

dependence on other nations' charity. The Indian space programme, mercifully free from military-missile projects, has brought home the power of satellites to the community in remote sensing, weather forecasting and communications.

The civilian atomic-energy programme is another story. The 13 pages covering this topic do not mention that it has failed to meet even the modest target, set years ago, of 10,000 MW, nor that breeder power reactors (touted as the only answer to India's endemic power shortage) are not realizable for at least five more decades. There are also stories of government science departments that seem to have no other reason for existing — other scientific organizations are doing their jobs better and more cost-effectively — except as retreats for bureaucrats and has-been scientists.

A few universities and, particularly, the Indian Institutes of Technology (IIT) have done exceptionally well. Professor M. M. Sharma, in different sections of this volume, describes the achievements of a single university department in partnering innovations in chemical industries in and around Mumbai. But the IIT's truly outstanding performance in building and sustaining high-quality engineering education and research are achievements that any country could be proud of. Many Silicon Valley entrepreneurs (and millionaires) are graduates from these institutes.

The country's achievements in biotechnology, fuelled by the Biotechnology Board, suggest that this field may soon turn out to be an Indian success story. If, in spite of all these, India remains poor with a high illiteracy rate, we must look for reasons elsewhere: failure to control population growth, or to eradicate illiteracy and eliminate the country's endemic corruption?

In the nineteenth century, Lord Thomas Macaulay argued for introduction of English as the language of teaching in India because he anticipated the need for a large number of clerks and petty bureaucrats to serve the Empire. Indians have every reason to thank him for it — not for the clerks the system produced, but for the scientists. This book recounts the road travelled with feeling. ■

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### More on science in Asia

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edited by Richard H. Grove, Vinita Damodaran & Satpal Sangwan  
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## Science in culture



### John Ruskin (1819–1900), man of art and science

Douglas Palmer

Our understanding and appreciation of landscape, and our access to some of the most beautiful countryside in Britain owe much to the powers of imagination and descriptive ability of that high priest of Victorian culture, John Ruskin, who died 100 years ago (on 20 January 1900). Although he had a predominantly arts background from his early education, he made serious studies of many areas of contemporary Victorian science, especially botany and geology, and helped to link science and the arts.

Ruskin was the first to anatomize and explain the surface form of landscape for the general reader, especially in volume IV of *Modern Painters* (1856). He simply applied the traditional methods of his training as a visual artist. To understand the surface form of landscape — the skin of the Earth — he realized that we must understand its underlying anatomy, in other words, its geological structure and material.

Rocky landscapes had been faithfully observed and accurately sketched by the likes of John Turner, Ruskin's hero among painters, but the underlying geological structure was not known to Turner. For many artists, landscape painting could never be the same again after Ruskin had revealed its hidden truths.

Ruskin looked to the work of professional geologists such as John Phillips, a colleague at Oxford, and especially the work of Horace Benedict de Saussure on the Alps. Ruskin took his geological studies seriously and was elected a Fellow of the Geological Society of London in 1840. Although he never contributed to the society's publications, he did write a number of geological essays for the Cambridge-based *Geological Magazine*.

Ruskin's artistic and descriptive skills allowed him to accurately depict the various rock types of the Alps, their igneous granites, metamorphic marbles, gneisses and schists, with their complex cleavages and folds. From this material base, he

### Ruskin's Matterhorn: contorted by folds and faults as if it were made of some plastic clay.

turned his attention to the large-scale structures, the immense, spectacular folds and faults that contort the great rock masses as if they were made of some plastic clay. Although his geological interpretations are somewhat out of date, his wonderfully accurate drawings and paintings clearly show the relationship of the surface topography to the underlying structure and rock type. In volume IV of *Modern Painters*, Ruskin elaborately details his understanding of the geology of the Alps with the forms of the aiguilles (sharp peaks), ridges, precipices and banks.

Ruskin construed all this structure as part of a purposeful design within the teleology of a fairly fundamentalist Christian belief. For many Christian thinkers, there had been a major question over what was the God-ordained use of infertile and wild mountain country. To Ruskin it was "absolutely necessary that such eminences should be created, in order to fit the earth ... for human habitation". Without mountains, air could not be purified, the flow of rivers sustained, and humans could not be startled out of their lethargy with the "deep and pure agitation of astonishment". For Ruskin, the grand and noble architecture of the mountains are the result of a higher mission with a deeply Christian moral agenda. They appeal to the higher faculties of the human spirit.

For scientists today, Ruskin's agenda may not seem particularly interesting. But his ideas and spiritual evangelism about landscape became influential in his day through his popular writing. His response to landscape led to his belief that access to mountain scenery was a spiritual necessity for Britain's urban poor. The practical impact of Ruskin's Christian socialism on Octavia Hill and Hardwicke Drummond Rawnsley, two of the founding members of Britain's National Trust, was particularly important.

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