Digging for Dinos

Grade Level: 6-8

Objectives:
Students will:
• research paleontological expeditions in the 1880s using the correspondence of Marsh and Felch.
• determine a budget for an expedition in the 1880s
• determine a budget for an expedition in the current year.

Colorado Standards Met:
Math 2, 4, 5, 6
Science 1, 3.1, 4.1, 5
Reading/Writing 1, 2, 4, 5

Time Required:
2 or 3 class periods

Materials and Equipment:
• Internet access to www.handsontheland.org/felch/map.htm
• Internet access to a search engine (Google, for example) and other websites
• Expedition forms included with this activity

Other Resources:
• For more information about paleontology in the Garden Park area: www.dinosaurdepot.com

Background

The Marsh-Felch Quarry #1 is located at the Garden Park Fossil Area north of Cañon City, Colorado. During the late 1800s, this area was the site of numerous fossil excavations. The type specimens (the specimens which define a particular species) for *Stegosaurus stenops*, *Ceratasaurus*, and *Allosaurus* were all discovered here.

Letters between paleontologist Othniel Marsh at Yale University in Connecticut and Marshall Felch, a local farmer who oversaw the excavations at the quarry, provided information about the dates and locations of bone groups. This information has been compiled as an interactive map, now online at www.handsontheland.org/felch/map.htm.

More historical information about the quarry is contained in an article by Evanoff and Carpenter, also available on this Marsh/Felch Quarry website, in the Resource section of the Lesson Plan page.

The interactive quarry map allows access to the following information:
1) location of dinosaur specimens excavated, by species.
2) individual bones excavated, by bone type.
3) current location of the excavated specimens, by institution.
4) the map can also overlay each year of the excavation at Quarry #1.

By selecting individual "Survey Years" on the Quarry map, students can access the correspondence between Marsh and Felch for that time period.

Procedure

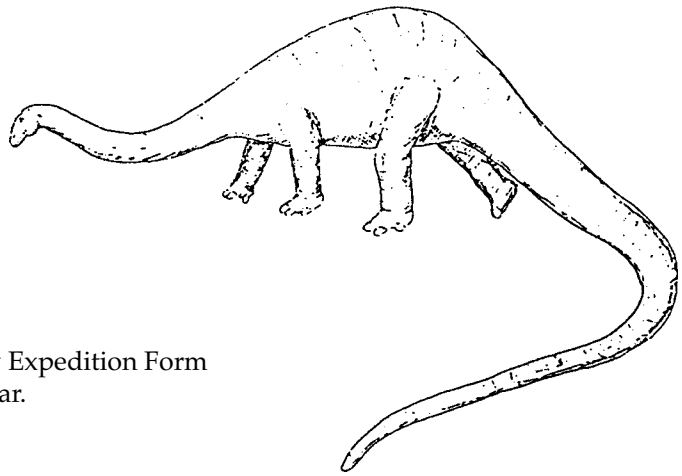
1. Read Marshall P. Felch's letter to Marsh in 1881, in which he describes a discovery. In 1882, Marsh writes to Felch and asks him to do some collecting for him. The fossils found by Felch are interesting enough for Marsh to offer paid work beginning in early 1883.

Expedition 1883

Explain to students that they are going to plan for a fossil expedition in the 1880s. Look through Felch's letter to Marsh in the spring of 1883 to find his estimates for hiring workers and for material expenses to work the Quarry. **Use this information to fill out the Expedition Form for 1883.**

Wages
Find monthly wages for a Foreman (Felch) and his assistants. Was this enough money for someone to live on in 1883? (Check out www.eh.net/hmit/compare to convert the amount to today's rate.)

Materials and Equipment
In May 1883, Felch includes a price list of materials and supplies he has purchased for the excavation work. Although this is not an extensive list, it gives us a good idea of where to start. Encourage students to think of other materials which might have been necessary. For example, Marsh describes the method for "jacketing" and stabilizing the fossil material in letters in 1883 (Sept. 28 and Oct. 16). Are these materials included in Felch's original supply list? Historic



prices for some items may be found online at www.endoftheoregontrail.org/outfit.html, but students may have to estimate based on prices they find in Felch's letter. Some libraries may have the book "The Value of a Dollar, 1860-1999," which includes prices for some common goods.

(Some price information also available through www.foodtimeline.org/foodfaq5.html)

Crating and Shipping
The best information we have from the Marsh/Felch letters in regards to shipping is a letter from Marsh dated 11 July, 1884 in which he acknowledges a receipt for a shipment from Cañon City to New York: 39 boxes, 7110 pounds, $253 per 100 pounds.

Have students calculate the mileage from Cañon City, Colorado to New Haven, Connecticut.
There is a mileage calculator online at http://www.randmcnally.com/rmc/directions/dirGetMileageInput.jsp?cmty=0

Choose a weight for students to use in shipping calculations. Use the same weight in 1883 and in the current year.

Expedition Today!

Now that students have had an opportunity to think about the logistics and costs of organizing a fossil excavation in the 1880s, discuss how such an expedition might be different today.

Keeping their ideas in mind, students will fill out a new Expedition Form for the current year.

Wages
What is the current minimum wage for workers? Multiply this amount by 40 hours in a week and 4 weeks in a month.
What is the current wage for field workers? Contact a museum or university paleontology department to find out.
Many people who work on field excavations today are trained volunteers. The Denver Museum of Nature and Science (DMNS.org), for example, has a paleontology certification program for people who are interested in helping with musem projects.

Materials and Equipment
There are many new tools available to modern explorers. For example, Felch had to draw his maps and diagrams by hand, but today we have GPS systems. Felch and his workers sometimes used explosives to clear large sections of rock, but today we have backhoes and other heavy equipment.

Still, the fine work is done by hand, using picks and shovels and brooms and brushes.

Crating and Shipping
There are also more options for transportation of freight in the current year. Is it less expensive to ship fossils by rail, by truck, or by air? What other options exist? In 1992, Denver Museum of Nature and Science paleontologists removed a large fossil from the Garden Park area using an army helicopter! (See attached article.) This certainly isn't practical on a regular basis, but it was an exciting option.

Use the same mileage and weight figures used for the 1883 expedition form to calculate for an imaginary shipment of fossils from Cañon City to New Haven today. There are several websites which offer free shipping estimates, or students can call a local freight company.

Extension

Now that students have an idea of how much it will cost to launch their expedition, they can write an advertisement for workers. Have students examine the Marsh/Felch letters and make a list of skills workers will need and under what conditions they might expect to work. Write an advertisement or design a poster to announce the new project.

Expedition Form 1883

Marsh/Felch Quarry Expenses 1883

Wages per month

Marshall Felch _____

Assistant #1 _____

Assistant #2 _____

Total Wages

Materials and Supplies, one month

Item/ Quantity	***Price per unit***	***Total Price***
____Shovel x 2____	_____$.75 _____	____ $1.50 _____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Total Materials

Shipping, one month

_____ pounds

Mileage from Cañon City, CO to New Haven, CT _____

Shipping rate _____ _____

Total shipping

EXPEDITION TOTAL COST FOR ONE MONTH

Expedition Form 20___

Marsh/Felch Quarry Expenses 20____

Wages per month

Quarry Foreman _____

Assistant #1 _____

Assistant #2 _____

Total Wages

Materials and Supplies, one month

Item/ Quantity	***Price per unit***	***Total Price***
____Shovel x 2____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Total Materials

Shipping, one month

_____ pounds

Mileage from Cañon City, CO to New Haven, CT _____

Shipping rate _____ _____

Total shipping

EXPEDITION TOTAL COST FOR ONE MONTH

-CANON CITY, COLORADO, DAILY RECORD

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AUG. 15-16, 1992
118TH YEAR

Helicopter gives stegosaurus a lift into the modern world

Linda Carlson
For the Daily Record

Cañon City — A 7-ton, plaster-jacketed stegosaurus skeleton was successfully airlifted Friday from a steep canyon in the Garden Park Fossil Area.

A 35,000-pound Chinook helicopter, operated by an expert crew from Fort Carson and piloted by Ron Noga, carefully hoisted the 15,000-pound load using a 100-foot steel sling, rigged by Sgt. Floyd.

"The operation went even more smoothly than we had hoped," said crew member Robert Wilson. "We had no concerns about the scaffolding, but it was hard to know how the wash from the rotors would affect the load in the narrow canyon. It certainly helped to have the 100-foot cable, and that the mass of the rock, plaster and lumber was high — if it had weighed less, then it might have swayed or rotated."

Friday's airlift was the culmination of several weeks of excavation and plaster-jacketing by a field crew from the Denver Museum of Natural History, followed by more than a week of skilled mining under the skeleton, the building of a lumber and steel support and other preparative work by Bill Tezak and his team from Colorado Quarries.

Bryan Small, discoverer of the stegosaurus and director of the excavation, Small's fiancee, archaeologist Yan Min, and Ken Carpenter, senior preparator at the Denver Museum, were all on-site as the huge package containing Small's discovery was raised from its 145-million-year-old resting place.

"The operation went even more smoothly than we had hoped," said crew member Robert Wilson. "We had no concerns about the scaffolding, but it was hard to know how the wash from the rotors would affect the load in the narrow canyon."

"This has been a lot of work, but it is most exciting to see the jacket come out intact. I must say that relief is the only thing I feel now," said Small.

BLM spokesman Dan Grenard said the entire project has demonstrated a unique partnership of the Denver Museum of Natural History, the Garden Park Paleontology Society, the Bureau of Land Management, Fort Carson, Colorado Quarries and a host of local businesses and individuals.

"All of them made significant contributions," he said. "Without their collective efforts, the project could not have been completed so successfully."

The next trip for the rock-embedded skeleton is to temporary safe-storage in Fremont County.

"The skeleton is going to take about three years of skilled paleontological preparation," Grenard said. "We hope to have the opportunity for the public to watch the preparation work in progress here in Cañon City. Eventually, the stegosaurus will be put on permanent exhibit, we hope here at the National Visitor Center. In any event, it will remain in Colorado, unlike so many of the splendid fossils found here in the past."

Tremendous local interest has been voiced in support of the stegosaurus being allowed to remain here because the Garden Park Fossil Area has supplied so much for the world in dinosaur knowledge over the last 120 yrs.

"There is preliminary discussion of preparative work on this specimen being performed under a cooperative management agreement between the BLM, Denver Museum and GPPS. We are hoping that the stegosaurus specimen and accompanying exhibits can be accommodated somewhere at the proposed River Station project, in downtown Cañon City," said Grenard.

Cañon City Mayor Roger Jensen, watching the preparations for the airlift, agreed.

"This is a great boost for the visitor center. To have this dinosaur on public display will be a wonderful tourist attraction — it is truly a unique asset for our community."

The River Station location would serve as an interim display facility while the National Visitor Center in Garden Park is being built, Grenard said.

According to GPPS President Donna Engard, the Visitor Center proposal is nearing completion of the Master Planning stage, and it is hoped that groundbreaking for the center will occur within two years.

A 35,000-pound Chinook helicopter, operated by an expert crew from Fort Carson and piloted by Ron Noga, carefully moves a 7-ton, plaster-jacketed stegosaurus skeleton (lifted out of a steep canyon in the Garden Park Fossil Area) onto a Colorado Quarries truck for transport into Cañon City.

photo by Linda Carlson