BOOK REVIEWS

COE, A. L., ARGLES, T. W., ROTHERY, D. A. & SPICER, R. A. (eds) 2010. *Geological Field Techniques*. xii + 323pp. Wiley-Blackwell/Open University. Price £80.00, €96.00, US$150.00 (HB); £24.99, €32.90, US$59.95 (PB). ISBN 978 1 44433 061 8 (HB); 978 1 44433 062 5 (PB).
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Field work has always been a central part of university geology courses. Without it, students can never hope to understand geological relationships at scales from metres to hundreds of metres, however many thin sections, hand specimens, aerial photographs or seismic profiles they see. Despite the dual threats of reduced financing and increased safety concerns for field work, most students spend many days in the field: a minimum of 60 days through a UK three-year course to qualify for professional accreditation. Traditional onshore field work has occupied geological researchers less over the past couple of decades, but it still survives, with sampling work predominating over geological mapping.

Since the 1980s, the standard books on geological field techniques have been the *Geological Field Guide* series led by Barnes & Lisle (2003) on *Basic Geological Mapping* and including companion volumes on sedimentary, igneous and metamorphic rocks, and on structures, field hydrogeology and field geophysics. Most of these volumes have gone through several editions, and are still reliable guides. However, the average student geological mapper might need at least two or three of these volumes, now at around £20 each, in the average mapping area. The new volume by Angela Coe and Open University colleagues Tom Argles, David Rothery and Robert Spicer, aims to combine much of the necessary information into one volume.

There are introductory chapters on field equipment and safety, making field observations, and on keeping a field notebook. Five central chapters then cover the recording of palaeontological and structural information, and the features of sedimentary, igneous and metamorphic rocks. Only then is there a chapter on making a geological map, before concluding chapters on instrumental observations, photography and sampling. There are seven appendices containing tabulated, diagrammatic and photographic reference material for the central and mapping chapters.

Overall, the content of *Geological Field Techniques* is excellent. The book is admirably suited to undergraduate students and amateur geologists, but research students and professionals will find much of interest. In the earlier part of the book, I particularly liked the chapter on keeping a field notebook. This is a skill as important as it is difficult to teach. Here some clear guidelines and copies of notebook pages from a variety of geologists are very effective. Similarly clear instructions on how to make a graphic lithological log are also welcome. I was nervous that geological mapping was not covered until two-thirds of the way through the book, the philosophy clearly being that by then the component observational skills had been taught. I was relieved to find that exposure mapping is encouraged in suitable terrain and that feature mapping is explicitly covered. I would have liked to see a section on using stereographic plots of structural data to tune up the mapping of major structures. I was also disappointed to see little guidance on mapping superficial deposits. Most of the solid rocks in temperate regions are covered in 'drift' which has its own fascinating geological story to tell, and which is often of more applied geological relevance than the bedrock. In more arid regions, distinguishing bedrock from regolith is one of the problems that students find most vexatious, and some guidance would have been helpful.

These criticisms, however, are minor in the context of a generally excellent book. It is highly informative, attractively designed and illustrated, reasonably priced and has its corners already rounded to survive in the rucksack. It deserves to be widely used.

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Reference

BARNES, J. W. & LISLE, R. J. 2003. *Basic Geological Mapping*, 4th ed. Wiley. 196pp.

ZALASIEWICZ, J. 2010. *The Planet in a Pebble. A Journey into Earth's Deep History*. xvi + 234pp. Oxford University Press. Price £16.99, US$27.95 (HB). ISBN 978 0 19956 970 0.
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Jan Zalaziewicz tells the story of an ordinary pebble of grey Silurian slate picked up from a beach in Wales, its components and history, going back as far as the Big Bang 13.7 million years ago. This is a wonderful book, in which hard science is explained in simple but effective terms. The prose is exquisite, and the starscapes and Earthscapes are conjured up with magical inward vision. Open a page at random, and read, as I have just done 'Field geology is the ultimate forensic science, the art of the possible, where one combines as much evidence as one can get hold of, with as much ingenuity as one can muster – and also with a keen sense of the limitations of one's deductions'. Who would not envy the ability to write like this? But purple prose is absent in this enchanting volume. This is all good stuff.

The first chapter takes us to the Big Bang and the formation of the elements now present in our pebble. Vast star systems originated, collisions of stellar bodies and young planets took place on an unimaginable scale. Our planet eventually stabilised, with convection currents below an evolving lithosphere (Ch. 2); quartz crystallised from granitic magma, to become an almost ubiquitous component of sedimentary rocks. Amongst the quartz fragments in a sediment we find rare minerals, including zircons (Ch. 3) that are often zoned, thereby recording events in their history as they grew.

So, the grains of our pebble, with their separate histories, came together in an oxygen-starved deep sea, off the Avalonian continent. On this deep sea floor mud accumulated, affected from time to time by turbidity currents and sea level changes, chiefly the result of glaciations (Chs 4 & 5), all neatly explained. Conditions were ideal for preserving the planktonic graptolites which rained down after death, to be preserved, unscavenged (Ch. 6). Their nature, biological relationships and stratigraphical uses are treated lovingly, as is their preservation, with fine drawings and colour plates.

Although other planktonic animals, apart from chitinozoans and acritarchs, are lacking, they may leave chemical traces (Ch. 7), including carbon isotopes. We learn that radioactive rhenium, decaying to osmium, has real potential for reliable radiometric dating; a prospect previously unknown to this reviewer.

Chapters 8–10 bring us ever closer to the present time. We read of the marine half graben on the edge of Avalonia in which our pebble formed, its burial deep in the sedimentary pile, and what happened to it during its long time of 'imprisonment'. 'Prison, in this case, was a place of reform', we are told, because of chemical changes in the mud, soon to become rock. The remaining chapters discuss tectonic events, the rise of the Welsh mountains, folding, faulting and conversion of the mud into slate. As the overlying mountains were eroded, and our 'pebble' nears the surface, pressures lessen and it eventually comes into the zone of rich bacterial life, which likewise leaves its mark. Ice, penetrating the upper layers of rock, alternately melts and thaws it, fracturing the rock. Our pebble, finally isolated, falls into the sea to be worn and polished by the tides. Eventually it is picked up by one of those recently arrived humans, to be taken to the laboratory, and studied by a range of optical, electronic, and expensive chemical equipment, which reveal its history, as so perfectly narrated here.

To portray the long history of the components of this pebble is an original and bold undertaking; the scope is phenomenal. We read about all kinds of things ranging from stellar theory, through mass-spectrometry and rare element analysis, to the geological history and ancient life of Wales to erosive processes operating now. I have found this to be a wonderful read, from which I have learned much that is new, written in elegant, expressive, but eminently readable prose. Professional, amateur geologists, teachers, students, and the informed general public would all derive very much from reading this book.

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HEFFERAN, K. & O'BRIEN, J. (2010) *Earth Materials*. vii + 608pp. Wiley-Blackwell. Price £85.00, €97.80, US$150.00 (HB); £37.50, €43.20, US$99.95 (PB). ISBN 978 1 40514 433 9 (HB); 978 1 4443 3460 9 (PB).
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In response to the changing demands of Earth Science courses, an undergraduate textbook covering the full range of Earth materials is welcome. Aspects of geochemistry are dealt with in the early chapters, then crystallography, mineralogy, igneous petrology, sedimentary petrology, metamorphic petrology and finally economic minerals. The preface sets out the authors' goal to provide an innovative, visually appealing, informative book with a good balance between different disciplines.

Is the book innovative? In the sense that there are few books that cover all aspects of mineralogy and petrology then *Earth Materials* does tick this particular box. Alas both the text and figures rely heavily on recycling material from existing textbooks and occasionally Wikipedia. Some topics are covered in an outdated fashion and there is little insight into recent research. Sections in the text appear to be extracted from lecture or laboratory notes and include phrases such as 'You may recall from earlier lectures…' and 'In your introductory courses…'. Instructions are included on to how to change objectives on an old petrographic microscope but there is no consideration of petrological techniques such as electron microscopy. Modern books must compete with web-based learning resources, however, the additional resources are disappointing, restricted to files containing the figures. Other material claimed to be available from the publisher's web-site is not present. The introduction of the word 'gravelstones' appears to be an innovation, but not one welcomed by my sedimentologist colleagues.

Is the book visually appealing? Given that Earth Science is a visual subject, the lack of colour figures within the text is a drawback. Although some separate colour plates are included, it is hard to imagine students being enthused by the images. Many photographs are badly lit and not annotated, and images of hand specimen rarely show features of significance. Original line drawings appear to have been prepared without much care. Images are used from other sources without modifying them for this book. Virtually all field photos and most examples quoted are from locations in the USA and this is undoubtedly the readership at which the book is targeted.

Is the book informative? For a large book a few mistakes might be predicted, however these include some glaring omissions and numerous editorial and factual errors.

Major omissions include: structural emplacement of igneous rocks; anorthosites; petrography of pyroclastic rocks; porphyroblast growth; low-pressure metamorphism in extensional environments; and metamorphism during obduction. Whilst there is a wealth of information present there are simply too many errors to give students confidence in the quality of that information. Simple mistakes in mineral formulae, optical properties, chemical components, and spelling of rock names are present. Many errors in metamorphic assemblages are quoted; apparently granoblastic texture simply consists of large equant grains; and accessory minerals in slates include quartz, chlorite, plagioclase and muscovite!

Is the book well balanced? The textbook is comprehensive in some respects; there are two and a half pages on lustre and streak, and many minerals are documented that 99.9% of earth scientists will never encounter. The text is often repetitive and list-like, generally lacks cross-referencing and clear indications of what prior knowledge is expected. If you want a book on Earth Materials that has 16 pages on optic axis figures, a technique now rarely used in Earth Science, then this may be the book for you. Unfortunately I feel that *Earth Materials* lacks a focus on what students need to know and I'll not be recommending it to undergraduates.

Finally congratulations to the town of Burton-upon-Trent for attaining 'city' status, and to Greenland (Fig. 18.5) on moving to the warmer climes of Newfoundland!

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JULIEN, P. Y. 2010. *Erosion and Sedimentation*, 2nd ed. xviii + 371 pp. Cambridge University Press. Price £80.00, US$ 140.00 (HB); £35.00, US$ 60.00 (PB). ISBN 978 0 521 83038 (HB); 978 0 521 53737 7 (PB).
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The second edition of Pierre Julien's *Erosion and Sedimentation* is a generally useful text for hydraulics and sedimentation engineers, as well as a good reference for geomorphologists grappling with applied sediment problems. Although the content is not noticeably different from that of the first edition, some sections are expanded for clarity, additional examples and problems are included, and there has been