

ROCK STARS

Charles Frederick Hartt—A Pioneer of Brazilian Geology

William R. Brice, Geology & Planetary Sciences, University of Pittsburgh, Johnstown, Pennsylvania 15904, USA, wbrice@pitt.edu

Silvia F. de M. Figueirôa, Instituto de Geociências/UNICAMP, Caixa Postal, 6152, 13083-970 Campinas, SP, Brazil



Figure 1. Charles Frederick Hartt, a self-portrait. (Department of Earth and Atmospheric Sciences, Cornell University.)

Introduction

With today's mechanical and computer-aided tools, it is easy to forget that 100 years ago geological work was accomplished on foot or from the backs of animals, using only great determination, a hammer, and a compass. Now relatively unknown north of the equator, Charles Frederick Hartt was a celebrity in his day (*The Daily Graphic: New York* devoted a full page to his obituary) and was one of the great explorer-geologists of the 19th century. He is best remembered for his work in Brazil. In 1875, he founded Comissão Geológica do Império do Brasil, the first countrywide geological survey.

Hartt was born in Fredericton, New Brunswick, on August 23, 1840, but grew up and was educated in Wolfville, Nova Scotia. Hartt's interest in geology started at age 10 or 11 when he began working for a professor at Acadia College, where he had his first field experiences. Eventually, Hartt received his B.A. (1860) and M.A. (1863) from Acadia College.

From immigrants in Wolfville, young Hartt discovered languages such as Italian and Gaelic, and a local shoemaker taught him Portuguese. Hartt was a remarkable linguist who could read ten or more languages, and he was fluent in five. He learned several Brazilian native languages and was preparing a dictionary of modern Tupí when he died.

From Student to Professional

His family moved to Saint John, New Brunswick, in the 1860s, and Hartt, then just 24, published a paper about a gold deposit at Corbitt's Mills (Nova Scotia) in which he disagreed with Roderick Murchison's theory of gold formation. Perhaps his most important discovery came at the Fern Ledges near Saint John.

In these beds, then considered Devonian in age (actually Carboniferous), Hartt unearthed the oldest insect fossils of the 1860s. Eventually, he came to the attention of Louis Agassiz, famous for his theory of continental glaciation and founder of the Museum of Comparative Zoology (1860), associated with Harvard University.

Agassiz and the Thayer Expedition

In 1865, Hartt was one of two geologists chosen to accompany Agassiz to Brazil on the Thayer Expedition, funded by Nathaniel Thayer, a benefactor and trustee of the museum. On this trip, Agassiz sought evidence of Pleistocene glaciation at sea level in the tropics that would have destroyed all land life and required a Divine recreation, thus refuting Darwin's ideas on the transmutation of species. Hartt was not totally convinced that what he was seeing was truly glacial drift and not just the result of intense weathering. At first he switched from one interpretation to the other until the evidence forced him to break with Agassiz. In the early 1870s, Hartt announced publicly that Agassiz's glacial drift was simply the result of bedrock weathering. This disagreement was really remarkable, for Hartt was challenging not only an important person of the day, but also his mentor and friend.

This first trip to Brazil struck a responsive chord within Hartt, perhaps prompted by learning Portuguese as a child, or his strong desire to succeed, or just the lure of being able to explore the geology of such a large unknown area. Nevertheless, Hartt's attraction to Brazil later proved stronger than his love for his wife and family.

Hartt and Cornell University

After his return from the Thayer

Expedition, Hartt established himself as a lecturer in New York City and became acquainted with José Carlos Rodrigues, the founder and editor of *O Novo Mundo*, a local Portuguese newspaper who may have supported Hartt's solo trip back to Brazil in mid-1867 to study the southernmost coral reefs in the Atlantic at the Abrolhos Islands, work Hartt later published in *The American Naturalist*. Hartt's work in Brazil inspired his student, John C. Branner, later the president of Stanford University, to study the eastern shorelines of Brazil. In the resulting monograph, Branner described occurrences of beach-rock, cemented beach sands, along 1000 miles of shoreline. These works of Hartt and Branner still have value in reef studies.

Before their disagreement, Agassiz had recommended Hartt for the position of inaugural professor of geology at the recently founded Cornell University in Ithaca, New York. Hartt accepted the challenge, and with a secure academic position, he married Lucy Lynde in December 1868.

While Hartt was organizing the department, he began raising funds to lead another expedition to Brazil. The results of the Thayer Expedition and his solo journey were published in 1870 as *Geology and Physical Geography of Brazil...*, one of a few such works in English about Brazilian geology. Although it received mixed reviews, it did boost his reputation, and in 1870, Hartt mounted his own Cornell expedition, the first of two Morgan Expeditions, named for Colonel Edwin P. Morgan, the major underwriter. Within a few months of his return from the trip, Hartt and one of the students, Orville A. Derby, were off on a second Morgan

Expedition. In a newspaper article (*New York Daily Tribune*, December 6, 1870) he wrote of the great adventure:

The river water does not cool much at night, and in the morning I usually found a difference of 15° [F.] between it and the air. It steamed like a hot bath, and felt hot to the body. I found a bath most invigorating soon after sunset, when the air had become cool. A good rubbing, some vigorous exercise, or a cup of coffee warmed one up, and one slept on his sand pillow as comfortably as possible.

On the first of these expeditions, Hartt and his group, headquartered at Pará, explored the geology of the Lower Amazonas, where the local government even provided the Cornell party with a small steamer. But, as he described in an expedition report, travel on land was not so easy:

The journey [to the high area of Parauaquára] was exceedingly fatiguing, and in the woods we were obliged to use our knives incessantly, but what made our progress most painful, were the high grass and bushes filled with caria, a long-leaved sword-grass that cuts like a razor. My heavy duck trowsers [sic] were soon cut out at the knees, and my hands and face were cut and bleeding, while the bare feet of my attendants suffered severely.

The brachiopods the group collected from Ereré, both old and new species, proved a match to the Devonian fauna of New York, and Hartt also discovered more evidence to refute Agassiz's glacial drift idea in the Amazon region.

The Geological Commission of Brazil

By 1874, the Hartts had two children, Rollin (1869) and Mary Bronson (1873). That year, Cornell granted Hartt a leave of absence for his fifth and final visit to Brazil, with the goal of conducting the first geological survey of the country. At first, Hartt worked on his own initiative, without any official endorsements, but with the encouragement of, and possible initial funding by, José Carlos Rodrigues. Hartt left his family in Ithaca, but took John C. Branner, his student at Cornell, with him in 1874.

After some political maneuvering, Hartt's Comissão Geológica do Império do Brasil became a reality in early 1875. Funded by the Imperial government, it was the first attempt to survey the geology of the entire country. To ensure a visual record of the commission, Hartt hired Marc Ferrez, a pioneer Brazilian photographer. However, Hartt's objectives for the commission and the outcome the government wanted were quite different. Using the North American model of such surveys, Hartt emphasized geological mapping and basic research, whereas the funding agency, with national economic benefits in mind, expected the "geologic map project" to produce quick results in locating exploitable mineral deposits. For a while the project went well, and Lucy and the children joined him in Rio de Janeiro. Contemporary reports state the commission eventually collected over 500,000 samples and did considerable basic geological research and mapping, but published few reports.

Hartt's Final Days and the Demise of the Comissão

By late 1877, the Imperial government, seeing little immediate economic benefit and few published results, reduced and then, by January 1878, cancelled all funding for the commission. Hartt's family had returned to the United States a few months earlier, but he continued his futile attempt to regain the commission's financial support. In early 1878, Hartt contracted yellow fever. On March 18, 1878, he died, not with his family but in a rooming house in Rio de Janeiro surrounded by the men of his commission. With his death, all hope of restarting the commission died as well. He was first buried in Rio de Janeiro, but in 1883, his

wife had his remains brought to Buffalo, New York, for interment in her family plot.

Hartt's Legacy

Though he died before age 38, Hartt made contributions to the geological knowledge of Nova Scotia, successfully challenged the interpretation of two senior and famous geologists, and started the geology department at Cornell University. In Brazil, he was a pioneer in both terrestrial and marine geological study and founded the first nationwide geological survey. Even though Hartt's commission lasted but two years, it set the stage for future endeavors. Hartt introduced many North Americans to Brazil who were later to play important roles in the development of Brazilian geology and its geological institutions. John C. Branner stayed in Brazil for almost ten years, and Orville A. Derby stayed until his death in 1915. Derby started the first state geological survey of the state of São Paulo in 1886 and eventually created another national survey in 1906. Branner prepared a text on Brazilian geology and even tried to find suitable fibers in the forests of Brazil for Thomas Edison's work with the light bulb. The geological collections of the commission became part of the National Museum in Rio de Janeiro. Eventually, the Brazilian government published more of the work, and these publications became the foundation of subsequent geological research in Brazil. Thus, while Hartt is no longer well known in North America, he is the "J.W. Powell" or the "Clarence King" of Brazil in regard to Brazilian geology and geological institutions.

Acknowledgments

The authors are indebted to the following persons and institutions: The Division of Rare and Manuscript Collections, Kroch Library, and the Department of Earth and Atmospheric Sciences, Cornell University, Ithaca, New York; Archives Department, New Brunswick Museum; Provincial Archives of New Brunswick, Fredericton; Manuscripts Department, William R. Perkins Library, Duke University; Biblioteca Nacional, Seção de Manuscritos; Rio de Janeiro; the J. Paul Getty Museum; and to the known and anonymous reviewers of the manuscript. For references, please contact Brice.

"Rock Stars" is produced by the GSA History of Geology Division. Editorial Committee: Robert Dott, Robert Ginsburg (editor of this profile), Gerard Middleton, and Peter von Bitter.



Figure 2. Pernambucan reef (beachrock). Hartt is sitting at the far right, and photographer (at tripod) is believed to be Marc Ferrez. (Photo no. 86.XA.749.1.16, "Part of the Pernambucan reef looking southward," courtesy of The J. Paul Getty Museum, Los Angeles; Frederick Hartt, chief geologist of survey, and Marc Ferrez, photographer; 1870s; Albumen; 19.2 × 25.2 cm.)