



The Willamette Meteorite

Lessons from Oregon's Ancient Extraterrestrial Visitor

Grade: Adaptable for 9-12

Overview

One of Oregon's unique natural treasures is the Willamette Meteorite, found near the town of West Linn in 1902. Using the [Historic Oregon Newspapers](#) website, students will access accounts of the meteorite's discovery and subsequent court battle to determine its rightful ownership. Further inquiry will reveal information about the science of meteors and a key event in the region's geological past. A mock trial will help personalize and elucidate the competing claims of rightful ownership that have continued to surround the meteorite up to the present day. This interdisciplinary lesson is designed to teach concepts of social history, natural history, physical science, and legal issues of personal and community property rights.

Oregon Common Core State Standards

Language Arts Standards: See below for a complete list of applicable standards.

- CCSS.ELA.RH.9-10.2 Determine the central ideas or information of a primary or secondary source; provide an accurate summary of how key events or ideas develop over the course of the text.
- CCSS.ELA.RH.9-10.6 Compare the points of view of two or more authors in their treatment of the same or similar topics, including which details they include and emphasize in their respective accounts.
- CCSS.ELA.RH.9-10.7 Integrate quantitative or technical analysis (e.g., charts, research data) with qualitative analysis in print or digital text.
- CCSS.ELA.RH.9-10.8 Assess the extent to which the reasoning and evidence in a text support the author's claims.

Social Studies Standards: See below for a complete list of applicable standards.

- Historical Knowledge HS.2 Analyze the complexity and investigate causes and effects of significant events in world, U.S., and Oregon history.
- Historical Knowledge HS.9 Identify historical and current events, issues, and problems when national interests and global interest have been in conflict, and analyze the values and arguments on both sides of the conflict.
- Historical Thinking HS.11 Gather and analyze historical information, including contradictory data, from a variety of primary and secondary sources, including online sources, to support or reject hypotheses.

- Historical Thinking HS.12 Construct and defend a written historical argument using relevant primary and secondary sources as evidence.

Materials

- [Historic Oregon Newspapers](#) website
- Access to the Internet
- Question activity sheet
- Mock trial information sheet

Lesson

- *Introduction:* Introduce the topic of study.
 - Begin by asking students if they are aware that the largest meteorite ever discovered in the United States—and the sixth largest in the entire world—was found right here in our home state of Oregon. Then ask how many of them have seen this remarkable object in person. If any students answer in the affirmative, solicit from them the story and circumstances of how and where they came to view the meteor.
- *Building background knowledge:* Students will build background knowledge by researching the case *Oregon Iron Co. v. Hughes* on the [Historic Oregon Newspapers](#) website.
 - Inform the class that there was an immediate controversy about the rightful ownership of the meteorite. Also, tell students that Mrs. William E. Dodge bought the meteorite in 1905 and donated it to the American Museum of Natural History in New York, where it is still on display.
 - Introduce the case *Oregon Iron Co. v. Hughes*.
 - Challenge students to locate the very first news story about the meteorite’s discovery, and a newspaper photograph.
 - Direct students to the website, and research the meteorite and the court case.
 - You may narrow searches by using the [advanced search](#) option, entering specific phrases and timeframes.
 - See below for a list of links to key stories.
- *Discussion:* After the students have completed their research, bring them together for a class discussion of what they have learned.
- Some discussion questions to consider:
 - Who first discovered the meteorite?
 - Where did they find it?
 - Why did they undertake the very difficult task of moving the 15-ton object $\frac{3}{4}$ of a mile?
 - How did this lead to a case in the Oregon Supreme Court?
 - What was the court’s decision?
 - How was the decision fair?
 - What did the winners of the court case do with the meteorite?

- Was it right to send the Willamette Meteorite to the other side of the country? Should this relic have remained in Oregon, where it was found?
- *Lesson activity:* The science of the Willamette Meteorite.
 - Ensure that students gain a basic knowledge of the nature of meteorites: what they are, where they come from, and how they have impacted the earth throughout time.
 - Some resource ideas include class discussions, science curricula, or online resources such as [Solar Views](#) and [Wikipedia](#).
 - Break students into groups to do more research on meteorites. An activity sheet is provided below.
- *Discussion:* Bring students together to share their findings and interesting facts. Make sure to discuss each of the questions that students were tasked in researching.
- *Transition:* Students should be made aware of a most perplexing fact about the Willamette Meteorite: It would be expected that an object of this mass falling from space would leave a huge crater where it struck the earth. However, where the meteorite was discovered in Oregon, it laid half-buried in the ground, with no crater.
 - Pose the question: How can this be explained?
 - Have students brainstorm hypotheses of their own before the class investigates further.
- *Building background knowledge:* This is a great segue to the subject of ice age glaciation and the Missoula Floods (also known as the Bretz Floods, or Spokane Floods) that played a key role in shaping the geography of Oregon.
 - Geologists have hypothesized that, during the last ice age, the Willamette Meteorite made its original impact on the great ice dam that lay far to the northeast, in present-day Canada. Around 11,000 years ago, this massive ice barrier was breached, releasing a torrent of water greater in volume than all Earth's rivers combined. Giant icebergs broke free in the floodwaters; one of these chunks of prehistoric ice rafted the meteorite hundreds of miles before depositing it where it would be found in the Willamette Valley.
 - Discuss the history and dynamics of the Cordilleran Ice Sheet and resulting Missoula Floods.
 - Some resources are listed below.
- *Discussion:* Bring students together as a class to discuss the information that they were presented with on the Missoula Floods and Cordilleran Ice Sheet.
- Some discussion questions to consider:
 - In what ways would Oregon circa 9,000 BCE have looked different from the present day?
 - What are some factors responsible for these changes?
 - Which of the state's geographic features were directly shaped because of the Missoula Floods?
 - Besides the Willamette Meteorite, what other pieces of evidence of these ice age floods have been discovered in Oregon?
- *Building background information:*
 - In 2000, the Confederated Tribes of the Grand Ronde Community of Oregon alleged that the meteorite was their rightful property. Before it was "discovered" by Ellis Hughes, Native Americans living in the Willamette Valley knew about the meteorite. In fact, they had a special name for it, *Tomanowos*, and used it in an annual religious ceremony. Thus, the Confederated Tribes argued, the meteorite should be returned to them.

- Against this claim, the American Museum of Natural History continued to assert that the meteorite was legally purchased and donated to it in 1905. Individuals who agreed with the museum also argued that the meteorite is a national treasure and should remain on prominent display in a place where the greatest number of people could see it.
- *Lesson preparation:* Divide students into two groups of equal size, with one group representing the Confederated Tribes of the Grande Ronde Community and the other the American Museum of Natural History.
 - Each group will divide into two smaller groups, with one group representing “Expert Witnesses” and the other “Lawyers.” Expert witnesses will take the stand and testify, and lawyers will ask questions to lead the testimony of their witnesses as well as cross-examine witnesses from the other side.
 - Some witness roles include: Native American Spiritual Leader, Native American Mother, Anthropologist, Historian, Astronomer, Public School Teacher, Museum Curator, and Museum Patron.
 - Give students adequate time to meet with their groups and collaboratively develop their roles, brainstorm the merits of their case, and form strategies for arguing it.
 - Students should research the case further and prepare “evidence” for court.
- *Mock trial:* When students’ “day in court” comes, the teacher should play the part of Judge.
 - Remind students to stay in character, even if they disagree with their roles. They must continue to provide the strongest case possible for parties they have been “hired” to represent in court.
 - To keep in character, begin the mock trial by “swearing in” the whole class as a group.
 - Lawyers from each side should be given the opportunity to call their expert witnesses to the stand and present their testimony in the case.
 - Each team of lawyers has the opportunity to call expert witnesses from the *other* side and cross-examine them.
 - Throughout the simulation, you as Judge can guide the activity by “overruling” lawyers and “striking from the record” expert testimony.
 - Allow students to self-direct the presentations of their cases.
 - Give students the information sheet for help during the mock trial.
- *Debrief:* Rather than issuing a judge’s ruling in favor of one side, tell students how the actual dispute was settled: with a mutual compromise.
 - The Confederated Tribes reached an agreement with the museum, stating their tribal members are allowed private time to conduct a traditional ceremony around the meteorite once a year, and that ownership will be transferred to the Tribes in the event that the museum removes the object from display.
- Some debrief questions to consider:
 - Do you think this decision was fair?
 - What do you think should have happened?
 - Who provided the most convincing argument?
 - How do you feel about your mock trial experience?
 - Do you think the decision had merit?

Extension Activity Ideas

- *Field trip:* Visit the site where the meteorite was found, near present-day Willamette Methodist Church in West Linn.
 - Another option: Visit a replica of the meteorite outside the Museum of Natural and Cultural History on the University of Oregon campus.
 - Another option: Visit the Evergreen Aviation and Space Museum in McMinnville, Oregon, where on display is a 7.5-inch piece of the actual meteorite.
 - Visit the American Museum of Natural History in New York City.

Resources

Links to coverage of the Willamette Meteorite

- *Morning Oregonian*, November 3, 1903, page 4: <http://oregonnews.uoregon.edu/lccn/sn83025138/1903-11-03/ed-1/seq-4/>
 - Photos of the meteorite.
- *Morning Oregonian*, April 29, 1904, page 4: <http://oregonnews.uoregon.edu/lccn/sn83025138/1904-04-29/ed-1/seq-4/>
 - A few details on Native American beliefs about the meteorite.
- *Morning Oregonian*, January 20, 1905, page 4: <http://oregonnews.uoregon.edu/lccn/sn83025138/1905-01-20/ed-1/seq-4/>
 - Account of the State Supreme Court case.
- *Morning Oregonian*, August 24, 1905, page 10: <http://oregonnews.uoregon.edu/lccn/sn83025138/1905-08-24/ed-1/seq-10/>
 - Unveiled at the Lewis & Clark Exhibition.
- *Morning Oregonian*, September 1, 1905, page 8: <http://oregonnews.uoregon.edu/lccn/sn83025138/1905-09-01/ed-1/seq-8/>
 - Published poem about the meteorite.
- *Daily Capital Journal*, October 10, 1905, page 6: <http://oregonnews.uoregon.edu/lccn/sn99063957/1905-10-10/ed-1/seq-6/>
 - More photos.
- *Daily Capital Journal*, February 22, 1906, page 4: <http://oregonnews.uoregon.edu/lccn/sn99063957/1906-02-22/ed-1/seq-4/>
 - Sold to museum in New York.

Links for supplementary material regarding the Missoula Floods and Ice Sheet

- “About the Ice Age Floods,” on [Ice Age Floods Institute website](#)
 - Provides background information on the floods, including how they were discovered.
- “The Cordilleran Ice Sheet and Missoula Floods,” on [U.S. Geological Survey website](#)
 - Provides more background information about the ice sheet and floods.
- Cordilleran Ice Sheet map, via [Google](#)
 - A valuable tool to help students visualize these ancient phenomena.
- Missoula Floods map, via [Google](#)
 - A valuable tool to help students visualize these ancient phenomena.
- “Mystery of the Megaflood,” by [PBS NOVA](#)
 - An episode discussing the floods. (A teacher’s guide is available on the website.)

Question Activity Sheet

Name: _____

Question Activity Sheet

1. Write your name.
2. Read the questions, and find responses using the available resources.
3. You may use your science textbook or the Internet.
4. Don't forget to write in complete sentences.
5. Prepare to share your findings during class discussion.

	Question	Response
1.	Which of these types is the Willamette Meteorite classified as?	
2.	What is the convention by which meteorites are named?	
3.	What is the evidence that meteorite impact may have played a key role in the extinction of dinosaurs 65.5 million years ago?	

4.	What is the approximate number of meteorites that strike Earth's surface every year?	
5.	What are the four periodic elements of which the Willamette Meteorite is composed?	
6.	Over the years, two smaller pieces of the meteorite have been for sale: one weighing 14 kg (30 lbs.), the other 130 g (4.5 oz.). If these pieces had never been broken off, how much would the meteorite weigh today?	
7.	What are the physical and chemical processes that led to the highly pitted appearance of the Willamette Meteorite?	

Mock Trial

Rule Sheet

You Must...

- Be respectful.
- Stay in character.
- Prepare opening and closing statements.
- Direct-examine all your witnesses.
- Call upon your own witnesses.

You Can...

- Cross-examine a witness.
- Swear in a witness.
- Object.

You Can't...

- Act on personal opinions.
- Personally attack your witness or peers.
- Object during opening statements and closing arguments.

Oath

“Do you promise that the testimony you are about to give will faithfully and truthfully conform to the facts and rules of the mock trial?”

Schedule of Trial

- Introduction of lawyers, clients (5 minutes)
- Opening Statements (5 minutes)
- Direct and Redirect* (25 minutes)
- Cross and Re-cross* (20 minutes)
- Closing Arguments (5 minutes)

*You may opt out of the redirect and re-cross portions of the trial.

Note: The group representing the Confederated Tribes of Grande Ronde Community will go first.

Continued list of applicable Language Arts standards

- CCSS.ELA.SL.9-10.1 Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9-10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.
- CCSS.ELA.SL.9-10.3 Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, identifying any fallacious reasoning or exaggerated or distorted evidence.
- CCSS.ELA.SL.9-10.4 Present information, findings, and supporting evidence clearly, concisely, and logically so that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.
- CCSS.ELA.SL.9-10.6 Adapt speech to a variety of contexts and tasks, demonstrating command of formal English when indicated or appropriate.
- CCSS.ELA.RH.11-12.2 Determine the central ideas or information of a primary or secondary source; provide an accurate summary that makes clear the relationships among key details and ideas.
- CCSS.ELA.RH.11-12.6 Evaluate authors' differing points of view on the same historical event or issue by assessing the authors' claims, reasoning, and evidence.
- CCSS.ELA.RH.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, as well as in words) in order to address a question or solve a problem.
- CCSS.ELA.RH.11-12.8 Evaluate an author's premises, claims, and evidence by corroborating or challenging them with other information.
- CCSS.ELA.SL.11-12.1 Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 11-12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.
- CCSS.ELA.SL.11-12.3 Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, assessing the stance, premises, links among ideas, word choice, points of emphasis, and tone used.
- CCSS.ELA.SL.11-12.4 Present information, findings, and supporting evidence, conveying a clear and distinct perspective, so that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks.
- CCSS.ELA.SL.11-12.6 Adapt speech to a variety of contexts and tasks, demonstrating a command of formal English when indicated or appropriate.

Continued list of applicable Social Studies standards

- Geography HS.19 Evaluate how differing points of view, self-interest, and global distribution of natural resources play a role in conflict over territory.
- Social Science Analysis HS.57 Define, research, and explain an event, issue, problem, or phenomenon and its significance to society.
- Social Science Analysis HS.58 Gather, analyze, use, and document information from various sources, distinguishing facts, opinions, inferences, biases, stereotypes, and persuasive appeals.
- Social Science Analysis HS.60 Analyze an event, issue, problem, or phenomenon from varied or opposing perspectives or points of view.

- Social Science Analysis HS.62 Propose, compare, and judge multiple responses, alternatives, or solutions to issues or problems; reach an informed, defensible, supported conclusion.
- Social Science Analysis HS.63 Engage in informed and respectful deliberation and discussion of issues, events, and ideas.