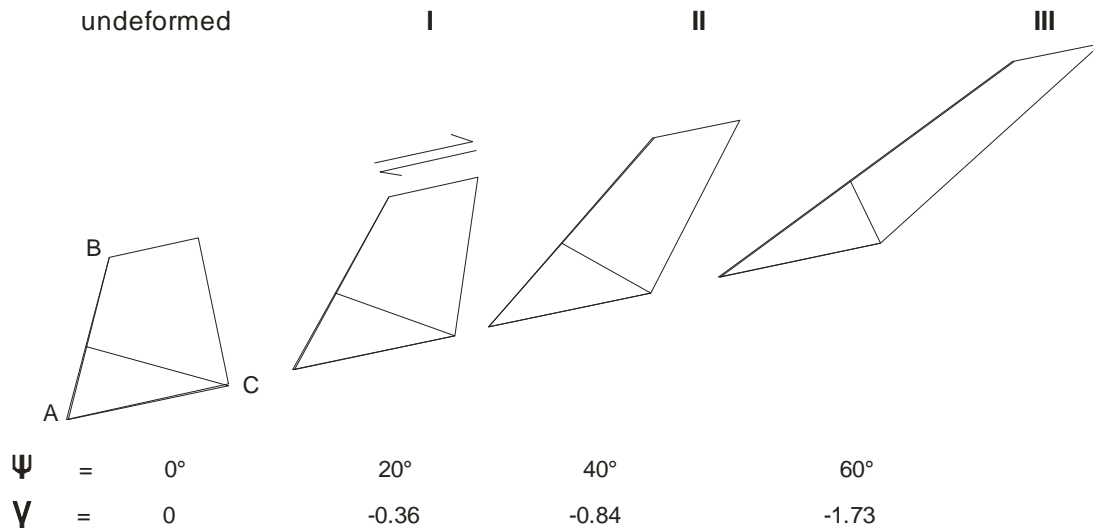


STRUCTURAL GEOLOGY

Final Exam Questions

22nd May 2006

1. The figure below has been deformed by simple shear.
- Calculate the longitudinal and angular changes along the line AB, and show it on the e - γ and γ - γ diagrams.
 - What are the **incremental** longitudinal strains along the line between stages II and III?



2. a) Find the orientation of the principal stresses σ_1 , σ_2 , σ_3 (trend and plunge) from two conjugate faults with orientations 124/65NE and 132/71SE.
- Find the angle between the fault planes.
 - What is the type of faulting. Give reasons for your answer.
3. The following maximum, intermediate and minimum axis of ooids have been measured in a deformed limestone:

max	interm	min
0.32 mm	0.28 mm	0.21 mm
0.78 mm	0.72 mm	0.41 mm
2.51 mm	2.32 mm	0.49 mm

- Determine the principal axial ratios and show them on a Flinn diagram.
 - Assuming that there has been no volume change during deformation calculate e_1 , e_2 and e_3 values.
 - Would you expect the development of lineation or foliation in this limestone? Give reasons for your choice.
4. Explain the following terms with the help of diagrams:
Pressure solution, parallel fold, kink band, incremental longitudinal strain, positive flower structure.

Bonus questions:

- What are the two most common common elements in the crust?
 - What are the differences between a mineral, crystal and rock?
 - What is the commonest mineral in the continental upper crust?
- What are the two commonest minerals in oceanic crust

Structural Geology

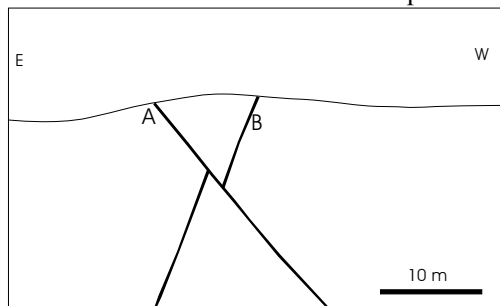
Final Exam questions

23.5.2005

1/ Explain the following terms with the help of diagrams

Kink bands, pure shear, half-graben, klippe, cataclasite, similar fold, imbricate faults, listric fault.

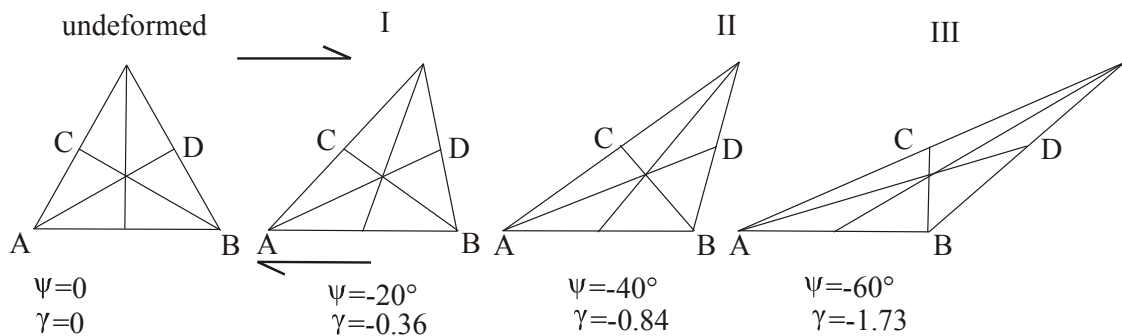
2. a) Explain the Anderson's theory of faulting
 b) The orientation of two conjugate faults are 10/60E and 176/55W. Determine the orientation (trend and plunge) of the principal stresses σ_1 , σ_2 and σ_3 .
 c) What is the type of faulting in (b). Provide an explanation for your answer.
 d) Sketched below are a pair of conjugate faults. Label the footwall and hangingwall blocks with respect to each fault A and B. Are they normal or reverse faults? Provide an explanation for your answer.



3. The equilateral triangle shown below is deformed by simple shear.

a) Calculate the longitudinal and angular changes along the lines AD and BC, and show them on e - γ and γ - γ diagrams.

b) What are the **incremental** longitudinal strains along lines AD and BC between stages II and III?



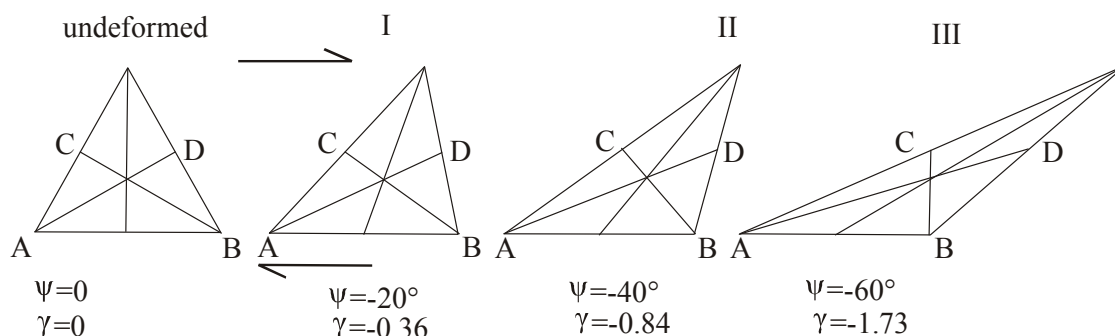
4. Which factors and in what way control ductile and brittle deformation in rocks ?

Bonus questions:

4. What is the difference between the oceanic and continental crust?
5. What is main rock type and mineral in the upper mantle?
6. What is the commonest **mineral** in the continental upper crust?
7. What is the commonest **rock type** in oceanic crust?

STRUCTURAL GEOLOGY
Mid-Term Exam Questions
7th April 2005

1. The equilateral triangle shown below is deformed by simple shear.
- a) Calculate the longitudinal and angular changes along the lines AD and BC, and show them on $e-\gamma$ and $\gamma-\gamma$ diagrams.
- b) What are the **incremental** longitudinal strains along lines AD and BC between stages II and III?



2. The following maximum, intermediate and minimum axis of ooids have been measured 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

- d) Determine the principal axial ratios and show them on a Flinn diagram.
- e) What are the k-values of the deformed oolites?
- f) Assuming that there has been no volume change during the deformation, calculate the e_1 , e_2 and e_3 values.
3. What is strain rate, how is it described? A cylindrical core of a limestone with a length of 3 cm is shortened by a constant strain rate of -10^{-5} s^{-1} . How much will its length be reduced in 5 minutes.
- 4 a) The dominant bedding in a region is 12/35NW. The bedding is cut by a cleavage at 160/67SW. Find the intersection lineation between the bedding and cleavage.
- b) What is the orientation (strike and dip) of a plane that includes the lines 28/67NE and 131/78NW?
5. What are stylolites and how are they formed?

Structural Geology

Final Exam questions

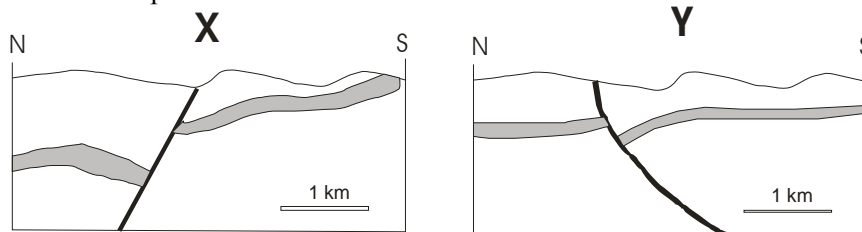
6.5.2004

1/ Explain the following terms with the help of diagrams

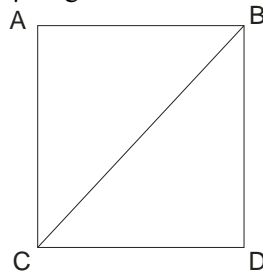
Boudinage, parallel fold, axial planar cleavage, mineral lineation, finite strain ellipsoid, nappe, duplex structure.

2. a. With the help of a block diagram explain the terms of hangingwall and footwall blocks, and fault plane striations (slickensides).

b. Shown below are two cross-sections X and Y with faults. On the diagram indicate the hanging wall and footwall blocks, and determine the nature of the fault. What would you call the curved fault profile in the cross-section Y ?



3/ The square below (side length 3 cm) is deformed by negative simple shear of 30° , 45° and 60° , calculate the changes in the lengths and angles of the side BD and the diagonal CB and show these changes on the e - γ and γ - γ diagrams.



4. a. Explain the relationship between faulting and principal stresses on the earth's surface (Anderson's theory of faulting)

- b. Two conjugate faults have the orientations of 60/60SE and 100/72 NE.
- Plot these faults on the stereographic projection.
 - Show the positions of the principal stresses σ_1 , σ_2 , and σ_3 on the stereogram.
 - Find out the trend and plunge of σ_1 , σ_2 , and σ_3 .
 - Find out the angle between the fault planes.
 - What type of faults are these? Give reasons for your choice.

Bonus questions:

- What is the main rock type and mineral in the upper mantle?
- What is the commonest **mineral** in the continental upper crust?
- What is the commonest **rock type** in oceanic crust?
- What are the main minerals in a granite?

Structural Geology
Mid-Term Exam questions
30.3.2004

1. Briefly answer the following questions:

- a) Describe the factors, that affect the mechanical behaviour of rocks.
- b) What are stylolites and pressure solution? How are they formed.
- c) How can the formation of extension (tension) cracks in rocks be explained in the strain theory?
- d) Explain the difference between finite strain and incremental strain.
- e) What is the difference between pure shear and simple shear?
- f) Define the following terms: quartz, rock, calcite, mineral.

2) a) In a deformed region the average foliation is 63/56NW, and the average mineral lineation on the foliation surface has the orientation of 40/34NE. Plot this values on a stereogram.

b) Find out the the plunge and trend of the X, Y and Z directions of the strain ellipsoid for this region using the stereogram in (a).

c) The foliation in (a) is cut by a weak crenulation cleavage with the general orientation of 168/80NE. Find out the intersection lineation using the stereogram.

3) The following maximum, indermediate and minimum axis of ooids have been measured in a deformed limestone:

max	interm	min
0.6 mm	0.5 mm	0.2 mm
0.9 mm	0.8 mm	0.4 mm
3.5 mm	3.3 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) Assuming no volume change during deformation, calculate the e_1 , e_2 and e_3 values.

d) Would you expect the development of lineation or foliation in this limestone? Give reasons for your choice.

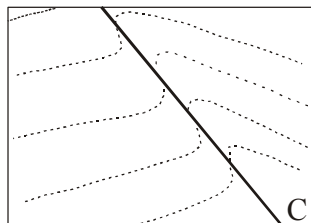
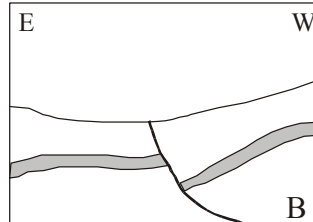
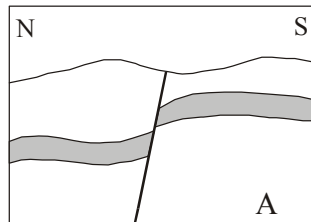
Structural Geology

Final exam questions

14.5.2002

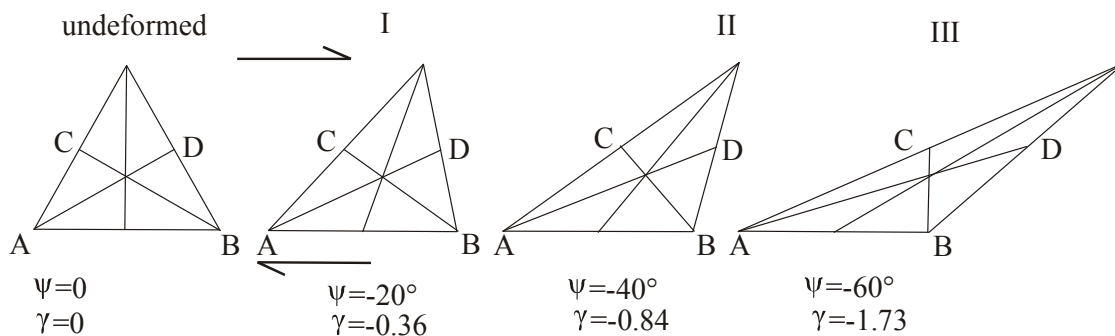
Answer questions 1 and 5, and two questions from 2, 3 and 4

1. Explain the following terms with the help of diagrams:
kink band, intersection lineation, parallel fold, transpression, half graben, duplex structure
2. a) Explain the Anderson's theory of faulting
b) The orientation of two conjugate faults are $110/60\text{SE}$ and $80/55\text{NW}$. Determine the orientation (trend and plunge) of the principal stresses σ_1 , σ_2 and σ_3 .
3. a) The dominant bedding in a region is $12/35\text{NW}$. The bedding is cut by a cleavage at $160/67\text{SW}$. Find the intersection lineation between the bedding and cleavage.
b) What is the relation between the cleavage and the axis of the strain ellipsoid ?
c) What is the orientation (strike and dip) of a plane that includes the lines $28/67\text{NE}$ and $131/78\text{NW}$?
4. a) Explain the origin of tension cracks in the framework of strain theory
b) Explain the difference between finite and incremental strain.
5. Field **cross-sections** of three faults are shown below. On the diagram indicate the hangingwall and footwall blocks and as far as possible determine the nature of the fault (normal, reverse or strike-slip). What can you say about the shape of the fold in B. **Give reasons for your choice.**



Structural Geology
Mid-Term Exam questions
11.4.2002

1. a) Strikes and dips of four bedding surfaces around a fold are: 32/60SE, 123/10NE, 28/55SE, 125/12NE. Find out the trend and plunge of the fold axis using a stereographic projection.
 b) Using a stereographic projection pass a plane from two lines of 08/15NE and 88/75E and determine the strike and dip of the plane.
2. The equilateral triangle shown below is deformed by simple shear.
 - a) Calculate the longitudinal and angular changes along the lines AD and BC, and show them on ϵ - γ and γ - γ diagrams.
 - b) What are the **incremental** longitudinal strains along lines AD and BC between stages II and III?



3. The following maximum, intermediate and minimum axis of ooids have been measured in a deformed limestone:

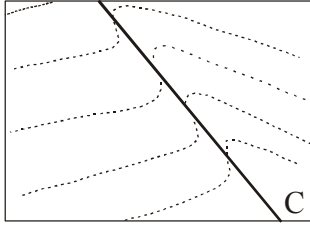
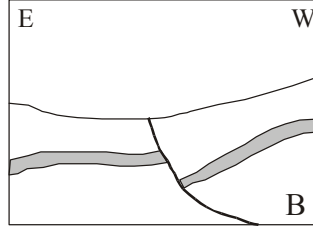
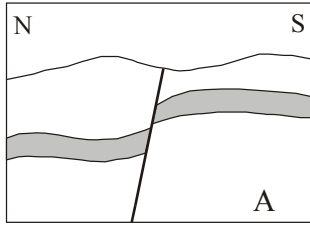
max	interm	min
0.5 mm	0.4 mm	0.2 mm
0.8 mm	0.7 mm	0.4 mm
2.5 mm	2.3 mm	0.4 mm

- g) Determine the principal axial ratios and show them on a Flinn diagram.
 - h) What are the k-values of the deformed oolites?
 - i) What has been the volume change during deformation ?
 - j) Would you expect the development of lineation or foliation in this limestone? Give reasons for your choice.
4. Briefly answer the following questions:
 - a) What is the geometric relationship between the foliation planes and the strain ellipsoid)
 - b) What is the difference between pure shear and simple shear?
 - c) Describe with the help of a diagram the difference between homogeneous and heterogeneous strain.
 - d) What are the types of lineation that do you know?

Yapısal Jeoloji
Final imtihanı
14 Haziran 2001

Aşağıdaki dört sorudan üçünü cevaplayınız.

1. Fay çeşitlerini anlatınız. Aşağıda çizili faylar normal mı yoksa ters fay mıdır. Gerekçeleri ile belirtiniz.



2. Paralel ve benzer kıvrımların özelliklerini belirtiniz.

3. Bir kıvrımın kanatlarından aşağıdaki ölçüler alınmıştır. Kıvrım ekseninin konumunu bulunuz: 87/60K, 90/55K, 145/26KD, 140/60KD

4. Açılma çatlaklarının evrimini yamulma teorisi ışığında anlatınız.

Structural Geology

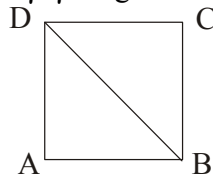
Final Exam questions

14.6.2001

1/ Explain the following terms with the help of diagrams:

crenulation cleavage, duplex structure, imbricate faults, shear zone, mylonite, pure shear.

2/ The square below (side length 3 cm) is deformed by negative simple shear of 30° , 45° and 60° , calculate the changes in the lengths and angles of the diagonal BD and show these changes on the ϵ - γ and γ - γ diagrams.

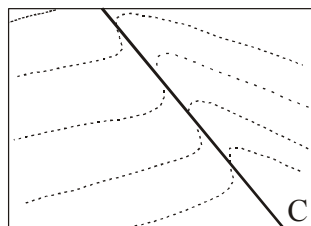
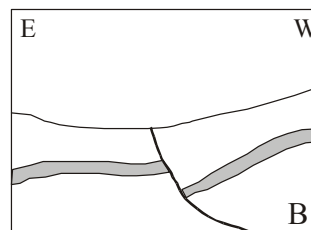


3/ a) The following measurements have been obtained from the limbs of a chevron fold: 145/67SW, 32/25NW, 138/73SW, 141/70SW, 28/22NW. Find out the trend and plunge of the fold axis. What is the angle between the fold limbs?

b) The attitude of the dominant foliation in a region is 47/56SE; this foliation is cut by a second foliation of 135/85NE. What is the trend and plunge of the intersection lineation?

4/ Describe the structures that arise when a dextral strike-slip fault bends along its strike.

5/ Various field cross-sections of faults are shown below. On the diagram indicate the hangingwall and footwall blocks and as far as possible determine the nature of the fault (normal, reverse or strike-slip). What can you say about the shape of the fold in B. **Give reasons for your choice.**



Structural Geology

Mid-Term Exam questions 26.4.2001

2. a) Strikes and dips of three bedding surfaces around a fold are: 102/60SW, 170/10W, 86/50N. Find out the trend and plunge of the fold axis using a stereographic projection.
- b) Using a stereographic projection locate two lines of your choice on a plane of 145/34SW, and determine the trend and plunge of these two lines.
- c) Using a stereographic projection pass a plane from two lines of 48/56NE and 177/65S and determine the strike and dip of the plane.

2. The following maximum, intermediate and minimum axis of ooids have been measured 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

- k) Determine the principal axial ratios and show them on a Flinn diagram.
- l) What are the k-values of the deformed oolites?
- m) What has been the volume change during deformation ?
- n) Would you expect the development of lineation or foliation in this limestone? Give reasons for your choice.
3. Briefly answer the following questions:
- a) What are stylolites and how are they formed?
- b) Describe the relationship between the axis of the strain ellipsoids with cleavage and lineation ?
- c) Describe with the help of a diagram the difference between homogeneous and heterogeneous strain.
- d) What is the difference between pure shear and simple shear?

Structural Geology
Final Exam questions
7.5.2000

3. Explain the following terms with the help of diagrams: Homogeneous deformation, pure shear, shear strain, cylindrical fold, listric fault, half graben.
4. Which factors and in what way control ductile and brittle deformation in rocks ?
5. In a dextral strike-slip fault zone shown below, the individual faults form a bend at A and jump northwards at B. What type of structures would you expect at A and B and why ? Make sketch cross-sections across A and B.
6.
 - a) The dominant bedding in a region is 76/35NW. The bedding is cut by a cleavage at 145/67SW. Find the intersection lineation between the bedding and cleavage.
 - b) What is the relation between the cleavage and the axis of the strain ellipsoid ?
 - c) The limbs of a chevron fold are oriented at 12/45SE and 36/60NW. Find the trend and plunge of the fold axis.
 - d) What is the orientation (strike and dip) of a plane that includes the lines 28/67NE and 131/78NW ?

Exam questions
16.6.1999

1. Explain the evolution of the extension fractures (extension fissures, açılma çatlakları) in shear zones in the light of the strain theory.
2. The following principal longitudinal extensions have been determined in three different areas. In which fields do these ellipsoids fall in the classification of strain ellipsoids (both Flinn classification and the classification using absolute values) ? Draw a Flinn diagram and show the location of these strain ellipsoids. What has been volume change during the deformation ?

$1 + e^1$	$1 + e^2$	$1 + e^3$
1.6	1.0	0.6
3.0	0.65	0.51
2.5	2.0	0.20

3. Explain the following terms with the help of diagrams:

Pressure solution, duplex structure, incremental longitudinal strain, box fold, positive flower structure.