SUE's World

3rd-5th Grade
NGSS: 3-LS4-1

Background

Lesson Description

Through this lesson, students learn how scientists use fossils to recreate what the world was like long ago. Students investigate the Cretaceous period and the life and environment of SUE the *Tyrannosaurus rex* by studying fossils found in the Hell's Creek formation of the western United States.

Driving Phenomenon

Tyrannosaurus rex (or *T. rex*) is the dinosaur that has captured the imagination of every dinosaur loving child and adult, for good reason, too. *T. rex* was the largest predator in North America during the Cretaceous period. It terrorized the landscape stalking beasts like *Edmontosaurus* that were as big as *Hippopotamus*, and it went toe to toe with the *Triceratops* which were larger than an African elephant. This extremely fierce predator ruled the top of the food web, but that did not mean that it lived an easy life.

One fossil has been very important to our knowledge of the Cretaceous forest ecosystem, and it's located at the Field Museum in Chicago. **By studying this extremely well preserved and complete specimen and the other fossils found near it, paleontologists have been able to reconstruct SUE's world in vivid detail.** As students explore SUE and the other fossils, they will answer some of their own questions about what this ancient ecosystem and the organisms that lived there.

Driving Questions

- How do we know what SUE's world was like?

Learning Objectives

- Students will demonstrate their understanding of how fossils provide evidence of organisms that lived long ago by describing and modeling.
- Students will demonstrate their understanding of what types of environments those organisms lived in by modeling environments by analyzing and interpreting date based on fossils.

Time Requirements

- Four 40-50 minute sessions

Prerequisite Knowledge

- Living things have needs for survival such as food, water, and air. The habitat where they live can meet their needs.
- Different types of plants and animals live in different types of habitats and environments.

Teacher Resources

1. SUE the *T. rex* KWEL Chart
2. SUE Question Exit Slips
3. Cretaceous Station Data Sheets

Student Resources

1. Adaptation from : A Dinosaur Named Sue: The Story of the Colossal Fossil
2. Fossil Investigation Tool
3. Size and Scale
4. SUE's World Model

A note about pronouns

Because internal organs are the only sure way of knowing the sex of an animal, and internal organs do not last 67 million years, scientists will probably never know for sure whether SUE was a male or female *T. rex*. Since we do not know SUE's biological sex, we refer to SUE as "they" instead of "she." It's the same way that we refer to someone whose gender we do not know. — "Someone left their backpack on the bench—they're probably worried." or "This assignment has no name, I won't be able to give them credit for their work."

How do we know what SUE's world was like?

Engage | 40 minutes	
Learn about the discovery of the largest, most complete *T. rex*, and ask questions that will lead to additional investigation. Discuss how to ask scientifically relevant questions and revise questions accordingly.	Notes
Teacher Resource: 1 & 2 Student Resource: 1	
Explore A | 40 minutes	
Students rotate through stations to investigate and record observations from various types of fossils that help us know what SUE's world was like.	Notes
Teacher Resource: 3 Student Resource: 2	
Explore B | 30-40 minutes	
Take a field trip to the Field Museum to visit the largest, most complete *T. rex* fossil ever found, and record observations about their life and environment.	Notes
Teacher Resource: Student Resource: 2	
Explain | 25 minutes	
After a sharing what they learned from the prior exploration and what evidence they found to acquire this new knowledge, students will explore how big SUE was compared to the other animals in their habitat.	Notes
Student Resource: 3	
Elaborate | 45 minutes	
Students synthesize a model of SUE's world from the data gathered previously.	Notes
Student Resource: 4	
Evaluate | 20 minutes	
Students present their model to the class via gallery walk.	Notes

Pre-Lesson Preparation

Materials Preparation

- Create a large K.W.E.L. chart that can be used with the class throughout the duration of the lesson either on the board or on chart paper.
- Print and cut SUE Question Exit slips
- Set up Cretaceous Stations using Teacher Resource 4
  - Station 1: Plants
  - Station 2: Water Animals
  - Station 3: Other Creatures
  - Station 4: Sue's Dinosaur Neighbors
- Student Resources: print one copy for each student; hand out each resource as it becomes relevant during the lesson.
- Gather drawing materials or art/craft supplies for students to create their models.

Notes

Cretacaceous Station Image Credits

Station 1: Plants

All images © Field Museum, Illustrations by Velizar Simeonovski

Station 2: Water Animals

All images © Field Museum, Illustrations by Velizar Simeonovski
Except tooth of Galagodon nordquistae © Terry Gates, Used with permission.

Station 3

All images © Field Museum, Illustrations by Velizar Simeonovski

Station 4

All images © Field Museum
Marginocephalian, Anzu, Thescelosaurus by Velizar Simeonovski
Triceratops and Edmontosaurus by Atlantic Productions

Lesson Enrichment Ideas

DO

Plan a trip to see the largest and most complete *Tyrannosaurus rex* ever discovered, SUE. Along with SUE's fossil, students will encounter additional fossils from the Cretaceous forest and riverbank SUE called home and new scientific discoveries that help bring more depth to Sue's story.

Utilize the 3D model of SUE the *T. rex* at the SUE Station:
fieldmuseum.org/educators/learning-resources/3d-model-tyrannosaurus-rex

Check out specimens and bring them to your classroom. If you live in the Chicago area, the *N. W. Harris Learning Collection* at the Field Museum offers numerous specimens that can be rented for study in the classroom. Two experience boxes that pair with this lesson:

- *T. rex* Named SUE
- Dinosaurs in the Cretaceous

READ

A Fresh Makeover for SUE
Learn about updates that SUE the *T. rex* received during their recent move, and some of the scientific discoveries that informed those updates.
https://www.fieldmuseum.org/blog/fresh-science-makeover-sue

A Dinosaur Named Sue the Story of the Colossal Fossil
by Pat Relf and the Field Museum Science Team
The article included in this lesson is from this book which provides many details about how Sue went from South Dakota to Chicago, IL.

WATCH

A Changing View of T. rex
Paleontologists are constantly learning new things about *T. rex* because they find new ways of investigating the fossils. Watch this video to see how are view of *T. rex* has change in the past 100+ years.
https://vimeo.com/50162654

Why Make a Cast of SUE?
Dig deeper into preparation and mounting techniques for fossils, and help students understand that some dinosaur fossils are the real thing and some are models created to share with a wider audience.
https://vimeo.com/34672509

Procedure

Engage

1. Pass out copies of the article Student Resource 1: A Dinosaur Named SUE: The Story of the Colossal Fossil to each student, and either read aloud or allow individual reading time according to how your class would best engage this material.

2. After reading invite the students to respond to the comprehension questions at the end of the article individually.

3. Transition to a full class discussion of the following questions:
   - How would you have felt to find a discovery as big as this?
   - Do you think that Susan Hendrickson's discovery was smart, lucky, or both? Why?
   - It took many scientists, mount makers, and preparators three years to get the SUE the *T. rex* fossils ready for display and research. How old were you three years ago? How were you different then? Imagine spending that long working on one job, everyday. Would you like that work?
   - Now imagine that you are one of the scientists studying SUE's fossils. What questions would you ask about these fossils or the *T. rex*'s life?

4. Start a class KWEL chart (See Teacher Resource 1 for an example) to record thoughts, questions, and observations throughout the lesson. KWEL stands for **Know, Wonder, Evidence, Learned**.

5. Begin by inviting students to share what they think they already **Know** about SUE the *T. rex*. Invite students to share facts they learned from the story, or might know from prior experiences.

6. Next record students' questions, or **Wonder** statements about SUE the *T. rex*. What are they wondering about the *T. rex* fossil or the *T. rex*'s life?

7. Thank the students for sharing their questions, and let them know that the class will review these questions again. In the next session, they will determine if their questions are are scientifically relevant and how they can become more scientifically relevant.

Optional Lesson Break

Engage

8 Begin this portion of the lesson with the KWEL chart at the front again. Remind the students, during the last session they read about how the fossil of SUE the *T. rex* was discovered and what questions our class would investigate about that fossil.

9 Ask the students to think-pair-share about the following questions with regard to the list of questions on the KWEL chart:

- What makes a question relevant to science?
- Would these questions be relevant to science?

10 Invite the pairs to share what they discussed. Answers will vary; record students' ideas on the board as they are shared. Listen for responses that include the following concepts. If any of the above are left out of the student generated ideas, you can present them and review all three concepts before moving on.

	Scientifically relevant questions are:
	Answerable through testing variables, making observations, and gathering data.
	Focused on a phenomena of the natural world.
	Not about opinions, feelings, or beliefs.

11 Share that even though all of the questions that brainstormed earlier are interesting to at least one person in the class, the questions can be reviewed and revised to make them scientifically relevant for this investigation of SUE the *T. rex*.

12 Ask students to reread the questions on the KWEL chart. Then, go down the list to each question and have the class evaluate if they meet each of the criteria that were just named. Use color-coded dots or post-its to record the criteria for each question. Do any of them already meet the three requirements? Circle or highlight the ones that are that do meet the requirements.

13 Assign students to groups and assign each group one to two questions to review and revise to a scientifically relevant question.

14 Have each group share out their revised questions, and record them onto a master list for the class.

Engage

15 Pass out a *My Question About SUE Exit Slip* (part of Teacher Resource 2) to each student. Allow time for students to think and choose which question they would like to explore. Invite them to write down any of the scientifically relevant questions from the revised list that they would like to investigate and why that question interests them. Collect the Exit Slips. You can use information on the exit slips as an insight into where students' interests lie; they can also be helpful in matching up groups for further exploration or field trips.

16 Share that even though all of the questions that brainstormed earlier are interesting to the class, the questions can be reviewed and revised to make them scientifically relevant for this investigation of Sue the *T. rex*.

17 Ask students to reread the questions on the KWEL chart. Then, go down the list to each question and have the class evaluate if they meet each of the criteria that were just named. Use color-coded dots or post-its to record the criteria for each question. Do any of them already meet the three requirements? Circle or highlight the ones that are that do meet the requirements.

18 Assign students to groups and assign each group one to two questions to review and revise to a scientifically relevant question. Invite the groups to review their question or questions and revise them against the three standards that are listed in the chart above. If the question is not meeting one or more criteria, they should rethink and revise that question to meet those three targets.

19 Have each group share out their revised questions, and record them onto a master list for the class.

20 Pass out *My Question About SUE Exit Slip* (part of Teacher Resource 2) to each student. Allow time for students to think and choose which question they would like to explore. Invite them to write down any of the scientifically relevant questions from the revised list that they would like to investigate and why that question interests them. Collect the Exit Slips. You can use information on the exit slips as an insight into where students' interests lie; they can also be helpful in matching up groups for further exploration or field trips.

Explore A (non field trip)

1. Pass out Student Resource 2: Fossil Investigation Guide to each student.
2. Tell students that the fossils they will be investigating are real specimens from the Field Museum in Chicago. These fossils were found near SUE's fossil, and they are important evidence that allowed scientists to answer many questions they had about how Sue lived during the Cretaceous time period 66 million years ago.
3. If any of your class list of questions focus on what SUE was like when they were living or the environment/habitat where Sue lived review them now and help students connect that they are about to investigate fossils that will help them address these questions.
4. Instruct students to spend time at each station and add information to their Fossil Investigation Guide to help complete SUE's world. Students should spend eight to ten minutes at each station. This can be adjusted to fit the class period.
5. Review each station focus with the class before beginning the rotation.
6. Explain to students that we will review and further analyze our observations in the next class session.

Explore B (at the Museum)

1. Prior to the field trip, prepare students by informing them that they will investigate their questions about SUE by examining fossils and objects in the SUE Experience at the Field Museum. All of the objects and specimens in that gallery are from when and where Sue lived, and they have helped scientists answer their questions about Sue's world.
2. Once at the museum, make sure each chaperone has enough copies of page 5 (SUE Investigation) from Student Resource 2: Fossil Investigation Guide to pass out to their group when they visit the SUE the *T. rex* gallery in the Griffin Halls of Evolving Planet.
3. Allow students time to explore the gallery and record observations about the fossils and replications that they find in the exhibit.
4. Have chaperones collect the Fossil Investigation Guide from each student as they leave the gallery and return them to you.

Lesson Options

Explore A or Explore B?

If you cannot make it to the museum follow the **Explore A** procedure.

If you are planning a field trip to see the Sue the *T. rex* in the Griffin Halls of Evolving Planet follow the **Explore B** procedure.

Either of these procedures scaffolds the Explain, Elaborate, and Evaluate portions of this lesson.

Explain

1. Pass back each copy of Student Resource 2: Fossil Investigation Guides to their respective authors.
2. Elicit student input, based on their investigations at the stations or the museum, to complete the class KWEL chart.
3. Students will share something that they **Learned** about SUE or SUE's world and what **Evidence** they observed from fossils/objects that allowed them to know that.
4. Pass out Student Resource 3: SUE's World Size and Scale. This activity is meant to help students think about how to represent different organisms in relation to one another. Explain that this is a model showing the size relationships between a *Tyrannosaurus rex* and a *Triceratops horridus*. Students will add an additional plant or animal to the scale model based upon an object or specimen that they studied during the prior investigation.
    a.) If they focused their study on a particular aspect of SUE, then they can add that part directly over the outline of the SUE body shape.
    b.) All other organisms can be added to the side based upon the grid measurements.

Size and Scale Reference

Explain | Step 4

Tyrannosaurus rex

Height: 15 to 20 feet
Length: 40 feet
Weight: 5 to 7 tons
Skull: 5 feet

Triceratops horridus

Height: 12 to 15 feet
Length: 30 feet
Weight: 5 to 6 tons
Skull: 3 to 4 feet

Elaborate

1. Tell students they will create a model to explain what they learned about their SUE question during the investigation.
2. Pass out Student Resource 4: SUE's World Model to each student.
3. Give students time to complete their models based on the information they collected. Students should add drawings or written descriptions from each station to create a two dimensional representation of SUE's environment. If time permits, students can create various types of models including three dimensional models, stories, or kinesthetic models.
4. Once students have completed their models, organize students into small groups to share and discuss their models. Students should then take time to revise their models based on peer feedback and discussion.
5. Creatively extend the models by making a travel poster for the Cretaceous riverside forest that highlights all of the features of the environment, or allowing groups to create a skit about different environmental roles and characters of SUE's world.

Alternative Approach

Elaborate | Step 3-5

Alternative approach: Allow students to work in small groups to develop their model. Assign roles such as curator, designer, science communicator to encourage students to take on different perspectives in the project.

Evaluate

1. Tell students that they will share their models with the class through a gallery walk.
2. When presenting their model, prompt students compare their initial ideas about SUE's world with the newest version of their model.
3. Students can use their models to describe what they have learned throughout the investigation and what evidence shaped their thinking.

Sue the *T. rex* KWEL Chart

Teacher Resource 1.0

K	W	E	L
Share what we think we already **know** about SUE the *T. rex*.	What are we still **wondering** about SUE the *T. rex*	What **evidence** did we find about SUE the *T. rex*?	What have we **learned** about SUE the *T. rex*?

Teacher Resource

Sue Question Exit Slip Copy Master

Teacher Resource 2.0

Copy this page and cut along the dotted lines to prepare exit slips.

What question do you have about SUE the *T. rex*? You may choose one from our class list, or write a new one.

_____

_____

What question do you have about SUE the *T. rex*? You may choose one from our class list, or write a new one.

_____

_____

What question do you have about SUE the *T. rex*? You may choose one from our class list, or write a new one.

_____

_____

What question do you have about SUE the *T. rex*? You may choose one from our class list, or write a new one.

_____

_____

What question do you have about SUE the *T. rex*? You may choose one from our class list, or write a new one.

_____

_____

Station 1:

Plants of the Cretaceous forest and riverside

Teacher Resource

Ferns

Cladophlebis sp.

Fossil Clues

Location found: South Dakota (with SUE)
Field Museum record number: PP45631
Notable features: adult form fern leaves

Modern Day Connection

Modern Cycad plants are all found in tropical areas. They definitely prefer warm environments. All modern cycads are considered threatened species. They can be confused with palm trees because of their leaves and where they are found, but they are not closely related.

What the clues tells us

Cycads in SUE's world indicate that it was warmer than it is now. Cycads may have provided food for some of the herbivores in that environment.

Fossil Clues

Location found: South Dakota (with SUE)
Field Museum record number: PP45626
Notable Features: leaves

Modern Day Connection

Ferns were some of the earliest plants to show up on land, and they can still be found today. Ferns do not reproduce from seeds. They produce tiny particles called spores. The spores grow into an alternate form of the plant called a gametophyte. If this form of the plant lives in a moist, sheltered environment it has a good chance of fertilizing and moving into the adult stage.

What the clues tells us

For ferns to be growing here, there must have been a lot of moisture or a water source like a stream or small river. There may have been shelter from large trees to protect the gametophyte.

Cycads

Nilssonia yukonensis

Station 1:

Plants of the Cretaceous forest and riverside

Teacher Resource

Conifer Tree

Metasequoia occidentalis

Fossil Clues

Location found: South Dakota (with SUE)
Field Museum record number: PP45613
Notable features: seed cone

Modern Day Connection

Modern *Metasequoia* is known to be sensitive to changes in rainfall, humidity, and temperature. It has even been used to predict past climate change.

What the clues tells us

Finding a fossilized Metasequoia near SUE tells us that South Dakota was warmer and wetter in the past. This would have helped lots of green leafy plants grow. This would also serve as food for other dinosaurs that ate plants.

Fossil Clues

Location found: South Dakota (with SUE)
Field Museum record number: PP45610
Notable Features: leaf impression

Modern Day Connection

Sycamore trees today have a characteristic look with its patchy bark of grey and white. It serves an important role to the ecosystem by providing a home to many small animals such as birds, rodents, and insects.

What the clues tells us

The ancestors of modern day sycamores may have provided natural homes and hiding places for the small animals of SUE's World.

Sycamore Relative

Platamites marginata

Station 1:

Plants of the Cretaceous forest and riverside

Teacher Resource

Conifer Tree

Sequoia dakotensis

Fossil Clues

Location found: South Dakota
Field Museum record number: PP45653
Notable features: pine cone

Modern Day Connection

Modern day Sequoia trees are almost exclusively found in the Pacific northwest coastal areas of the United States. They thrive in temperate (not too hot, not too cold) climates with lots of humidity and moisture in the air.

What the clues tells us

Today South Dakota is dry and desert-like, but when Sue was alive it was wet.

Fossil Clues

Location found: South Dakota (with SUE)
Field Museum record number: PP45609a
Notable features: large round leaves

Modern Day Connection

With its roots hanging down into the water below, modern Pistia is found floating in many tropical lakes and quiet, slow-flowing rivers.

What the clues tells us

The presence of these fossilized plants at the SUE excavation site tell us that South Dakota was warmer and wetter a long time ago.

Water Lettuce

Pistia corrugata

Station 2:

Water animals

Teacher Resource

Turtle relative

Cedrobaena putoris

Fossil Clues

Location found: South Dakota
Field Museum record number: PP258
Specific Features: skull

Modern Day Connection

This skull belongs to a now-extinct family of turtles (Baenidae) that lived only in North America during the Cretaceous period.

What the clues tells us

Finding so many turtle fossils near SUE helps confirm that they died near water, probably very near a water source.

Soft-shelled turtle

Trionyx sp.

Fossil Clues

Location found: South Dakota
Field Museum record number: PR673
Specific Features: Cast of a nearly complete animal

Modern Day Connection

This is a cast of a nearly complete soft-shelled turtle fossil. Soft-shelled turtles live in freshwater environments where there is little to no current. They are well adapted to swimming on the muddy bottom of the stream or lake. They typically eat fish and other aquatic invertebrates.

What the clues tells us

Finding so many turtle fossils near SUE helps confirm that they died near water that was rich in aquatic life.

Station 2:

Water animals

Teacher Resource

Small Shark

Galagodon nordquistae

Fossil Clues

Location found: Montana
Field Museum record number: PF17083
Specific Features: gar fish scales

Modern Day Connection

There are still several species of Gar fish living in North America today, though human activity is negatively affecting their homes in lakes and rivers. These fish are long and slender like a spear, and they have an extra-long jaw filled with sharp teeth. They are voracious hunters of smaller fish in their habitat.

What the clues tells us

Finding the scales of a predator such as the gar tells us that the water near where SUE died was full of life.

Fossil Clues

Location found: South Dakota (with SUE)
Field Museum record number: PF15778
Specific Features: shark tooth

Modern Day Connection

Some shark species can live in fresh or saltwater. This tiny tooth was found in the rock that surrounded Sue's bones. Preparators found it by running the left over rocks and dirt through screens to identify the remains. Since sharks don't have bony structures that can fossilize, often all that remains of them are teeth.

What the clues tells us

Finding the remains of this saltwater species near SUE's bones indicates that the river fed into a shallow sea.

Gar fish

Lepisosteidae sp.

Station 2:

Water animals

Teacher Resource

Freshwater Ray

Myledaphus sp.

Fossil Clues

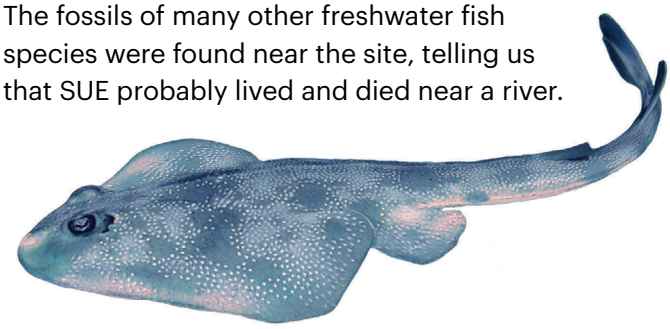
Location found: South Dakota (with SUE)
Field Museum record number: PF15313
Specific Features: ray tooth

Modern Day Connection

Like sharks, various ray species can live in fresh or saltwater. This tooth belonged to a freshwater ray.

What the clues tells us

The fossils of many other freshwater fish species were found near the site, telling us that SUE probably lived and died near a river.



Station 3:

Animals of the forest and riverside

Teacher Resource

Lizard

Palaeosaniwa sp.

Fossil Clues

Location found: South Dakota (with SUE)
Field Museum record number: PR2381
Specific Features: arm bone

Modern Day Connection

Scientists are still trying to discover what animals this lizard is closely related to, but their hypothesis is modern day Monitor lizards and Gila monsters.

What the clues tells us

This was probably a lizard that ate smaller creatures like the ground squirrel and small amphibians. However, it probably was food for some of the smaller carnivorous dinosaurs in the area.

Pterosaur

Quetzalcoatlus northropi

Fossil Clues

Location found: Texas
Field Museum record number: PR1077
Specific Features: finger bone

Modern Day Connection

Imagine if your finger bones were as long as your arm bones! Long finger bones were important to pterosaurs' wing spans. Pterosaurs' wings were formed by skin that stretched across the span between their finger and arm bones, and sometimes the skin stretched all the way down the side of their body to their feet. *Quetzalcoatlus* is considered the largest animal to have ever flown.

What the clues tells us

Pterosaurs were not dinosaurs, but they lived during the same time as the dinosaurs. Pterosaurs are flying reptiles that often ate fish or other small prey.

Station 3:

Animals of the forest and riverside

Fossil Clues
Location found: South Dakota (with SUE)
Field Museum record number: uncatalogued
Specific Features: skull cast

Modern Day Connection
Opossums in the present day get a bad rap for eating human garbage and lurking in shadows. However, when you think about the fact that these animals have been around for over 100 million years, and have survived mass extinction they must have some pretty successful survival habits.

What the clues tells us
Mammals have been around for a very long time in the fossil record, but they did not develop as much diversity as dinosaurs until after the dinosaurs went extinct.

Oppossum-sized mammal

Didelphadon vorax

Teacher Resource

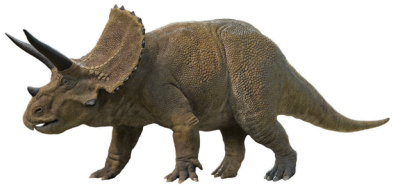
Station 4:

Sue's Dinosaur Neighbors

Teacher Resource

Horned dinosaur

Triceratops horridus



Fossil Clues

Location found: South Dakota (near SUE)
Field Museum record number:
Specific Features: triceratops tooth

Modern Day Connection

Triceratops was one of the most common dinosaurs in North America during the Late Cretaceous period. It was not surprising to find a Triceratops tooth near SUE. Big, dramatic frills and sharp pointy horns set dinosaurs like Triceratops apart from other dinosaurs.

What the clues tells us

Triceratops was the size of a modern day African elephant, and they roamed the land grazing similar to the way elephants do today, probably eating a lot of cycads and ferns.

Fossil Clues

Location found: South Dakota (with SUE)
Field Museum record number: PR2390, PR2385, P15004
Specific Features: toe bone, skull bone, skull cast

Modern Day Connection

Edmontosaurus are sometimes called the cattle of the Cretaceous period. They roamed in herds and ate a lot of vegetation similar to the was cows can today. The front of Edmontosaurus' mouth had a beak-like structure that helped it clip bits of leaves from plants.

What the clues tells us

Edmontosaurus was a prey of *T. rex*.

Hadrosaur dinosaur

Edmontosaurus annectens

Station 4:

Sue's Dinosaur Neighbors

Teacher Resource

Marginocephalian dinosaur

Pachycephalosaurus wyomingensis

Fossil Clues

Location found: Montana
Field Museum record number: PR4975
Specific Features: skull

Modern Day Connection

Pachycephalosaurs have very thick skulls. Some paleontologists think that they may have engaged in head-butting behaviors similar to the way that moden bighorn sheep might ram each other over territory or mates.

What the clues tells us

The skull shows that this animal had different kinds of teeth in its mouth indicating that it had a diverse diet of seeds, fruit, and insects.

Theropod dinosaur

Anzu wyliei

Fossil Clues

Location found: South Dakota
Field Museum record number:
Specific Features: vertebra

Modern Day Connection

Anzu possessed a prominent crest on its head similar to Cassowary birds of today, and it is thought to have been feathered. However, it's not a dinosaur in the avian group that is directly related to modern birds.

What the clues tells us

Scientists think it could run fast on powerful legs, and was probably an omnivore eating both plants and smaller animals.

Station 4:

Sue's Dinosaur Neighbors

Teacher Resource

Armored dinosaur

Ankylosaurus

Fossil Clues

Location found: South Dakota

Field Museum record number: PR2397

Specific Features: vertebral

Modern Day Connection

What the clues tells us

Ankylosaurs head armored plates to protect it from predators like *T. rex*.

Adaptation from: A Dinosaur Named SUE: The Story of the Colossal Fossil

Student Resource 1.0

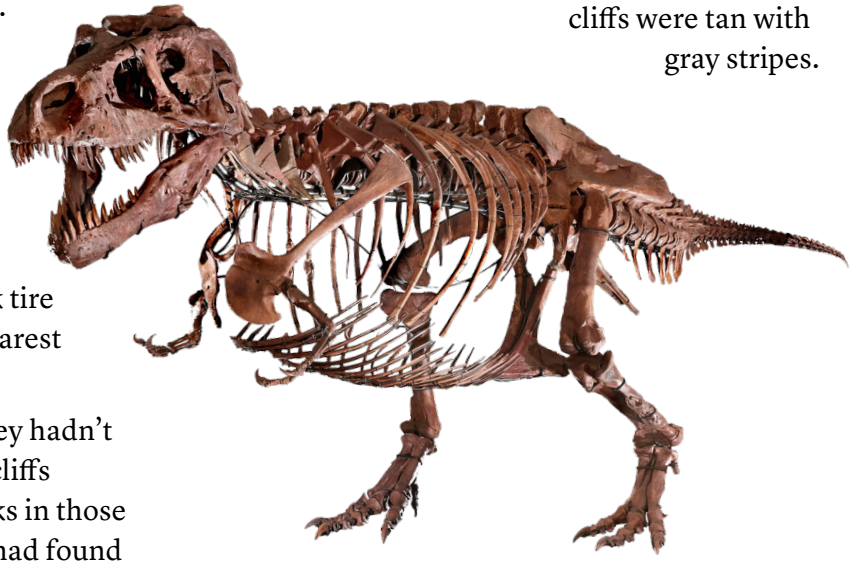
The Discovery

Susan had spent all summer finding fossils. She worked with a group of fossil hunters. Fossils are the preserved remains of plants or animals that lived long ago. The group was hunting for fossils in South Dakota. Everyday, they searched for fossils, like dinosaur bones, in the cliffs. They had found many fossils this summer such as a duck billed dinosaur named *Edmontosaurus*.

Now it was the end of the summer and group's work was almost finished. The group was packing up to go home. Right before they were ready to leave, their truck tire got a flat! Everyone decided to go to the nearest town to fix the tire. Everyone but Susan.

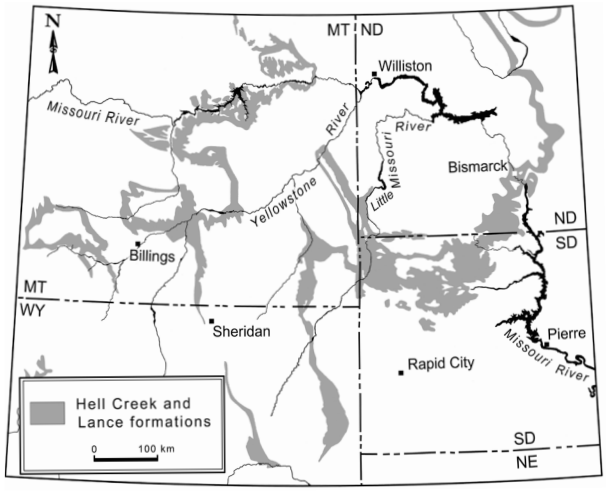
Susan had an idea. There was one place they hadn't looked for fossils yet. She could see these cliffs across the valley and could tell the the rocks in those cliffs were similar to the rocks where they had found other dinosaur fossils. She decided to walk there with her golden retriever, Gypsy. Even though she could see these cliffs across the valley, they were seven miles away. It took her and Gypsy two hours to walk there through foggy weather.

By the time they arrived at the cliffs, the fog was gone and the sun was out. Susan walked close to the cliffs to look for fossils. The rock cliffs were tan with gray stripes.



She knew that fossils were brown though, so she looked for those. After looking for 15 minutes, Susan saw something. On the ground there were small brown pieces of bone! Susan looked up the cliff to see where the pieces of bone had come from. Eight feet up she saw more bones sticking out of the cliff.

Susan was excited. She climbed up and looked at them. The bones sticking out the cliff were huge. She could see three backbones, a leg bone, and a rib bone. She observed closer and saw the bones were hollow, or empty, inside. This meant the bones were from a carnivore, or meat eating dinosaur. Susan knew that the only big, meat-eating dinosaur that lived in North America was *Tyrannosaurus rex*. So this had to be a *Tyrannosaurus rex*!



Adapted from: A Dinosaur Named SUE: The Story of the Colossal Fossil
by Pat Relf and the SUE Science Team of the Field Museum. © 2000 The Field Museum. Published by Scholastic.

Student Resource 1.0: Adaptation from: A Dinosaur Named SUE: The Story of the Colossal Fossil

The Dig

Susan told the crew when they returned about the dinosaur she'd found. They were excited and got to work right away removing the rocks around the fossil. As they looked at the bones that stuck out from the cliff, they could see that the fossils were buried under twenty-five to thirty feet of rock and dirt. All of that rock needed to be removed before they could reach the rest of the bones. Big heavy machines might damage the bones, so the crew moved all of the rocky earth with handheld tools. They broke up the rock with picks. They pried away huge pieces of rock with crowbars and pushed them down the hill. They dug with shovels. They worked all day in the blazing hot sun.

In just a few days of hard work, the diggers reached the level of the bones. Now they worked more gently to protect the bones. With picks, smaller shovels, small hammers, chisels, and even brushes, they removed most of the rock around the bones. The workers were amazed as they uncovered more and more bones because they had found nearly all of the animal's bones. Before this, every *T. rex* that had been found was missing over half of its bones!

They were also surprised to see the leg bones were **massive**! Once they had removed all of SUE's bones from the cliff, they realized that this was the largest *T. rex* ever found. They named the *T.rex* SUE in honor of Susan even though they weren't sure if the dinosaur was a boy or a girl. After a long journey, SUE the *T. rex* now calls the Field Museum home.

Student Resource

Student Resource 1.0: Adaptation from: A Dinosaur Named SUE: The Story of the Colossal Fossil

Answer the following questions about the story you just read.

1. A fossil is

_____

_____

_____

_____

2. Which of these sentences from A Dinosaur named SUE: the Story of a Colossal Fossil BEST describes the main idea of the entire article?

a.) They had found many fossils this summer such as a duck billed dinosaur named *Edmontosaurus*.
b.) They worked all day in the blazing hot sun.
c.) Once they had removed all of SUE's bones from the cliff, they realized that this was the largest *T. rex* ever found.
d.) Even though she could see these cliffs across the valley, they were seven miles away.

3. How did Susan know she had found a fossil?

_____

_____

4. Which isn't true about the fossil Susan found?

a.) The fossil was covered by twenty-five to thirty feet of rocks and dirt.
b.) The team was not very excited because of all the other Edmontosaurus fossils that they had found during the season.
c.) The bones were hollow (or empty) inside.
d.) Susan was searching for fossils alone because the rest of the crew were in town fixing a flat tire on their truck.

5. Draw a picture using details from the story of what the scene looked like when Susan first discovered the fossil bones in the cliff with her dog, Gypsy.

Fossil Investigation Tool

Student Resource 2.0

Plant Station

- ☐ Draw a picture of the specimen to help you make observations about the fossil.
- ☐ Label four parts of the picture to highlight discoveries you made during your investigation.
- ☐ Draw a line from each written discovery to the evidence that you drew.

What questions do you have?

Fossil Investigation Tool

Student Resource 2.0

Water Animals Station

- ☐ Draw a picture of the specimen to help you make observations about the fossil.
- ☐ Label four parts of the picture to highlight discoveries you made during your investigation.
- ☐ Draw a line from each written discovery to the evidence that you drew.

What questions do you have?

Fossil Investigation Tool

Student Resource 2.0

Animals of the Forest and Riverside Station

- ☐ Draw a picture of the specimen to help you make observations about the fossil.
- ☐ Label four parts of the picture to highlight discoveries you made during your investigation.
- ☐ Draw a line from each written discovery to the evidence that you drew.

What questions do you have?

Fossil Investigation Tool

Student Resource 2.0

SUE's Dinosaur Neighbors Station

- ☐ Draw a picture of the specimen to help you make observations about the fossil.
- ☐ Label four parts of the picture to highlight discoveries you made during your investigation.
- ☐ Draw a line from each written discovery to the evidence that you drew.

What questions do you have?

Fossil Investigation Tool

Student Resource 2.0

SUE Fossil Investigation Station

Write your Sue question in the space below:

_____

_____

_____

- ☐ Draw a picture of the specimen to help you make observations about the fossil.
- ☐ Label four parts of the picture to highlight discoveries you made during your investigation.
- ☐ Draw a line from each written discovery to the evidence that you drew.

Size and Scale in SUE's World

Student Resource 3.0

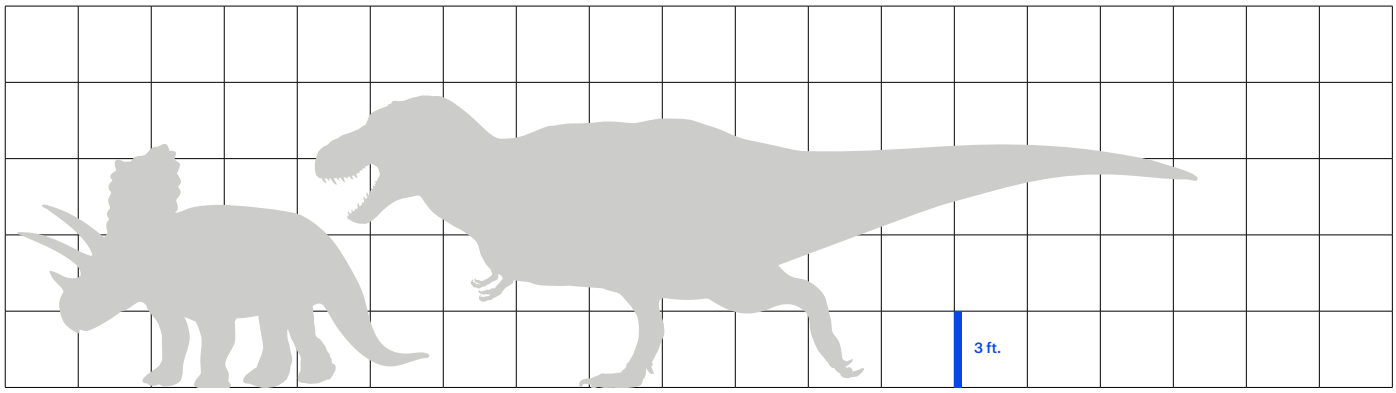
When scientists go about recreating plants and animals from the past, size and scale *(how sizes of organisms compare to one another)* are important things to think about in order to make an accurate picture.

1 Use the grid and scale below to estimate the length and height of SUE the *T. rex* and the *Triceratops* and write your answers in the table below.

2 Choose one of the plants or animals from SUE's World and use the facts that you have learned about it to show how that plant or animal would have compared in size to SUE the *T. rex*.

- Write the facts in box three.
- Make a sketch of the plant or animal next to Sue, and use the grid to help you make its size accurate.

Tyrannosaurus rex	***Triceratops horridus***	Species name: _____
Height: _____	Height: _____	Height: _____
Length: _____	Length: _____	Length: _____
Weight: 5 to 7 tons	Weight: 5 to 7 tons	Weight: _____
Skull length: _____	Skull length: _____	Other feature name: _____
		Other feature size: _____



Triceratops horridus

Tyrannosaurus rex

Student Resource

SUE's World Model

Student Resource 4.0

My Question:	What I learned:

Draw a scene showing what SUE's world would have looked like. Include items that show what you learned related to your SUE question as well as any other details that you uncovered during the investigation.

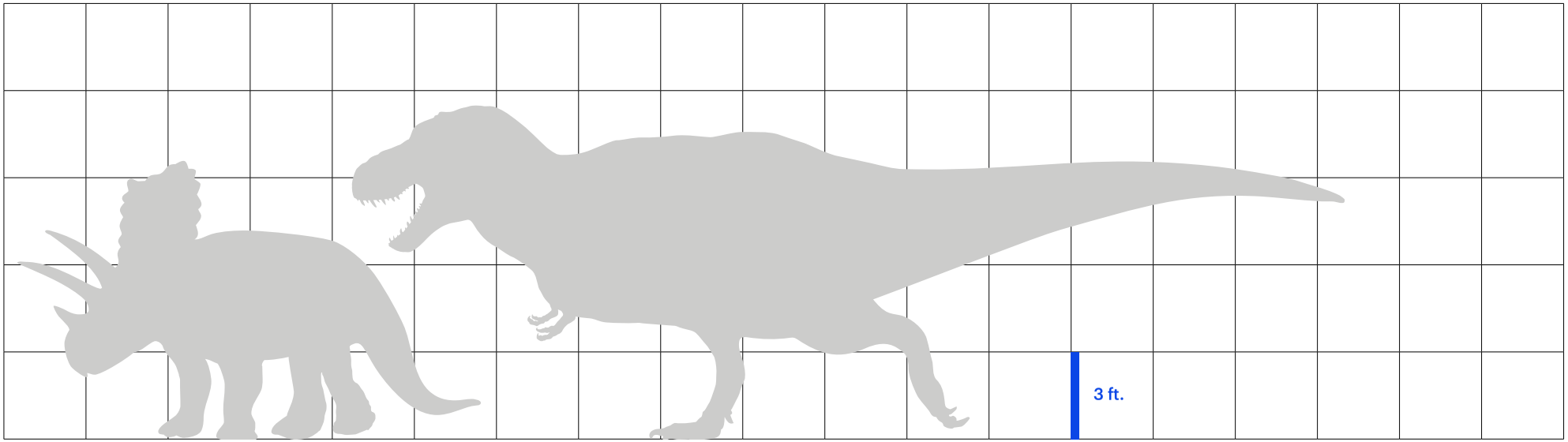
THE GRIFFIN DINOSAUR EXPERIENCE

FIELD MUSEUM

The Educator Toolkit is part of the Griffin Dinosaur Experience, made possible by the generous support of the Kenneth C. Griffin Charitable Fund.

Sponsor

Scale and Size in SUE's World



Triceratops horridus

Tyrannosaurus rex