



Smithsonian

Guided by Stars



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Oceanic Explorers

The Pacific Ocean is a huge body of water. It covers nearly one-third of Earth's surface. It is so large that all the land in the world could fit into its area.

Within this large ocean there are more than 25,000 islands. Hundreds of kilometers separate many of them. Despite the vast distances, the people of this region—Oceania—sailed these waters for more than a thousand years. They discovered every island and settled the major ones.

One group, the Polynesians, traveled the farthest. They settled what we call Polynesia. This triangle extends from the Hawaiian Islands in the north to New Zealand in the southwest. The eastern point of the triangle was Rapa Nui (RAH-puh NOO-ee), or Easter Island. Some of the world's most incredible mariners sailed within the triangular region's boundaries.

You might ask: How did these ancient sailors travel such extreme distances? How did they know where they were going? Didn't they have smartphones, satellites, or even magnetic compasses to guide them?

You are not the only person with those questions. Early British explorers had questions as well. When they first came in their large sailing ships to Hawai'i in the late 1700s, they were amazed at what the Polynesians had accomplished. You will be too!



Pacific Ocean

North America

Hawai'i

Polynesia

Australia

Rapa Nui

New Zealand

Journey Preparation

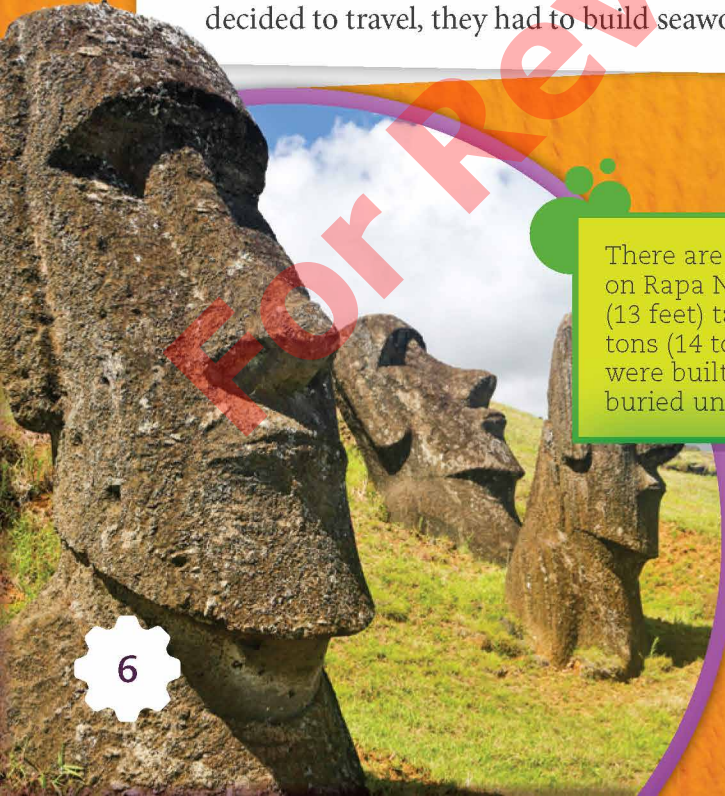
Before these ancient travelers could find their way, they had to have a reason to go. They also needed a means of transportation and had to pack certain **provisions** for the long trip.

A Mighty Migration

It began a few thousand years ago. Ancient people of Southeast Asia began to take to the ocean. In time, they moved down the nearby islands and developed new cultures and languages. They did so for many reasons.

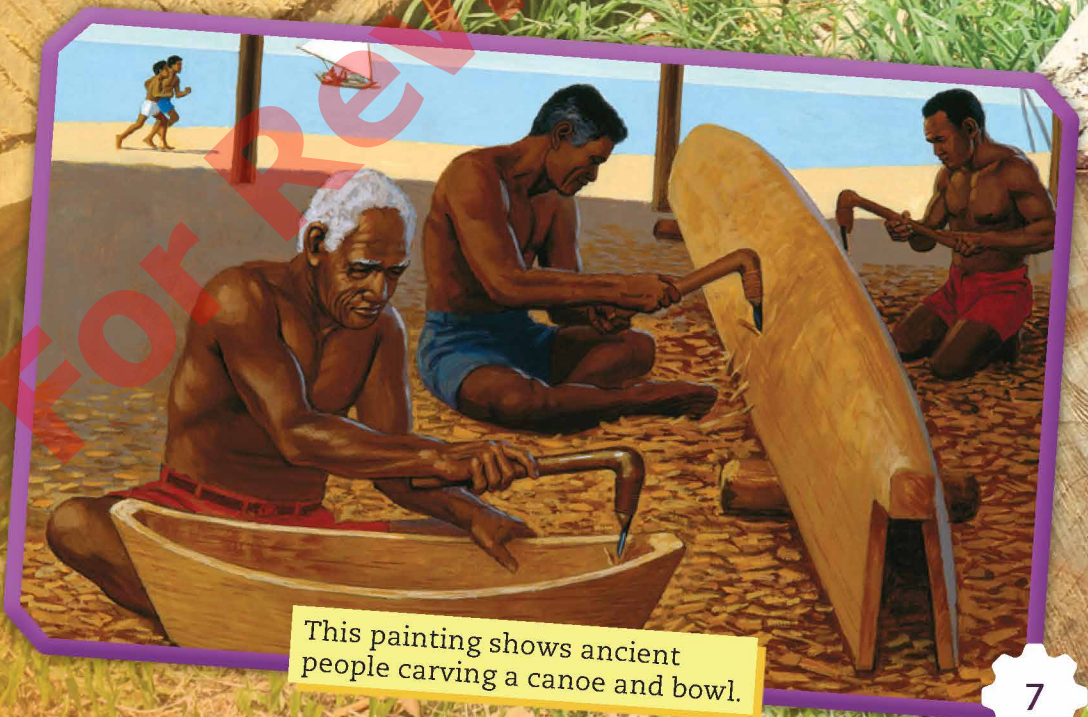
Some people left because their homes were getting overcrowded. This meant they were using more and more of their natural resources, such as land, water, and food. Some people left so they could settle new lands. And some people left just for the thrill of adventure.

It was not just men who journeyed. Whole families, including babies and grandparents, made the trips. Many passages took a day or two. But some took weeks or months. One of the greatest trips was to Hawai'i. The ancient Polynesians traveled more than 3,700 kilometers (2,300 miles) from the Marquesas Islands to get there. Whatever their reasons, once they decided to travel, they had to build seaworthy vessels.

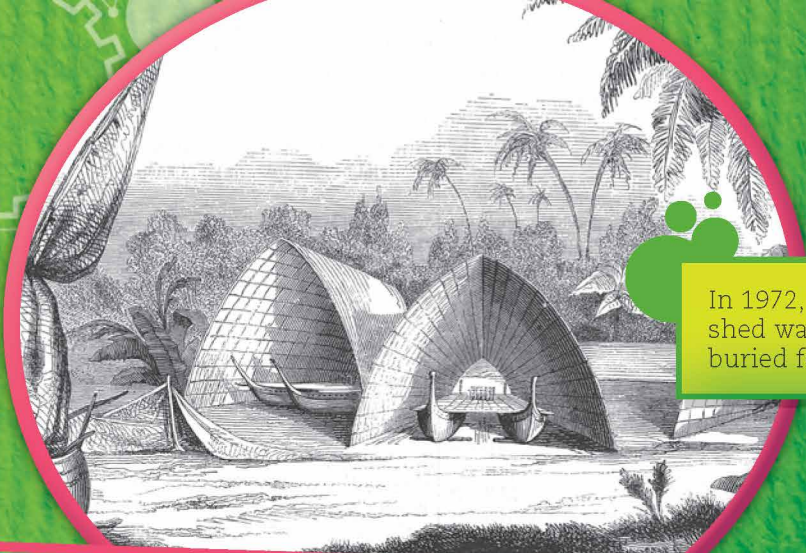


There are more than 600 stone heads on Rapa Nui that stand about 4 meters (13 feet) tall and weigh 12.7 metric tons (14 tons). No one knows how they were built, and some have full bodies buried under hundreds of years of dirt!


partially carved Polynesian canoe



This painting shows ancient people carving a canoe and bowl.



In 1972, the remains of a canoe shed was found after having been buried for over a thousand years.



single-hulled sailing canoe with an outrigger

hull

sail

outrigger

ENGINEERING

Achieving Balance

Polynesians needed boats that would not tip over in rough surf. To solve this problem, they designed, built, and attached outriggers to their single-hulled canoes. The outrigger is made of booms and a float. The booms held the float, which acted as a counterbalance to steady the canoe.

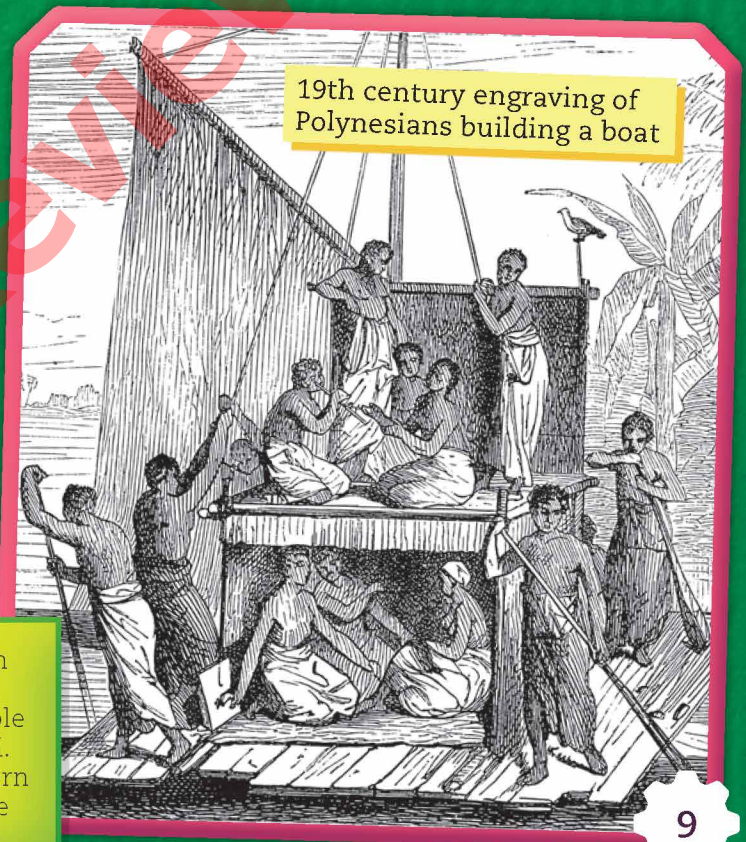
A New Canoe

Although people still paddle single **outrigger** canoes, these classic canoes were not used for deep-ocean trips. Instead, ancient builders had to construct double-hulled outriggers to be powered by the wind.

Some of these boats were more than 30 m (100 ft.) long. They could carry as many as three hundred passengers. With the right wind, they could travel **more** than 160 km (100 mi.) each day. A small canoe might take a year to **build**. The larger double-hulled canoes took even longer.

Polynesians built a special shed for building their boats. To **build** their boats, they first ground down stone **adzes**, until they were sharp **and** tied them to handles. Then, they cut down special trees. They used the adzes to **dig out** **hulls** from the tree trunks. To raise the sides, they sewed planks together **using** strong rope made from coconut fibers. Workers filled the cracks between the planks with soft, green coconut fibers and **breadfruit sap**. They painted the **boats** with a mixture of saps and ashes to waterproof them.

Crossbeams connected the two hulls, and a deck was mounted in between. In the middle, workers built a small shelter as protection from any bad weather the **sailors** might encounter. The **boats** may have had one or two sails, typically made from **pandanus** (pan-DAH-nuhs) matting. They were steered with a **single oar** in the back.



19th century engraving of Polynesians building a boat

In 1977, the first Polynesian voyaging canoe was uncovered by modern people on Huahine island in Tahiti. Before this discovery, modern people only knew about the canoes through legends.



STEAM CHALLENGE

Define the Problem

Ancient Polynesians designed outrigger canoes that allowed them to explore the vast ocean around them. They were successful because the canoes were stable in the water and used wind power to move. Your task is to build a model of an outrigger canoe that is both stable in the water and powered by wind.



Constraints: Your canoe must be made out of at least one material found in nature.



Criteria: Build a small model of an outrigger canoe that floats and moves across the water without tipping over when it is blown by wind.





Research and Brainstorm

How did ancient navigators design and build outrigger canoes? How was wind power used? What types of navigational information can wind provide? Will your canoe have sails? Will it be a single-hulled or double-hulled canoe?



Design and Build

Sketch your design of the canoe. What purpose does each part serve? What materials will work best? Collect materials and build the model.



Test and Improve

Test your canoe by placing it in a large basin filled with water. Use a fan to act as wind. Does the canoe float? Does it move without tipping over? How can it be improved? Modify your design and try again.



Reflect and Share

Can you build an outrigger canoe using fewer materials? Can you design a different model? Can you think of another way to test your canoe?