CHAPTER 3

OUR LOCATION; BATHYMETRY; AND ISLAND FEATURES

3. 1. INTRODUCTION

We begin the investigation of our islands' ecology by focusing our attention on our location. We will seek to understand exactly where it is that we exist on this planet of ours. We will look at our surrounding environment, including our islands and our nearby seas, to see what each is like.

How deep are our nearby waters? What are some of the important features of the CNMI island upon which we live? What are some of the features of our Commonwealth's other islands to the north or south of our own island? How can we begin to find out more about our island's environment?

We will seek to understand exactly where it is that we exist on this planet of ours.

3. 2. THE EARTH AS A GLOBE

3. 2. 1. Introduction

To find locations on the earth's surface, **geographers** use imaginary lines. The lines are like those on graph paper and are used to divide the earth into sections—forming a 'grid'.

Because our earth is a three-dimensional circle, we measure these lines in degrees (°) just like a circle. These lines are called lines of **latitude** and lines of **longitude**. They are also called **parallels** and **meridians**.

In essence, a 'latitude' is the same as a 'parallel' and a 'longitude' is the same as a 'meridian'. These relative terms are used inter-changeably. It is important for us to learn each and to know which each refers to.

3. 2. 2. Divided into Latitudes

The most important line of latitude is the **equator**, which is an imaginary circle that goes around the earth, halfway between both poles. The equator is assigned 0° latitude. Distances north or south of the equator are called latitudes and are marked by imaginary lines called parallels because they are parallel to the equator.

By definition, parallels can never converge, or meet. Parallels of latitude go east-west and west-east. They increase in incremental

Lines of Latitude

value extending from the equator until they reach either the North or South Pole. Both the North and South Pole are at 90° latitude. Using the lines of latitude, we can locate any place north or south of the equator.

3. 2. 3. Divided into Longitudes

Lines of longitude determine location east or west of the **Prime Meridian**, 0° longitude. The Prime Meridian acts like a base line for longitudes, as the equator does for latitudes.

This imaginary line runs from the North Pole to the South Pole through Greenwich, England. Like the Prime Meridian, all meridians of longitude are drawn from the North Pole to South Pole, and all meridians converge at the poles. Meridians (longitudes) run north-south and south-north.

Using meridians of longitude, we can locate any place east or west of the Prime Meridian. As we travel either east or west from the Prime Meridian, meridians increase in value, until we reach 180° longitude.

3. 2. 4. The International Date Line

The International Date Line is located, for the most part, at 180° longitude. The International Date Line is the imaginary line at which the date is adjusted. It is one day (date) later on the western side of this line than on the eastern side of it.

Here we say, "for the most part", because in actuality, this line is shifted in several places east and west for various political reasons. Check this out on a globe. Find out about the nations and events for which these adjustments were made. It makes for good Pacific Region historical reading.

Lines of Longitude

3. 2. 5. Our Location and Breadth

The location of our Commonwealth's islands is, therefore, north of the equator and east of the Prime Meridian. We are also west of the International Date Line. Should anyone ask, tell him or her that you live in the northwestern area of the Pacific Ocean.

Our greater geologic archipelago of the Mariana Islands, including Guam, totals fifteen major islands that cover a distance of 550 miles from the north to the south.

3. 3. OUR REGIONAL LOCATION, NEAREST NEIGHBORS AND RELATIVE DISTANCES

3. 3. 1. Relative Distances

One way to establish the location of a place is to compare known distances to other places on the earth. It is a good idea to have an idea of the size of the place we are at before finding out how far it is to other locations.

For example, Saipan Island's greatest length is $14^1/_2$ miles, and its greatest width is $5^1/_2$ miles. Once we know the size of our islands, we can use their size to get an idea of how far it is to other places. Note: Saipan is just used here as an example. Tinian's greatest length is $12^1/_2$ miles. Rota's greatest length is also $12^1/_2$ miles. Residents of these CNMI islands should calculate their distances accordingly within the following examples.

The CNMI is located about 1,400 miles south-southeast of Japan. It is also about the same distance to the east from the Philippines, and to the north from New Guinea.

To get to one of these locations, we would have to walk the length of about 100 Saipans laid end to end. The main islands of Hawaii are 3,300 miles east of our islands. We would have to walk the length of 230 Saipans to get to Hawaii. However, to get a real idea of our islands' size and location, we must compare Saipan's size to the entire earth's circumference.

The earth's circumference, or the distance around the earth at the equator, is 24,900 miles. It would take about 1,720 Saipans laid end to end to go once around the earth. By comparison it would take only about nine United States mainlands to stretch around the equator from end to end. We should realize that our Mariana Islands are small places located in a big ocean, in a big world.

3. 3. 2. Regional Locations and Nearest Neighbors

As in a town or village, it is important to know our islands' neighbors. Our Mariana Islands' closest neighbor is the Federated States of Micronesia, located from southwest to southeast of our islands. The next closest neighbor is the Volcano Islands, north of the Mariana Islands and south of Japan.

Our closest neighbor to the east, at a distance of 1,500 miles, is the Republic of the Marshall Islands. The closest neighbor to the west is the Philippines. The Republic of Belau is located to the southwest of the Marianas.

One reason it is important to know our location and the location of our neighbors is that many of the organisms living on our islands came from our neighbors.

3. 4. TOPOGRAPHY AND BATHYMETRY

3. 4. 1. Mapping

The purpose of making maps is to enable us to have an easily understandable depiction of the features of the earth. Maps are representations of the earth's surface. There are many kinds of maps but the type of map that describes the surface features of an area is called a **topographic map**. On land, surveyors can measure heights, elevations, depths, and distances by direct methods of measurement.

3. 4. 2. Studying the Ocean Floor

In mapping the land under the ocean, only indirect methods can be used. To map the ocean**, oceanographers** must use echo sounding, sonar, radar, and seismographic surveys. All of these methods employ vibrations of some kind.

The vibrations are sent down through the ocean from a device on a ship. These vibrations then bounce off the ocean floor and return to the ship where they are recorded. Oceanographers then determine the distance to the bottom by calculating the time it takes for the vibration to travel from the ship to the ocean floor and back again.

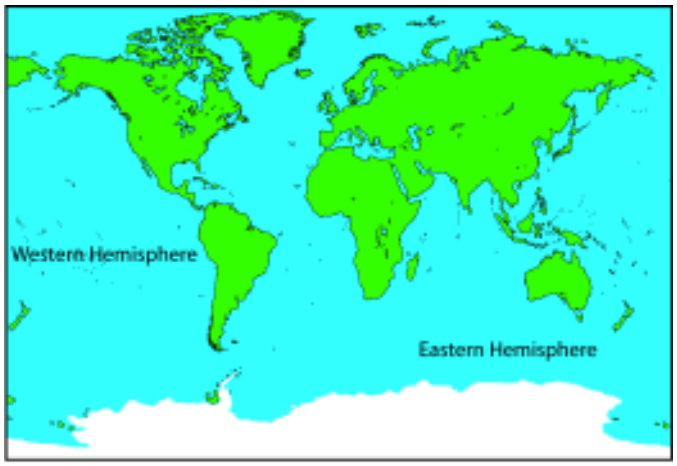
Seismographic surveys use vibrations similar to sound waves. These surveys require two ships. One ship sets off vibrations while the other ship records the time it takes for the vibrations to travel to the ocean floor and return.

Seismic vibrations can pass through most rock layers, but they pass through different layers and types of rock material at different speeds. This enables scientists to also determine the different kinds of rock found on the ocean floor by interpreting the different speeds of the vibrations they have recorded.

3. 5. OUR WORLD'S OCEANS AND OUR WORLD'S OCEAN

3. 5. 1. How Many Oceans?

There is actually only a single huge ocean on the earth. Within this global ocean are numerous bodies of land, some very large, others very small. The larger of these land masses are called **continents**.



The Earth is a water planet.

The location of the continents tends to separate this single ocean into several different large bodies of water also called oceans. These areas are known as the major oceans of the world: the Pacific Ocean, the Atlantic Ocean, the Indian Ocean, and the Arctic Ocean. If we look at the locations of these four major bodies of water on the map, we can note that they all connect as part of our one great ocean.

3. 5. 2. Proportions of Land and Water, Including Heights and Depths

The total surface area of the ocean is about 140 million square miles (362 million square kilometers), or about 71% of the earth's total surface area.

The depth of the ocean varies tremendously because just as on land, there are mountains, valleys, and plains. The deepest spot of the ocean is southwest of Guam in the **Mariana Trench** where ocean depths reach over 36,000 feet (11,000 meters).

Most of the ocean regions are not this deep. Still, the average depth of the ocean is 12,216 feet (3,729 meters), or 2.3 miles. The average height of land areas on the earth is only 2,755 feet (840 meters).

3. 5. 3. Truly a Water Planet

The total volume of water in the ocean is about 350 million cubic miles (1.35 billion km^3). This represents 97% of all the water on the earth. Another 1.6% of the earth's water is frozen in glaciers. The water in all the world's lakes, rivers, underground aquifers, and in the atmosphere as clouds and water vapor, makes up the remaining 1.4%.

We have seen how uneven the proportions of land and water are on the earth. In addition, the distribution of land and water is very uneven. For example, about two-thirds of all the earth's land areas are located in the Northern Hemisphere (north of the equator).

The Southern Hemisphere is sometimes called the "Water Hemisphere" since it has so little land. Indeed, more than 80% of the Southern Hemisphere is covered with water. In the Southern Hemisphere, between 50° and 60° south latitude, there is a band of ocean around the globe that essentially has no land at all.

3. 5. 4. Our Pacific Ocean

Our Pacific Ocean is by far the largest ocean on the earth. This nearly circular shaped body of water covers about one-third of the entire surface of the earth.

In both area and volume, the Pacific Ocean is larger than the Atlantic and Indian Oceans combined. It is also about 25% larger than the combined land areas of the earth. The Pacific Ocean is the deepest of all oceans, with an average depth of nearly 13,000 feet (3,940 meters).

Waters of the Pacific Ocean touch the shores of five of the earth's seven major continents. In the far south is Antarctica, while the southwest portion lies next to the continent of Australia. In the west and northwest, the Pacific borders Asia, while on its far eastern edge lie the continents of North and South America.

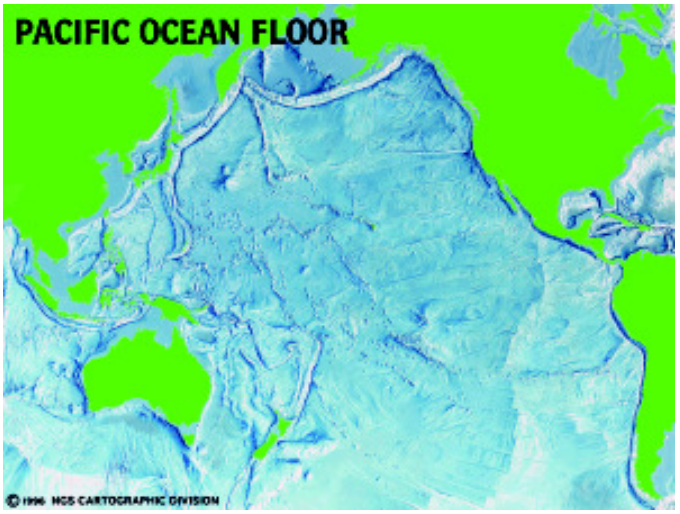
Another important feature of our Pacific Ocean is its large number of islands. Most of these island chains are located in the west-central and southwestern portions of the Pacific.

3. 5. 5. Seas

Besides the major oceans, there are many smaller areas of water known as seas. Many of these are located along the margins of the major oceans. The seas are usually areas of water that are partially enclosed by islands or some other form of land.

For example, the westernmost area of the Pacific Ocean is known as the Philippine Sea. This sea is the portion of the Pacific Ocean that is "enclosed" between the Philippines and the islands of Western Micronesia, including our Northern Mariana Islands. Thus, the CNMI actually borders on two different bodies of water, the Pacific Ocean on the east and the Philippine Sea on the west.

Some seas are mostly enclosed by land while others are completely enclosed by land. For example, the Mediterranean Sea and the Red Sea are connected to the major oceans only by narrow passes called straits. The Caspian Sea in west-central Asia is entirely land-locked.



The Bathymetry of the Pacific Ocean.

3. 6. THE OCEAN'S BATHYMETRY

3. 6. 1. Introduction

An important aspect of learning what the topography of our islands is like is achieved by focusing on the ocean's **bathymetry**. Our islands rise from the sea floor. What is this unseen area like? How deep is it? How is it patterned? Is it flat or are there mountains under the sea? Are there deep valleys? What are the various zones within it? Where do our islands fit into the overall picture?

3. 6. 2. Zones and Features of the Ocean's Floor

Scientists have been mapping the ocean floor for many years and have discovered many different topographic features. Topography describes the surface features, such as mountains, valleys, and plains, of an area.

The ocean floor has a diverse topography with mountain ranges and immense plains. Just as land topography affects air currents, the topography of the ocean floor affects the water current patterns of the ocean.

3. 7. OCEANIC ZONES

3. 7. 1. Sea Level

The shoreline is the boundary where land and sea meet. The exact point where land and water meet is always changing. Shorelines mark the average position of **sea level**.

Sea level is the actual elevation of the shoreline, or the average height of the sea without consideration of the tides. Sea level is defined as zero elevation. All ocean depths are below sea level: most land elevations are above sea level.

3. 7. 2. The Shore Zone

The **shore zone** includes the area lying between the highest high tides and the lowest low tides. The exact location of the shore zone constantly changes, sometimes from hour to hour depending on the wind and tides.

Waves and water currents move sand and other materials in the shore zone; thus, the materials that make up our beaches are almost always in motion, shaping our shorelines.

The North American continental shelf.

The shape and size of our beaches can also change from hour to hour, from day to day, from month to month, and from season to season.

Extra strong trade winds, strong typhoons, extra high and low tides, and very large tsunami waves are some of the factors that can affect the size, shape, and appearance of the shore zone.

The shore zone is also fundamentally affected by the type of **substrate** that it is made of. Soft surfaces erode easily. Hard surfaces resist erosion.

3. 7. 3. Continental Shelf Zones

A continental shelf is a relatively flat or gently sloping part of the continent that is covered by sea water. If there are mountains near the shore, the shelf is usually narrow. Where land near the shore is flat and gently sloping, the shelf is usually the same shape.

Approximately 90% of all marine organisms live on a continental shelf, around islands, or on rises, less than 200 meters below sea level. The nearest continental shelf to our islands is the Asian Continental Shelf.

3. 7. 4. Continental Slope Zones

A continental slope is the steep slope between the outer edge of a continental shelf and the deeper, ocean basin floor. If one can think of the ocean basin as a pan, the continental slope would be the side of the pan. The ocean basin would be the flat bottom of the pan.

3. 7. 5. Ocean Floor Basins

Ocean floor basins are the long, wide, flat portions of the ocean floor. The average depth of the ocean floor basin is greater than 4,000 meters. This part of the ocean is also called the **abyss**.

Another name for an ocean floor basin is an **abyssal plain**. Abyssal plains are generally flat, level areas of the deep ocean floor. For many years, these areas were thought to be completely flat and smooth. However, oceanographers have discovered that the ocean basin actually contains many mountains and valleys.

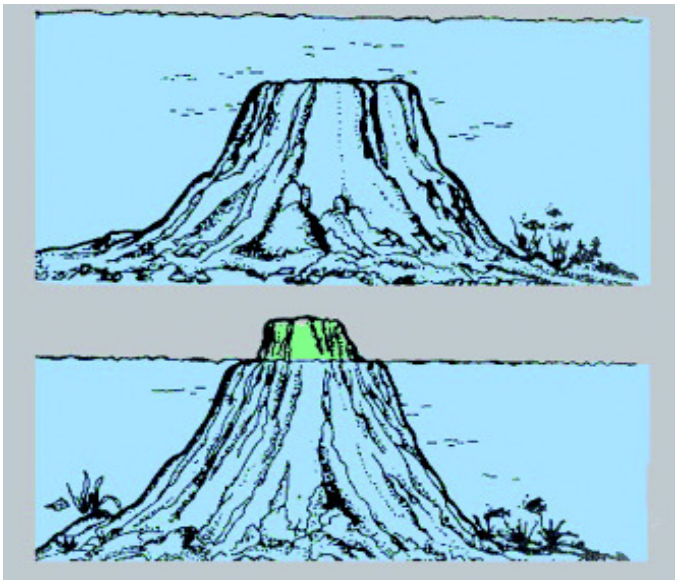
3. 7. 6. Guyots, Seamounts, and Islands

Many volcanic peaks rise from the abyssal plain. Volcanic peaks may stand alone or may occur in chains. **Islands** are formed when volcanoes erupt many times over many thousands of years, and later "land" emerges above the surface of the ocean.

Our Mariana Islands are, in fact, a chain of volcanic islands that have their foundations on the deep "Philippine Sea" ocean basin.

Many old volcanic islands are now submerged underwater. Mountains below the sea are called **seamounts**. Many have flat tops from the erosion created by the wind, waves, and rain during the earlier time when these islands were above sea level.

A flat-topped seamount is known as a **guyot**. Today many guyots are found in the Pacific Ocean. Scientists have evidence which suggests many seamounts are sinking.



(a) Flat-topped Guyot (b) Volcanic Island (Notice terrace being cut by present sea level).

3. 7. 7. Oceanic Trenches

Ocean trenches are another feature of the ocean floor's topography. Trenches are deep ocean canyons. Trenches are deeper than abyssal plains and deeper and longer than anything found on dry land.

The Mariana Trench is the deepest of all the trenches in the world. Its deepest point, '**Challenger Deep**', is 11,033 meters (or 36,200 feet) below sea level. This is so deep that if Mount Everest, the world's tallest continental mountain at 29,023 feet (8,846 meters) above sea level, could be placed into the Challenger Deep, its tip would still be more than a mile beneath the ocean's surface.

3. 8. ISLAND ARCS, OCEAN TRENCHES AND ISLAND AGES

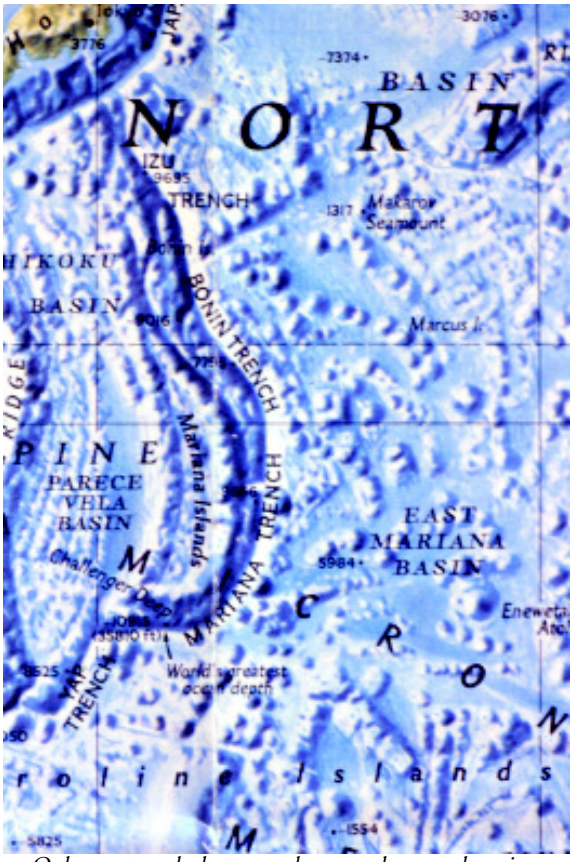
3. 8. 1. Introduction

An **island arc** is a curved line of islands found next to a deep ocean trench. As mentioned, a deep ocean trench is a place where the ocean bottom drops rapidly into a deep canyon.

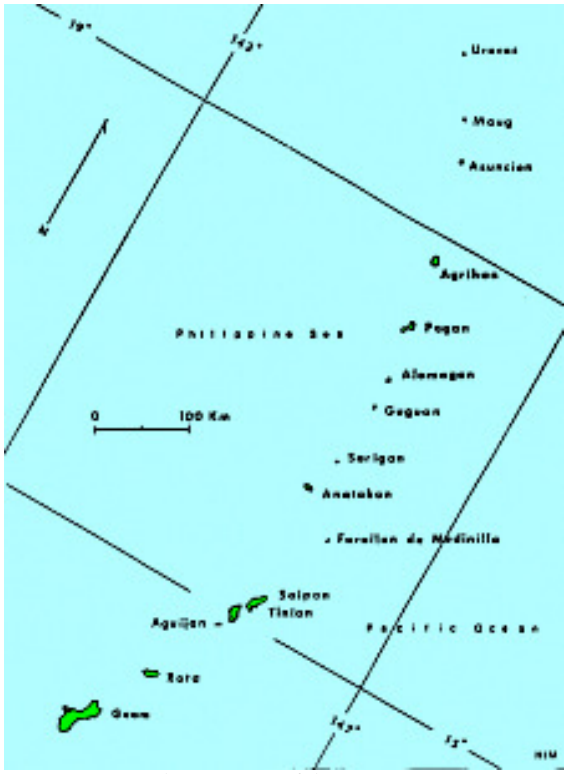
Some examples of island arcs are the Mariana Islands, the Aleutian Islands, and Japan. Trenches parallel these islands and parallel other island arcs as well.

Island arcs and trenches are always paired with each other and always run parallel to each other. The trench is always on the outside of the arc.

In the Western Pacific, the trench is always on the side toward the Pacific Ocean, and the convex (bulging) side of the island arc always faces away the continent of Asia. As mentioned, the Mariana Island Arc divides the Pacific Basin from the Philippine Sea Basin.



Only one trench, but several separately named sections.



The twin arcs of the Marianas

3. 8. 2. Our Philippine Sea Basin

Ocean basins surround the Northern Mariana Islands. The Philippine Sea Basin, between the Philippines and the Mariana Islands, has the following features:

The Mindanao Trench
The Philippine Basin
The Palau-Kyushu Ridge
The Yap Basin
The West Caroline Ridge
The West Mariana Basin
The Mariana Back-Arc Ridge
The East Mariana Basin

3. 8. 3. Isobaths and Our Island Arc's Bathymetry

An **isobath** is a line on a bathymetric map connecting places of equal depth. A **bathymetric** map is a map that indicates ocean depths. Bathymetric maps often use '**fathoms**' to indicate depths. 'Fathom' is an Old English word referring to the length of one's outstretched arms. A fathom equals 6 feet (1.8 meters) in modern measurement.

Our Mariana Islands rise on top of what was once thought to be a single submarine ridge. The envisioned arc extended in a northeastern direction through Guam, Rota, Aguiguan, Tinian, Saipan, and Farallon de Medinilla.

It then seemingly, and somewhat awkwardly, curved northward and then northwestward through the islands of Anatahan, Sarigan, Guguan, Alamagan, Pagan, Asuncion, Maug, and Uracas.

Between Farallon de Medinilla and Anatahan, an unnatural change was thought to have occurred in the otherwise smooth, curving axis extending through all the Mariana Islands.

South of this change the major southern islands, from Guam to Saipan, are enclosed by the 1,000 fathom isobath. North of the change, each of the younger volcanic islands tends to be enclosed by its own 1,000 fathom isobath.

3. 8. 4. Our Two Island Arcs

As a result of the ocean depth mapping work, we now understand that there actually was no "unnatural change" of direction of our island arc at Farallon de Medinilla.

Oceanographers discovered several more undersea volcanoes (seamounts) to the west of the southern Mariana Islands. These are in line with those of our northernmost islands. This means that both of the two arcs and the two respective isobaths continue in smooth, predictable lines.

We now know that there are two distinct arcs rising above the sea floor. One arc includes the younger volcanoes. It passes through the Esmeralda Bank west of Tinian and extends south-southwestward through two submerged volcanoes, west of Rota.

The other axis is east of this first one and passes though the islands of Farallon de Medinilla, Saipan, Tinian, Rota, and Guam. These are the older limestone-capped islands of our Marianas.

Pagan and the other emerged volcanoes protrude upward from the sea floor beginning at depths of 1,000 to 2,000 fathoms. The sea floor then slopes from these islands off to the west. Depths reach 3,000 fathoms before coming to a reversing, upward slope that forms the eastern flank of the Iwo Jima Submarine Ridge.

3. 8. 5. Where and How Far Away is the Marianas Trench?

Eastward toward the Pacific Basin, the east flank of the Mariana submarine ridge slopes downward into the Mariana Trench. Its axis is about 125 miles from Rota, Tinian, and Saipan. This is just a little farther than the distance from Saipan to Guam, except it's to the east. The Nero and Challenger Deeps, both exceeding 5,000 fathoms, are features of this trench.

Aguiguan, Tinian, and Saipan are enclosed by a single 500 fathom isobath, as are Rota and Guam further to the south. Each of the islands of the southernmost Marianas is enclosed by its own respective 100-fathom isobath.

3. 8. 6. Our Rock Ages

As stated, we now know that two island arc-chains make up the Mariana Islands. The northern islands are active volcanoes and thus have formed our Commonwealth's youngest rocks. Our oldest rocks are from the non-active southern arc chain, and date back to the late Eocene Epoch, about 45 million years ago. (See chapter five for more on rock dating.)

Thus, the southern arc is much older than the still-forming northern arc. Our southern arc at one time had active volcanoes. All the volcanoes here are now extinct. Living on Rota, Tinian, or Saipan, we do not have to fear a volcanic eruption happening on our islands.

Uracas Island

3. 9. THE PRECISE LOCATIONS AND BRIEF DESCRIPTIONS OF OUR COMMONWEALTH'S NORTHERNMOST ISLANDS

3. 9. 1. Introduction

Our northernmost Northern Marianas are small or of intermediate size in area, and they are high, including several of the highest islands of Micronesia. They are strictly volcanic, with little to no raised coral. There are no atolls or low islands.

Our northernmost islands include the only active volcanoes of Micronesia proper. Vegetation is somewhat limited in extent and variety.

3. 9. 2. Uracas (Farallon de Pajaros)

Farallon de Pajaros, or Uracas Island, is the northernmost of the Northern Mariana Islands. Uracas is located at 20 degrees 32 minutes N and 144 degrees 54 minutes E.

It is an active volcano covered with ash and lava flows. Uracas is 319 meters in altitude and only 2 square kilometers in area. The slopes are steep, there are no beaches, and the island has never been inhabited. Grass and a few trees grow only on the south-side at two rock outcrops. Colonies of seabirds occupy these outcrops.

Maug's three separate islet's.

DFW Biologists visiting Maug.

Asuncion Island

Agrihan Island

3. 9. 3. Maug

The Maug Islands are a group of three steep peaks surrounding a circular lagoon, which represents a sunken crater, approximately one kilometer wide. These are located at 20 degrees 01' N and 145 degrees 13' E.

North Island has an altitude of 228 meters and an area of 0.5 square kilometers. There are no beaches, no fresh water, and only a few shrubs. Colonies of sea birds also nest there.

West Island is 180 meters high and 0.7 square kilometers in area. There is a small group of pandanus and papaya trees. Grass and vines grow on the gentler slopes.

East Island has an altitude of 216 meters and an area of 0.9 square kilometers. It has an old weather station that was inhabited during the Japanese period. At that time, there were vegetables and a few coconut palms. Dense low bushes and trees grow on the northwest side.

3. 9. 4. Asuncion

Asuncion Island is an almost perfect volcanic cone, 891 meters high. It displays signs of recent volcanic activity. Erosion has not been as severe here as it has been on Agrihan. The total area is 7.3 square kilometers.

There are several coconut groves, as well as bananas, taro, pineapples, breadfruit, squash, limes, and mangoes on Asuncion. There were two villages there during the war. There are no feral animals and the high density of the understory plants reflects this. Native birds and bats are abundant.

3. 9. 5. Agrihan

Agrihan Island is a steep, heavily eroded volcanic cone 966 meters high and 47 square kilometers in area. It was last active in 1917. It has numerous ravines and ridges radiating outward from the summit of the island.

Agrihan's summit is the highest peak in Micronesia. Its slopes are covered by swordgrass and have deep ravines and sharp ridges covered by dense vegetation, partly consisting of introduced plants. These introduced plants include coconuts, papayas, breadfruit, mangoes, limes, oranges, taro, yams, sugar cane, and pineapples. Many native plants are also still found there.

The highest elevations are topped with swordgrass. Less steep areas occur on the southern end near the village. Monitor lizards, colonies of sea birds, and goats are also present. At the time of this book's writing, two families currently live on Agrihan.

3. 9. 6. Pagan

Pagan Island is a large island consisting of two separate volcanic peaks with a low connecting isthmus. The northern area is the larger of the two. Layers of ash cover almost all of both areas, except for the eastern and southeastern portion of the northern half.

A large lava flow more than a kilometer wide and 15 feet high at its edge covers the flats south of the volcano. In 1981, the volcano erupted and the lava flow covered half of the Pagan airstrip. Small planes landing there must stop quickly before hitting this huge wall of black basalt rock.

The total area of Pagan is 48 square kilometers. The northeastern part contains Mount Pagan, which is 580 meters high and an active volcano. The southwestern part is 518 meters high and has several craters, some of them periodically active.

Feral animals (cows, pigs, and goats) have caused extensive destruction to the remaining vegetation. Prior to the 1981 eruption, Pagan was inhabited.

Pagan Island

3. 9. 7. Alamagan

Alamagan Island is a volcanic cone 745 meters high and is presently inactive. There are trees, undergrowth, coconuts, bananas, papayas, pandanus, ferns, and other plants growing in the ravines and on the lava flows. Brush and swordgrass grow on the upper slopes.

At one time, there were two entire villages. At the time of this book's writing, there were still two families living there but these people were evacuated in December 1998, due to volcanic activity.

Alamagan Island

3. 9. 8. Guguan

Guguan Island has two volcanic peaks, the northern one is 248 meters high and the active, southern one is 301 meters high. Guguan is located at 17 degrees 19' N and 145 degrees 51' E.

The land area is 4.2 square kilometers. The northern half of the island consists of extensive ash and lava fields. The southern half is forested except for cliff areas at the very southern end.

Low grass grows on top of the volcanic ash. Breadfruit and certain trees and shrubs grow in the southern ravines, but there are no coconut palms. Feral animals are lacking and Guguan has been designated as a wildlife refuge. The island is uninhabited. There are two small, exposed rocks between Guguan and Sarigan.

Sarigan Island

3. 9. 9. Sarigan

Sarigan (Sariguan) Island is a volcanic cone with twin summits, 548 and 549 meters in altitude. The area is 5 square kilometers. The island was inhabited during the Japanese times. These inhabitants grew coconuts, papayas, taro, yams, pineapples, and squash. Monitor lizards, nesting sea birds, feral jungle fowls (chickens), and fruit bats are present.

Anatahan Island

3. 9. 10. Anatahan

On a clear day Anatahan can be seen looking northwest from Saipan's 'Suicide Cliff' lookout at Marpi or from the peak of Mt. Tapotchau. Anatahan Island is oblong, and rises 788 meters high toward the west end. Anatahan is located at 16 degrees 21' N and 145 degrees 40' E. The longest axis of this island runs east and west, with the eastern two-thirds dominated by two large, volcanic craters at the summit. The land area is 32 square kilometers.

Our southernmost islands, such as Saipan, shown here, are also volcanic islands which have, at several levels, great amounts of coral reef limestone found on their tops.

Four principal types of vegetation are found on our southern islands.

The island is generally steep, although the northwestern coast has a more moderate slope. Three small beaches and the formerly inhabited portion of the island are on the west end.

Vegetation is diverse and forests are well developed. Most of this part of the island is covered with native vegetation or coconut palms, but bananas, papayas, ferns, vines, shrubs, and tree ferns are all present, too.

Ed. note: Anatahan under went a major series of eruptions beginning on May 11, 2003. The eruptions undoubtedly affected much of the just discussed vegetation but follow up studies have yet to be conducted.

3. 10. THE PRECISE LOCATIONS AND BRIEF DESCRIPTIONS OF OUR COMMONWEALTH'S SOUTHERNMOST ISLANDS

3. 10. 1. Introduction

Our southernmost Northern Mariana Islands include several of the larger islands of Micronesia. Guam is the largest island in all of Micronesia.

Our southernmost islands are also volcanic islands which have, at several levels, great amounts of limestone found on their tops. This occurred when portions of the islands were underwater and coral reefs grew on top of them. They later rose from beneath the sea. In some places, coral limestone forms terraces. These are huge blocks of land in the form of a plateau, several cubic kilometers in volume. Coral limestone also occurs on the tops of our highest peaks, indicating that these too were once below sea level.

Four principal types of vegetation are found on our southern, limestone islands. Strand vegetation is normal, except where it merges with the raised-limestone forest. The latter was formerly extensive, but much of it has been cleared in the past century. "Savanna" grassland dominates much of the remaining, exposed volcanic areas. Mangrove is relatively minor in extent.

3. 10. 2. Farallon de Medinilla

Farallon de Medinilla is sometimes classed with the northern, and sometimes with the southern Marianas. Geologically, it is more like the southern Marianas since it also has raised coral limestone.

Farallon de Medinilla is a long, steep narrow ridge of raised coral limestone. The longest axis runs approximately north to south. This island is 72 kilometers (45 miles), north-northeast of Saipan.

At its highest point, it is 80 meters above sea level. The land area is 0.9 square kilometers. The ridge is somewhat flat-topped and covered with shrubs. A vast extent of coral reef grows in the island's vicinity. This is the largest of all of the CNMI's reef systems, and comprises the majority of the reefs of our Commonwealth.

Large numbers of seabirds nest here, so there are deposits of guano. The island has probably never been inhabited. As mentioned, geologically it belongs to the southern Marianas, though it is a little closer in distance to Anatahan than to Saipan.

Under the CNMI's Covenant with the U.S. federal government, this island is designated in a lease agreement as a bombing target for the U.S. Department of Defense.

3. 10. 3. Saipan

Saipan Island is located at 15° 12' North and, 145° 45' East. Saipan is 22 kilometers long and from 3-10 kilometers wide. It is 120 square kilometers in area and is the largest island of the CNMI.

Topographically, Saipan is more diverse than the other Northern Mariana Islands, and its geology is more complex. A rugged limestone ridge extends along the centerline of the northern three-fourths of Saipan. The outline of the island is irregular, with bays on both sides. Coral reef is extensive on the west coast, but limited on the east side.

A small plateau, Marpi, may be found on the northern tip of the island of Saipan.

The highest peak is Mount Tapotchau, 473 meters high, just south of the island's center. The lesser peaks of Mount Atchugau, Mount Petsukara, and Marpi Peak are in the northern third of Saipan.

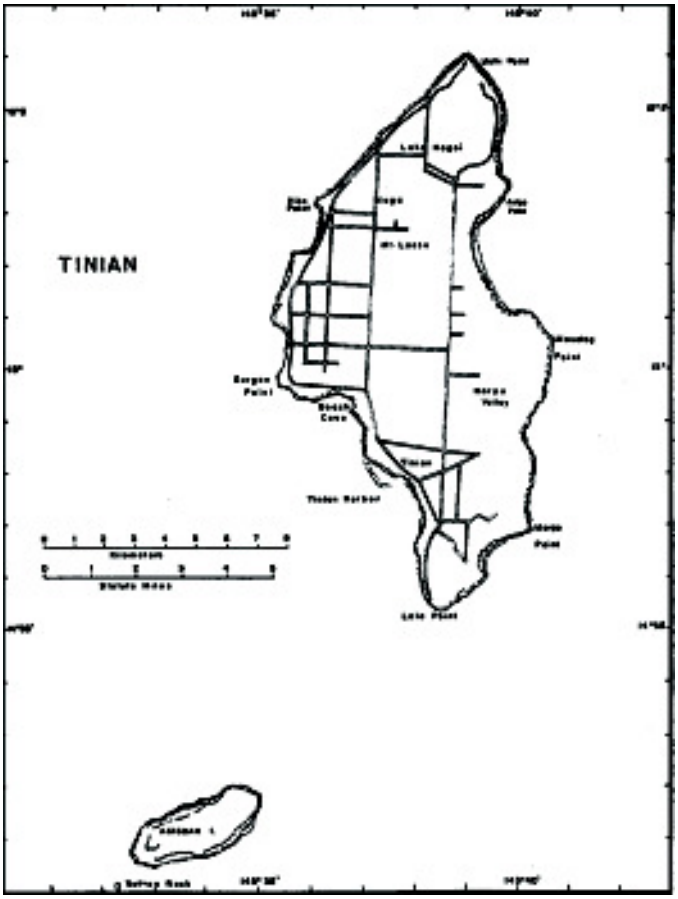
Much of this higher land consists of irregularly raised coral limestone pushed up by volcanic action. There is also a considerable area of remnant volcanic land exposed at various locations.

Three major, low-lying plateaus extend from the base of the dominant ridge. These are the southern one-fourth of the island where the airport is located, the eastern peninsula called Kagman, and a small plateau, Marpi, on the northern tip of the island.

The shoreline along the northeast and south sides of the island consists essentially of steep cliffs broken occasionally by small coral sand beaches. Nearly the entire western coastline is an extensive sandy beach. It is protected by a barrier reef and an inner lagoon, which form a broad coastal plain from 1 to 4 meters high.

Most of Saipan's population resides on the coastal plain along this western shore, and in homesteads established at Dandan and Kagman. At the time of this book's writing, eighty-nine percent of our CNMI's population lives on Saipan.

Lake Susupe and its adjacent wetlands are situated about one kilometer inland from the west coast along the southern third of the island. This is the largest wetland in the CNMI. Only a few small streams are found on Saipan.



Tinian and Aguiguan Islands.

3. 10. 4. Tinian

Tinian Island is located at 15° North, 145° 38' East. It is the second largest island of the CNMI. Tinian is 20 kilometers long and 8 kilometers at its widest point.

The dominant physical feature is the low level terrain broken only by a few relatively gentle cliff lines. The highest point, 178 meters, is in the southern portion of the island.

Only the small open bay at the Taga Beach, Tinian harbor on the southwest coast offers the protection of a reef system.

Recently, almost half of the island was devoted to grazing cattle.

Aguiguan is unpopulated and lies just off the southwest coast of Tinian. Just south of Aguiguan lies Naftan Rock.

Tinian (101 square kilometers) is a relatively low island of plateaus that consist primarily of terraces. These are made of raised reef limestone found on four or more levels. They are divided by lines of cliffs or bluffs.

Most of the level surfaces of the terraces are covered with soil of varying thickness. There are some limestone sinks, one of which contains a small lake, Lake Hagoi.

Tinian was used by the Spanish for grazing cattle, which were hunted for meat. The island lost most of the natural vegetation of its limestone terraces to cultivation. Eighty percent of the area is arable.

During the Japanese period, this was mostly planted with sugar cane. Much of it has been taken over by tangantangan since World War II. Cattle grazing and vegetable farming are now well developed. Recently, almost half of the island was devoted to grazing cattle.

The north, east, south, and most of the west coastlines are rocky and rugged. These are unprotected from wave action. Only the small open bay at the harbor on the southwest coast offers the protection of a reef system. The town of San Jose and the harbor are located adjacent to this bay.

Most of the population resides in San Jose, though some reside at the Carolinas Heights homestead area, and others also live in scattered agricultural areas, particularly in Marpo Valley to the east of San Jose.

The northern two-thirds has long been uninhabited since it was leased as a training site by the U.S. Department of Defense under the Covenant. Later, one half of this area was leased back to the CNMI Government.

Though only 15 hectares in size, Hagoi Marsh on northern Tinian is an important habitat for wetland birds. Another small wetland, Marpo Swamp, is found in Marpo Valley. This serves as the major domestic and agricultural water source for the island. Today it is heavily overgrown and there is no open water in the swamp.

There are no streams on Tinian. The native vegetation has been greatly altered by grazing cattle and goats, and by human activities. Today, a great portion of the island consists of extensive stands of tangantangan trees and shrubs. The small amount of native forest remaining is primarily restricted to the limestone cliff areas.

3. 10. 5. Aguiguan

Aguiguan Island is located at 14° 51' North and 145° 34' East. An unpopulated island, it lies just off the southwest coast of Tinian. A number of feral goats inhabit Aguiguan, and the island is frequently referred to locally as “Goat Island.”

Aguiguan is 5 kilometers long and 1.5 kilometers wide. It has 7 square kilometers in total land area. The island is officially designated as a refuge by the Commonwealth Government, though the hunting of goats and the harvesting of coconut crabs is allowed by permit during the open season.

Aguiguan is made up of several well defined limestone plateaus or shelves. The highest is a central, rectangular mesa 1 by 3 kilometers in area and about 150 meters in elevation. The highest point on the island is 163 meters. There are no streams.

Steep escarpments (cliffs) about 30 meters high surround the entire coastline making access by boat extremely difficult. It has been possible of late to land, with great care, a small aircraft at an unimproved airstrip on the upper plateau.

In the 1930s, the Japanese cleared native forests and began growing sugar cane and pineapples on the plateaus of Aguiguan. These abandoned fields are now overgrown with weeds.

Much of the vegetation on the steep cliffs leading up to the central plateau is native forest, though it is scrubby and the understory is very open due to foraging by goats. A variety of introduced vegetation also grows on the island, mostly in or along the edge of openings on the cliffs, or around former Japanese establishments.

A large offshore rock called "Naftan Rock" is just south of Aguiguan. Here a large population of seabirds nest each year, protected from cats, rats, and other potential predators.

On the extreme western tip of Luta is a narrow, prominent peninsula.

3. 10. 6. Rota (Luta)

Rota Island—also called Luta—is located at 14° 10' North and 145° 12' East.

Interestingly, the indigenous name 'Luta' proved difficult for Japanese colonists to pronounce, having no 'L' in their spoken language. The 'R' sound was substituted for 'L', along with the following-vowel 'U' being changed to 'O'. Thus 'Luta' changed to 'Rota'. Today many indigenous islanders once again refer to their home island by its original name, 'Luta'. [Ed. note: With a bit of editorial license, we use both—as you may already have noticed.]

Wedding Cake Mountain lies at the end of the peninsula.

Luta island consists of a series of ten or more elevated coral limestone terraces. The highest point consists of remnant volcanic rock projecting through the limestone. More volcanic rock and soil is exposed on the south side, Talakaya Watershed, but it is capped in the center with limestone. The aquifer within this cap is where the island's principal water supply flows from.

Rota is 20 kilometers long and 6 kilometers wide. It is 85 square kilometers in area. The highest point is 496 meters. The highest uplifted mesa is the Sabana. At 450 meters in elevation and 2 by 4 kilometers in area, the Sabana dominates the topography of the western half of the island.

Steep, sheer cliffs on the north, west, and south sides of the Sabana, drop down to narrow coastal shelves and then on to the ocean. The jagged, contorted limestone along the rim of the steep cliffs is nearly impassable.

Songsong Village lies in the neck of land between the Wedding Cake peninsula and the rest of Rota.

A more gentle decline slopes from the northeast side of the Sabana. It continues on to a large plateau about 150 meters in elevation which covers the eastern half of the island. Rota's airfield and the village of Sinapalu are situated on this eastern plateau.

Sasanhaya Bay, Rota

On the extreme western tip of the island is a narrow, prominent peninsula containing the landmark, Wedding Cake Mountain. Songsong Village lies in the neck of land between the Wedding Cake peninsula and the rest of Rota. Although much of Rota's coastline is steep and rocky, sandy beaches extend along most of the northern coast.

In general, the soil is fairly thin. The Japanese cultivated sugar cane on the level areas of Rota. Despite the once fairly extensive agricultural system, much of Rota's steep terrain is unsuitable for agriculture.

The Sabana area is the exception; it has deeper soils, higher rainfall, and cooler temperatures than the rest of the island. These conditions allow for more extensive farming activities there.

Rota's native vegetation was less disturbed than on other islands of the southern Marianas since it was spared a direct invasion by Allied troops during World War II. Nearly all of the slopes leading up to the Sabana still support well-developed native forest.

Areas on the eastern plateau and coastal shelves, which were previously farmed, have regenerated with native species. Some of the areas have been developed for grazing. Where not grazed, these openings are heavily overgrown with grasses, vines, shrubs, and native trees.