Module 4, Investigation 1: Briefing 1

Photographs—Chaco Canyon

Study the photographs to identify physical features of the region. What is the land like? What type of climate exists in this region? The photographs show some evidence of ancient and modern human occupation. What features are from the ancient Anasazi culture? What features show modern changes to the environment?

Fajada Butte in Chaco Canyon

Hungo Pavi Trailhead

Pueblo Del Arroyo from the South Gap

http://members.aol.com/mjhinton/chaco/9905/index.html

Module 4, Investigation 1: Briefing 2

Who were the Anasazi?

Use this briefing to study maps and remotely sensed images to learn about the culture of the Anasazi and the physical geography of the region inhabited by the Anasazi.

The Anasazi built their towns, or pueblos, between 1100 and 1300 A.D. near the Chaco River and Canyon in northwest New Mexico.

http://www.cr.nps.gov/worldheritage/chaco.htm

The dwellings were built out of sandstone blocks and mud to create small rooms. There were few doors on the ground level.

Pueblo villages had underground chambers called kivas. Kivas were used for council meetings and religious ceremonies. The pueblos appear to be the centers of communities.

In the past, it was believed that Chaco Canyon was a major city and ceremonial center. New interpretations indicate that there were few permanent residents and that it was a religious or ceremonial center to which the Anasazi traveled.

Geoarchaeologists have learned about the Anasazi lifestyle from artifacts found in and around the cliff dwellings. Items found include bows and arrows, clothing, and wooden implements. The Anasazi were farmers. They grew beans, squash, corn, cotton, and tobacco on the mesas above them or on the flat canyon bottoms. They hunted deer and mountain sheep. Dishes and bowls were made of clay pottery painted with red and black designs. Summer clothing was made from cotton, milkweed, and yucca fibers. In winter, fur robes and blankets made of turkey feathers kept them warm.

Evidence of an elaborate road system has emerged through the use of remotely sensed images. Many remnants of a road system have been found, some only after using the images to predict where they might be. Wide, paved roads were laid out in straight lines, despite the canyons, mesas, and hills. The Anasazi used no carts or work animals, so the size and condition of the roads is a mystery.

Figure 1

http://www.ghcc.msfc.nasa.gov/archeology/chaco_compare.html

Module 4, Investigation 1: Briefing 2

Who were the Anasazi?

Figure 1 is a remotely sensed image of the Chacoan region. Ancient Anasazi roads, detected using TIMS (thermal infrared multispectral scanner), are represented in red. The yellow lines are modern roads.

As you can see in Figure 2, the region is, for the most part, a plateau but is deeply cut by old rivers, creating a rough terrain and many mesas. Today the region has a dry climate with shrub and small tree growth on the top of the mesas.

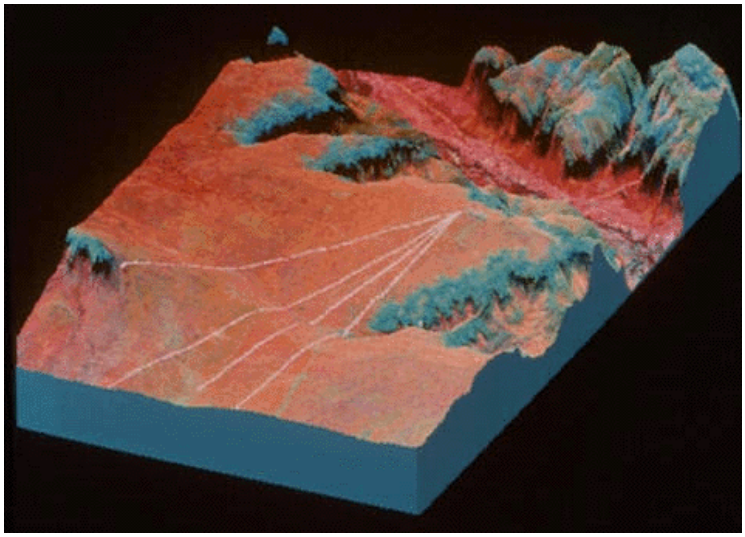


Figure 2: Chaco Canyon, looking from the southwest

http://www.ghcc.msfc.nasa.gov/archeology/chaco_canyon.html

Geoarchaeologists do not understand many parts of the Anasazi culture. For example, they do not know why the civilization disappeared around 1300. There are three commonly held theories. One is that the climate changed very drastically in a short time. This may have caused severe drought or loss of food supply. In order to survive, the Anasazi moved to where water was more dependable from year to year. Another theory is that the Anasazi, a seemingly peaceful group, were attacked by more warlike people. They perished (although there is no evidence of burials or bones) or they moved, giving up their homes and their land. A third theory is that the Anasazi population grew and exceeded the carrying capacity of this arid region. There may have been too many people and too few resources.

In 1999, the National Park Service declared this region a "vanishing treasure." Uncovering the ruins of this ancient civilization has exposed buildings and foundations to erosion from rain and freezing and thawing. There is also deterioration from tourists who walk through the dwellings.

The Park Service is unsure as to the next course to take: close the ruins altogether to public viewing, limit the number of visitors per year, or cover up the ruins so they are no longer exposed to erosion.

Resources

Chaco Culture National Historical Park http://www.nps.gov/chcu/home.htm

Chaco in the News—Conservation Group: Chaco Canyon endangered http://members.aol.com/mjhinton/chaco/chaconews.htm

"Cliff Dwellers." *World Book Encyclopedia*. 1999.

Seaver, Tom. Presentation: Global Hydrology and Climate Center. Huntsville, Alabama, March 2000.

TIMS Image http://www.ghcc.msfc.nasa.gov.archeology/chaco_compare.html

The Anasazi Culture

Put a check in front of the statements which correctly describe the Anasazi culture.

_____ 1. Built homes from sandstone

_____ 2. Constructed roads

_____ 3. Grew agricultural crops

_____ 4. Had horses

_____ 5. Had pottery

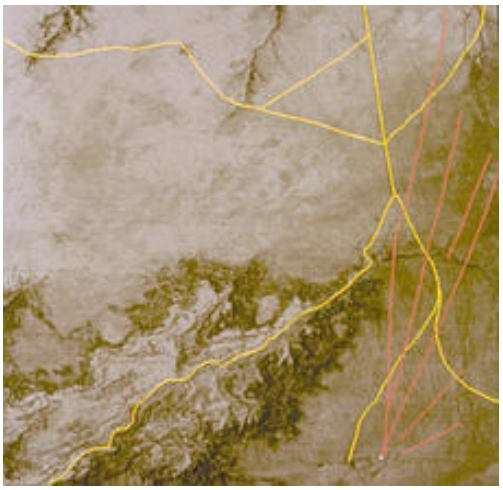
_____ 6. Roads followed the terrain

_____ 7. Square kivas provided dwelling accommodations

_____ 8. Warlike people

Module 4, Investigation 1: Log 1

Comparing maps and remotely sensed images



The image at the left shows the Anasazi roads in red and the modern roads, which follow the terrain, in yellow.

http://www.ghcc.msfc.nasa.gov.archeology/chaco_compare.html

Objective

In this investigation, you learn how to determine scale and direction on unmarked aerial images. You also explore new insights about the Anasazi by analyzing remotely sensed images.

Part I. Determining a Scale

You need

- colored pencils
- a ruler
- Map 1
- Map 2

Map 1 is a modern road map of the Chaco Canyon region in northwestern New Mexico. Map 2 is a map of ancient Anasazi settlements and roads in relation to present-day features.

To help you orient yourself to the maps, it is suggested that you color the maps as follows:

On Map 1

- Locate the following cities and highlight them in red: Shiprock, Farmington, Gallup, Cuba, Grants.
- Circle the Chaco Culture National Historical Park with a yellow pencil.
- Circle Aztec Ruins and Salmon Ruins in yellow.
- Trace over modern roads in red.
- Trace over prehistoric roads in yellow.
- Trace over rivers in blue.

On Map 2

- Circle the Chaco Core with a yellow pencil. Color in the outlier settlement symbols in yellow.
- Add and label Aztec Ruins and Salmon Ruins in yellow.
- Sketch in modern roads in red.
- Trace over prehistoric roads in yellow.
- Trace over rivers in blue.
- Use shades of tan and brown to shade in the mountains, plateaus, and mesas.

Use Maps 1 and 2 to complete the following statements.

1. Map 2 does not name the outlying settlements. The Anasazi roads on this map have been grouped and identified by direction. Find the group of roads marked A.

   Look at Map 1. Can you find the same Anasazi pattern of roads running northward from the Chaco Culture National Historical Park? Notice the angle in the road as it gets close to Salmon Ruins. Find this angle on both maps.

   On Map 2 the end of the Chacoan road is at the outlying settlement named:

   _____

Module 4, Investigation 1: Log 1

Comparing maps and remotely sensed images

2. Map 2 has a scale of kilometers and a directional arrow, but Map 1 does not.

   On Map 2, with your ruler measure the distance of the longest Chacoan road from the vertex of A to the farthest outlier point at Salmon Ruins. Compare the distance to the scale of kilometers.

   The road measures _____ cm and equals _____ km.

3. Now measure the same road on Map 1 with your ruler.

   The road measures _____ cm.

   Is this **more, the same**, or **less** than the measurement on Map 2? _____

4. Create a scale of kilometers and directional arrow on Map 1.

Part II. How Are Known Chacoan Roads Related to the TIMS Images?

The Anasazi developed extensive and elaborate road systems connecting communities and resources. In the Chacoan culture, more than 645 kilometers of prehistoric roadways have been identified. The roads connect 75 known communities.

Many of these roads are not visible from ground level. They were not detected from aerial photographs or color infrared photographs. Not until the use of TIMS did the ancient Anasazi road system become visible.

Chaco was at the center with roads radiating outward in many directions as seen on Maps 1 and 2. The longest identified road is one stretching from Bonito to the Salmon and Aztec communities. The north-south routes had settlements spaced apart at intervals of one day's travel time.

The roads were not simple trails. They were planned, constructed of stone, and maintained. They averaged about 9 meters wide. If the roadbed needed to be filled in to make it level, rocks were used to form a retaining wall so the soil would not wash out. In areas of bedrock, a masonry wall or line of boulders marked the edges of the roads.

Geoarchaeologists believed that the roads were used for transportation of goods and for communication between communities. Evidence suggests that Bonito was not the center of the population. It appears to have had only 25–30 permanent residents. The roads to Bonito may have been ceremonial. Although the maps show the roads reaching outliers, new interpretations suggest that the roads may have been used for ceremonial processions to sacred destinations. They often lead to topographic features, such as mountain crests. At these mountain crests, much broken pottery has been found. There may be a religious connection between the pottery and these significant ending points of the roads.

Figures 2 and 3, on the following page, show the same location. Different colors were assigned to the data. As you compare the two images, notice that features can be seen better by using different colors.

Module 4, Investigation 1: Log 1

Comparing maps and remotely sensed images

Figure 2

Figure 3

http://www.ghcc.msfc.nasa.gov/archeology/chaco_compare.html

Answer the following questions about the TIMS images. Refer to Maps 1 and 2 for reference points and additional information.

1. What does the mottled (darker, textured) area show?

   _____

2. The straight lines in Figure 2 are Chacoan roads. The brighter lines on Figure 3 are current roads. How are the Chacoan roads and current roads similar?

   _____

   _____

3. Why are there differences between the routes of current roads and ancient Chacoan roads?

   _____

   _____

4. Compare the current roads marked on TIMS Figure 3 with the terrain of Map 2. Complete the following sentence (select the phrases which complete the statement correctly):

Chacoan roads	run in straight lines	follow the terrain
	whereas	
current roads	run in straight lines	follow the terrain

5. Using the directional arrow on Map 2, match Chacoan roads and put a directional arrow on the TIMS Figures 2 and 3.

Are these images oriented in the same direction as the maps? _____

References

Baker Aerial Archaeology's Chaco Project
http://www.mia.com/~jaybird/AANewsletter/ChacoPage2.html

Chaco Culture National Historical Park
http://www.cr.nps.gov/worldheritage/chaco.htm
http://www.nps.gov/chcu/roads.htm

Chaco in the News—Conservation Group: Chaco Canyon endangered http://members.aol.com/mjhinton/chaco/chaconews.htm

Seaver, Tom. Presentation: Global Hydrology and Climate Center. Huntsville, Alabama, March 2000.

TIMS images of Chaco Canyon, New Mexico
http://www.ghcc.msfc.nasa.gov.archeology/chaco_compare.html

Module 4, Investigation 1: Log 2

Should Chaco Canyon be preserved?

The photograph at the left shows the ruins of a village.

Source: http://members.aol.com/mjhinton/chaco/9905/index.html

Objective

In this part of the investigation you review the conditions at Chaco Canyon that make it an endangered site. After taking a survey of public opinion, you recommend what action should be taken to preserve the site.

Close the Park?

Closing the park to tourists is an option to preserve the ruins. Prohibiting tourists would protect the ruins from wear and tear and vandalism. Also, the ruins could be protected from weather damage by covering them.

The chief ranger at Chaco Canyon National Historic Site has received many letters from tourists who think that the entire site should continue to be open to visitors. He has also received information from preservation groups, indicating that the Chaco ruins are in danger of disappearing.

Find out how others think about preservation of a national historic site. Here are two ways to do this:

1) Select a class or group in your school to survey. Arrange a time with the teacher when you might speak to the class or distribute information regarding Chaco Canyon. Be sure to discuss the alternatives to preservation.

Survey the class about what they think should be done:

- Should Chaco Canyon be closed to visitors?
- Should only selected archaeological sites of Chaco Canyon be open to the public, while others are closed to public viewing ?
- Should all archaeological sites in Chaco Canyon be open to the public?

Remember to ask the survey group to state reasons for their selection.

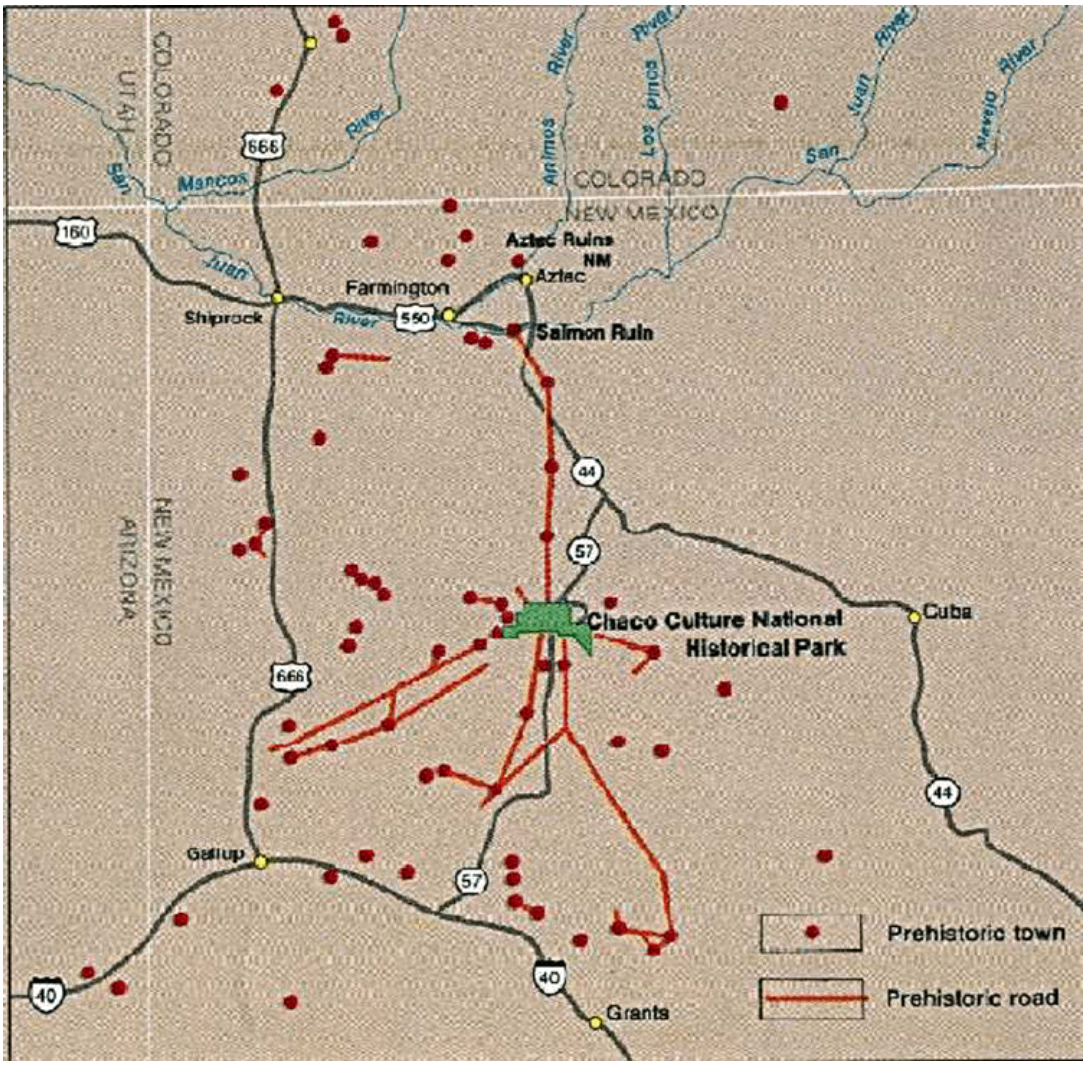
2) Prepare a one-page flyer and survey to distribute in school. The flyer should summarize key issues related to preserving Chaco Canyon and the survey questions. Hand it out to students at a time and place to ensure a high rate of return.

Compile the results of your survey and draw conclusions about public opinion. Write a recommendation concerning the preservation of the ruins to the chief ranger of the Chaco Culture National Historical Park.

- Include a summary of what you learned while studying Chaco Canyon.
- Include a summary of the survey results and conclusions.
- Make a recommendation concerning future action.

Module 4, Investigation 1: Map 1

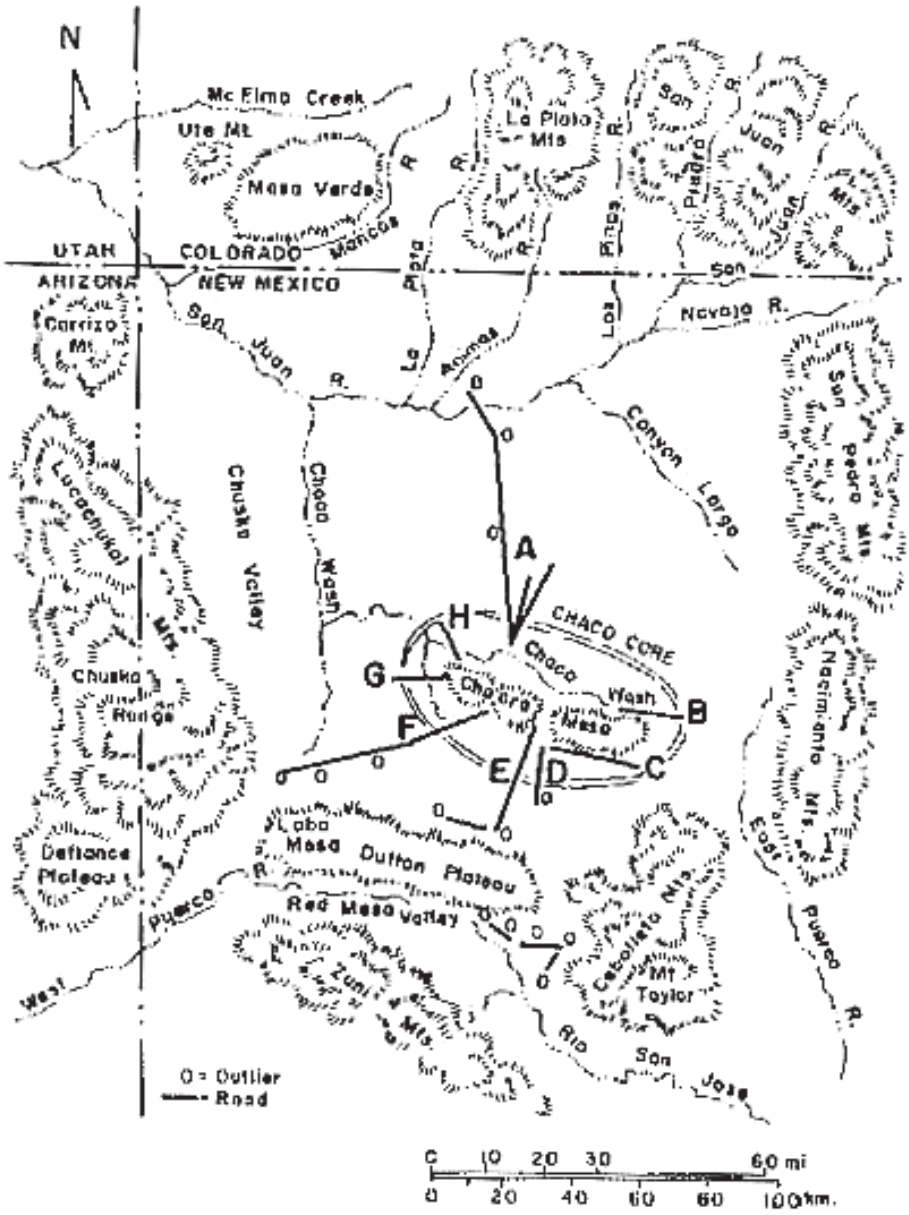
Modern road map of Chaco Canyon region



http://members.aol.com/mjhinton/chaco/maps.htm

Module 4, Investigation 1: Map 2

Map of ancient Anasazi outlier settlements and roads



http://www.nps.gov/chcu.roads.htm

Module 4, Investigation 1: Log 3
In conclusion

Briefly describe how each of the following graphics in Investigation 1 are helpful to a geoarchaeologist.

1. Photographs of Site

_____

_____

2. Map 1

_____

_____

3. Map 2

_____

_____

4. TIMS Image 1 (Figure 2)

_____

_____

5. TIMS Image 2 (Figure 3)

_____

_____

6. What do you think should be done regarding preservation of Chaco Canyon Historic Site? Support your answer.

_____

_____

_____

_____

_____

_____