LESSON #5: Writing about the Burgess

Focus questions

1. What is the importance of the Burgess Shale?
2. What is the importance of being able to get your ideas clearly and concisely down on paper?

What students do in this activity

Students will write a short letter (called a query letter or pitch) trying to convince a magazine editor that he/she should hire the student to write an article about the Burgess Shale. The students will be given background material on how to write a query letter, details on the Burgess Shale and its discoverer Charles Walcott, and Web sites for additional research.

Estimated teaching time

One period to present and set up the writing activity. One period to read query letters written by students and discuss what they learned.

General supplies to complete this lesson plan

- Computers with Internet access and/or Background Material
- Paper

Each student will need

Sample Query Letter, **Additional Query Tips**, and **How to Write a Query Letter**

Learning goals

Students will:

1. Learn the importance of the Burgess Shale
2. Learn how to write a clear and concise document
3. Learn how to take a complex concept and put it into a succinct form

Advance preparation

1. Read the Background Material.
2. Look at Web sites on how to write a query letter.
3. Look at Web sites for additional background on the Burgess Shale.
4. Copy the Sample Query Letter and Additional Query Tips back to back (one/student).
5. Copy the Background Materials, back to back. See Teaching Tip below for thoughts on how much material to copy.

Teaching tip:

Part of the challenge of this activity for students is boiling down the large amount of information on the Burgess. This is a central aspect of writing a query letter or of writing a cover letter for a job or of auditioning for a part. One way to make this activity easier would be to give less information to the students, so they don't have to do as much condensing of the facts.

Another aspect of this lesson is plagiarism. It is important to at least touch on this subject and warn the students about copying from the background material or from information they might find on the Internet.

The Dawn of Diversity
LIFE IN THE BURGESS SHALE

Introducing the activity

1. Tell the students that they are going to write a short letter about the Burgess Shale. In that letter, they are going to try to convince a newspaper or magazine editor to hire them to write an article about the Burgess Shale.

2. Tell them that getting their ideas down on paper in a clear, succinct manner is an important skill to learn. A query letter is analogous to a cover letter for a job. First impressions are key.

3. Tell them that there are many ways to craft this letter. They could pretend they are Charles Walcott trying to interest an editor in a first-hand report of his discovery. Another approach would be to pretend to be Walcott writing about the science exclusively. A third tact would be to be a reporter traveling with Walcott, reporting specifically on the science or on a particular species. The approach generally depends on the magazine. More scientific magazines want more science. A travel magazine would want to emphasize how to get there or if a person could go on a dig and participate with the scientists. Again, the goal is to convince an editor that the Burgess Shale is interesting and important.

4. Tell them they will have time in class to do additional research on the Burgess Shale and possibly on how to write a query letter. They will then have a chance to write the letter at home.

Facilitating the activity

1. Pass out the **Sample Query Letter** and **Additional Query Tips**.

2. Pass out the **Background Material**.

3. Go over the **Sample Query Letter** emphasizing how to write one.

4. Let them do additional research on the Internet and/or read the Background Material.

5. Depending upon your students' comfort level, you may want to have a general discussion about the Burgess Shale, its importance, and how they might approach writing the letter.

Summarizing and reflecting

A central goal of this activity is to get the students to think about why the Burgess Shale is important. You may want to begin, after they have turned in their letters, by asking them what makes the Burgess interesting to paleontologists. What aspects of the Burgess Shale interested them the most?

A secondary goal is learning how to write succinctly and clearly. Ask the students what they found most challenging about writing so little about the topic. Was it easier or harder than writing a longer report on the subject?

Extensions

If you want to emphasize the writing aspect, students could research a topic relevant to today and craft another query letter. They could also write the article they proposed, which would require them to do more research on the Burgess Shale.

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Teaching tip:
This is a sample letter of one possible way to write a query about the Burgess — written from the point of view of a journalist who has been out in the field with Walcott. It could be passed out to students after they write their own letter.

THE DAWN OF DIVERSITY — LIFE IN THE BURGESS SHALE

Charles Walcott had been searching for fossils for more than four decades when he made one of the most important fossil discoveries ever, the Burgess Shale, on August 31, 1909. High on a wind-swept slope in the Canadian Rockies, he found numerous, dark gray rocks dotted with what Walcott recognized as fossil crustaceans, but they were crustaceans unlike any he, or any other paleontologist, had ever seen. Walcott has continued to return to Canada and now has more than 20,000 specimens, displaying more than 60 species, many more of which no one has ever encountered.

Over 505 million years old, the Burgess Shale fossils are the best record of the critical moment in Earth's history when life began to become complex. They show how life, after nearly 3 billion years of evolution, rapidly speciated into a myriad group of body shapes, all of which persist to the present. Furthermore, because the Burgess fossils preserve soft body parts, as opposed to the more typical hard ones, they are even more important and more unusual.

In ***The Dawn of Diversity***, I propose an article focusing on Charles Walcott and his discoveries. I will look at what led Dr. Walcott to Canada, how he works in the field, and the importance of his fossils. I have been to Burgess with Dr. Walcott, as well as visited him in his laboratory at the Smithsonian Institution, where he is the Secretary. Dr. Walcott has agreed to provide photographs of the fossils and the sites.

I am a professional natural history writer with 20 years of experience working with scientists in the field. My work has appeared in the *New York Times, National Geographic*, and *Century Illustrated*.

Thank you for your consideration. I look forward to hearing from you.

Sincerely,

John Smith

Sample Query Letter

HERBERT ESKERGRASS
1234 FOSSIL AVENUE NORTH
SEATTLE, WA 98999

SIMPLE LETTERHEAD WORKS WELL.

November 18, 2004

Lucretia Laccolith, Senior Editor
National Geographic
P.O. Box 1111
Washington, DC 20002

ALWAYS ADDRESS THE QUERY TO A SPECIFIC PERSON. MAKE SURE THAT PERSON'S NAME IS SPELLED CORRECTLY.

Dear Ms. Laccolith,

Peak of Danger

A CATCHY TITLE SHOWS YOU HAVE THOUGHT ABOUT THE STORY'S MARKET

THE GOAL OF THE 1ST PARAGRAPH IS TO ENTICE THE EDITOR. THEY MIGHT READ ONLY THE 1ST SENTENCE OR TWO. ADD KEY BACKUP MATERIAL IN THE 2ND PARAGRAPH. KEEP THIS SECTION SHORT. THINK ABOUT TRYING TO TELL/SELL THE STORY DURING AN ELEVATOR RIDE.

The Hook

Geologists call it the most dangerous volcano in America. In the past 10,000 years at least 60 rivers of a wet cement-like ooze, called a lahar, have cascaded down the slopes of Mt. Rainier, destroying all life in their paths. One of the lahars, the Osceola Mudflow, left deposits that cover 220 square miles and extend 60 miles to Puget Sound. At least 100,000 people now live on these solidified sheets of destruction. The most recent notable event, an October 23 landslide that sent mud and debris shooting down a creek next to the park's Cougar Rock campground, created a perfect stage for rangers to give impromptu interpretive talks.

With such a potentially dangerous situation in the park, geologists and park employees are being proactive, conducting studies, educating the public, and monitoring river valleys with underground microphones. Scientists are literally crawling across Mt. Rainier to better understand the geology, while the NPS and USGS have produced videos, CD-ROMs, and handouts for the public.

TELL THE EDITOR WHAT ANGLE YOU ARE GOING TO TAKE WITH THE STORY.

The Angle

In *Peak of Danger* I propose a 1,500-word story that explores how scientists and national park officials are working together to address this potential problem. I will discuss the geology of the mountain, including recent studies, as well as the various educational initiatives. I have spoken with Dirk Elbowgrease, a geologist with the state of Washington, and Dr. Opal Jokulhlaup, an educator with the Cascade Volcanoes Observatory and plan on talking with park employees and people who live in the path of the lahars.

SELL YOURSELF. WHY SHOULD YOU WRITE THE STORY?

Why me!

I am the author of *A Field Guide to Rocks*, and a regular contributor to *Geology Today, Cool Rocks Weekly,* and *The Traveler*. At present, I am working on a book on the geology of the Cascade volcanoes.

Thank you for your consideration. I look forward to hearing from you.

Sincerely,

Herbert Eskergrass

How to write a query letter

In non-fiction writing, one of the key skills to learn is how to write a query or pitch because most magazines prefer to receive a short description about a story instead of the story itself. Reasons include editors not having time to read the entire story and the editor will generally want to have some say over the direction of the story. You need to think of the query as a cover letter or audition showing all the qualities of the story and the writer.

The query is your only chance with the editor. You want it to read well and look good. Use good paper, an easy-to-read font, high quality printing, and no gimmicks. Spell everything, particularly the editor's name, correctly. Query letters need to be short, at most a page or page and a half. If you cannot convince an editor in a couple of paragraphs, more will not help. Dropping names usually doesn't work.

The opening is the key. It has to grab the editor. Short, tight sentences often work well. Get in the important facts.

The second and/or third paragraphs summarize the piece and tell the editor how you will write it. You may want to tell why you think the article is right for that magazine's readers. Many writers put in a title, word length, and the section of the magazine for which the story is appropriate. Some people use quotes from a researcher they will interview for the article. This is the place where you will list who you plan on interviewing or have already contacted.

The last paragraph should toot your own horn. Who are you and why are you the only person to write this article. List relevant past credits.

In producing a query, writers are often advised to read carefully the magazine for which they want to write, to get a feel for its style and content. You don't want to send a query on food to a magazine that only focuses on dogs, for example. In this project, we will assume that the story is going to go to a magazine that does have natural history stories.

Good sites about query writing:

freelancewrite.about.com/cs/howto/ht/htquery.htm

writing-world.com/basics/query.shtml

poewar.com/articles/beginner.htm

Additional query tips

1. Use a title or headline. Again, this shows you are considering the market and the angle.

2. One tactic is to open the letter with what will probably be your lead for the story. No matter what, the opening paragraph has to grab the editor; this may be your only chance and first impressions are key.

3. The second and third paragraphs can provide additional background and/or why the story is important for their readers.

4. Include one paragraph on why you are the right person to do the story and your background. This is where you'll want to mention previous work and experiences that make you uniquely suited to write the piece.

5. Include one paragraph where you tell the editor how you will write the story and who you will interview. You may want to say how many words the story will be and if you can help in providing photographs or drawings.

6. No more than a page and a half, single-spaced.

7. You have to do enough research to write a convincing query, but not enough to write the story. You should know who you want to interview, although you may or may not identify all these people in the proposal.

8. Make sure everything, particularly names, is spelled correctly.

The Dawn of Diversity
LIFE IN THE BURGESS SHALE

STUDENT HANDOUT

The discovery

Charles Walcott made his most famous discovery, the Burgess Shale, on August 31, 1909. He was on a steep rocky slope at over 8,000 feet in the Canadian Rockies when he found numerous, smooth dark gray rocks dotted with what Walcott recognized as fossil crustaceans, but they were crustaceans unlike any he, or any other paleontologist, had ever seen.

Over the next 15 years, Walcott returned seven times and collected more than 65,000 specimens from the Burgess Shale, which he deposited at the Smithsonian Institution in Washington D.C. where he was the director. The collection is one of the most important records of early life on the planet.

Walcott's fossils were from more than 120 species that lived 505 million years ago. They inhabited the muddy bottom at the base of a steep cliff in a warm sea located just off the northern coast of ancestral North America. At the time, North America lay on its side with the area we know as Canada to the east and Mexico to the west. The continent straddled the equator. No plants or animals had invaded land, the sea lacked fishes, and no birds populated the skies.

If we could visit the Burgess sea, two aspects of the fauna would stand out. The first is that we would recognize some of the animals as relatives of modern species. We would see primitive mollusks (e.g. clams and slugs), brachiopods (lampshells), and sponges, as well as many trilobites, the well-known relative of insects, spiders, crabs and lobsters. We would also observe many animals that have no or few modern counterparts, such as the largest Burgess beast, *Anomalocaris*, a three-foot long predator with two long, jointed arms that could stuff most any other animal into its armored circular mouth. In contrast was *Hallucigenia*, an inch-long, tubular critter topped by seven pairs of inch-long spikes. Other novel animals included what looks like an armored, spiky slug that paleontologists can't agree how to classify and a five-eyed swimmer with a flexible proboscis, the animal that led to the wholesale reinterpretation of the Burgess Shale fauna.

For paleontologists, the Burgess Shale is one of the handful of most significant fossil discoveries. They cite three reasons for its importance. The first is that most of the Burgess specimens preserve the soft parts of animals. Generally fossils preserve hard parts, such as bones, teeth and shells, only giving part of the picture of an organism. In addition, only about one quarter of modern marine organisms have hard "shelly" parts; therefore, the fossil record is even less clear because most animals are never preserved as a fossil.

Second, the Burgess Shale records a fantastic diversity of life known as the Cambrian Explosion. Paleontologists know that life on Earth began 3.5 billion years ago, but they also know that for the first 2.7 billion or so years, life was little more than single-celled organisms. And then in a span of 10 million years, around 545 to 535 million years ago, life multiplied precipitously. Animals with shells and complex habits appeared. They began to hunt each other. They developed eyes and brains. Nowhere is this record of change better preserved than in the Burgess Shale.

And finally, Burgess Shale fossils show that when complex life finally exploded on Earth, a certain number of body plans, or phyla, evolved and that they have persisted to this day. Thirty or so phyla, such as mollusks and arthropods, existed in the Cambrian and 30 or so phyla exist today. Species diversity has increased, but the overall shape of life has not. Walcott was truly prescient when he wrote "Found a remarkable group." In the story of life on Earth, there are few more important chapters than the one told by the Burgess Shale.

Charles Walcott

Charles Walcott did not just come stumbling across the Burgess Shales fossils; he had been searching for fossils of that age, the Cambrian Period, for decades. As early as 1888, he had known that *trilobites*, the charismatic minifauna of the Cambrian, had been found in the mountains near Burgess Pass and he made his first collection of those *trilobites* in 1907. At the time of his most famous discovery, Walcott was Secretary of the Smithsonian Institution and had been the third director of the United States Geological Survey, from 1894 to 1907.

In the summer of 1909, Walcott had already been traveling by horseback, collecting fossils, and mapping the geology for six weeks when he made his famous discovery. When Walcott was out in the field, his fossil hunting was a family affair. In addition to his wife Helena, he was joined by daughter Helen, age 15, and youngest son, Stuart, age 14. His family, including his middle son Sidney and his third wife, Mary, (Helena died in a train wreck in 1911), returned year after year to help at the dig. Sidney was even honored by his father by having the first formally described fossil from Burgess named after him, *Sidneyia inexpectans*.

They camped in the forest below Burgess Pass. They appear to have cut many of those trees to support their large tents. A cook made their meals. They had wood burning stoves and in one picture from the camp, Helena sits before a table cloth-covered table with an extensive array of plates, bowls and cups. Modern fossil collecting expeditions also have elaborate camps but probably don't need a home made gun rack, such as the Walcott boys had, to hold five shotguns. Nor would the trip leader have to resort to this action. "Dad made me carry his big Colt revolver. One day he tried to tell me that I might someday meet a crazy man who, if he tried to molest me, I was to shoot down without hesitation," Helen wrote years later.

To collect their specimens, they would initially dig, or blast out, slabs of fossiliferous rock, slide them down to a trail, load the material onto horses and take it to camp, located in trees about 300 feet below the fossil quarry. In camp, Walcott or one of his family members split the stones into smaller samples and packed them in bags for the journey to the town of Field, 3,000 feet below. The specimens finally reached Washington, D.C. where Walcott worked, over a month after leaving Field, B.C., by train.

Over the next 15 years, Walcott returned seven times and collected more than 65,000 specimens from the Burgess Shale, and he accumulated one of the most important records of early life on the planet. He published his first paper on the fossils in April 1910, and another five more over the next nine years. He called these preliminary reports, always hoping to do a more definitive study on the fossils that made him famous. He never did; his final paper was published three years after he died.

Later studies of the Burgess Shale

In the late 1960s and continuing to this day, a variety of researchers have restudied the fossils collected by Walcott. The first group, an English trio from Cambridge University, Harry Whittington and his two students, Derek Briggs and Simon Conway Morris, did most of their research in the lab, from specimens they found in the drawers at the Smithsonian Institution in Washington, D.C., as well as from two later expeditions that were collected at Burgess.

Their approach to studying the fossils differed from Walcott's. First, Whittington and his students discovered that they could use fine tools to remove very thin layers of the fossiliferous shale. For example, removal of the outer shell could reveal the legs and further dissection could uncover limb after limb. Second, the researchers started to look at specimens that were not just upright and flat. During burial, the animals occassionaly ended up willy-nilly, on their sides or straight up and down, which means that Walcott only looked at part of each body. By looking at individuals in odd positions, Whittington often found legs, antennae or tails.

Third, they took photos of the specimens at many angles, often using UV-light to highlight specific areas. This is analogous to using a spotlight; move the spotlight around on something and you can emphasize different details. Finally, they made detailed drawings. By combining these methods, the Cambridge trio was able to create three-dimensional views of the animals and rewrite Walcott's interpretation of the Burgess.

When Walcott studied his specimens, he had placed most of the Burgess animals into established major groups, called "shoehorning" in Stephen Jay Gould's classic description of the Burgess Shale, *Wonderful Life: The Burgess Shale and the Nature of History*. Whittington, Briggs and Conway Morris, on the other hand, believed that the Burgess was far more complicated. In a 14-year period from 1971 to 1985, they reclassified more than 25 genera of Walcott's, and they also created completely new phyla for many species. This should not be interpreted as any lack of skill on Walcott's part; he was one of the foremost paleontologists of his day. The Cambridge trio benefited from more than 50 years of advancements in technology and biological knowledge.

These new interpretations helped show the incredible diversity of organisms in the Burgess and how it exemplified the Cambrian explosion. As ongoing research on the Burgess occurs around the world, it has added more layers to the stories told by Walcott, Whittington, Briggs and Conway Morris. The Burgess Shale is still one of the most fascinating and important fossil discoveries ever made.

Eleven facts and figures about the Burgess Shale

1. Deposited in the sea near the equator roughly 505 million years ago.

2. First discovered in 1909 by Charles Walcott at nearly 8,000 feet in elevation in the Canadian Rockies, near the town of Field, British Columbia.

3. Walcott was a foremost expert on the Cambrian period, Secretary of the Smithsonian Institution, and former director of the United States Geological Survey.

4. He returned seven times to Burgess, collecting more than 65,000 specimens, now housed at the Smithsonian.

5. Walcott wrote his first paper on the Burgess in 1910. His last was published in 1931, three years after he died.

6. More than 120 species have been described, many new to science.

7. The majority of the fossils preserve soft body parts, which is unusual in the fossil record where generally only the hard parts, such as shells, bones or teeth, are preserved.

8. Cambridge researchers Harry Whittington, Derek Briggs and Simon Conway Morris began to restudy the Burgess fossils in the late 1960s and early 1970s.

9. Their research provided much better descriptions of the fauna and helped show how complex life was during the Cambrian.

10. In 1989, Stephen Jay Gould's *Wonderful Life: The Burgess Shale and the Nature of History* was published. It was the first and one of the best popular books written on the fossils.

11. Ongoing research and discovery has found Burgess Shale age and type deposits around the world, including Greenland, China, Australia and the United States.