

National University of Ireland, Galway  
OLLSCOIL NA hÉIREANN, GAILLIMH

SUMMER EXAMINATIONS 2001

**3rd SCIENCE  
GEOLOGY [GE 322]**

**PAPER TWO**

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Time allowed: Three hours

Answer four questions:

**One** from Section A, **one** from Section B, **one** from Section C and **one other** from **any** section.

Please use separate Answer Books for each Section.

Illustrate your answers with neat sketches and diagrams where appropriate.

**SECTION A**

Q1. Define retardation. Then show how the quartz wedge may be used to define a) sign of elongation b) the optic sign of a centred acute bisectrix interference figure with a 2V angle of approximately 35 degrees.

Q2. Define extinction. Illustrate the relationships that exist in general, between the crystallographic axes and the principle optical directions in the Orthopyroxenes and Clinopyroxenes. Comment on how inclined extinction can be used in the estimation of the composition of some silicate minerals.

Q3. Show with the aid of labelled diagrams how you would estimate plagioclase feldspar composition using the polarising microscope.

## SECTION B

1. "Any igneous province...may display a range of igneous rock types. This variation may be primary...or secondary." (Hall, Igneous Petrology, 1996). In the above statement, what is meant by (1) primary variation, and (2) secondary variation? (These need only be one sentence answers.) Using diagrams where appropriate, describe in detail two causes of primary variation, and two processes leading to secondary variation.
2. "The mode of intrusion of plutonic igneous rocks is largely determined by the difference in density between the magma and its country rocks". Discuss the above statement using diagrams and examples to illustrate your answer.
3. (a) Figure A shows the olivine solid solution series. A melt of composition m cools from 1900° C to 1200° C. What is the composition of the first-formed crystals? At 1500°C, what is the proportion of crystals to melt? At what temperature does the system finally become completely solid? What is the composition of the last remaining melt?  
  
(b) Define (i) silica saturation; (ii) silica undersaturation; (iii) silica oversaturation. On Figure B, which line divides the silica oversaturation field from the silica undersaturation field? Describe the processes that occur as a melt of composition m is cooled from 1600°C to 1500°C.

## SECTION C

- Q7. Write an illustrated essay on the regional metamorphism of pelites.

Q8. Give an account of how the mineralogy of metamorphosed siliceous dolomitic limestones can vary with increasing temperature and pressure in a Barrovian style regional metamorphic setting.

Q9. Give an account of the benefits or otherwise of the microscopic examination of Si and Se fabrics in metamorphosed pelites.

Figure A

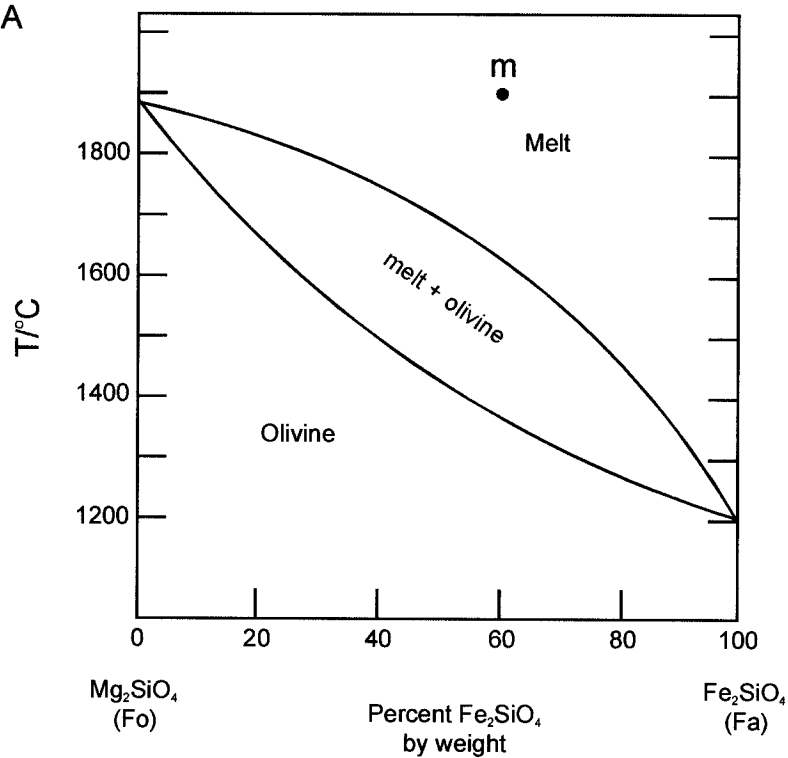
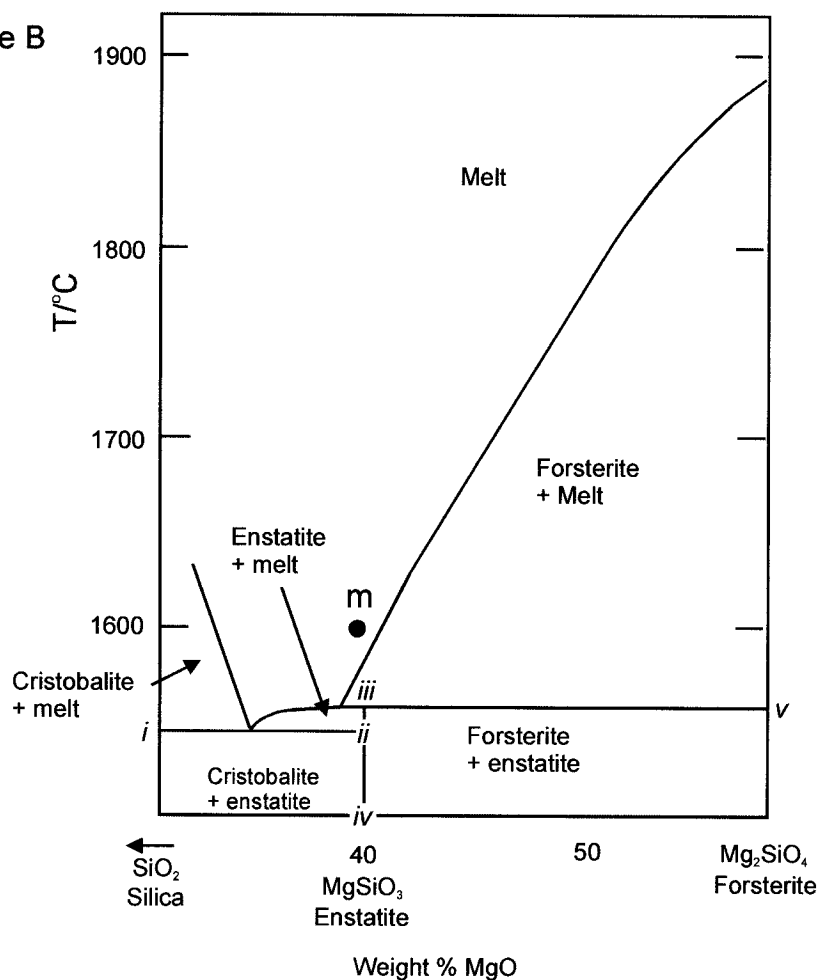


Figure B



(Roman numerals (in italics) are for identifying the lines - see question)