

Lab 2 : Strain

Fall 2005

1 Particle trajectories

Figure 1 shows the deformation of a regular grid undergoing specific, "canonical" strains. For each grid pair, draw the displacement vector field. Then, name the strain, and classify it as homogenous or heterogenous, rigid or distortional, rotational or non-rotational. Finally, write down either the coordinate transformation equations or matrix relevant to the strain.

2 Mohr circles for strain

Figure 2 shows a sketch of deformed belemnites. Measure the strained length and the original length to determine the elongation (and quadratic elongation) for both these fossils. Use the angle between the belemnites and the stretching lineation to construct a Mohr circle (using the version of the Mohr circle for the strained reference state). Determine the values of the principal strains. Can you determine the original orientations of the belemnites?

3 Progressive deformation of vein sets

Figure 3 is a photograph of calcite filled veins in highly deformed marbles in the Yulong mountains of southwestern China (south and east of the Tibetan plateau). The photograph was taken parallel to the stretching lineation and perpendicular to the mylonitic foliation. Assume that deformation consisted of plane strain, simple shear. Draw the infinitesimal strain ellipse for these rocks and identify the shortening and extension quadrants. Sketch a plausible representation of the finite strain ellipse. Sketch or trace the photo. On both this sketch and the sketch of the finite strain ellipse, identify quadrants of finite shortening, finite extension, the shear plane and show the sense of shear.

Write a short paragraph interpreting this outcrop picture in terms of the sense of shear of these rocks. Which vein came first? What happened to it? What happened next? How does this interpretation lead you to conclude the sense of shear?

Finally, draw a simple sketch what might have happened if the rocks kept shearing, the veins rotated and a new vein opened up.

4 Naragansett stretched conglomerates

Compile the measurements of ellipsoid semi-axes taken by the entire class on Monday's field trip. Convert the measurements to ratios normalized such that the intermediate strain axis = 1. Find the average $\lambda_1 : \lambda_2$ and $\lambda_2 : \lambda_3$ ratios. Was the strain ellipse prolate (cigar shaped) or oblate (pancake shaped)?

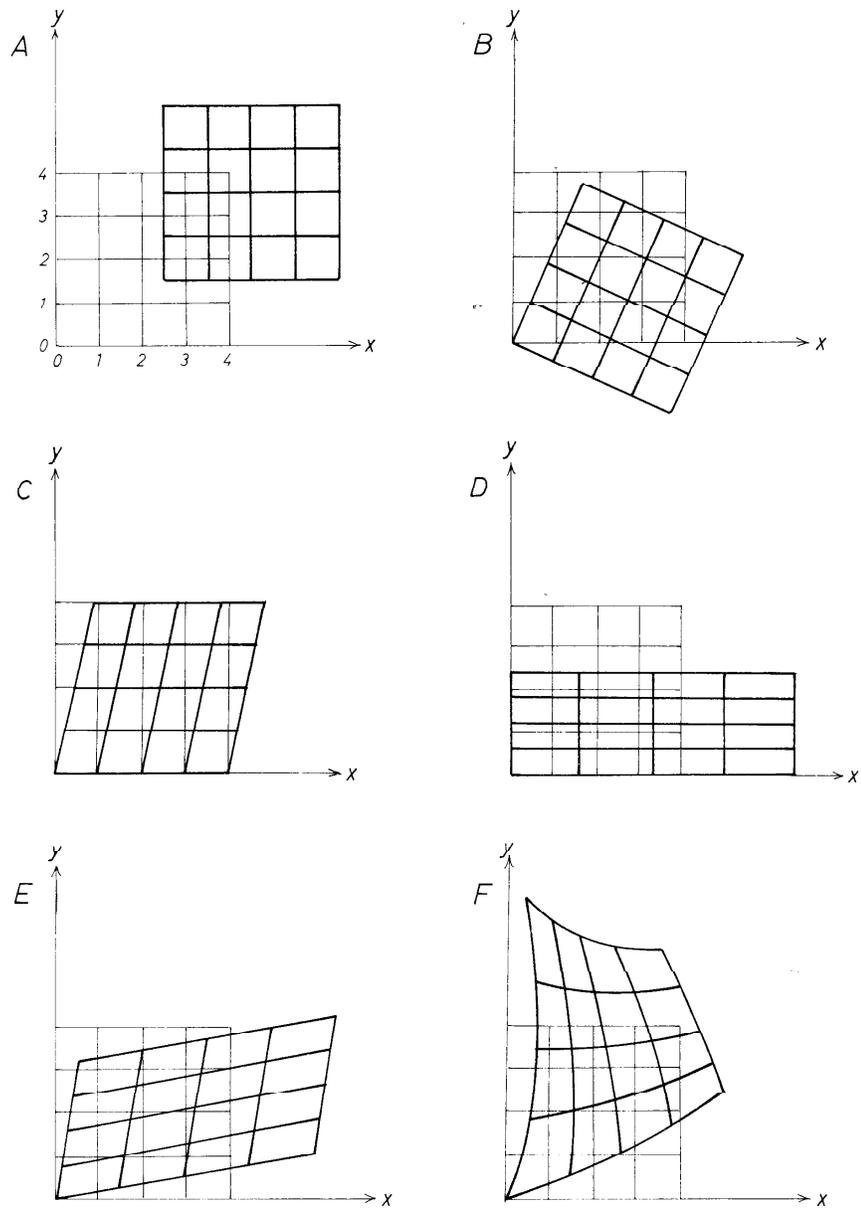


Figure 1:

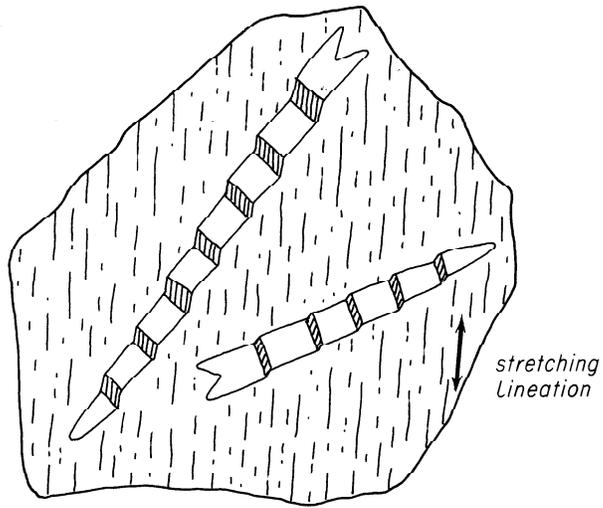


Figure 2:



Figure 3: