

# 1

## An introduction to biodiversity bioinformatics using

**NMITA** Neogene Marine Biota of Tropical America

### Lesson 1: Learn how to use a bioinformatics database known as NMITA

This lesson is designed to help you become familiar with the overall structure of a bioinformatics database known as NMITA and learn about the types of data that are contained within it. This lesson takes you on a virtual journey to the Dominican Republic, a country located on the island of Hispaniola in the Caribbean Sea. On the island you will explore the marine fossils that occur in the sedimentary rock layers that were formed when parts of the island were under the Caribbean Sea. Specifically, you will study fossil corals exposed in rock layers from along the banks of the Rio Gurabo in the Cibao Valley. At the end of the first lesson you should be familiar enough with the database to begin using it to gather larger amounts of data and answer specific questions about evolution and biodiversity. Two additional lessons are provided that build upon what you learn here.

#### Key Terms:

*Marine*  
*Biodiversity*  
*Genus*  
*Species*  
*Fossil*

*Coral*  
*Fauna*  
*Sedimentary rock*  
*Formation*  
*Stratigraphy*

#### Key Concepts:

*Fossilization*  
*Sedimentation*  
*Superposition*  
*Extinction*  
*Dating rock*



#### Directions:

1. Go to NMITA <http://porites.geology.uiowa.edu/index.htm>
2. Click Maps & Faunal Lists
3. Click Dominican Republic

4. A map of the Dominican Republic will appear. West of *Santiago*, a large city, there are three rivers. List the names of the three rivers: \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_.
5. Click on the Rio Gurabo and a map of the river will load. Name the three regions that the river is divided into: \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_.
6. To view the layers of sedimentary rock exposed along the river, select "[Click here for stratigraphic column](#)" at the **top left** of the page.
7. A diagram showing the rock layers along the banks of the Rio Gurabo will load. This diagram is known as a *stratigraphic column*. It shows the locations (in both time and space) of the samples taken from these layers. The *layers* of rock were measured, studied, and named as different *formations*. The position of each sample is indicated in meters relative to the base of a geological formation known as the Tabera Formation. Approximately 400 samples of fossils were taken from these rock layers. Each sample typically has five numbers (e.g., 15804). These numbers correspond to museum samples that contain the actual specimens. Several million fossils were collected from the banks along the Rio Gurabo.
8. The layers of rock in the Rio Gurabo section are divided into three different formations (abbreviated "Fm"). List the names of the three formations exposed along the banks of the Rio Gurabo: \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_.
9. Where is the boundary between the Cercado and Gurabo Formations in the Rio Gurabo section? (Your answer should be in meters) \_\_\_\_\_ m.
10. Locate sample 15901 and then click on it. Information about this sample will subsequently load. A diagram below explains how to interpret the information:

**NMB 15901** = locality

**Gurabo** = River name

**122m** = position of sample in the column (in meters)

**Cercado Fm.** = Formation the sample is located within.

**Miocene** = Age (epoch) of the sample

Dominican Republic NMB15901 Locality Page - Microsoft Internet Explorer

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Address [http://nmb1a.geology.uiowa.edu:8001/ows-bin/owa/LOCALITY\\_FORM?page=NMB15901](http://nmb1a.geology.uiowa.edu:8001/ows-bin/owa/LOCALITY_FORM?page=NMB15901)

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Locality = NMB15901 Gurabo, 122 m, Cercado Formation, nn11, l.Miocene

Locality Group = G1, Gurabo1, 120 - 140 m, Rio Gurabo, fig.4&6, Saunders et al. 1986, 8.3 - 7.5 Ma

Faunal List:

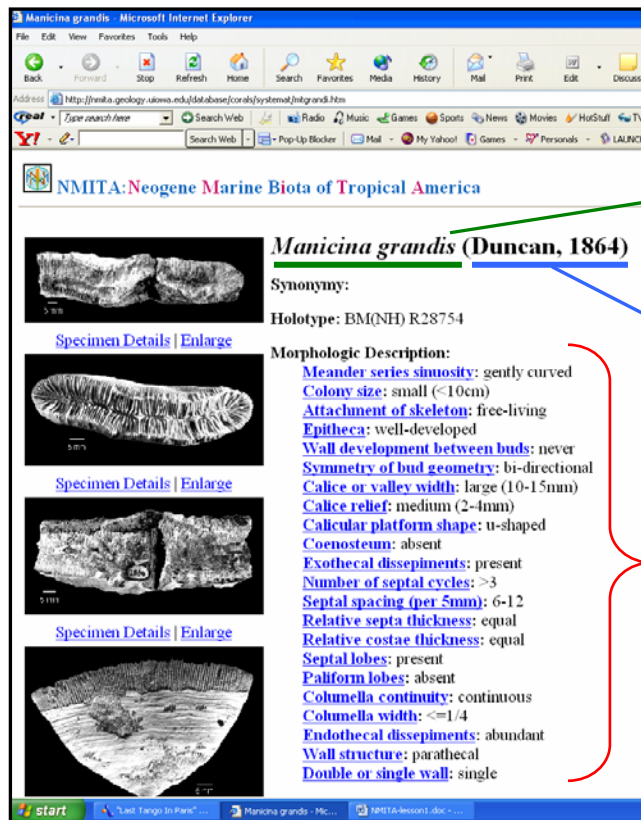
[Manicina grandis](#) ← Species in the sample

Localities within the Gurabo1 section:

NMB15898  
NMB15899  
NMB15901  
NMB15902  
NMB15905  
NMB15906

For the total fauna identified in section [Gurabo1 click here.](#)

11. What is the exact location of sample number 15901 (in meters) in the Rio Gurabo stratigraphic column? \_\_\_\_\_ meters.
12. Look at the *faunal* (fossil animal) list and find how many species have been identified in sample 15901: \_\_\_\_\_ species.
13. What are the names of the species in sample 15901? \_\_\_\_\_
14. What is the age of the sample? \_\_\_\_\_
15. In which formation does sample 15901 occur? \_\_\_\_\_
16. Click on the coral species *Manicina grandis*. Information about this species will load. Below is a key to the information about this species:



Genus and species of coral found in the sample

Author who first described this species and the year the description was published

Photos and characteristic features of this coral species

Geographic and geologic distribution of this species is listed below the features

17. What is the name of the person who first described this species? (this information is located after the scientific name of the species)\_\_\_\_\_.
18. In what year did this person first describe this coral species? \_\_\_\_\_.
19. How big is this species? (Hint: look under Morphologic description and locate colony size). \_\_\_\_\_centimeters.
20. Has this species ever been found in Jamaica? \_\_\_\_\_.

21. **Go back to the Rio Gurabo rock layer diagram** by clicking the “back” button twice and find locality **15841**. Click on this sample.
22. What is the exact location of sample number 15841 (in meters) in the Rio Gurabo section? \_\_\_\_\_ meters.
23. How many species occur in sample number 15841? \_\_\_\_\_ species
24. List the names of the species that occur in sample number 15841:
  
25. Did any of these species occur in sample 15901? If so, which species?
  
26. Compare the number of species (diversity) among samples 15901, 15841, and 16934.
  - a. Which sample has the greatest number of species? \_\_\_\_\_
  - b. Which sample is the oldest? (*Hint*: use your knowledge of superposition to look at the vertical position of the samples in the rock layers).  
\_\_\_\_\_.

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### Discussion questions

1. What evidence do scientists require in order to determine if the sedimentary rock layers containing fossils were of marine (saltwater), freshwater, or terrestrial (land) origin?
2. How do biologists identify or classify *fossil* specimens as different species? Is knowledge of living species necessary to identify and name fossil species?
3. Most reef corals have skeletons made of minerals similar to some types of rock (calcium carbonate) and therefore they are often well-preserved in the fossil record. Name some marine animal fossils that we would not expect to find in the sedimentary rock layers in the Rio Gurabo stratigraphic section.
4. Why were areas of the Dominican Republic once beneath the Caribbean Sea but today they are above sea level? What mechanisms cause sea level to change?
5. How do we know if a coral species is extinct? How do biodiversity databases help us determine the answer to this question?
6. Corals require very specific marine environments in order to survive. Can this information help us interpret what the Dominican Republic was like millions of years ago?