



Marianas Trench Marine National Monument Lesson Organization

Lesson 1: Tectonic Evolution – How do the tectonic forces at the Mariana convergent margin create the unique bathymetric landforms of the area?

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Preface: Marianas Trench Marine National Monument

There are a few places on Earth so unique and unusual that they warrant special attention and protection. The Marianas Archipelago, though only partially explored, is one of these places. Located east of the Philippines in the Western Pacific Ocean, this region encompasses both geological and biological environments seen nowhere else on Earth. Recognizing the uniqueness of this area President George W. Bush in 2009 used the Antiquities Act of 1906 to establish the Marianas Trench Marine National Monument. The importance of this region was described in the presidential proclamation as follows:

“Over approximately 480 nautical miles, the Mariana Archipelago encompasses the 14 islands of the United States Commonwealth of the Northern Mariana Islands and the United States Territory of Guam that sit atop the Mariana Ridge in an area known as the Mariana Volcanic Arc. The Mariana Volcanic Arc is part of a subduction system in which the Pacific Plate plunges beneath the Philippine Sea Plate and into the Earth’s mantle, creating the Mariana Trench. Six of the archipelago’s islands have been volcanically active in historic times, and numerous seamounts along the Mariana Ridge are volcanically or hydrothermally active. The Mariana Trench is approximately 940 nautical miles long and 38 nautical miles wide within the United States Exclusive Economic Zone and contains the deepest known points in the global ocean.

The Mariana Volcanic Arc contains objects of scientific interest, including the largest active mud volcanoes on Earth. The Champagne vent, located at the Eifuku submarine volcano, produces almost pure liquid carbon dioxide. This phenomenon has only been observed at one other site in the world. The Sulfur Cauldron, a pool of liquid sulfur, is found at the Daikoku submarine volcano. The only other known location of molten sulfur is on Io, a moon of Jupiter. Unlike other reefs across the Pacific, the northernmost Mariana reefs provide unique volcanic habitats that support marine biological communities requiring basalt. Maug Crater represents one of only a handful of places on Earth where photosynthetic and chemosynthetic communities of life are known to come together.

The waters of the archipelago’s northern islands are among the most biologically diverse in the Western Pacific and include the greatest diversity of seamount and hydrothermal vent life yet discovered. These volcanic islands are ringed by coral ecosystems with very high numbers of apex predators, including large numbers of sharks. They also contain one of the most diverse collections of stony corals in the Western Pacific. The northern islands and shoals in the archipelago have substantially higher large fish biomass, including apex predators, than the southern islands and Guam. The waters of Farallon de Pajaros (also known as Uracas), Maug, and Asuncion support some of the largest biomass of reef fishes in the Mariana Archipelago. These relatively pristine coral reef ecosystems are objects of scientific interest and essential to the long-term study of tropical marine ecosystems.”

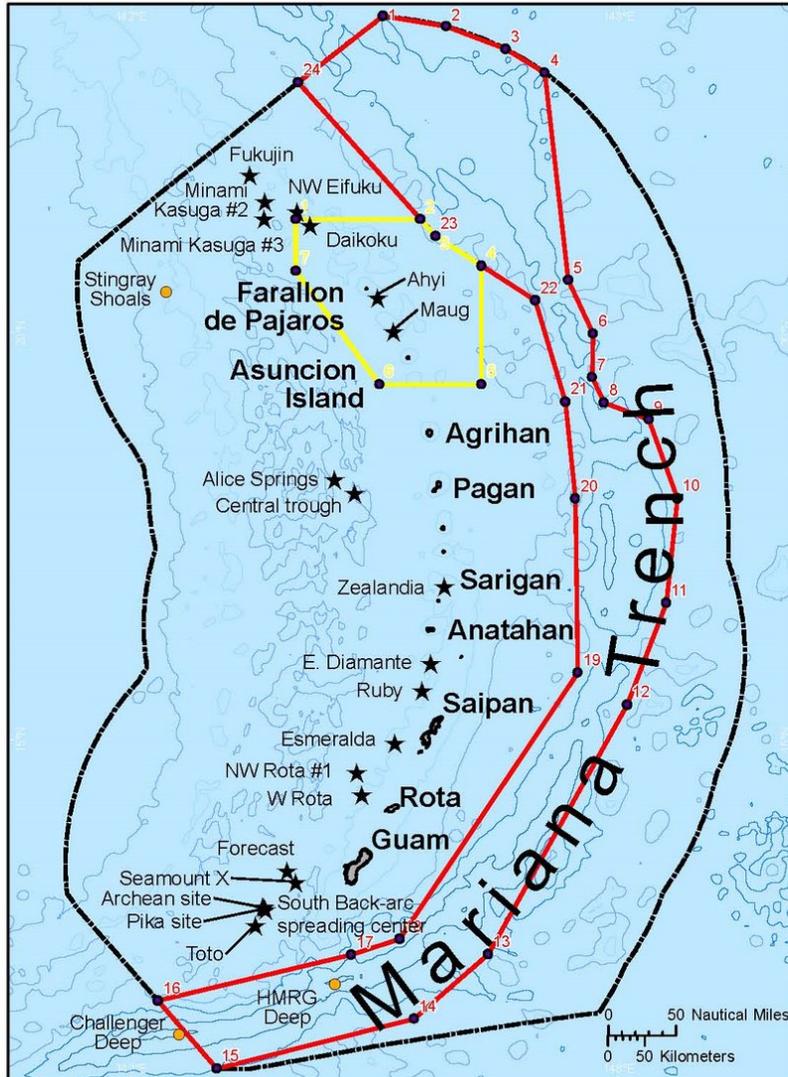
-Presidential Proclamation 8335, January 12, 2009

The Marianas Trench Marine National Monument (Monument) protects approximately 95,216 square miles of submerged lands and waters in three separate units: the Islands Unit, which includes the waters

and submerged lands of the three northernmost Mariana Islands; the Volcanic Unit, which includes the submerged lands within 1 nautical mile of 21 designated volcanic sites; and the Trench Unit, which includes the submerged lands extending from the northern limit of the Exclusive Economic Zone of the United States in the Commonwealth of the Northern Mariana Islands (CNMI) to the southern limit of the Exclusive Economic Zone of the United States in the Territory of Guam.

The Secretaries of Commerce, through the National Oceanic and Atmospheric Administration, and the Interior, through the U.S. Fish and Wildlife Service, manage the monument in cooperation with the CNMI Government. Additionally, the Marianas Trench and Volcanic Units have been included within the National Wildlife Refuge System. Jointly the Secretaries have established a Marianas Trench Monument Advisory Council to provide advice and recommendations on the development of management plans and management of the Monument. The Council includes three officials of the Commonwealth of the Northern Mariana Islands government and one representative each from the Department of Defense and the U.S. Coast Guard.

Mariana Trench Marine National Monument



Trench Unit		
Id	Longitude	Latitude
1	145° 5' 46" E	23° 53' 35" N
2	145° 52' 27.10" E	23° 45' 50.54" N
3	146° 36' 18.91" E	23° 29' 18.33" N
4	147° 5' 16.84" E	23° 11' 43.92" N
5	147° 22' 31.43" E	20° 38' 41.35" N
6	147° 40' 48.31" E	19° 59' 23.30" N
7	147° 39' 59.51" E	19° 27' 2.96" N
8	147° 48' 51.61" E	19° 8' 18.74" N
9	148° 21' 47.20" E	18° 56' 6.46" N
10	148° 42' 50.50" E	17° 58' 2.20" N
11	148° 34' 47.12" E	16° 40' 53.86" N
12	148° 5' 39.95" E	15° 25' 51.09" N
13	146° 23' 24.38" E	12° 21' 38.38" N
14	145° 28' 33.28" E	11° 34' 7.64" N
15	143° 3' 9" E	10° 57' 30" N
16	142° 19' 54.93" E	11° 47' 24.83" N
17	144° 42' 31.24" E	12° 21' 24.65" N
18	145° 17' 59.93" E	12° 33' 5.35" N
19	147° 29' 32.24" E	15° 49' 25.53" N
20	147° 27' 32.35" E	17° 57' 52.76" N
21	147° 20' 16.96" E	19° 9' 19.41" N
22	146° 57' 55.31" E	20° 23' 58.80" N
23	145° 44' 31.14" E	21° 11' 14.60" N
24	144° 5' 27.55" E	23° 2' 28.67" N

Islands Unit		
Id	Longitude	Latitude
1	144° 1' 22.97" E	21° 23' 42.40" N
2	145° 33' 25.20" E	21° 36' 36" N
3	145° 44' 31.14" E	21° 11' 14.60" N
4	146° 18' 36.75" E	20° 49' 17.46" N
5	146° 18' 36.75" E	19° 22' 0.00" N
6	145° 3' 12.22" E	19° 22' 0.00" N
7	144° 1' 22.97" E	20° 45' 44.11" N

Volcano Unit		
Volcano	Longitude	Latitude
Fukujin	143° 27' 30" E	21° 56' 30" N
Minami Kasuga #2	143° 38' 30" E	21° 36' 36" N
NW Eifuku	144° 2' 36" E	21° 29' 15" N
Minami Kasuga #3	143° 38' 0" E	21° 24' 0" N
Daikoku	144° 11' 39" E	21° 19' 27" N
Ahyi	145° 1' 45" E	20° 28' 15" N
Maug	145° 13' 18" E	20° 11' 15" N
Alice Springs	144° 30' 0" E	18° 12' 0" N
Central trough	144° 45' 0" E	18° 1' 0" N
Zealandia	145° 51' 4" E	16° 52' 57" N
E. Diamante	145° 40' 47" E	15° 56' 31" N
Ruby	145° 34' 24" E	15° 36' 15" N
Esmeralda	145° 14' 45" E	14° 57' 30" N
NW Rota #1	144° 46' 30" E	14° 36' 0" N
W Rota	144° 50' 0" E	14° 19' 30" N
Forecast	143° 55' 12" E	13° 23' 30" N
Seamount X	144° 1' 0" E	13° 14' 48" N
South Backarc	143° 37' 8" E	12° 57' 12" N
Archean site	143° 37' 55" E	12° 56' 23" N
Pika site	143° 38' 55" E	12° 55' 7" N
Toto	143° 31' 42" E	12° 42' 48" N

Sources:
 NOAA Coral Reef Conservation Program
 NMFS Coral Reef Ecosystem Division
 NESDIS NGDC
 NOS/CCMA
 Biogeography Branch
 OAR Pacific Marine Environmental Lab

- -10000 m
- -8000 m
- -6000 m
- -4000 m
- -2000 m
- ★ Active Hydrothermal Submarine Volcanoes
- Trench Unit (59,732 nm²)
- Islands Unit (12,388 nm²)
- EEZ



For more information:

Marianas Trench Marine National Monument

http://www.fpir.noaa.gov/MNM/mnm_marianas-trench.html

http://www.fws.gov/refuge/mariana_trench_marine_national_monument/

http://www.fpir.noaa.gov/MNM/mnm_mtmac.html

NOAA Marine National Monument Program

http://www.fpir.noaa.gov/MNM/mnm_index.html

Presidential Proclamation

<http://www.fpir.noaa.gov/Library/MNM/Proclamation%208335%20-%20Marianas%20Trench.pdf>