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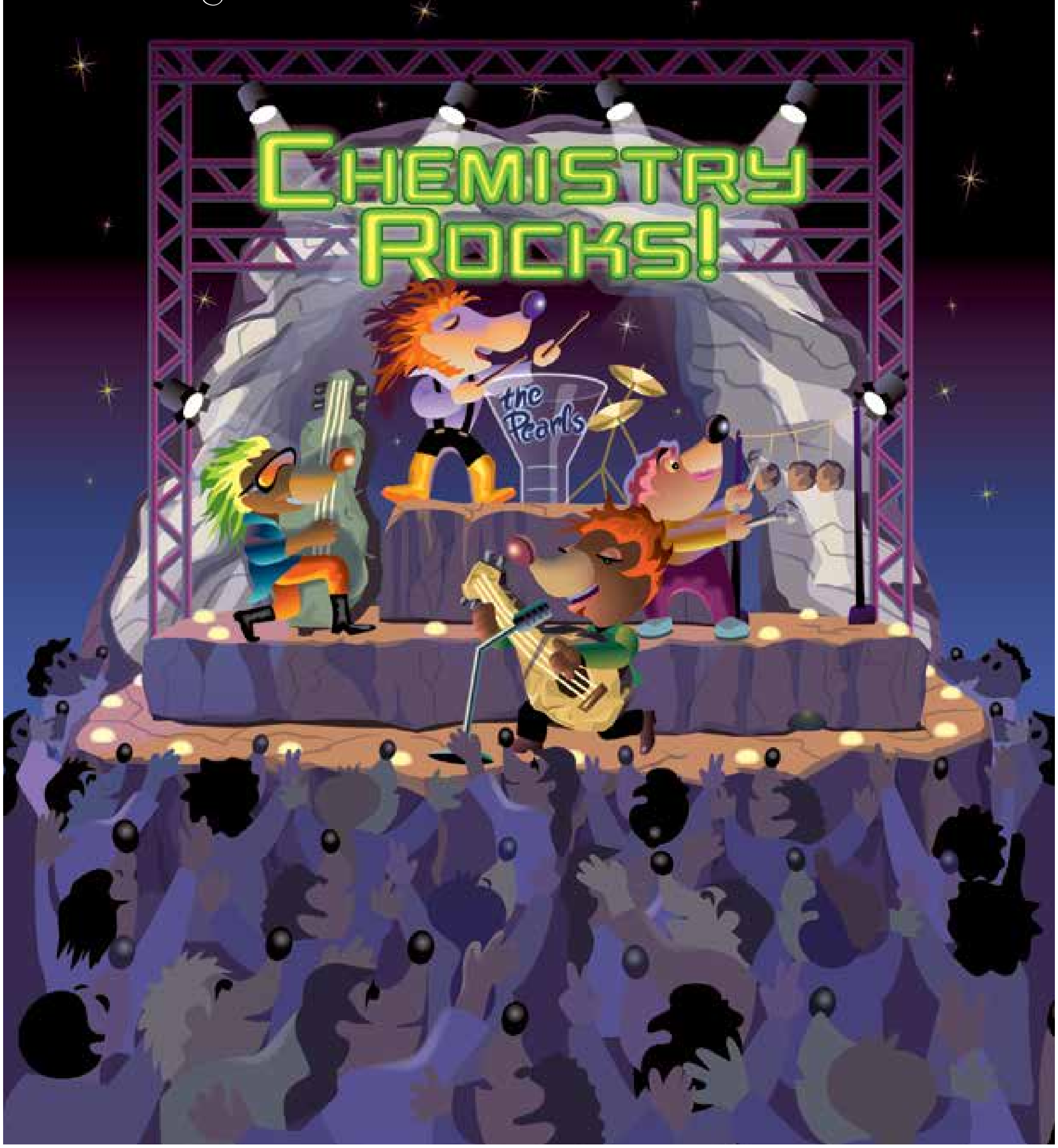
NATIONAL CHEMISTRY WEEK 30 YEARS

# Celebrating Chemistry

NATIONAL CHEMISTRY WEEK AMERICAN CHEMICAL SOCIETY

Celebrating the 30th Anniversary of National Chemistry Week



# Celebrating 30 Years of National Chemistry Week

**Verrill M. Norwood III**

This year marks the 30th anniversary (a celebration also known as the "Pearl Jubilee") of National Chemistry Week (NCW), a program of the American Chemical Society (ACS). Each year, NCW informs millions of people about the positive contributions of chemistry to everyday life. The program is designed to reach the public, particularly elementary and secondary school children, with positive messages about chemistry. Thousands of ACS volunteers, teachers, and students celebrate NCW in their communities and schools.

National Chemistry Week began as National Chemistry Day, and was a vision of then-ACS President, George C. Pimentel. His vision led the ACS Board of Directors to establish National Chemistry Day (NCD), which was first celebrated on November 6, 1987. A parade in Washington, D.C. helped kicked off the celebration, with 173 out of 182 ACS local sections participating in the festivities within their communities across the United States. NCD was so well-received by the general public that, in 1988, it received the highest honor given out for excellence in public relations, the Public Relations Society of America's Silver Anvil.

The original idea was to celebrate NCD every two years. Because of how popular it was in its debut year, NCD was expanded to a week-long celebration and renamed, "National Chemistry Week" (NCW) in 1989. In 1993, NCW officially became an annual event, although many ACS local sections had already been celebrating it each year.

During the fourth week of October every year, outreach coordinators designated by your ACS local section and other NCW enthusiasts can be found organizing hands-on activities and demonstrations at malls, museums, schools, stores, and neighborhoods, to name only a few! Their passion for celebrating chemistry each year has captured the attention of hundreds of thousands of children, who anxiously wait for the exciting and fun hands-on activities relating to NCW's theme. This year's theme is "Chemistry Rocks!" — and it focuses on geochemistry.

The traditional gemstone for any 30th anniversary is the pearl. Pearls are one of the oldest known gemstones. They are made from layers of the mineral calcium carbonate (aragonite). Amazingly, the oldest-known gem that was worn as jewelry is a piece of pearl that dates back to around 520 B.C!

You will learn more about gemstones and the interesting world of rocks and minerals in this issue of *Celebrating Chemistry*. We hope that you'll enjoy reading the articles, doing some hands-on chemistry activities, and learning more about how "Chemistry Rocks!" Additional articles and activities are available online on the Educational Resources page at www.acs.org/ncw.

***Verrill M. Norwood III, Ph.D.,*** *is an Associate Professor of Chemistry at Cleveland State Community College in Cleveland, Tennessee.*

# The SALT of the Earth

## The Story of Sodium Chloride!

**By Lori Stepan Van Der Sluys**

Have you ever eaten French fries without salt? They just don't taste the same. In fact, some people think that a pretzel without salt is boring, and that popcorn without salt or butter is only fit to use as duck food!

**Salt** is a seasoning that makes food taste better. Have you ever heard someone say that another person is the "salt of the earth"? The expression means a person who is precious and who makes the earth a better place. In fact, salt was once so precious that ancient Roman soldiers were sometimes paid in salt. That's why we have the word "salary" (it comes from "sal," the Latin word for salt).

Have you ever wondered what really makes up those tiny and delicious white **crystals** in your saltshaker? It is a mineral called sodium chloride.

**Figure 1: A photo of some evaporation ponds of salt water near San Francisco.**

Minerals are naturally-occurring substances that are essential for good health. Salt can be found in salt mines deep underground, but also in seawater. In fact, many salt mines harvest underground mineral deposits that are really ancient sea beds. These ancient seas dried up and became buried over thousands of years. Many years later, we are able to dig up the salt, and use it for everything from melting the ice on roads to making hot dogs and sauerkraut.

Salt can also be directly extracted from seawater or salt lakes such as Great Salt Lake in Utah. This process is often done by solar evaporation, as the saltwater is dried in the sun. As the water evaporates, the pond turns white — and the salt that remains is called "sea salt." Have you ever had to take a shower after spending a day at the beach near an ocean? You were really washing off sea salt!

Salt is called sodium chloride because it is made of a combination of two chemical elements: sodium (symbol Na), and chlorine (symbol Cl). That's why its chemical formula is NaCl.

We know that all matter is made up of tiny particles called atoms, and if the atoms are positively or negatively charged, they are called **ions**. Salt contains two different ions in equal amounts: positively-charged sodium ions and negatively-charged chloride ions.

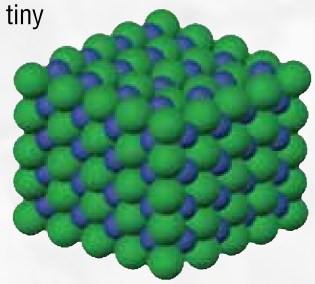


**Figure 2: Microscopic view of a salt crystal.**

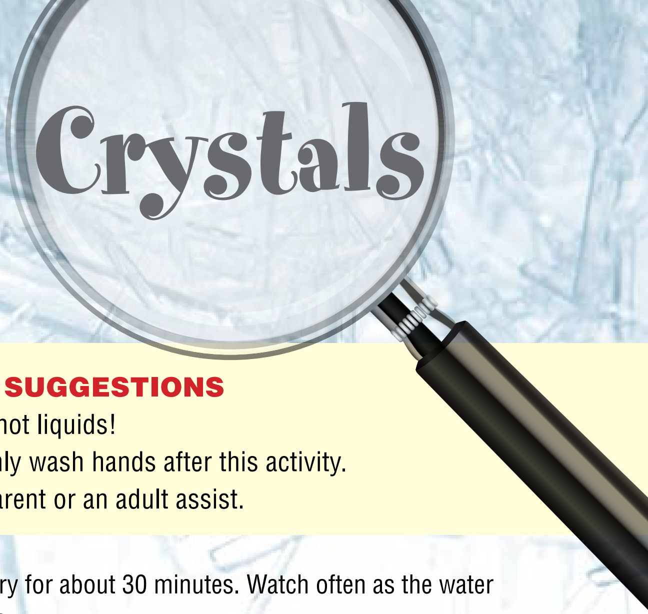
If we were able to look very closely at a microscopic view of a salt crystal we would see an alternating pattern of sodium and chloride ions called a **lattice**. The lattice is held together by the attraction of the oppositely-charged ions for each other, similar to the way magnets are drawn together. The sodium ions are colored blue in this picture, and the chloride ions are colored green. Real atoms are not blue, green, or any color. They are only colored here so that we can tell them apart in the model.

Salt is added to many foods to improve the taste, including butter, cheese, crackers, and potato chips. Saltiness is important because it is one of the four basic taste sensations. These include sweet, sour, bitter, and salty. Many chefs believe that a recipe is not complete without a dash of salt. Many restaurants and homes always keep a saltshaker on the table for people to season their food. Salt is also used to preserve food so that it lasts longer — that's why foods like ham, bacon, beef jerky, smoked fish, pickles, and canned vegetables all taste salty.

A dash of salt makes many foods taste better, but you should be careful not to add too much! Using too much salt can ruin the taste of foods, and it can also be bad for your health. Salt contains sodium, and high levels of sodium are known to affect your body's blood pressure and to increase the risk of heart attack and stroke. So the next time you eat potato chips or French fries, think of the salt that you are eating … and imagine the tiny sodium and chloride ions. Salt can be a wonderful thing!

***Lori Stepan Van Der Sluys, Ph.D.,*** *is a Chemistry Lecturer at Penn State University in State College, PA.*

# Epsom Salt Needle Crystals



**By Marilyn D. Duerst**

## Introduction

Most mineral crystals take thousands of years to "grow"… but some can form so quickly that you can watch them grow at home. Let's grow crystals from Epsom salt (magnesium sulfate, or $MgSO_4$), a material that some people use to make a soothing solution for sore feet and muscles. Some people even use it to help heal wounds.

## Materials

- **1/4 cup (59 mL) Epsom salt (magnesium sulfate), obtained from the pharmacy section of a grocery store**
- **5" x 7" (13 cm x 18 cm) picture frame with the glass left in the frame, but with the picture and cardboard backing removed, or a piece of plexiglass about the same size**
- **measuring spoons**
- **3 or 4 cotton balls**
- **2 small bowls, such as soup bowls**
- **a few drops of liquid dish soap**
- **1/3 cup (79 mL) of very warm water (the hottest you can get from your kitchen faucet)**
- **Tablecloth or paper to cover your work surface**
- **Optional: 1 small magnifying glass**

## Procedure

1. Cover your work surface with newspaper or a plastic tablecloth.
2. Mix a few drops of dish soap in about 1 tbsp. water in a small bowl.
3. Dip one cotton ball into the soap mixture and spread the liquid over the entire piece of glass in the picture frame (or the piece of plexiglass). Repeat dipping if needed. Throw away the cotton ball.
4. Allow the soap mixture to dry on the glass surface.
5. In a small bowl, mix the Epsom salt crystals in about 1/3 cup of the warm water. Mix in a little at a time and stir until no more will dissolve.
6. Dip a new cotton ball into the Epsom salt solution and carefully spread it over the glass in the picture frame. Repeat dipping if needed. Throw away the cotton ball.
7. Wash your hands.

**SAFETY SUGGESTIONS**

- Caution: hot liquids!
- Thoroughly wash hands after this activity.
- Have a parent or an adult assist.

8. Allow to dry for about 30 minutes. Watch often as the water evaporates.
9. Look carefully at the designs formed and the shape of the crystals. Use a small magnifying glass, if you have one, to see the details. Draw a picture of what you see.
10. Ask an adult to help rinse off the glass in the sink, dry it and put back in the picture frame. The leftover soap solution and Epsom salt solution can be poured down the sink, or used again for a second trial, to see if other crystals shapes will form.

### How does it work? Where's the chemistry?

"Saturated" means that the water cannot dissolve any more of the solid. As the water evaporates, the solid reforms. Often you can see interesting patterns, like long needle-like crystals in a starburst, or what looks like ferns or even fireworks. On a two-dimensional (flat) surface, the crystals build outward from tiny, individual specks of the Epsom salt as the water evaporates.

## What did you see?

In this box, draw what you observed.

## Milli's Safety Tips Safety First!

**ALWAYS:**

- Work with an adult.
- Read and follow all directions for the activity.
- Read all warning labels on all materials being used.
- Use all materials carefully, following the directions given.
- Follow safety warnings or precautions, such as wearing gloves or tying back long hair.
- Be sure to clean up and dispose of materials properly when you are finished with an activity.
- Wash your hands well after every activity.

**NEVER** eat or drink while conducting an experiment, and be careful to keep all of the materials away from your mouth, nose, and eyes!

**NEVER** experiment on your own!

# Borax Crystal Snowflakes

By Marilyn D. Duerst

## Introduction

Borax is a mineral that has been extracted from deserts in California and Nevada since the late 1800s and used in laundry detergent to make water "soft" and to kill fungus. Let's use borax to make crystals, and compare the size of crystals formed when the solution is cooled either slowly or quickly

## Materials

- **6 heaping tbsp. (about 90 mL) borax powder (you can find it in the laundry aisle of grocery stores, sold as "20 Mule Team Borax")**
- **2 cups (500 mL) water**
- **2 large glass jars or tall glasses**
- **1 cooking pot or large ceramic bowl**
- **1 large bowl with ice and water**
- **1 12-inch ruler**
- **pipe cleaners**
- **food coloring (any color)**

## Procedure

1. Bend pipe cleaners into two interesting shapes, such as a snowflake, star, butterfly, or spiral, and then twist the ends together. The shapes should be small enough to fit inside the tall glasses or jars.
2. With an adult's help, heat two cups of water to a boil in a cooking pot on the stove or in a large ceramic bowl in the microwave. If using the microwave, be sure to stop and stir the water every 30 seconds.
3. Add 6 heaping tbsp.. of borax powder and 2 to 4 drops of food coloring to the hot water. Use a spoon to stir until all the powder is dissolved.
4. Carefully pour half the borax solution into one jar or tall glass and the other half into another one. Both jars should be about 3/4 full.
5. Insert one pipe cleaner shape into each jar or glass.
6. Set one jar on a countertop and place the second one in a large bowl nearly filled with ice and a little water.
7. Look at crystals forming in each jar after about 4-6 hours. Look at them the next day, and continue observing the crystals forming for several days.
8. Remove the pipe cleaner shapes and place them on a paper towel. Dump the colored borax solution down the sink. Compare the sizes and shapes of the crystals that grew in the solution that was quickly cooled with the ones that were in the slowly-cooled solution. Measure the size of the crystals with a ruler. Did the crystals change color? You can save the pipe cleaner shapes with the borax crystals for a long time.

**SAFETY SUGGESTIONS**

- Safety goggles required.
- Caution: hot liquids.
- Caution: Borax can be irritating to the skin. Have an adult handle the borax powder before the experiment, and thoroughly wash your hands after working with your crystal snowflakes.
- Do not eat or drink any of the materials used in this activity.
- Thoroughly wash hands after this activity.
- Have a parent or an adult assist.

### How does it work? Where's the chemistry?

The solution you created was "saturated" with borax, which means it could not dissolve any more borax. As the water evaporated, the borax formed a solid again. If the solution is quickly cooled, impurities form in the crystals and they do not grow very large. If cooled slowly, the borax crystals can become large, possibly even 1 cm across.

## What did you see?

| Cooling Speed | Average Size of Crystals (cm) | Shape of Crystals |
|---|---|---|
| At room temperature | | |
| In ice water | | |

Once you do the Epsom Salt "Needle Crystals" activity in this issue of *Celebrating Chemistry*, compare the shape of the Epsom salt crystals you grew with the borax crystals. How are they the same? How are they different?

***Marilyn Duerst** is a retired Distinguished Lecturer in Chemistry at the University of Wisconsin-River Falls.*

# The Three Basic Types

# of Rock

The very top layer of the Earth, where we live, is called the Earth's crust – just like the outside of sandwich bread! The Earth's crust is not perfectly smooth, and the different pieces that fit together are called **tectonic plates**. Tectonic plates are always moving very slowly.

Why do tectonic plates move? The Earth gets hotter and hotter the closer you get to the center. The layer right underneath the Earth's crust is called the **mantle**. The mantle is so hot, the rocks in this layer have all melted! We call these melted, molten, rocks **magma.**

The tectonic plates we live on are floating on this magma all the time. When two tectonic plates smash together, they can form mountains. Sometimes some magma slips through the smashed tectonic plates and it comes to the surface. This is how volcanoes form. When magma reaches the Earth's surface, it is called lava.

When lava is on the Earth's surface, it cools down and becomes solid again. It freezes, just like how water freezes into ice cubes! When the lava cools down, this forms **igneous** rocks. This word comes from the Latin word *ignis*, meaning "of fire."

Igneous rocks can be broken down by the weather and by erosion. When pieces of rocks settle to the bottom of rivers and streams, we call this **sediment**. Sediment can build up in layers over time, and when this happens over a long time this can form **sedimentary** rocks.

When the pieces of sediment that form sedimentary rocks stick together because of high pressure, we call these clastic sedimentary rocks. When the minerals in sediment are dissolved in water, sometimes they form layers by **precipitation**. These sedimentary rocks are called chemical sedimentary rocks.

Precipitation is a process where a chemical moves from being dissolved in a liquid to being a solid. Precipitation of minerals from water dripping in caves form **stalactites** and **stalagmites**.

If a rock gets buried very deep underground, it can get hotter – remember, the Earth gets hotter and hotter as you get to the center – and be under a lot of pressure. This pressure and heat can be so intense, it changes the rock completely. We call these rocks **metamorphic**, a word that comes from the Greek words *meta*, meaning "change", and *morph,* meaning "form".

If a metamorphic or sedimentary rock goes really deep in the Earth, it can become magma and eventually an igneous rock. If a metamorphic rock or igneous rock falls into a river and becomes sediment, it can become a sedimentary rock. The rock cycle never ends!

# Caught Between a Rock and Hard Place: Rocks, Minerals, and Gemstones

**By Ronald P. D'Amelia**

Do you know the differences between a mineral, a rock, and a gemstone? Can a mineral be a gemstone? Can a rock be a mineral? These are hard questions to answer, but let's try to answer them simply.

A **mineral** is a solid found in nature that has a unique chemical composition. Minerals have a special atomic structure that is normally crystalline, so light reflects from its surfaces and the mineral sample may appear shiny or sparkly. Minerals range in composition from pure elements like gold (symbol Au) and silver (symbol Ag) to chemical compounds such as calcite (calcium carbonate, or $CaCO_3$), quartz (silicon dioxide, or $SiO_2$), feldspar (aluminum silicate, or $Al_2SiO_5$) and halite (sodium chloride, or NaCl). The science of minerals is called mineralogy.

A rock, by comparison, is a combination of minerals and does not have a specific chemical composition. The science of rocks is called petrology. In general, there are three types of rocks:

- **Igneous rocks** are the oldest rocks, and form after magma or lava produced by volcanic activity cools and hardens. Some examples of igneous rocks are basalt, granite, obsidian, and pumice — which is the only rock that floats in water! Most granite is made up of the minerals of quartz, feldspar, and mica.
- **Sedimentary rocks** were formed millions of years ago, and are made mostly from deposited minerals and the shells and bones of sea creatures that settled as sediment on the ocean floor. One example is limestone, which is composed of the minerals calcite and aragonite — both are forms of calcium carbonate.
- **Metamorphic rocks** make up at least twelve percent of the Earth's crust. The word "metamorphic" means to change form. When rocks are buried deep under the earth's surface, extreme heat and pressure can change them into new minerals or rocks with different textures. Examples of metamorphic rocks are marble and slate.

**Gemstones** are very attractive and valuable pieces of cut and polished minerals or rocks that are very hard, and used in jewelry or other decorations. Some examples of gemstones are diamond (pure carbon), emerald, ruby, and sapphire. The ruby is the most popular gemstone because of its fiery red color, but diamonds are usually the most expensive. The value of gemstones depends on their cut, color, clarity, size, and rarity.

***Ronald P. D'Amelia, Ph.D.,*** *retired from Kraft/Nabisco as a senior Principal Scientist after 32 years of service. He is currently an Adjunct Professor of Chemistry at Hofstra University, the Faculty Advisor to the Hofstra chapter of student members of ACS, and a Fellow of the ACS.*

# Mole Libs: Rock Hunt!

**By Lori Stepan Van Der Sluys**

## Instructions

Create your own story about rock hunting! Fill in the following numbered blanks with minerals or rocks that you find in any of the articles of this issue of *Celebrating Chemistry.* Then go to the story below, and fill in the numbered blanks with the phrases from your numbered list. Then read your brand-new story! (For example, you might write, "salt" in blank number 1, and then also write, "pieces of salt" in blank number 1 of the story.) Fill in the blanks with minerals or rocks that you have read about in this booklet:

Write the plural forms of minerals or rocks:

1. Pieces of ______________________________
2. Chunks of ______________________________
3. Crystals of ______________________________
4. Pieces of ______________________________
5. Chunks of ______________________________
6. Crystals of ______________________________

## The Moles Go Rock Hunting

Meg, Nano, and Milli Mole were bored one day. It was a fall weekend and they had done everything they were supposed to do at home.

"Let's go hunting for (4) ____________________", said Meg.

"OK," Nano said, "That's a great idea! Where do we find them?"

"Well, they are either rocks or minerals. I say we look down by the quarry," said Milli. "I found (6) ____________________ there the other day!" They gathered up a shovel, a pick, some water, and some snacks, and off they went.

"Look at me, I'm a Rock Hound!" cried Nano, holding up some chunks of wood.

"Those aren't (1) ____________________, Nano!" said Milli. "Remember, anything that came from a plant is not a rock."

"That's not true, Milli" said Meg. "If a piece of wood stays under the right conditions over millions of years, it can become **petrified**! That means minerals have crystallized within the wood and turned it into a rock."

"Well, I think I've hit the jackpot, then," said Milli.

"What did you find?" she asked. "They're (5) ____________________!" Milli cried happily.

"Really? Let me see!" Everyone crowded around her. She was holding (2) ____________________ in her hands.

"Those are super cool, but I think they are (3) ____________________," said Meg doubtfully. "We're going to have to bring them back and ask Avi. He knows a lot about geochemistry."

"This is great!" said Nano. "Maybe they came from deep within the Earth. I want to figure out more about these cool rocks. Let's go ask!"

The three friends grabbed their equipment and practically bounced all the way home with their treasure. Hunting rocks is a great way to spend a beautiful afternoon!

**Lori Stepan Van Der Sluys, Ph.D.,** *is a Chemistry Lecturer at Penn State University in State College, PA.*

### Word Search

Try to find the words listed below — they can be horizontal, vertical or diagonal, and read forward or backward!

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

| | | | |
|---|---|---|---|
| CRYSTAL | MAGMA | PETRIFICATION | SEDIMENT |
| IGNEOUS | MANTLE | PRECIPITATION | STALACTITE |
| ION | METAMORPHIC | SALT | STALAGMITE |
| LATTICE | ORGANIC | SATURATION | TECTONIC |

For answers to the word search, please visit the Educational Resources page at **www.acs.org/ncw**.

# How Much Mud (or Clay) is in Your Mud Pie?

By Bob Goss and Avrom Litin

**SAFETY SUGGESTIONS**

- Safety goggles required.
- Protective clothing suggested.
- Do not eat or drink any of the materials used in this activity.
- Thoroughly wash hands after this activity.

## Introduction

Did you ever notice that when you jump in a mud puddle, the puddle gets cloudy? Some mud puddles get clear again quickly if you leave them alone for a little while, while other mud puddles remain quite cloudy for a longer time. Why is that?

Soil is made up of a mixture of mineral particles including sand, silt, and clay. Different soil types have differing percentages of each. The size and form of those particles make up basic soil structure.

Clay is the smallest mineral component. The tiny flat particles of clay fit closely together to create the greatest surface area of all soil types. Sand makes up the largest particles in soil structure. Silt represents the middle-sized pieces. It is made up of rock and mineral particles that are larger than clay but smaller than sand. Individual silt particles are so small that they are difficult to see.

Knowing the sand, silt, and clay content of a soil helps people know how they can use the soil. A farmer, for example, wants soil that will be easy to grow plants in. But soil that has too little clay in it (or too much sand) can dry up too quickly. And soil that has too much clay in it can be hard to dig and won't dry well to leave air spaces for oxygen, which could kill a plant.

So, how long a mud puddle stays muddy depends on the size of the soil particles in the water. If the surrounding soil has a lot of sand and not much clay, the mud puddle will get clear quickly. If the soil has a lot of clay in it, the puddle will stay cloudy for a long time. Have you heard of "the Muddy Mississippi"? It earned that name because the river contains a lot of clay, which makes the water appear cloudy or muddy.

Here is an experiment to compare the clay content of soil and a mud pie. The idea is that if one disperses soil (a mud pie) in water and lets it sit, the water that remains the cloudiest the longest has the most clay.

## Materials

- **A mud pie 5" wide x 1 ½" thick (12 cm x 4 cm)**
- **1 ¾ cups of garden soil (about 415 mL)**
- **2 1-quart (about 1 liter) wide-mouth Mason jars with lids**
- **3 quarts tap water**
- **A timer**
- **Brown paper or old newspaper to cover your workspace**

## Procedure

1. Go out to your favorite mud puddle and collect some mud. Or make a mud pie by collecting soil and adding water to make a paste about 5" wide x 1 ½" thick.
2. Gather about 415 mL of a soil sample. This sample can be from a garden, store, or any convenient location — as long as it is from a different place than the soil in your mud pie.
3. Cover your work area with paper, such as old newspaper.
4. Put one of your samples (the mud pie or soil) into one jar until it is about 1/3 full. Fill the other jar up to the same height with the other sample.
5. Fill the jars with tap water to about 1 inch (2.5 cm) from the top. Screw on the lids and shake both well.
6. Allow the jars to stand. Write down your observations after 10 minutes and 24 hours.
7. Dispose of materials either in the soil or in a waste container.

### How does it work? Where's the chemistry?

Once the solids start to settle out, you should be able to see different layers appearing. Sand particles are the biggest and weigh more than silt — so the bottom layer will be the sand part of the soil. Any pebbles will also be at the bottom.

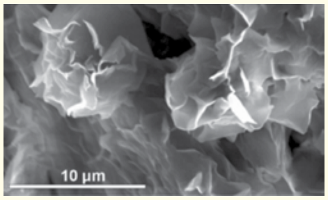
The next layer up from the sand is silt. Silt particles are smaller than sand and weigh less, so they will end up above the sand.

Clay particles are the smallest particles in soil, and they will end up on top of the sand and silt. Clay is the mud you see a little while after you've disturbed a mud puddle. Some soils contain more clay than others, which is why some mud puddles clear up quickly while others stay cloudy.

The next layer is water. It probably will have a different color, because of rotted plant (**organic**) material from outside that is soluble in water. Finally, at the top will be any floating organic material that hasn't fully rotted.

There are many different kinds of clay minerals, but they all have crystals that are small and flat.

Below is a picture of crystals of a clay called montmorillonite, the clay that is most common in the Mississippi River.



# The Adventures of Meg A. Mole, Future Chemist

## Dr. Elizabeth Herndon

### Educator and Soil Scientist

In honor of this year's NCW theme, "Chemistry Rocks!," I traveled to Kent State University in Ohio, where I met Dr. Elizabeth Herndon. Dr. Herndon is an Assistant Professor in the Department of Geology. Dr. Herndon explained that as an environmental geochemist, she studies soil, rocks, and water to learn how people change the chemistry of their environment.

So where does Dr. Herndon do most of her work? "I spend a lot of time writing in my office," she said, "but I also teach in my classroom, run experiments in the lab, and collect more samples to analyze out in the field."

I could not wait to go outdoors with her to learn more about field sampling! When we arrived at the collection site, Dr. Herndon pulled out her auger — a metal pole with a tube on the end that she uses to collect soil samples. I told her that moles (like me) love to dig into the dirt, too!

I asked Dr. Herndon what she liked the most about her job. "Scientists never stop exploring," she said. "I get to ask questions about the world around me that no one knows the answers to, and then try to find answers to those questions." The work she does impacts a lot of people. She explained, "My work can help kids have beautiful and fun places where they can go to explore nature."

Growing up, Dr. Herndon did not have to go far to learn about science. "My dad is a high school science teacher, so I grew up around science," she said. "When I was in kindergarten, he had me help his science club build a model rocket ship out of balloons and cardboard. Our rocket flew farther than any of the others." How exciting!

I also asked Dr. Herndon why she decided to pursue a career in science. "I enjoyed learning about the mysteries of the Earth and other planets. I always wanted to find out more." She did not decide to be a soil scientist as a child, but was always interested in our planet itself. "I wanted to be an astronomer when I was growing up," she recalled. "I read books about astronomy and memorized the names of galaxies and stars in different constellations."

She also shared another memory from high school, saying, "I participated in the science fair in high school, and my experiments tested how different pollutants impacted the health of plants and creatures such as sea urchins. I had a wonderful teacher who made it possible to do these projects as part of a science class."

So, as many of you know, moles like me love dirt! I am very thankful that there are scientists like Dr. Herndon who continually study the soil, rocks, and water around us to ensure it is safe for all of us!

## Personal Profile


**Favorite color?**
Green

**Favorite food?**
Chocolate ice cream

**Birthdate?**
August 24

**Favorite hobby/pastime?**
Running

**Very interesting project you were a part of?**
I went to Alaska to study how warming climate is changing the geochemistry of boreal forests and tundra ecosystems.

## Mud Pie *continued*

### What did you see?

| Sample | Time | Observations |
|---|---|---|
| Mud Pie | 10 minutes | |
| Mud Pie | 24 hours | |
| Soil Sample #1 | 10 minutes | |
| Soil Sample #1 | 24 hours | |

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## Words to Know

**Crystal** – a solid that is made up of one type of molecule arranged in a specific, repeating pattern. Examples are salt crystals, quartz, and various minerals.

**Lattice** – the repeating pattern of molecules that make up a crystal. Lattices are often held together by the attraction between positive and negative ions.

**Igneous** – describes a rock formed by the cooling of lava. Comes from the Latin word *ignis*, meaning "of fire."

**Ion** – an atom or molecule with either a positive or negative charge. Examples include the positively charged sodium and negatively charged chloride atoms that make up table salt.

**Magma** – the melted rocks within the Earth's mantle, on top of which all the tectonic plates float. When magma reaches the Earth's surface, it is called lava.

**Mantle** – the layer of the Earth below the crust that is so hot, all rocks in that layer are melted.

**Metamorphic** – describes a rock that is neither igneous nor sedimentary. Metamorphic rocks, when buried deep underground, are changed by the high heat and high pressure. Comes from the Greek words *meta*, meaning "change", and *morph*, meaning "form".

**Organic** – from an organism, or something that is alive. This includes plants and animals. Organic material always contains the element carbon.

**Petrification** – the process through which organic material becomes a stony fossil, such as when petrified wood is formed. Comes from the Greek words *petros* meaning "stone or rock."

**Precipitation** – when a solid that was dissolved in a liquid becomes a solid again.

**Salt** – a compound with any two oppositely charged ions that join together. The most common example is the table salt we eat (sodium chloride). Other salts include magnesium sulfate and calcium carbonate, which are very important in forming many rocks and minerals.

**Saturation** – when the maximum amount of a solid is dissolved within a liquid.

**Sediment** – the layers of rocks and minerals that settle at the bottom of bodies of water, such as rivers and streams. Over long periods of time, sediment can form sedimentary rocks.

**Stalactite** – a rock that forms when water that is saturated with calcium and/or magnesium salts drips from the top of a cave. The calcium and magnesium salts precipitate and form an icicle like structure that hangs down.

**Stalagmite** – a rock that forms on the bottom of a cave when water that is saturated with calcium and/or magnesium salts drips and forms a puddle. The calcium and magnesium salts precipitate and form a rock that looks like it is growing upward.

**Tectonic Plates** – the pieces of the Earth's crust that are always moving very slowly. When they collide, they can form mountains or volcanoes.

## What is the American Chemical Society?

The American Chemical Society (ACS) is the largest scientific organization in the world. ACS members are mostly chemists, chemical engineers, and other professionals who work in chemistry or chemistry-related jobs. The ACS has more than 157,000 members. ACS members live in the United States and different countries around the world. Members of the ACS share ideas with each other and learn about important discoveries in chemistry during scientific meetings held around the United States several times a year, through the use of the ACS website, and through the many peer-reviewed scientific journals the ACS publishes. The members of the ACS carry out many programs that help the public learn about chemistry. One of these programs is National Chemistry Week, held annually the fourth week of October. ACS members celebrate by holding events in schools, shopping malls, science museums, libraries, and even train stations! Activities at these events include carrying out chemistry investigations and participating in contests and games. If you'd like more information about these programs, please contact us at **outreach@acs.org**.


## Celebrating Chemistry

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