LG 2

GEOLOGY 12 **STUDENT EXERCISE**
PLATE TECTONICS
RATE OF SEA FLOOR SPREADING

As molten rock pours out onto the Earth's surface, the iron minerals in it tend to line up in the Earth's magnetic field. Each molecule of the iron mineral acts like a tiny compass needle and aligns itself with the magnetic lines of force of the Earth's field. As the rock solidifies and crystallizes, these iron minerals are locked in place making a permanent record of the direction of the Earth's field at the time. The magnetic record of the rock can be identified by using a sensitive instrument called a Magnetometer.

The graphs on the attached page were made from magnetometer readings taken on three passes across the Mid-Atlantic Ridge just south of Iceland. The peaks above the base line represent magnetism in the "normal" direction, that is the same as today's direction. The peaks below the base line represent magnetism in the "reverse" direction, that is opposite to today's direction. The distance below or above the base line represents the strength of the magnetism locked in the rock.

The pattern of normal and reverse direction of magnetic records in indicates that the Earth's magnetic field has changed several times in Geologic Time. At times the North Magnetic Pole was were it is now and at other times it was located at the South Pole region of the Earth. The times at which the reversals occurred have been documented at other locations on the Earth's surface and the date of reversal has been found. From the data on the attached graphs it is possible to calculate the speed at which the sea floor has been spreading and find the rate at which the plate have been moving.

In this exercise you will calculate the rate of movement of the plate at the Mid-Atlantic ridge.

PROCEDURES:

1. Number the peaks above the base line, 1, 2, 3, 4, 5, and 6 both to the east and west of the central line. Note: on some of the traces not all of the peaks are present. What could cause them to be missing?

2. Draw lines, parallel to the central line, that come as near as possible to the peaks numbered 1, east and west of the center. The lines do not have to go through each peak but as near to each as you can and still be parallel to the center. The process averages the distance the peak is from the centre.

3. Measure the distance the lines are from the center using the scale at the bottom of the graph. (1mm : 2km) Record these distances in the data table.

4. Repeat the process for the other peaks.

5. Find the average distance the set of peaks is from the ridge for each peak number. {(distance west + distance east) ÷ 2} and enter this data in the table.

6. Using the time scale across the bottom of the page, convert the average distance of the peak to age of the rock at that distance. (10mm : 10km and 12.5mm : 1my)

7. Calculate the rate of movement of the rock for each peak in cm/y to complete the data table. Calculate the overall average rate for all of the data. Note: this rate is for one side of the Ridge only. It is doubled for the whole Atlantic Ocean.

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DATA TABLE:

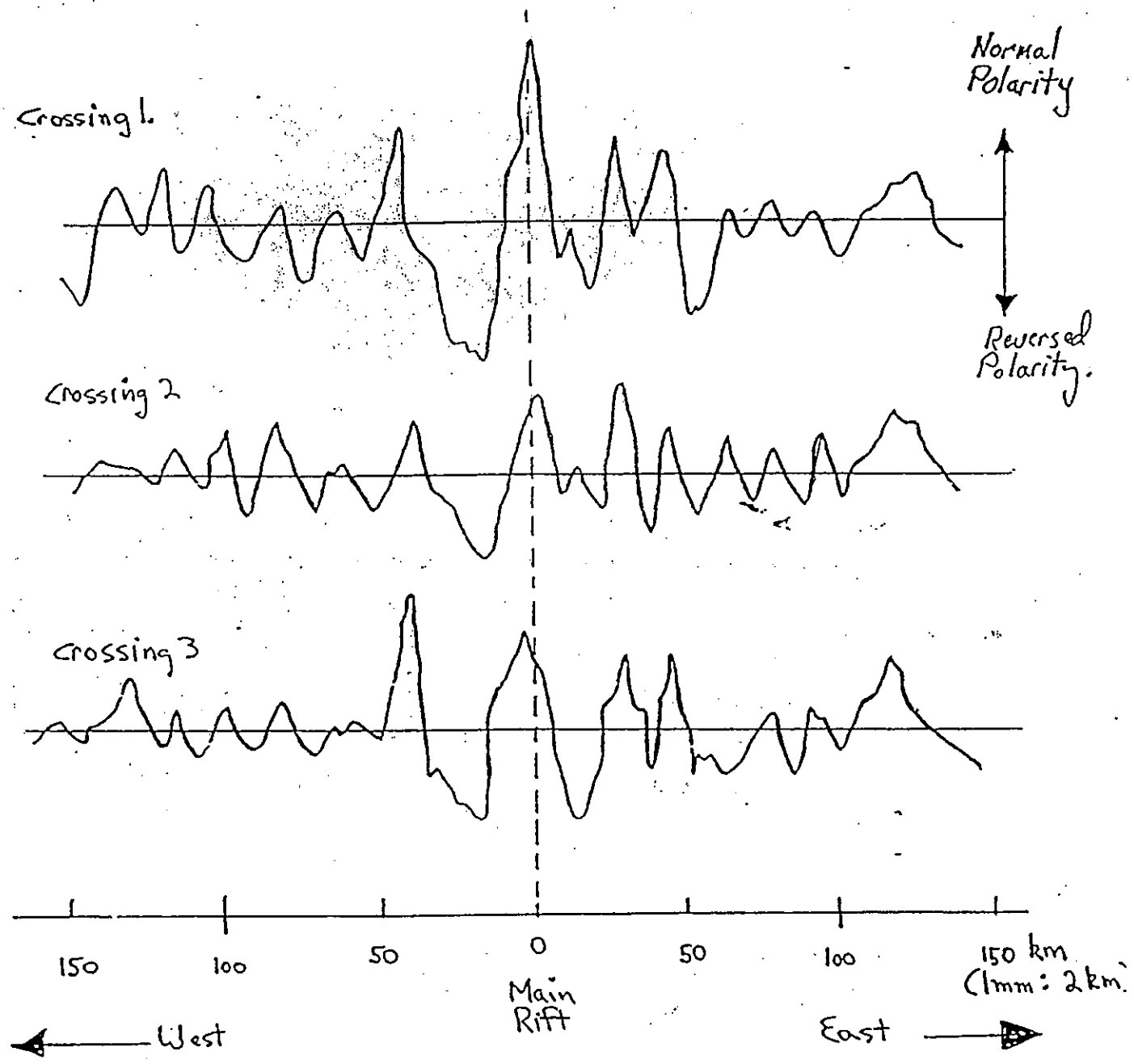
PEAK NUMBER	1	2	3	4	5	6
Distance West (km)						
Distance East (km)						
Average distance from Ridge (km)						
Age (my)						
Rate of Movement (cm/y)						

OVERALL AVERAGE RATE (cm/y) | |

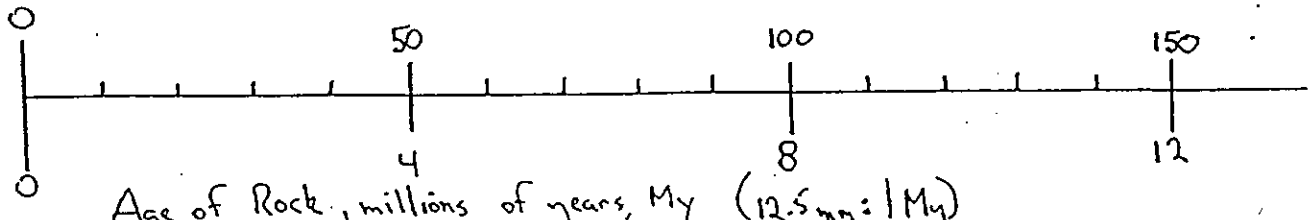
QUESTIONS:

1. Where would you find the youngest rock on the Atlantic Ocean floor? Explain your answer.
2. Where would you find the oldest rock on the Atlantic Ocean floor? Explain your answer.
3. The magnetic peaks are symmetrical East and West of the ridge. Explain why.
4. Draw a line that is the length of the average rate of movement for one year of one side of the Atlantic Ocean floor. Draw a line that represents the amount of movement of both sides of the floor in one year.
5. How does this evidence for the age of the sea floor and rate of spreading complement the theory of Plate Tectonics?
6. Draw a line that represents the amount that the Atlantic Ocean has widened in your life time. Show how you calculated this distance.
7. The distance from Africa to the Mid-Atlantic Ridge is 2400 km. How long ago was Africa at the Ridge according to your calculation of rate of movement? Is this consistent with the Theory of Plate Tectonics and the breakup of Pangaea?
8. BONUS: How old is your favorite Geology teacher? The Atlantic Ocean has widened by ___% of his height in his lifetime. What is his age? Show your calculations.
9. BONUS BONUS: How far, in cm, does the tip of the hour hand of the classroom clock travel in a year? How does this compare to Sea Floor Spreading rates? Show your calculations.

Rock Polarity Across the Mid Atlantic Ridge



Distance from Rift, km (10 mm : 10 km)



Age of Rock, millions of years, My (12.5 mm : 1 My)