

GEOL106 Earthquake Country

Activity 5: Global Positioning System Based Geodesy

Name (Last, First): _____ Date: _____

Exploring Plate Motion and Deformation in Cascadia Using GPS Data

By: Shelley Olds, UNAVCO Education and Outreach, Anne Sheehan, University of Colorado

In this activity you will work with GPS data to explore plate motion and deformation in the Pacific Northwest. By analyzing multiple GPS Time Series Plots you can determine the direction and rate of regional deformation.

Part I: Analyzing real time series data to calculate GPS velocity vectors

SEAT: North (mm)

North (mm)

1/1/04 12/31/04 12/31/05 1/1/07 1/1/08 1/1/09

a) Average position on 1/1/2007 = 12.5 mm

b) Average position on 1/1/2008 = 15.6 mm

Yearly change in position (b-a) = $15.6 - 12.5 = 3.1$ mm/yr
to the North / South (circle the direction)

On your graph paper, each block represents 1mm.
Draw an arrow 3.1 blocks (mm) along the North axis

North

5

0 5 East

After calculating the yearly change in position for the East time series plot, draw an arrow 3.4 blocks (mm) along the East axis

5

0 5

SEAT: East (mm)

East (mm)

1/1/04 12/31/04 12/31/05 1/1/07 1/1/08 1/1/09

a) Average position on 1/1/2007 = 14.8 mm

b) Average position on 1/1/2008 = 18.2 mm

Yearly change in position (b-a) = $18.2 - 14.8 = 3.4$ mm/yr
to the West / East (circle the direction)

Add up your vectors (tail head method)

5

0 5

20

15

10

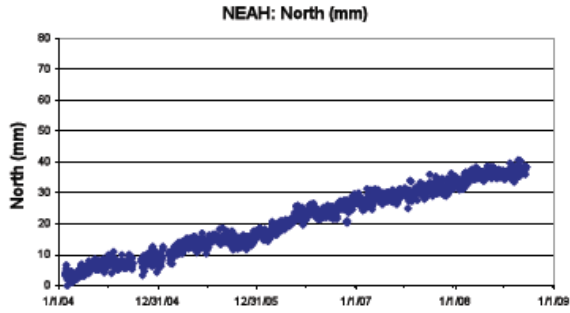
5

0 5 10 15 20 25

E
N

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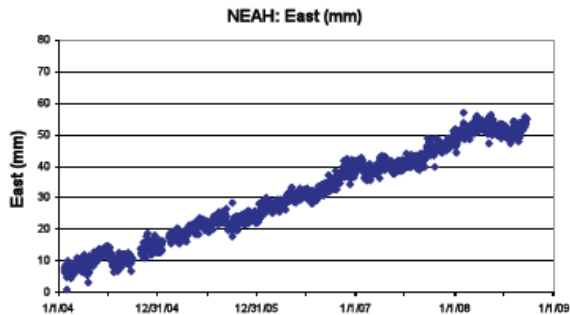
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a) Average position on 1/1/2007 = _____ mm

b) Average position on 1/1/2008 = _____ mm

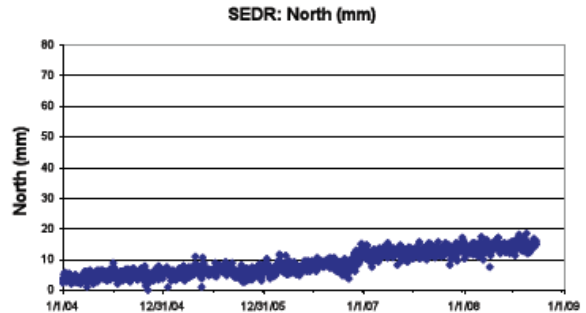
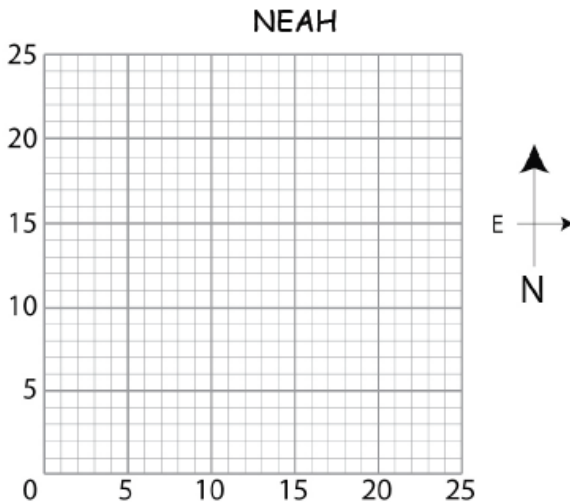
Yearly change in position (b-a) = _____ mm/yr to the North / South (circle the direction)



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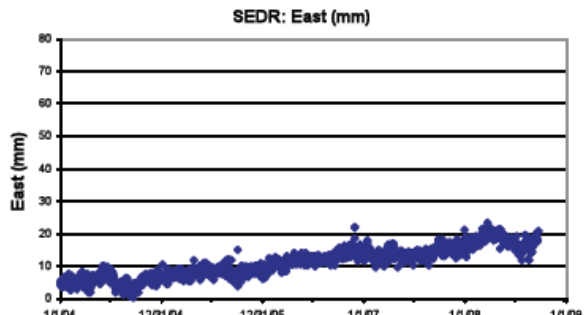
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b) Average position on 1/1/2008 = _____ mm

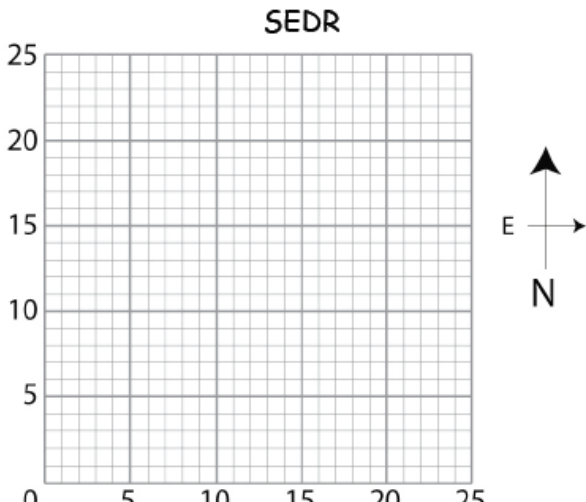
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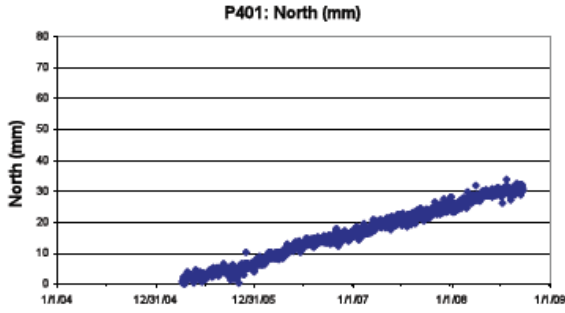
b) Average position on 1/1/2008 = _____ mm

Yearly change in position (b-a) = _____ mm/yr to the West / East (circle the direction)

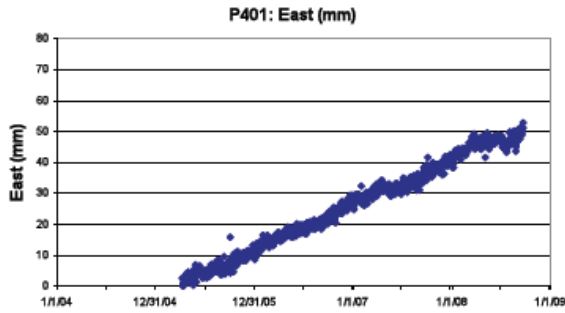


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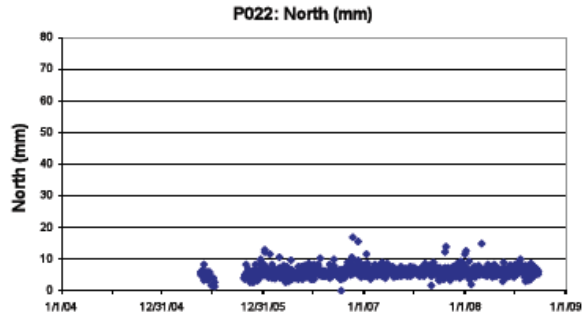
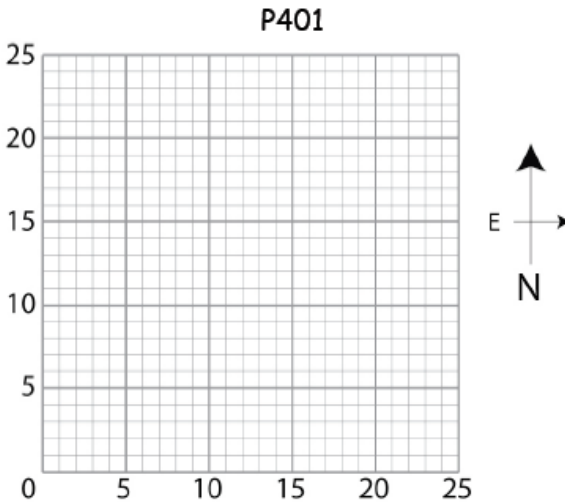
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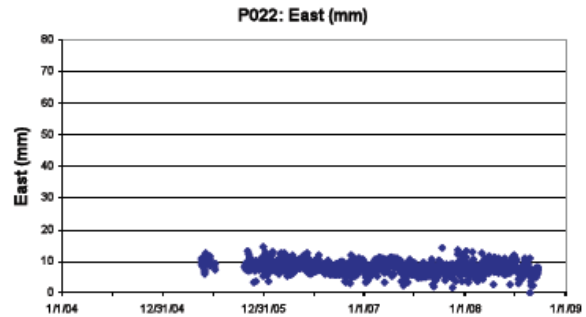
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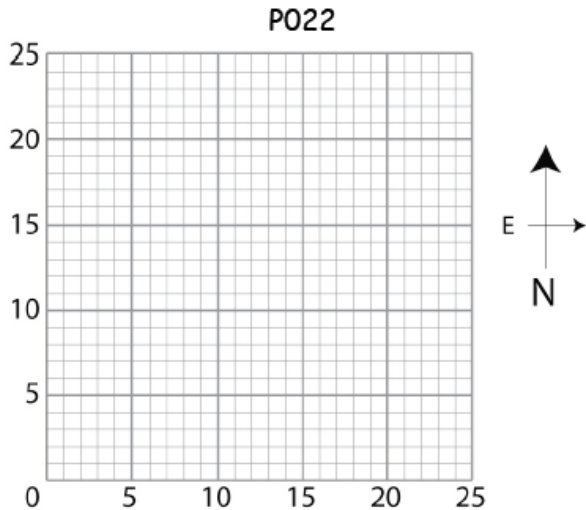
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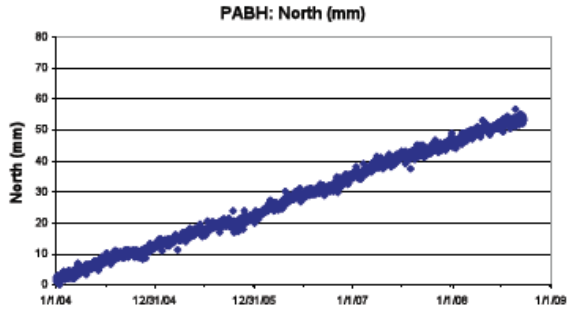


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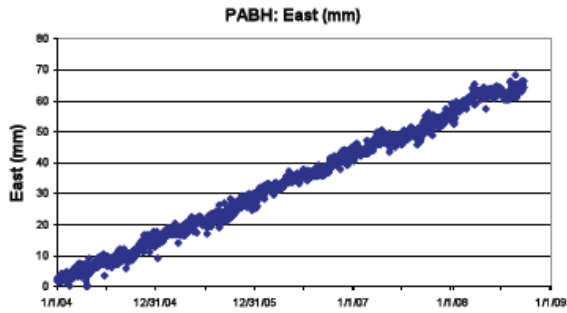


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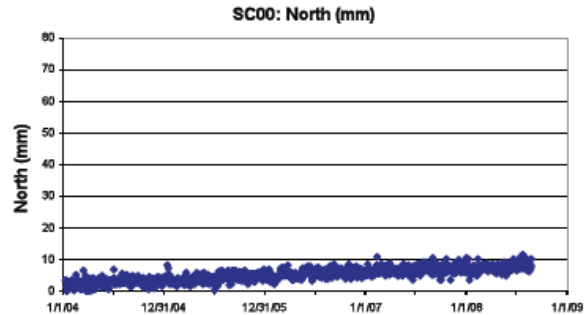
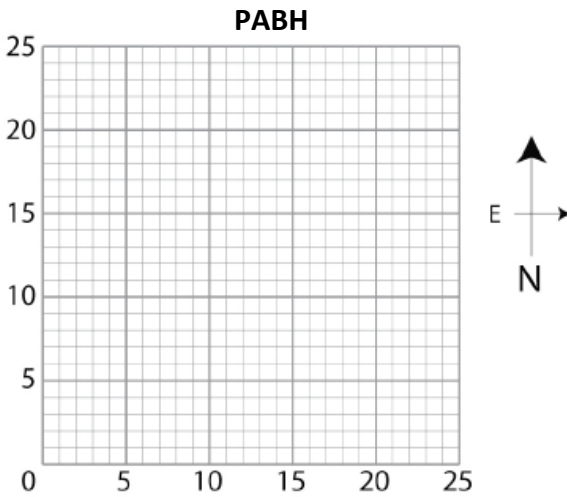
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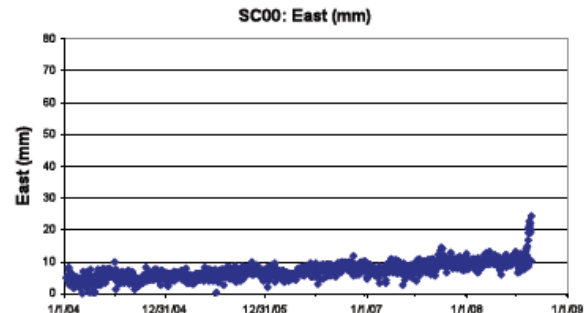
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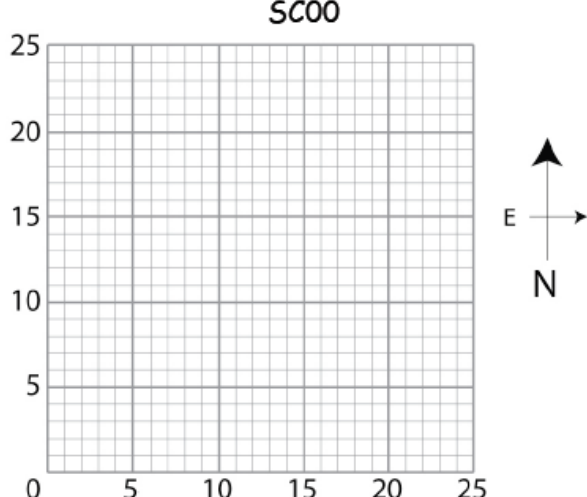
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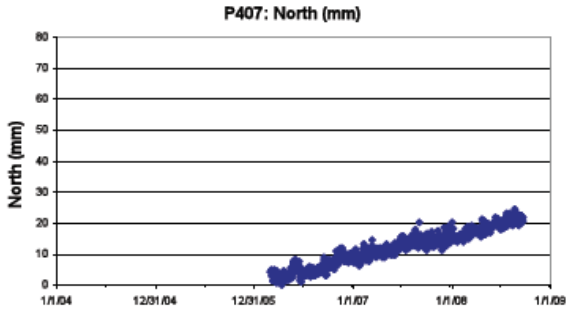


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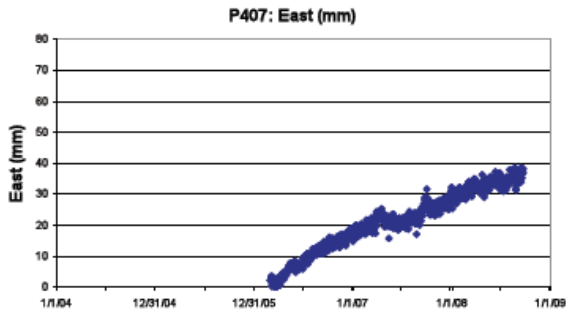


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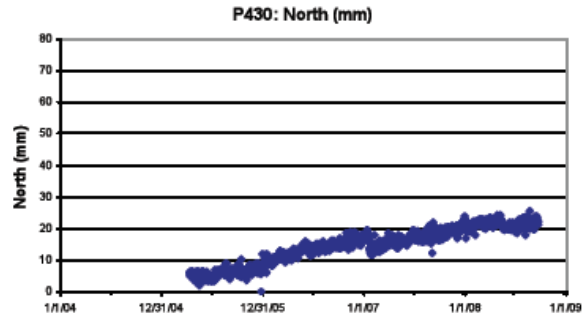
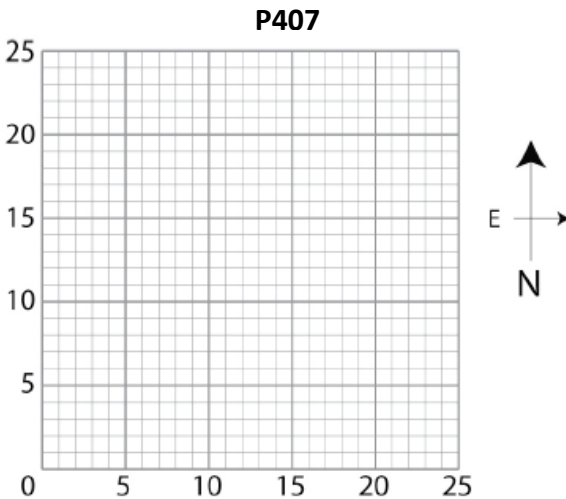
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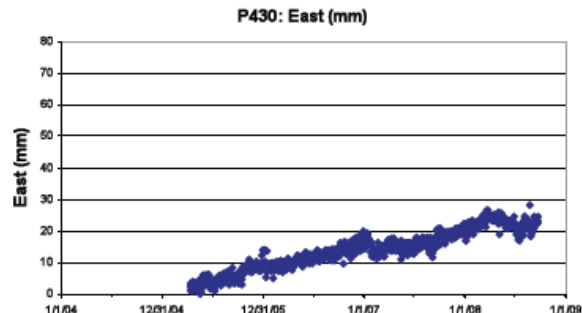
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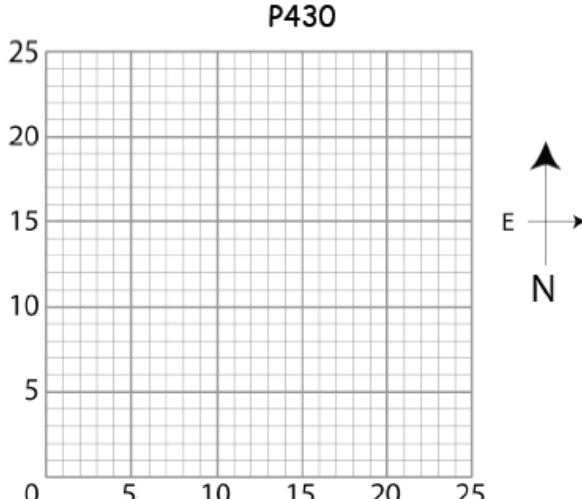
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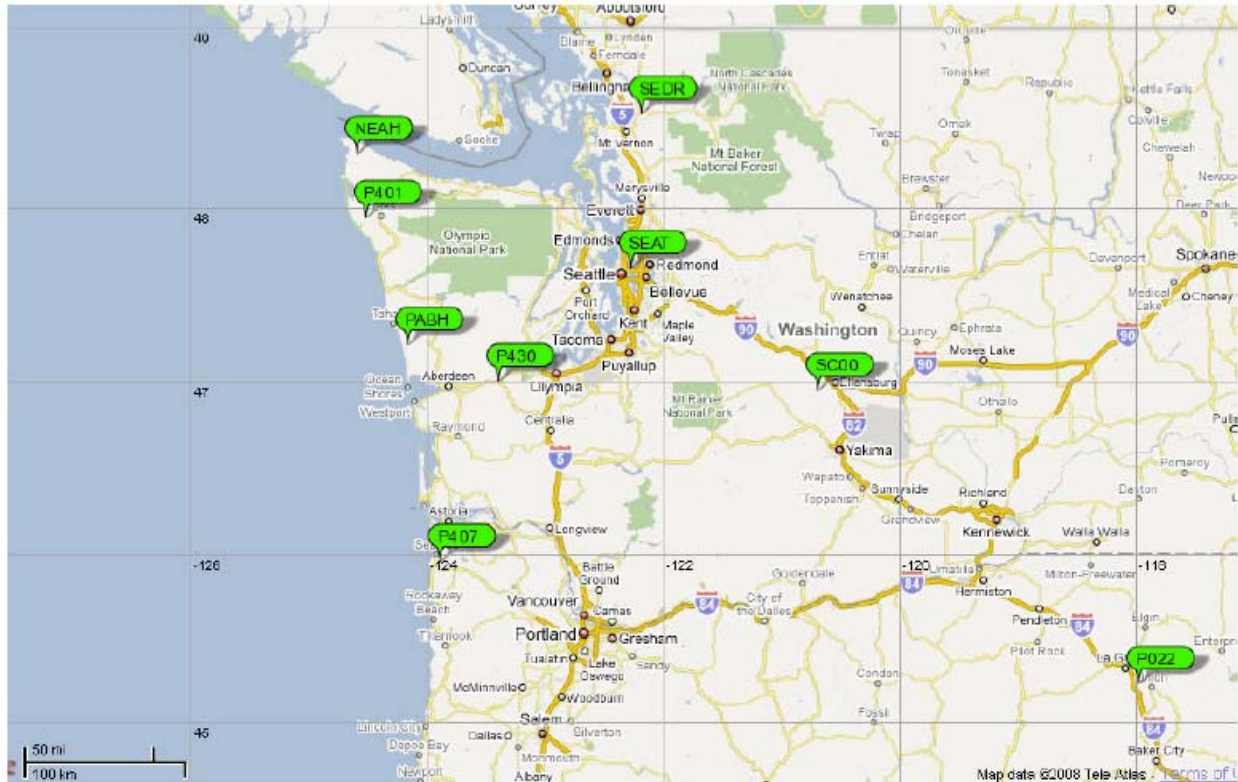


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Part II: Drawing your vectors on the map of Cascadia

Place the tail of the vector on the 'point' of the corresponding bubble and trace the arrow from your worksheet. Place the GPS station graph behind the map, then copy the vector onto your map.



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Part III: Questions

What do you notice about the velocities of the GPS stations and their geographic locations?

How do the velocities at each station change from west to east?

Which stations are moving fastest?

In 500 years, how far will the stations along the coast have moved?

What possible outcomes can you imagine if different portions of the plate continue moving at different rates over millions of years?