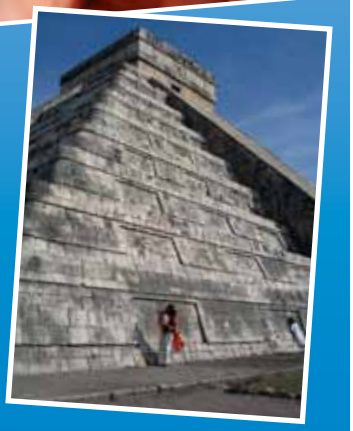
OCEAN EXPLORATION & RESEARCH

Exploring the Hidden World of the Maritime Maya 2011 Expedition

What Happened to the Maya?



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lesson plan

Focus
Collapse of Maya Cities

Grade Level
7-8 (Life Science/Social Studies)

Focus Question
What are possible causes for the collapse of ancient Maya cities?

Learning Objectives
- Students will discuss the maritime cultural landscape approach, describe some of the interactions between human activities and ecological resources, and investigate reasons for the "collapse" of various Maya cities.
- Students will infer how these factors might have impacted settlements at Vista Alegre.
- Students will discuss how maritime trading activities might have influenced or have been influenced by these factors.

Materials
- ❑ None

Audio-Visual Materials
- ❑ (Optional) Interactive white board or other technology to display Figure 1

Teaching Time
One or two 45-minute class periods, plus time for student research

Seating Arrangement
Groups of two to four students

Maximum Number of Students
30

Key Words
Maya
Vista Alegre
Archaeology

Maritime trading
Tikal
Copán
Chichén Itzá
Mayapán

Background Information

NOTE: Explanations and procedures in this lesson are written at a level appropriate to professional educators. In presenting and discussing this material with students, educators may need to adapt the language and instructional approach to styles that are best suited to specific student groups.

Vista Alegre is the site of a Maya settlement on a small mangrove-shrouded island on the southern coast of the Yalahau Lagoon at the northeastern tip of the Yucatán Peninsula. The lagoon connects to the Gulf of Mexico, and most of Vista Alegre is surrounded by lagoons or estuaries. The lagoon connects to the Gulf of Mexico, and most of Vista Alegre is surrounded by lagoons or estuaries. This community was part of the great Mesoamerican civilization that developed true writing, sophisticated mathematics and astronomy, and trade networks that spanned thousands of miles. Archaeologists first visited the site in 1954, and subsequent research has recovered pottery remains that suggest Maya peoples have inhabited Vista Alegre for about 3,000 years. The site has not been continuously occupied, however; and archaeological evidence suggests that there have been four distinct periods of occupancy:

Vista Alegre I (800/700 BC to 450/400 BC)
Vista Alegre II (100/150 AD to 650 AD)
Vista Alegre III (850/900 AD to 1100 AD)
Vista Alegre IV (1100 AD to 1521 AD)

For more information about these periods and their relationship to the overall chronology of the Maya civilization, please see the Expedition Purpose for the Exploring the Hidden World of the Maritime Maya 2011 Expedition, http://oceanexplorer.noaa.gov/explorations/11maya/background/edu/purpose.html.

This discontinuous occupancy raises many questions: What challenges did the first settlers face as they established the community of Vista Alegre? What attracted them to this place, and how did they make a living? What kept people at Vista Alegre after inland sites were abandoned during the Early and Middle Classic Periods? Why did the settlement eventually fail? What brought settlers back to the site in the Terminal Classic Period and why did they eventually leave?

Environmental conditions in the vicinity of Vista Alegre are very different from those around other Maya settlements. Fresh water is scarce; the complex coastal ecology is not suitable for the types of agriculture practiced by Maya in other regions; and the coastal

Images from Page 1 top to bottom:
Canoe-based reconnaissance along the Yucatan's north coast. Dominique Rissolo and Jeffrey Glover (pictured) along with Zachary Hruby explored the north coast of the Peninsula in 2006 searching for Prehispanic and historical sites. Image courtesy of Proyecto Costa Escondida Maritime Maya 2011 Expedition, NOAA-OER.
http://oceanexplorer.noaa.gov/explorations/11maya/background/hires/canoeexploration2006_hires.jpg

A profile view of a partially preserved stucco floor that would have covered the entire plaza area north of the main pyramid at Vista Alegre. The profile allows one to study the construction technique of the stucco floor, including the subfloor ballast. Image courtesy of Proyecto Costa Escondida Maritime Maya 2011 Expedition, NOAA-OER.
http://oceanexplorer.noaa.gov/explorations/11maya/background/hires/u2_piso_profile_2619_hires.jpg

Mold-made ceramic spindle whorl from Vista Alegre. These disks functioned as fly-wheels for handheld fiber spinning rigs. Spindle whorls are quite common at Vista Alegre and suggest that the site's ancient inhabitants were manufacturing cotton yarn or even bulk cloth, a major trade item at the time of Spanish Contact. Image courtesy of Proyecto Costa Escondida Maritime Maya 2011 Expedition, NOAA-OER.
http://oceanexplorer.noaa.gov/explorations/11maya/background/hires/spindlewhorl_kh_hires.jpg

The Castillo at Chichén Itzá is one of the most well-known buildings in Mesoamerica. It is a radial pyramid (with a set of stairs on each side) and is positioned in the middle of the massive plaza area that would have held large numbers of visitors at the height of Chichén's power much as it still does today during the Equinox and Solstice. Image courtesy of Proyecto Costa Escondida Maritime Maya 2011 Expedition, NOAA-OER.
http://oceanexplorer.noaa.gov/explorations/11maya/background/hires/castillo_chichen_hires.jpg

environment offers food resources and transportation opportunities that are not available to inland inhabitants. Maya living at Vista Alegre must have developed specialized ways to live with these conditions, and these different lifeways may have caused Vista Alegre Maya to become culturally distinct from Maya living elsewhere. In fact, records from early European contacts state that the coastal Maya saw themselves as more "refined" than inland peoples. These considerations cause archaeologists to ask whether physical evidence at Vista Alegre demonstrates that its inhabitants had a distinct coastal identity that was significantly different from that of Maya living inland.

In this lesson students will investigate factors that may have contributed to the collapse of ancient Maya cities, and infer how these factors and events may have influenced maritime trading and settlements at Vista Alegre.

Learning Procedure

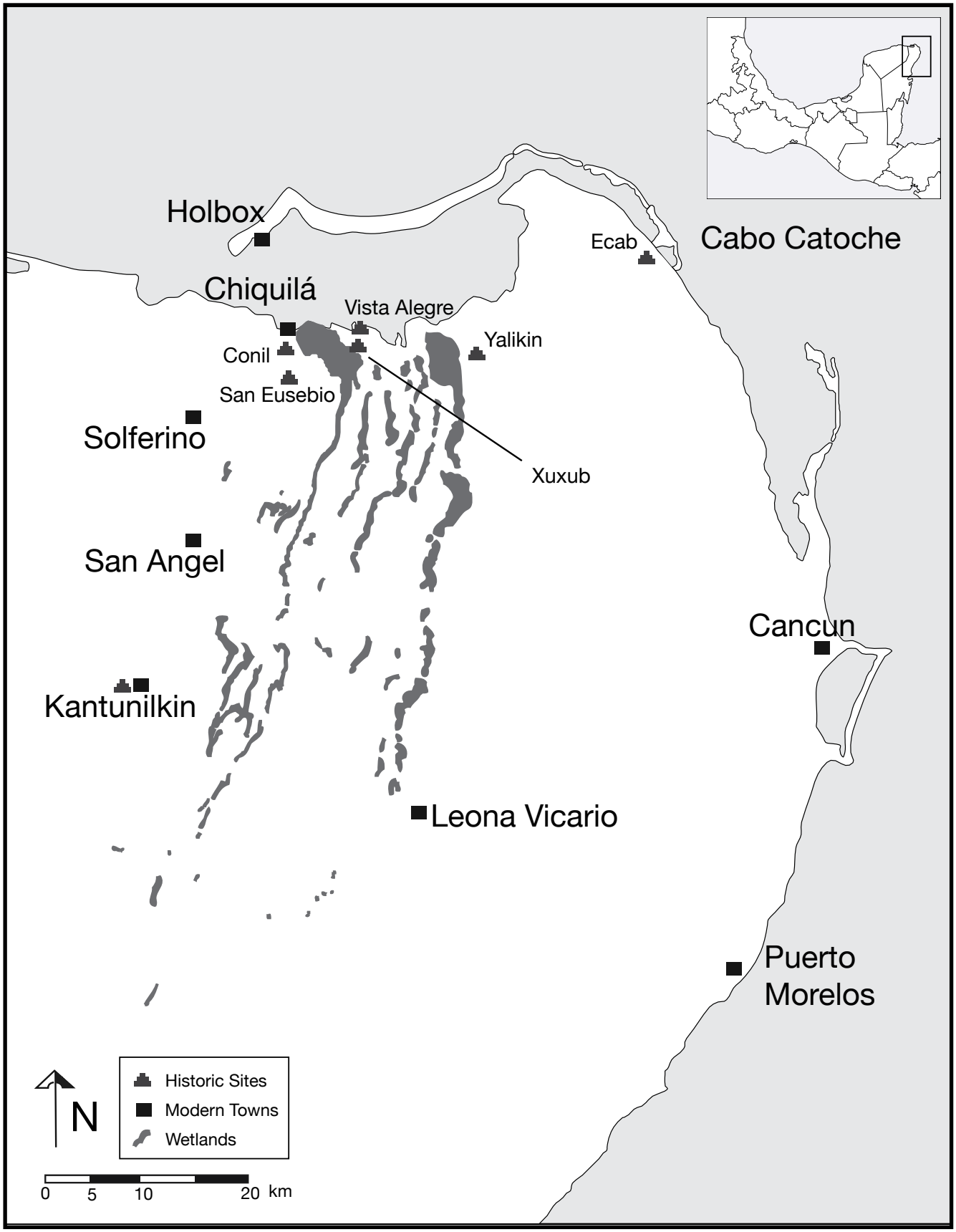
1. To prepare for this lesson:
   a. Review introductory essays for the Exploring the Hidden World of the Maritime Maya 2011 Expedition at http://oceanexplorer.noaa.gov/explorations/11maya/welcome.html.

2. Introduce Exploring the Hidden World of the Maritime Maya 2011 Expedition, briefly describe the Maya civilization. See the resources listed below and the Expedition Purpose for the Exploring the Hidden World of the Maritime Maya 2011 Expedition (http://oceanexplorer.noaa.gov/explorations/11maya/background/edu/purpose.html) for more information. Show students the map of the Yucatán Peninsula (Figure 1, page 4), and point out the location of Vista Alegre, the Yalahau region, and the wetlands near the northern tip of the peninsula. Tell students that the Maya settlement at Vista Alegre was not constantly occupied. Based on research by members of the Exploring the Hidden World of the Maritime Maya 2011 Expedition, Vista Alegre appears to have been occupied during the following periods:

   Vista Alegre I (800/700 BC to 450/400 BC)
   Vista Alegre II (100/150 AD to 650 AD)
   Vista Alegre III (850/900 AD to 1100 AD)
   Vista Alegre IV (1100 AD to 1521 AD)

   Describe the maritime cultural landscape approach, and emphasize that this concept is based on recognizing that artifacts and structures that form the archaeological record are the result of complex interactions between human activities and geographical and ecological features and events that provided the context for these activities. Point out that archaeologists often excavate trash pits (also called middens) to find object that give clues about these interactions, ecological features, and events. Tell students that when

Figure 1. Map of the Yucatán Peninsula including Vista Alegre, the Yalahau region, and the wetlands near the northern tip of the peninsula



this type of archaeological study is applied to modern cultures it is sometimes called "garbology."

3. Show students Table 1, and point out the repeated instances in which ancient cities rose to prominence and power, but eventually collapsed. Tell students that their assignment is to investigate possible reasons for the collapse of selected ancient Maya cities, and to infer what type of evidence archaeologists might find that could help establish why these collapses occurred. Assign one of the following cities to each student group, or alternatively, assign all cities to all groups:

    Tikal
    Copán
    Chichén Itzá
    Mayapán

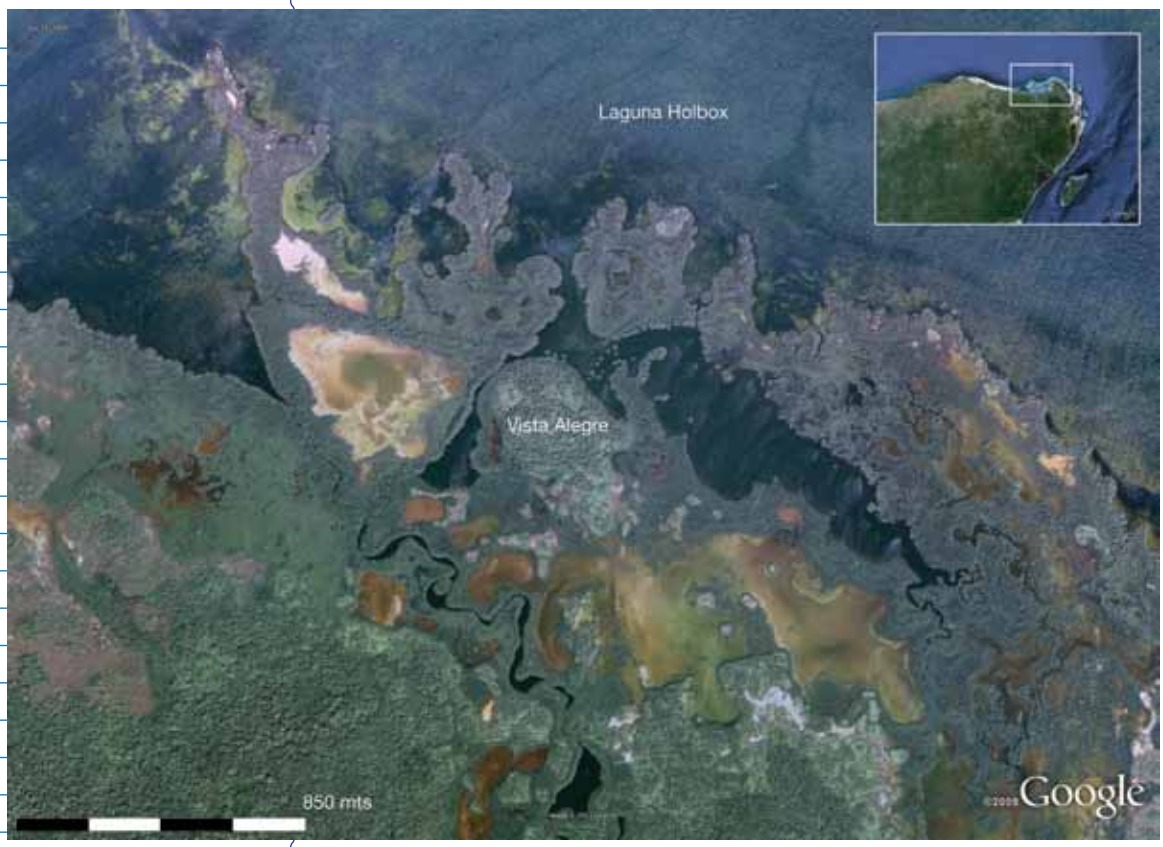
   Students should be expected to prepare a written report that documents possible reasons for their city's collapse, and archaeological evidence that substantiates these possibilities. References should be included to at least three sources of information that were used to prepare the reports.

4. Have each student group present their reports, then lead a discussion of the results. The following points should be included:

   • Factors that are often cited as contributing to the collapse of Maya cities include:
   - Invasion by other cultures
   - Collapse of trade routes
   - Disease and malnutrition
   - Drought
   - Overpopulation and unsustainable agricultural practices leading to erosion and poor crop yields

   • These factors are not mutually exclusive. In fact, it is likely that several factors contributed to the collapse of specific cities. Recent interpretations of the archaeological record give greater importance to ecological factors than to warfare. It is important to remember that Maya civilization was based on a hierarchical society and that rival groups within the ruling class sometimes competed for control. These circumstances led to frequent conflicts between cities, and occasionally within individual cities as rivals struggled for power.

   • Archaeological evidence associated with these factors could include:
   - Accumulations of erosion debris near hillsides suggesting poor farming practices
   - Bone abnormalities that indicate malnutrition and/or disease



Aerial map showing a portion of Laguna Holbox where Vista Alegre is located. Click on the link below to see the entire picture. Image courtesy of Proyecto Costa Escondida Maritime Maya 2011 Expedition, NOAA-OER.
http://oceanexplorer.noaa.gov/explorations/11maya/background/hires/va_plan.jpg

- Pollen and tree ring data showing periods of drought
- Burned structural materials indicating violent conflict
- Hieroglyphic records of battles and conquests

• Tikal is known to have had a large population that would have required large amounts of food, which may have resulted in unsustainable agricultural practices. Tikal was periodically attacked by people from rival cities, which would have caused Tikal's population to withdraw into the city placing additional strain on agricultural production and possibly accelerating environmental decline.

• Copán was one of the most powerful Maya cities between the 5th and 9th centuries A.D. An unfinished stone monument at the Copán site includes hieroglyphics that show a date equivalent to February 10, 822 A.D. No monuments have been found at Copán with a more recent date. Archaeological evidence points toward ecological factors as a major factor in the city's decline. Mahogany pollen recovered from the site has been dated to about 1200 A.D., but there is very little pollen from large trees prior to this date. This suggests that forests near the city had been cleared for intensive

agriculture. Particularly on hillsides, this type of farming can result in serious erosion; and some houses found near hillsides contain erosion debris. Accumulation of this type of debris seems to have begun in the eighth century A.D. Eventually, some houses were completely buried by erosion debris. Dependence on unsustainable agricultural practices probably also contributed to malnutrition; 80 percent of skeletons recovered from the Copán site show evidence of anemia.

- Chichén Itzá was particularly focused on developing coastal resources and long-distance trade routes, which may have contributed to the third re-occupation at Vista Alegre. The culture at Chichén Itzá also included human sacrifice and other forms of forced tribute that could have contributed to civil unrest. Once again, increasing population could have placed heavy demands on agricultural systems which may have been exacerbated by drought. Archaeological data include evidence that important structures were burned, suggesting that violent events accompanied Chichén Itzá's collapse.

- The history of Mayapán included similar social hierarchy, subjugation of lower classes, and periodic conflicts with rival cities. It is known that conflict between rival elite families in 1441 resulted in the killing of most of the ruling family, and archaeological evidence confirms widespread destruction and burning.

- The history of these cities underscores a close connection to their local ecology, as well as how human activities may have changed local environmental conditions. When cities' populations exceed the local environmental capacity to provide food, malnutrition can lead to disease and social unrest that leaves these cities more vulnerable to external threats and other environmental problems, such as drought.

- These factors may not have affected settlements at Vista Alegre in the same way they affected major Maya cities. The agricultural systems that provided food for Vista Alegre were probably different from those that served major cities, since the local ecological setting for Vista Alegre was different than the ecological setting for major inland cities. Moreover, the population at Vista Alegre would have been much smaller than the population of cities, and this may have reduced the likelihood that food resources around Vista Alegre would be over-exploited. Smaller populations may have meant that social stratification was not as severe; alternatively, stratification may have been intensified by the close proximity of people. Vista Alegre, at least during some of its periods of occupation, seems to have been oriented strongly toward maritime

trade. This meant that inhabitants of Vista Alegre had access to food, materials, and ideas from other areas, which may have reduced the impact of some factors that led to collapse of major cities. Nevertheless, Vista Alegre probably was never entirely independent of inland cities, and the collapse of these cities must have eventually led to a similar result at Vista Alegre.

The BRIDGE Connection

www.vims.edu/bridge/archeology.html

The "Me" Connection

Have students write a brief essay about how knowledge of ancient Maya settlements might be of personal importance or benefit.

Connections to Other Subjects

English/Language Arts, Geography

Assessment

Students' research reports and class discussions provide opportunities for assessment.

Extensions

1. Visit http://oceanexplorer.noaa.gov/explorations/11maya/welcome.html for more about the Exploring the Hidden World of the Maritime Maya 2011 Expedition.
2. For more activities about the Maya civilization, see Other Resources, below.

Other Relevant Lesson Plans from NOAA's Ocean Exploration Program

Paleo-Diving
(from the Exploring the Submerged New World 2009 Expedition)
http://oceanexplorer.noaa.gov/explorations/09newworld/background/edu/media/paleodiving.pdf

Focus: Underwater Archaeology of Sinkholes (Physical Science/Archaeology)

Students will explain how sinkholes are formed, why they may be associated with paleoamerican settlements, and how artifacts retrieved from sinkholes may be interpreted.

We Arrived 10,000 Years Ago...
(from the Exploring the Submerged New World 2009 Expedition)
http://oceanexplorer.noaa.gov/explorations/09newworld/background/edu/media/10000yrs.pdf

Focus: Lifeways of Paleoamericans (Archaeology/Anthropology)

Students will explain at least two ways that humans migrating from eastern Asia may have settled North and South America, and will make inferences about lifeways of paleoamericans based on an extant 10,000 year-old human culture in southern California.

Other Resources

The Web links below are provided for informational purposes only. Links outside of Ocean Explorer have been checked at the time of this page's publication, but the linking sites may become outdated or non-operational over time.

http://oceanexplorer.noaa.gov/explorations/11maya/welcome.html – Web site for the Exploring the Hidden World of the Maritime Maya 2011 Expedition

http://celebrating200years.noaa.gov/edufun/book/welcome.html#book - A free printable book for home and school use introduced in 2004 to celebrate the 200th anniversary of NOAA; nearly 200 pages of lessons focusing on the exploration, understanding, and protection of Earth as a whole system

Glover, J. B., D. Rissolo, and J. P. Mathews, 2011. The Hidden World of the Maritime Maya: Lost Landscapes Along the North Coast of Quintana Roo, Mexico. -in- B. Ford, ed. When the Land Meets the Sea. Volume 2, pp 195-216, The Archaeology of Maritime Landscapes. Springer Science+Business Media. New York.

http://www.smm.org/sln/ma/ – Maya Adventure, from the Science Museum of Minnesota; includes science activities and information related to ancient and modern Maya culture

http://teacher.scholastic.com/lessonrepro/lessonplans/profbooks/ss970818d.htm – Peoples of Mexico - The Maya from Scholastic.com

http://www.pbs.org/wgbh/nova/teachers/programs/2804_maya.html – Teacher's Guide to accompany the NOVA production, Lost King of the Maya; includes an activity using the Maya calendar

http://www.civilization.ca/cmc/exhibitions/civil/maya/mminteng.shtml – "Mystery of the Maya" Web site from the Canadian Museum of Civilization

http://school.discoveryeducation.com/lessonplans/programs/mayanewsreport/ – Lesson plan (grades 9-12), "A Classical Maya News Report" from Discovery Education

Fedick, S. L., M. de L. Flores Delgadillo, S. Sedov, E. Solleiro Rebolledo, and S. Palacios Mayor. 2008. Adaptation of Maya homegardens by "container gardening" in limestone bedrock cavities. Journal of Ethnobiology 28(2): 290–304; available from: ftp://ftp.flmnh.ufl.edu/Projects/EmeryPublications/ForestLegacy/FedicketalJEthnobio-28-2-290.pdf

Fedick, S. L. 1997. Ancient Manipulation of Wetlands in the Northern Maya Lowlands: Report on Archaeological Investigations of 1996-97. Foundation for the Advancement of Mesoamerican Studies, Inc.; available from: www.famsi.org/reports/95087/95087Fedick01.pdf

Martin, Simon and Nikolai Grube. 1995. Maya Superstates. *Archaeology* 48(6):41-46.

Webster, David L. 2002. The Fall of the Ancient Maya. Thames & Hudson, London.

Correlations

Framework for K-12 Science Education

B. Crosscutting Concepts
- 2. Cause and effect: Mechanism and explanation
- 7. Stability and change

C. Disciplinary Core Ideas

Life Sciences
- Core Idea LS2: Ecosystems: Interactions, Energy, and Dynamics
  - LS2.A: Interdependent Relationships in Ecosystems
  - LS2.C: Ecosystems Dynamics, Functioning, and Resilience
  - LS2.D: Social Interactions and Group Behavior
- Core Idea LS4: Biological Evolution: Unity and Diversity
  - LS4.D: Biodiversity and Humans

Earth and Space Sciences
- Core Idea ESS3: Earth and Human Activity
  - ESS3.C: Human Impacts on Earth Systems
- Core Idea ETS2: Links Among Engineering, Technology, Science, and Society
  - ETS2.B: Influence of Engineering, Technology and Science on Society and the Natural World

Ocean Literacy Essential Principles and Fundamental Concepts

Essential Principle 2.

The ocean and life in the ocean shape the features of the Earth.

Fundamental Concept c. Erosion—the wearing away of rock, soil and other biotic and abiotic earth materials—occurs in coastal areas as wind, waves, and currents in rivers and the ocean move sediments.

Essential Principle 5.
The ocean supports a great diversity of life and ecosystems.

Fundamental Concept i. Estuaries provide important and productive nursery areas for many marine and aquatic species.

Essential Principle 6.
The ocean and humans are inextricably interconnected.

Fundamental Concept b. From the ocean we get foods, medicines, and mineral and energy resources. In addition, it provides jobs, supports our nation's economy, serves as a highway for transportation of goods and people, and plays a role in national security.

Fundamental Concept c. The ocean is a source of inspiration, recreation, rejuvenation and discovery. It is also an important element in the heritage of many cultures.

Fundamental Concept f. Coastal regions are susceptible to natural hazards (such as tsunamis, hurricanes, cyclones, sea level change, and storm surges).

Send Us Your Feedback

In addition to consultation with expedition scientists, the development of lesson plans and other education products is guided by comments and suggestions from educators and others who use these materials. Please send questions and comments about these materials to: oceanexeducation@noaa.gov.

For More Information

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Credit

Table 1: Maya Civilization Timeline

2600 BC - Cuello (Belize) is occupied by Maya or Maya-like people
2000 BC - Village farming begins to take root in Mesoamerica
1800 BC - Early Pre-classic Period begins; some structures associated with specific activities at specific places
1200 BC - Olmec culture based on social hierarchy emerges in Gulf Coast area of Mexico
900 BC - Middle Pre-classic Period begins; monumental architecture defines major centers of activity
700 BC - Writing is developed in Mesoamerica
600 BC - City of Tikal is founded
400 BC - Earliest known solar calendars carved in stone in use
300 BC - Late Pre-classic Period begins; Maya adopt hierarchical society
100 AD - Olmecs decline
250 AD - Early Classic Period begins
400 AD - Oldest part of city of Chichén Itzá is founded
500 AD - Tikal and Copán become dominant Maya cities
600 AD - Late Classic Period begins; Calakmul, the other major Maya city at this time period, defeats Tikal in the 7th century with help from its allies and sends Tikal into an almost 100 year decline
700 AD - Tikal reemerges as a dominant power in the Maya lowlands, with as many as 60,000 inhabitants
Late 700s AD - Long-standing Maya alliances begin to break down; trade between Maya states declines; conflict between states increases
[NOTE: It is important to understand that the collapse of the southern lowland cities took place over a century, and was not a single event with a single cause. It is also important to recognize that the Maya did not disappear, and that there are still Maya peoples living today.]
800-900 AD - City of Chichén Itzá develops increasing importance
822 - Last known monument constructed at Copán
869 AD - Construction ceases in Tikal
899 AD - Tikal largely abandoned
900 AD - The Terminal Classic Period begins, southern lowland cities collapse; cities in northern Yucatán continue to thrive
1000 AD - City of Chichén Itzá is a major center of commerce, culture, and military power with strong connections (religious, political, and economic) with Central Mexico.
1220 AD (approximate) - City of Chichén Itzá collapses
1263 AD - City of Mayapán founded
1283 AD - Mayapán becomes the capital of Yucatán
1441 AD - Rebellion within Mayapán
1461 AD - Mayapán abandoned; Yucatán degenerates into sixteen rival statelets
1517 AD - Spanish arrive in Yucatán