FOSS ® EARTH MATERIALS
TEACHER PREPARATION VIDEO TRANSCRIPT

<Larry Lowery Introduction to FOSS Program>
Lowery: Hello. Welcome to the Full Option Science System. This program was funded by the National Science Foundation. Its goal was to develop materials that would involve youngsters with both the processes and the content of science.

The program is developed with the Lawrence Hall of Science, with scientists, science educators and teachers working together as a team to develop the materials. The materials are tested in the hands of teachers and children in classrooms. It takes about two years to turn out a module.

Each module begins with firsthand experiences. This is done because it has been found that firsthand experiences are the best way for youngsters to learn about the concepts of science. As the module progresses, children are introduced to abstractions and reading materials. The sequence from firsthand experiences through reading materials is deliberate because it has been found that youngsters, when they have some experience before they read, learn and understand more from the reading. Authors of reading materials can then take youngsters to greater abstractions.

Trust the materials that you are getting acquainted with. They have been well tested. We found that they work extremely well in the hands of all teachers and are effective for youngsters in learning about science.
<Larry Lowery Introduction to Earth Materials>
Geology is the study of earth materials. Two important earth materials that geologists study are rocks and minerals. Minerals are pure materials. When they are combined, they form rocks. This module begins by introducing students to some of the tools and techniques used by geologists when they investigate rocks and minerals. Through their investigations, students develop the concept that minerals are the basic ingredients of rocks.

Student: It's mica.

<Laura Louttit Introduction to Module>
Narrator/Laura Louttit: Hi, I'm Laura Louttit and I'm a Foss teacher. And I'm here to help you get started using the Earth Materials module. The Earth Materials module consists of four investigations. Each investigation is designed to introduce students to rocks and minerals and to help them learn about what geologists do to study them.

Most of the equipment you'll need to teach the module comes in the kit. Everything you see here comes in two boxes. There is enough equipment for a class of 32 students. You'll need to check the inventory list to know which items are considered consumable and which are permanent.

If you have a measurement kit, you will also need the balances, the cups and mass pieces and the syringes. Here is what you'll need to supply: Paper towels, food coloring, 16 pennies and scratch paper, kosher salt, transparent tape, flour, 16 pieces of chalk, a large magnifying lens, if

you have one, and three quarts of vinegar.

Before you begin teaching the module, it's important that you look through the entire Teacher's Guide. First you'll find the Overview folio which points out the national standards addressed in the module as well as information about how to make the best use of the Teacher Guide. It also includes valuable background information specially written for teachers who have not had extensive science training.

Next you'll find the Materials folio. If you are the first teacher using a new kit, you'll want to turn to the section that describes first time prep. If the kit has been used before, check the section with directions for each classroom use. Both of these sections will give you helpful hints that will save you lots of prep time later.

The next four folios are the Investigation folios. Each takes one or two weeks to complete. In these folios, you'll find overview information, a matrix which summarizes the investigation and helps you plan for assessment and extension activities, background information specific to this investigation, a Teaching Children About section, which gives you some insight into research about how children think and learn.

Then for each part of the investigation, you'll find a materials list, Getting Ready section, and step-by-step instructions for how to proceed through the investigation. At the end of the folio, you'll find Interdisciplinary Extensions. You can do some of these extensions with the class or students may choose to do some of them as projects at the end of the module.

Next are the investigation duplication masters. Each master is labeled with a number so it will be easy to find when you need it. Shortly before beginning this module, duplicate the Letter To Parents and send it home with the students. This letter tells parents about the module and suggests some activities that they can do at home with their children.

It's important to read the Assessment folio before you begin teaching. It describes a system for assessing students throughout the investigations and also gives you ideas for end-of-the-module testing or portfolio assembly. The folio contains scoring guides for each of the assessments suggested.

Next are the assessment duplication masters. Here you'll find all the masters for the assessment charts and end-of-the-module assessments. As part of the kit, there are Science Stories for the students to read. The Science Stories folio gives you background information, recommends when to read the stories and suggests follow-up activities. You may want to read the Science Stories during a reading period rather than science time, especially if you only teach science a couple of times a week.

In the resource folio, you will find lists of trade books, videos, computer software and other resources that you can use to enrich the program. The final tab is the FOSS web site folio. At www.fossweb.com, you'll find activities and resources for both students and educators. Each module for Grades 3 through 6 has interactive simulations, movies, Internet links, career information and opportunities to find out what other classes are doing with FOSS.
In addition, teachers will find sections on tips and tricks, standards correlations, teacher exchange and implementation information.

If you're the first teacher to use this kit, there are a few things you'll need to do to get the kit ready. First you'll need to make a permanent reference set of rocks and minerals. Find the bag labeled numbered rocks and minerals for the teacher. Take the rocks and minerals out of the bag and match the number on the rock to the key on the lid.

You'll need to assemble a toolkit for each group of students. To assemble a toolkit, place four large paper clips and four pennies, which you provide, in a zip bag.

The most important prep of this module is making the mock rocks. You'll need to do this one week ahead of time. This is a mock rock. We use these to help students understand the difference between rocks and minerals. Now I'm going to show you how to make the mock rocks. You'll find the recipe in the Teacher's Guide.

Mix together the flour, the salt and the alum in a bowl. Then add food coloring to water and mix the water with the flour mixture. Knead the dough until it no longer sticks to the side of the bowl and is uniform in color and texture. If the dough is crumbly, you can add more water.
Add two colors of gravel and sand to the dough and knead the dough until it is well mixed and looks like this.

Next you'll divide the dough into 18 pieces to make the mock rocks. Here I'll show you how to make one. Place the dough in the palm of your hand in a ball. Smush the middle part of the ball to make a little pocket. Place about 10 to 12 oyster shells in the hole and then mold the mock rock around the shells so that the shells are not showing from the outside.

Shape each mock rock a little bit differently. Once again, check to make sure the shells are not sticking through so the students can't see them. Place it on a paper towel to dry for about a week making sure they are not touching.

It's also a good idea to make copies of all of the assessment charts at this time. There's one chart for each investigation.

Next you'll need to make copies of the Earth Material Notebook for each student. Copy the sheets back to back and then fold the sheets together and staple to make a little notebook.

The final prep for this investigation is to make the Word Bank and Content/Inquiry charts. To make these charts, you write the titles at the top of a large piece of butcher paper or a flip chart. You use the charts at the end of each investigation in the wrapping up section. Add new words to the Word Bank and concepts and questions to the Content/Inquiry Chart.

You will also want to keep a Project Folder of student ideas. The program is set up so that you model the investigations at the beginning of the module and gradually turn it over to students as they become more skilled in scientific investigation.

In the final investigation, students are challenged to design their own investigation. If you have kept a Project Folder with their ideas and questions, they will have an additional resource to draw on.

<Investigation 1, Part 1>

Narrator: For each investigation, you'll need to set up a materials station. Here is what you'll need for Part 1: From the kit you'll need paper plates, meter tapes and the hand lenses. If you have a measurement kit, you'll need the balances, cups and mass pieces.

You will need to provide the mock rocks, which you have prepared a week prior to beginning the activity, Earth Materials Notebooks and colored pencils.

Now let's join a class in session as they begin Part 1. The teacher has introduced geology as the study of the materials that make up the earth. Scientists who study the earth materials are called geologists.

The students' first job is to observe mock rocks and take careful notes just like a geologist would. Getters go to the materials station to get the equipment they will need to complete the investigation. The students examine their rocks and sketch them on a grid. Colored pencils or crayons work well if students want their drawings to be in color. Avoid markers since they bleed through to the other side of the page.

Teacher: What do you see?

Student: I see like little white things. A bunch of like bubbles.

Student: Those red things look like they are the rocks that you put in the bottom of fish tanks.

Student: I know.

Narrator: Students use a meter tape to determine their mock rocks' diameter, circumference and depth.

Student: 14 and a half centimeters.

Narrator: Notice how the teacher uses this opportunity to assess students' ability to use the meter tape.

Student: Oh, it is 7. Okay. 10, 15, 16, 17, 18, 19, 20, 21.

Narrator: As students finish recording their data, the teacher calls the class together to discuss what they've learned about mock rocks. In order to understand the importance of writing detailed observations, students put their mock rocks back on the materials station, then trade notebooks with another student to see if they can find the mock rock based on the notes. Students may have a hard time identifying the rocks described. But it is a good lesson to learn early that notes need to contain as much detail as possible.

Bringing closure to a lesson is important. You can do this routinely by adding new vocabulary to the Word Bank.

Teacher: What do we call the people who study rocks? They have a special name.
Alex?

Student: Geologists.

Teacher: Geologists.

Narrator: You'll also want to review the concepts that students learn from the investigation and record them on the Content/Inquiry Chart. Student ideas for projects can be written down and placed in the Project Folder at any time during the investigation.

<Investigation 1, Part 2>

Narrator: In Part 2 of the investigation, students use a geologist pick, actually a nail, to break apart the mock rocks into smaller and smaller pieces. The purpose of this is to find and analyze the mineral ingredients that make up the mock rock. Here is what you'll need for this part: from the kit you'll need the Foss trays, plastic cups, nails, paper plates, the 12 dram vials, the hand lenses and sticky notes. You'll need to supply water and safety goggles for when the students start taking the rocks apart.

The optional items you could have available are the syringes for the measurement kit. If you have access to the syringes, it is a good opportunity for children to practice using them to measure liquids. If you have a large magnifying lens, you may want to make it available for your students to use.

You'll also need to make copies of the response sheet for mock rocks to assess students' understanding of rocks and minerals at the end of this part. If you have not used the syringes before, you will need to demonstrate how to use them for the class. To use a syringe, depress the plunger all the way in the barrel. Submerge the tip into a cup of water. Pull the plunger up until the notch reaches the end of the barrel. Then you have measured 25 milliliters of water.

Teacher: To learn more about rocks, geologists use special tools. And one of the tools they use is a pick. Today we are going to be using a nail as our geologist pick. Now, our challenge today is to see if we can tell more about rocks, about our mock rocks, by breaking them apart and using our pick.

Now, before we do this, you're going to be wearing your safety glasses for your own protection because we don't want any pieces of the mock rock in your eyes. Then you're going to go ahead and break the rocks in half, one on each plate. Each student has a rock. You can go ahead and get to work.

Student: It looks like a tooth. It looks like wisdom teeth or something.

Student: Whoa!

Teacher: Okay. You should be separating and breaking apart the different ingredients into a pile.

You see how these are fine grains. I can see --

Student: This one?

Teacher: Yeah, these are little particles on there.

Student: When do you write down observations?

Teacher: You can write down observations right now. But I think you need to start sorting yours. Sort your ingredients into different minerals.

Student: Very little shells.

Student: There's shells in here?

Student: Yeah.

Student: What color are they?

Student: Here is one.

Student: Oh, I didn't notice those shells.

Narrator: When students have their piles sorted, you'll lead a discussion to help refine the students' understanding of the difference between rocks and minerals. If, for example, you try to break the red gravel into smaller pieces, you would just have smaller pieces of red gravel. It is made of only one ingredient. The same is true of the green gravel. When an ingredient cannot be broken down into other ingredients, it is called a mineral. A rock is made of a number of mineral ingredients.

After all observations are completed, students collect the gravel and shells to be recycled for the next class. They are left with still unidentified gray stuff. The challenge is to see if the gray stuff can be broken down into further ingredients. If students don't think of it, you suggest they add water to see if that will break it down any further.

Teacher: So Sara thinks it might dissolve. Let's see if she's right. What I'm going to do in a minute is send the getters back to get vials. You're going to take your leftover material and carefully pour it into the vial.

Narrator: Students fill the vial about one-third full with the gray stuff and add 25 milliliters of water, if you have syringes. If you don't, students can just fill up the vial leaving about one centimeter of airspace at the top. You'll want to caution students to check that the lids are on tightly before they begin shaking them up.

As soon as students stop shaking the vial, they'll notice that small particles begin to settle on the bottom right away. But the liquid will still be quite cloudy. You'll need to guide the discussion for students to think about the possibility of materials dissolving in the water. You'll need to find a safe place to store the vials so that they can settle overnight without being bumped.

Before calling the session to a close, you'll give each student a copy of the response sheet for this part. It will take about ten minutes for them to complete or you can send it home for homework.

The purpose of this sheet is to help you get a closer look at students' thinking. You'll wrap up the session as usual by making entries on the Word Bank and the Content/Inquiry Chart.

<Investigation 1, Part 3>
Narrator: The next day students observe the vials that have now settled. Their challenge for this session is to separate any dissolved ingredient from the water. For this part you'll need the settled vials and Foss trays, sticky notes, evaporation dishes and a basin of water for rinsing the vials. And you will also need a copy of the crystal identification key.

Now we'll rejoin the class observing their vials that have settled overnight.

Student: Look at that green.

Student: It's like green and purple.

Student: The gravel there.

Narrator: The students record their observations in their notebooks. Some students get very descriptive.

Teacher: Yesterday we made this list of ingredients that we thought -- that we noticed in our mock rocks, ingredients we observed. Now, Stephanie mentioned that there was dough. Now that we've poured the leftover material in the water, do we know what this dough could be made out of? It's not dough. What is it?
Jay, what's something you noticed?

Student: Flour.

Teacher: What's your evidence that there's flour?

Student: This is -- it looks like it right here.

Teacher: Okay. That one layer right there. Okay. So we know the dough part is made up of flour. Is it made up of anything else? Michelle?

Student: Sand.

Teacher: What's your evidence that there's sand?

Student: Because down here it looks all like sand and . . .

Teacher: Okay. So we have sand. Okay. Anything else?
Stephanie?

Student: I think that there's salt in it, too, because it looks like the salt that we used with our maps. And I think that salt can be in this, too.

Teacher: Okay. If there was salt in here, how do we know? How can we find out?

Silas?

Student: I think it dissolved in the water because I put salt in water once before and all of the salt like dissolved.

Teacher: If that's true, how can we get the salt out of the water? How can we find out where -- how can we see the salt?
Jay?

Student: I think if you let the water evaporate, maybe the salt would be there then.

Narrator: The getters get one FOSS tray and four evaporation dishes for each group. The students attach their names to their dishes using sticky notes and pour just enough liquid in the dish to cover the bottom. They place the dishes on the tray.

The getters take the vials and rinse them out before using them to stack the trays.

Teacher: Okay.

Narrator: While you're waiting a few days for the water to evaporate, you can work on the math problem of the week, read a science story or try one of the extensions listed at the end of the folio. When the water has completely evaporated and all that is left is a crystal residue, the getters will bring the trays to the table. The students are ready to make their observations.

Teacher: Write your observations on Page 5 of your notebook.

Student: It looks like square crystals.

Student: There's little X's on the crystals.

Student: Let me see.

Student: You can even see it better like this because you have more light.

Narrator: When students are given plenty of time for examination, their drawings become quite detailed. This investigation ends with a discussion reinforcing the idea that rocks are made of many ingredients called minerals. It's not important that the students list every ingredient. But they should have evidence to support the ones that they do list.

You'll wrap up this part by making entries to the charts. It's important that students remember that water can be used to separate some ingredients; some ingredients break into smaller pieces, some dissolve. Evaporation is a way to separate liquid and solid ingredients. Make sure that the students understand that when the salt dissolves in the water, it's still there, even though they can't see it. And that's why the salt crystals were left in the dish after the water evaporated.

<Investigation 2, Part 1>
Narrator: In the scratch test, students investigate four unknown minerals. Since three of the minerals are white, students need to use a property other than color in order to help them identify

the minerals. That property is hardness.

Students use the same procedures geologists do in order to help them determine the hardness of the minerals. Here is what you'll need to set up the materials station for this part: The FOSS trays and hand lenses, the half liter containers and sticky notes, the mineral samples in half liter containers -- No. 1, calcite. No. 2, quartz. No. 3, gypsum. And No. 4, fluorite -- the mineral identification sheet to be used by students as a reference in case they mix up their minerals and the rock and mineral sample box. You'll need copies of the mineral properties student sheets to assess how students think about mineral properties one and two at a time at the end of this session.

This investigation begins with a review of the Content/Inquiry CHART. Most important is that students are able to tell the difference between a rock and a mineral. In this part, students will be investigating four minerals.

Each person in the group takes a number between 1 and 4, writes his or her number on the sticky note and places it in a compartment on the tray.

Teacher: What we're going to do, each of you has a number. You're going to go back there and get the mineral that's your number. For example, Liam is No. 1. You'll get Mineral No. 1.

You're going to go one at a time. I'm not going to tell you when to go. We'll start with the 1s and when the 1s come back, then the next group can go.

Student: You got green. Is that the green rock?

Student: Yours is kind of pinkish.

Student: I think this is a salt rock.

Student: Can I see this one?

Student: Sure.

Student: No. Let me see; let me see; let me see.

Student: Let go.

Student: This is real. Can I see this?

Student: Yes.

Student: This looks like a crystal.

Teacher: Okay. You've had a chance to look at your minerals carefully. What you're going to do in your Earth Materials Notebook is you're going to write a detailed description of your minerals so that you'll always know what it looks like even if you don't have the mineral in front of you. Be sure to put -- list all of the properties you can think of in this notebook. Okay?

Let's get to work. Look at the mineral and describe what you notice.

Student: It's a square.

Student: Rectangle.

Student: It's square.

Teacher: You don't have to write in complete sentences. You can just use words.

Student: Striped.

Student: One side is kind of -- it's rocky. There's some rock. Like in parts on the side of the rock.

Teacher: Looking at your list, which properties or combination of properties are most helpful or most useful to you in identifying a mineral? Which ones -- looking at your list, which ones are most useful?
Andy?

Student: The colors and the shapes on the inner layers and outer layers kind of help me to recognize which one is which.

Teacher: Okay. If I were to ask the starters to hold up the white mineral, starters, would you hold up the white mineral for me? But I'm noticing that the starters, are they all holding up the same mineral?

Student: No.

Teacher: Well, we went by basis of color. It's difficult to tell minerals apart just by using property of texture or color. Tomorrow we're going to learn about a new property. So what I need is the getters to bring up the materials back to the materials stations for us. Okay, getters.

Narrator: After the students have returned all of the materials to the materials station, you should have them complete the minerals properties student sheet which gives you information about how students think about two properties at one time. You'll find a scoring guide in the Assessment folio. By the end of this part, your goal is to have students understand that they need some additional information in order to identify the minerals on the tray.

<Investigation 2, Part 2>
Narrator: In this part, students learn how to test the hardness of minerals. This test gives another piece of evidence that helps them to identify the unknown minerals. Here is what you'll need to set up the materials station for this part: The FOSS trays with the minerals from Part 1, the ceramic tiles, the mineral identification sheet with the mineral set from Part 1, half liter containers and sticky notes. You need to provide chalk and the toolkits which you prepared earlier.

For assessment, you'll need to make copies of the response sheet called Scratch Test. You may want to practice doing the scratch test first since it can be tricky to identify the scratches. The best way to do a scratch test is to find a place on the mineral that hasn't been scratched, use your tool to scratch across the surface of the mineral, dust it and use your hand lens to help identify that there is a scratch.

The scratching tool will leave a residue if the mineral is harder than the tool. So be sure there's a permanent grove in the mineral in order to count it as a scratch.

An important part of this session is to give the students plenty of time with the practice materials, a tile and a piece of chalk, in order to help develop their skills at scratching so that they will be able to make decisions about whether or not there's a scratch on the minerals. In the classroom, the teacher has just asked the students to hold up the quartz, which is the white mineral. But since three of the minerals are white, it's difficult to identify it. That's where the scratch test comes in.

Teacher: Now, geologists use special tools to test the hardness. And they test it by scratching the mineral. The three tools we're going to be using are a paper clip, a penny and our finger. And we're going to be scratching the minerals to test how hard they are. But before we do that, we're going to practice using chalk and tile.

I'm going to have the getters go up to the materials station and they are going to get two pieces of chalk and two chunks of tile, bring it back to their groups and each partnership is going to practice testing the hardness of those objects by scratching them with the tools. We'll start first with the paper clips.

Student: Weird.

Student: There's a scratch here already.

Student: Is it black? Here, let me see it.

Student: Yeah, it's black.

Student: I see a big --

Narrator: The results on the chalk are easy to see. The tile proves more of a challenge. The children need to understand that there has to be a grove left in the material to be counted as a scratch. Otherwise, it is probably material left from the scratch tool.

Student: I can't see anything.

Teacher: You had a chance to practice. Now we're going to determine which mineral is the quartz. Now, of the four that we have, quartz is the hardest mineral that we have today. Which tool should we use to test it? Which would be the most logical tool to use?
Jay?

Student: A paper clip.

Teacher: Excellent. A paper clip will test which one is the hardest. You're going to test all four minerals and figure out which one is the hardest. That will be our quartz. Go ahead and start testing them.

Student: I don't think this is quartz.

Student: The dent is pretty deep.

Student: I don't think it is, either.

Student: I don't think this is, either.

Student: Let's try this one.

Student: Whoa. I don't think that one is quartz.

Student: I don't think this is it.

Narrator: In their groups, the students debate the results. This is an important part of the process. In giving enough time to debate the evidence and test again, if necessary, students almost always come to the correct conclusion.

Student: This one is harder than that.

Student: That one is definitely not.

Student: This one has to be it.

Student: Let me see that one.

Student: That's got to be it.

Student: It's impossible to scratch it.

Teacher: Okay. We had a chance to test each mineral. I'm going to have you show me with your fingers which mineral was the quartz. Can you all show me? Hold up your fingers. Jeffrey, do you know?

Student: 2.

Teacher: Okay. Good. We are all showing 2. And that's correct. You can put your hands down. Now, what we're going to do is we are going to figure out which one is gypsum. Gypsum is the softest mineral we have. So raise your hand if you can tell me which tool should we use to test the gypsum of our three tools?
Thomas?

Student: Penny.

Teacher: Okay. Is penny the softest tool we can use?

Student: Fingernail.

Teacher: Fingernail would be a better choice. What you're going to be doing is testing the remaining minerals to find out which one is the softest. Okay. Let's get to work.

Narrator: A fingernail proves to be the best tool here because a fingernail will only scratch the gypsum. Next the students need to identify the calcite and fluorite. A penny proves to be the best tool to use here because the penny will scratch the calcite but not the fluorite.

Teacher: This was the hardest. This was not quite as hard. This was softer. And this was the softest?

Student: Yeah.

Teacher: Now, how do you know this is the correct order?

Student: You scratch this with the hardest scratcher, nothing got scratched. It didn't get the scratch.

Teacher: You didn't notice any marks?

Student: No.

Teacher: How else? Keep going. Keep explaining for me.

Student: This got some scratches from this -- the hardest scratcher. And then -- and it didn't get any scratches from the penny.

Teacher: Oh, okay.

Student: And this did get scratches from the penny. And this got scratches from everything.

Teacher: Okay. Great. Good job.

Narrator: The students need about ten minutes to complete the response sheet or they can take it home for homework. As you add words to the Word Bank and ideas to the chart, you'll want to emphasize that hardness is another property that geologists use to help them identify minerals.

<Investigation 3, Part 1>

Narrator: Now you're ready to start the calcite quest. In this investigation, students work with four rock samples testing them in vinegar to see which of them contains calcite as a mineral ingredient. Here is what you'll need from the kit for this part: The FOSS trays and hand lenses, five vials per group, plastic cups and sticky notes, rock samples in labeled half liter containers, calcite in an unlabeled container and the rock identification sheet. From the measurement kit, you'll need syringes and you will need to provide vinegar and paper towels.

Teacher: If you are No. 3, you will write marble. If you are No. 4, you will write sandstone. And you will write that on both sides of your Post-It. Not your name. Just the name of your rock.

You are going to get your earth material. You're going to bring it up, put it in the tray. And then each of you will make an observation of all four earth materials and then write your observations on this page.

Narrator: The teacher tells the students that one of the minerals they have already studied is an ingredient in one or more of their rocks. The getters go to the materials station to get the unidentified mineral and using their previous notes, they determine what it is.

Once the students have identified the mineral as calcite, the teacher brings the vinegar around to the tables. She fills each cup about three-quarters full. The starters place their calcite sample into the vial and then fill the vial with 25 milliliters of vinegar. If you don't have syringes, students can simply pour the vinegar into the vials. They should stop when the vinegar reaches about one centimeter from the top.

Student: It's sort of bubbly.

Student: The bubbles are coming up.

Student: Oh, now the bubbles are rising.

Student: Fast. Very fast.

Student: Let me see it.

Student: The bubbles are . . .

Student: Do you wonder if this stops?

Teacher: All right. Now, let's go back to the rocks that we were working with. Do we have any evidence at this moment of calcite in any one of those rocks?

>>Class: No.

Teacher: All right. So what could we do to find out whether or not there is calcite in any of the rocks?
What could we do, Amanda?

Student: We could put the rocks in vinegar.

Teacher: And then what would we learn from that?

Student: Well, if it bubbled, then maybe it would have calcite in it.

Teacher: All right. Very good.

Student: Oh, that one has calcite.

Student: Oh, my gosh. It's turning the color of that, the water.

Student: Sandstone has it.

Student: There's a lot coming out of both.

Student: I know. Air bubbles wouldn't go in a line like that.

Student: So it could have calcite in it.

Student: Marble.

Narrator: You should allow about ten minutes for observations.

Student: It's a little of both.

Narrator: The class then needs to discuss which rocks they think contain calcite and cite evidence for their conclusions.

Student: It's bubbling up.

Teacher: So it sounds like you're not real sure. So maybe that means we need to gather more evidence before we can be absolutely certain whether or not calcite is present in the sandstone. Right?

Narrator: The class decides to let the vials sit overnight and to check them the next day for additional clues. They label their trays with a sticky note and stack them in a place where they won't get bumped. Store the calcite in vials in a place near the stacked trays. At the end of the session you still want students to be arguing about which rocks contain calcite and which don't. The important point here is that sometimes you need to conduct more than one test to be sure about your conclusions.

Any unused vinegar can be poured back in the bottle for the next investigation and the syringes and cups should be rinsed out.

<Investigation 3, Part 2>

Narrator: In Part 2, students once again use evaporation to help them gather more evidence. First they set up the evaporation dishes. After two or three days when the evaporation dishes have dried, they analyze the results. Here is what you'll need for this part: The FOSS trays with the rock samples in vinegar from Part 1, the calcite in vinegar, evaporation dishes, hand lenses, plastic cups and sticky notes, the rock identification sheet. And you will need to provide vinegar.

You need to make copies of the response sheet Calcite Quest to give to students near the end of

the part. This session begins with a review of what the students have learned about calcite and the four rocks. They are reminded that today they will look for more evidence. Getters retrieve the trays and students look for changes.

Student: They are still bubbling.

Student: It has a little bit of bubbles. But the limestone doesn't have any bubbles. None.

Teacher: All right. Now that you've had your rocks back and were able to observe, can we think of more ways of gathering evidence whether or not these rocks contain calcite? Now, think back to the mock rocks. What did we do with mock rocks? How did we discover the salt? All right, Chris?

Student: We could evaporate it.

Teacher: All right. So what was left in the dish then?

Student: It was salt for the mock rock. But it could be calcite for this.

Narrator: The getters pick up six evaporation dishes and two sticky notes from the materials station. The students put the rock name labels from the previous session underneath the dishes so they will be able to identify them later.

The students pour the vinegar from the vials containing the rocks into their dishes. They pour out just enough liquid to cover the bottom of the dish. They set up a control dish by pouring out some of the vinegar from the vial that contained the calcite and set up a dish with just plain vinegar.

To clean up, getters bring the vials to the materials station and pour the rocks and any remaining vinegar into a basin. The rocks need to be rinsed thoroughly and dried before storing them in the kit.

While you're waiting for the liquid to evaporate, you can read a science story, complete a math problem of the week or try one of the extensions listed at the end of the folio. The students who are naturally curious will check their dishes daily for progress. When the liquid has evaporated, they'll let you know.

Here is what you should find in the dishes. Notice that you find deposits of white crystals in the calcite, the limestone and the marble and only a slight clear residue in the vinegar, basalt and sandstone.

Student: It looks like sandstone had very little.

Student: Marble had some.

Student: Marble.

Student: Marble had some.

Student: This has a little bit white and this has a little bit white in it.

Student: But still this has it.

Student: Limestone definitely has calcite.

Teacher: Now, if there was something in the dish that you observed, how do you know that that is evidence that there was calcite in that rock?
Amanda?

Student: You can see if it has calcite because the calcite one. It looks like the calcite kind of in the dish.

Teacher: All right. Now, how do we know that the calcite was in the rock and maybe not just in the vinegar? How could we find that out? Catherine?

Student: We could find that out by looking at the vinegar dish and comparing it to the other ones that looked like the vinegar.

Teacher: All right. So do we have --?

Narrator: In wrapping up this part, you'll want to review the entire process with the students and add significant information to the charts.

<Investigation 4, Part 1>
Narrator: In this investigation, the students use all the tools and techniques they have learned throughout the module. Their challenge is to determine which minerals from their sample set are ingredients in pink granite. Each group will need rock and mineral samples consisting of calcite, feldspar, pink granite, hornblende, mica, quartz in a half liter container, the toolkits, hand lenses and the Earth Material Notebooks.

You need to supply vinegar and paper towels. You make a reference set as you have before making a copy of the reference sheet, then keeping a sample of each rock or mineral on the sheet.

Teacher: You need to decide which are rocks and which are minerals.

Student: This is definitely a rock.

Student: This is a rock.

Student: Yeah, these are -- this one is definitely a mineral.

Student: These two are minerals.

Student: I think that's a mineral.

Student: This is a regular rock.

Student: These two we think are minerals and these four are probably rocks.

Teacher: All right. Now, each group has divided rocks and minerals. Who would like to show us one example of a rock and tell us why your group decided it was a rock? All right. Brook?

Student: We decided that this is a rock because rocks have more ingredients than minerals.

Student: We decided this was a rock because it's basically the same thing as granite except it's different colors.

Student: I think this is a mineral because it doesn't have so many ingredients as the rock does. And this has different spots.

Student: Our group decided that this was calcite because we've used it before and it's a mineral.

Student: We think that this is a rock because it's kind of -- it's black and gold. And I don't know the name.

Student: This one is a rock because it's black and has some different colors in it. And -- but we don't know what it's called.

Narrator: The students should be able to identify the materials they've worked with before, quartz and calcite. You'll need to give them the names of the other minerals: Feldspar, the pink mineral; mica, the very thin black mineral; and hornblende, the other black mineral with sharp jagged edges.

Teacher: Now, that takes care of the six samples of earth materials. Now, what would happen if I told you that actually only one of these is a rock? All the rest are minerals. Which one of these do you think is a true rock? Shadia?

Student: I think that this rock is the one because it has so many different colors in it.

Teacher: Okay. Many different ingredients. And that is called?

Student: Granite.

Teacher: Granite. All right.

Narrator: Once the students agree that the granite is the rock, their new challenge is to determine which of the other minerals are ingredients in granite. Students can refer to earlier observations and should record everything in their notebooks.

Student: Yeah.

Student: Which is the solid block?

Student: Yeah, it's mica.

Student: This is quartz, too.

Student: It's mica. Because all the little black spots are sort of two colors, the same colors as mica.

Narrator: As the students work, visit the groups to assess their thinking. Keep your notes on the assessment chart for this investigation.

Teacher: When you get to the granite part here, which minerals do you think are in granite? What's your evidence?

Student: Hornblende.

Teacher: Okay. Good, Chris. Then what are you writing there?

Student: Hornblende because it has black things.

Teacher: Because it has the same color of the hornblende?

Student: Yes.

Teacher: But are there other minerals that might have that color?

Student: Yes.

Teacher: So that's just a good guess. But it says evidence. Can you prove it? What can you prove?

Student: There might be calcite in it because calcite is kind of shiny.

Teacher: How could you prove that, Scott? Calcite -- how could you prove whether or not calcite is in granite?

Student: You could put -- you could put it in vinegar or soak it in vinegar.

Teacher: All right. The vinegar test. Why don't you try that?

Narrator: When someone in the class suggests that they test the granite for calcite by putting it in vinegar, you can set it up like this: Find a convenient location where groups can go and observe the granite in the vinegar. They may see a few air bubbles clinging to the granite. But it will not bubble vigorously. There is no calcite in granite.

Student: Underneath?

Student: There's none underneath.

Student: It doesn't have enough bubbles for it to be calcite.

Student: There's no calcite -- there's no bubbles.

Student: Those are air bubbles.

Student: So there's definitely no calcite.

Student: They are just a little darker.

Student: So it's --

Student: It's extra dark.

Student: It looks cleaner.

Student: No calcite.

Student: No calcite because it's not bubbling.

Student: Okay.

Teacher: The question is: What do you think the minerals are in granite? Okay. Who can give us one mineral that he or she thinks is in there? Okay.
Amanda?

Student: Our group thinks mica -- mica.

Teacher: Mica.

Student: Quartz.

Student: Back there on that table we did a test and -- to see if there was calcite in the granite. And since there wasn't, the quartz is the only other thing that's white. So I thought that there was probably quartz in the granite.

Student: I think there are some of every mineral that we were working with in granite. Because I saw at least one color from every mineral was in granite that I saw. And I saw different textures that match the minerals. So that's why I thought maybe every mineral we were working with was in granite.

Teacher: All right. Now, do we have disagreement with what Patrick said? It looks like not everyone agrees with that.

Student: Well, I forgot to say except calcite.

Student: I don't think the mica is in it because it's so soft that it bends sort of. And in the granite, it's really rough and very shiny of the same color. This is -- some is shiny brown. Some is shiny black. Some is shiny gray. So this is -- and this is harder.

Student: I sort of agree that probably some hornblende. This shiny stuff on hornblende might be on the granite instead of the mica. So I sort of agree with Scott.

Student: I think that mica and hornblende might be in granite because there's some parts of the granite that is shiny. The black is shiny. And some parts that it's just dull.

Teacher: In reality these are the minerals that are in granite. All except one. Which one of these is not in granite? All right. Why don't you just tell me.

Class: Calcite.

Teacher: Right. We know that's not in granite.

Narrator: You may want to review the Content/Inquiry Chart focusing on all of the information the students used to draw their conclusions about granite.

<Investigation 4, Part 2>

Narrator: The last part of this module gives students an opportunity to choose their own investigation. The projects allows students to follow their own interests and gives you insight into how well they understand rocks and minerals.

This is the time to bring out the Project Ideas Folder. As much as possible you want students to use their own ideas and investigate the questions that they have come up with during the module. If you don't have enough ideas in the Project Folder for everyone to investigate, you can use the project ideas sheet to help students think about more investigations.

The project plan sheet should be completed by each student or team of students during a project. This sheet helps you control materials and keep tabs on what the students are working on. You will also want to make sure that the projects the students propose are realistic and will be of some benefit to the class.

FOSS suggests students give three-minute presentations following the guidelines on the presentation guidelines sheets. They can also make a poster to help them explain their investigation to the class.

You should plan about two weeks for students to work on their projects. You can give them time at school, but you may also suggest that they do some of the work at home.

The assessment folio has suggestions for scoring the students' work on the projects. Also in that folio you will find information and masters for two kinds of summative assessment, an end-of-module test given in a variety of formats and suggestions for assembling portfolios.

This is the end of the Earth Materials module. Keep in mind that there are a lot of details in the Teacher's Guide that we weren't able to show you on the video. But most of all, I hope you have a lot of fun doing this module with your students.