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).
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

some effort made to update the material to account for recent advances in the field. The quality of the print and the graphics is much improved, so the book looks and feels more professional than the first edition. The text is organized logically, building from physical principles and properties of water and sediment, to dimensional analysis (Ch. 2), momentum and continuity (Ch. 3), particle motion in fluids (Chs 4 & 5), velocity and resistance (Ch. 6), incipient motion of sediment (Ch. 7), bedforms (Ch. 8), bedload transport and measurement (Ch. 9), suspended load transport and measurement (Ch. 10), total load and sediment yield (Ch. 11), and reservoir sedimentation (Ch. 12).

The strengths of this text lie in detailed derivation and presentation of equations of flow, which are fundamental to sediment transport theory, and empirical exploration of their application in field and laboratory problems. I am particularly impressed with the thorough explanations of drag, moment stability, and bedforms. The section on reservoir sedimentation is very detailed and helpful, as is the range of worked examples and practical problems provided to elaborate the presented concepts. The problems become more 'applied' as the book progresses.

However, the book exhibits an uneven treatment of material. For example, concepts of sediment mixtures and active layers, which are important frontier subjects in sediment transport theory, are given scant attention, while Julien devotes 15 pages to hyperconcentrated flows. There is limited exploration of concepts such as fractional sediment transport, the difference between surface-based and substrate-based equations, or the impact of particle shape on settling velocity, and the discussion of sediment yield is woefully out of date. The real-world context for sediment transport theory is also lacking in many sections, such that the book reads dryly and lacks a modern perspective. The particular selections of sediment transport equations, for example, are apparently based on the author's own experience, rather than on efforts to explain the range of equations of various types and their limitations of application. My primary criticism is that the book reads as if the field of erosion and sedimentation is a collection of 'settled law', rather than an active area of research with many uncertainties and inadequacies. For example, there is no mention of the limited ability of sediment transport equations to accurately predict measured rates or an evaluation of the strength of the science.

Despite my criticism, I believe Julien's new edition is an improved and very useful reference text for research and teaching, although it lacks a strong foundation in some recent advances in sediment transport and fluvial geomorphology.

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PEDLEY, H. M. & ROGERSON, M. (eds) 2010. *Tufas and Speleothems: Unravelling the Microbial and Physical Controls*. Geological Society Special Publication 336. vi + 362pp. Geological Society of London. Price £90.00, US$180.00; GSL £45.00, US$90.00; other qualifying societies £54.00, US$108.00 (HB). ISBN 978 1 86239 301 1.
doi:10.1017/S0016756811000203

Are the microbes found in non-marine carbonates guilty of causing carbonate precipitation themselves? Or are they innocent bystanders, suffering calcite entombment only because of the physical environments in which they grow up? Martyn Pedley and Mike Rogerson hosted a meeting aimed at answering such questions at Hull University in 2008. The ultimate result is this well-timed collection of 17 papers, mostly from European authors. This book should be useful to those making palaeoenvironmental reconstructions from such tufa (stream, lake and swamp carbonate) and speleothem (cave carbonate) petrography and geochemistry. It could also be of interest to those studying early life and astrobiology, and to petroleum geologists exploring microbial carbonate reservoirs like those of the South Atlantic.

Pedley and Rogerson begin with a brief introduction. In this they remind the reader that tufa and speleothem can be considered as end-members of a continuum reflecting different degrees of biologically and physico-chemically controlled precipitation. This is strongly backed up by Brian Jones, who uses stunning Scanning Electron Microscopy (SEM) imagery to show not all speleothems are devoid of microbes. Bindschedler *et al*. are equally effective in their use of SEM images to illustrate their case for a fungal origin of calcitic nanofibres. A further highlight for petrographers and artists is a beautifully illustrated paper on Polish and Slovakian tufas by Gradziński.

Overall the reader is given little room to doubt that microbes can and do influence precipitation of non-marine carbonates. For example Dittrich and Sibler implicate cyanobacterial slime in microbial carbonate precipitation, and González-Munoz and others describe biomineralization of bacteria like *Myxococcus*. The book editors provided two interesting contributions themeselves, both resulting from their experiments growing tufa in laboratory flumes. First they used artificial lighting to simulate night and day, showing the effects photosynthesis has on pH and carbonate precipitation. Further towards the back of the book (presumably for reasons of modesty) are their SEM images of the microbial mats and resulting precipitates. Some of the papers also examine the case for abiotic physico-chemical tufa precipitation, such as the detailed study by Arp *et al*. of some modern tufa depositing streams in Germany. For those interested in palaeoenvironmental reconstruction, Arenas *et al*. explore oxygen isotope palaeothermometry using Spanish tufas. Capezzuoli *et al*. used radiometric dating techniques to examine whether Quaternary tufa deposition was associated with warmer interglacial climates.

At times this book seems more a collection of loosely related articles by authors with overlapping interests than a co-ordinated attack on the subject. A few papers relegated to the back of the book focus on chemistry and deposit morphology of (abiotic) speleothem and hydrothermal travertine. As interetesting as these papers are, they might have fitted the rest of the book better if there was some additional discussion of why these particular precipitates are believed to be (totally?) abiotic. This will no doubt prove to be a useful collection of papers, perhaps accompanied on the shelf by the two recent volumes edited by Alonso-Zarza & Tanner (2010*a, b*) which provide nice introductory reviews of 'carbonates in continental settings'.

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