

ception of it some deeper significance for the artist. Yet any quest for a universal, culturally independent interpretation of colour, says Gage, is destined to be fruitless.

But this is not a light read, even for someone moderately informed — whether scientist or artist. If you do not, for example, already have Delacroix and Ingres firmly in place as the precursors of Impressionism, this is not the book to tell you. The reader who does not know what “the ideas of Wilhelm Ostwald” on colour harmony actually were is left for more than 50 pages before being told. Cross-referencing in a book of this scope is far from trivial, especially as several chapters are compiled from articles published elsewhere. Yet this makes it all the more surprising that an editor was not on hand to excise some obvious repetitions in the initial chapters.

My only real complaint, however, is that although the book is generously endowed with high-quality colour reproduction, the very subject matter makes colour indispensable in far more cases than it is used. The monochrome illustrations are sometimes worse than useless, they are frustrating: a Turner becomes barely distinguishable from a smeared, grimy window. Obviously the economics is limiting here, but maybe electronic media could have helped?

Everything Gage writes is essential reading for the serious student of colour in art — although this book is strictly the offspring of *Colour and Culture* and you'd be well advised to read that first. *Colour and Meaning* comes as a welcome antidote to the canard that only scientists can straddle the two cultures. □  
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## Bedrock of geology

### Lyell: The Past is the Key to the Present

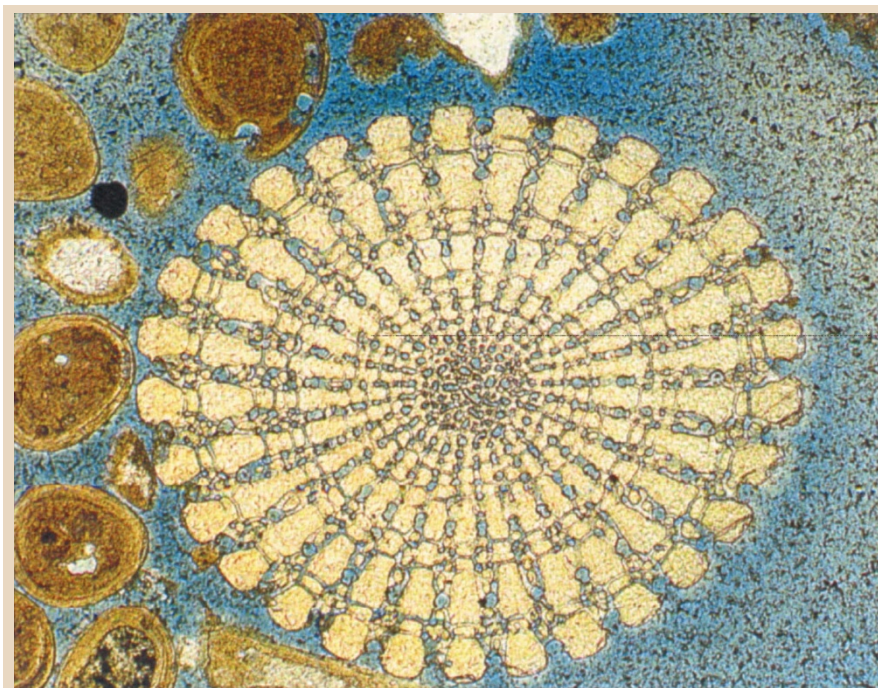
edited by D. J. Blundell and A. C. Scott  
*Geological Society: 1998. 376 pp. £79, \$132*

### Lyell in America: Transatlantic Geology, 1841–1853

by Leonard G. Wilson  
*Johns Hopkins University Press: 1999. 472 pp. \$45, £37*

#### Paul Lucier

Charles Lyell (1797–1875) was one of the great scientists of the nineteenth century. He, more than anyone else, made geology a scientific discipline. Best known as the author of *Principles of Geology* (1830–1833), Lyell was the foremost advocate of what was termed uniformitarianism — the idea that the causes of geological change in the past are similar in both kind and degree to the causes of change at work today. Geologists recognize Lyell as responsible for dividing the Ter-



## Patterns in the sea floor

The examination of thin sections under the microscope is a key part of any study of carbonate sediments. Intended as a laboratory manual, *A Colour Atlas of Carbonate Sediments and Rocks Under the Microscope* by A. E. Adams and W. S. MacKenzie (Manson, £24.95, pbk) contains many examples of carbonate grains and textures, such as the echinoderm spines shown here.



tiary period into Eocene, Miocene, Pliocene and Pleistocene epochs. Others might know him as Charles Darwin's mentor. Given Lyell's central role in the major intellectual debates of his time, it seems only fitting that we should have two celebratory books to mark the bicentenary of Lyell's birth.

In the book edited by Blundell and Scott, we have the results of an international conference of historians and Earth scientists held in the summer of 1997 at the Geological Society of London (where Lyell himself served as secretary during 1823–26, foreign secretary in 1826, and president during 1835–36 and 1849–50) to discuss Lyell's contributions to the geology of his own day and his influence on Earth sciences of the present.

The collection is divided into three parts. The first addresses Lyell's life and work in geology, his travels in Europe and North America, his interactions with fellow geologists, and the impact of his ideas and discoveries on contemporaries. There are good discussions of Lyell's reasons for writing the *Principles*, of its translation and reception in continental Europe and of the fieldwork that went into it. *Principles of Geology* was not intended as a once-and-for-all work; it was an ongoing argument that continually changed over the course of 40 years and 12 editions. During Lyell's lifetime, some of the

ideas in the book were accepted and incorporated into standard geological practice — for example, his notion of vast amounts of time — while others were rejected. In particular, Lyell steadfastly opposed most of his contemporaries in his belief that the Earth's history had no direction; in other words, Lyell maintained that the rock record did not reveal a progression from a hot active past to a cool quiescent present, with a broadly progressive history of life from simple plants to complex animals.

As can be seen from the subject of evolution, Lyell's work dealt with much more than geology. The second part of the volume tries to evaluate his contributions to related scientific specialisms such as sedimentology, stratigraphy, evolution and climatic change. While many of the essays, such as a fine account of Lyell's reception and rejection of the idea of continental glaciation, complement themes from the first part, some do not — for example, an otherwise very interesting history of hydrogeology, “a subject of passing interest to Charles Lyell”. Similarly in the third part of the volume, “The Legacy of Lyell”, studies of plate tectonics, salt tectonics or sequence stratigraphy have little

to do with Lyell, however valuable these essays are in their own right. Readers should turn to the review of research on coal or the essay on earthquakes and seismology for excellent examples of how to combine history and science.

In Leonard Wilson's book, we have a historical travelogue rather than a history of science. Wilson has given us a densely and minutely described account of the four visits (1841–42, 1845–56, 1852 and 1853) Lyell and his wife Mary made to the United States and Canada. The book is filled with the Lyells' insightful comments on American culture, customs and regional differences, such as their observations of Southern slavery and race relations. Based almost exclusively on Lyell's letters, notebooks, journals and diaries — invaluable sources to which Wilson has had unique access — it gives a tangible sense of what the Lyells experienced on their journeys: clean beds, tasty meals and congenial hosts, for the most part. But readers may start to feel suffocated by detail.

Like Wilson's first volume on Lyell's life, this is an unimaginative chronology of events. It doggedly follows Lyell between 1841 and 1853, a simplistic approach that leads to organizational imbalance. More than two-thirds of the book is devoted to a day-to-day report of the Lyells' travels in America, but in between Wilson has squeezed chapters that rush over Lyell's life between 1842 and 1845, and then between 1846 and 1852. These years were filled with travel in continental Europe, revising manuscripts (editions of the *Principles* as well as his *Elements of Geology*), delivering scientific papers and other events of greater or lesser importance, such as buying houses.

What sometimes gets lost in all the particulars is the point — geology, we assume; and Wilson does on occasion provide clear guidance on specific topics in American geology. After all, Lyell's larger purpose in going to America was to geologize. During his first two visits, he and Mary took extended tours ranging from Nova Scotia to Georgia, and from the Atlantic seaboard to the Mississippi and Ohio rivers. Lyell intended to examine the Tertiary formations and compare them with their European counterparts. He also wanted to study Niagara Falls, the Appalachians, and the coal fields and swamps of North America. Most of all, he went to collect more evidence for his theory of uniformity, which he seems to have accomplished.

Scholars, however, might question how much Lyell took versus how much he gave back. The Blundell and Scott volume includes an even-handed summary of Lyell's debt to America. Wilson, on the other hand, sees the relationship entirely through Lyell's eyes. Few scholars will see any mention of their names. Regrettably, Wilson largely ignores, or dismisses in a sharp footnote, work by fellow historians. The Blundell and Scott volume

amply demonstrates how much top-notch research has been and is being done on Lyell and nineteenth-century geology in general. Their edited volume, much more than Wilson's book, engages our interest by making the history of the Earth sciences an active part of our world today. Blundell and Scott's subtitle — *The Past is the Key to the Present* — is not only a clever reversal of the familiar uniformitarian slogan, but timely advice on how to join history and science. □

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## Everyday extinctions in embattled forests

### Our Forests, Our Future: World Commission on Forests and Sustainable Development

Cambridge University Press: 1999. 205 pp. £19.95, \$32.95 (pbk)

Norman Myers

As recently as 1950, forests covered 50 million square kilometres or almost 40 per cent of Earth's ice-free land. Today they cover 34 million square kilometres at most, and almost half of this has been degraded from its primary form. This is far and away the biggest land-use change to overtake the planet in such a short space of time.

We shall pay heavily for what is lost already (developing nations forgo \$45 billion per year through poor forest management), let alone what will be eliminated if we allow present exploitation patterns to persist. At the current rate of deforestation, we are likely to witness the demise of most tropical forests within the lifetimes of most readers of this journal. In addition, global warming, with its shifts in temperature and precipitation bands, may well cause an extensive die-back of boreal forests.

As this book demonstrates at length, forests are fundamental to our biosphere's workings. They provide commercial timber, fuel and many non-wood products. Tropical forests alone contain more than half of all species and, because some 160,000 square kilometres of them are destroyed every year, they are the site of most extinctions. Some 30,000 plant and animal species out of a planetary spectrum of 10 million become extinct every year.

Still more valuable are forests' environmental services. They protect soils with their moisture and nutrients. They protect watersheds and thus regulate water flows in quantity and quality. They modulate climate at local and regional levels through regulation of rainfall regimes and the albedo effect.

They help to slow global warming by virtue of their carbon sinks with 1,200 giga-

tonnes out of 2,000 gigatonnes of carbon in all terrestrial plants and soils. At present rates of burning (1998 saw more forests sent up in smoke than ever before, not just in Borneo and Amazonia but in Canada and Siberia as well), they release perhaps 1.3 gigatonnes of carbon per year, or one-fifth as much as emitted by combustion of fossil fuels. Conversely, forests absorb carbon dioxide from the global atmosphere, and the Northern Hemisphere's forests may be sequestering a large but indeterminate amount of carbon. A salient way to resist global warming would be through grand-scale reforestation of the humid tropics, where trees grow several times faster than in, say, Britain.

Despite their many benefits, forests rank among the least developed of all natural resources. They are still not used in the sustainable ways that could provide both material goods and environmental services, while serving the long-term interests of all communities concerned. Many forests are exploited for only a few outputs, notably timber and agriculture, with adverse consequences for their many other actual or potential outputs. They are both over-exploited and under-utilized.

We should therefore welcome this report of the World Commission on Forests and Sustainable Development. An attempt to tackle the decline of forests was broached at the Rio Earth Summit, all the more pertinent in light of forests' many linkages to the Climate and Biodiversity Conventions achieved at Rio. Alas, the effort foundered on the politics of sovereignty: all forests fall within the jurisdiction of individual nations, and many governments, notably that of Brazil (with two-fifths of tropical forests), were not willing to cede any element of perceived control to a global institution.

This was the rationale for the World Commission's attempt to take another crack at one of the great issues of our time: "The decline of forests could change the very character of the planet and the human enterprise within a few years unless we make some choices." These choices include "radical reform, a new political agenda, greater civil society involvement, and more science in policy making".

Fortunately the book recognizes a key constraint: that forestry policy is not generally set by foresters, however much they may believe the contrary. Forests are largely eliminated not by over-logging but by agricultural encroachment, industrial pollution and a host of other non-forestry factors. To save the day, there is urgent need for (a) a greater appreciation by governments of the full panoply of forest values, and (b) a more vigorous assertion by foresters of what is at stake for activities and sectors far beyond forests. To the book's credit, this point is hammered home time and again.

This is a fine book, which reviews the