CORAL RESTORATION FOUNDATION™

Sibilating Scleractinia

with Science, Art, Math, and Language Arts Extensions

ADAPTED FROM CORAL REEF TEACHER'S GUIDE: $CaCO_3$ AND CORAL

Objective

Students will understand that coral skeletons are the basic structure of the coral reef, and that these skeletons are made of calcium carbonate, extracted by the polyps of hard corals from seawater to form limestone.

Overview

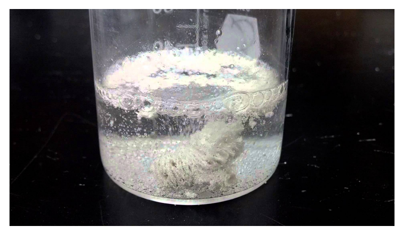
This interdisciplinary activity encourages students to think about what coral reefs are made of, and how long coral reefs have been on our planet. This activity has the ability to have a long-term impact on both corals and ocean stewardship at large, giving the students understanding of this organism and a chance to help save our reefs. This activity can be adapted to a single day or longer, with the inclusion of art, math, and language art extensions.

Background Information

What is limestone? Stony corals (or Scleractinians) are the corals primarily responsible for laying the foundations of, and building up, reef structures. Massive reef structures are formed when each individual stony coral organism—or polyp—secretes a skeleton of calcium carbonate. As these ancient skeletons are broken up, the calcium carbonate forms a mineral known as calcite or limestone. A majority of the Upper Keys of Florida are made from limestone.

Materials

- Piece of limestone
- Shell
- 2 rocks that are not limestone
- Piece of chalk
- Other common object (pencil e.g.)
- Specimen dish for each object



Vocabulary

- Limestone
- Skeleton
- Coral
- Calcium Carbonate
- Ocean Acidification

Standards

SC.K.P.8	SC.2.L.17	SC.3.P.9	SC.5.P.8	SC.8.P.9
SC.K.P.9	SC.2.P.8	SC.4.L.14	SC.5.P.9	SC.912.L.14
SC.K.L.14	SC.2.P.9	SC.4.P.8	SC.6.L.14	SC.912.L.15
SC.1.L.14	SC.3.L.14	SC.4.P.9	SC.6.L.15	SC.912.L.17
SC.1.L.17	SC.3.L.15	SC.5.L.14	SC.7.L.15	SC.912.L.18
SC.1.P.8	SC.3.L.17	SC.5.L.15	SC.7.L.17	SC.912.P.8
SC.2.L.14	SC.3.P.8	SC.5.L.17	SC.8.P.8	

Preliminary Phase

Find out what the students already know.

Teacher talk:

- *What is coral? Is it an animal? Is it a plant? Is it a mineral?*

At this point, depending on the age of the students, Teacher might have to explain the differences between animals, plants, and minerals are. Teacher makes a table on the board, and students vote and their votes are placed on the board for all to see.

Teacher talk:

- *If you answered animal, you are 100% correct. If you answered vegetable or mineral, you are not 100% wrong though. Corals are animals that may have a special relationship with a microscopic plant (or vegetable) and that can make an external limestone (or mineral) skeleton.*

Teacher shows a picture or video of a coral reef.

Teacher talk:

- *Individual coral **polyps** in a reef are typically very small. But because corals are colonial, the size of a **colony** can be much larger: big mounds can be the size of a small car, and a single branching colony can cover an entire reef. Reefs, which are usually made up of many colonies, are much bigger still. The **Great Barrier Reef** which spans 1,600 miles (2,600 km) off the east coast of Australia is so large that it can be seen from space. It takes a long time to grow a big coral colony or a coral reef, because each coral naturally grows slowly. Reefs themselves grow even more slowly because after the corals die, they break into smaller pieces and become compacted. Individual colonies can often live decades to centuries, and some deep sea colonies can live up to 4000 years. One way we know this is because corals lay down annual rings, just as trees do. These skeletons can tell us about what conditions were like hundreds or thousands of years ago. The Great Barrier Reef as it exists today began growing about 20,000 years ago. But let's look closer at the individual polyp…*

Focus Phase

The students explore examples of the concept.

Teacher draws a picture or shows a picture of a coral polyp. If the students have already done the activity, "Appetizing Acropora". Have the students name the body parts. If not, label it for them, include a minimum of tentacles, mouth, stomach, zooxanthellae, and limestone exoskeleton.

Teacher talk:

- *Coral colonies are made up of individual animals known as polyps. Without its skeleton, these polyps would be soft, fleshy animals a lot like micro anemones. But, if anemones don't need these skeletons, why do corals have them?*

Teacher works with the class to make a list of possible reasons. The most common one would be protection, but try to make them think more about why corals do as well.)

Exploration Phase

The students exchange, debate, and test ideas.

Teacher talk:

- *What are some reasons that animals grow hard exoskeletons?*

Teacher works with the class to make a list of possible reasons. The most common one would be protection, but try to make them think more about why corals do as well.)

Application Phase

The students apply their rules to new situations.

Teacher then displays pictures of different animals with hard shells or **exoskeletons**. See if one of their reasons would match each of the animals. If they do not match, then add to the list. The final picture that should be shown is the coral.

Challenge Phase

The students take their application to a real-world situation

Teacher talk:

- *A test for calcium carbonate is to pour vinegar over an object and observe it. If the object bubbles and/or makes a fizzing sound, it probably contains calcium carbonate. (Note: sodium bicarbonate also bubbles with vinegar.)*

Teacher places the limestone, shell, and two rocks in separate dishes. Have the students tell you which ones they think contain calcium carbonate and why. Perform the test, and identify the calcium carbonate object(s).

Have the students choose items from the room that they think might be made from calcium carbonate. If chalk is not chosen, the teacher should add it.

Place each of the selected items in a separate dish and pour vinegar over each one.

Observe which items cause the vinegar to bubble.

Discuss which items are made of calcium carbonate and contain the same material as coral skeletons. Since chalk is made of calcium carbonate, it will bubble.

Synthesis Phase

The students take their overall understanding to the next level.

Teacher talk:

- *So, what do you think would happen if we poured vinegar, which is a weak acid, all over the coral reefs? Did you know we are practically doing this through* CO_2 *emissions?*
- *Over the past two centuries,* ***humans have dramatically altered the composition of the earth's atmosphere*** *through deforestation and the burning of fossil fuel.* ***Atmospheric carbon dioxide*** *(*CO_2*) concentrations have increased to the highest level experienced on Earth for at least the past 650,000 years. The rate of increase has also been faster than at any time during that period. The global oceans are the largest natural reservoir for much of this excess* CO_2*, absorbing approximately one-third of that attributed to human activities each year. As a result,* ***dissolved*** CO_2 *in the surface ocean will likely double over its pre-industrial value by the middle of this century, representing perhaps the most dramatic change in ocean chemistry in over 20 million years.*
- *As* CO_2 *reacts with seawater it forms* ***carbonic acid****, causing a reduction in seawater pH. Seawater is naturally 'buffered' against these pH changes, but the buffering process consumes carbonate ions. Carbonate ions are an essential ingredient in the creation of calcium carbonate shells and skeletons produced by a large number of marine organisms (e.g., corals, marine plankton, coralline algae, and shellfish). This is called* ***Ocean Acidification****! We will talk more about the creation of calcium carbonate in another lesson – Creating Calcium Carbonate.*

Extension 1 – Coral Crystals (SCIENCE)

ADAPTED FROM SEA WORLD: GROWING CORAL

Materials

- Plastic Bowls
- Pieces of charcoal, porous brick, tile, cement, or sponge
- Water
- Table salt
- Liquid bluing (found in bleaches at grocery stores)
- Food coloring
- Measuring tablespoons
- Masking tape
- Pens

Instructions:

1. Ask students to label their bowl with pieces of masking tape with their names on them. Have them put some pieces of charcoal, brick, tile, sponge, or cement into their bowls.
2. Students should pour two tablespoons of water, two tablespoons of salt, and two tablespoons of liquid bluing over the base material (charcoal, etc.) Set bowls on a table or counter top. Formations need free air circulation to develop.
3. The next day have them add two more tablespoons of salt.
4. On the third day, pour in the bottom of the bowl (not directly on the base material) two tablespoons each of salt, water, and bluing, then add a few drops of food coloring to each piece of base material.
5. A crystal formation should appear by the third day. If not, it may be necessary to add two tablespoons of household ammonia to aid the growth. (Only teachers or other adults should handle and add the ammonia). To keep your formation growing, just add more bluing, salt, and water from time to time.
6. Explain to the students that just as the water, bluing, and dissolved salt combined to form crystals, coral polyps use dissolved calcium carbonate to create the stony cup that protects their soft bodies and creates reefs.

Extension 2 – Lustrous Limestone (ART)

Materials

- Vinegar
- Gloves
- Limestone rocks
- Plastic bin to hold the vinegar
- Plastic bin of water

Instructions:

1. Give each student gloves and a piece of limestone.
2. With the knowledge that vinegar breaks down limestone, students can use vinegar to carve and shape the piece of limestone. You can challenge them to make a sphere, a cube, or many other things. For the more advanced students, they can attempt to carve out words and faces in the limestone using only vinegar.
3. Put the bin of vinegar and water with each student in a group or each having their own individual bins. If you have access to a sink in the room, rather then using bins of water, just tell the students to wash off their limestone. Remember, as long as vinegar is still present on the limestone, it will continue to break down. If you are using individual bins, they will need to be changed out periodically.
4. Warning! Because of the strong smell of vinegar, this experiment might be better to be done outside, so that the smell does not get overwhelming.

Extension 3 – Acidification Algebra (MATH)

The time it takes a piece of chalk and/or limestone in vinegar can be calculated and students can create a formula based on it. Allow students to experiment with this, and try to discover how to create a formula for this.

Possible things they may need to know about the object, and can be encouraged by the teacher include mass, volume, and surface area.

	Mass (g)	Volume (ml)	Surface Area (cm^3)	…	Time to dissolve (s)
Object 1					
Object 2					
…					

Extension 4 – Sizzling Senses (LANGUAGE ARTS)

Materials

- Paper
- Pencil
- Salt and Vinegar Chips

Instructions:

1. This extension can be done within the Sibilating Scleractina lab, or shortly after it's completion.
2. Have students write about what happened to the calcium carbonate in terms of their five senses.
3. For sight, write about what they observed.
4. For sound, write about what they heard.
5. For smell, warn the students not to stick their noses into any chemicals, and instead waft the smell. Teacher should demonstrate proper wafting technique.
6. For taste, let the student try Salt and Vinegar Chips, or other food that is high in vinegar content. Do not let the students eat the vinegar and chalk mix.
7. For touch, let the students touch the limestone before entering the vinegar bath and after being in the bath for a few seconds and or minutes, depending on the size of the limestone piece.