The University of Texas at Austin
Environmental Science Institute

Finding Ancient Water

Lesson Plan for Grades: Middle School Science
Length of Lesson: 60 min

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Subject area/course:

- Environmental Science

Materials:

- *Finding Ancient Water Research Packet* (attached)
- Colored Pencils
- Laptops (or available internet-capable device for research)
- U.S. Drought Monitor https://droughtmonitor.unl.edu/ (Exploration Resource)

TEKS/SEs:

§112.28. Grade 8 Science, Adopted 2021.

(4) Scientific and engineering practices. The student knows the contributions of scientists and recognizes the importance of scientific research and innovation on society. The student is expected to:

- (A) relate the impact of past and current research on scientific thought and society, including the process of science, cost-benefit analysis, and contributions of diverse scientists as related to the content;

(11) Earth and space. The student knows that natural events and human activity can impact global climate. The student is expected to:

- (A) use scientific evidence to describe how natural events, including volcanic eruptions, meteor impacts, abrupt changes in ocean currents, and the release and absorption of greenhouse gases influence climate;

Lesson objective(s):

- Students will be able to identify key characteristics of stalagmites and stalactites.
- Students will be able to describe how historical information about the Earth can be revealed from ancient deposits.
- Students will be able to explain how climate change can be exemplified through past major climatic changes.

Differentiation strategies to meet diverse learner needs:

- The teacher should ask students whether they prefer to read or watch videos to learn about concepts; then have students learn in their preferred learning style. However, the teacher may assign students certain methods to improve their skills. For example, if a student prefers reading, teachers may have them watch a video and take notes to improve their listening skills.

- ELL students and students with learning disabilities should have multiple forms of instruction including visual and written instruction sheets as well as a verbal instruction and demonstration.

ENGAGEMENT (15 minutes)

- The teacher will begin the lesson by playing part of the *Hot Science at Home "Finding Ancient Water*" video from 2:18-4:16 at https://youtu.be/Xlp25OCdvTs.
- Students will engage in a think-pair-share. Students will first be given 2 minutes to independently reflect on the video and think about the quote "the past informs the future" and how scientists might be able to find information about the past. Students will then group into teams of two. Once paired, groups will have five minutes to discuss what they thought about the video, what they thought of the quote, and how they think scientists could extract information about the future from the past.
- The teacher will ask a couple groups to share what their group talked about, pointing out some similarities and differences in the different responses.
- The teacher will then play part of the *Hot Science at Home "Finding Ancient Water"* video from 5:09-9:00 at https://youtu.be/Xlp25OCdvTs.
- The teacher should instruct students to fill out part of their *Finding Ancient Water Research Packet* while watching the video.
- At the completion of the video, students will be given 5 more minutes to engage in further dialogue with their partner, focusing on discussing what stalagmites are and what kind of information they think could be extracted from looking at fossil drip water.

  Transition: I'm hearing some good conversations going on around the room, especially some interesting hypothesis revolving around what exactly we can find out by looking at the fossil drip water in these stalagmites. Let's dive into the next part of today's lesson to find out exactly what Dr. Montañez has found with her team.

EXPLORATION (25 minutes)

- The teacher will play a segment from the *Hot Science at Home "Finding Ancient Water"* video from 9:00-16:58 at https://youtu.be/Xlp25OCdvTs.
- Students will read the instructions located at the *Activity* section of their *Finding Ancient Water Research Packet* and begin accessing the U.S. Drought Monitor (https://droughtmonitor.unl.edu/)
- Students will begin the activity by finding out information about Drought Classification Categories, then transition into recording current drought data by coloring in the map provided to replicate the current US Drought Monitor Map. Once students have completed coloring that in, they will find they will access the Map Archives to find two other maps, one from the year 2000 and one from the year 2010 to color in.
- Students will then compare data from the different maps and draw conclusions from what they found, answering some of the corresponding prompt questions in the *Reflection* section of their *Finding Ancient Water Research Packet*.
- The teacher should continue to walk around the room during exploration, prompting groups to have conversations about what they are finding, how it relates to what they know about climate change and what Dr. Montañez had described in the *Hot Science at Home Video*.

EXPLANATION (10 minutes)

- The teacher will ask groups to share what they found during their activity. Probing questions should focus first on comparative data of the charts and then reflection question content. Example probing questions:
  - What were the key differences between the different maps? Was there an increase in droughts across the U.S.? Were there changes in the severity of droughts in different regions?
  - Why would it be important to have research like what Dr. Montañez is doing with stalagmites? Do you think looking at this ancient water data can give us a glimpse into the future?
- The teacher will summarize the classroom's collective findings and ask, "We've talked a lot about the U.S. as a whole and an outlook on the future. How does this impact you right now?", allowing students to respond with their hypothesized answers.

Transition: An important thing to think about with climate is while there might be this increase over time, there are times where droughts and wet seasons spring back and forth on that cumulative increase. Let's take a look at what Dr. Montañez has to say about a new cutting-edge area of research that expands our understanding of this back-and-forth phenomenon.

ELABORATION (10 minutes)

- The teacher will play a segment from the *Hot Science at Home "Finding Ancient Water"* video from 17:00-19:52 at https://youtu.be/Xlp25OCdvTs.
- The teacher will ask probing questions to further solidify the content of the day's lesson and tie in the new area of research proposed in the video, asking students why they think it is important.
  - How is this new area of research Dr. Montañez talks about potentially revolutionary in the field of climate change and natural disaster prevention/relief?
  - Why is it important that we can draw this information from stalagmites and ancient water?
- Students will engage in personal and collective reflection throughout the class discussion.

EVALUATION (throughout entire lesson)

- Formative assessment will be performed throughout the lesson. As the students are working in their groups during the Explore stage, the teacher will be walking around assessing the students and the connections they continue to make to the content. The teacher can take note of intriguing connections made by students to bring up during the elaboration section.
- A summative assessment can be implemented at the end of the class, having students write down 3 things they learned after going through the day's lesson as an exit-ticket activity. Additionally, all materials written on can be collected to assess student learning and overall acquisition of knowledge.

SOURCES AND RESOURCES

- Dr. Isabel Montañez's *Hot Science at Home #1.13,* **"Finding Ancient Water",** https://youtu.be/Xlp25OCdvTs.
- **U.S. Drought Monitor**, https://droughtmonitor.unl.edu/**.**

Exploration - Student Handout

Finding Ancient Water Research Packet

Objective:

As the world's climate continues to change it is important to have a scientific grasp on how it is shifting and what the world may look like in the future. In her *Hot Science at Home* episode, "Finding Ancient Water", Dr. Isabel Montañez talks about gaining this view of the future by looking at the past. Specifically, through her work with stalagmites, she describes how scientists have been able to extract ancient water samples from within these fossilized mineral deposits and analyze the isotopes within them to find out prehistoric information about climate change that serves to give us perspective on similar changes we are going through now with increasing severity of droughts in the United States. This activity aims to look at documented drought data to understand the relationships Dr. Montañez describes.

Activity:

Instructions:

1. Access the U.S. Drought Monitor at https://droughtmonitor.unl.edu/.
2. Under the "About" Tab, click on "About the Data" and read through the chart, recording data in the Drought Classification Chart.
3. Color corresponding colors in the Category column of the Drought Classification Chart to match the one on the U.S. Drought Monitor website.
4. Under the "Maps" Tab, click on "Map Archive" and view the current map.
5. Color in the Current U.S. Drought Map corresponding to the data shown on the U.S. Drought Monitor Website.
6. Change the Map Date to the same month in the year 2010. Color in corresponding data.
7. Change the Map Date to the same month in the year 2000. Color in corresponding data.
8. Answer Reflection Questions.

Drought Classification:

Category	Description	Possible Impacts

Current U.S. Drought Map:

Year 2010 U.S. Drought Map:

Year 2000 U.S. Drought Map:

Reflection:

1. How does the data from the year 2000 differ from the data from the year 2010? How do those years differ from the current drought data?

2. What is the pattern of change you notice in the data? (i.e., are there more areas affected, more severely impacted areas etc.)

3. Dr. Montañez talked about looking at ancient water data to understand future climate events. How would her research be beneficial to look at as we see changes in our more recent climate data?