STRUCTURAL GEOLOGY

Final Exam Questions

23rd May 2015

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1. Provide text and diagrams to the following questions:
   a) What are stylolytes and how are they formed? 8
   b) Describe with the help of a diagram the difference between homogeneous and heterogeneous strain. 8
   c) What is boudinage and chocolate-type boudinage and how are they formed? Explain with the help of diagrams. 8
   d) What is a cataclasite, and what is mylonite? 8

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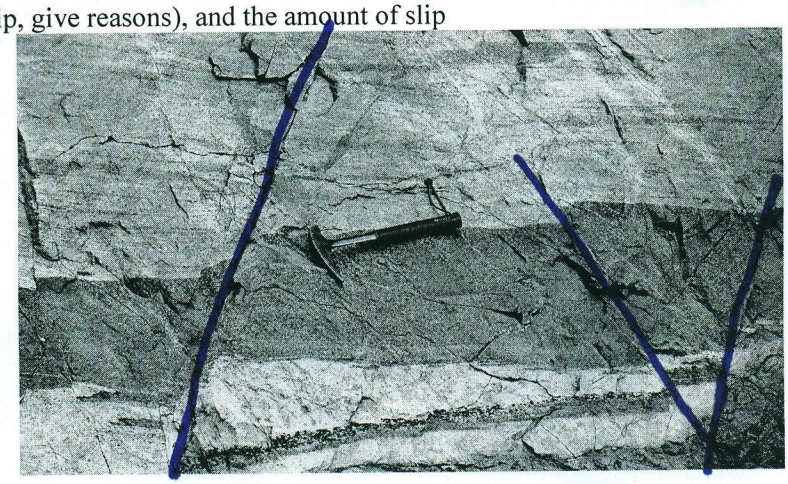
2) On the photograph below trace the faults, indicate the hangingwall and footwall, determine the nature of the faulting (normal, reverse or strike-slip, give reasons), and the amount of slip



3 × 1 = 3
3 × 3 = 9
3 × 2 = 6
6

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3) The orientations of two conjugate faults are: 90/65N and 85/60S
   a) Plot the faults on a stereographic projection as great circles (β-diagram). 4 × 2 = 8
   b) Show the principal stress directions σ1, σ2 and σ3 on the projection. 6
   c) Find out the trend and plunge of σ1, σ2 and σ3. 3 × 3 = 9
   d) Find out the angle between the conjugate faults. 4

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4. Aegean region extends in north-south direction with a rate of 1.5 cm per year. Assuming that the extension occurs over a distance of 500 km, calculate the north-south strain rate in the Aegean.

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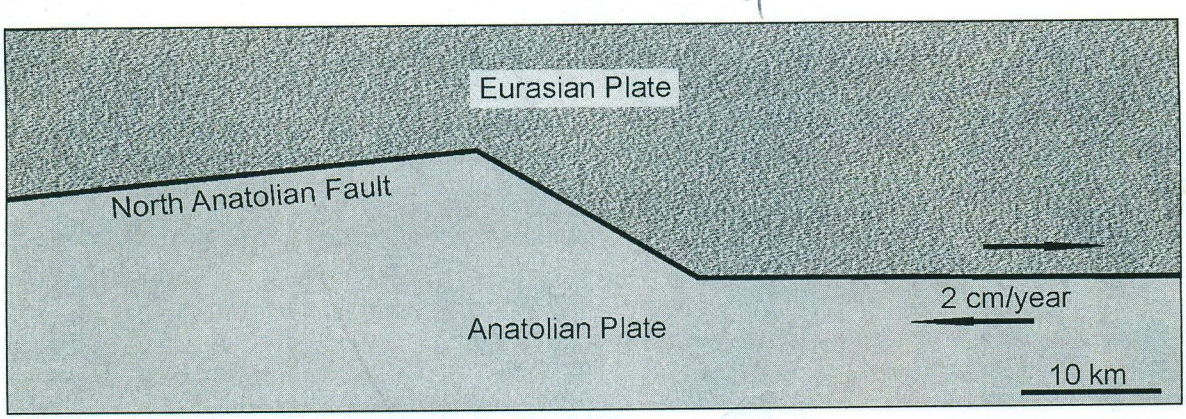
5. The diagram below shows an idealized sketch of the North Anatolian Fault in the Marmara Sea region.
   a) Redraw the diagram on your answer sheet taking care to draw the displacement vector and the orientation of the fault segments correctly.
   b) Taking the annual displacement value (2cm/year), and the scale of the sketch, draw another diagram with the same scale to show how the region will look after five million years. 8
   c) Draw on the second diagram the regions where you would expect transtension and/or transpression. 8
   d) Do any of the regions of transtension and/or transpression correspond to features you know from the Marmara Sea. 4
   e) Assuming that displacement during an earthquake in the Marmara region is 3 m on average, how many earthquakes will occur in the region in five million years? 4



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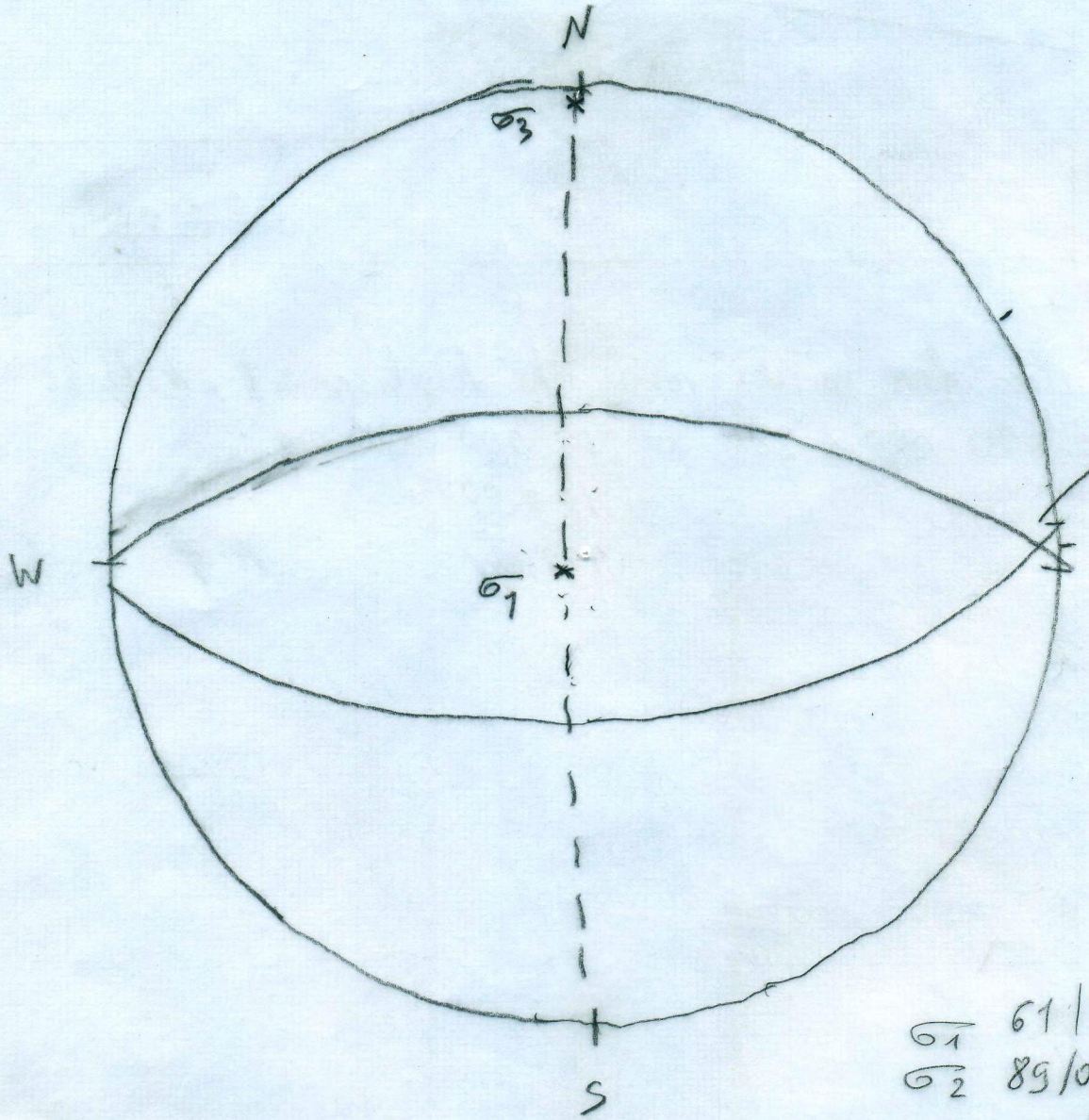
4. Bonus questions
   a) What are the minerals in a granite? 2
   b) How deep is Bosphorus and the Marmara Sea? 2
   c) When did the dinasours died out? 1
   d)What are the compositions of olivine and dolomite? 2

3/

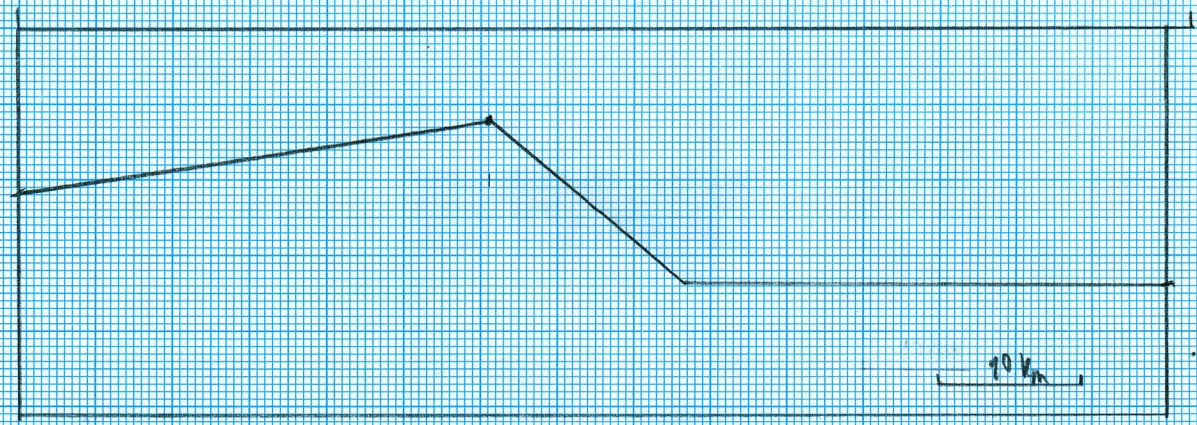


σ_1 61/86 SW
σ_2 89/04
σ_3 179/02 N
angle · 55°

4/ $\dot{e} = \frac{e}{t}$ $\quad e = \frac{1.5\ cm}{500 \times 10^5\ cm} = 0.3 \times 10^{-7}$

$\dot{e} = \frac{0.3 \times 10^{-7}}{365 \times 24 \times 60 \times 60} = \frac{0.3 \times 10^{-7}}{3.15 \times 10^7} = 0.1 \times 10^{-17}\ s^{-1}$

4/



b) after five million years, the displacement will be

$5\,000\,000 \times 2\,cm = 10\,000\,000\,cm$

$= 100\,000\,m$

$= 100\,km$