LAB-- Subduction Zones

NAME_____

Deep ocean trenches represent zones of subduction where ocean-floor rock sinks into the mantle. Evidence for this is the distribution of intermediate and deep focus earthquakes. Earthquakes occur only in rigid rock material. Earthquakes do not occur in in the asthenosphere where hot rock bends and flows rather than breaks. Earthquakes also do not occur in the mantle where rock is molten or in the core.

It has been observed that most earthquakes occur at shallow focal depths within the lithosphere. Earthquakes of intermediate and deep focal depths occur only near trenches. This is evidence that solid and rigid material is being forced down into the mantle at these locations. These earthquakes occur within the subducting plate. Therefore, plotting earthquakes and their **focal depths** (exact location where they occur) relative to a trench provides a profile (side view) of the subducting plate.

1. Using the data table of earthquake focal depths (Table 1), construct a cross-section of a subducting plate along line B-B'on the map. You will only be plotting a few of the earthquake locations to get a general view of the angle of the subducting plate.
    a. The focal depth of each earthquake event is listed along with its distance from a seismic monitoring station on Bonin Island. (Bonin Island is at 0 km on the horizontal axis.)
    b. On the graph paper (C-C') construct the cross-section by plotting the focal depth of each earthquake at its distance from the Bonin Island monitoring station. **(3pts for accurate plots)**
    c. Use the appropriate symbol for each earthquake depth category as shown on the map and graph paper. (DOTS, X'S, TRIANGLES at bottom)
    d. Draw a "best fit" line through the graph plots. This will identify the boundary between the two plates. (1pts) (on graph)
2. Repeat the above process for (A-A') using Table 2. **(5pts for accurate plots with dots, x's, and triangles)**
3. Repeat the above process for (B-B') using Table 3. **(5pts for accurate plots with dots, x's, and triangles)**

4. For each graph, determine the approximate angle for the subducting plate. Record the angle in the box at the top of the graph that is labeled "*subduction angle*." **(1pt) (on graph)**
5. Based on the map and the graph plots, label the upper plate and the lower plate on the cross-section.
   (2pts) (on graph)
6. On the cross-section draw an arrow on the subducting plate showing the direction in which it's moving. **(1pt)**

Table 1 for zone B-B′

Earthquake	Distance from Station (km)	Depth (km)
1	60	30
2	180	380
3	270	650

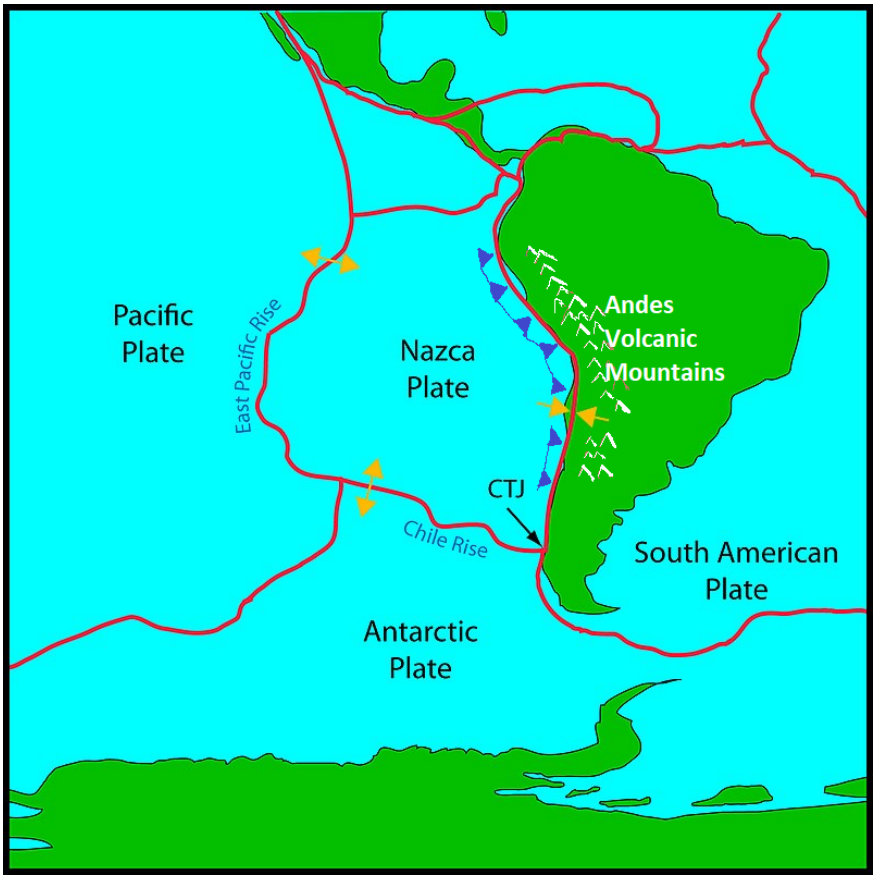
Table 2 for zone A-A′

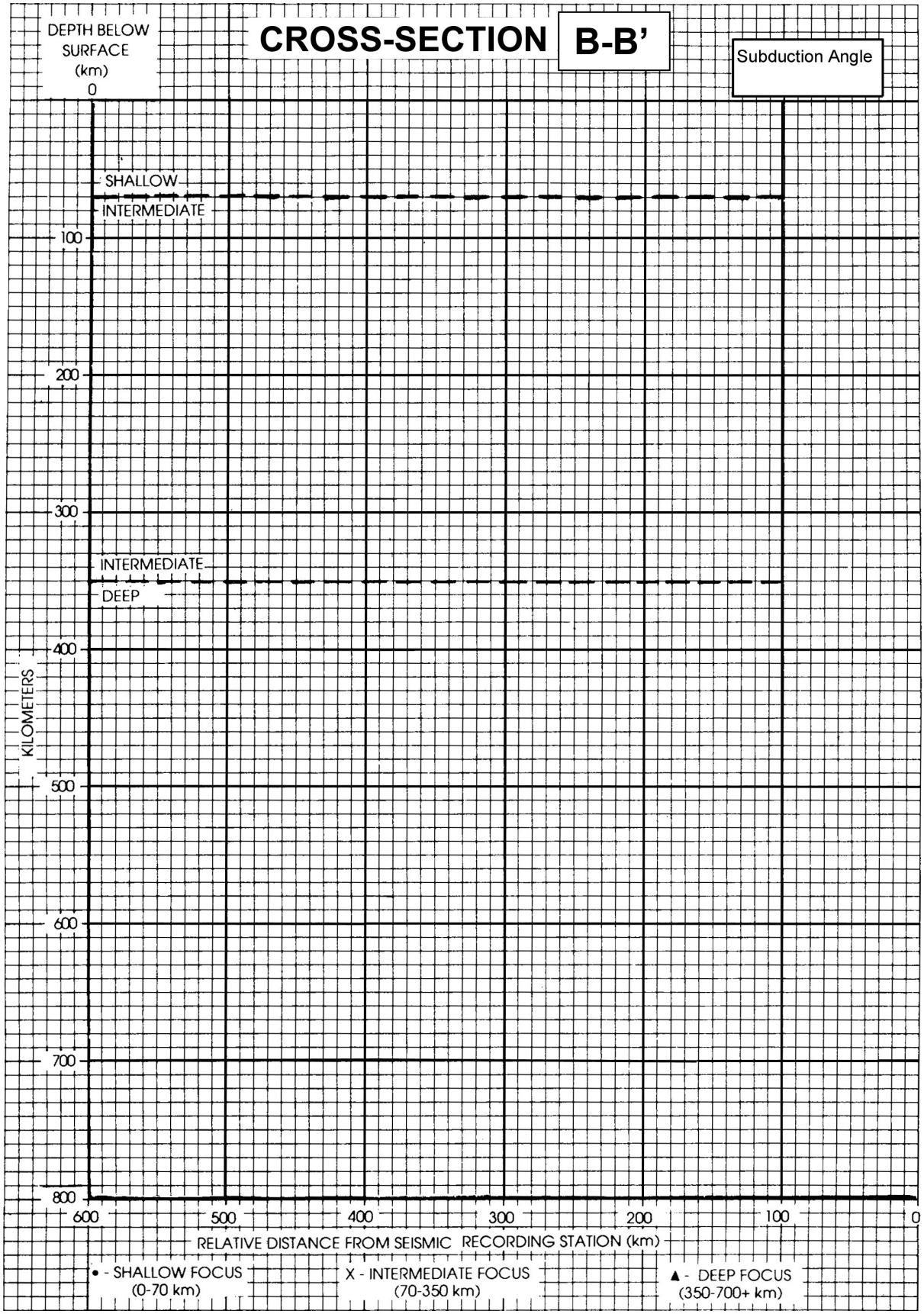
Earthquake	Distance from Station (km)	Depth (km)
1	400	390
2	50	10
3	190	70
4	310	230
5	580	680

Table 3 for zone C-C′

Earthquake	Distance from Station (km)	Depth (km)
1	120	10
2	370	130
3	590	240

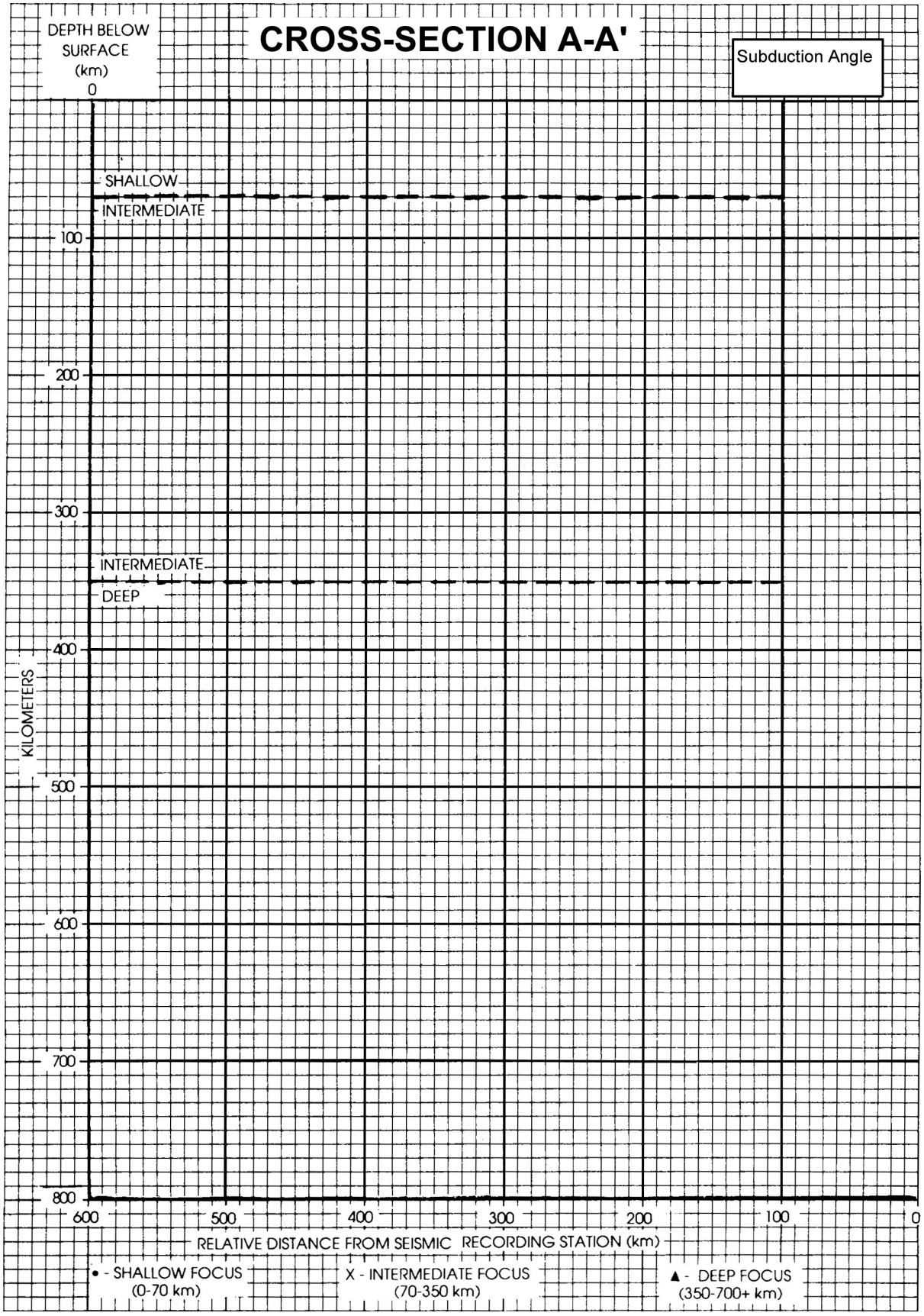
MAP 4—NAZCA PLATE SUBDUCTION ZONE





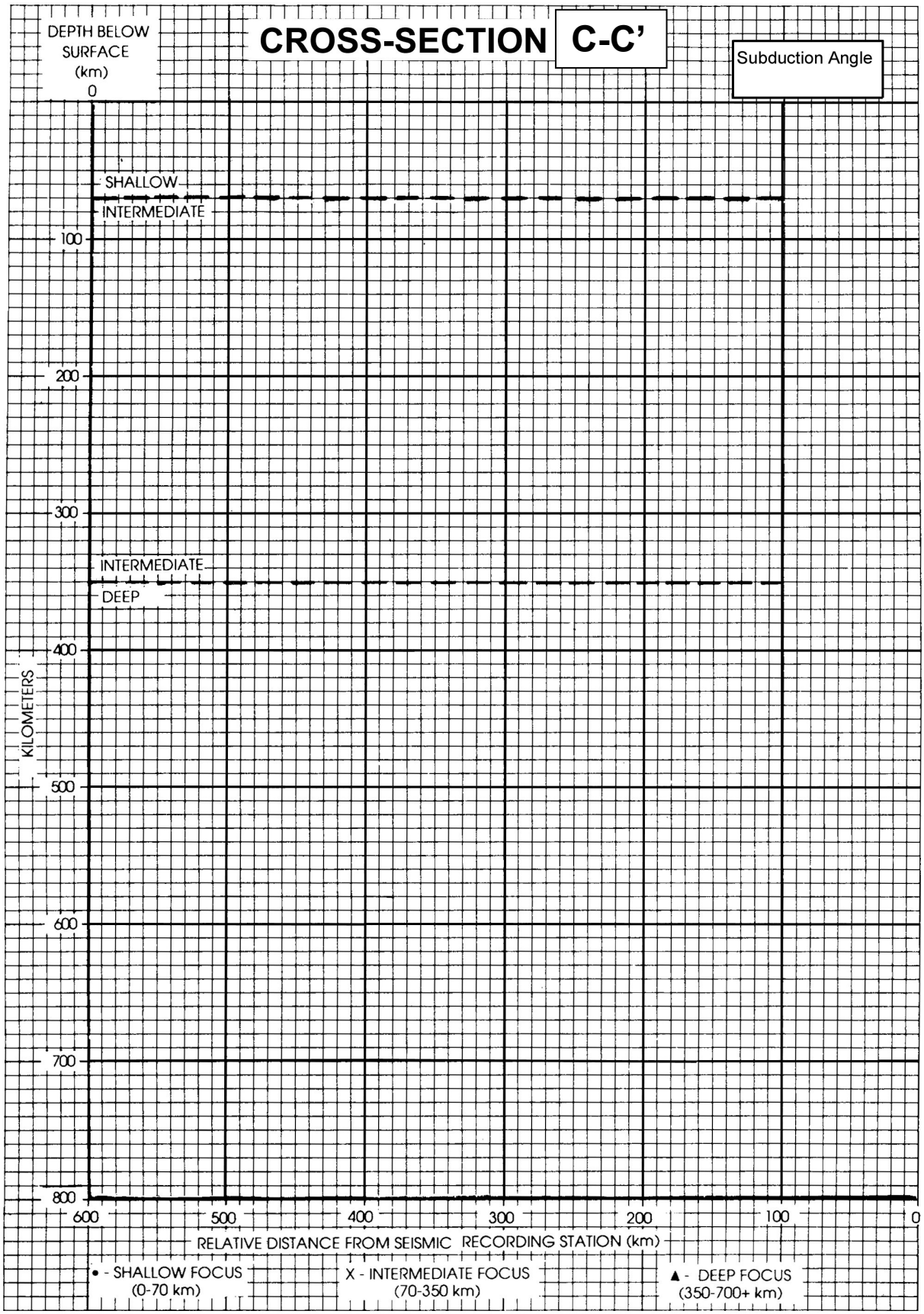
___ accurate plot points (3possible)
___ angle of subducting plate (1)
___ labelled upper plate (1)
___ labelled lower plate (1)
___ accurate arrow on subducting plate (1)

7 points possible



___ accurate plot points (5possible)
___ angle of subducting plate (1)
___ labelled upper plate (1)
___ labelled lower plate (1)
___ accurate arrow on subducting plate (1)

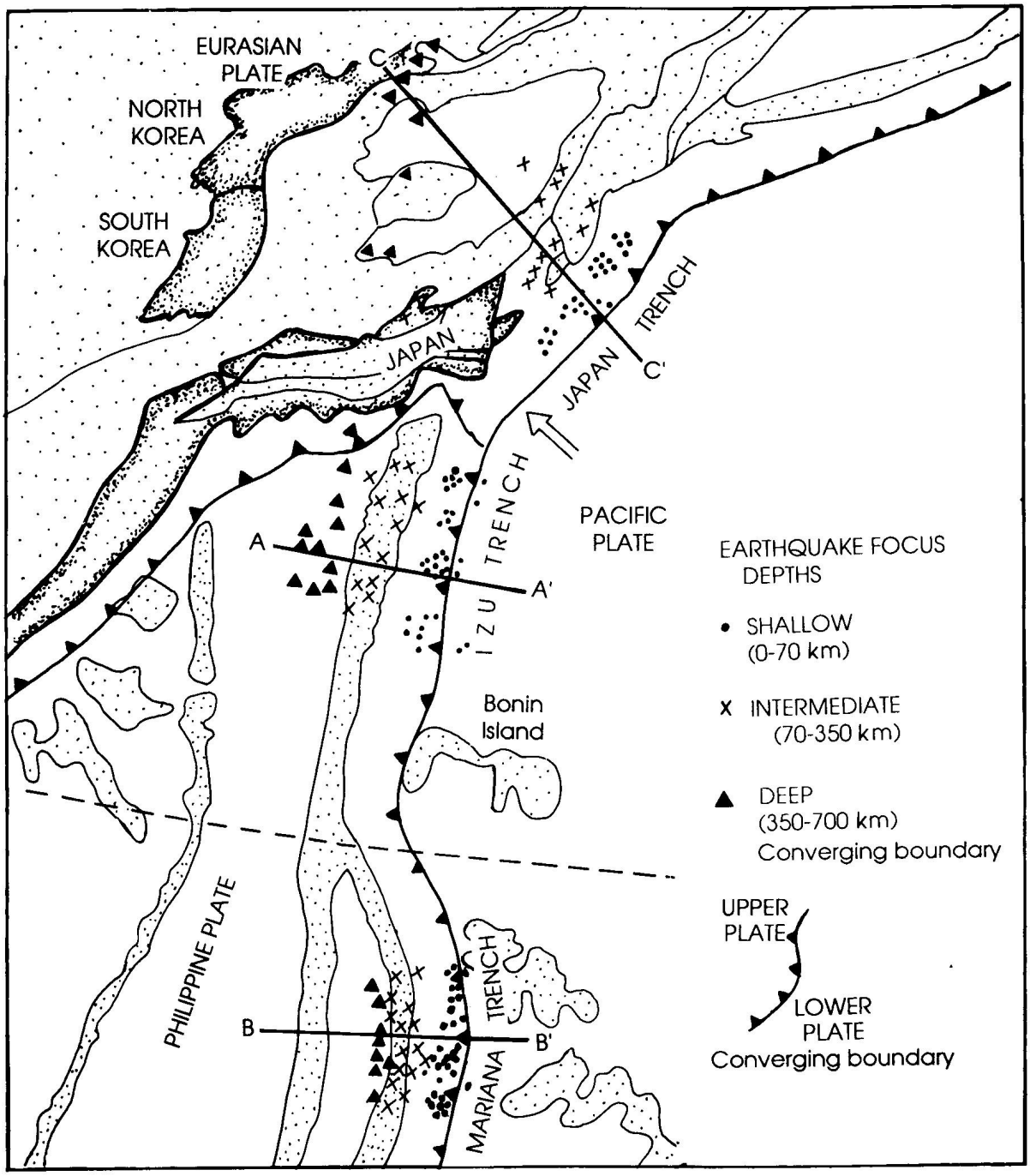
9 points possible



___ accurate plot points (3possible)
___ angle of subducting plate (1)
___ labelled upper plate (1)
___ labelled lower plate (1)
___ accurate arrow on subducting plate (1)

7 points possible

Map 5: Trenches of the Western Pacific



SCALE 1: 17000 000

500 0 500 1000 1500 2000 KILOMETERS

500 0 500 1000 MILES

400 0 400 800 NAUTICAL MILES

Lambert Azimuthal Equal-Area Projection
(Map center point: Equator, 160° W.)

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1. Which plates (types of crust) are involved in these converging boundaries? (2pts)

_____ _____

2. Looking at your graphs, is the subducting plate on the right side of the page or the left? (1pt)

_____

3. What is a trench?

_____

4. Which of the three ***trenches*** has the steepest subduction angle? (1pt)

_____

5. Which of the three ***trenches*** has the shallowest subduction angle? (1pt)

_____

6. Is the horizontal scale on the cross-section the same as the vertical scale? (1pt)

_____

7. Based on your answer to question 5, is the cross-section vertically exaggerated? (1pt)

_____

8. What is the angle of descent like when the spacing between shallow, intermediate, and deep focus earthquakes is far apart? *(use map 5 and your graphs to answer this question)*

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9. What angle does the subducting plate have when the spacing between shallow, intermediate, and deep focus earthquakes is close together? *(use map 5 and your graphs to answer this question)*

_____

10. How does the type of convergent boundary shown by these cross-sections differ from the convergent boundary where the Nazca Plate is colliding with the South American Plate? *(refer to map 4)*

_____

11. What surface feature has formed on along the west coast of South American as a result of the collision of the Nazca Plate with the South American Plate? *(refer to map 4)*

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12. What surface feature might you expect to see in Japan?

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