These activities and experiments are from the book *Rocks and Minerals: Get the Dirt on Geology (Inquire & Investigate)* by Chris Eboch

How do we know about events that took place long before humans existed?

By studying rocks and minerals, geologists can determine when and how changes to the Earth's surface occurred. Rocks are clues on a scientific treasure hunt!

Rocks and Minerals: Get the Dirt on Geology
A fun and informative introduction to the earth science happening beneath our feet, packed with hands-on science experiments and STEM research projects that help readers ages 12 to 15 discover the amazing world of geology!

Inquire & Investigate: The Geologic Timescale

We usually measure time in years, days, hours, and minutes. Geologists need to measure the Earth's entire 4.54-billion-year history! The geologic timescale is the calendar of events in the planet's history. It divides all that time into units called eons, eras, periods, epochs, and ages. These time units match the Earth's rock formations.

Research the geologic timescale and find a chart that illustrates the different ages. Then, make your own toilet paper geologic timescale. This will help you visualize the immense time in question.

Take a roll of toilet paper with at least 5,000 squares. Each square of toilet paper represents 1 million years of the Earth's history.

On the first square, mark the age of humans. Recorded human history has lasted about 10,000 years, or 1/100 of a square. Our species has been around for about 50,000 years, or 1/20 of a square.

Start unrolling the toilet paper. You could put a pencil or stick through the roll's tube and have a partner gently pull on the loose end to unwind it. If the paper rips, tape it back together.

As the toilet paper unrolls, count the squares and match them to the eons and eras on the geologic timescale. Lay the paper along the ground, circling the room if necessary.

Go back to the first square. How far away are the dinosaurs? How far away are the Hadean eon and the Archean eon? What does this tell you about geologic time?

To investigate more, become a rock hound. A rock hound collects rocks, minerals, and fossils. You can become a rock hound! Explore your area and collect rocks where it is legal to do so. Check the laws for rock hounding in your state. In most cases, except for National Parks and National Monuments, public lands are open to rock hounding—but you cannot collect historical

artifacts or fossils from vertebrates. And sometimes, you may need a permit. See if you can identify the types of rocks you find.
A natural history museum is a great place to see more rocks. Also, visit these sites for more information!

mindat
https://www.mindat.org/

Friends of Mineralogy
http://www.friendsofmineralogy.org/

Inquire & Investigate: Volcanoes

Watch this Science Trek video to learn about answers to students' questions about volcanoes.
https://www.pbs.org/video/science-trek-volcanoes/

Inquire & Investigate: Earthquakes

Earthquake in a Box
Scientists use models to better understand complex concepts and processes. Model what happens during an earthquake and see what new things you discover.

Using building materials such as wooden blocks, heavy paper, thin paper, and interlocking plastic blocks such as LEGO bricks, build some structures inside a shallow box or box lid. Fold sheets of paper and balance pieces of building material on each other. Do not attach the building pieces together with tape or glue.

Gently shake the box. What happens? If some structures are still standing, shake a little bit harder. What happens now?

Now, rebuild your structures. This time try different ways of attaching the pieces.

Gently shake the box again. What happens?

Put a layer of sand or gravel in the bottom of the box. How does this new "ground" affect the structures when you shake the box?

What can you learn about how different building materials and different geology affect buildings in an earthquake? Did heavy, solid pieces survive better? Or did lighter, flexible pieces do better?

To investigate more, research what building materials are recommended for areas prone to earthquakes. What are the advantages and disadvantages of different building materials?

Learn about recent earthquakes. Visit the USGS (United States Geological Survey) to find lists, maps, and statistics on recent and historical earthquakes.
https://earthquake.usgs.gov/earthquakes/

Inquire & Investigate: **Water Education**

Where does your water come from? Depending on where you live, you might get your water from a public system or a private well. And how does the water get there? Do some research to find out!

Research your community's public water systems. A good place to start is a town office or city hall. Is your town fed by a reservoir? If you have a private well, find some maps that show where the water flows in your area.

Is there a local water treatment plant near you? With an adult's permission, contact the plant to see if they allow visitors! You can learn a lot from a field trip. Where does the water come from? How is it treated before being distributed to the community? What happens after it is used?

Create a water education presentation for your community! Show where water comes from, how it is used, and where it goes afterwards. Include some ideas on how to conserve water, too.

To investigate more, do some research on regions that are or have been in danger of running out of water, such as Cape Town, South Africa. What factors contributed to the crisis? How did the residents of Cape Town handle the near-disaster? What can they do to prevent something like that from happening in the future?

Find your region's watershed at this website. How large is it? How many people use water from that watershed? https://water.usgs.gov/wsc/map_index.html.
kp: USGS locate watershed

Inquire & Investigate: Your Water Use

Think about all the ways you use water. Water conservation is a critical part of taking care of planet Earth. Take a good look at your own water usage and find ways to be better about water.

Track your water use throughout the day. Make a note every time you turn on a faucet or flush a toilet. Make a note of other sources of water as well, such as canned or bottled beverages.

Research how much water is used for various activities. The USGS provides some estimates here.
https://water.usgs.gov/edu/qa-home-percapita.html

You can also try the 30by30 app from the Groundwater Foundation. It is a free water-tracking app for Android and Apple devices.

How much water do you use every day? Can you find instances throughout your day where you could cut back on water usage? What about the rest of your family? Can you be a positive force for change when it comes to water consumption?

To investigate more, consider that water is used to grow food as well. It is also used in manufacturing many of the objects around us. The Environmental Protection Agency includes these sources in its water use estimates.
https://www.epa.gov/watersense/how-we-use-water

Conserve!
Conserving water helps ensure we will have enough for the future. Here are some ways your family can conserve water.
Turn off the water when brushing your teeth.
Take short showers rather than long showers or baths.
Fix leaky faucets, toilets, and showerheads.
Use low-flow shower heads and toilets.
Use high-efficiency dishwashers and clothes washers. Run full loads in the dishwasher and clothes washer.
Landscape with plants that need little water. Then water only when necessary.
Have a family meeting. Which of these are you already doing? Which might you like to try? How can you get started?

Inquire & Investigate: Map Your School Yard or Neighborhood
Maps are crucial in the study of geology. A good way to learn about maps is to make a map of a familiar area. Choose a fairly small location, such as your schoolyard, an outdoor shopping area, or a few city blocks.
Start by studying other maps. Get several of different scales and designed for different purposes. What do they include? Do they show only streets? Do they show natural formations? Do they show elevation changes? What features do they all show?

What kind of map do you want to make?

Gather some supplies, including tracing paper, tape measure, colored pencils, transparent tape, and scissors. You can also print an aerial image of the area you want to map from The National Geologic Map Database at this website. https://ngmdb.usgs.gov/topoview/viewer/

Study the features on the printed map. Make sure you can tell the difference between shadows, the sides of buildings, and the tops of buildings and objects. Determine which objects you want to add to your map. Trace them with a dark marker.

Place tracing paper on top of the image. Tape the top of the tracing paper to the aerial map.

If it's hard to see through the tracing paper, you can tape the map to a window so light shines through it.

Determine what colors you want to use for different objects. Buildings might be one color, grass another.

Trace the objects you want to add to your map onto the tracing paper. Color code them.
Make a legend for your map. A legend explains what each color means. Indicate which direction is north.

Add the map scale. Find a feature that will be easy to measure, such as a yard or parking space.

Measure it with the tape measure. Then measure the feature on your map with a ruler. Determine the scale and add it to your map. For more detailed instructions, look up "how to make a map scale."

To investigate more, explore the area your map covers. Note what kind of geological features are present. How big should a rock be before it goes on your map? You might include individual large boulders. But a gravel yard might be better marked with a special color to indicate gravel. For photo examples of stone buildings, and the types of stone used, visit the Department of Geology at University of Georgia.
http://www.gly.uga.edu/railsback/BS-Main.html

Study Your Neighborhood
Go on a neighborhood walk and see what you can determine about the ages of things you see. For example, which is older, a building, or the bricks used to make the building? Does a sidewalk show signs of cracks or repairs that came after the sidewalk was poured? Can you determine the effects weathering or erosion on buildings, streets, or the landscape? Can you find records of "absolute" ages, such as dates stamped on manhole covers or plaques on buildings?

If you have a GPS device or GPS in a phone, use it to determine the location of your observations. Take a photo and record notes at each location. Many apps can help you map these points.