

Exercise 6. Seismic-Reflection Profiling

The principles used in this exercise are the same as those used for Question 4 in Exercise 1 (Bathymetry—the Shape of the Sea Floor). The text accompanying this exercise is very brief, so it is important to clarify the concepts of reflections, multiples and true depth vs. apparent depth — concepts that will likely be new to students. We suggest that you teach this exercise concurrent with or after presentation of the topic in lecture.

1. Note that each increment of one-way travel time is represented in Figure 6-6 by a number on the right side of the chart and a line to the right of each number. Therefore, line "2" represents the second increment or 18.4 meters depth.

Each interval of 0.00625 seconds is equal to 9.2 meters of water depth and 11.44 meters of penetration into sediments. Therefore, the water depth at the station, which extends down to division "5," is 46 meters. The thickness of the sediments extend from division "5" to the first multiple at division "11." Thus sediment thickness is $6 \times 11.44 \text{ m} = 68.64 \text{ m}$.

2. Because the sled is being towed beneath the water surface, the apparent water depth shown is not the true depth. True depth of the water is found by subtracting the apparent depth (circled reflection "2") from the first multiple (circled reflection "4"). The true depth of the water along the center mark is approximately $150 \text{ m} - 62 \text{ m} = 88 \text{ m}$. Answers will vary according to students' ability to scale distances.

3. From the calculations for question 2, the sled must be riding at a depth of 26 meters (true depth - circled reflection "2"). Alternatively, the sled depth may be calculated by subtracting the depth of circled reflection "2" from that of circled reflection "3." Once again, accuracy of the answers will depend on students' ability to scale the distances correctly, so allow for variation in their results.

4. a. The base of the unconformity is at the bottom of the brackets on the left and right margins, therefore the overlying sediment is ~21 meters on the right side and ~9 meters on the left. These two thicknesses average to ~15 meters.

b. Assuming a sedimentation rate of 40 cm per 10,000 years, a thickness of 15 m = $1,500 \text{ cm} \times 10,000 \text{ years} / 40 \text{ cm} = 375,000 \text{ years}$.

c. These sediments were deposited during the Holocene and early Pleistocene Epochs of the Quaternary Period of the Cenozoic Era.

5. The smooth areas within and around the rocky outcrops result from sediment covering the rough edges of the outcrops.

6. The length of the side-scan record is 1,050 meters (150 meters per interval \times 7 intervals).

7. The ship's course is 270 degrees and the beds are trending northeast-southwest across the chart. The strike is northeasterly.