

National University of Ireland, Galway
OLLSCOIL NA hÉIREANN, GAILLIMH
CHRISTMAS EXAMINATIONS 1ST SEMESTER 2002

4TH SCIENCE
IGNEOUS PETROLOGY(GE411) & METAMORPHIC GEOLOGY(GE412)

PAPER ONE

Prof. B.P.J. Williams
Dr. S. Baxter
Dr. M. Feely

Time allowed: **Three** hours

Answer: **Four** questions: **Two** from Section A, and **Two** from Section B.
(Pocket calculators allowed). Allow about 45 minutes for each question.

Please use separate answer books for each section.

Use diagrams and examples to illustrate your answers to the following questions.

SECTION A (GE411)

1. Discuss the uses of radiogenic isotopes in the study of igneous petrogenesis.
2. How does geochemistry allow us to identify the source region(s) of subduction-related magmas?
3. How and why does the mineralogy and chemistry of a granite relate to the tectonic setting in which it formed?
4. Compare and contrast the main features of four of the British Tertiary Igneous Province intrusive centres.

SECTION B (GE412)

5. Outline three methods that are used to determine the pressure and /or temperature conditions of metamorphism. Comment on the relative precision of each method you describe and their application to P-T-t studies of metamorphic terrains.
6. Discuss the hypothesis that CO₂ -rich fluids were a major factor in the origin of granulite facies rocks. Comment on the contribution made to this hypothesis by fluid inclusion studies.
7. Discuss the contribution laboratory-based melting experiments have made to our understanding of how migmatites form. Describe a simple geochemical method that can be used to determine the degree of melting that has taken place in a migmatite belt.
8. Explain how the fluid composition (X_{CO₂}) in marbles can be controlled by internal and external buffering. Show how the shape of univariant reaction curves in T-X_{CO₂} space are dependent on reaction type.