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978-0-521-63555-4 - Exploring Geology on the Isle of Arran: A Set of Field Exercises that Introduce the Practical Skills of Geological Science

C. J. Nicholas

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Exploring geology on the Isle of Arran

The Isle of Arran has an amazingly rich and varied geological history spanning nearly 600 million years, and it has now become a classic location in which to begin exploring geology in the field. This workbook teaches the practical field skills needed by anyone, A-level student, undergraduate, or just keen amateur, who wants to find out more about the rocks that shape our landscape. Step-by-step instructions guide the user through a collection of ten problem-solving exercises based on the most interesting aspects of Arran's geological history. The exercises also introduce concepts that underpin geology as a science and affect the way in which we view the Earth. This approach injects a greater flexibility into the way field geology is taught and shows the subject to be dynamic, thought provoking and fun.

CHRIS NICHOLAS is an experienced field geologist and course leader of students at all levels, and has spent many years exploring and teaching geology, particularly on Arran. He was recently involved in the production of the major BBC TV series *Earth Story* and is currently at the Department of Earth Sciences, University of Oxford.

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'Let us turn from the lessons of the lecture-room to the lessons of the crags and ravines, appealing constantly to nature for the explanation and verification of what is taught. And thus, whatsoever may be your career in the future, you will in the meantime cultivate habits of observation and communion with the free fresh world around you – habits which will give a zest to every journey, which will enable you to add to the sum of human knowledge, and which will assuredly make you wiser and better'

Sir Archibald Geikie, 1871

Director General of the Geological Survey of Great Britain

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Preface

It was during the summer of 1787 that James Hutton and his colleague, John Clerk, succeeded in making the first serious geological survey of the Island of Arran. Since that time many have followed in their footsteps and the ferries now carry geological field parties over to Arran almost every month of the year. The reason for this popularity is that the island has a rich and varied geological history spanning nearly 600 million years packed into its relatively small geographic area. This makes it the ideal training ground in which to put geological science into practice.

Geology as a science is now over two hundred years old and is undergoing a major transformation with the dawn of the twenty-first century. Technological advances are being made at an increasing rate and are providing a multitude of new ways in which to investigate the Earth's dynamics. Consequently, geology is now amongst a number of disciplines collected together as the 'Earth Sciences'. With such a diversity of approaches it is more important than ever for a student of the Earth Sciences to have a solid, central, supporting knowledge of geological processes and principles from which to branch out into further, more specialised studies. To master geology in the field is still the most intensive and effective way in which to achieve this as it develops the mind to think quickly in a logical and scientific manner, as well as introducing practical methods of dealing with rocks on a large scale.

Many geological field trips follow the traditional format of walking a group of students over the rocks during a day in the field, pointing out localities of interest and posing questions. Two published excursion guides currently exist which follow this approach and ably summarise much that is of geological importance on the Isle of Arran. However, those who have led field trips in this way have often found that the problem with this method of teaching is that students must all walk at the same pace and think at the same speed. Everyone, of course, is different; some walk more slowly and arrive as the main group is about to leave the outcrop, whilst others may need a longer look but find time is too short. Consequently, this regime can be frustrating to both students and leaders alike.

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This book is designed to inject a greater flexibility into the way geology can be explored in the field; not necessarily by replacing day excursions entirely but by supplementing them with a different approach. It provides a collection of ten, observation-based, structured exercises graded according to their difficulty and covering the spectrum of *field skills* that a novice student in field geology needs to master. The work can be carried out in pairs or small groups within the confines of each exercise area with data and observations being recorded directly onto pages within the book. This freedom allows everyone to work at their own pace and encourages solution of geological problems individually or through discussion with friends. Leaders can attend to those who need more help whilst the others have a relatively free rein to explore the subject. The structure of the exercises and the provision for answers also makes it easy to mark and assess a student's progress.

Exercises can be attempted in any order. Alternatively, the book can be treated as a field course in itself with exercises becoming progressively harder over the days and drawing on the skills learnt in earlier ones. Following this philosophy, there are two principal aims of the book:

- 1 To teach the basic skills of field geology by guiding students through a series of field-based problem-solving exercises.
- 2 To demonstrate some of the more interesting aspects of Arran's geological history by setting the exercises around them.

A field geologist uses a whole host of field skills in order to gain the maximum amount of information from the rocks. These might range from simply using a hand lens effectively to constructing a geological map with cross-sections. The practicalities of these skills are rarely found explained in text books and are still mostly taught by word of mouth. So it is a further aim of this book to 'demystify' field geology by listing what might be thought of as the twenty-five most commonly used skills. Each one has been allocated a number and is explained as simply as possible with notes and diagrams in Part 4 of this book. Whenever a field exercise requires the use of a certain skill, the corresponding number is given so that it can be referred to if necessary in Part 4. It is hoped that gradually the user will turn to this section less and less as the skills become second nature. However, practice makes perfect, and whilst practising it is extremely useful to have the technique written down somewhere to check on if in trouble.

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Many of the principal ideas behind the science of geology date back to the nineteenth century or earlier. So several exercises in Part 3 include a historical slant specifically to introduce some of these and how they were accepted by the scientific community of the time. This also helps to show how science actually 'works' as well as providing a glimpse of some of the more influential early geologists and how their theories still affect the way in which we view the planet today. Above all, this book is intended to show that field geology is dynamic, thought provoking, fun and as crucial in geological teaching today as it has always been.

C. J. Nicholas

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Acknowledgements

The first geological field course that I ever went on was to the Isle of Arran. At that time I could not have predicted that I would return for many years and eventually write a book. It began in earnest around 1991 with a few simple field exercises for the undergraduates at the Department of Earth Sciences in Cambridge. From that time I have been fortunate to have the encouragement of many people from universities around the country who also lead field trips to Arran year after year whatever the weather. In particular at Cambridge I would like to thank Andy Buckley. Many of us who thought we knew a thing or two about field geology have passed before Andy's perceptive eye and learnt more than we might like to admit in public. But others who have always taken a keen interest in how to teach field geology, and the fortunes of these exercises, are Paul Pearson, Pete Ditchfield, Mark Hallworth and Simon Price. Once the book was truly underway, additional volunteer help in the field was provided by Liz Hide, Steph Lewis and Clare Glover. Also, my thanks to Rose Edwards for her continual support and patience during the final stages of writing and editing. Finally, I am indebted to all those who have helped at Cambridge University Press. All topographic maps in this book are based on the 1:25 000 Ordnance Survey Outdoor Leisure Map 37 for the Isle of Arran (1995).

C. J. Nicholas

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