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.

Euan Clarkson
Edinburgh

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).
doi:10.1017/S0016756811000136

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!

Tim Dempster
University of Glasgow

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).
doi:10.1017/S0016756811000215

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