PART 1: E_Subsidence

At the end of the activity, each group member will turn in:
1. *Three maps with paleoshorelines indicated and a completed table of Subsidence for Hawaiian Ridge Volcanoes*.

2. *One graph with plotted Depth of paleoshoreline below sea level versus Distance from Kīlauea, and completed questions below.*

What is the paleoshoreline**?* A paleoshoreline is a distinct change in slope in the topography near the coastline. This former, or old, shoreline was the shoreline when lava flows were actively flowing in that area. The paleoshoreline is a noticeble kink, or change in the slope, from shallowly-dipping slopes above sea-level to steeply-dipping slopes below sea-level. The ***subaerial slopes (above sea-level) of Kīlauea and Mauna Loa average 4° up to about 1,000 meters in elevation. The ***submarine*** slopes (below sea-level) of Kīlauea and Mauna Loa average ~13° down to ~500 meters water depth. The paleoshorelines around Hawaiian volcanoes can be preserved for millions to tens of millions of years, and tell us where the shoreline was a volcano was active, when lava flows were forming a coastline.**

Overview
- You will estimate the depth of paleoshorelines around several of the Main Hawaiian Islands.
- Then you will try to estimate the depth of paleoshorelines around several Northwestern Hawaiian Islands.
- You will plot the Depth of paleoshorelines for a number of Hawaiian Ridge volcanoes versus Distance from Kīlauea on a graph provided and discuss with your group possible explanations for the variation in subsidence and uplift along the Hawaiian Ridge.

Directions and Questions

1) Look at the figure provided of the Island of Hawaiʻi, with a map of the island and three elevation profiles (yellow lines). Discuss these questions with your group members, and write your answers below and on the map.

— Indicate on your map and the three elevation profiles, with **BOLD ARROWS**, where the paleoshoreline is around the Island of Hawaiʻi.

—Use the elevation profiles for the three areas, to estimate the elevation of the paleoshoreline (in meters below sea level) for **S of Kīlauea**, **E of Mauna Kea**, and **N of Kohala**.

Depth of paleoshoreline (m):	**S of Kīlauea**	**E of Mauna Kea**	**N of Kohala**

—What are TWO possible explanations for why this sharp change in slope (paleoshoreline) forms around Island of Hawaiʻi?

—Why is the sharp change in slope far offshore around the northern half of the island, but right at the coastline on most of the southern half of the Island of Hawaiʻi?

2) Look at the figure provided of the islands of Oʻahu to Maui, with a map and two elevation profiles.

— Indicate on your map and the two elevation profiles, with **BOLD ARROWS,** where the paleoshorelines are around Oʻahu to Maui.

—Use the elevation profiles for the two areas, to estimate the elevation of the paleoshoreline (in meters below sea level) for **Oʻahu (N of north tip of island)** and **Maui (N of Haleakala Volcano)**.

Depth of paleoshoreline (m): **Oʻahu (N of north tip of island)** **Maui (N of Haleakalā Volcano)**.

—**COMPLETE THE LOWER PART OF TABLE PROVIDED:** From your estimates above, complete the blank spaces for the depth of paleoshoreline on the table of **Subsidence for Hawaiian Ridge Volcanoes** for the Main Hawaiian Islands

3) ***Check with your Instructor to see how you did for the Main Hawaiian Islands before estimating the Depth of paleoshorelines for areas in the Northwestern Hawaiian Islands.

4) Look at the figure provided of Gardner Pinnacles and Maro Reef, with a map and two elevation profiles.

— Indicate on your map and the two elevation profiles, with **BOLD ARROWS,** where the paleoshorelines are around Gardner Pinnacles and Maro Reef

—Use the elevation profiles for the two areas, to estimate the elevation of the paleoshoreline (in meters below sea level) for **Gardner Pinnacles** and **Maro Reef**

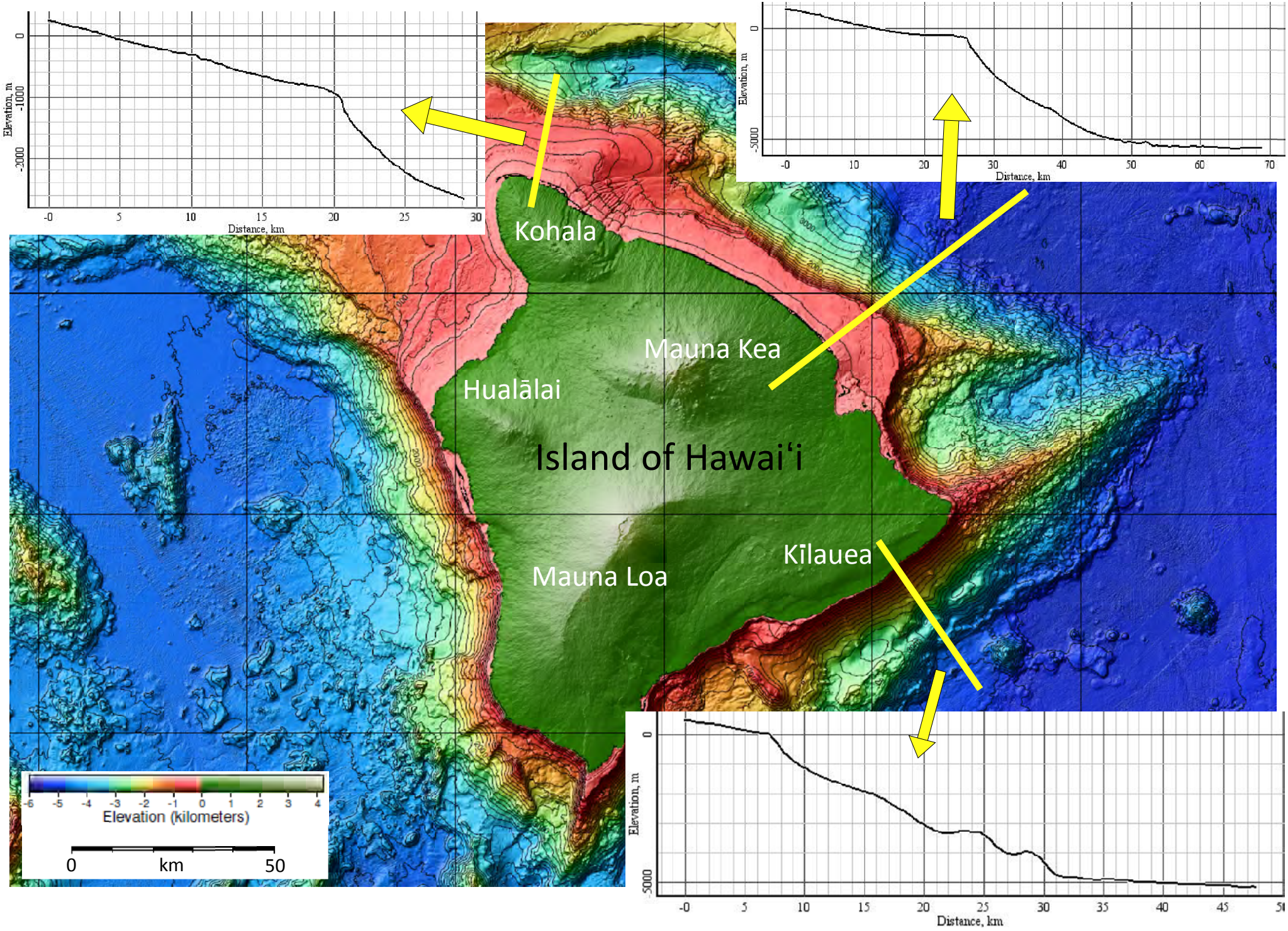
Depth of paleoshoreline (m): **Gardner Pinnacles** **Maro Reef**

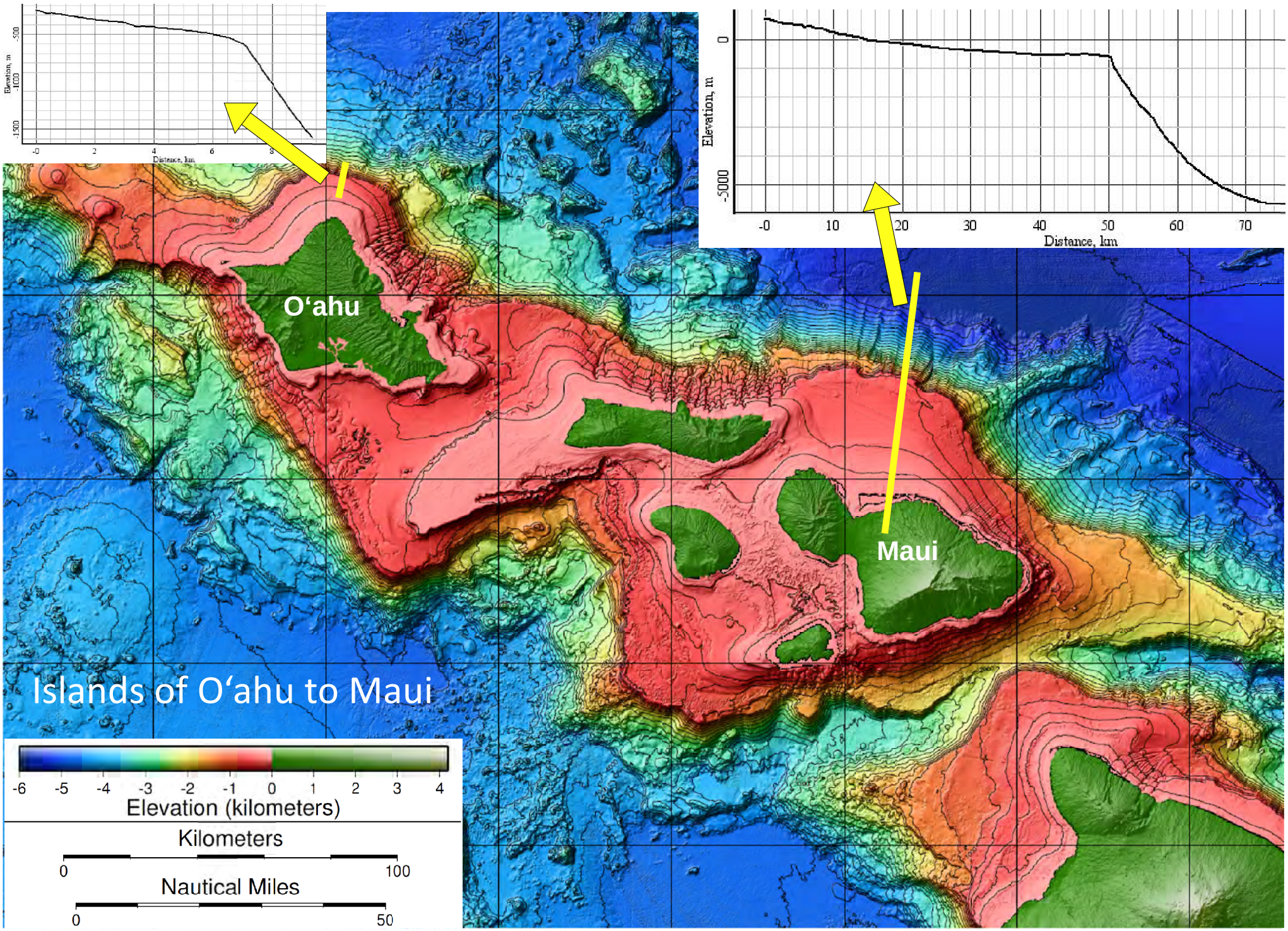
FINISH COMPLETING UPPER PART OF TABLE PROVIDED: Complete the blank spaces with your group for the Northwestern Hawaiian Islands on the table of **Subsidence for Hawaiian Ridge Volcanoes**. Use the large strip map to estimate the depth of the paleoshorelines in meters below sea level for the remaining volcanoes listed in the table of Subsidence for Hawaiian Ridge Volcanoes.

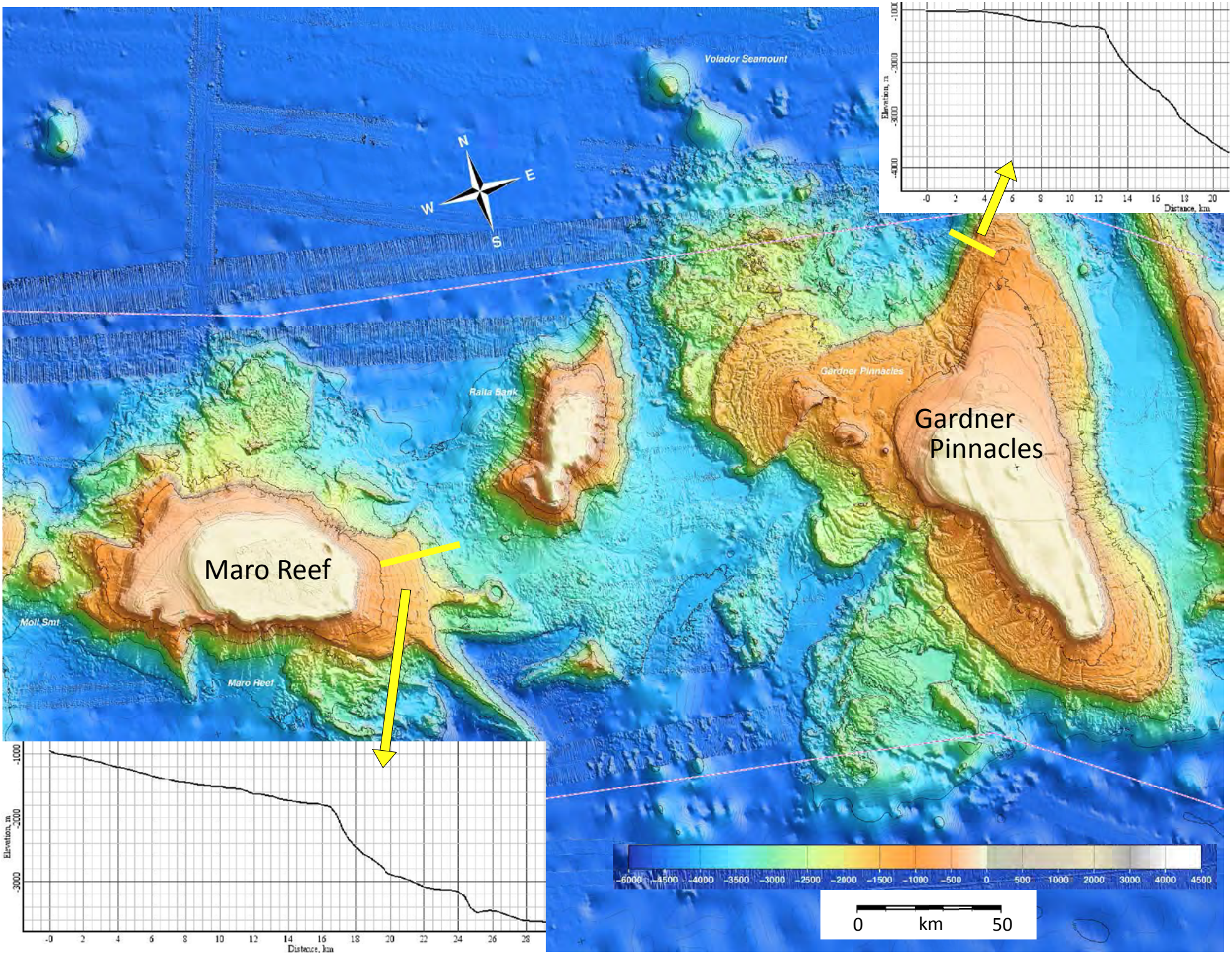
5) **COMPLETE GRAPH PROVIDED:** Once the table is completed, each group member will plot the Depth of paleoshorelines on the graph provided of Depth of paleoshoreline below sea level (m) versus Distance from Kīlauea (km). After all of the Depths in the table are plotted, draw a smooth line connecting all of the data points.

6) Discuss the variation in your graph with your group members. **Summarize your observations and ideas in several sentences** below, and answer:

—What are TWO possible explanations for the variation in subsidence and uplift along the Hawaiian Ridge?
[Hint: Look at some of the figures in your Pre-activity reading for ideas]


Kohala
Mauna Kea
Hualālai
Island of Hawai‘i
Mauna Loa
Kīlauea
Elevation (kilometers)
0
km
50
Elevation, m
Distance, km

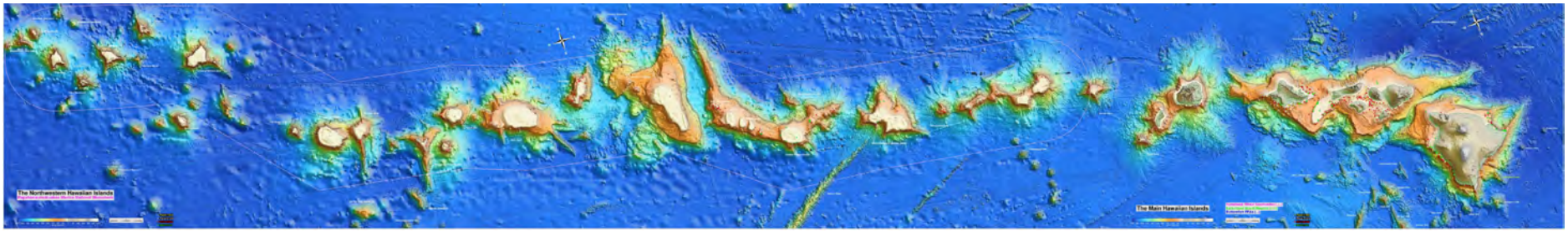

Elevation, m
-500
-1000
-1500
-0
2
4
6
Distance, km
Elevation, m
0
-5000
-0
10
20
30
40
50
60
70
Distance, km
O‘ahu
Maui
Islands of O‘ahu to Maui
-6
-5
-4
-3
-2
-1
0
1
2
3
4
Elevation (kilometers)
Kilometers
0
100
Nautical Miles
0
50


Volador Seamount
N
E
S
W
Gardner Pinnacles
Raita Bank
Gardner
Pinnacles
Maro Reef
Moll Smt
Maro Reef
Elevation, m
-1000
-2000
-3000
-4000
-0
2
4
6
8
10
12
14
16
18
20
Distance, km
Elevation, m
-1000
-2000
-3000
-0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
Distance, km
-6000
-4500
-4000
-3500
-3000
-2500
-2000
-1500
-1000
-500
0
500
1000
2000
3000
4000
4500
0
km
50

SUBSIDENCE FOR HAWAIIAN RIDGE VOLCANOES

	Island or Volcano name (area to estimate paleoshoreline)	Depth of Paleoshoreline (m)	Dist. from Kilauea (km)	Estimated Age (Myr)
Northwest Hawaiian Islands	Lisianski (N side)		2052	*21**
	West Northampton (NE side)		1886	*20**
	Maro (ENE side)		1700	*17**
	Gardner (N side)		1449	12.3
	Mokumanamana (NE of seamount)		1080	10.3
	Twin Banks (N of seamount)		920	9.6
	Westpac Bank (N of seamount)		871	*8**
Main Hawaiian Islands	Kauaʻi (WNW of island)		550	5.0
	Oʻahu (N of North tip island)		350	2.5
	Maui (N of Haleakala)		180	1.5
	Hawaiʻi (N of Kohala)		120	1.1
	Hawaiʻi (E of Mauna Kea)		60	0.6
	Hawaiʻi (S of Kilauea)		0	0.0

* estimated age



Depth of paleoshoreline below sea level (m)

0
500
1000
1500
2000

2800
2400
2000
1600
1200
800
400
0

Distance to Kilauea (km)