Structural Geology and Tectonics GEO3-1307 – "tussentoets"

Date: Wednesday March 12th 2014
Time: 15.15-16.45 hr.

Please read the complete exam before starting. Ask any language-related question. Always explain how you got to the answer. Make a good estimate of the time required for question 1 w.r.t. that of question 2.

Be creative and good luck!

Question 1: Quantification of strain

A young and promising geologist from Utrecht University has investigated folded limestones in the Dolomites, Italy (Fig. 1). The folds have horizontal fold axis. The limestones show many deformed fossils. The deformation of these fossils can be quantified using the Breddin graph method. Strikingly, the fossils look undeformed in North-South sections through the rock. The layers visible in the outcrop are full of tension gashes. They indicate a 10% volume change during folding.

a) Explain why this promising geologist chose to apply the Breddin method rather than the R_f-ϕ' method or the centre-to-centre (Fry) method.

b) Determine strain ratio of the deformed fossils for both limbs of the fold. Also determine the orientation of the long and short axes of the strain ellipse and put these on Fig. 1a. Make sure that you HAND-IN the figure after having finished the exam.

c) What can you learn from the analysis of the outcrop with respect to the fold mechanism? Explain your answer.

d) Add a drawing to Fig. 1 showing the expected shape and orientation of the tension gashes.

e) Quantify the strain of the limestone in 3 dimensions by giving values for the three principal strains.

f) The tensor that is believed to describe the deformation of the western limb of the folded limestone is given below. The base of the limestone is used as reference line (so *not* the horizontal!). Analyze the tensor in order to check if your results of b) are consistent with the predictions of the tensor.

$$F_{ij} = \begin{pmatrix} 1 & -1.1 \\ 0.1 & 1 \end{pmatrix}$$