
Lesson One

Simple Sorting

Background:

This activity encourages students to work together sorting various minerals based on these simple characteristics:

- color
- size
- shape
- physical texture
- size

Procedure:

As a class, introduce the topic by asking students to think about minerals. What is a mineral? Describe them as the simplest type of rock, because they have only one ingredient; a mineral is a single element. All rocks are made of minerals, and a single mineral can be compared to the chocolate in chocolate chip cookies. Ask students to name some characteristics of rocks and minerals.

1) Choose a mineral from the classroom collection and ask the students to describe it. Write down the responses in a location where students can refer to them throughout the activity. As a class, describe two or three minerals emphasizing the similarities and differences between each sample.

2) Let the students know they will be working in small groups to sort the minerals, using some of the characteristics they defined before splitting up into small groups, and other criteria they might come up with as a group while studying their minerals.

3) Arrange students in groups of 3 or 4, and give each group a bag of minerals.

4) Ask the groups to take the minerals out of the bags, and spend a few minutes thinking about how the minerals might be sorted.

5) Once the groups have had a few minutes to explore the selection of minerals, tell them to sort them based on characteristics they notice. Let the students know that everyone in the group must agree on how they will sort their samples.

6) Each group should sort their minerals 3 or 4 different ways then swap their minerals with another group to see how their sorting criteria applies to a different selection of minerals.

7) Wrap up: When all the groups have completed the above exercises, return to a full class format and discuss the characteristics the students used and challenges they faced when sorting their minerals.

8) Note: Advanced or older students should then be asked to sort minerals based on two characteristics at once (texture and color; size and shape).

9) Have students write a few sentences and/or draw a picture based on how they sorted their minerals.

Extensions:

Ask the students to make a chart to record how they sorted their minerals. If multiple methods of sorting are used, you may choose to ask for multiple charts. In this way it would be possible for a group of 5 students to choose 5 different ways to sort their minerals, each student charts the results of one method of sorting.

GRADE: K-2 (3-5)

SUBJECT: SCIENCE

DURATION: 30 MINUTES

Materials

One 'Bag of Minerals' for each small group, assembled from the mineral collection and drawstring bags, found in the [ROCKS AND MINERALS KIT](#).

Each bag should have four to six minerals depending on the size of each group. The bags do not need to have the same minerals them.

Goals

While working in small groups, students will begin to understand the properties of minerals by sorting them according to basic characteristics, such as color, shape, physical texture, and size.

Objectives

Students will recognize 3 mineral characteristics. Students will identify two methods for sorting minerals.

Evaluation:

Assessment for this activity is teacher's observations of student understanding and participation in class discussion and group work.

GLEs: 1.1.5

Lesson Two

What is a Mineral?

Procedure:

1) Ask the students what they know about minerals. Lead a discussion about what they are, where we find them and how they're used based on the class' general knowledge of minerals. Minerals are found in metals, in the form or iron ore, foods and table salt, in the form of vitamins and minerals, and computers, cell phones and watches in the form of silica and metals.

2) Explain to the students that five characteristics must be met in order to classify a mineral.
1: Minerals must be natural and not man-made.
2: Minerals must be inorganic, meaning that they were never alive or derived from something living.
3: Minerals must be solid.
4: Minerals must have a definite chemical composition; you can explain this as the mineral always has the same ingredients, just like chocolate cookies must always have the same ingredients to be chocolate chip cookies.
5: Minerals must have an ordered structure which is the crystal form.

3) Write the characteristics on the board and/or ask students to write them down.

4) Once the students know what a mineral is, hold up one of the minerals, such as quartz, and tell them the name. If you are using the worksheet, have them write the name down. Go through each characteristic asking them what they think. Have the students check off the characteristics it meets on the worksheet or count them off on their fingers.

5) Go through each item individually

6) Optional: Water/Ice: Once you get to water, it is obvious that it is not a solid, and therefore lacks a crystal structure. Ask the students if you

boiled the water, would the steam be considered a mineral? If it was frozen would you consider the ice a mineral? Natural ice is considered a mineral. Go through the first four points and once you get to crystal structure, the students might disagree, or they may not think ice could be a mineral since water is not. If they disagree on this last point, show them the picture of a snowflake. Snowflakes always have 6 point symmetry, and have a crystal structure.

7) Break into small groups (2-3), distribute one set of Mineral Matching cards to each group.

8) Give the groups 5-10 minutes to match the minerals to the everyday items.

9) On the back of the worksheet or on a second piece of paper, ask students to write down which items they matched to the minerals.

10) As a full class discuss the matches. Help students correct mismatched pairs.

Extensions:

1) Ask students to make a list of 5-10 items at home that are made of minerals. Be prepared to discuss the lists in class the next day.

2) Birthstones are examples of minerals that are valued as gems. Visit the Burke Museum's Birthstone web pages at <http://www.washington.edu/burkemuseum/collections/geology/birthstones/>. Ask students to identify and research their birthstone. Research can be presented to the class or in a written report.

Evaluation:

Assessment for this activity is the teacher's observations of student participation and understanding and/or the mineral worksheet.

GLEs: 1.1.5, 1.2.3

GRADE: 4-6
SUBJECT: SCIENCE
DURATION: 45-60 MINUTES

Goals:

In this exercise, students will learn how to recognize differences between minerals, and be able to define a mineral.

Objectives:

What does it mean to be a mineral? Students will answer this question through the examination of different specimens.

Through this study, they will be able to explain the characteristics minerals, and why some of the specimens cannot be called minerals.

Materials:

Small group collection of minerals, one for each group. Optional: glass of water, ice cube, picture of a snowflake.

Background:

In this activity, students will learn the definition of a mineral, and will observe several different objects to determine what is, and what is not, a mineral.

MINERAL DEFINITION: A naturally occurring, inorganic, solid, definite chemical composition and crystal structure. All minerals have a crystal structure, though it is not always apparent.

Lesson Three

Mineral Matching

Background:

Minerals are everywhere; in the food we eat, in the metal of the car or bus that gets us to school every day. Minerals can even be found in our toothpaste!

This matching game will help students recognize every day items that are made of common minerals.

Procedure:

1) Begin discussing minerals as a whole class, by asking the following questions:

- What is a mineral?
- Where are they found?
- How do we use minerals?

Then, identify minerals that can be found in every day items, such as:

- Copper (in a penny)
- Calcite (in calcium, in milk)
- Graphite (in pencil lead)

2) Divide students into groups of two or three.

3) Give each group a set of MINERAL MATCHING CARDS.

4) Ask students to carefully study the raw minerals and the everyday items.

5) As a class, make sure that each group knows what they're looking at. You might use the large Teacher's set cards to help them recognize their items.

6) Ask students to make as many mineral/item matches as they can.

7) While the students are matching their minerals sets, display the TEACHER'S SET of cards.

9) With the students still in their small groups, so they can refer to the matches they've made, direct their attention to the TEACHER'S SET of cards on display.

Invite one group at a time to come up, and make a match of the full sized cards. Continue until the students run out of match ideas, or all the cards have been matched. If there are left over cards that the students don't recognize as correct matches, discuss the mineral and how it is used in the everyday item.

Extension:

Using the Teacher's cards only, distribute the cards to students within the room. Give students time to move around the classroom to find the student who is their match.

When the pairs have been matched, ask the students to take 10-20 minutes to work together preparing a presentation about their mineral, based on the information provided on the back of the card. Both students should be involved in the presentation. Call the pairs up one at a time to present their mineral to the class.

Evaluation:

Assessment for this activity is teacher's observations of student understanding and participation in class discussion and group work.

GLEs: 1.1.1, 2.1.1

GRADE: 2-4
SUBJECT: SCIENCE
DURATION: 30 MINUTES

Materials:

Ten student sets of MINERAL MATCHING CARDS

One TEACHER'S SET

Goals:

To help students connect naturally occurring minerals to items that they use on a daily basis.

Objectives:

Students will recognize three minerals that can be found in everyday items.

Students will describe three everyday items that are made of minerals.

Lesson Four

Ingredients of a ROCK

Background:

In this activity, students will begin to explore the idea that rocks are made of minerals. Within granite, for example, the minerals quartz, feldspar, and mica can easily be identified.

Procedure:

1) Ask students what they would need to bake a chocolate chip cookie. Tell them that baking cookies is like making a rock. While cookies are made of ingredients, rocks are made of minerals. The baking transforms the mixture of individual materials into one solid material.

2) Review the concepts of a mineral. A mineral must meet five characteristics: naturally occurring, solid, inorganic, definite chemical composition, and ordered atomic structure.

Point out that definite chemical composition means that a mineral always has the same ingredient. For example, a piece of quartz is made only of quartz; a piece of feldspar is made only of feldspar.

3) Break students into groups of three to five. Give each student a copy of the two worksheets for this lesson, and each group, a piece of granite, feldspar, mica and quartz and a hand lens (or 2).

4) In small groups, have the students observe the minerals with the hand lens. Then observe a piece of granite. The students should be able to identify each mineral within the piece of granite.

5) Using the INGREDIENTS OF A ROCK WORKSHEET, draw a picture of the granite as seen through the hand lens. Label each mineral in the drawing.

Extensions:

1) Using WORKSHEET TWO, create a piece of granite based on the average mineral percentages found in granite. One 5x5 inch square, one 4x4 inch square, one 2x2 inch square, and one 1x1 inch square, all from different colors of paper.

Color and cut out each of the 'minerals' represented on the worksheet. Use the mineral pieces to cover the 5 inch square, try to cover the entire square.

Compare the mineral content of the granite creation to the mineral content of the granite sample.

2) Use a piece of basalt to illustrate that all rocks are made of minerals, even if you can't see the individual minerals. Basalt is made up of pyroxene, olivine and feldspar.

Some examples of these minerals can be found in the small groups collections. Compare granite to basalt (Sometimes you can see green specks of olivine when you look at basalt with a hand lens). Can you identify crystal size? Texture? If the students were to color the lens on worksheet 1 based on what they see in the basalt, how would it look?

Evaluation:

Teacher observations of students' participation and understanding, drawing and worksheet questions.

GLEs: 1.1.5, 1.2.3

GRADE: 4-6
SUBJECT: SCIENCE
DURATION: 40 MINUTES

Materials:

- Hand lens
- Scissors
- WORKSHEET TWO
- Colored pencils/crayons
- Granite
- Quartz
- Feldspar
- Mica

Goals: While working in small groups, students will learn to difference between a rock and mineral, and to observe the minerals within a rock.

Objectives: Students will identify the minerals found in Granite.

Ingredients of a ROCK

Name: _____

DIRECTIONS

Make up a key for each of the three minerals in granite. Use different colors or patterns (for example, dots, or stripes) for each different mineral.

Sketch the granite in the circle. Use the key you made to represent each mineral. Label each mineral.

1. Describe what the rock looks like.

2. Which minerals show up the most?

3. Which minerals are light in color?

4. Which minerals are dark in color?

5. How do minerals differ from rocks?

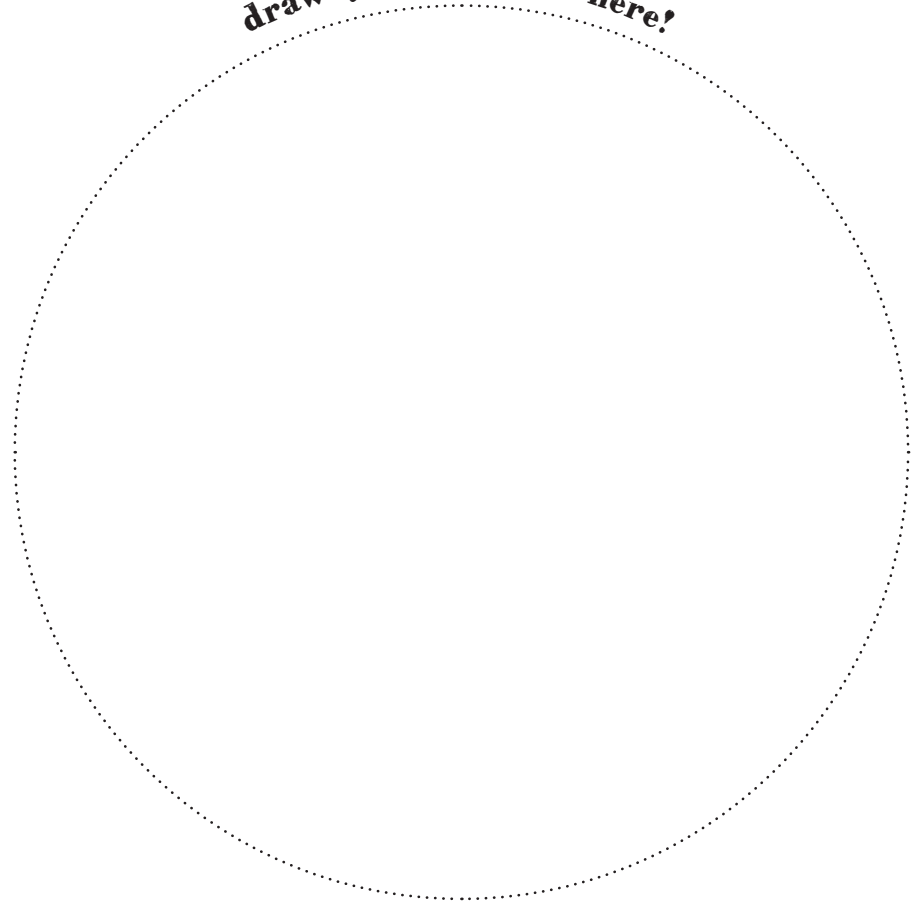
KEY

QUARTZ

FELDSPAR

MICA

draw your granite here!



Worksheet Two: Ingredients of a ROCK

Name: _____

DIRECTIONS:

1) Cut one color piece of paper into a 5x5 inch square. This will be the background for your granite.

2) Cut a second color piece of paper into a 4x4 inch square.

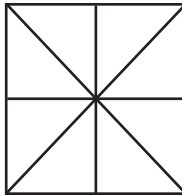
Following the example (right), cut this piece into 16 smaller squares. These pieces represent the FELDSPAR in your granite.

3) Cut a third color piece of paper into a 2x2 inch square.

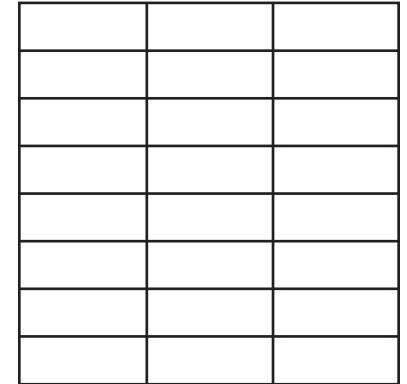
Following the example (right), cut this piece into 24 little rectangles. These pieces represent the QUARTZ in your granite.

4) Cut a fourth color piece of paper into a 1x1 inch square.

Following the example (right), cut this piece into 8 triangles. These pieces represent the MICA in your granite.

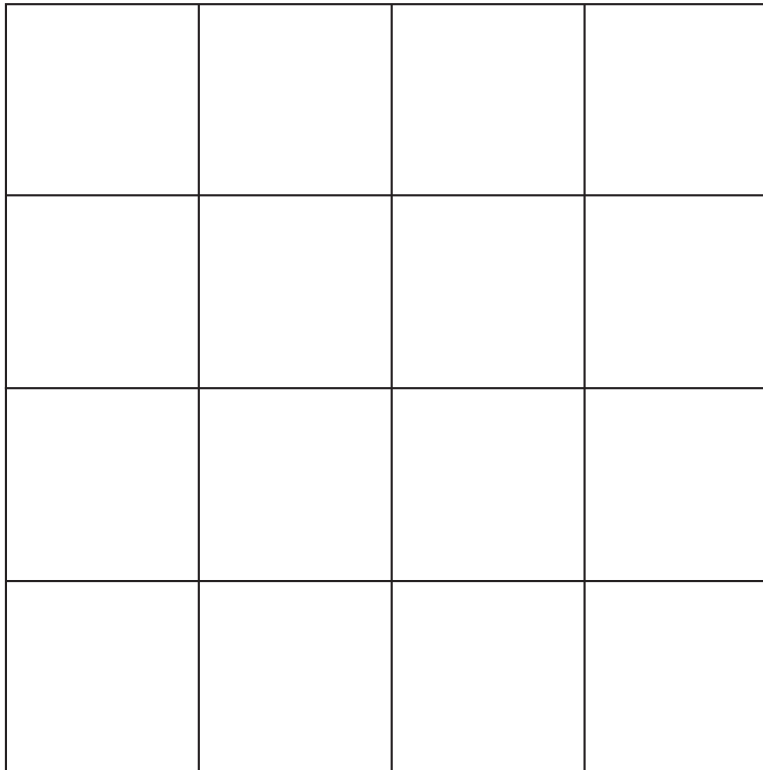


MICA cutting template (1x1)



QUARTZ cutting template (2x2)

FELDSPAR cutting template (4x4)



Lesson five

Rock Collection

Background:

Starting a rock collection is an excellent way to help students connect the Rocks and Minerals Lessons to their local environments.

Before sending students out to collect, discuss places to find rocks. Point out that in many places (such as the school grounds) rocks or gravel has been brought in as part of the building process often to help control drainage or erosion. While gravel usually comes from a local quarry since it is so expensive to transport, encourage students to think of places to collect that haven't been affected by building.

Procedure:

1) Ask each student to bring a small rock from home. Should be smaller than an egg.

2) Introduce the topic by leading a discussion of collections.

• Do any of the students have a collection?

• What do they collect?

• Why did they choose to collect that item?

• Who else collects things?

Libraries collect books for lending, Museums collect artifacts, Scientist collect specimens.

3) Tell the students that they will be starting a rock collection.

4) Give each student a 6 egg section of egg carton. Ask them to decorate the carton including their name.

5) Add the rock they brought from home as the first rock of their collection.

6) Tell students that it is important for scientists to document where they collected their specimens. As student scientists, they will need to write where they found their rock, what time of day and what the weather was like.

For younger students create a separate sheet of paper for this information. Older students might want to record this on the inside lid of their carton. Use the rock they brought from home to practice recording collection information.

7) (Optional) Take a walk outside with the class, help them find the next rock in their collection. Practice recording collection information.

8) Tell students they have a week to complete their rock collection.

9) At the end of the week ask the students to bring their rock collection to school.

10) Distribute the Classroom Collection of rocks and minerals from the kit. Ask each student to compare their rocks to the rocks in the collection. Based on what they've learned, make an educated guess at what their rock might be.

Extension:

Host a rock show. Tell each student to take the rocks out of their egg cartons and turn the carton upside down on their desk. Ask students to arrange their rocks on their carton using the egg holders as pedestals for each sample. They will then learn about their local rocks by observing, and identify them.

Have students tour the classroom in shifts while the other students tend their collection. While touring, students should examine the rocks that their student scientist colleagues have collected. Suggest that students ask questions about the rocks on display.

GRADE: 1-3

SUBJECT: SCIENCE

DURATION: 30 MINUTES

Add collection time.

Optional: 20 minute wrap-up.

Materials

- Egg cartons, cut into six egg sections, one six egg section per student.
- Crayons
- Color pencils, markers (optional).
- Space to lay out rock collections.

Goals

Students will learn collection and identification techniques as well as gain an awareness of the variety of rocks that can be found within the local environment.

Objectives:

Students will practice collection techniques, by collecting six different rocks from their local environment.

GLEs: 2.1.5

Lesson six

Rock and Mineral OBSERVATIONS

Background:

This activity can be used to introduce the unit of rocks and minerals. The specimens do not need to be identified at this time, just observed and described. The characteristics described can range from simple (color, texture, shape), to complex (crystal shape, cleavage, hardness). Keep in mind that this lesson is intended to be an introduction.

Procedure:

- 1) Introduce the large classroom collection of Rocks and Minerals
- 2) Discuss at least three characteristics students might use to describe the specimens shape, color, texture and relative weight are all good characteristics.
- 3) Ask students to choose two specimens to observe. Have them write their observations including three of the characteristics you've just discussed, and three things they'd like to know about each example.

If necessary, specimens can be identified by the catalog number. In the case of very young students, have them take turns talking about their specimen instead of writing.

- 4) Save the specimen observations and questions. At the end of the Rocks and Minerals unit, ask students to review their observations and answer the questions based on what they've learned.

Making Connections:

The Classroom Collection samples come from various areas in Washington State. Use the

diverse collection to help illustrate the complex geologic history of the state. For example, on a map of Washington State, mark where each sample was collected.

As you work through the lesson plans, revisit the map to apply what students have learned to the geology of the state.

Adaptations:

For younger students: Read Everybody Needs a Rock. As a class, choose two or three specimens from the collection, and discuss them.

Ask students what they notice about each rock.

What are it's individual characteristics?

What makes is special?

Evaluation:

Teacher observation of student participation and understanding and written observations and questions.

GLEs: 1.1.5

GRADE: 1-6

SUBJECT: EARTH SCIENCE.

LANGUAGE ARTS

DURATION: 30 MINUTES

Materials:

- Classroom Collection of Rocks and Minerals;
- Hand lens

Goals:

To learn the characteristics of rocks and minerals by observing, and describing, the samples provided within the Rocks and Minerals Kit.

Objectives:

Students will name three characteristics used to identify rocks and minerals.

Lesson seven

Pet Mineral

Background:

Each mineral has a unique set of characteristics. Scientists use these characteristics to identify individual minerals mixed into rock formations.

Color: Minerals come in a variety of colors and color variations. While color is often used to help identify minerals, it is important to remember that color should not be the only identifying factor, because the color of a mineral can vary widely. Use quartz as an example by showing different colors. Also, many different minerals can be the same color.

Luster: The two main differences in luster are metallic, and non metallic. Ask students to point out which minerals have a metallic luster. Other luster types include earthy (such as red hematite), pearly (such as talc), vitreous (or glassy, such as quartz), and greasy (such as graphite).

Shape: Shape is especially important when referring to crystal structure. For the purpose of this lesson, it is sufficient to discuss crystal shape as an identifying factor. This concept is explored in further detail in the lesson: *Classifying Minerals by Shape*.

Smell: Some minerals have a unique scent. While it is not necessarily a determining factor in identifying a mineral, introducing this characteristic helps students explore the minerals provided.

Procedure:

Introduce the students to the classroom collection of minerals. Discuss the unique characteristics of minerals. Point out that not only do these characteristics help identify each mineral from the next, but also provide us with clues as to how that mineral was formed. As a class, identify

similarities and differences within the collection of minerals. The list below explains some characteristics of minerals.

- 1) Distribute the Classroom Collection of minerals from the Rocks and Minerals box around the room in locations where students can gather to observe and sketch the specimens.
- 2) Ask each student to choose 2 samples.
- 3) On paper, have students draw each of the two minerals. Students should include colors and details.
- 4) Students should have 20 minutes to work on their drawings.
- 5) Below the drawing, list 4 characteristics of that mineral. It is OK for students to touch the mineral as they explore the characteristics.
- 6) After 20 minutes, collect the drawings and redistribute them so every student has two mineral drawings from another student.
- 7) Add name labels to the samples distributed around the room.
- 8) Ask students to match the drawings they've been given to the samples. Once they've identified the drawings, write the name of the rock/mineral on the paper.

Extensions/Adaptations:

- 1) Have students make mineral ID books by drawing each of the minerals and listing four characteristics. Bind the drawings together with staples, string, or brads. Use these ID guides for identification through out the unit of study.
- 2) Follow the directions described in the procedures section of this lesson. Instead of asking students to list the characteristics of each mineral, ask them to compare and contrast the two minerals they drew.
- 3) Read *Everybody Needs a Rock* by Byrd Baylor, take a school yard fieldtrip so each student

GRADE: ELEMENTARY
SUBJECT: ART, SCIENCE
DURATION: 60 MINUTES

Materials:

- CLASS SET OF MINERALS
- colored pencils
- paper

Goals:

To increase the students' observation skills by learning about the unique characteristics of minerals, practicing representational drawing (extension 1), and by comparing and contrasting two different specimens (extension 2).

can find their own rock. Finding a rock could also be done as homework. It's important to point out that often, rocks found in public places, were brought there by humans during construction or maintenance of the facility.

Evaluation: Collect drawings for evaluation. Students should list appropriate characteristics for each mineral such as color, luster, shape, texture, smell.

GLEs: 1.1.5

Lesson eight

Washington State Geology Puzzle

Background:

Washington State has a complicated geologic history. In this lesson, students explore step by step the geologic events that build the state of Washington as we know it today.

For more information, please refer to the background materials provided at the beginning of this manual, the animated map available on the DVD included in this box and the Burke Museum Website, at www.washington.edu/burkemuseum/geo_history_wa/index.htm

Procedure:

1) Using the Washington State Timeline of Geological Events (online), and the Washington State puzzle overheads, discuss the accretion and major events that helped to create the geography of Washington State as we know it today.

2) Give students copies of the Washington State Geology puzzle. It is helpful to copy each layer on a different color paper or have students color each piece, so as to better differentiate each layer, or each geological event illustrated.

3) Ask students to build the state, layer by layer, noting how each layer changed the geography of the state.

4) Compare the puzzle maps to the Geologic map of Washington State. Have students locate all of the:

- volcanic rocks (extrusive igneous)
- plutonic rocks (intrusive igneous)
- sedimentary rocks
- metamorphic rocks.

Based on what we know, do these rock types relate to the geologic changes to the state?

Extensions:

1) Ask students to place landmarks on the completed puzzle maps. The Columbia River, major cities and the city where you live are good examples of landmarks that will help students relate to present day Washington State.

2) Copy all the puzzle pieces on white paper. Once students have built their puzzle, have them compare their map to the Geologic Map of Washington. Ask them to color in the general rock types, using:

- Green for ALL sedimentary rocks
- Red or pink for ALL volcanic rock,
- Orange for all plutonic igneous,
- Grey or blue for ALL metamorphic rocks.

3) Using the class collection of rocks and minerals, ask students to illustrate on their puzzle where each mineral was found.

Evaluation:

Teacher observation of student participation and understanding and written observations and questions.

GLEs: 1.3.4

GRADE: 4-6

SUBJECT: SCIENCE, GEOGRAPHY

DURATION: 45-60 MINUTES

Materials

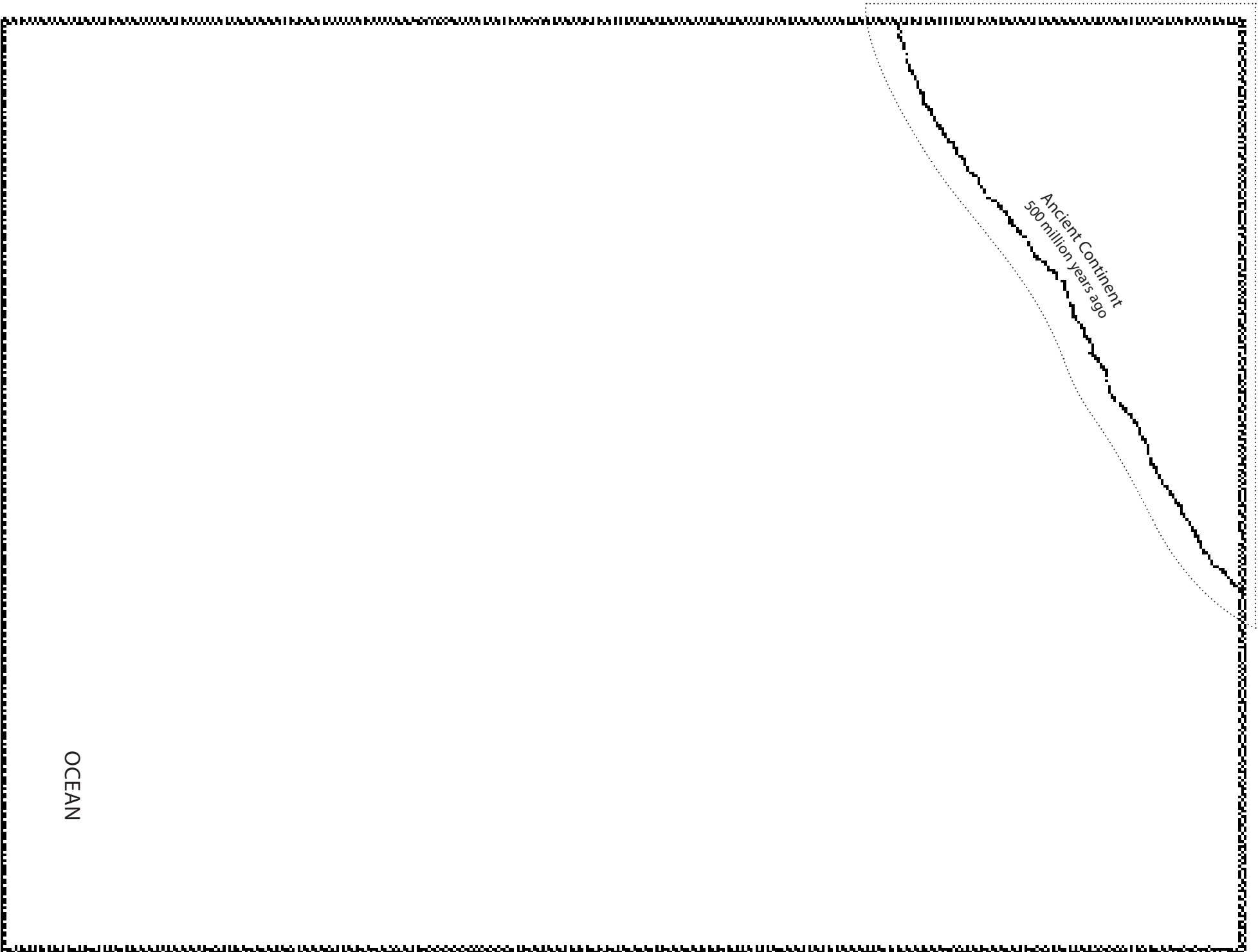
GEOLOGY OF WASHINGTON STATE PUZZLE. Make one copy of the set of layers for each student. The project works best if each layer is copied onto a different color paper or students have time to color each layer.

Goals

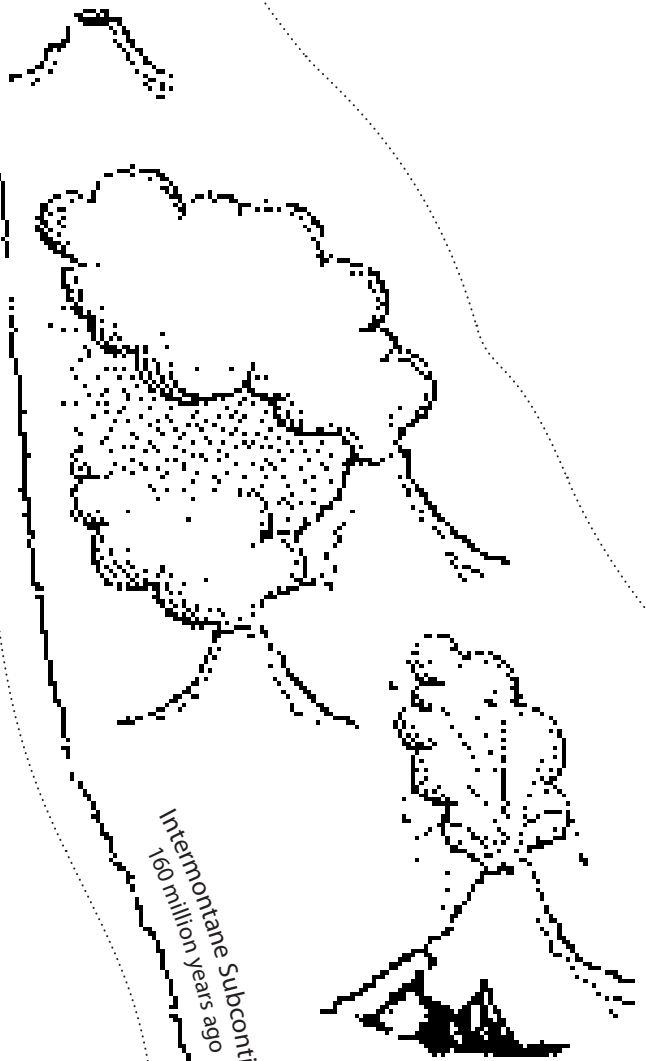
While working in with the map layers, students will begin to understand the major geological events that created what we now know as Washington State.

Objectives

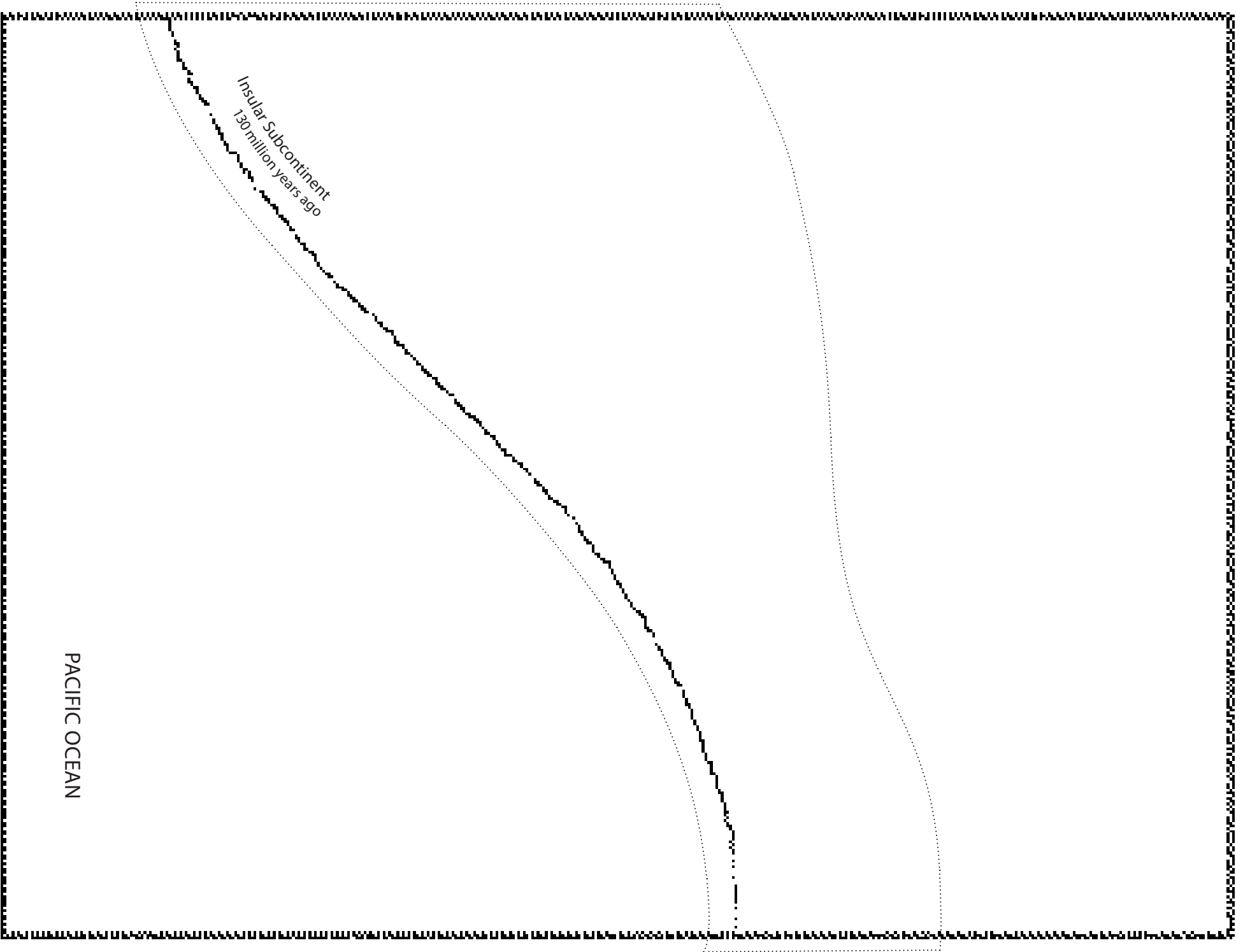
Students will identify stages in the geologic history of Washington state. Students will also locate rock types, and illustrate those on their maps.



PACIFIC OCEAN

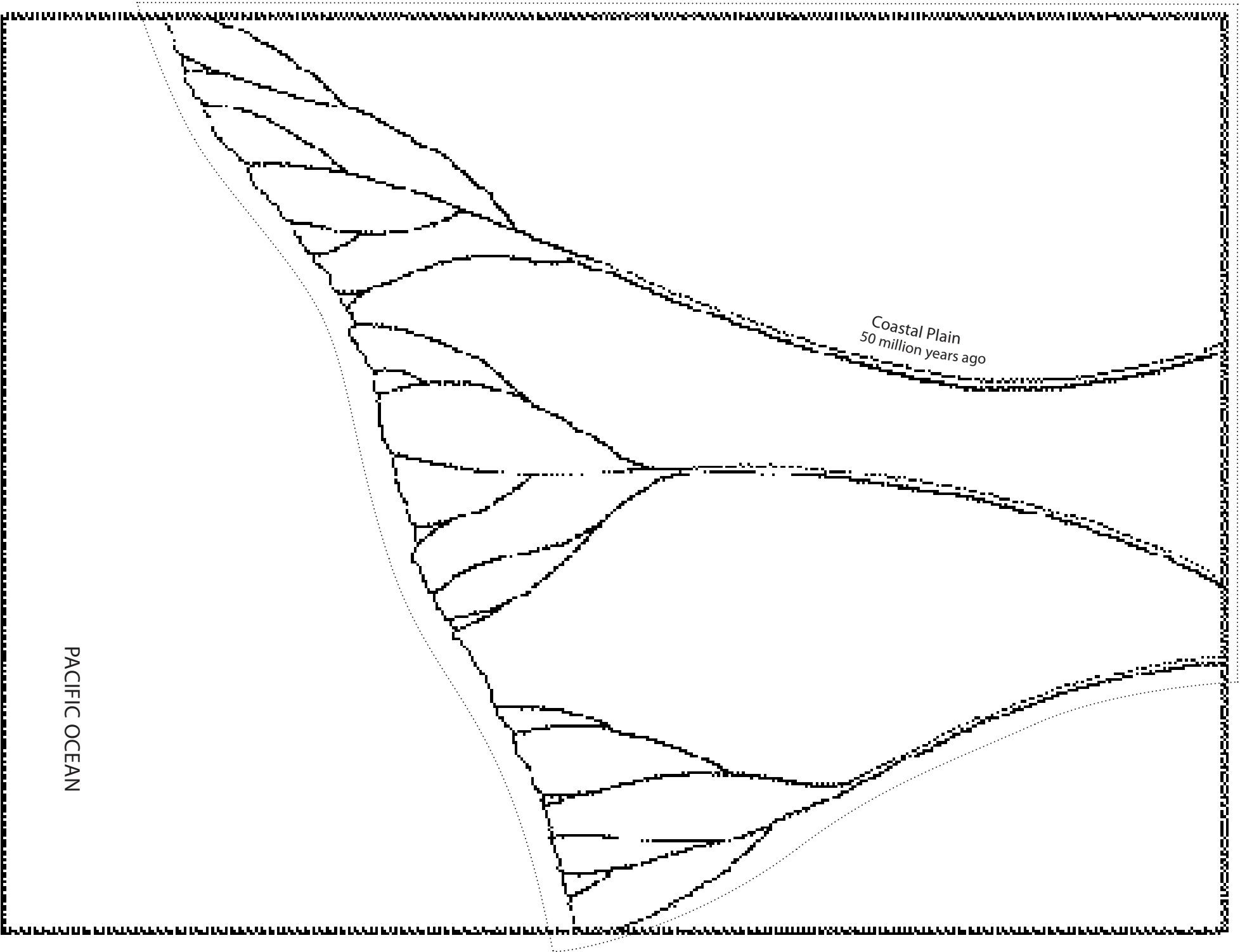


Intermontane Subcontinent
160 million years ago



PACIFIC OCEAN

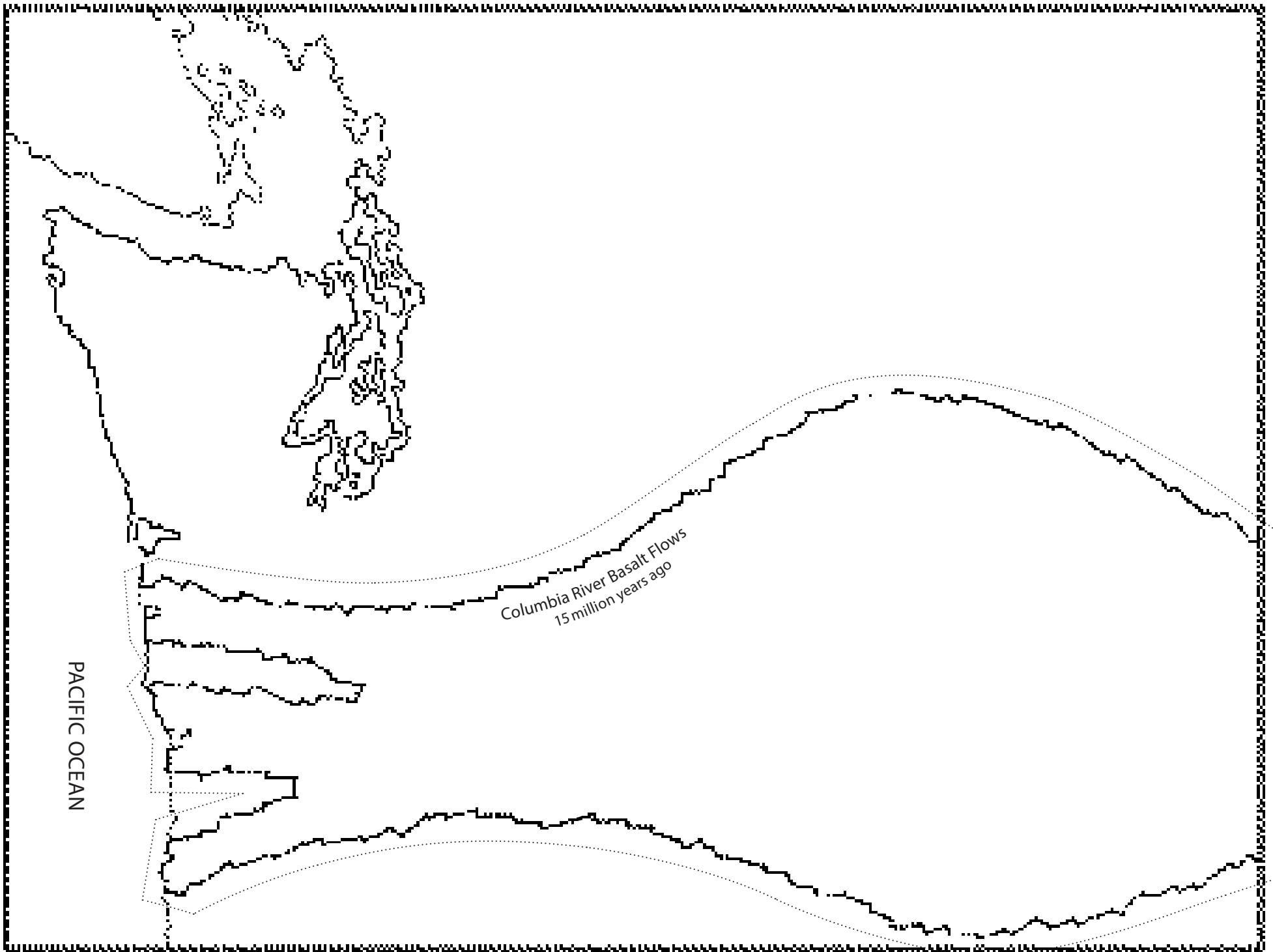
*Insular Subcontinent
130 million years ago*





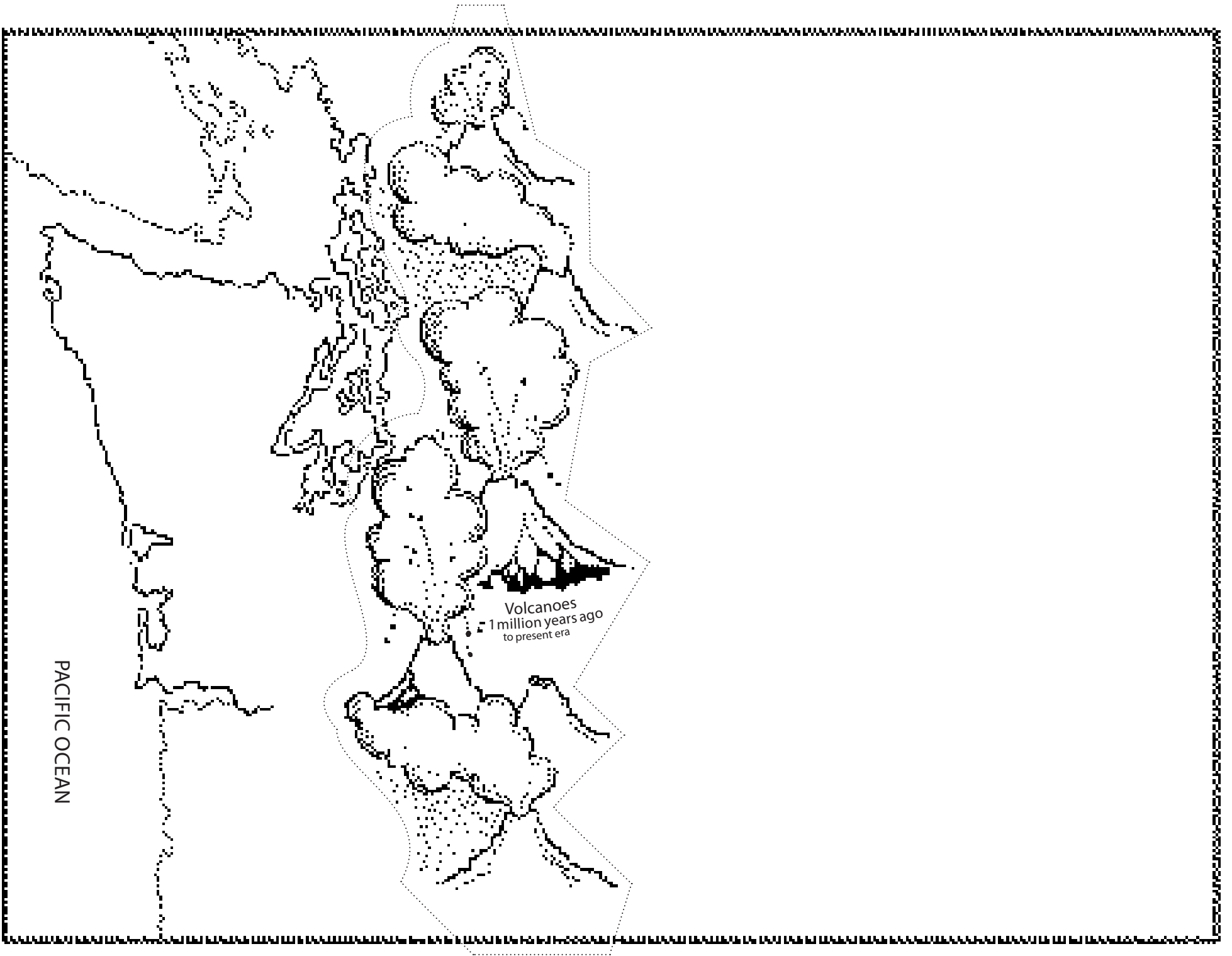
PACIFIC OCEAN

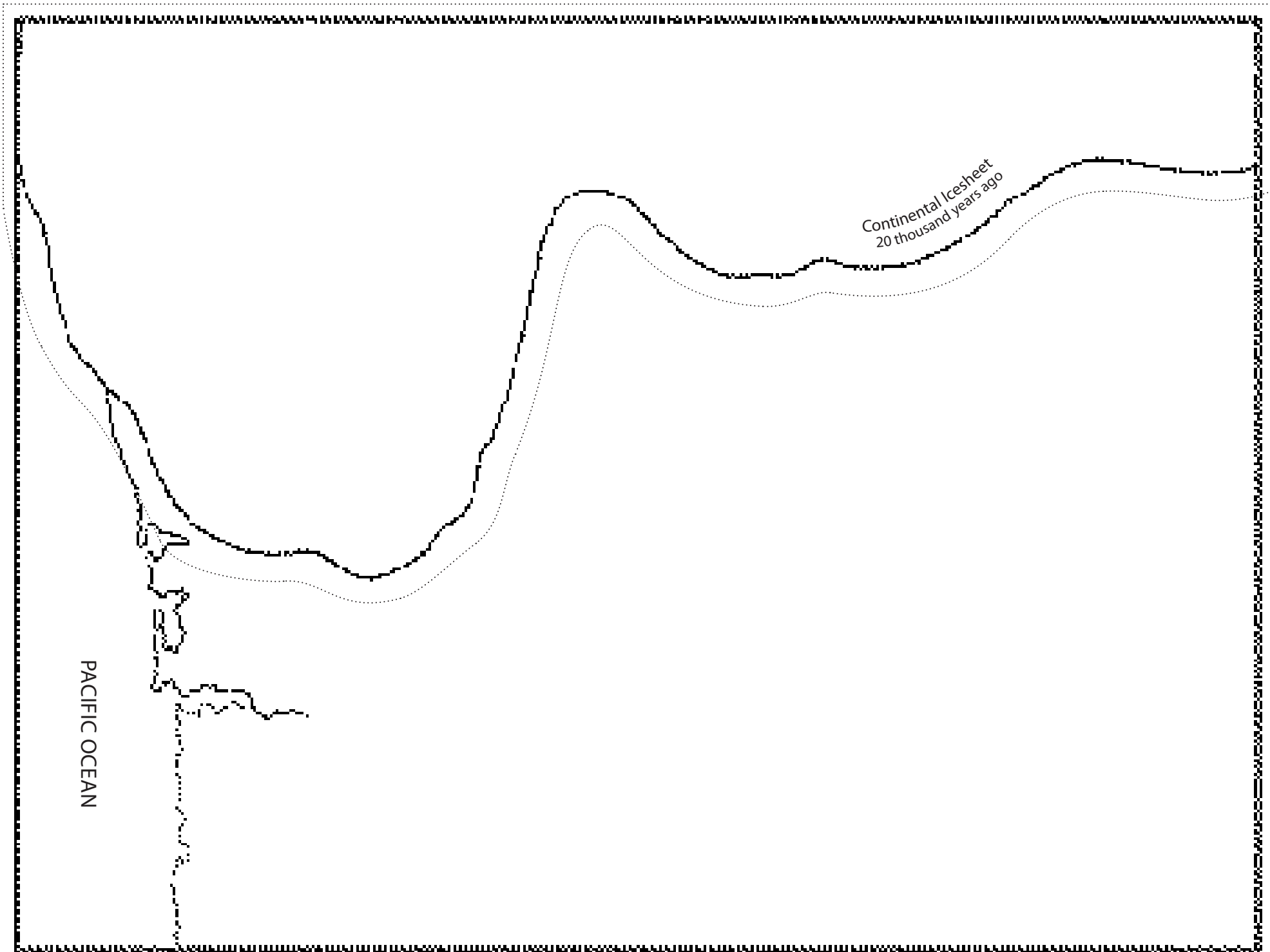
Olympic Peninsula
15 million years ago

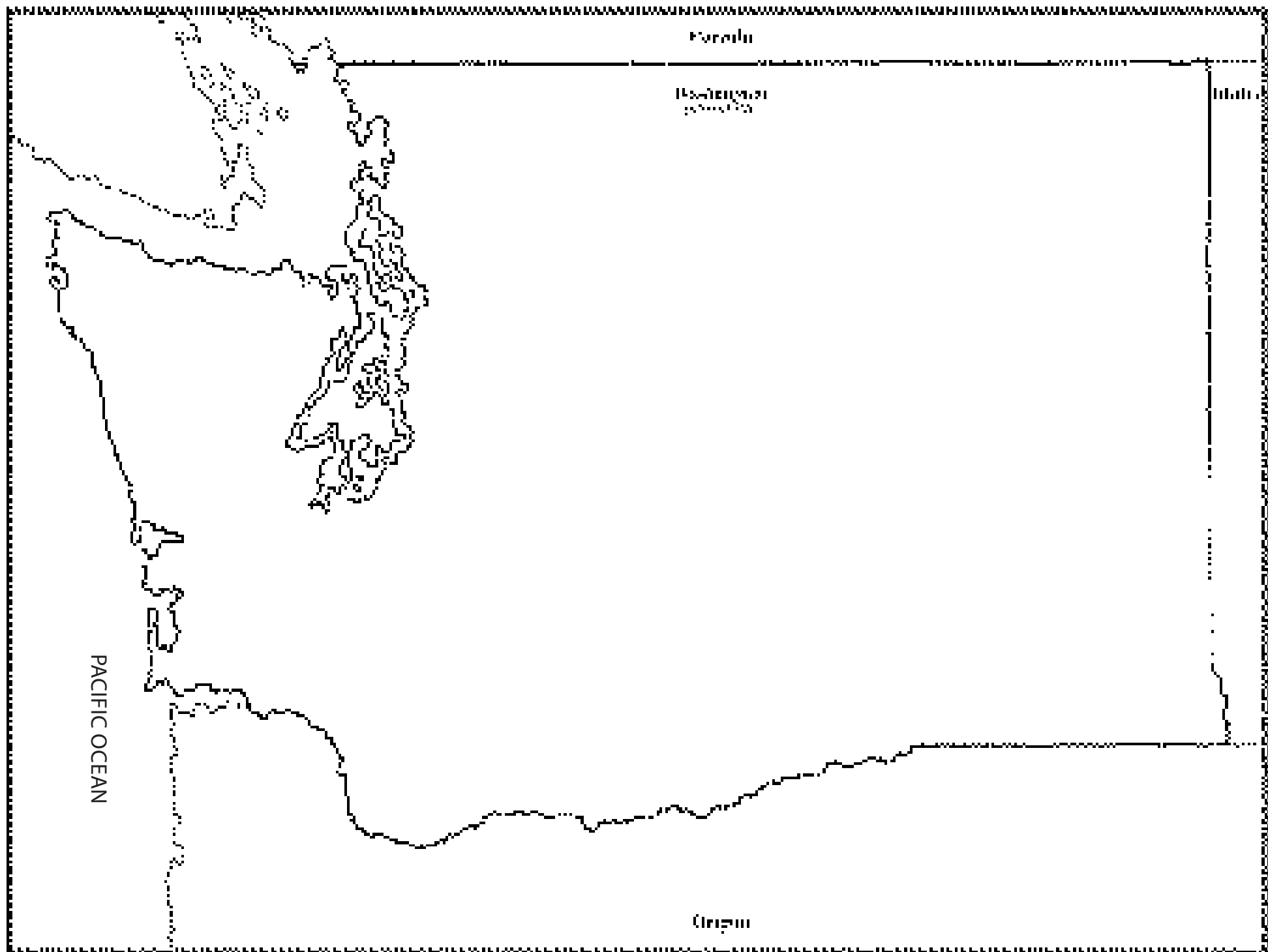


PACIFIC OCEAN

Columbia River Basalt Flows
15 million years ago







Canada

Washington

Idaho

PACIFIC OCEAN

Oregon

