process of erosion smaller lumps move away from their original location.*** Forces such as wind, moving water and living things transport the pieces. Moving things tends to sort their pieces (clasts) by size and density.
3. ***During the process of deposition or sedimentation the broken off pieces are dropped as the moving force loses energy, to create a sediment.***

Weathering of rocks takes many years, indeed for some hard rocks like granite and quartzite it may take thousands of years. The speed of weathering is also dependent on climate. Weathering is faster in the tropics than towards the poles. A basalt rock that has been freshly extruded from a volcano in the tropics can weather down into rich soil in less than 5 years. This is why people live near volcanoes in tropical areas. Some of the soils are so rich that three crops can be harvested each year. Basalt outcrops near Bunbury however have only a thin skin of weathering.

### Oxidation - A common chemical reaction in the weathering process



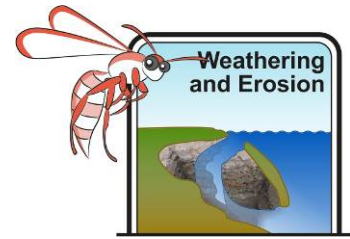
Our atmosphere is a mixture of about 1/5<sup>th</sup> oxygen, 4/5<sup>th</sup> nitrogen and a tiny part of carbon dioxide. The nitrogen is pretty inactive but oxygen is not. Exposing the fresh surface of a rock to air can be the start of a chemical reaction where oxygen in the atmosphere binds to rock minerals and

starts to break down the rock. The whitish crust visible on this brown sedimentary rock (left) is due to oxidation. The weathered crust can be easier to break down physically.

Aboriginal petroglyphs (rock engravings) often use the difference between the colour of the weathered outside of the rock and the unweathered underlying rock to define the engraved outline. This petroglyph is of a kangaroo and is from Burrup peninsula in WA's north-west



**Teacher hint:** The easiest way to obtain broken rock showing weathered and fresh surfaces is by collecting the darker rocks from the railway track or road “metal” dump. They usually show an almost black unweathered surface and a brownish rusty weathered surface.



# Rapid Oxidation – Teacher Demonstrations

## Rapid Oxidation Weathering - Three Teacher Demonstrations

1) Weathering of rock is a slow process taking hundreds and in some cases thousands of years to create an oxidised crust. A similar, but much faster reaction can be seen when an apple is cut into quarters. After a few hours the cut surfaces are oxidised to a brownish colour whereas any freshly cut surfaces are cream coloured. Adding an acid, such as lemon juice, slows the process. That is why we squeeze a lemon over fruit salad to keep it fresh longer.



2) If your school has un-anodised (not covered with a coloured coating) aluminium frames on the windows, students can compare the clean silvery metal of an aluminium cool drink can (bend it a few times until it breaks in two) with the whitish powdery covering of the aluminium metal of the frames. The oxidised aluminium powder can easily be removed by rubbing it with your finger. A gentle scrape with a metal nail or rub with a pot cleaner will reveal the shining un-oxidised metal below. Weathering action on aluminium stops after a couple of years as the crust of aluminium oxide creates a protective coat around the fresh metal.

3) Rusting (oxidised) rocks



Students may also have noticed that iron left exposed to oxygen in the air rusts to a dark red/brown colour. In the Hamersley Ranges that produce much of Western Australia’s iron ore, the sediments of Banded Iron Formation consist of layers of greyish silica rich rock interleaved with dark iron rich bands. Over millions of years the iron rich bands have oxidised to rust. This is what gives these mountain ranges their wonderful dark red colours.

The long weathering process also removed most of the silica further increasing the percentage of iron ore making these deposits amazingly rich and much easier to refine.

(Students may also be interested to know that oxidation of iron in the blood is what turns fresh red blood to dark brownish red.)

Example	Evidence of weathering
Cut apple	Fresh cut white. Brown surface on exposed/weathered cut.
Broken rock	Lighter/darker on exposed/weathered surface
Aluminium frame	White powder on weathered surface. Shiny metal on fresh surface

Students can compare and contrast the differences between the outside of pebbles and rocks with their fresh surface inside. If you intend breaking rock please wear safety glasses and make sure your hammer is in good condition. If you are concerned about rock fragments flying from hard rock, wrap the rock in an old tea towel or rag before you hit it.

