

National University of Ireland, Galway
OLLSCOIL NA hÉIREANN, GAILLIMH

SUMMER EXAMINATIONS 1999

3rd SCIENCE
GEOLOGY [GE 311/GE313]

PAPER TWO

Prof. B.P.J. Williams
Prof. P.D. Ryan
Dr. M. Feely

Time allowed: Three hours

Answer four questions: two from Section A two from Section B.

Please use separate Answer Books for each Section.

Illustrate your answers with neat sketches and diagrams where appropriate.

SECTION A

1. Use the Barrovian sequences from the Scottish Dalradian to illustrate how the mineralogy of pelites can vary with increasing temperature and pressure.
2. Write an illustrated essay on the facies classification of metamorphic rocks.
3. Show how textural studies can assist in charting the history of porphyroblastic growth in metamorphic rocks.
4. Describe the mineralogical changes that you would expect to encounter in a granite aureole originally composed of (a) slates and (b) siliceous dolomitic limestones.

SECTION B

5. Define "normal" and "shear" stress. Show how a Mohr diagram can be used to explain why faults develop at $\sim 30^\circ$ to the maximum compressive stress, not 45° . How can Mohr diagrams help us understand why high fluid stress promotes faulting?
- 6.a What is a strain ellipsoid? Show how a Flynn Plot (X/Y Vs Y/Z) can be used to graphically represent different types of strain ellipsoid. Indicate on the plot the regions where flattening, plane and constrictional strains occur, and discuss the tectonic environment in which these different types of strains are expected.

or
- 6.b Discuss the deformation mechanisms that allow rocks to acquire both non-permanent and permanent strains. How are these dependent upon the physical and chemical conditions during deformation?
7. How may the concepts of "facing", "fold vergence" and "cleavage vergence" be used to identify the stratigraphy and structure of an area affected by two phases of folding, but where "way up" structures are locally preserved?
8. What structures are associated with major strike-slip faults? Show, using diagrams, how such a fault zone could act as a focus for sedimentation or granite emplacement.