GRADE LEVEL: 6-8 | TIME REQUIREMENT: 2 HOURS

EARTH AND SPACE SCIENCE: PLATE TECTONICS

1 READING | 1 ACTIVITY

INTRODUCTION

The vast Pacific Ocean and the islands scattered across it were almost as tough an enemy as the Japanese forces that controlled much of that territory during World War II. Those islands were formed by forces not fully understood by science until decades later. The "Ring of Fire" is a term used to describe a huge circle of volcanic activity that forms a ring around the Pacific, from New Zealand in the south to the Aleutians in the north. In the region where most of the US battles in the Pacific during World War II took place, there are many active volcanoes, and there were dozens of earthquakes during that time. The islands varied greatly in their physical geography—in a manner that was only understandable once the theory of plate tectonics was formalized in the late 1960s.

The many volcanoes of the western Pacific are formed through a process known as subduction where one continental plate moves under another and sinks into the earth's mantle; magma from the subducted crust then bubbles up to the surface.

Most of the islands in this Ring of Fire formed when undersea volcanoes emerged from the ocean. Over time, coral reefs formed around them, and the volcanoes eroded to form rich soils. The youngest islands have high elevation and active volcanoes. The oldest have only a ring of reefs remaining. These oldest islands are referred to as atolls.

OBJECTIVE

Use these two resources to show the pattern of volcanoes and earthquakes in the South Pacific and then learn and make diagrams about plate tectonics. These are reversed in order from most of our sets—we suggest you use the activity first and then the reading. You can supplement with physical maps from these areas, and even use maps of volcanoes and at other plate boundaries as an extension.

STANDARDS

NGSS DCI ESS2.B
Plate Tectonics and Large-Scale System Interactions

NGSS DCI ESS3.B
Natural Hazards

NGSS SEP
Analyzing and Interpreting Data

NGSS SEP
Engaging in Argument from Evidence

NGSS CCC
Patterns

NGSS CCC
Stability and Change

PERFORMANCE EXPECTATIONS

MS-ESS2-3
Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.

MS-ESS3-2
Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.

READING (1)

1. GEOLOGY AND HISTORY

Description
This resource is a reading for students to understand how active geologic features like volcanoes and earthquakes shaped some of the events in World War II. It has descriptions of the geologic forces acting in a region, and asks students to make a diagram based on the descriptions.

Supplies
Paper and colored pencils
Physical maps of the Philippines and Italy (optional)

Instructions
Have the students read the handout, then discuss it in small groups or the whole class. Have them follow the instructions to make a geologic diagram. The optional maps may help them to understand the plate tectonic forces in the regions discussed.

ACTIVITY (1)

1. MAPPING DANGER

Description
This is an activity in which students map volcanoes and earthquakes using a table of data. Students will explore and explain the pattern as seen in the data that they map.

Supplies
Pencils or pens in contrasting colors
Map of the South Pacific (that includes latitude and longitude grids)

Instructions
Show students how to use the latitudes and longitudes to locate the spots on the map. Have them mark earthquakes in one color and volcanoes in a contrasting color. To lighten the work load you could divide the data up so that some groups only do some lines of the data, and then put them together to make the bigger picture. With small modifications you could use Google Maps to map the data. In this case you need to change all S latitudes to a negative value.

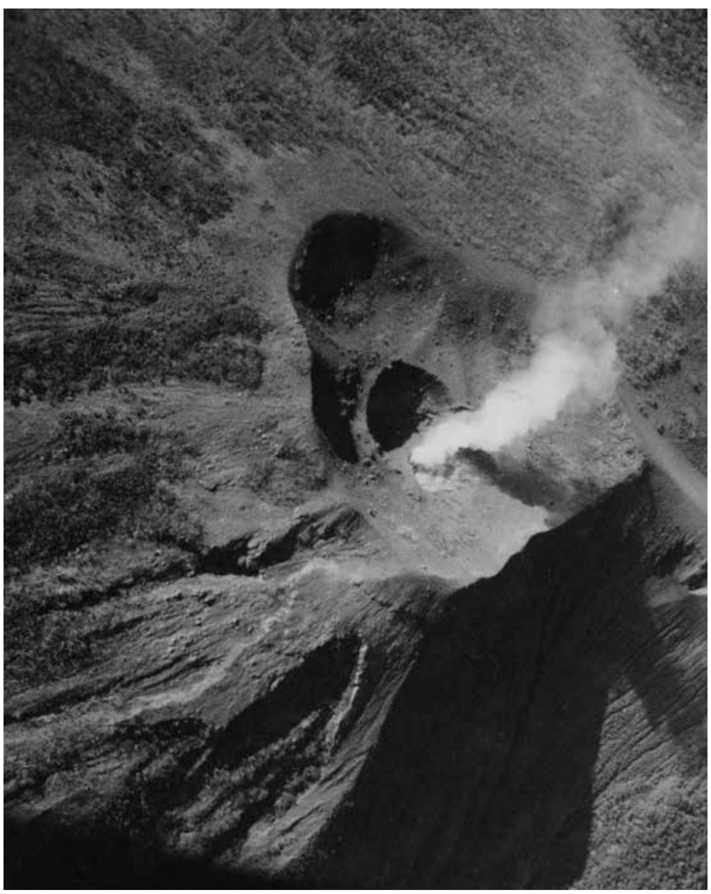
ACTIVITY

MAPPING DANGERS

INTRODUCTION

In World War II, our troops moved across the Pacific Ocean, exploring areas and islands that were very exotic. This area was known to be home to many volcanoes and frequent earthquakes. These natural hazards and the manner in which they shaped the landscape were very challenging in many ways to the soldiers and military planners and leaders. In those decades, there was really no understanding of why volcanoes occurred in these places or of what caused earthquakes.

On a map, place dots in one color for each location where there was an earthquake, and a use a different color to show every location where there was a volcano in this region during World War II.



Ash rising from a volcano in New Britain, the South Pacific, in August 1944.
(Image: The National WWII Museum, 2008.354.114.)

1. **What do you notice about the patterns of each type of hazard (earthquake or volcano) and of all the hazards together?**

2. **What could possibly be causing such a huge pattern on the surface of the Earth?**

3. **Imagine that the US commanders in World War II had understood what caused earthquakes and volcanoes. How do you think it would have changed their plans?**

NAME: **DATE:**

SELECT VOLCANOES IN THE PACIFIC THEATER

NAME	LATITUDE	LONGITUDE	LAST ERUPTION
Abu	34 N	131 E	9,000 ya
Adatara	37 N	140 E	1996
Agrigan	18 N	139 E	1990
Akagi	36 N	139 E	1938
Akan	43 N	144 E	1988
Akita Yakeyama	39 N	140 E	1997
Akuseki-Jima	29 N	129 E	?
Alamagan	17 N	145 E	1887
Ambrym	16 S	168 E	2015
Anathan	16 N	145 E	1993
Aso	32 N	131 E	1993
Bam	4 S	144 E	1960
Bamus	5 S	151 E	2006
Bulusan	12 N	124 E	1988
Canalaon	10 N	123 E	2016
Camiguin	9 N	124 E	1953
Dakatua	5 S	150 E	1895
Daisetsu	43 N	142 E	1739
Fuji	35 N	138 E	1708
Hibok-hibok	9 N	124 E	1953
Ioto (Iwo-jima)	24 N	141 E	2012
Iraya	20 N	122 E	1454
Kanlaon	10 N	123 E	2015
Kirishima	31 N	130 E	2011
Kamagatake	35 N	139 E	2015
Kusatsu-Shirane	36 N	138 E	1983
Lamington	9 S	148 E	1956
Loloru	6 S	155 E	1994
Long Island	5 S	147 E	1993
Lopevi	16 S	168 E	2007
Mayon	13 N	123 E	2014
Nikko-Shirane	36 N	139 E	1952
Ragang	7 N	124 E	1915
Suwanose-jima	29 N	129 E	2016
Yake-dake	36 N	137 E	1995

EARTHQUAKES IN THE PACIFIC THEATER

YEAR	LATITUDE	LONGITUDE	MAGNITUDE
1940	41 N	137.2	7.5
1940	4 S	152.8	7.1
1940	8 N	123.4	7
1941	32 N	130.2	7.7
1941	5 S	153.5	7.1
1941	4 S	151.6	7
1941	10 N	123.6	7
1942	12 N	121.2	7.4
1942	8 N	123.4	7.2
1943	8 N	124	7.8
1943	16 N	121	7.2
1943	40 N	143.1	7.2
1943	4 S	143	7.2
1943	35 N	134	7
1943	6 S	154.3	7
1944	32 N	138	8.1
1944	4 S	142	7.1
1944	2 S	152	7.1
1944	43 N	143.5	7
1945	5 S	149.8	7.8
1945	40 N	149.9	7.2
1945	24 N	141	7.2
1945	37 N	143.2	7.2
1945	43 N	147.2	7
1945	3.9 S	149	7