STRUCTURAL GEOLOGY

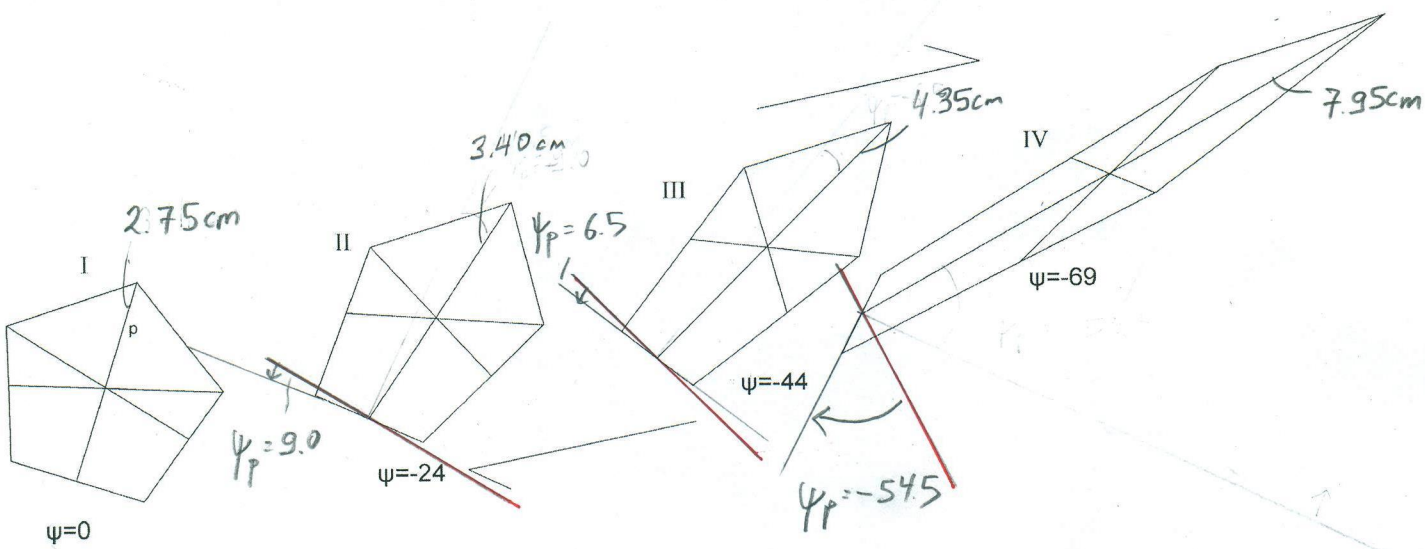
Mid-Term Exam Questions

12th April 2016

1. Use stereographic projections to answer the following questions.
   a) The measurements of strike and dip around a fold are: 48/12NW, 125/74SW, 54/15NW,1 21/72SW and 52/16SW. Find out the trend and plunge of the fold axis.
   b) Horizontal bedding has been cut by cleavage at 13/74SW. Find the trend and plunge of the intersection lineation.
   b) Pass a plane through the lines 18/62NW and 112/12SE. Find out the strike and dip of this plane.

2. Provide text and diagrams to the following questions:
   a) Draw a 3D diagram of a fold showing anticline/antiform, syncline/synform, fold/hinge axis, fold limbs, fold axial plane.
   b) Explain pure shear and simple shear with the help of diagrams
   c) What are the factors that control the ductile versus brittle behaviour of the rocks, and how do they affect ductile versus brittel behaviour?
   d) What is the relation between cleavage plane, mineral streching lineation and the axes of the finite strain ellipsoid. Explain your answer with the help of a diagram.
   e) What are crenulation cleavage and axial planar cleavage.

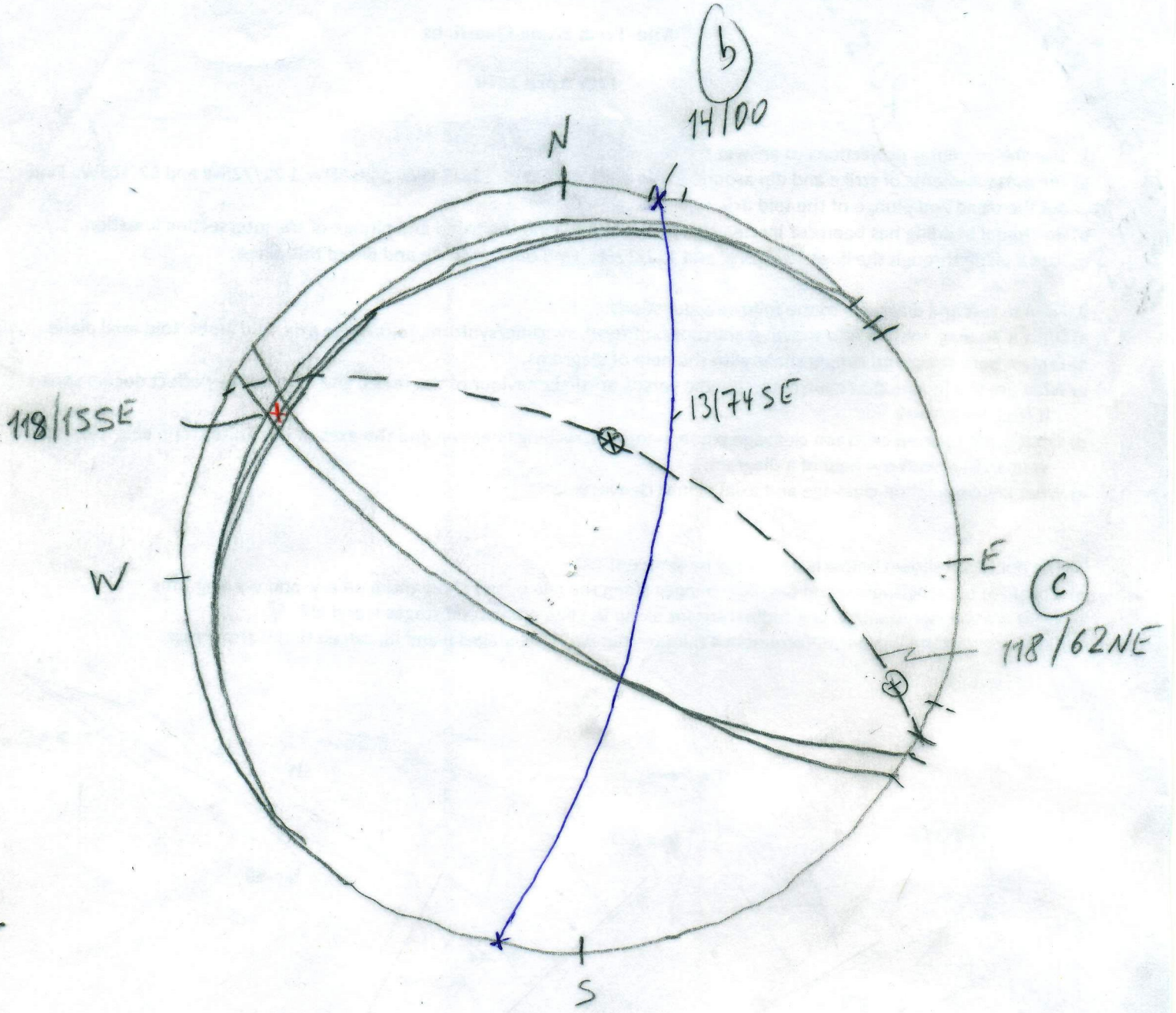
3) The pentagon shown below is deformed by simple shear.
   a) Calculate the longitudinal and angular changes along the line p, and show them on e-γ and γ-γ diagrams.
   b) What are the **incremental** longitudinal strains along the line p between stages II and III?
   c) Assuming that the line p is deformed in 4 minutes between the stages II and III, calculate the strain rate.



4. The following maximum, indermediate and minimum axis have been measured in three ooids in a deformed limestone:

max	interm	min
1.6 mm	0.4 mm	0.3 mm
3.0 mm	0.7 mm	0.5 mm
2.5 mm	0.5 mm	0.4 mm

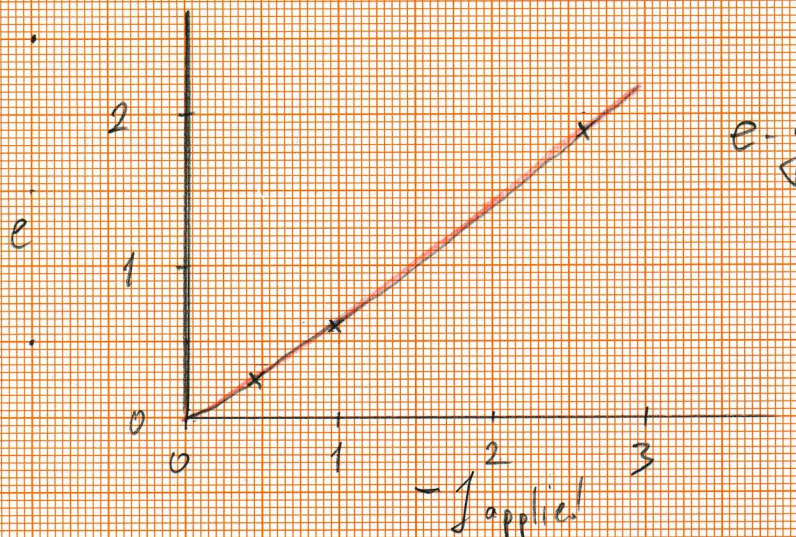
   a) Determine the principal axial ratios and show them on a Flinn diagram.
   b) What are the k-values of the deformed oolites?
   c) Would you expect the development of lineation or foliation in this limestone? Give reasons for your choice.


b
14/00
N
118/15SE
13/74SE
W
E
C
118/62NE
S

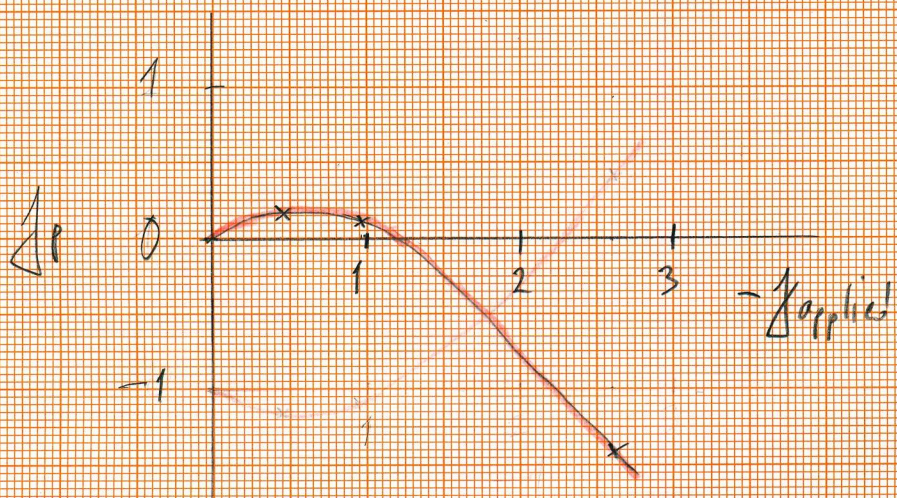
Answer to question 3

Okay

	I	II	III	IV
ψ	0	-24	-44	-69
$\int$	0	-045	-097	-261
ψ_p	0	9	65	-545
$\int_p$	0	016	0.11	-140
P	275cm	3.4	435	795 cm
e	0	024	058	189



e-$\int$ diagram



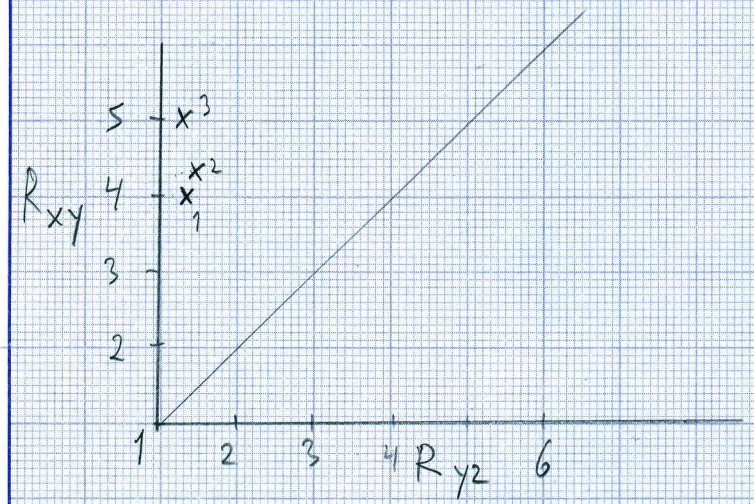
b) incremental strain for p between II and III $e_i = \frac{435-34}{3.4} = 0.28$

c) $\dot{e} = \frac{e}{t} = \frac{0.28}{4\times60} = 1.17\times10^{-3}\ sec^{-1}$

Answer to question 4

a)

	1	2	3
R_{xy}	4.0	4.3	5.0
R_{y2}	1.3	1.4	1.3
R_{x2}	5.3	6.0	6.3



b) $K = \frac{R_{xy}-1}{R_{y2}-1}$ =

for 1 $K_1 = \frac{3.0}{0.3} = 9.05$

$K_2 = \frac{3.3}{0.4} = 8.2$

$K_3 = \frac{4.0}{0.3} = 13.3$

c) I would expect the development of lineation since intermediate and short axis of the strain ellipsoid are similar in length and much shorter than the long axis, which suggests streching rather than flattening.

γ

- scale ?

b) $\frac{\text{II}, \text{III}}{\frac{3,4 - 3,3}{3,4}} = 0,0294$ 2

c) for II, III strain rate.

$\dot{\varepsilon} = \frac{e}{t} = \frac{0,0294}{4 \times 60} = 1,225.10^{-4}$ 6

7

0,17

0,12

0,44

0,96

2,60

γ_{opp} (-)

7,42