Ages:
6th grade and up

Duration:
30 minutes

Materials:
One large copy of map of South America for the class, or a regular sized map for each group of students

Per group of 2-5 students
- Set of earthquake data for a specific range of latitudes
- Student data sheets

(optional) image of the 3D subduction plate boundary from http://rses.anu.edu.au/seismology/projects/RUM/slabs/slabs.html

~ LPI Education/Public Outreach Science Activities ~

Subducting Plate Graphs

Based on "Real Evidence of a Subducting Plate" by McLelland and Martin

Overview —

The students will graph earthquakes along the west coast of South America to create a graphic outline of the shape of the subducting plate.

Objective —

The students will:
- Graph the longitude and depth of earthquakes in South America
- Use the graph to visualize the descending slab of oceanic crust at this subduction boundary
- Compare the graphs for various latitudes and describe their similarities and differences

Before You Start: *The students should be familiar with the concepts of plate tectonics, subduction, and the relationship between subduction and earthquakes.*

Activity —

This activity could be done individually, with each student creating a graph, or in groups. It can be done in conjunction with the 3D modeling activity "Real Evidence of a Subducting Plate".

1. Show the students the map of South America. Ask them whether they've heard of any earthquakes on that continent. Where did they occur? *(Earthquakes often occur in Peru and Chile, along the west coast.)*
2. Explain to the students that they will be graphing the earthquakes depth compared to their longitude, in order to get a better picture of the plate boundary.
3. Arrange the students into pairs or groups, and hand out copies of the datasets and data sheets A and B (one each per group). Explain that they will be graphing the depth so that the numbers are increasing as you descend (zero is near the top of the graph). Explain that to match the map, they will be graphing west longitude so that it decreases to the right.
4. Ask the students to describe the two different data sheets—why would they use sheet A? Why would they use sheet B? Invite them to examine their data to determine which is better for their dataset.
5. After the students have finished creating their graphs, invite them to compare their data to another group's data.

   How do they compare? Why might some of the graphs look different from others? How could we determine if the graphs should all have the same pattern?
   [The data are each for different parts of South America, each with its own individual characteristics. To determine if the different patterns are errors, students could re-graph the data; or additional data could be gathered.]

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Discussion questions

- *Do you see a pattern in some of the graphs? What is the pattern?*
- *What do you notice about the depth of the focus of the earthquakes as you go further inland from the coast of South America?*
- *What appears to be happening to the two plates that meet along the west coast of South America, according to your model?*
- *Describe the type of plate boundary which you think is present along the west coast of South America.*
- *How can our model explain the deep trench that lies just off the coast of South America?*

Show the students the three dimensional model of the subducting plate from the website.

TIES TO STANDARDS —

Texas Essential Knowledge and Skills for Science
Science Concept Standards

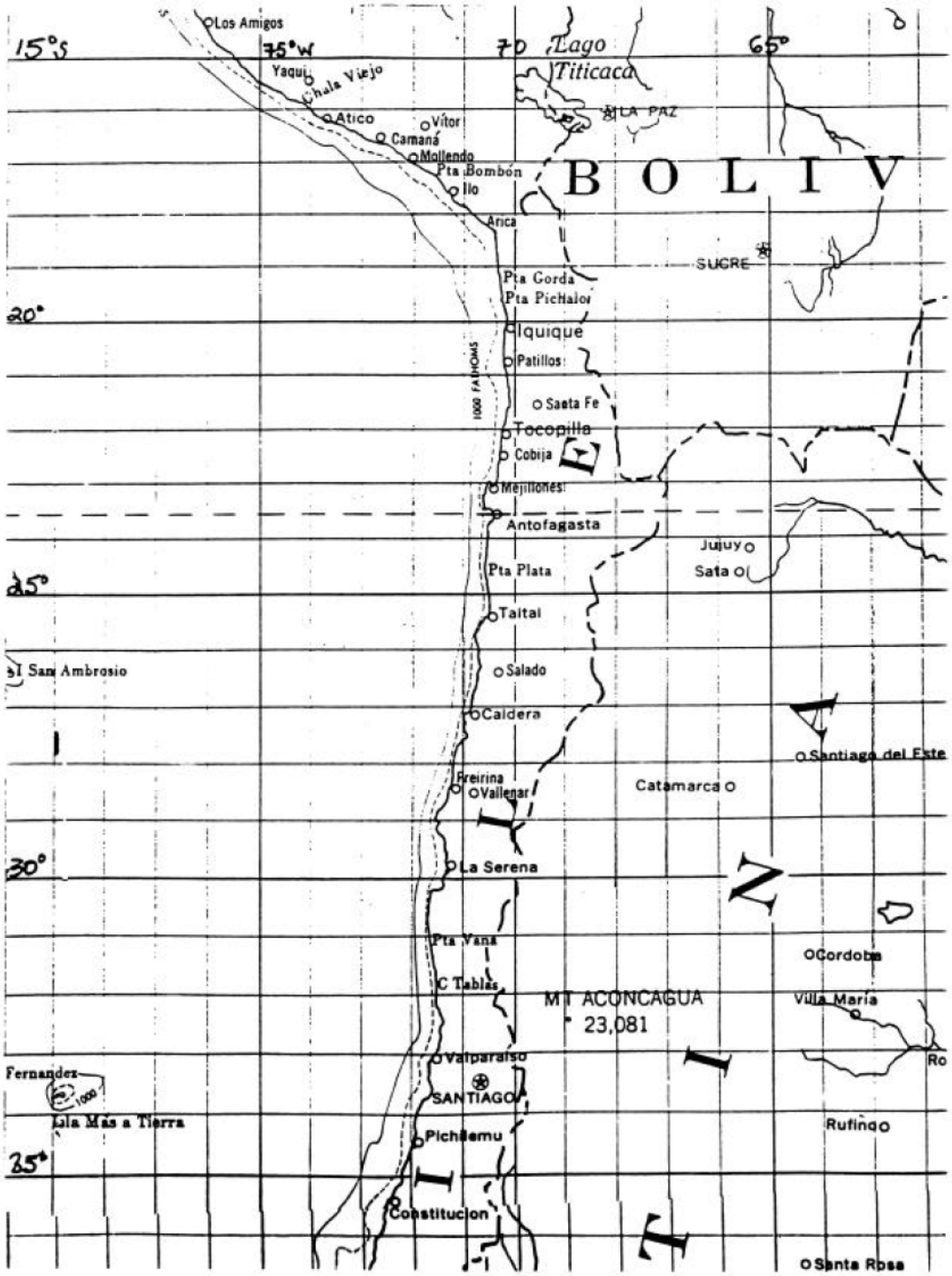
6(10) Earth and space. The student understands the structure of Earth, the rock cycle, and plate tectonics. The student is expected to:

(C) identify the major tectonic plates, including Eurasian, African, Indo-Australian, Pacific, North American, and South American; and

(D) describe how plate tectonics causes major geological events such as ocean basins, earthquakes, volcanic eruptions, and mountain building.

8(9) Earth and space. The student knows that natural events can impact Earth systems. The student is expected to:

(B) relate plate tectonics to the formation of crustal features;



Map of South America between latitudes 35°S and 15°S and between longitudes 70°W and 62°W.

Group 1 Earthquake Data

Lat	Lon ▾	Depth (km)
-17.84	66.64	269.0
-21.11	67.23	145.0
-18.98	67.39	142.0
-19.11	67.47	190.0
-21.16	68.13	92.0
-21.26	68.20	117.0
-21.09	68.21	139.0
-20.83	68.33	132.0
-21.09	68.35	109.0
-21.03	68.39	117.0
-21.14	68.53	97.0
-20.43	68.64	111.1
-20.28	68.70	116.7
-18.89	68.75	131.0
-20.55	68.80	105.0
-21.17	68.91	123.0
-18.07	68.99	146.0
-18.88	69.09	107.0
-18.66	69.14	104.0
-18.08	69.26	108.0
-18.08	69.32	136.0
-18.97	69.46	86.0
-17.04	69.52	139.6
-18.24	69.66	132.5
-18.06	69.68	124.3
-19.55	69.74	35.0
-17.02	70.03	95.0
-20.38	70.17	35.0
-17.34	70.23	81.0
-19.92	70.36	34.0
-20.04	70.49	38.0
-18.05	70.53	37.0
-18.41	70.71	34.8
-18.34	71.21	45.0
-17.30	72.59	36.3

Group 2 Earthquake Data

Lat	Lon ▾	Depth (km)
-26.79	63.21	559.9
-28.18	63.22	554.9
-26.38	64.58	10.0
-28.91	64.59	65.0
-27.58	65.83	26.8
-28.09	66.52	188.0
-28.09	66.54	155.7
-28.76	66.86	7.4
-28.67	67.54	132.2
-28.56	68.12	117.7
-29.19	68.16	43.5
-29.32	68.48	46.2
-30.26	69.02	36.2
-30.23	69.27	89.0
-29.13	69.82	102.6
-28.13	70.40	78.4
-28.42	70.67	35.0
-28.23	70.70	57.4
-27.14	70.72	40.0
-27.90	70.72	67.0
-27.95	70.82	42.0
-28.50	70.86	51.8
-29.38	70.96	81.6
-29.39	71.03	62.0
-29.59	71.11	44.0
-27.14	71.23	22.8
-28.38	71.35	34.0
-29.98	71.38	39.4
-29.59	71.46	35.0
-29.87	71.53	50.0
-29.47	71.55	35.1
-30.06	71.58	30.2
-29.92	71.62	31.3
-29.93	71.92	31.7
-27.86	72.26	35.0
-26.80	72.54	16.0
-30.00	72.66	31.8

Group 3 Earthquake Data

Lat	Lon ▾	Depth (km)
-23.27	70.66	35
-21.81	70.20	26.8
-22.84	68.99	95
-22.70	68.91	35.9
-22.86	68.91	96.5
-22.63	68.83	114.1
-22.27	68.80	100.9
-21.96	68.80	111
-22.53	68.76	73
-23.29	68.74	97.3
-22.70	68.68	112.2
-22.25	68.67	95.2
-21.79	68.64	144.6
-22.88	68.52	99
-23.07	68.51	114.7
-22.06	68.51	107.2
-22.78	68.46	137.2
-22.33	68.41	98.1
-22.23	68.33	114
-22.88	68.32	35
-22.02	68.32	112.9
-21.87	68.24	92
-22.07	68.18	120
-21.81	68.16	95
-21.86	68.07	102.7
-22.30	67.77	204.8
-22.06	67.48	122
-22.73	67.41	231.5
-21.80	67.16	185.7
-22.05	66.76	163
-22.84	66.65	193.6
-23.23	66.56	238.9
-23.02	66.32	208
-22.65	66.19	260.5
-22.73	66.14	232.2
-21.95	65.76	246.6

Group 4 Earthquake Data

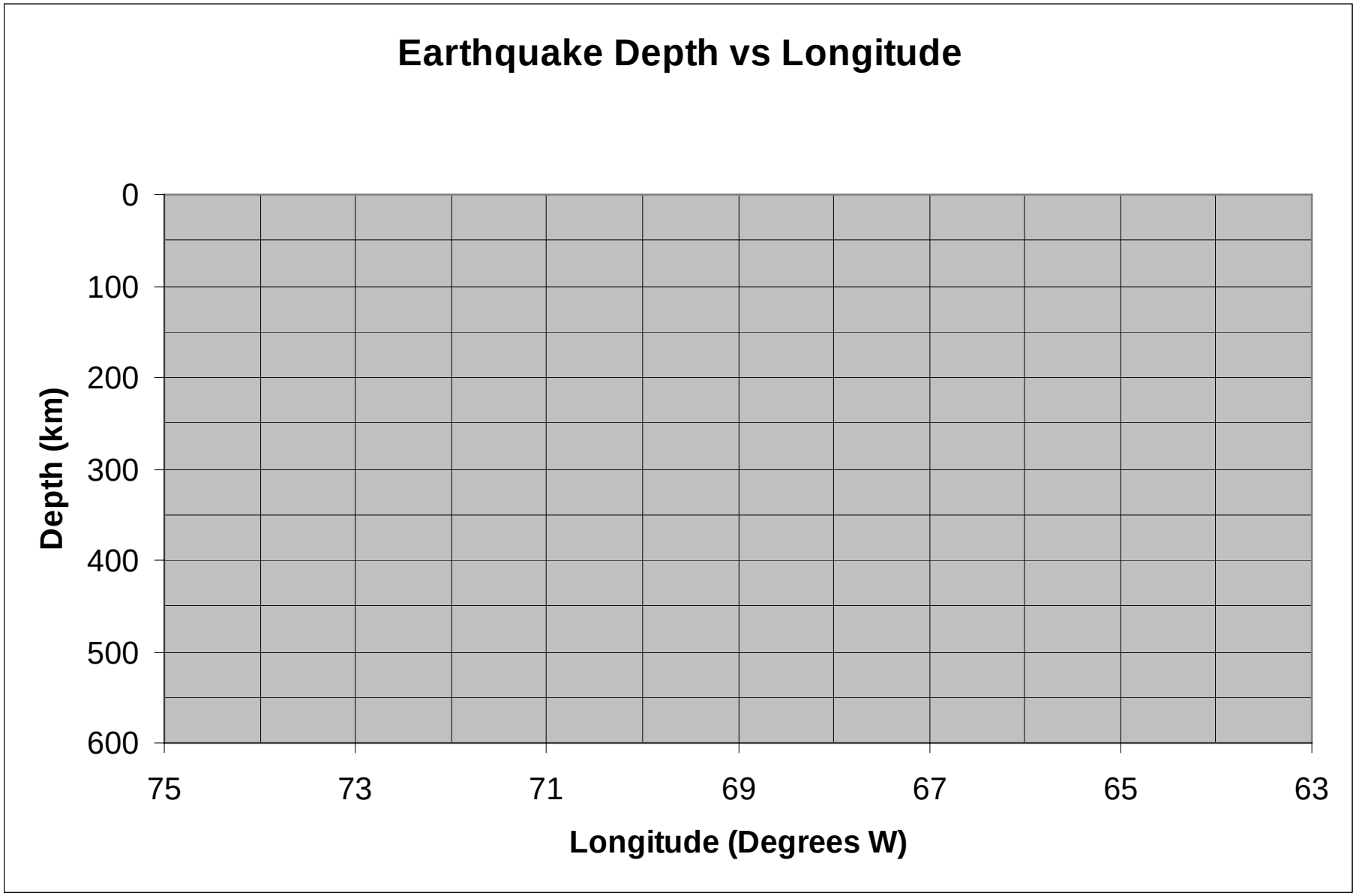
Lat	Lon ▾	Depth (km)
-34.74	73.72	10.0
-34.32	73.39	16.0
-34.74	72.97	28.0
-31.82	72.73	35.0
-33.98	72.34	30.0
-34.00	72.34	33.0
-34.23	72.33	15.0
-33.94	72.32	35.0
-34.01	72.31	24.0
-34.01	72.31	30.0
-34.15	72.30	9.0
-33.96	72.29	35.0
-33.93	72.26	35.0
-34.25	72.20	21.7
-33.86	72.05	68.8
-33.64	72.00	27.0
-33.62	71.99	25.0
-33.68	71.92	25.6
-34.73	71.88	32.0
-34.38	71.86	35.0
-34.72	71.85	27.0
-32.82	71.84	38.0
-33.60	71.83	30.0
-34.72	71.83	39.2
-34.75	71.82	39.0
-34.71	71.80	35.0
-34.72	71.76	43.0
-33.80	71.75	38.0
-34.76	71.72	47.0
-32.57	71.61	35.0
-34.66	71.53	46.0
-34.71	71.47	47.0
-34.66	71.36	64.0
-31.85	70.23	101.0
-31.30	68.28	104.0
-31.68	67.97	94.0

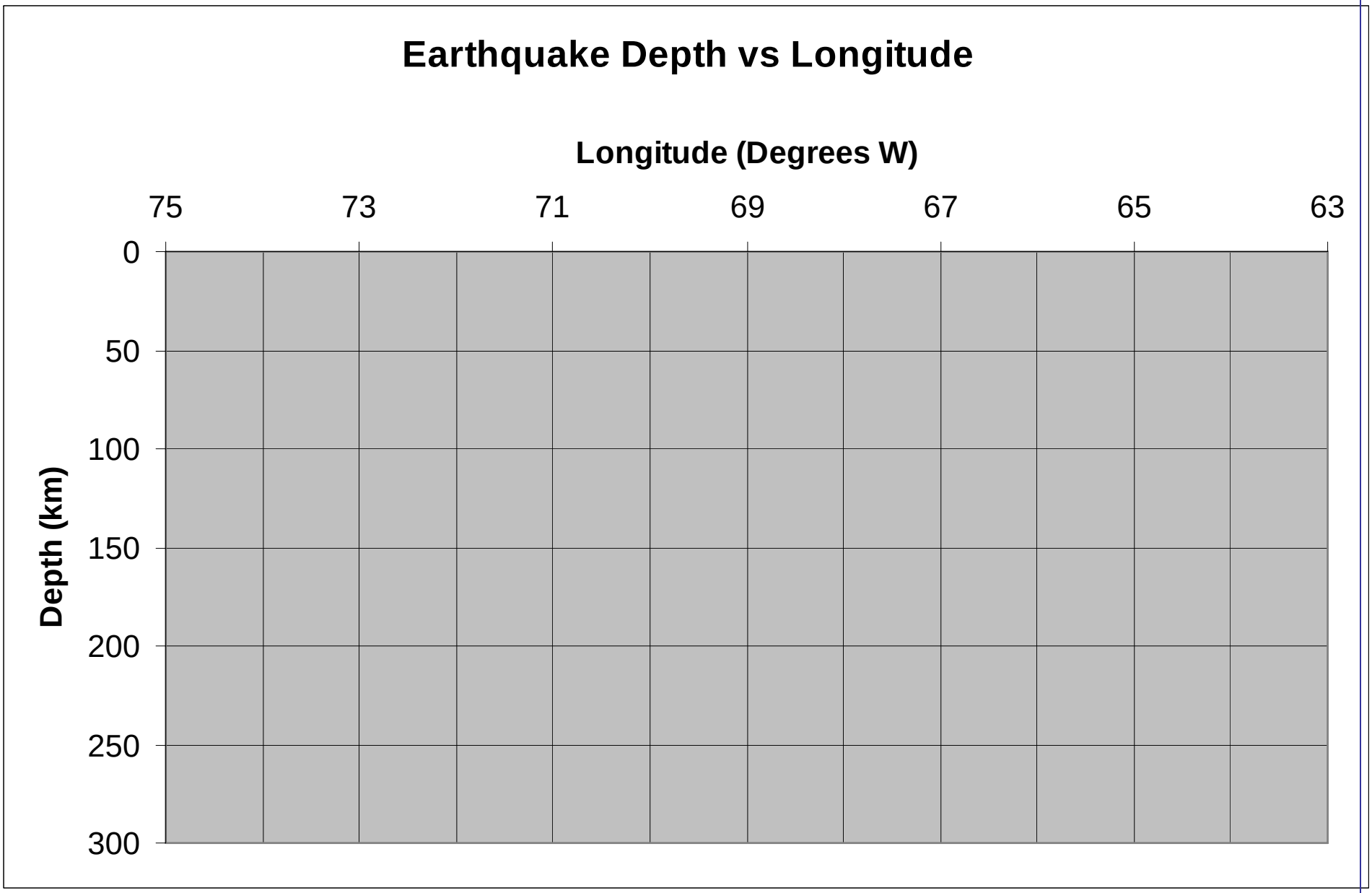
Group 5 Earthquake Data

Lat	Lon ▾	Depth (km)
-25.02	72.10	35
-25.68	70.67	49.5
-25.62	70.59	17
-24.90	70.30	38.8
-24.19	70.25	28
-24.69	69.82	49
-23.89	69.41	96.9
-23.85	69.18	82
-23.90	68.53	104.3
-23.74	67.71	235.8
-24.06	67.60	220
-23.66	67.35	251.8
-24.21	67.18	217.1
-24.29	67.10	157.6
-24.19	67.03	192
-24.43	67.03	160.9
-24.25	66.90	172
-25.80	66.88	43.6
-25.82	66.81	63.8
-24.08	66.78	194
-25.81	66.74	10
-24.06	66.70	178.4
-25.87	66.66	35
-23.87	66.66	203.2
-24.05	66.63	190.9
-25.71	66.62	10
-23.65	66.57	200.8
-23.83	66.52	149
-25.02	65.75	24.4
-24.87	65.60	10
-24.92	65.53	10
-24.65	65.49	61.4
-24.86	65.42	39.4
-24.69	65.39	24
-24.80	65.23	35
-23.76	64.96	18

Student Data Sheet A

Latitudes range from _____ to _____



Student Data Sheet B

Latitudes range from _____ to _____