

muse

JANUARY 2016

Explore Earth

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Teachers' Guide for *MUSE: Explore Earth*

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OVERVIEW

In this magazine, readers will learn how courageous researchers are undertaking monumental Earth explorations to gain more insight into our

*amazing planet. **Muse: Explore Earth** includes information explaining the scientific processes of crystal and diamond formation, as well as taking the reader on a journey under the earth, below the sea, and to faraway lands.*

ESSENTIAL QUESTION:

How do modern-day explorers aid scientists in their quest to learn more about our Earth?

We invite you to use this magazine as a flexible teaching tool, which is ideal for interdisciplinary learning of social studies and science content and core literacy concepts. Find practical advice for teaching articles individually or utilize a mini-unit that helps your students' make cross-text connections as they integrate ideas and information.

READ MULTIPLE ARTICLES PAGES 4 - 8

Each article in this magazine is well-suited for teaching Common Core literacy concepts and content area knowledge. For each individual article page in this guide, you'll find the following:

Essential Question

Content Concepts
Next Generation Science Standards

Key Vocabulary
CCSS.Read.4

Prepare to Read
CCSS.SpeakListen.1, 2, 4

Close Reading Questions
CCSS.Reading.1-10

Common Core Connections to teach
reading and writing standards.
CCSS.Writing.1, 2, 3 & 6

TEACH A MINI-UNIT PAGES 10 - 12

Magazine articles can be easily grouped to make cross text connections and comparisons. Our Common Core mini-unit guides students to read and discuss multiple articles and integrate ideas and information. (CCSS.Reading InfoText.9) Discussing multiple articles (CCSS.SpeakListen.1, 2, 4) prepares students to write informational texts to share and publish in a variety of ways. (CCSS.Writing.2)

READING

Core literacy concepts, such as the ones found in the Common Core State Standards, help students access social studies and science content. Integration of both literacy thinking and content study offers students a great way to become experts in reading informational text and literature for content knowledge. This guide provides questions to cover many core literacy concepts.

Draw Inferences (CCSS.InfoText.1)

Describe Relationships (CCSS.InfoText.3)

Analyze Text Structure (CCSS.InfoText.5)

Interpret Visual Information (CCSS.InfoText.7)

Summarize (CCSS.InfoText.2)

Determine Word Meaning (CCSS.InfoText.4)

Understand Author’s Point of View (CCSS.InfoText.6)

Explain Reasons and Evidence (CCSS.InfoText.8)

FOCUS STANDARD: CCSS. InfoText 9: Integrate Ideas and Information:

Have students read multiple articles from this magazine on the same topic, build knowledge, and make cross-text comparisons.

SPEAKING AND LISTENING

Use the articles in this magazine to spark meaningful discussions in person and online. Encourage deeper discussions where students can become topic experts. (CCSS.SpeakListen.1, 2, 4)

DISCUSSION OPTIONS—IN CLASS OR ONLINE

Article Clubs: Form small reading groups of students reading the *same* article. Have students discuss the content, share ideas, and critically evaluate the text.

Jigsaw Clubs: Form small reading groups of students reading *different* articles. Invite students to share information and resources with each other.

Whole Class: Launch with an essential question. Encourage students to find and share evidence from different articles building a greater understanding of the question.

WRITING

Use the articles in this magazine to prompt **informative/explanatory writing** (CCSS.Writing.2). Have students use evidence from the texts to share information about social studies, language arts, or science content in the articles. See the **Mini-Unit** section of this guide (pages 10 – 12) as well as the **article pages** (pages 4 - 8) for ways to incorporate writing into your instruction.

ARTICLE: Breathtaking Crystals

Magazine pages 9 - 13, Expository Nonfiction



This article will take the reader on a journey into the Naica mine. The world's largest naturally occurring gypsum crystals are found deep within this cave. Discover the beauty, danger, and the hidden secrets of the Earth that lie within Naica.

ESSENTIAL QUESTION

How do modern-day explorers aid scientists in their quest to learn more about our Earth?

SCIENCE CONCEPT

Atoms may join together in well-defined molecules or may be arranged in regular geometric patterns. (NGSS 4, Key Idea 3.3c)

CROSS-CURRICULAR EXTENSION

Art in Science

Have students work cooperatively to create a three-dimensional model of Naica Mountain and the chambers below. Supply various materials, and instruct the groups to label prominent features. Encourage creativity.

KEY VOCABULARY

chamber (p. 10) a small space inside something

deposit (p. 10) leave an amount of something on area over a period of time

enamel (p. 10) very hard outer layer of a tooth

miniscule (p. 11) extremely tiny

molecule (p. 10) the smallest possible amount of a substance

PREPARE TO READ

Direct the class to locate Mexico on the map and discuss the climate and geography of this country. Include information about the magma chamber beneath Naica Mountain. Have students hypothesize about what they think lies within that chamber today. Generate a list of ideas, and then introduce the title of the article, "Breathtaking Crystals".

CLOSE READING QUESTIONS

- Why is exploring the Naica Mine so dangerous? Is the knowledge worth the risks? Find evidence to support your opinion.
- How does the author use descriptive language to engage the reader? Share text examples.
- Use the information from the article to explain how crystals form and grow.

COMMON CORE CONNECTIONS

Describe Relationships *CCSS Info Text 1*

Describe the relationship between underground conditions and crystal formation. Discuss how a shift in conditions could affect these magnificent structures.

Draw Inferences *CCSS Info Text 1*

Garcia-Ruiz is concerned that his research in this mine could come to a swift end. Why is he worried about this and what questions may go unanswered if this occurs?

Summarize Main Ideas *CCSS Writing 1 & 6*

Is it important to continue to support this type of underground research? Support your answer.



Board the *Challenger* and experience the discovery of the Mariana Trench. Learn how new technology has helped us to understand more about this 'hole' in the ocean floor, and what obstacles lie in the way of further knowledge.

ESSENTIAL QUESTION

How do modern-day explorers aid scientists in their quest to learn more about our Earth?

SCIENCE CONCEPT

Many of the phenomena that we observe on Earth involve interactions among components of air, water and land (NGSS 4, Key Idea 2)

CROSS-CURRICULAR EXTENSION

Careers in Science

This article gives a glimpse into the research work of a hydrographer. Explore other oceanography career paths and explain their specialty areas.

KEY VOCABULARY

hydrographer (p. 18) a person trained to work in deep sea vessels

spewing (p. 17) flowing out of something in a fast and forceful way

trench (p. 18) a long, narrow hole in the ocean floor

PREPARE TO READ

Have the students brainstorm to create a list of probable obstacles regarding underwater exploration. Show the class video clips and images of underwater footage in the Pacific to spark interest and ideas.

CLOSE READING QUESTIONS

- What is the Mariana Trench and what are the difficulties of studying it? Support your answer with examples in the article.
- What text features did the author include to help the reader?
- How and when is future exploration of the trench expected to occur?

COMMON CORE CONNECTIONS

Interpret Visual Information *CCSS Info Text 7*

Examine the graphic features within the article and describe how they enhance your understanding of the content.

Analyze Text Structure *CCSS Info Text 5*

Use the information from the article to demonstrate the cause and effect relationships that make underwater research so treacherous.

Research-Based Writing *CCSS Writing 2 & 6*

Using information from this article, as well as books and the Internet, create a mural depicting the changes in life and conditions as you descend below the sea. Label each part of the mural, and use details to explain each level.



This article delves into an unseen world on our own planet, Antarctica's hidden wetland. Learn why astronomers are excited by this discovery and how it may suggest life on other planets.

ESSENTIAL QUESTION

How do modern-day explorers aid scientists in their quest to learn more about our Earth?

SCIENCE CONCEPTS

Many of the phenomena that we observe on Earth involve interactions among components of air, water and land (NGSS 4, Key Idea 2)

CROSS-CURRICULAR EXTENSION

Science

Explore the definition and characteristics of an ecosystem. Research the interconnectedness of life in a wetland.

KEY VOCABULARY

penetrate (p. 21) to go through or into something

thrive (p. 22) to grow or develop success

wetland (p. 21) an area of land that is covered with shallow water

PREPARE TO READ

Visit the school library and give the students an opportunity to peruse books about the planets. Direct them to notice the physical features and the properties that deem them uninhabitable. Discuss what parts of Earth are currently uninhabited and why. Motivate the class to read by telling them that "Antarctica's Hidden Wetland" may challenge their current beliefs.

CLOSE READING QUESTIONS

- How did scientists discover the hidden wetland under Antarctica? Find text evidence for your answer.
- The article includes many questions scientists pose. Which ones are still unanswered?
- How does the author make the comparison between Earth and space science?

COMMON CORE CONNECTIONS

Draw Inferences *CCSS Info Text 1*

Why are astronomers so excited about the discovery of this hidden wetland under Antarctica? What information from the article supports your inference?

Explain Reasons and Evidence *CCSS Info Text 8*

What research is currently leading scientists to believe that life on other planets may be a legitimate possibility? What evidence are they using to support this theory?

Opinion Writing *CCSS Writing 1*

The scientists in this article state that Antarctica's lake is one of the Earth's most valuable environments. Do you agree or disagree? Support your answer with details.



Geologists have discovered a strange plant in the African jungle that can help prospectors locate diamonds. Explore how this discovery can make the search for diamonds less intrusive, more profitable, and give us valuable insight into our planet's development.

ESSENTIAL QUESTION

How do modern-day explorers aid scientists in their quest to learn more about our Earth?

SCIENCE CONCEPT

Human decisions and activities have a profound impact on the physical and living environment. (NGSS 4, Key Idea 7)

CROSS CURRICULAR EXTENSION

Economics

Research the benefits, as well as the costs of diamond mining. Is the monetary aspect worth the impact on the land and the danger to the miners?

KEY VOCABULARY

botanical (p. 32) relating to plants or the study of plants

epidemic (p. 33) occurrence in which a disease spreads quickly and affects a large number of people

plunger (p. 32) part that moves up and down inside a tube/cylinder to push something out

revenue (p. 33) money that is made by or paid to a business or organization

PREPARE TO READ

Engage the students in discussion to determine what prior knowledge they have about diamonds. Create a K-W-L chart (know, want to know, learned) for this article. Aim for complete class participation.

CLOSE READING QUESTIONS

- How is location of the pamaya plant helping prospectors to locate diamonds? Support your answer with text evidence.
- What is the double meaning of the cartoon on page 32 and how does it relate to the article?
- What connections is the author making in the article? Create a diagram or chart to show these connections.

COMMON CORE CONNECTIONS

Discuss Relationships *CCSS Info Text 3*

Examine the connection between the growth of the pandanus candelabrum plant and the location of diamonds. Why is this discovery so beneficial to the prospectors and to the land?

Interpret Visual Information *CCSS Info Text 7*

Analyze the graphic feature on page 33 that depicts how diamonds form. Rewrite the information found here into paragraph form.

Presentation of Knowledge and Ideas *CCSS Speaking and Listening 4*

Divide into groups and practice presenting one aspect of this article. One member of each group rotates to the other groups to present the content and answer questions.



This article will take you on an adventure into the Amazon to meet the Piraha, a river-dwelling native people. Exciting linguistic and cultural differences are examined as the researcher confronts the dangers of his environment and the challenges of communication.

ESSENTIAL QUESTION

How do modern-day explorers aid scientists in their quest to learn more about our Earth?

SOCIAL STUDIES CONCEPT

Complex societies and civilizations adapted to and modified their environment to meet the needs of their population. (C3 Framework, D2.Geo.4)

CROSS CURRICULAR EXTENSION

Regional Geography

Explain how physical features of the environment and human culture interact to define the life of the river-dwelling native people, the Piraha. How are societies in general affected through similar interactions?

KEY VOCABULARY

- frothing (p. 43)** bubbles that form in or on a liquid
- translation (p. 43)** words that have been changed from one language into another
- trilingual (p. 44)** a person able to speak three languages fluently

PREPARE TO READ

Instruct the class to demonstrate their knowledge of a jungle biome by drawing a sketch and labeling the features. Next, pose the question: *What CANNOT be seen in the drawings?* Lead the discussion towards culture and language and then introduce, "The Accidental Explorer".

CLOSE READING QUESTIONS

- In what ways is the Piraha language unique? Use text evidence to support your answer.
- How does the author help you understand the people and environment of the Amazon?
- What kind of text is this? What other text structures could be used to share this information?

COMMON CORE CONNECTIONS

Drawing Inferences *CCSS Info Text 1*

How does the fascinating language of the Piraha reflect the culture of the Piraha people? What conclusions can you draw from the information in this article?

Discuss Relationships *CCSS Info Text 3*

Examine the relationship between people and their land. How can interactions between human culture and the physical environment create a beneficial, but sometimes disastrous cycle? Why is it so important to create harmony?

Opinion Writing *CCSS Writing 1 & 6*

Choose a detail from the article about daily life in the Amazon. Would you enjoy that aspect of life with the Piraha? Why or why not?

CROSS-TEXT CONNECTIONS WITH MULTIPLE ARTICLES

COMPARE ARTICLES

SYNTHESIZE: Guide students to compare articles they read. Help students find the connections between pieces of information in multiple texts. Use prompts, such as the following examples, to have students work together to **Integrate Ideas and Information** (*CCSS.Reading.9*):

- The articles “Breathtaking Crystals and “Diamonds Buried Here” both address the bounty of gems and minerals that lie deep below the Earth. Compare the benefits and risks of sustaining these explorations. Create debate teams to speak in favor of, and against, continuing research in this manner.
- All of these articles mention specific research explorers or teams of explorers. Reread the articles to generate a list of common characteristics among these adventurous individuals and teams. Can you determine a specific motivating factor that fuels their research?
- The articles, “Going off the (Really) Deep End” and “Antarctica’s Hidden Wetland” both discuss the difficulties of accessing what lies deep below the surface. How do the treacherous conditions faced when trying to gain access to these sites determine what we can learn? How is modern technology helping to overcome such obstacles?
- Reread the feature articles and highlight sentences that contain mathematical information. Take this opportunity to examine the interconnectedness of Math and the Sciences. List the reasons that a strong foundation in Math is essential in helping scientists conduct accurate research. Use information directly from the articles to prove the connection.
- “The Accidental Explorer” is an interesting article that examines how the goal of a particular exploration can easily be altered as the journey proceeds. Using information from all of the feature articles, as well as your prior knowledge, explain how and why explorer’s missions evolve.

EXPLORATORY LEARNING - FLEXIBLE MINI-UNIT DESIGN

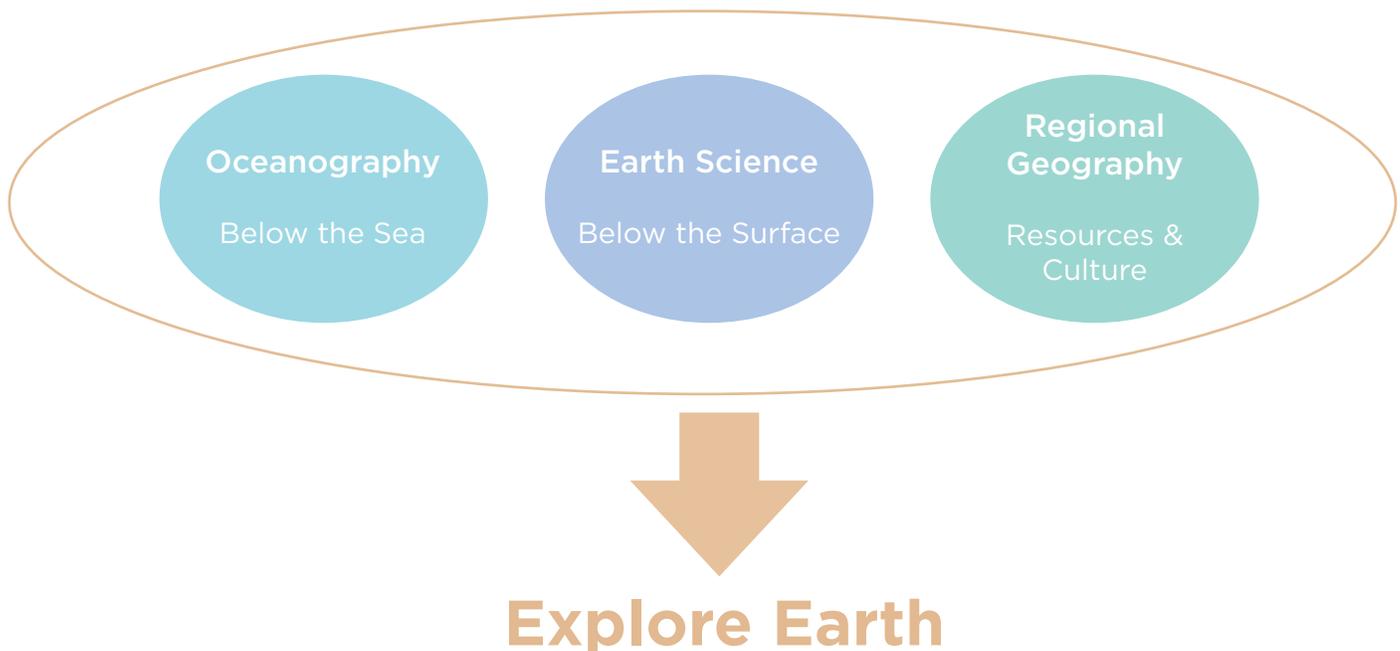
This mini-unit is designed as a flexible teaching tool that can be taught in any order. It lends itself well to the articles mentioned within **MUSE: Explore Earth** or you may choose to substitute your own selection of articles. It would be beneficial to gauge the interest level of your students when determining your focus.

ENGAGE

READ AND
COMPARE

APPLY

ENGAGE: Engage the students in the topic of exploring the many facets of the planet Earth. Have students page through the magazine looking at photographs and reading article titles to spark a readiness to read. Invite the class to view short video clips portraying the wonders below the sea and below the surface. Discuss the interconnectedness of human culture and its relationship to the geography of the Earth. Create a concept web to display prior knowledge.



Share the essential question:

How do modern-day explorers aid scientists in their quest to learn more about our Earth?

READ AND COMPARE ARTICLES: Begin with a focus article as a base for building content knowledge and model how to work through the text.

1) READ ALOUD: Use “Breathtaking Crystals” on pages 9 - 13 as a focus article, or choose a different article that works well for your teaching goals. Share the article summary on page 4 of this guide. Students can read using their own copies of the article and sticky notes to mark places they find interesting or have questions about.

2) DISCUSS THE ARTICLE: After reading, guide students to turn and talk about the article. See the Article Pages for Close Reading Questions to enhance the material.

3) READ NEW ARTICLES: Help students choose additional articles to read based on their inquiry questions or what they wonder. Refer to the Article Pages for summaries of each article within MUSE: “Explore Earth”

4) COMPARE ARTICLES: After students have read multiple articles, guide them to make cross-text connections. Refer to page 9 to compare articles using prompts that help students integrate ideas and information.

CHOOSE A PURPOSE FOR READING

CLOSE READ: *CCSS.Reading Info Text.1* Mark the text, noting important details and highlighting what interests, surprises, or confuses you.

UNDERSTAND MAIN IDEAS TO DEVELOP EXPERTISE: *CCSS.Reading Info Text.2* Record the main ideas in a second article. Note how these main ideas build on the main ideas from the focus article, or other readings. How is your topic knowledge growing?

REVIEW GRAPHIC FEATURES: *CCSS.Reading Info Text.7* Examine graphic features within this issue and describe how the images, charts and photographs enhance your understanding of the content.

APPLY: CONTEMPORARY EXPLORATION

Focus on the essential question: How do modern-day explorers aid scientists in their quest to learn more about our Earth? Return to the feature articles to formulate possible responses. Divide the class into groups to discuss and help them complete the Explore Earth and Comparing Concepts graphic organizers to study different facets of this question. Use the activities below to further immerse your students in the material presented in this issue of *MUSE*.



- **Group One: *Regions of the World Poster Gallery***

Have students reread the feature articles from *MUSE: Explore Earth*, and highlight any geographical locations that are explored. Have pairs of students within the group select one geographical location. Instruct them to create a world map with the significant features of their region - discussed in the articles - clearly identified both on the map and in a key. Also ask each pair to include a brief written summary of each article they used to help guide the construction of the map as well as a visual element or graphic associated with the details discussed in the article. To create the opportunity for a classroom walkthrough gallery where pairs can present their maps, make sure there are at least 3 student pairs in this group.



- **Group Two: *Future of Expeditions Discussion***

Many of the feature articles mention the costs and rewards of modern-day exploration. Have students research where funding for these expeditions comes from. Instruct them to evaluate the following questions:

- o Why would it be beneficial for these missions to continue?
- o How can monetary obstacles prevent humans from attaining important information?
- o What is the main criteria used to determine if it is worth it to launch an expedition?

Then, have students in this group join with the class, and chair an open discussion about these questions. Help students in this group to model critical thinking about these topics for other students.



- **Group Three: *Change Over Time Presentation***

Compare brave modern-day explorers with the courageous explorers of the past. How has technology advanced the success rates of the missions while also providing some safety measures for the explorers? What specific systems and devices have been implemented that give researchers today a huge advantage over the voyagers of earlier decades/centuries?

NAME: _____

Mini-Unit Graphic Organizer

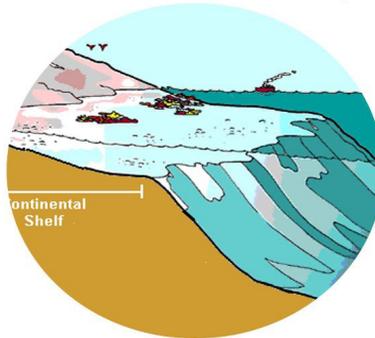
Use the graphic organizer below to list the benefits, as well as the risks of each type of exploration. On the arrow at the bottom, write a single sentence that demonstrates the interconnectedness of all of the disciplines. (Earth, Sea and Space)

EXPLORE EARTH

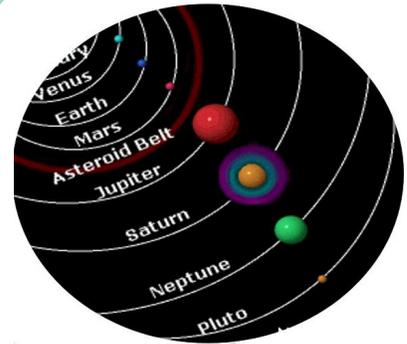
Under the Earth



Under the Sea



Outer Space



Benefits

Risks

Interconnectedness



NAME: _____

Mini-Unit Graphic Organizer

Comparing Concepts

Complete the organizer below to compare clinical research with field exploration. Use your own knowledge, as well as information directly from the articles in this issue of *MUSE: Explore Earth*.

CONCEPT 1:

CONCEPT 2:

HOW ARE THEY ALIKE?

HOW ARE THEY DIFFERENT?

NAME: _____

ANALYZE GRAPHIC FEATURES

GRAPHIC FEATURE	PAGE LOCATION	HOW THIS FEATURE HELPED YOUR UNDERSTANDING

NAME: _____

CONCEPT CHART

Show how reading multiple articles developed your understanding of the essential question or or your own inquiry question.

ESSENTIAL QUESTION OR INQUIRY QUESTION:

ARTICLE 1:	ARTICLE 2:	ARTICLE 3:



botanical relating to plants or the study of plants

*But when Haggerty sent pictures to tropical plant specialists, he found out that its **botanical** name is *Pandanus candelabrum*. (p. 32)*

chamber a small space inside something

*More than 20 million years ago, a magma **chamber** beneath Naica Mountain rumbled, shaking and shaping the land. (p. 10)*

deposit leave an amount of something on an area over a period of time

*Rust-colored iron oxide **deposits** coat the walls and ceiling of the limestone chamber. (p. 10)*

enamel very hard outer layer of tooth

*When you brush your teeth, you're cleaning tooth **enamel** made of crystals. (p. 10)*

epidemic occurrence in which a disease spreads quickly and affects a large number people

*"Many of the countries where diamonds are mined have been through conflict, Ebola **epidemics**, and droughts and desperately need the revenue that diamond mining can bring," says Shirey. (p. 33)*

frothing bubbles that form in or on a liquid

*When water began **frothing**, Everett realized he was sharing the river with piranhas as well as with his friend! (p. 43)*

hydronaut a person trained to work in deep sea vessels

*But for all its size, the two **hydronauts** would spend their journey in a round capsule only six feet in diameter. (p. 18)*

miniscule extremely tiny

*This **miniscule** amount of liquid provides clues about the climate when the giant crystal formed. (p. 11)*

molecules the smallest possible amount of a substance

*Crystals are three-dimensional solid objects constructed from repeating patterns of **molecules**. (p. 10)*

penetrating going through or into something

*As part of a mapping project, pilots flew ground **penetrating** radar over the Vostok station. (p. 21)*

plunger part that moves up and down inside a tube/cylinder to push something out

*Haggerty designed a special **plunger** to poke down under the *Pandanus candelabrum*. (p.32)*

revenue money that is made by or paid to a business or organization

*Many of the countries where diamonds are mined have been through conflict, Ebola epidemics, and droughts and desperately need the **revenue** that diamond mining can bring, says Shirey. (p. 33)*

spewing flowing out of something in a fast and forceful way

*Must be able to navigate safely past vents **spewing** liquid carbon dioxide, erupting mud volcanoes, and a treacherous lake of molten sulfur. (p. 17)*

thrive to grow or develop successfully

*These creatures have developed qualities that allow them to **thrive** under the weight of tons of water. (p. 22)*

translation words that have been changed from one language into another

*He planned to use his background in the study of languages to learn enough of the Piraha language and culture to write a **translation** of the Bible that they could understand.*

trench a long, narrow hole in the ocean floor

*Using sonar, scientists discovered that the hole was actually a **trench**. (p. 18)*

trilingual a person able to speak three languages fluently

*They grew up **trilingual**: speaking English, Portuguese, and Piraha. (p. 44)*

wetland an area of land that is covered with shallow water

*This could be the largest **wetland** in the world, as much as one and a half times the size of the United States. (p. 21)*



Breathtaking Crystals

- <http://www.neok12.com/pres/ZTYROCK6>
<http://news.discovery.com/earth/weather-extreme-events/naica-big-pics.htm>

These websites show the process of crystal formation below the Earth, and include information and photos of the Naica Mine which is discussed in this article.

Going Off the (Really) Deep End

- <http://www.livescience.com/23387-mariana-trench.html>

Explore the Mariana Trench on a virtual tour of this underwater wonder.

Antarctica's Hidden Wetland

- <http://www.npr.org/2014/08/23/342652126/antarctic-lakes-rivers-wetlands-all-under-a-kilometer-of-ice>

Read and listen an interview with the lead scientist on the expedition that discovered 'Antarctica's Hidden Wetland'.

Diamonds Buried Here

- <http://news.discovery.com/earth/african-plant-acts-like-a-diamond-detector-150601.htm>

View an article and photo gallery depicting how it was discovered that an African plant can be efficiently used as a diamond detector.

The Accidental Explorer

- <http://www.crystalinks.com/piraha.html>

Engage with interesting facts and beautiful photos of the Piraha people and their culture.

