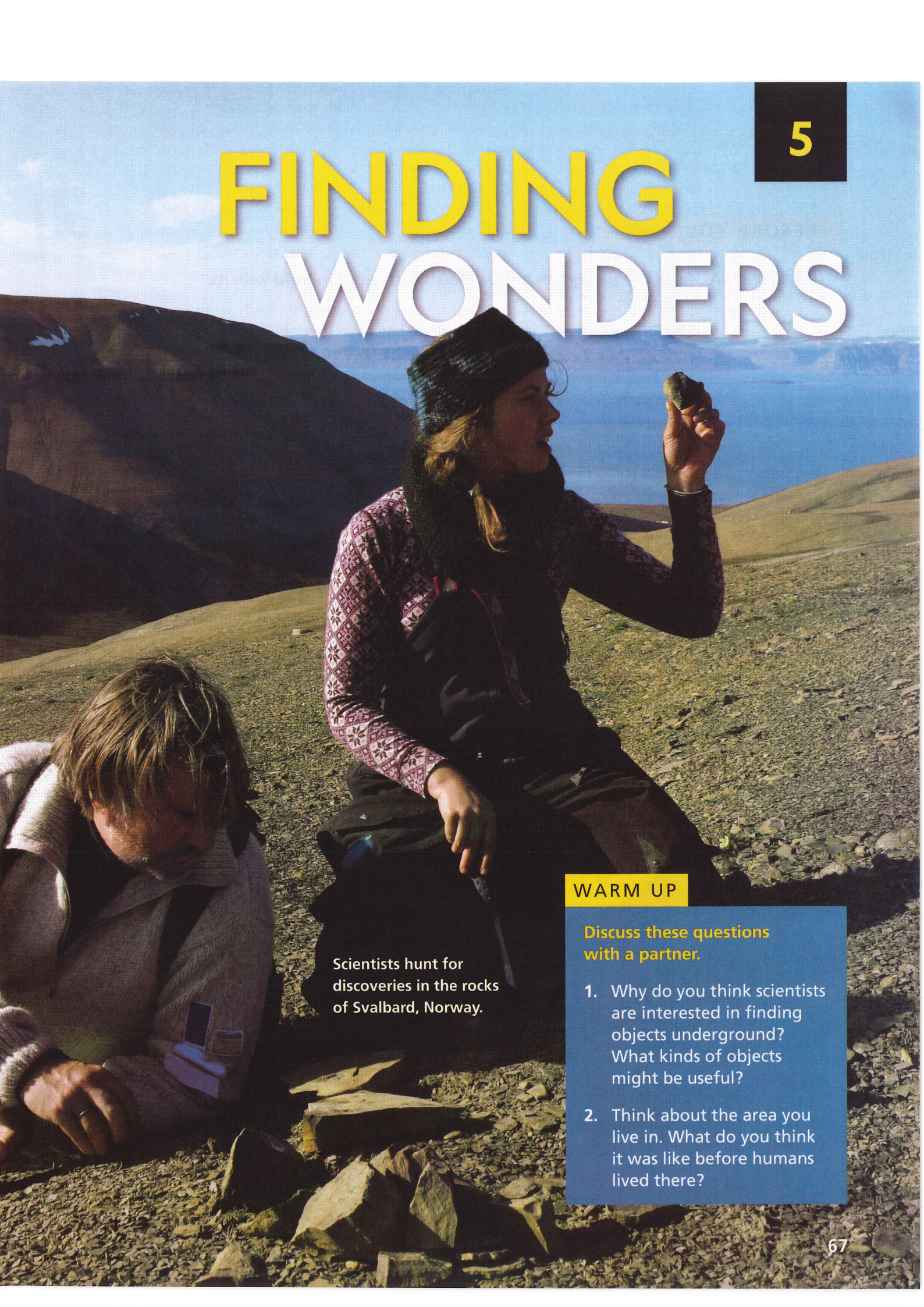


FINDING WONDERS



Scientists hunt for discoveries in the rocks of Svalbard, Norway.

WARM UP

Discuss these questions with a partner.

1. Why do you think scientists are interested in finding objects underground? What kinds of objects might be useful?
2. Think about the area you live in. What do you think it was like before humans lived there?

BEFORE YOU READ

DEFINITIONS A. Read the paragraph below. Match each word in **bold** with its definition.

The “Jurassic Coast” in south England has been described as a walk through time. Over millions of years, it has been a desert, a warm sea, and a thick forest. The changes can be seen in rock layers in cliffs along the **beach**. The coastline here is especially famous for its fossils of **extinct** animals—remains of **creatures** that died out long ago. Many are now kept in **museums**. Some have just a few bones, while others show a complete **skeleton**.

1. _____ (adj) no longer living; died out
2. _____ (n) animals (not human beings)
3. _____ (n) a sandy area along the edge of the sea
4. _____ (n) the set of bones inside an animal’s body
5. _____ (n) buildings with many cultural or scientific objects

SKIMMING / PREDICTING B. Read the first sentence of each paragraph of Reading A. Why do you think Mary Anning is remembered today? Discuss with a partner and check your ideas as you read.

▲ The cliffs and beach of Lulworth Cove form part of England’s Jurassic Coast.

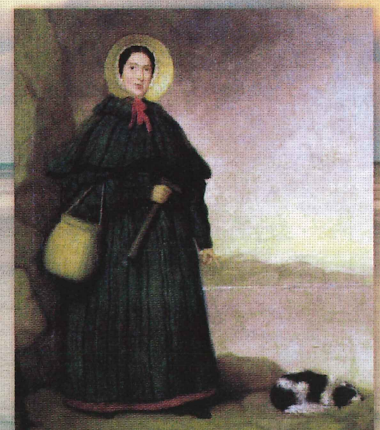
THE SECRETS IN THE SAND

- A In 1823, a young woman **noticed** a strange fossil on a beach near Lyme Regis, England. She dug out the bones and had them carried to her home. She carefully **arranged** the skeleton on a table. Then she saw something **extraordinary**. The creature's neck was a meter long—more than half the length of its body. It was unlike any animal living on Earth.
- B Even at a young age, Mary Anning had a **talent** for spotting “curies”—unusual or curious, fossils. Her father died in 1810, leaving her family **in debt**, so Mary began selling her fossils to collectors. A year later, aged just 12, she made her first **major** discovery—a crocodile-like skull¹ with a long skeleton. It turned out to be a sea creature that lived long ago. Named *ichthyosaur*, or “fish-lizard,” it was the first extinct animal known to science.
- C Fossil hunting brought in money, but it was a dangerous occupation. One day, a rock fall killed her dog and almost buried Mary. Despite the dangers, she **continued** to look for new finds. The long-necked fossil she
- uncovered in 1823 was another long-dead sea reptile.² Known as a *plesiosaur*, it would inspire legends—including that of the Loch Ness Monster. Five years later, she found a fossil with wing bones and a long tail. It was one of the first examples of a *pterosaur*—a flying creature that disappeared millions of years ago.
- D Mary was not only a skilled fossil hunter; she also carefully examined and recorded her finds. However, she received little **credit** from other scientists. Only one of her scientific writings was published in her lifetime, in 1839. She was also not allowed to join London's Geological Society, as only men could become members.
- E Mary Anning died in 1847, but her **contributions** have not been forgotten. Her finds are now **displayed** in museums in London and Paris. The beach near her home is a UNESCO World Heritage Site, known as the Jurassic Coast. Her life continues to inspire visitors hoping to find their own fossil wonders. According to Britain's Natural History Museum, Mary Anning was “the greatest fossil hunter the world has ever known.” She was also a scientist who changed the way we think about life on Earth.

¹ An animal's **skull** is the part of its skeleton covering its brain.

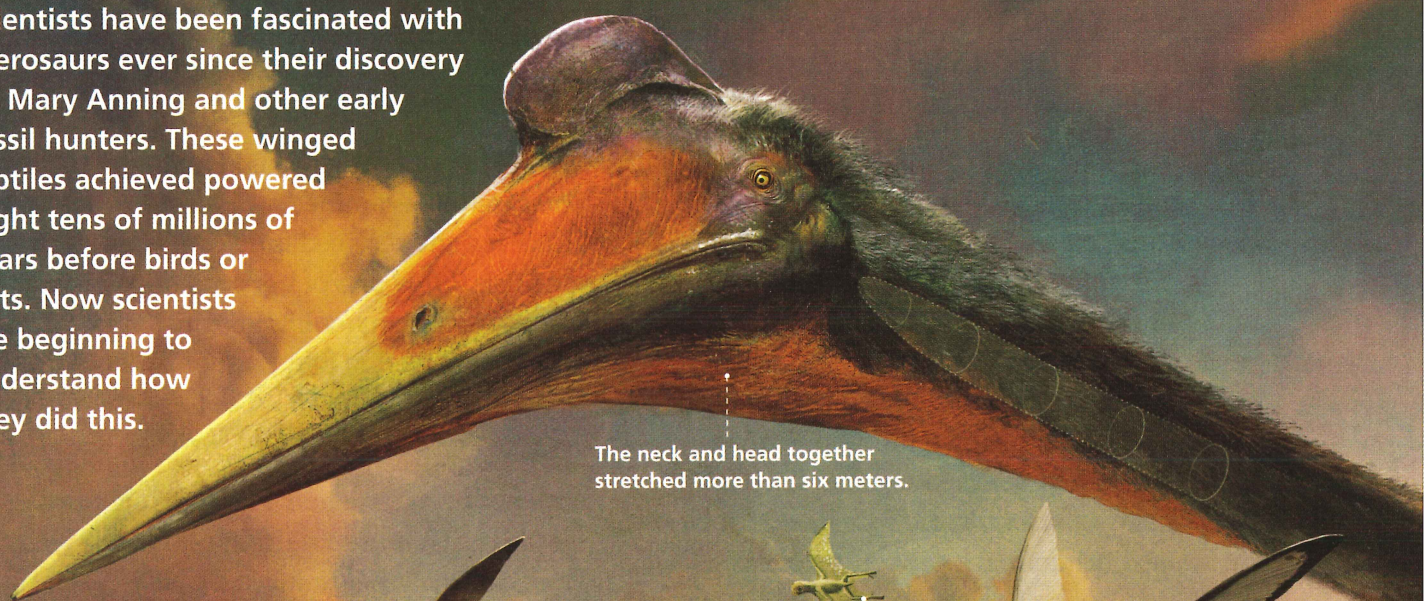
² **Reptiles** are cold-blooded animals such as snakes, lizards, and crocodiles.

➤ Mary Anning with her dog, Tray. Her life inspired the famous tongue twister: “She sells sea shells on the seashore.”

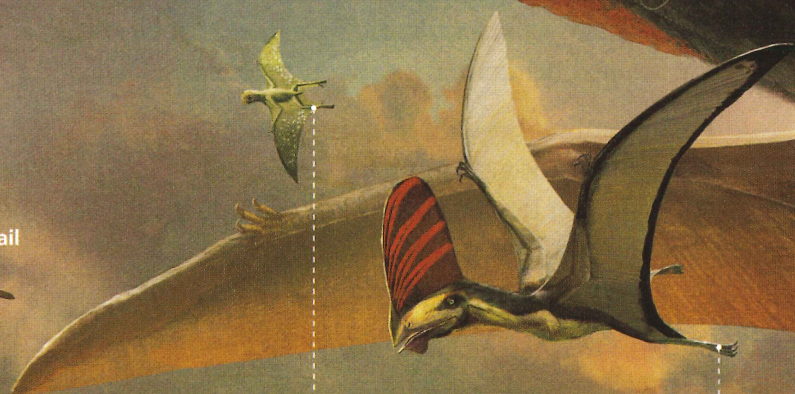
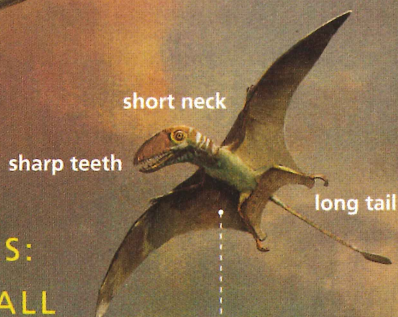


GIANTS OF THE SKIES

Scientists have been fascinated with pterosaurs ever since their discovery by Mary Anning and other early fossil hunters. These winged reptiles achieved powered flight tens of millions of years before birds or bats. Now scientists are beginning to understand how they did this.



The neck and head together stretched more than six meters.



PTEROSAURS: RISE AND FALL

Pterosaurs ruled the skies for over 160 million years. The earliest were small with long tails; later versions—like *Quetzalcoatlus*—stood as tall as giraffes. Pterosaur fossils have been discovered around the world, mostly in China, Brazil, the United States, Germany, and England.

TRIASSIC

JURASSIC

CRETACEOUS

228 mya

145 mya

PTEROSAURS

Dimorphodon
Wingspan: 1.2 m

Anurognathus ammoni
Wingspan: 60 cm

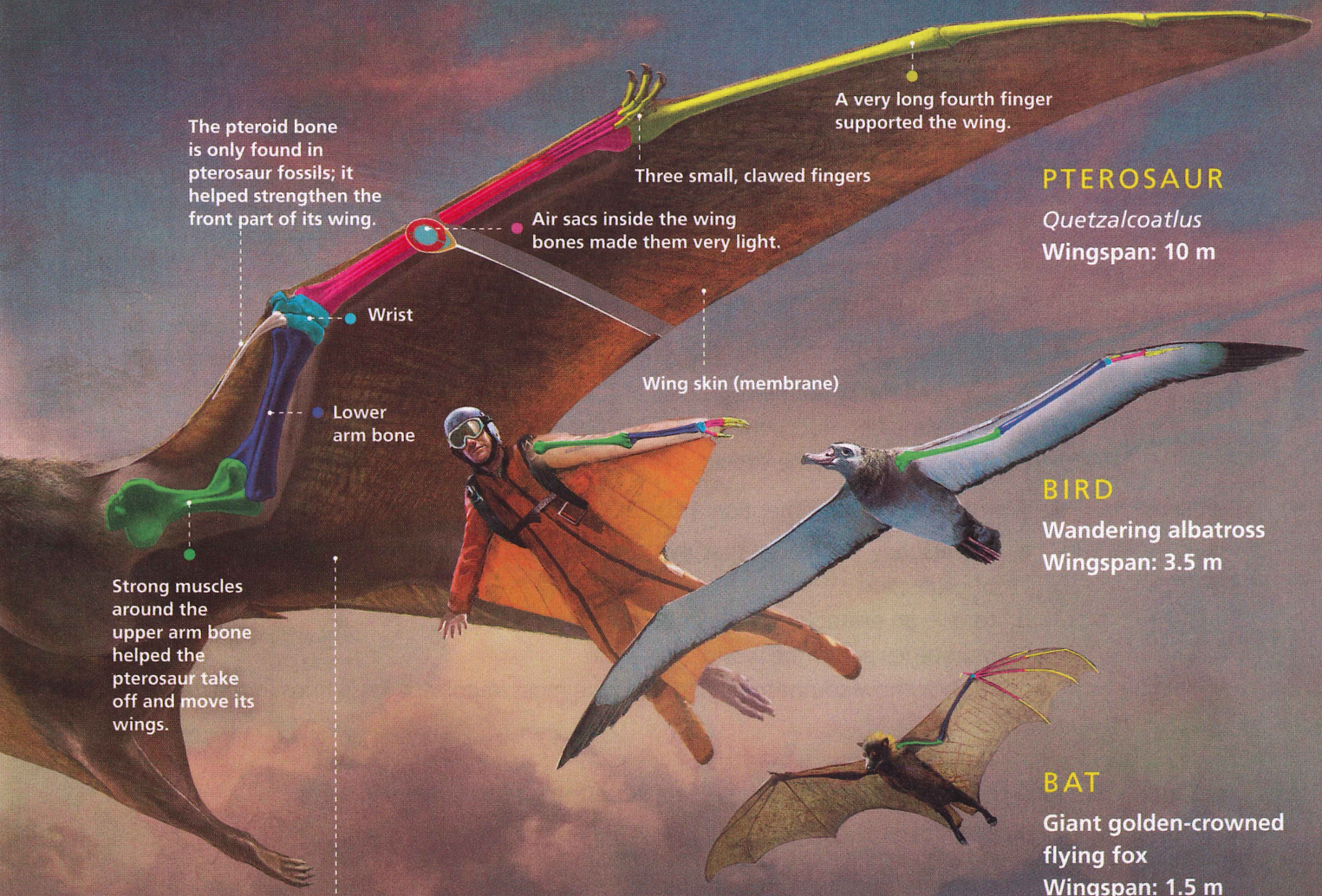
Tupandactylus navigans
Wingspan: 3 m

Mary Anning discovered the first fossil of this early pterosaur at Lyme Regis in 1828.

BIRDS

DESIGNED FOR FLIGHT

Over millions of years, pterosaurs, bats, and birds adapted the same five arm bones (color-coded here) into three different wing designs.



PTEROSAUR

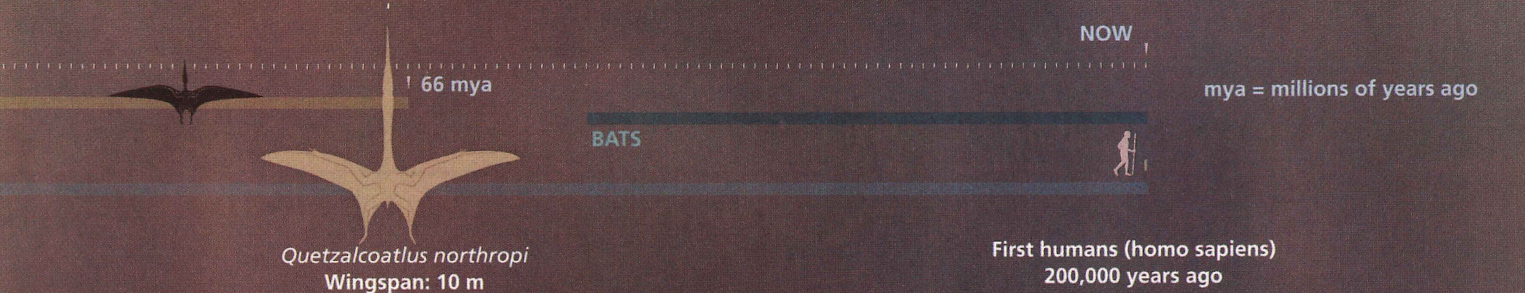
Quetzalcoatlus
Wingspan: 10 m

BIRD

Wandering albatross
Wingspan: 3.5 m

BAT

Giant golden-crowned flying fox
Wingspan: 1.5 m

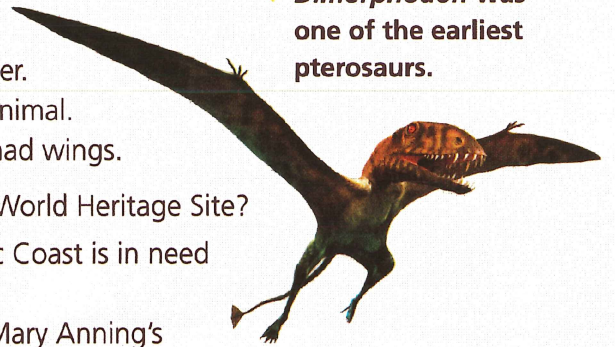


READING COMPREHENSION

A. Choose the best answer for each question.

- GIST** 1. What would be the best alternative title for the passage?
- Long-Necked Creatures from the Past
 - The World's Greatest Fossil Hunter
 - The Discovery of the First Pterosaur
- MAIN IDEA** 2. Why did Mary Anning start selling fossils?
- to earn money to support her family
 - to raise public interest in her articles
 - to gain money to start a museum
- DETAIL** 3. Which of the following is true about Mary Anning?
- She published several scientific articles in her lifetime.
 - She was nearly killed by a rock fall near the beach.
 - She was a member of the London Geological Society.
- DETAIL** 4. What is true about the pterosaur find?
- It looked similar to the Loch Ness Monster.
 - It was the first discovery of an extinct animal.
 - It showed that some extinct creatures had wings.
- PURPOSE** 5. Why does the author mention a UNESCO World Heritage Site?
- to persuade the reader that the Jurassic Coast is in need of protection
 - to give an example of how important Mary Anning's discoveries are to the world
 - to show how southern England has the most important fossil finds in the world

✓ *Dimorphodon* was one of the earliest pterosaurs.

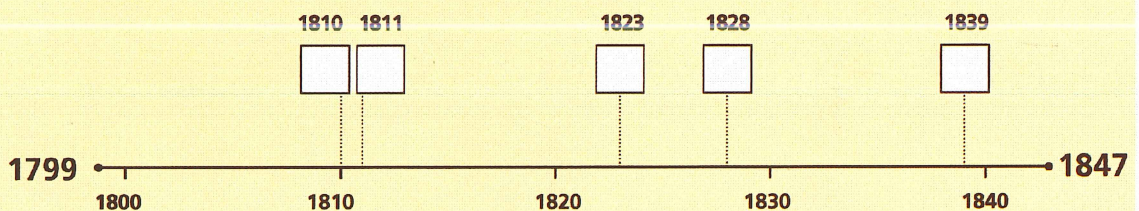


CREATING A TIMELINE

Review this reading skill in Unit 3A

B. Add the events (1–5) to complete a timeline of Mary Anning's life.

- discovers an early pterosaur
- finds a long-necked fossil
- makes her first important discovery
- only scientific writing published
- starts selling fossils to earn money



Interpreting Infographics

An information graphic (infographic) uses both text and visuals to present information about a certain topic. It may show many different kinds of information, such as images, diagrams, timelines, as well as text captions and labels. Look for information in keys, and other clues such as use of colors, to help you understand how the parts of the infographic relate to each other.

ANALYZING A. What information does the infographic *Giants of the Skies* show? Check (✓) all that are true.

- a. the features of a pterosaur wing that enabled it to fly
- b. how arm bones developed in four different animals
- c. the relationship between adult pterosaurs and their young
- d. how long pterosaurs lived on Earth compared with other animals

ANALYZING B. Check (✓) all the statements that are true for each question.

1. Look at the wing labels on the *Quetzalcoatlus*. What helped it fly?
 - a. a special bone to strengthen the front part of the wing
 - b. a long finger to support the wing end
 - c. strong muscles to help with takeoff
 - d. light feathers to control direction
 - e. air sacs to reduce bone weight
2. What can we learn from the timeline on the infographic?
 - a. The first pterosaurs lived more than sixty million years before the first birds.
 - b. Pterosaurs, birds, and bats all lived on Earth at the same time millions of years ago.
 - c. *Quetzalcoatlus* was one of the last types of pterosaur to live on Earth.

CRITICAL THINKING Analyzing Claims The writer claims that Mary Anning was “a scientist who changed the way we think about life on Earth.” What evidence is given to support this claim? Note three facts or examples from the passage.

VOCABULARY PRACTICE

COMPLETION A. Complete the information using the words in the box. One item is extra.

continue credit displayed extraordinary major noticed talent



^ *Quetzalcoatlus northropi* was a giant pterosaur.

The ¹ _____ creature pictured here, *Quetzalcoatlus*, was one of the largest flying animals of all time. An American graduate student, Douglas A. Lawson, is given ² _____ for its discovery in 1971. One day, Lawson ³ _____ a large wing bone on the ground during a visit to Big Bend National Park in Texas. Since then, only a few remains have been found, but scientists ⁴ _____ to look for more. This life-size model will be ⁵ _____ in Sheikh Jaber Al Ahmad Cultural Center, a ⁶ _____ new museum project in Kuwait.

DEFINITIONS B. Complete the definitions. Circle the correct options.

1. Someone who has **debt**, or is **in debt**, *needs to pay back / wants to give out* money to other people.
2. If you make a **contribution** to something, you *help with it / make it more difficult*.
3. Someone with a lot of **talent** *hopes / is able* to do something very well.
4. If you **arrange** objects, you place them in a *hidden location / particular position*.

WORD FORMS C. Some words, like **notice** and **credit**, can act as nouns and verbs.

Example: Did you **notice** the unusual rocks along the coastline?
The **notice** says we're not allowed to enter the beach.

Choose two words from the box. Write two sentences using each one, first as a noun and then as a verb.

find record rescue spot store

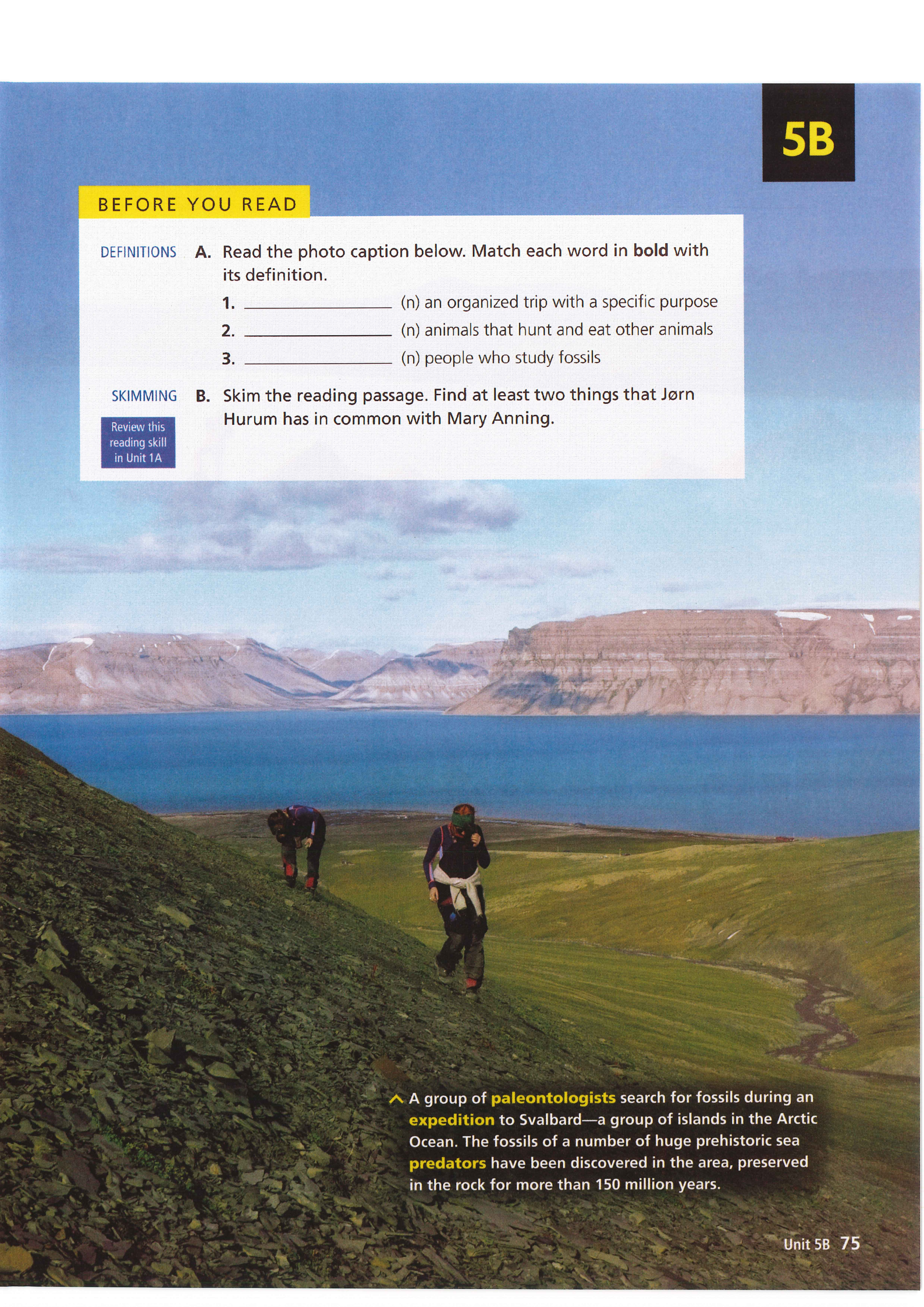
BEFORE YOU READ

DEFINITIONS A. Read the photo caption below. Match each word in **bold** with its definition.


1. _____ (n) an organized trip with a specific purpose
2. _____ (n) animals that hunt and eat other animals
3. _____ (n) people who study fossils

SKIMMING B. Skim the reading passage. Find at least two things that Jørn Hurum has in common with Mary Anning.

Review this reading skill in Unit 1A

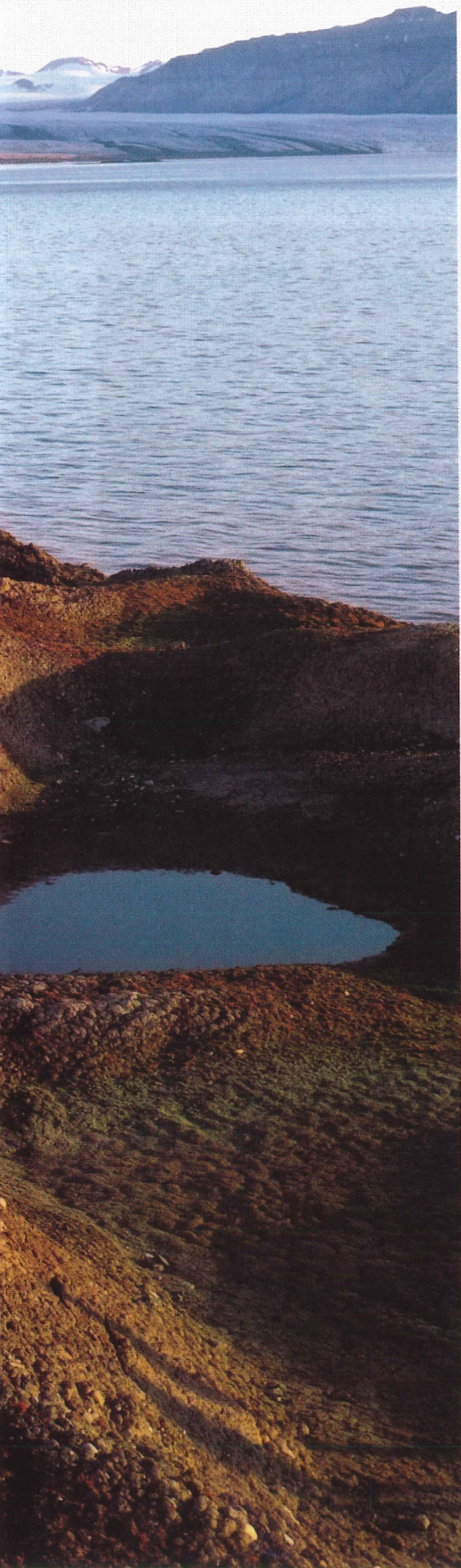


^ A group of **paleontologists** search for fossils during an **expedition** to Svalbard—a group of islands in the Arctic Ocean. The fossils of a number of huge prehistoric sea **predators** have been discovered in the area, preserved in the rock for more than 150 million years.

A photograph of a person in a red jacket standing on a large, dark, conical rock formation. The rock formation is in the foreground, and a body of water is in the middle ground. In the background, there are mountains with patches of snow under a clear sky.

THE STORIES IN THE ROCKS

▲ Jørn Hurum
on expedition



- A When he was just six years old, Jørn Hurum turned his bedroom into a small museum. His shelves became filled with a growing **collection** of fossils. For Hurum, these fossils were not just rocks, but things that could tell the history of life on this planet. He imagined them saying, “I am not a rock. I am a fossil. I have a story to tell.”
- B Hurum earned a PhD in paleontology in his native Norway. Since then, he has been on expeditions seeking fossils all over the world. Much of his work has been carried out in Svalbard, a group of Norwegian islands north of the Arctic Circle. In the hills of this cold and **remote** region, Hurum and his team have found the fossils of many sea creatures. It might seem surprising to find the remains¹ of such animals at the tops of hills, but in prehistoric times, these areas were actually seabeds about 100 meters deep.
- C Hurum has returned to Svalbard many times. The “dig season” in the region is very short—from July to August. During that time, the temperature is just about warm enough to **soften** the frozen ground, allowing easier **access** to the fossils. There is also less wind, and the “midnight sun” makes it easy for the scientists to have long, **productive** days.
- D Even a dream job has its challenges, however. “Sometimes, we find ‘explodasaurus,’” he says. The team may find many broken bone pieces spread across a hillside. Then it becomes impossible to recreate the entire animal: “We have to identify the **entire** animal from **individual** pieces.” Each of Hurum’s expeditions also requires a lot of **preparation**. “We have between 15 and 20 people, tons of equipment—food, jackhammers,² water,” he explains. “There’s a lot of work before you start the cool thing.”
- E For Hurum, the “cool thing,” is the act of discovery. In 2006, his team made its greatest discovery so far. After **removing** about 60 tons of rock by hand, Hurum and his team **eventually** dug out an enormous fossil. “We knew immediately this was something special,” says Hurum. “The large pieces of bone ... told us that this was big.” It was a plesiosaur—a prehistoric sea monster with teeth the size of cucumbers. The fossil was not complete, but it included a front flipper, a shoulder, and pieces of skull and neck.
- F For Hurum, the discovery of this 15-meter-long creature—nicknamed “Predator X”—was an amazing moment. “It’s like one of those scratch-off lottery tickets every time you dig,” he explains. “Sometimes, you start digging and you might just find part of a skull or other bone. Sometimes, you find the skull and the vertebra ... Then you know it’s a jackpot!”

¹ The **remains** of something are the parts of it that are left once it has been destroyed or taken away.

² **Jackhammers** are large tools used for breaking up rocks.

READING COMPREHENSION

A. Choose the best answer for each question.

- GIST** 1. What is the reading mainly about?
- a paleontologist who followed his dream from a young age
 - the best areas in the world to find fossils of sea creatures
 - the discovery of the largest plesiosaur ever found

- DETAIL** 2. In Svalbard, where does Hurum find most fossils?
- on the hills
 - at the bottom of lakes and rivers
 - on beaches near the sea

- DETAIL** 3. Which of the following is NOT mentioned as a reason why July to August is the best time to search for fossils in Svalbard?
- The ground is softer than usual.
 - There are long hours of daylight.
 - There is regular transport to the area.

- INFERENCE** 4. What is Hurum referring to when he mentions "explodasaurus"?
- a species of dinosaur that he wants to discover
 - the fossil of Predator X
 - fossils that are found in many pieces

- INFERENCE** 5. Why does Hurum mention "scratch-off lottery tickets"?
- to give an example of how much money the expeditions cost
 - to describe how lucky he feels to work as a paleontologist
 - to explain that you need luck to find the most amazing discoveries



^ Jørn Hurum

SCANNING B. Write short answers to the questions below. Use 2–3 words from the passage for each answer.

Review this reading skill in Unit 2B

1. How did the paleontologists remove the rock surrounding the Predator X fossil?

2. Where was the museum that Hurum created when he was a child?

3. What name is used to refer to the period in Svalbard from July to August?

4. What three examples of expedition equipment does Hurum mention?

Dealing with Unfamiliar Vocabulary (2)—Affixes

Affixes are word parts that are added to a word's base form to modify its meaning or to create a new word. Understanding the meaning of certain affixes can help you guess the meaning of unfamiliar vocabulary as you read. There are two types of affix: **prefixes** (at the beginning of a word) and **suffixes** (at the end of a word). Here are some examples with their usual meanings:

Prefix	Example	Suffix	Example
un- = not	<i>unfriendly</i>	-en = cause to be	<i>widen</i>
over- = too much	<i>overcook</i>	-er / -or / -ist = one who	<i>worker</i>
pre- = before	<i>preview</i>	-ful = full of	<i>fearful</i>
re- = again, back	<i>replace</i>	-ion / -tion = act or process	<i>attraction</i>

DEFINITIONS A. In each sentence from Reading B, underline the word that contains a prefix or suffix from the box above. Then write a short definition for the underlined word.

Example: He had wanted to be a paleontologist from a very young age.

Definition: (n) *someone who studies fossils*

1. ... in prehistoric times, these areas were actually seabeds ...

Definition: _____

2. When he was just six years old, Hurum had his own collection of fossils ...

Definition: _____

3. There is also less wind, and the "midnight sun" makes it easy for the scientists ...

Definition: _____

4. During that time, the temperature is just about warm enough to soften the ... ground.

Definition: _____

SCANNING B. Look back at Reading A. Find and write a word that contains each prefix or suffix below. Then write a sentence with each word.

1. un- (paragraph A) _____ 3. -er (paragraph D) _____

2. un- (paragraph B) _____ 4. -or (paragraph E) _____

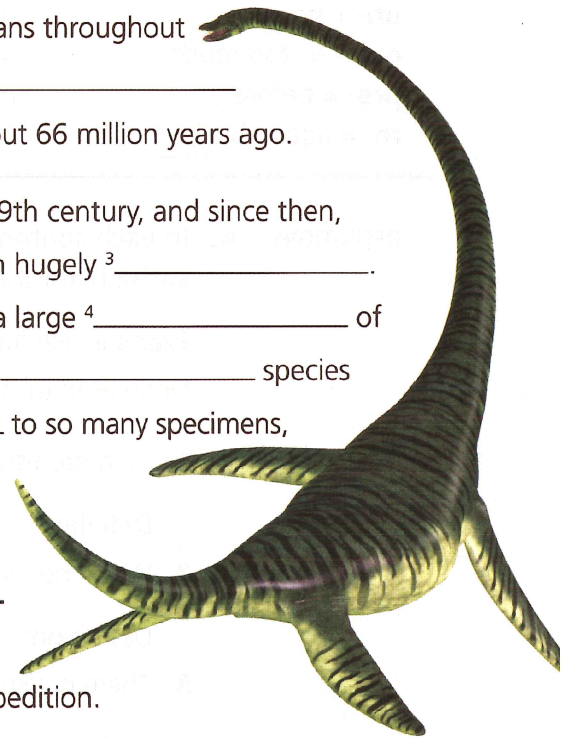
VOCABULARY PRACTICE

COMPLETION A. Complete the information using the words in the box. Two words are extra.

access (n)	collection	entire	eventually
individual	preparation	productive	remote

Plesiosaurs were a species of prehistoric marine reptile. They first appeared about 203 million years ago and became especially common during the Jurassic Period. They lived in oceans throughout the ¹_____ world, thriving until they ²_____ disappeared at the end of the Cretaceous Period, about 66 million years ago.

Plesiosaurs were discovered in the beginning of the 19th century, and since then, efforts to learn more about these creatures have been hugely ³_____. Many more discoveries have provided scientists with a large ⁴_____ of plesiosaur fossils to study, and more than a hundred ⁵_____ species have now been described. With ⁶_____ to so many specimens, paleontologists now have a fairly complete idea of what these amazing animals looked like.



COMPLETION B. Complete the sentences. Circle the correct words.

- Paleontologists need to do a lot of **preparation** / **collection** before going on an expedition.
- Fossils are often found in **remote** / **entire** regions of the world.
- Special equipment is needed to **remote** / **remove** large fossils from the ground.
- Rather than trying to recover a fossil in freezing conditions, it's best to wait until the temperature rises and the ground **removes** / **softens**.

COLLOCATIONS C. The verbs in the box are frequently used with the noun **access**. Complete the sentences using the correct form of the words.

deny	gain	provide
------	------	---------

- The new road will _____ easier access to the region's national park.
- The hackers were able to _____ access to the customers' bank account details in just a few minutes.
- I was _____ access to the website because I had forgotten my password.



DIGGING INTO THE PAST

◀ Scientist Aubrey Jane Roberts uncovers a fossil in Spitsbergen, Norway.

BEFORE YOU WATCH

- DEFINITIONS** A. The words in **bold** appear in the video. Complete the definitions by circling the correct options.
1. A **marine** reptile is an animal such as a snake or lizard that lives *in the sea / on land*.
 2. If you have a **passion** for something, you really *don't like / like* it.
 3. **Backbreaking** work involves *a lot of / very little* physical effort.
- PREVIEWING** B. Look at the information about Aubrey Roberts below that appears in the video. What words do you think complete the text? Discuss your ideas with a partner.

Name: Aubrey Jane Roberts **Job:** P_____

Location: Spitsbergen, Norway

Objective: Uncover 250-million-year-old marine reptile b_____.

Qualifications: Ability to d_____ o_____ 40 tons of earth.

Requirements: Love d_____, digging, and demolition.

WHILE YOU WATCH

GIST A. Watch the video. Check your predictions in Before You Watch B.

MULTIPLE CHOICE

B. Watch the video again. Choose the correct answer for each question.

1. What would be a suitable alternative title for the video?
 - a. How to Become a Fossil Hunter
 - b. The Dream Job of a Dinosaur Lover
2. Why did people think Roberts was unusual as a child?
 - a. because she had a great passion for dinosaurs
 - b. because she loved going on outdoor adventures
3. According to Roberts, what part of the job "makes your heart leap"?
 - a. discovering something under a rock
 - b. seeing the amazing scenery for the first time
4. What does Roberts say she loves about paleontology?
 - a. Any new discovery involves a lot of teamwork.
 - b. New discoveries are being made all the time.

CRITICAL THINKING Ranking Items

Imagine you are a member of a fossil-hunting expedition

heading to Svalbard. Which of the following items do you think will be most useful to take with you? Check (✓) the five most useful items. Share the reasons for your choices with a partner.

- | | | |
|--|--|--|
| <input type="checkbox"/> a fishing kit | <input type="checkbox"/> a gun | <input type="checkbox"/> a jackhammer |
| <input type="checkbox"/> a small radio | <input type="checkbox"/> a map of Svalbard | <input type="checkbox"/> a magnifying glass |
| <input type="checkbox"/> a medical kit | <input type="checkbox"/> a smart phone | <input type="checkbox"/> a 5 × 5 meter plastic sheet |

VOCABULARY REVIEW

Do you remember the meanings of these words? Check (✓) the ones you know. Look back at the unit and review any words you're not sure of.

Reading A

- | | | | | |
|-----------------------------------|--|--|----------------------------------|---------------------------------|
| <input type="checkbox"/> arrange | <input type="checkbox"/> continue | <input type="checkbox"/> contribution* | <input type="checkbox"/> credit* | <input type="checkbox"/> debt |
| <input type="checkbox"/> display* | <input type="checkbox"/> extraordinary | <input type="checkbox"/> major* | <input type="checkbox"/> notice | <input type="checkbox"/> talent |

Reading B

- | | | | | |
|--------------------------------------|-------------------------------------|---------------------------------|--------------------------------------|--------------------------------------|
| <input type="checkbox"/> access* | <input type="checkbox"/> collection | <input type="checkbox"/> entire | <input type="checkbox"/> eventually* | <input type="checkbox"/> individual* |
| <input type="checkbox"/> preparation | <input type="checkbox"/> productive | <input type="checkbox"/> remote | <input type="checkbox"/> remove* | <input type="checkbox"/> soften |

* Academic Word List