Teacher's Guide Motion of the Magnetic Pole

Introduction

The Magnetic North Pole has been charted over the past several hundred years. The pole shifts an average of 15 kilometers/year. Navigation by compass is especially difficult during a magnetic storm. Compass bearings can shift by 10 degrees or more within the course of a few hours, therefore, it is important to kno the pole's present location.

Objective

The student will plot the latitude and longitude involved in the movement of the Magnetic North Pole over a period of time, predict its location by the year 2000, and justify their reasoning.

Procedure

1) Students will plot the latitude and the longitude for the given years using the data in the table.

2) Students will connect the points in the given order to see the pattern of movement in the Magnetic North Pole.

3) Students will measure the distances between the points, and using the time between the years in the table, arrive at an average rate of movement. (See explanation).

4) Students will plot and justif their choice of location based on their results. Student's prediction and justification should be based on the speed and the distance that the Magnetic North Pole has shifted in prior years.

EXPLANATION:

To calculate the speed, use the following formula:

$$\text{speed} = \frac{\text{Tabulated Distance}}{\text{Difference in Years}}$$

Example:

For the first interval between 1831 and 1904, the North Magnetic Pole moved 50 kilometers. The difference in the years is 1904-1831 = 73 years, so the speed during this interval is

$$\text{speed} = \frac{50}{73}$$

$$= 0.7 \text{ kilometers/year}$$

Materials

—Student Page
—Teacher Graph
—Ruler with millimeter units
—Calculator

Conclusion:

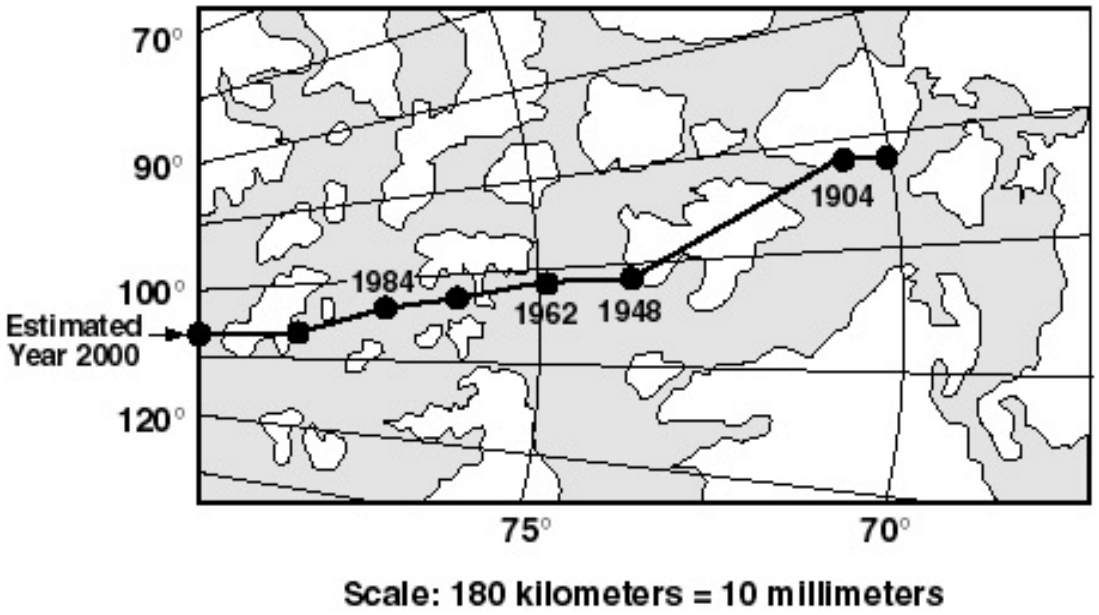
Students will understand that the Magnetic North Pole is not fixed at a specific geographic location, but moves from year to year by a significant amount.

Teacher's Answer Key

1. Plot the longitude and the latitude for the following years on the map below. NOTE: The distance that the Magnetic North Pole moved between the years has been calculated using the map scale.

YEAR	Longitude	Latitude	Distance	Speed (km/year)
1831	96.5	70.1		
1904	96.2	70.5	50 k	0.7 km/year
1948	101.1	73.8	420 k	9.5 km/year
1962	100.8	75.0	150 k	10.7 km/year
1973	101.3	76.1	120 k	10.9 km/year
1984	102.1	77.2	120 k	10.9 km/year
1994	104.0	78.5	180 k	18.0 km/year

2. Given the data in the table, plot a prediction for the location of the North Magnetic Pole for the year 2000.



3. In your own words, justify the location of the prediction you have chosen.

The student prediction and justification should be based on the speed and the distance that the Magnetic North Pole has shifted in prior years. Students may either use an average speed based on the motion between 1831 to 1994 (= 1040 km/163 years = 6.4 kilometers/year) or may use the speed during the last 10 years (18.0 kilometers/year) but should justify which way they computed the speed. Either method is technically correct.

Name _____ Date_____

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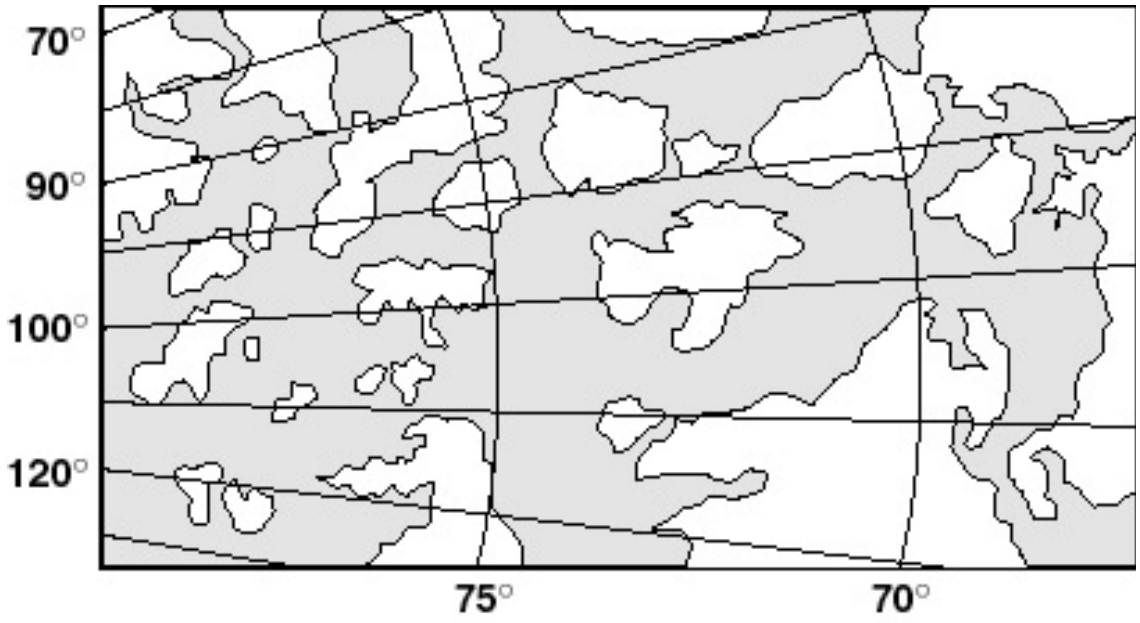

2. Given the data in the table, plot a prediction for the location of the North Magnetic Pole for the year 2000. Hint: Find the average rate of speed and complete the table. To calculate this for the given data, you will need to kno that the speed is the distance the pole has moved divided by the difference between the two years in each interval . You may also decide to calculate the average speed for ALL of the time between 1831 and 1994. The units will be in kilometers/year.

3. In your own words, justify the location of the prediction you have chosen.