was assembling 10,000 to 20,000 fibres into a bundle with their ends aligned to carry an image. They spent months assembling equipment to wind fibres and getting it to function properly. In November 1953, they sent a paper to *Nature* which was published in January 1954 together with a paper by van Heel. Unfortunately, Hopkins and Kapany fell to quarrelling even before Kapany finished his dissertation in 1955. Hopkins claimed the Kapany was nothing more than 'a pair of hands', while Kapany thought the 'Professor was too much a theorist to appreciate his practical skills'.

Kapany moved to the University of Rochester and then the Illinois Institute of Technology, eventually setting up his own company. He also authored the first book on the subject *Fibre Optics – Principles and Applications*, published by Academic Press in 1967. As a tireless crusader for fibre optics, he called sending an image through a knotted bundle of optical fibres his 'Indian optical rope trick'. Hopkins and van Heel abandoned fibre optics soon after their initial papers, but Kapany went on to write 45 papers in a decade and acquire ten patents. His company Optics Technology based in California, built one of the first lasers used in eye surgery and became one of the first to mass produce He–Ne lasers. Hecht recognizes him as a charismatic figure in the field and a tireless crusader.

Serendipity stepped in with the simultaneous development of the laser light source and the ultra-pure glass fibre as a medium to convey the message. In 1970, Zhores Alferov and his group at the Ioffe Institute were the first to fabricate a semiconductor laser that worked continuously at room temperature. This was recognized by the award of a Nobel Prize in 2002. The wavelength for communication shifted three times in a decade – from the original 0.85 μm dictated by the available GaAs source, to 1.3 μm where dispersion was minimum and then to the current 1.55 μm where the loss is a minimum of 0.2 dB/km. Horiguchi and Osanai of NTT Japan were the discoverers of this low-loss window at 1.55 μm. Each change required new materials for sources and detectors. Serendipity stepped in again as long wavelength 1.3 and 1.55 μm sources, first demonstrated by Jim Hsieh at Lincoln Laboratories, although requiring quaternary compositions consisting of InGaAsP, proved robust with no lifetime problems at all. There was improved performance and distance-coverage with each generation.

An unforeseen hazard appeared during the first trials of long-distance underwater cables. Sudden shorts appeared that knocked out the repeater cable. Was it sea water getting in? The cables had to be hauled out and they showed unmistakably the teeth marks of sharks! A minor discovery was that sharks swam as deep as 1 km; but why did they attack the optical fibres and not the coaxial cables? Apparently, it was the electrical fields around the repeaters that attracted them. Use of strong steel tape that shielded the electric field solved that problem.

Fourth-generation systems are all-optical erbium-doped fibres as amplifiers. In fact, soliton waves have been sent many times around the world without the need for any amplification. Wavelength-division multiplexing has increased the capacity of each fibre by sending over 100 channels at slightly different wavelengths. Hecht has not gone beyond existing technology and speculates on the prospects of IR transmitting fibres, while 'fibre-to-the-home' still remains a challenge and a dream. What began as a small community of believers in fibre optics has, according to the author, now burgeoned into a 'City of light'.

D. N. BOSE

University of Calcutta,
Kolkata 700 073, India
e-mail: tutubose@yahoo.co.in

Principles of Radiometry in Radioactive Metal Exploration. B. K. Bhaumik, T. Bhattacharya, A. A. P. S. R. Acharyulu, D. Srinivas and M. K. Sandilya. Physics Laboratory, Eastern Region, Department of Atomic Energy, AMD Complex, Khasmahal, Jamshedpur 831 002. 2004. 292 pp. Price: Rs 600.

This book, as stated by the authors in the preface, is intended for earth sciences students with physics background. The book is in six chapters, some written by the authors together, and some by individual authors.

An introduction to the concept of radioactivity, relevant for study of subsequent chapters, is given in the first chapter. It includes discussions on different decay schemes, decay and transmutation equations, geochronologic principles and different units of radioactivity.

Chapter 2 introduces radiation detectors useful for terrestrial radiation detection and encompasses radiation classification, detection principles, choice of detectors and description of different detector types, including scintillation- and Geiger Muller tube detectors.

Chapter 3 deals with radiation survey meters in airborne surveys, jeep-borne surveys, soil surveys, etc. Airborne survey is covered in detail and includes data acquisition, processing and interpretation.

Chapter 4, in its first part, illustrates gamma ray-, radiation- and rock spectrometry and describes, in the appendix, precision estimate for gamma-ray spectrometric data. The second part of this chapter deals with actual concentration estimation of uranium by total beta and total gamma counting methods.

Chapter 5 describes in detail the natural gamma-ray log and incorporates fundamentals of passive logging borehole; theory, calibration and limitations of gross counting gamma log; counting rate meter – its working principles, advantages and disadvantages.

Finally, chapter 6 gives major instrumental modules: log probe and counting rate meters, statistical analysis of the latter type; and shot hole- and shielded-hole logging.

Indian case histories have been mentioned in appropriate contexts, e.g. chapter 3 mentions ROAC (radon on activated charcoal) vs eU (radium equivalent to uranium) plot for Singhbhum area; chapter 4 includes a note on the disequilibrium factor for different uranium deposits in India and chapter 5 discusses gamma log calibration method using model borehole at Jaduguda.

The book is written in simple language. A subject index of moderate detail is provided at the end of the book. An adequate balance between theoretical and practical aspects in radioactivity survey is presented in the book. The advantage of such a book is that one can understand the theory behind radioactivity survey and can also get into its detail by looking at the bibliography, if interested. After each chapter, a bibliography is provided with a good number of references of recent past. The bibliography should have been written with more care; lack of uniformity is noted. Besides, the following drawbacks are noted: In the cover page of the book, names of the authors have not been printed. At many places in the running text, year of reference has not been given; for example, p. 1: 'A. H. Becquerel was studying…' year not specified. Same problem with diagrams and figures throughout the book has been noted. The first chapter of this book sounds like 'spoken English'. Further, the book requires thorough correction for punctuation; for example, 'Unlike alpha and beta particles gamma rays are…' should be 'Unlike alpha and beta particles, gamma rays are…'. In the bibliography, journal names have been abbreviated. Also, some of the references are incompletely given. At places English is poor; for example, p. 52, 2nd para, 1st line: 'In this chapter, one shall be introduced with', can be replaced with 'We introduce'. Some of the figures and their captions are impossible to read; e.g. figure 1.10 (p. 27); figure 2.24 (p. 107); figure 3.16 (p. 158); figure 6.7 (p. 283).

It must be mentioned here that radioactive mineral survey is not taught as a separate subject in the geology course curriculum in India, but is covered partly under economic geology and partly under sub-surface geophysics, in Bachelor's and Master's level respectively. Secondly, in the UPSC examination conducted by the Geological Survey of India and in its interviews, basic questions are asked from this subject. The book can, therefore, be made more 'effective' in its next edition, by making necessary modifications with respect to university and other examination syllabi. With the present subject treatment, the book seems to be advanced for B Sc geology students. As far as Master's degree geology students are concerned, they come from different subject backgrounds. Any Master's degree geology student, who has not studied physics and mathematics in his Bachelor's degree, might not be able to follow the advanced treatment of the subject in this book. Thus, the book is not targeted at geology students in general, as is also accepted by the authors in the preface. At the same time, the book can be of great use to Master's degree geophysics students, researchers, professionals, and advanced geology students or those who intend to make a class seminar on this topic. This book is not recommended as a reference book to Master's degree students in their compulsory course, but it is suitable in their elective courses such as nuclear geophysics and advanced mineral exploration.

SOUMYAJIT MUKHERJEE

Department of Earth Sciences,
Indian Institute of Technology Roorkee,
Roorkee 247 667, India
e-mail: msoumyajit@yahoo.com