

Introducing the Rock Cycle By Creating a 3D Model

An activity for primary students

Goals:

- To introduce students to the three kinds of rocks
- To help them understand how they are formed
- To help them recognize their unique characteristics

General Overview:

This project is designed to be completed over about 20 blocks (40 minutes each) of Science, depending, of course, on the age of the children. During that period, the children learn the main facts about the Earth's formation and structure through videos, books, conversations and direct instruction. Each new concept is reinforced by the hands-on creation of a three-dimensional rock cycle model. As each addition to the model is completed, so is the topic of study. [We generally combine Socials and Science as part of Theme Studies and devote a large block of time to the Socials component, complete it, and then concentrate on a Science project (or vice versa). That way we do not try to include major projects in both areas at the same time.] It is helpful to allow two blocks (80 minutes) for some parts of the activity.



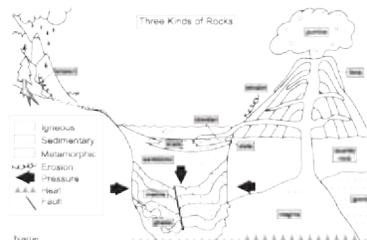
Some General Considerations:

- We piloted this activity with split Grade 2/3 and 3/4 classes. Older students would learn as much, but could work more quickly.
 - During this unit each group may be given a *rock sample kit* held in an egg carton and containing as many of the rock types identified in the cross-section as possible. Groups write their names on their carton and have responsibility for its completeness. Allowing students some time initially to explore these *rock sample kits* might help them concentrate better when they need to use them later.
 - Feel free to make any changes or adaptations which suit your particular supplies, student ability or time available. (For example, coloured pencils or wax crayons may be substituted for paint.) The daily plans provided here are guides to help you plan for your class.
 - Some children are not very able cutters, and the fabric shapes may not be perfect. (Students can help each other.) The overall value of the activity is in understanding the concepts (i.e. matching a fabric pattern or texture to a particular rock texture - e.g. fine woven fabric for sandstone; coarse tweedy fabric for granite) and the placement of the rock types into the general geological picture.
 - Yarn and fabric samples may be obtained from an upholsterer and from parents' castoffs.
 - Fabric may be stored in a box and kept handy. We scattered pieces on the floor at the front of the room for easy picking during work times.
 - While glue or paint is setting, models are best set on the floor against a wall or along the chalk board ledge. However, the models are sturdy when dried and completed pictures may be stacked.
 - To enhance learning and enjoyment, play Joan Corner's CD "Rocks" while students work on their models. (See Page 13.) They can sing along or just listen as they work, and quite quickly they learn the lyrics and understand the geological concepts.
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Materials:

A) For each student:

- Photocopies of the Three Kinds of Rocks cross-section (*Page 7*): 1 - 8.5" x 11" copy to colour and put into Theme Studies duotangs
- 1 - 11" x 17" copy for the 3-D model
- Piece of corrugated cardboard (about 13" x 19" or 32.5 x 47.5 cm). Use a 2-hole punch to make holes along the top edge for wire if you plan to hang the pictures up.
- Photocopy of the Rock Body Patterns (*Page 8*)



B) For the entire class:

Equipment:

- Rock sample kits (e.g. egg cartons containing a variety of identifiable rock types: conglomerate, gneiss, granite, obsidian, pumice, sandstone, shale, slate, marble); there should be 1 egg carton per group
- Magnifying glasses (1 or 2 per team) for looking closely at rocks
- Scissors
- Glue (wet and stick)
- Black felt pens
- Thin wire (*optional*) for hanging final projects
- "Rocks" a music CD by Joan Corner (*Page 13* and www.songs-about-rocks.com) (*optional*)



Model Materials:

- Red and black (or grey) yarn (bulky types work well)
- Brown and grey plasticene (small amount)
- Variety of fabric samples (e.g. coarse tweed, fine stripes, fine squiggly, paisley)
- Cotton batting
- Sparkles
- Sand (kindergarten type) and gravel (playground variety - rinsed and dried) in paper cups to share
- Paint or pencils/wax crayons: blue, brown, plus three different colours for the rock type key and labels
- Brown paper (small scraps)
- Pencils
- Pencil Crayons (assorted colours including red and black or gray) for individual pictures





Step-by-Step Instructions: (Day plans are rough guides)

General Overview of the Structure of the Earth

Day 1 Working on Reference Diagrams for Duotangs



1. Have students look closely at their rock samples in the egg cartons. Guide them to check for colour, layers, holes or other distinctive features. Guide the class as each student colours the 8.5" x 11" Three Types of Rocks cross-section together. Describe and discuss these major rock categories as they colour. Use a *unique* colour for all igneous rocks; another for all sedimentary rocks; a third for all metamorphic rocks. Explain that *country rock* refers to the rock that igneous rocks *intrude*, i.e. that magma squeezes up into or pushes between. Country rock can be any kind of rock and/or more than one type (igneous, sedimentary, or metamorphic). It is always older than the igneous rock that intrudes it. Individual children can chose the kind of rock they want to draw.

(Later, when the children select fabric samples for the country rock, they can pick pieces that represent igneous, sedimentary, *or* metamorphic.) Put this completed cross-section into their duotangs for reference later if needed.

Day 2

2. Play the "Rocks" music. Listen for information that might help with identification.
3. On the larger, 11" x 17" Three Types of Rocks cross-section, each child colours the magma *red*. The volcano can be coloured *grey* or alternating *grey and brown layers*.
4. Colour the sky and the subsurface country rock around the legend on the left.

Building Up The Earth's Crust Through Magmatic Activity

IGNEOUS ROCK

Day 3

5. Students trim off the white borders on the 11" x 17" cross-section. Glue the cross-section to *cardboard* using stick glue. Leave cardboard edges bare for glued on pebbles later.
6. Illustrate volcanic activity and the flow of lava by showing a video (e.g. *Bill Nye's "Earth's Crust" or "Earthquakes"*) or sharing a picture book (e.g. "Magic School Bus - Inside a Volcano"). Point out lines on the picture showing the direction of lava flow and how it builds up to form volcanic mountains or islands. Similarly, pumice and ash blown out of volcanoes fall to the ground forming layers around the volcano's *vent*. Remind them that not all mountains are volcanoes; some are formed by folding and uplifting of the Earth's crust due to powerful pressure caused by moving crustal plates. Explain that when lava flows into water and cools *very* quickly (so that no crystals form), it forms a glassy rock called obsidian.



7. Sing "Igneous Cha Cha" from Joan Corner's CD "Rocks".



Igneous

Day 4, 5 and 6

8. Students examine obsidian samples in their boxes. Note how different it is from other rocks.
9. Spread liquid glue on the magma and lava areas of the cross-section. Cut and glue pieces of *red* yarn onto these areas *parallel to the direction of flow*. Do not cover the word magma.
10. In same way, glue on the *black* or *grey* yarn for hardened lava, which can be generally referred to as volcanic rock, forming the sides of the volcano. Try to parallel the layering lines. Leave one side of the volcano uncovered so the lines remain evident.
11. Put a small trickle of wet glue on the obsidian area. Allow to dry.
12. Lightly colour the pumice cloud on the cross-section with pencil lead. Rub a small amount of cotton batting around on the cloud until it also becomes *grey*, then glue it to the cloud using stick glue.



Figure 1 - Red and black yarn represent lava and volcanic rocks; ash clouds - cotton batting.

Day 7

13. Examine granite rock samples from kits. Identify its main characteristics (e.g. large, angular specks of different colours, etc.), then as a group look through fabric samples together at the front of the room. Try to find fabrics most like granite and note what makes them that way (e.g. light colour, coarse weave, speckles). Tweeds and obvious weaves are good choices. Discuss using plain, light coloured fabric and then adding dots with a felt pen to represent dark mineral crystals.



14. Each student picks an appropriate granite fabric. (Share with a buddy if it is a good, big piece.) Cut granite pattern 1. Put *wet glue* on the labeled side of the pattern, then lay the pattern onto the back of the fabric piece. Leave to dry.

Day 8

15. Students cut the granite fabric and paper, following the pattern lines. Wet glue the granite fabric in place on the cross-section.
16. Carefully colour the igneous key and all the igneous vocabulary (e.g. pumice, lava, magma and obsidian, granite) with a pencil crayon. (Use a single, unique colour, such as red, for all of these.) Play the “Rocks” music as often as possible while the children work.



Figure 2 - Igneous rocks represented by fabric, yarn, cotton batting and glue. Note here that the country rock is also represented by “coarse-grained, igneous” fabric.

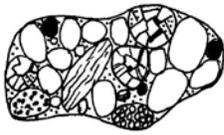
Breaking Down the Earth's Crust by Erosion SEDIMENTARY ROCKS

Day 9, 10 and/or 11

17. Show the class a video, or look at books or posters that show weathering, erosion and sedimentary rocks. It is fine to repeat one used before.



18. Have student groups examine rocks in their kits and find those that match what they have learned about sedimentary rocks (i.e. fairly uniform colour, small rounded grains visible, layers of different colours or shades, relatively soft (i.e. easy to break off grains)). Name a few examples, such as conglomerate, sandstone, and shale, and look for them on their cross-sections.



19. Look together at fabric samples displayed at the front of the room. Identify ones that are quite plain (e.g. small weave, etc.), or have thin, flat layers.

20. Students select fabric pieces they wish to use. Cut out sandstone and shale patterns 2a and 2b. These are fiddly pieces, but if in the end the shapes are not quite accurate, the effect is the same. (Alternativley, students may use the single block pattern to represent a single sedimentary rock sequence.) Also, students may cut small strips of *brown paper* for the shale. Put *wet glue* on the labeled side of the pattern, then lay the pattern onto the back of the fabric piece. Leave to dry.



21. Play "Rocks" music as they work, repeating "Sedimentary Song" to reinforce sedimentary processes.



Figure 3 - Sedimentary rock sequence represented by three different materials, including brown paper for shale.

Day 12, 13 and 14

22. Review how rocks are broken down by water and ice, how rain erodes rocks, and how plant roots and burrowing creatures help break large rocks into pieces.



Rivers carry sediment (silt, sand and pebbles) downhill and deposit them in layers in river, lakes and oceans. Sedimentary layers can be quite different (coarse or fine grained, different colours) depending on the landscape drained by the river.

They can contain fossils, which will differ depending on if the sediment was deposited in fresh water or in salt water. (You might ask students what kind of fossils they would find in river sediments versus ocean sediments.)

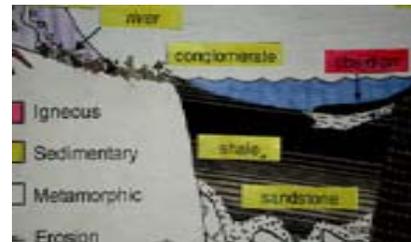


Figure 4 - Sedimentary rock sequence represented by a single, striped fabric.

23. Students colour the water, mountains and trees on the cross-section
24. Students cut out the sedimentary rock fabric pieces 2a and 2b following pattern lines. Wet glue these pieces on the cross-section.
25. Give each table group a small cup of sand and one of small pebbles. Students put a small amount of wet glue on the river and conglomerate areas on their cross-section and then sprinkle with sand and pebbles appropriately.
26. Students find *green* fabric to cut out tree greenery and wet glue to the cross-section. They glue on white cotton batting as clouds.
27. Carefully colour the sedimentary key and all the sedimentary vocabulary (conglomerate, sandstone, shale, erosion, river) using the same colour, such as yellow.



Figure 5 - Add fine pebbles and sand to highlight the river flowing into the water.

Reshaping the Earth's Crust by Heat, Pressure and/or Chemical Change

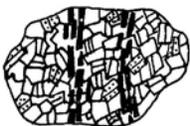
METAMORPHIC ROCKS

Day 15

28. Use videos (e.g. Bill Nye's "Earth's Crust") or picture books (e.g. The Magic School Bus) to demonstrate rock formation.
29. Review how metamorphic rocks are formed from pre-existing rocks due to changes caused by *heat, pressure and/or chemical change*. Metamorphic rocks commonly preserve hints of what kind of rock they were before. Mineral composition, mineral grain size, and the presence or absence of layering, may help determine if the original rock was igneous, sedimentary or even metamorphic!
30. Together sing "Metamorphosis" from Joan Corner's CD "Rocks".



Day 16



31. Point out to students the fault line and pressure arrows on their cross-sections. Remind them that they have covered two other arrows. One of these showed the downward pressure in the sedimentary rocks under the water, which is caused by the weight of the sediment pile. The other arrow showed horizontal pressure related to tectonic plate motion. (It is along the boundaries between moving plates that volcanic activity, earthquake activity and metamorphism occur.) Have them look for slate (from shale), gneiss (from granite), and marble (from limestone) on the cross-section.
32. Students locate metamorphic rock samples in their egg carton rock kits. Try to identify them by name and note their special features.

33. Use a thin layer of *brown* or *black* plasticine to fill the slate area on the cross-section. Streak in the layers with a pencil. Discuss with the class how heat from volcanic eruptions may metamorphose underlying sediments or rocks.

34. Students look for metamorphic fabric samples that generally show deformed, wavy-layered patterns or discontinuous, streaky patterns. For marble they might look for muted florals, brocades or naugahyde. Cut out marble and gneiss patterns 3a and 3b. These are also fiddly pieces, but if in the end the shapes are not quite accurate, the effect is the same. (Alternativley, students may here also use the single block pattern to represent a single metamorphic rock sequence.) Put *wet glue* on the labeled side of the pattern, then lay the pattern onto the back of the fabric pieces. Leave to dry. If appropriate fabrics are not available students may fill the marble and gneiss areas with *grey* (black and white mixed) *plasticine* spread thinly with sparkles pressed into it.

Day 17

35. Colour metamorphic key and all the metamorphic vocabulary (pressure, slate, marble, gneiss).

36. Students cut out the metamorphic rock fabric pieces 3a and 3b, following pattern lines. Wet glue these pieces on the cross-section.

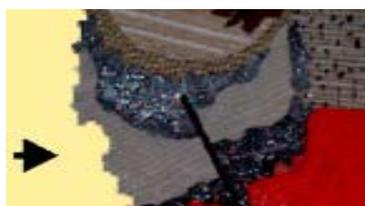


Figure 7 - Metamorphic sequence represented by fabric and plasticine with sparkles.

37. Briefly review again the effects of horizontal and vertical pressure in making metamorphic rocks. Cut short pieces of *black wool* and glue them in the shape of *arrows* that show directions of pressure.



Figure 6 - Brown plasticine represents fine-grained slate formed beneath the obsidian flow.

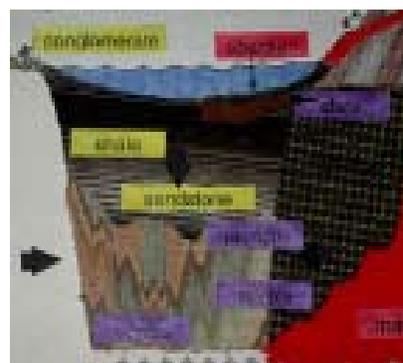


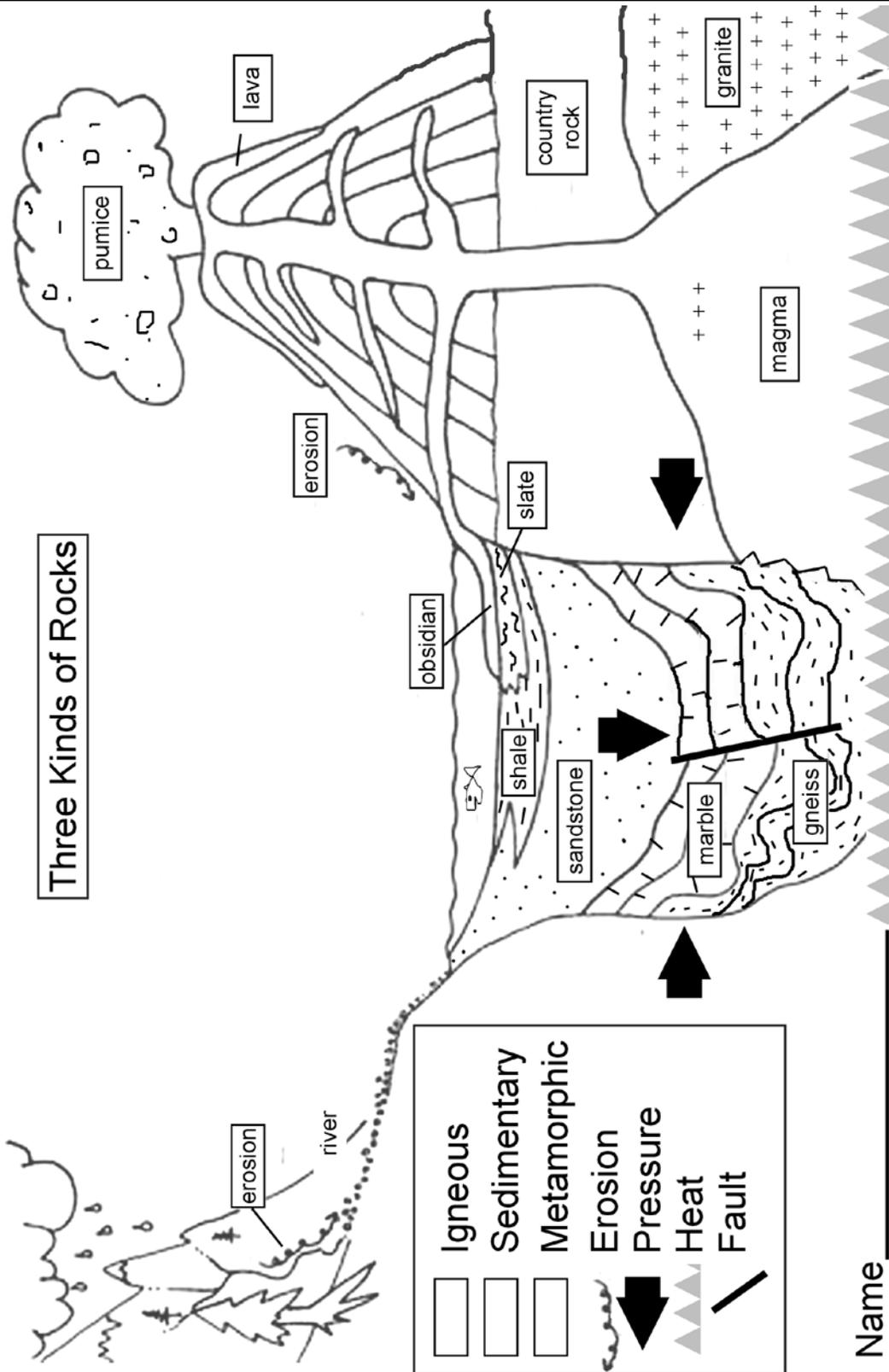
Figure 7 - Deformed metamorphic sequence represented by a single piece of irregularly folded fabric.

Day 18 and 19

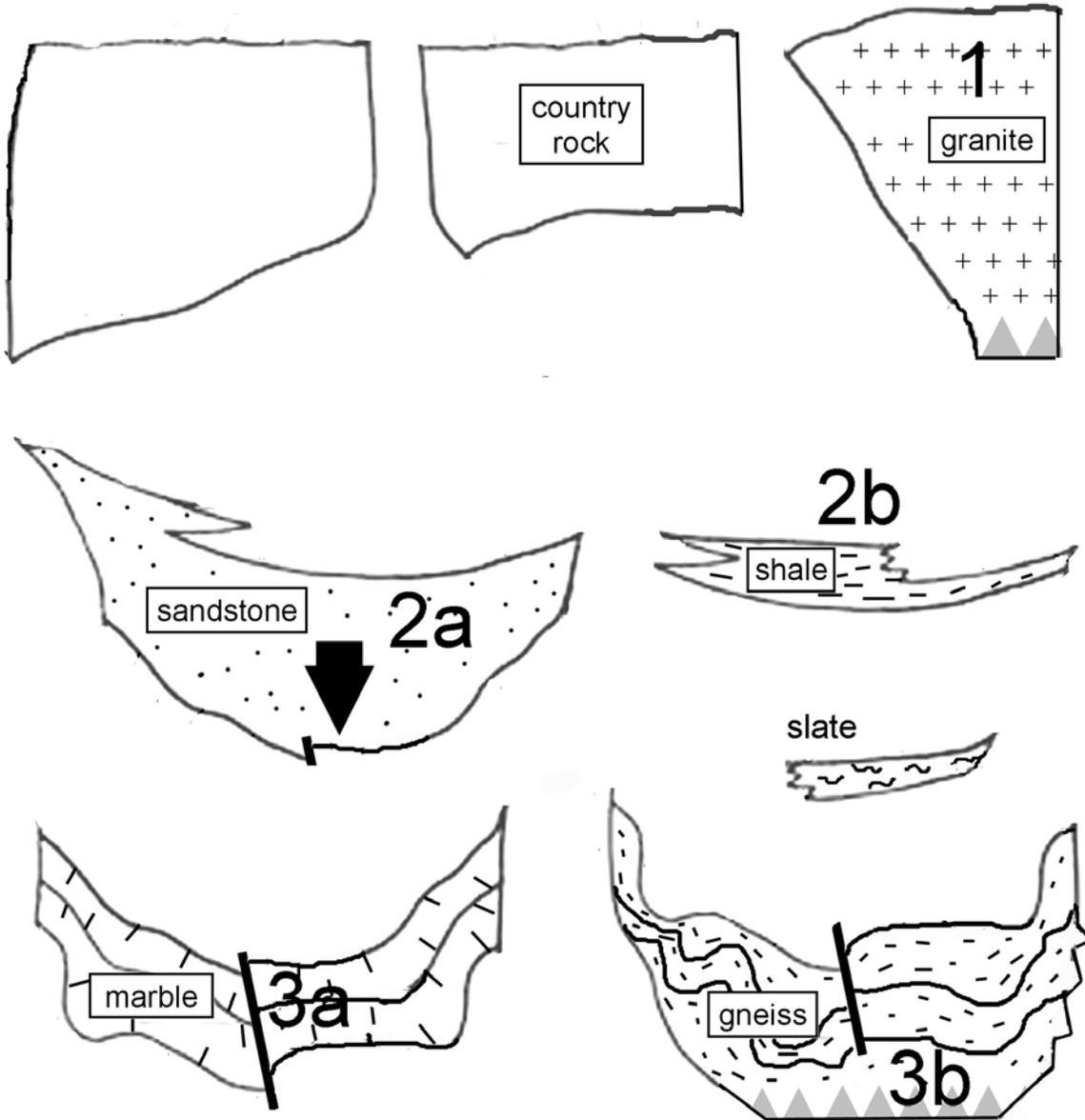
Note: As students begin Step 38 along the bottom edge of their cross-sections, punch two holes at the top of each child's cardboard and put a thin wire through them for hanging.

38. Spread wet glue along the edge of the cardboard frame around the cross-section. Press small pea gravel in the glue to form a frame for the finished picture. (One layer of pebbles works, but you can drizzle white glue over the top to catch loose pebbles in a thicker layer). Some students are painstaking with this, fitting the pebbles together. Others are content to lump them. Have copies of the Three Kinds of Rocks Word Search on Page 10 available for early finishers to work on.





Three Kinds of Rocks
Patterns



This page of patterns must also be enlarged to 11" x 17" to fit the model.

Glue the BACK of the fabric to this PRINTED side of each pattern piece

Three Kinds of Rocks Word Search

Look for the words below vertically, horizontally, forwards & backwards!

E	R	O	S	I	O	N	X	V	S	A	M
T	R	M	A	G	M	A	C	S	A	T	E
A	I	Z	Q	N	O	E	F	E	N	Y	T
R	R	I	U	E	R	L	A	D	D	J	A
E	U	H	A	O	D	B	V	I	S	N	M
M	P	E	R	U	P	R	A	M	T	A	O
O	U	T	T	S	H	A	L	E	O	I	R
L	M	I	Z	S	B	M	L	N	N	D	P
G	I	N	I	E	G	A	T	T	E	I	H
N	C	A	T	I	J	E	T	A	L	S	I
O	E	R	E	F	W	C	H	R	O	B	C
C	D	G	N	E	I	S	S	Y	M	O	S

Word List

CONGLOMERATE
 EROSION
 GNEISS
 GRANITE
 IGNEOUS

LAVA
 MAGMA
 MARBLE
 METAMORPHIC
 OBSIDIAN
 PUMICE

QUARTZITE
 RIVER
 SANDSTONE
 SEDIMENTARY
 SHALE
 SLATE

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1.) What grades did you do the activity with? How long did your students work on it?

2.) How well did the activity work with your class?

3.) What parts of the activity did the students respond best to?

4.) Do you have any suggestions on ways to vary or improve upon this activity?

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