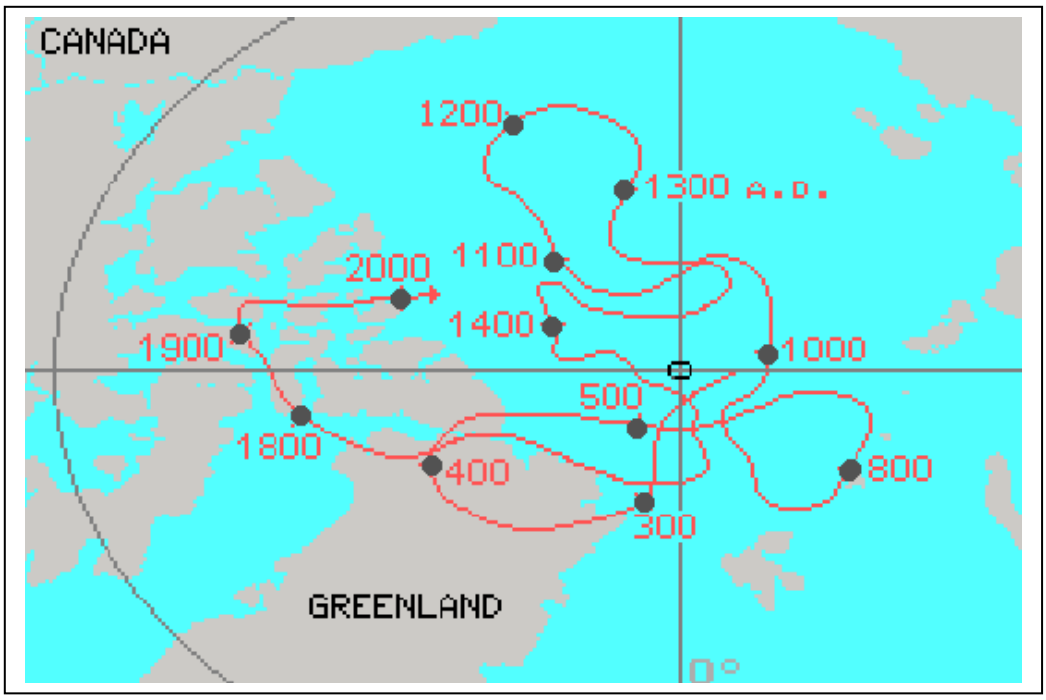

The Earth's magnetic North Pole moves around quite a bit, especially if you plot its position during the last 1700 years! The scale of the above plot is approximately 380 km per centimeter. Use this scale and a piece of string and the dates for each position, to answer the following questions:

Question 1: What is the total distance that the North Magnetic Pole wandered from 300 AD to 2000 AD?

Question 2: What is the shortest distance that the pole wandered in a 100-year period?

Question 3: What is the longest distance that the pole wandered in a 100-year period?

Question 4: What is the average speed of the wander from 300 AD to 2000 AD?

Question 5: What is the fastest speed it traveled in a 100-year period?

Question 6: Is the speed of the wander during the last 100 years unusual compared to the average speed or to the fastest speed?

This exercise introduces students to the idea that Earth's magnetic poles are not fixed in space and time. Since the 1700's, mapmakers have known that the bearings to seaports and other fixed landmarks change in a steady manner from decade to decade so that maps often have to be re-drawn to reflect the new bearings. Geologists call this phenomenon 'polar wander'. (It has nothing to do with Earth's rotation axis!!)

Students will be asked to study a map of the wandering magnetic North Pole and answer some quantitative questions. To measure the distance (along the red track) that the magnetic pole has wandered, have students use a piece of string laid along the track, and then measure the length of the track in centimeters. The scale of their map is about 380 km/cm, so multiplying the string length by this scale factor, they can easily compute the track length and answer the questions. Students will also need to compute the speed of the pole movement between the years indicated on the map, by dividing the relevant track interval they measured by the difference in the years.

Question 1 - What is the total distance that the North Magnetic Pole wandered from 300 AD to 2000 AD? **Answer:** The string was 48 cm long which equals 48 cm x 380 km/cm = 18,240 km.

Question 2 - What is the shortest distance that the pole wandered in a 100-year period? **Answer:** Between 500 and 800 AD the string measured 4 cm or 1520 km. The time interval is 3 centuries, so in 1 century the pole traveled 1520/3 = 507 km.

Question 3 - What is the longest distance that the pole wandered in a 100-year period? **Answer:** The longest distance is between 1300 and 1400 AD for a length of 6.5 cm or 2470 km

Question 4 - What is the average speed of the wander from 300 AD to 2000 AD? **Answer:** Average speed is the distance divided by time = 18,240 km/1700 years or 11 km/year.

Question 5 - What is the average fastest speed it traveled in a 100-year period? **Answer:** Between 1300 and 1400 it traveled 2470 km in 100 years or 24.7 km/year!

Question 6 - Is the speed of the wander during the last 100 years unusual compared to the average speed or to the fastest speed? **Answer:** 2.5 cm = 960 km so 950km/100yrs = 9.5 km/year. It's slightly below average but not a record-holder!

Note to teachers: If you have the students calculate the average speeds for each 100-year period and plot this on a speed vs year graph, the students will see that the polar wander represents accelerated motion because the speed is not constant from century to century!