Soil & Parent Rock - Teacher's Notes

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The surface of the Earth is constantly changing due to natural processes such as weathering and erosion and human activity. The results of the changes can be beneficial to humans such as the formation of soils or the building of schools but others, such as storms that erode soil and earthquakes that cause buildings, are damaging to humans.
Soils contain soluble minerals that feed plants and animals both on land and, when carried to the sea by rivers and groundwater, feed the plants and animals there too. Early civilisations grew where rivers brought in fresh soil and water was available.
Although the planet is over 4.5 billion years old most soil only dates from the end of the last Ice Age, about 1 million to 70,000 years ago when great glaciers scoured away old soils and then as they melted replaced them with new mineral rich soils from freshly exposed rock. Most of these soils are very fertile.
In Australia, however, our soils have been exposed to weathering and erosion for about the last 300 million years. Glaciation only affected Tasmania, the Eastern Alps and a very small area south of the Stirling Ranges in WA. There has been no replenishment by significant volcanism or earth movement. Our inland soil has been directly derived from the granite-like rocks below and remained in situ as dry red and grey plains, depleted by many years of weathering. Soil depth can range from a few centimetres to over 100 metres. Where cut by rivers old hard land surfaces form flat-topped mesas. The coastal plains are mostly bleached grey sandy subsoil overlaying organic and ferruginous hardpan. These are one of the least fertile soils in the world.

Minerals are the building blocks of rocks. Weathering breaks rocks into smaller pieces. Erosion sorts these out and some minerals survive these processes better than others. The sediment deposited only contains a

fraction of the minerals present in the parent rock.

Gneiss *Limestone* *Sandstone* *Banded Iron Formation*
SW of WA *Mid west* *Broome* *Hamersley Ranges*

The chemical composition and colour of soils depends on minerals present in their parent rocks and on the climate or climates under which they formed. The student worksheet asks students to match the sediment with its parent rock and to guess where they came from.

Some background for teachers
The rock on the left is **gneiss**. This was formed when hard bands of igneous rocks such as granite and dolerite were buried at about 5km depth in the earth about 1.8 billion years ago. They were squashed together and heated.

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Some of the minerals which formed at these amazingly high temperatures and pressures are weathered out of the rock and form the mineral sands we now mine as titanium for colouring paint, lithium for modern batteries, garnet for abrasives and zircon for making ceramics.

The rock second from left is **fossiliferous limestone** laid down just before the time of the dinosaurs about 290 million years ago. It was deposited in warm seas where lime dissolved from weathered rock entered the seas and was used for skeletons and shells by sea creatures. When they died, their hard parts fell to the bottom of the sea making lime rich rocks. Some of the fossils can be found in the soil.

The rock second from right is sedimentary **sandstone** and was made from layers upon layers of sandy sediments weathered from hard igneous rocks such as granites and swept out to sea by great rivers flowing from the Canning Basin about 5 million years ago.

The rock on the right is part of the world famous **Banded Iron Formations** of our Pilbara. Great volcanoes threw out iron rich rocks, which did not weather away like they would nowadays. 2.4 billion years ago there was hardly any free oxygen in the atmosphere so when these rocks weathered they did not "rust" and lose their rich iron content. Later weathering removed most of the other minerals so their iron content increased further. This is the source of much of our export iron. Since plants have evolved in the sea and on land we now no longer have the conditions under which they formed.

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Match the soil with its parent rock

A B C D

These soils are not matched to their parent rock.

1 2 3 4

Minerals are the building blocks of rocks. Soils are made of minerals from weathered rock, living things such as worms, bacteria and fungi, and moisture. We can often match the soil to its parent rock by comparing mineral content and colour.

Materials

1. Projected image above
2. Scraps of paper to be used as voting slips

Method

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1. Copy the image and display it by projector or Smart Board or use the worksheet provided
2. Label the rocks from left to right A, B, C and D
3. Label the soils from left to right 1, 2, 3 and 4
4. Ask student groups to discuss strategies for deciding which soil belongs to which rock such as colour for colour or choose the easy ones first and "best guess" the ones remaining
5. Ask each group to write down their choice on the voting slip
6. Board the class answers

Correct matches are A4 B1 C2 D3

Observations

	A	B	C	D
1				
2				
3				
4				

What fraction of the class got all the correct answers?

What strategies were used to get the correct answer?