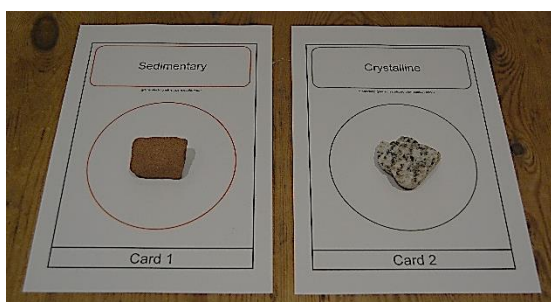


From 'Rock detective' to 'Laying out the rock cycle' Investigate rocks to sort them into groups, add them to the rock cycle and name them

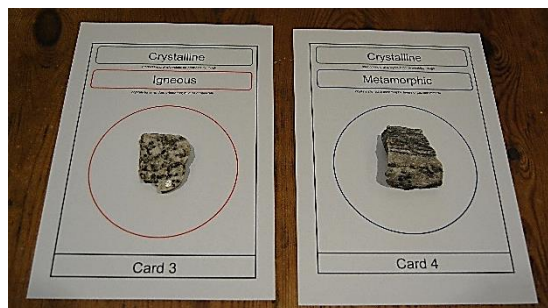
This activity takes the '**Rock detective**' Earthlearningidea activity (https://www.earthlearningidea.com/PDF/Rock_detective.pdf) and extends it to link with the '**Laying out the rock cycle**' activity (https://www.earthlearningidea.com/PDF/253_Rock_cycle_product_process.pdf), by using a series of sorting cards, attached below. By carrying out this link activity, pupils should not only be able to use simple observations and tests to investigate rocks, but should be able to name the rocks and link them to the rock cycle too.

Try following this sequence with your class.

1. Carry out the '**Rock detective**', '**Rock clues**' activity by asking pupils to work in groups of three, as described in the Earthlearningidea, to describe two different rocks, a sandstone (here 'the red rock') and a granite ('the speckled rock'), to each other, so identifying key properties: *their colour, that they are made of 'bits', and that the surfaces feel rough.*
2. Then ask them to do the same for the '**Bit clues**' activity ('bits' are now called 'grains'); they should note the: *grain colour, grain shape, grain size and surface shininess (lustre).*
3. They carry out the '**Predicting properties**' activity, by following the method which shows that bubbles flow freely from sandstone placed in water, but are only seen on the surface of the granite; the mass of the sandstone increases because it absorbs water whilst the mass of the granite is nearly unchanged. This shows: *the spherical shape of the grains in sandstone means that there are spaces; the interlocking shape of the grains in the granite causes no spaces.*
4. Do the '**Testing toughness**' activity, by scratching both rocks with a metal object (e.g. a teaspoon). They will find that: *it is easy to scrape grains off the sandstone, but much harder to scrape them off the granite.*
5. '**Rock sort 1**'. Give each group of pupils Cards 1 and 2, the '**Sedimentary**' and '**Crystalline**' sorting cards and then ask them to put each rock onto the correct card, by using the evidence they have collected.



6. '**Rock sort 2**'. Now give the pupils a piece of banded gneiss ('the striped rock'); ask them to test it as they tested the previous rocks (describe rock, describe grains, observe in water and scratch with a metal object). Ask them to put this new rock on to the correct sorting card. Then take away the '**Crystalline**' card and replace it with Cards 3 and 4 the '**Crystalline – Igneous**' and the '**Crystalline – Metamorphic**' sorting cards. Ask them to study how the grains in the granite and the gneiss are arranged, and put them on the right sorting card.



Now go beyond the '**Rock detective**' Earthlearningidea activity to investigate and sort a wider range of rocks.

7. '**Rock sort 3**'. Fold the right-hand side of Card 6 over so the sedimentary part is hidden. Then remove Cards 1, 3 and 4 from each group and replace them with Cards 5, 6 and 7. Ask them to put the three rock specimens they have studied on to these new cards. Then give them specimens of the remaining rocks listed in the resources section below, namely: [sedimentary] conglomerate, limestone and mudstone; [metamorphic] slate, schist, metaquartzite, marble and [igneous] gabbro and basalt. Now that they know the methods used to test rocks, they should test all these rocks and put them in the correct places on the sorting cards. You will either have to tell them which two rocks react with acid, or give them some dilute acid (with health and safety instructions) to test the rocks.



8. '**Checking**'. Check that each group has put the rocks in the correct places. Note for them that they have done all this complicated sorting and have only had to learn the new terms 'sedimentary', 'crystalline', 'igneous' and 'metamorphic' so far.

9. **'From sedimentary to metamorphic'**. Explain that rocks can become metamorphosed to become metamorphic rocks. This can happen to any rock, but here we focus on how sedimentary rocks are metamorphosed. By unfolding the right-hand side of Card 6, the pupils can see how this works. When increased heat and pressure affect the 'mud stuck together' rock, first a low-grade metamorphic rock is formed; with more heat and pressure a medium-grade metamorphic rock forms and at high pressure and temperature a high-grade metamorphic rock is formed. Meanwhile, when the 'sand stuck together' rock is metamorphosed, it becomes a tough sand-like metamorphic rock. When 'lime sand stuck together' is metamorphosed it becomes impermeable – but both the 'lime sand' and the 'metamorphosed lime sand' rocks react with acid.



10. **'Naming rocks'**. Remove Cards 5, 6 and 7 from each group, and replace them with Cards 8, 9 and 10, enabling each group to name the rocks that they have been studying. The rock names can be reinforced by using the rock name flash cards in the **'Laying out the rock cycle'** Earthlearningidea activity.



11. **'Laying out the rock cycle'**. Now ask them to carry out the **'Laying out the rock cycle'** Earthlearningidea activity. They will need the rock cycle card described in the activity, the bags of sand and soil and the two photographs. They should find it quite easy to complete this activity, since they have already sorted and named the different rock types.



12. **'Laying out the classroom/lab rock cycle'**. Lay out the lab/classroom rock cycle, as described in the **'Laying out the rock cycle'** Earthlearningidea, to emphasise how the products of the rock cycle, that they have been investigating are linked to the processes, whilst noting the usual time spans of these processes.

The back up

Title: From 'Rock detective' to 'Laying out the rock cycle'

Subtitle: Investigate rocks to sort them into groups, add them to the rock cycle and name them

Topic: Using sorting cards to help pupils to link the **'Rock detective'** and **'Laying out the rock cycle'** Earthlearningidea activities to name observe, identify and name rocks.

Age range of pupils: 8 – 18 years

Time needed to complete activity: 50 minutes

Pupil learning outcomes: Pupils can:

- meet the learning outcomes described in the **'Rock detective'** and the **'Laying out the rock cycle'** Earthlearningideas.

Context:

This activity links the **'Rock detective'** and the **'Laying out the rock cycle'** activities together, allowing pupils to investigate a range of rocks from first principles, identify and name them and then build understanding of them in a rock cycle context. It helps them to name rocks, not just by recognising them but by using first principles of observation and investigation.

Following up the activity:

Ask pupils to sort out a wider selection of rocks, using the principles they have learned.

Underlying principles:

- These are described in the '**Rock detective**' and the '**Laying out the rock cycle**' Earthlearningidea activities.

Thinking skill development:

These also are described in the '**Rock detective**' and the '**Laying out the rock cycle**' Earthlearningideas.

Resource list:

Per group, for '**Rock detective**'

- a selection of small specimens of:
 - sedimentary rocks: conglomerate, sandstone, limestone, mudstone
 - metamorphic rocks: slate, schist, gneiss, marble and metaquartzite (rock suppliers often sell metaquartzite as 'quartzite' – but be wary as some sedimentary rocks are also described as 'quartzite' because they have strong silica cement)
 - igneous rocks: granite, gabbro and basalt
- a container (preferably transparent) of water
- a metal object, e.g. a knife, fork or spoon
- copies of the sorting cards attached below

Per group for '**Laying out the rock cycle**'

- rock cycle diagram
- photographs of 'Rocks at the Earth's surface' and of layers of coloured sand in a measuring cylinder, representing a 'Sedimentary sequence'
- small bag of soil
- small bag of sand

One of:

- rock cycle 'product' and 'process' cards for a room-sized rock cycle to be laid out
- optional rock name flash cards
- optional 0.5M hydrochloric acid in a dropper bottle

Useful links:

The '**Rock detective**' Earthlearningidea at: https://www.earthlearningidea.com/PDF/Rock_detective.pdf and the '**Laying out the rock cycle**' Earthlearningidea at: https://www.earthlearningidea.com/PDF/253_Rock_cycle_product_process.pdf

Also the '**Modelling for rocks**' Earthlearningidea shows how grain arrangements affect rock permeability, at: https://www.earthlearningidea.com/PDF/Modelling_for_rocks.pdf

The Earth Science Education Unit virtual rock kit at: http://www.earthscienceeducation.com/virtual_rock_kit/DOUBLE%20CLICK%20TO%20START.htm has photographs of common rock cycle rocks in hand specimen, close-up, at outcrop and in use.

The Geological Society of London has produced a useful animation of the rock cycle with a range of associated activities for pupils and teachers including rock photographs and descriptions at: <http://www.geolsoc.org.uk/ks3/gsl/education/resources/rockcycle.html>

There are more than twenty Earthlearningideas investigating rock cycle processes.

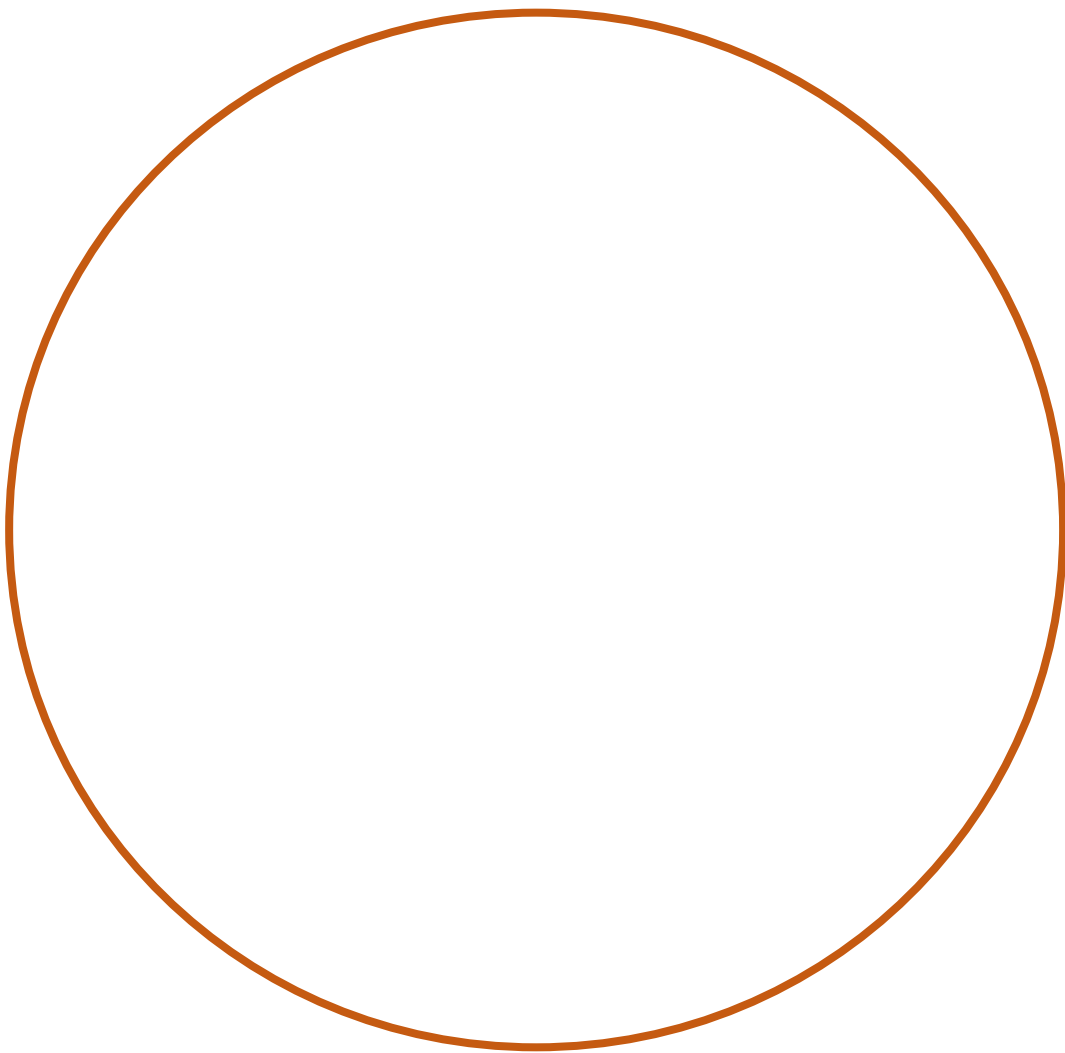
Source: Chris King of the Earthlearningidea Team.

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Sedimentary

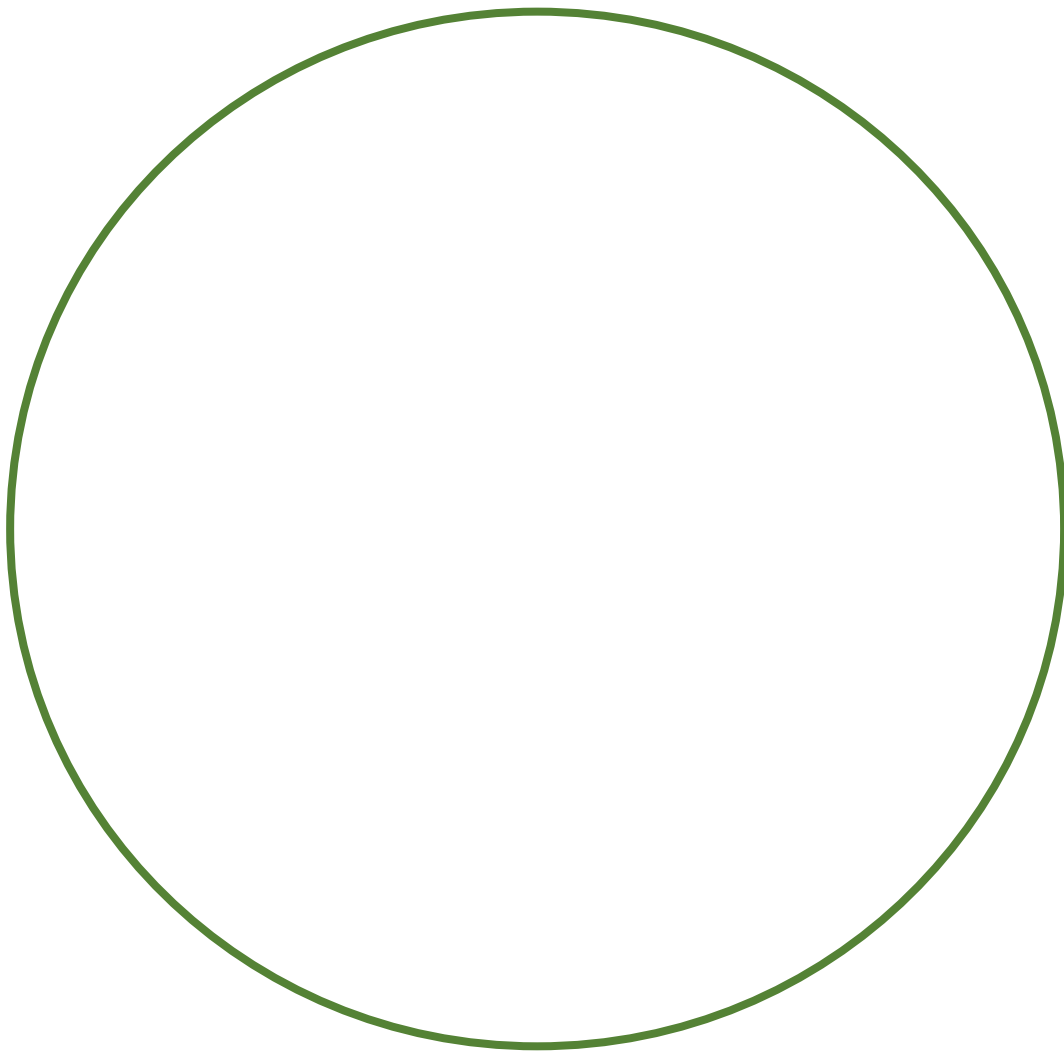
grains stuck together; permeable; weak



Card 1

Crystalline

interlocking grains/crystals; no permeability; tough



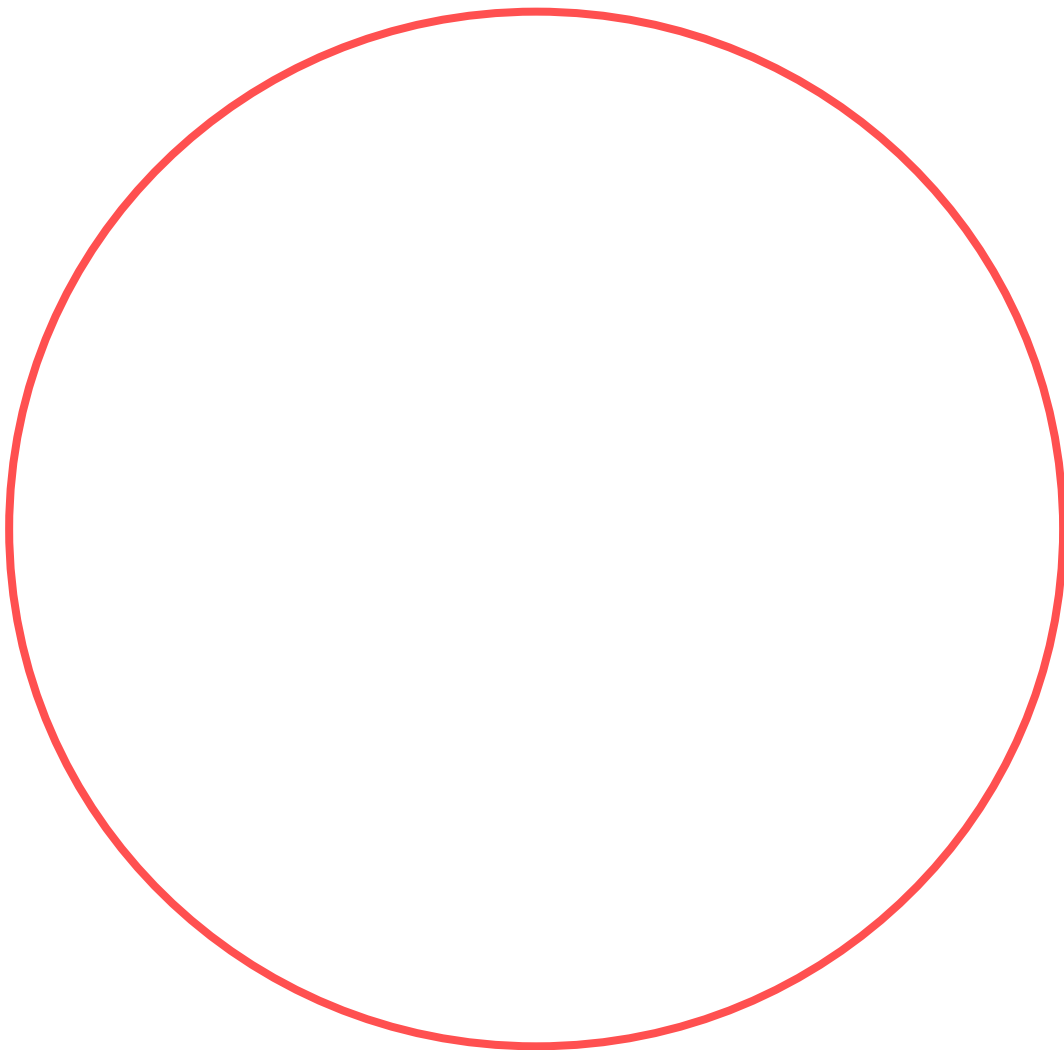
Card 2

Crystalline

interlocking grains/crystals; no permeability; tough

Igneous

crystals have random orientation; mixture of minerals



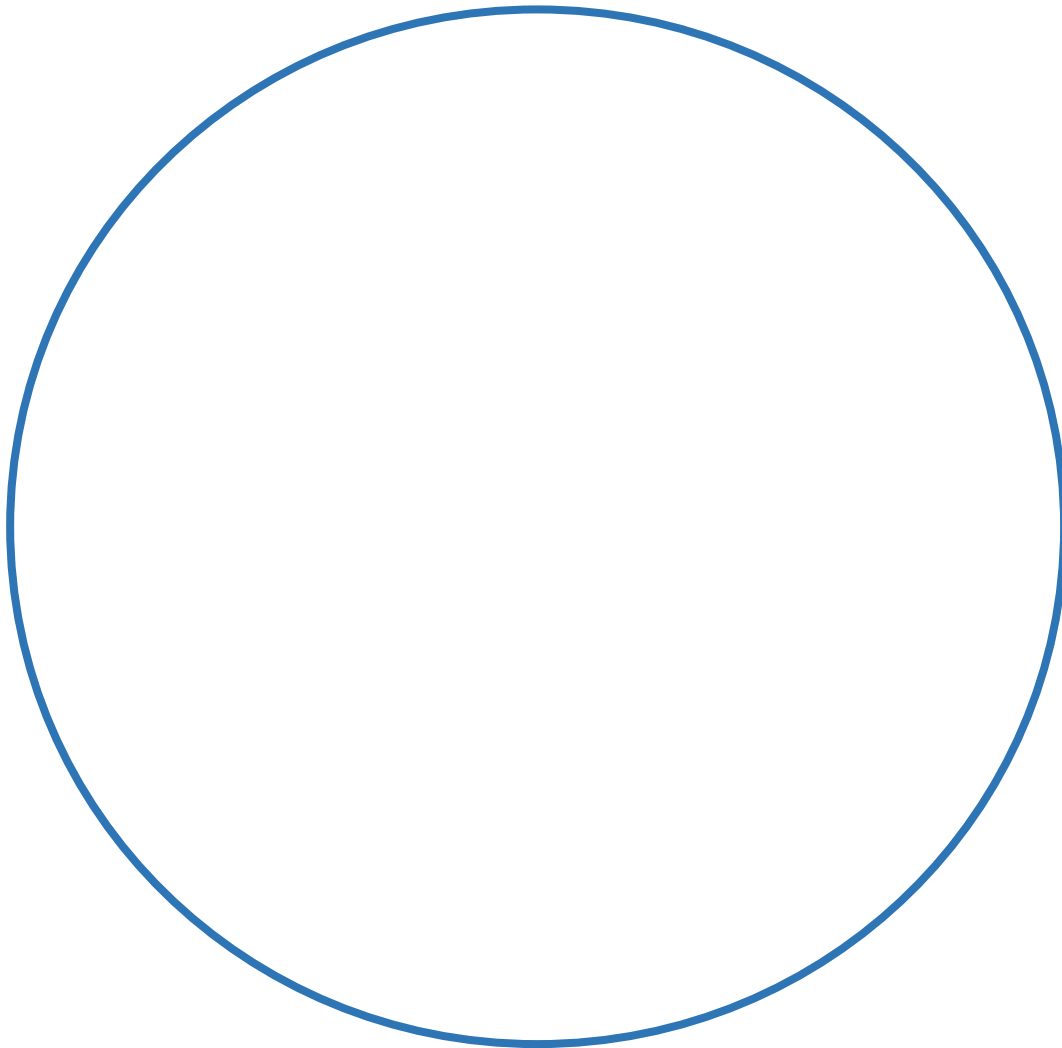
Card 3

Crystalline

interlocking grains/crystals; no permeability; tough

Metamorphic

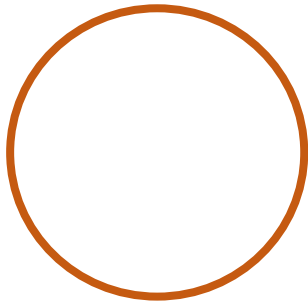
crystals aligned in metamorphic layers or just one mineral



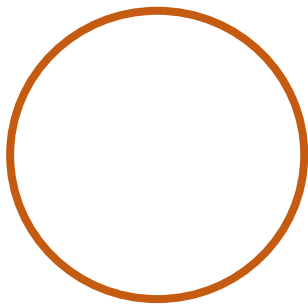
Card 4

Sedimentary

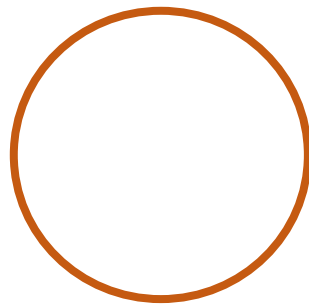
grains stuck together; permeable; weak



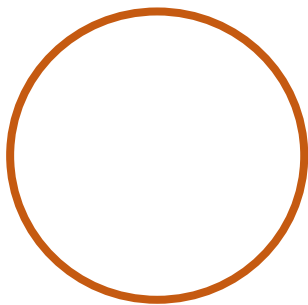
mud stuck together



sand stuck together



pebbles stuck together



lime sand stuck together

reacts
with acid

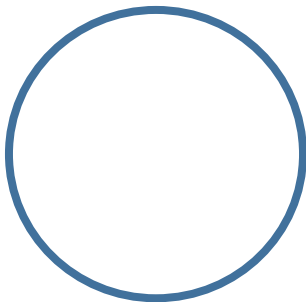
Card 5

Crystalline

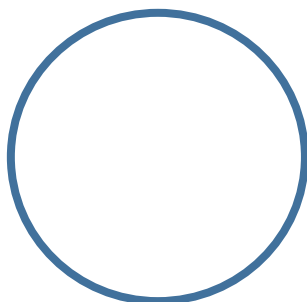
interlocking grains/crystals; no permeability; tough

Metamorphic

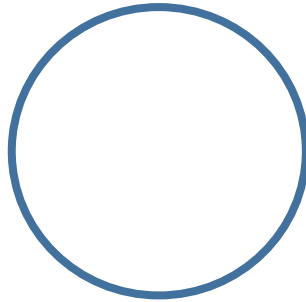
crystals aligned in metamorphic layers or just one mineral



high grade;
bands



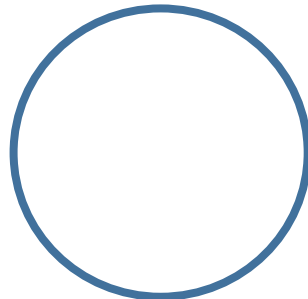
medium grade;
aligned crystals



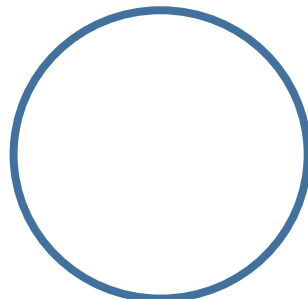
low grade;
fine-grained



increase in metamorphism

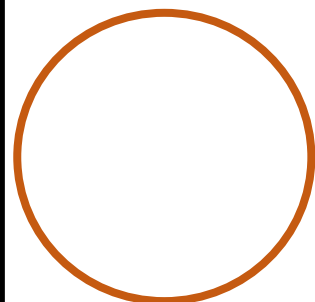


sand-like but tough;
impermeable

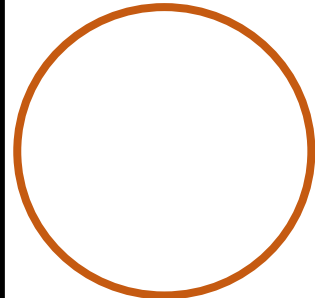


reacts with acid;
impermeable

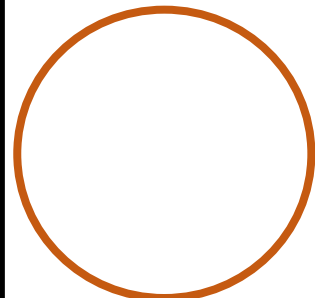
Sedi- ment- ary



mud stuck together



sand stuck together



lime sand
stuck together

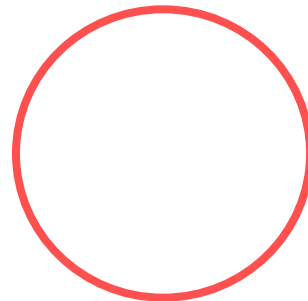
Card 6

Crystalline

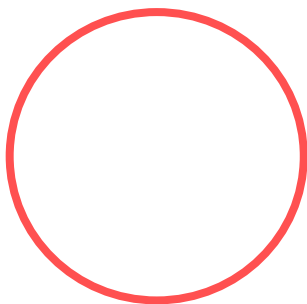
interlocking grains/crystals; no permeability; tough

Igneous

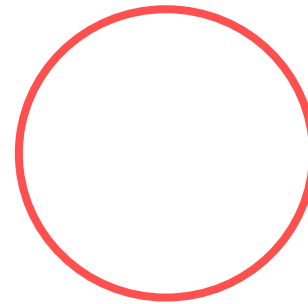
crystals have random orientation; mixture of minerals



dark minerals;
fine-grained



pale minerals;
coarse-grained

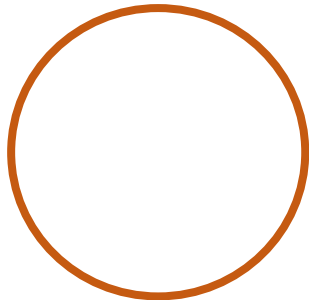


dark minerals;
coarse-grained

Card 7

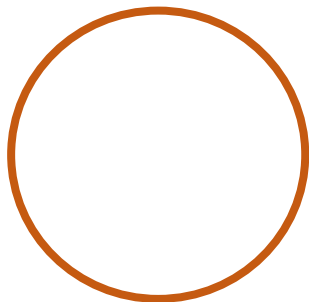
Sedimentary

grains stuck together; permeable; weak



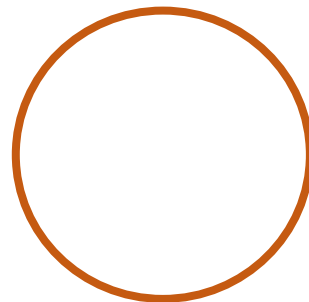
mud stuck together

Mudstone



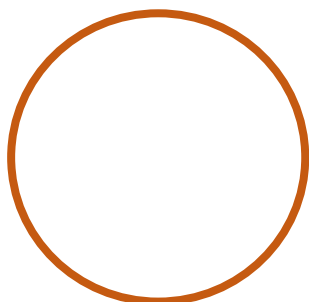
sand stuck together

Sandstone



pebbles stuck together

Conglomerate



lime sand stuck together

Limestone

reacts
with acid

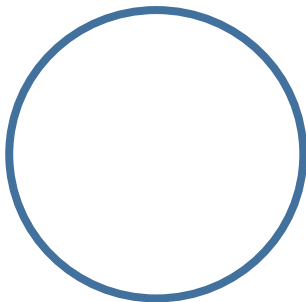
Card 8

Crystalline

interlocking grains/crystals; no permeability; tough

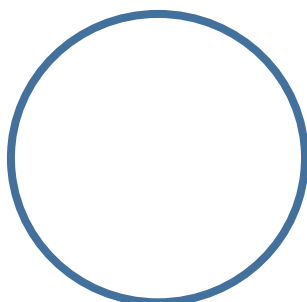
Metamorphic

crystals aligned in metamorphic layers or just one mineral



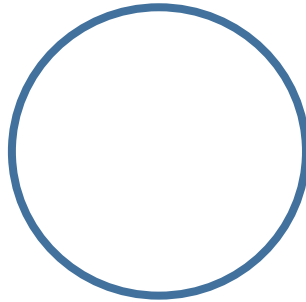
high grade;
bands

Gneiss



medium grade;
aligned crystals

Schist

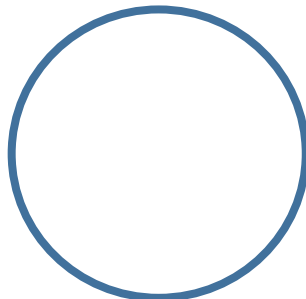


low grade;
fine-grained

Slate

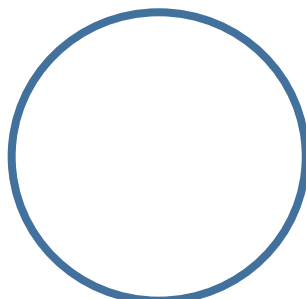
← increase in metamorphism →

Metaquartzite



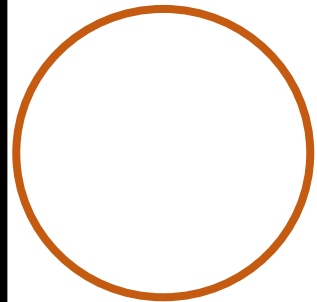
sand-like but tough;
impermeable

Marble

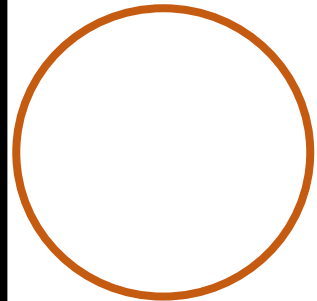


reacts with acid;
impermeable

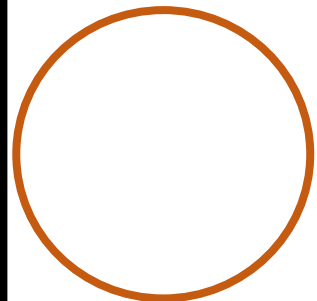
Sedi- ment- ary



Mudstone



Sandstone



Limestone

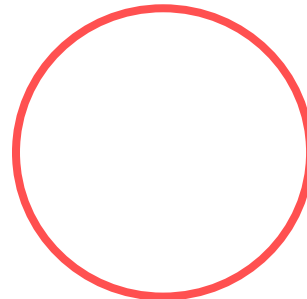
Card 9

Crystalline

interlocking grains/crystals; no permeability; tough

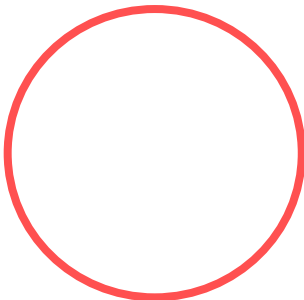
Igneous

crystals have random orientation; mixture of minerals



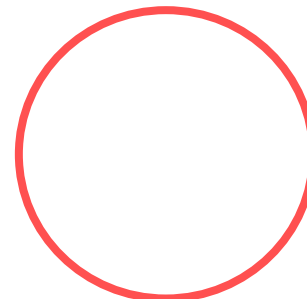
dark minerals;
fine-grained

Basalt



pale minerals;
coarse-grained

Granite



dark minerals;
coarse-grained

Gabbro

Card 10