UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education
Advanced Subsidiary Level and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

9121979638

MARINE SCIENCE **9693/02**

Paper 2 AS Data Handling and Free Response **May/June 2009**

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams, graphs or rough work.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

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1	
2	
3	
4	
Total	

This document consists of **8** printed pages, **6** lined pages and **2** blank pages.

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Section A

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1 Zooxanthellae live within the tissues of corals, in a symbiotic relationship. Large temperature changes or pollution can cause the zooxanthellae to die. This results in coral bleaching.

(a) (i) Explain why the death of zooxanthellae results in coral bleaching.

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..... [1]

(ii) Explain why the death of the zooxanthellae may lead to the death of the coral.

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..... [2]

(b) An investigation was carried out into the distribution of different types of zooxanthellae, called **A**, **B**, **C** and **E**, in the coral *Montastraea franksi* on two reefs.

- Rio Carti is a fringing reef near to the mouth of a river that brings sediment into the sea.
- Cayos Limones is 15 km off shore, in clear water.

The samples were taken at various depths from the top and sides of the reefs.

Fig. 1.1 shows the presence of zooxanthellae **C** and **E** in colonies of *M. franksi* on the reef near the river mouth, Rio Carti. Types **A** and **B** did not occur on this reef.

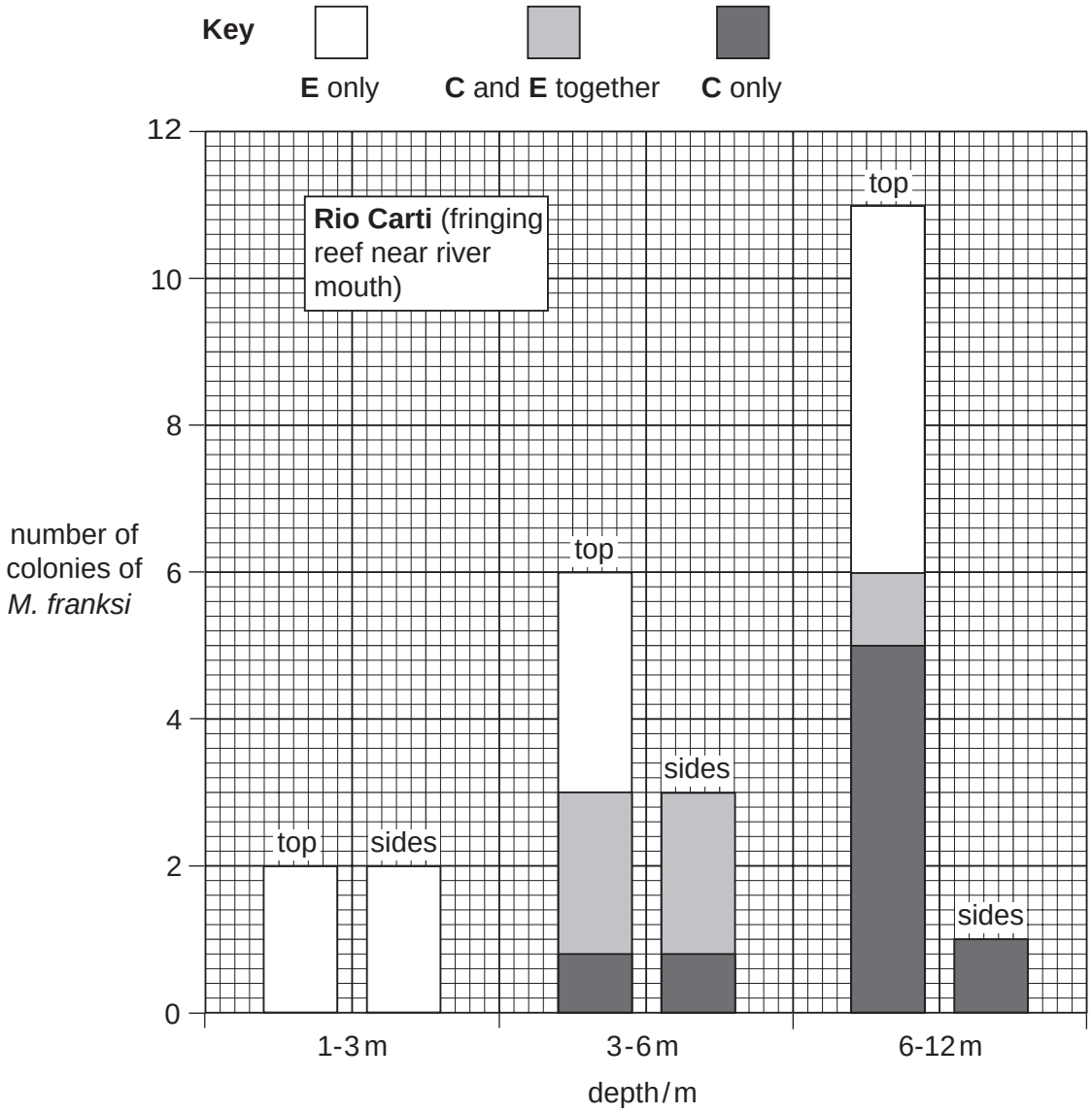

Fig. 1.1

(i) With reference to Fig. 1.1, explain how these results suggest that zooxanthella type **C** does not require as much light as type **E**.

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..... [2]

Fig. 1.2 shows the distribution of the different types of zooxanthallae in colonies of *M. franksi* on the offshore reef, Cayos Limones.

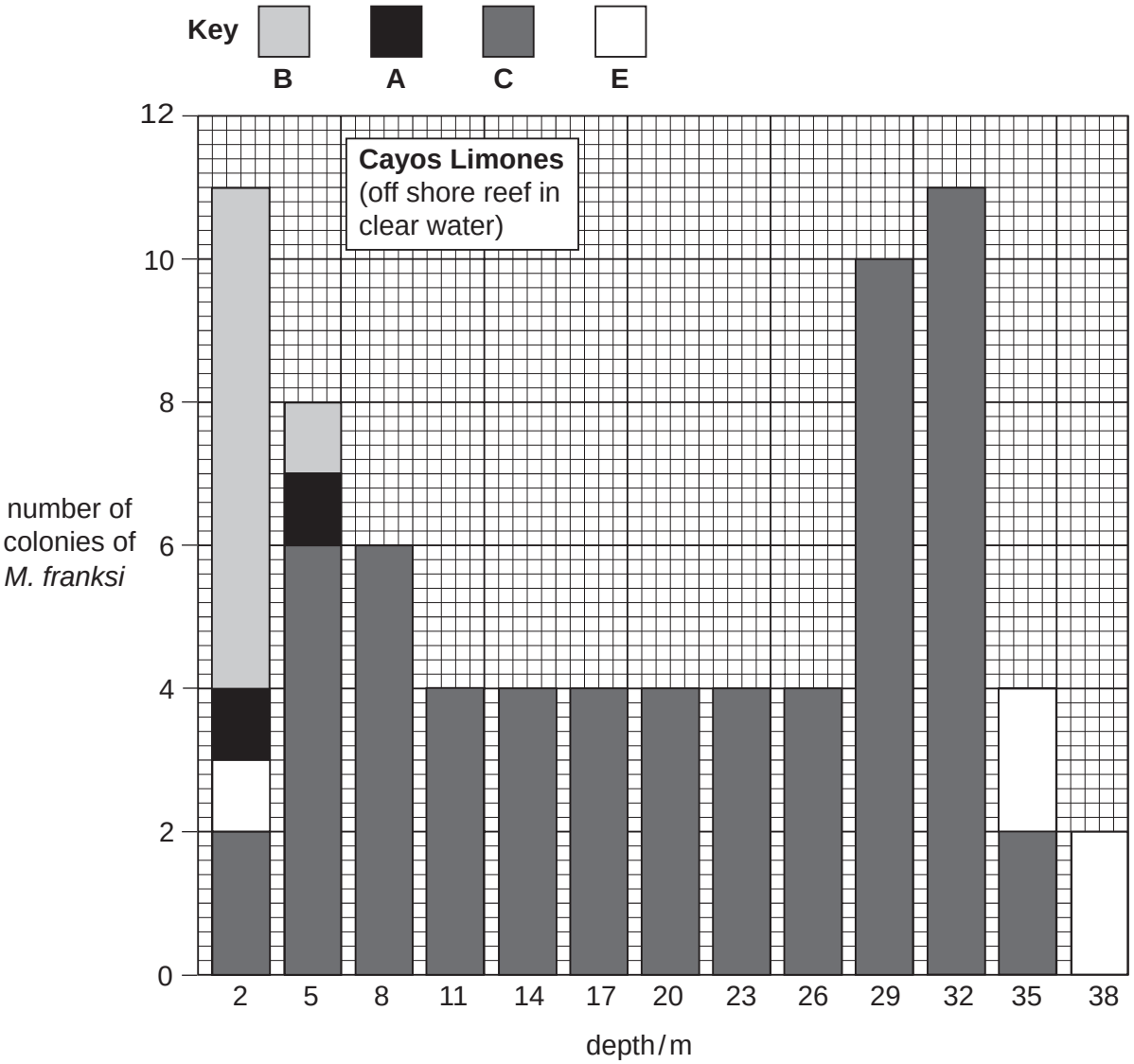

Fig. 1.2

(ii) Compare the numbers of colonies of *M. franksi* containing the different types of zooxanthellae at a depth of 2 m on Cayos Limones and Rio Carti.

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(c) The researchers used their results to put forward this hypothesis:

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Zooxanthella type **E** is better able to survive in water containing sediment than type **A**.

(i) Discuss whether the differences between the results for Rio Carti and Cayos Limones, shown in Fig. 1.1 and Fig. 1.2, support this hypothesis.

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(ii) Outline a **laboratory-based** experiment that the researchers could do to test their hypothesis.

Your answer should include reference to the control of variables, and the collection of quantitative results.

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..... [5]

[Total: 14]

2 As continental plates move apart, new oceans form between them. In all the major ocean basins, there is a ridge and rift system in mid-ocean, where new oceanic crust is formed as liquid magma emerges between the spreading plates, and solidifies. This is called sea floor spreading.

The magma contains magnetic minerals, whose particles orientate themselves in relation to the north and south poles of the Earth's magnetic field. This magnetic field has switched polarity several times in the past.

(a) Fig. 2.1 shows the pattern of differently orientated magnetic minerals in the crust of the ocean floor. Fig. 2.2 shows the polarity of the Earth's magnetic field in the last 3.5 million years.

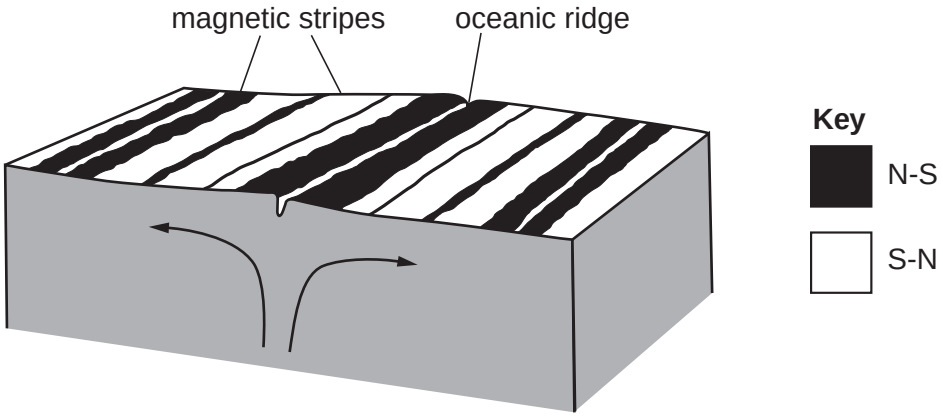

Fig. 2.1

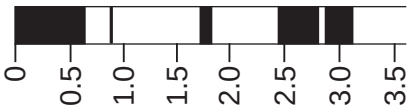

Fig. 2.2

Explain how the information in Fig. 2.1 and Fig. 2.2 provides evidence that sea floor spreading is occurring.

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..... [3]

(b) As the plates on either side of the ocean spread apart, the crust at their edges is stretched and thinned. Fig. 2.3 shows the density and thickness of the crust, sediments and water at the edge of a continent.

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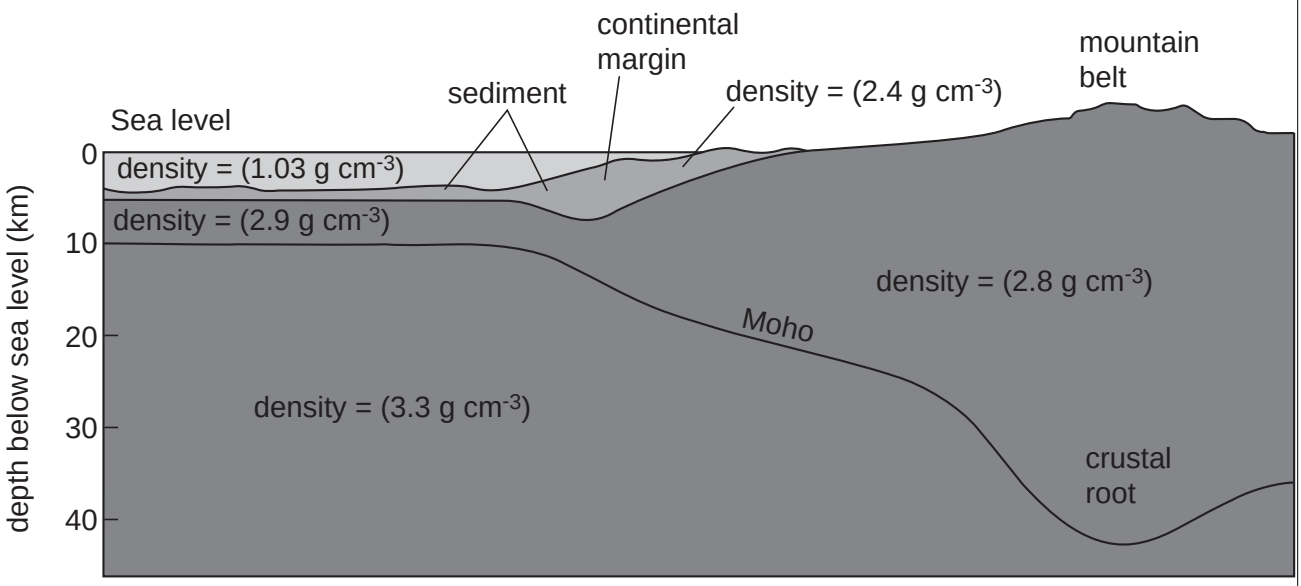

Fig. 2.3

Use the concept of isostasy and the information in Fig. 2.3 to explain why shallow seas may be formed at the edge of a continent.

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..... [3]

[Total: 6]

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PLEASE TURN OVER FOR SECTION B.

Section B

Answer both questions in this section.

3 **(a)** Explain why India experiences a wet summer monsoon. [5]

(b) Describe how a region of low pressure over a tropical ocean can develop into a hurricane or typhoon. [6]

(c) Discuss the impact of hurricanes and typhoons on coastal communities. [4]

[Total: 15]

4 **(a)** Explain how the reservoir of nutrients in the upper layers of the ocean is replenished. [6]

(b) Describe how calcium is cycled in a marine ecosystem. [5]

(c) Discuss the ways in which productivity in the oceans may be limited by availability of nutrients. [4]

[Total: 15]

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