Gems and Gem Industry in India. R. V. Karanth. Geological Society of India, P.B. No. 1922, Gavipuram, Bangalore 560 019, India. 2000. Mem. 45. 405 pp. Price: Rs 750/US $. 75 pp.

It is well known that due to the rapid advances made in the understanding of the materials behaviour, metals and alloys, inorganic and organic materials and pharmaceuticals (to cite a few) can be bought by giving detailed specifications. The suppliers, in turn, produce test certificates to describe their materials with adequate precision. The situation is not quite the same when one wants to buy a gemstone! To quote from the book (p. 21), 'A green garnet or diopside could visually appear like an emerald. There is, however, a vast difference in the price of the two. Similarly, the difference in the value of natural and synthetic stone which look alike . . . could be in the ratio of 1 : 10 to over 1 : 1000'.

R. V. Karanth, a specialist in the science of gems, has presented to the geological community a valuable book on gems. This work will definitely be also appreciated by physicists, chemists and materials scientists as well.

What is a 'gem'? Karanth begins the book by providing a reasonably clear answer in the introductory chapter and has assembled in the remaining eleven chapters, the vast amount of scientific knowledge on gems, employing an elegant approach. Over 240 and odd gems known to mankind are listed along with their important physical properties in the 'gem index' (Appendix-1). I feel that perusing this gem directory first may be a better way to start reading the book. Only a specialist can point out whether there are significant omissions in the gem index!

Since the chemical and structural, physical, optical and defect properties of gems are the most important, four chapters (chapter 3–6), one each on the above topics, follow the introductory chapter to review the basic aspects. The next four chapters contain detailed description of the characteristics, their occurrences in India, etc. by classifying them into isotropic (ch 9), uniaxial (ch 10), biaxial (ch 11) and organic and miscellaneous gems (ch 12). In my opinion, these nine chapters along with Appendix-1 form the core of the book (say, Part I).

The other three chapters are devoted to gem industry in India (ch 2), synthetic gems (ch 7) and gem cutting (ch 8). They could well have been shifted after the above-mentioned nine chapters, to retain the development and flow of the main theme (and called Parts II and III). There are 48 beautiful colour photographs (60 mm × 50 mm size) and one of them, the cut forms of crystalline silica, adorns the dust jacket of the book. The bibliography has over 180 references for further reading.

As I have pointed out, the book could have been divided into three parts: (i) gems and their properties (chapters 1, 3–6 and 9–12); (ii) synthetic gems (ch 7), and (iii) gem trade and gem cutting industries in India. Taking advantage of this classification, I now wish to describe the contents of the book in some more detail.

Considering the third part first, the chapter on gem trading traces the origins of the gem industry in our country, starting from the earliest known history. The author then goes on to emphasize the important role played by the gemmologist in safeguarding the customer's interests. Karanth humourously recommends that (p. 21) 'it is appropriate to extend the concept of 4-Cs, i.e. colour, clarity, cut and carat to 5-Cs and add *confidence* (the 5th C) in the merchant'. The commendable work done by the Gem and Jewellery Export Promotion Council – Ministry of Commerce, has been pointed out and a directory of organizations dealing with gems and jewellery appears as Appendix-2. The chapter on gem cutting describes the art of fashioning gems to result in a final saleble product and therefore of aesthetic value. One finds (like in the early days of crystal growth technology) the 'art' content to be still much higher than the 'science' content. The author has given a detailed description of the terminologies employed in gem cutting as well as the special tools developed for the tasks. He has presented the status of the gem cutting trade in India (quite woeful!!). The photographs show how the equipment used in our industry are still crude (photos 8.13 and 8.17 seem to clearly show child labour being employed!).

About the second part of the book which deals with synthetic gems, it appears that the author has obviously included it in the book for the sake of completion. The mere nine pages devoted to this topic do not cover all the details prevailing in this area.

Let me now return to the main part of the book – gems and their properties. The material appearing in chapters 3–6 is to refresh the basic concepts, definitions, etc. one has to be familiar with crystallography, structure, habit and morphology, optical properties of crystals (colour, luminescence, diaphaneity, lustre, chatoyancy, asterism), mechanical, thermal and electrical properties. A short paragraph on odour, taste and feel also has been added! It is clear that considering the wide spectrum of properties that are relevant to gems, it is hardly possible to go into depth on any of these properties. However, the two chapters, one on optical properties and the other on internal features, contain important material relevant to gems. (I do not understand the meaning of sentences like (p 81), 'According to the quantum theory evolved by Planck, energy is radiated in indivisible particles called quanta, whose size is controlled by the frequency of the radiation'.)

The other four chapters (9–12) describe the known properties of individual gems by classifying them on the basis of their optical sign. The first one on *isotropic gems* is, as expected, dominated by diamond. The four Cs are explained in great detail and a thorough description on its occurrence in India is given. Following diamond are garnets, spinels and other cubic stones. The reader can learn about synthetic garnets, cubic zirconia (American diamond), etc. from this chapter. Chapter 10 on *uniaxial gems* concentrates on gem crystals, in the tetragonal and hexagonal systems. The familiar ruby (ratna raja), beryl, emerald, zircon, quartz, silicon carbide as well as the other not so familiar gems are described in detail. A careful survey of the occurrences in India is also given. Chapter 11 on *biaxial gems* contains the minerals with orthorhomic, monoclinic and triclinic systems. The gem varieties such as chrysoberyl, jade, andalusite, sillimanite, kyanite, feldspars, pyriboles, topaz, turquoise, etc. are described in the chapter.

The final chapter (ch 12) is devoted to the gems formed by organic activities. One can learn about pearls, amber (a gem in which organisms are sometiems encased in a transparent tomb and which also was the source of inspiration to Crichton to write his novel *Jurassic Park*), corals, ivory and even some unusual gem materials.

I learnt many new facts about gems after reading this book. It is written in a easily readable style. Barring one single equation for the refractive index, the book is non-mathematical. A specialist on diamonds will definitely feel that the important books such as *Physical Properties of Diamond* by Simon and Berman, *Low Pressure Synthetic Diamond – Manufacturing and Applications* by Dischler and Wild, *Properties of Diamond* by T. E. Field, and *Precious Stones* by Bauer should have been included in the bibliography.

I have enjoyed reading this book. At the same time, the author silently conveys the feeling that we have neglected to nurture serious study and research in this important class of materials.

The Geological Society of India is to be complimented for bringing out this book. Some of the gems are studied in the M Sc Materials Science course in view of their applications in lasers and other optoelectronic devices. May be it will be a good idea to introduce in the M Sc course an elective paper on gems. I hope that a second edition of the book (with enlarged portions on synthetic gems, including the active work going on in many laboratories and universities in our country) would be published soon.

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The Freshwater Fishes of the Indian Region. K. C. Jayaram. Narendra Publishing House, Delhi 110 006, India. 1999. 551 pp. Price: Rs. 995.00.

India has a large part of its land mass surrounded by water. It boasts of a long coastline of about 7000 km and has 40 major rivers, not to mention numerous stagnant water bodies like lakes, tanks, and reservoirs. Almost all these water bodies have a variety of fish species living in them. Hence it is not surprising that a large section of the Indian population depends on fishes (both freshwater and marine) for its food and livelihood. We have as many as 2500 species of fishes of which about 930 (40% of the total!) are freshwater inhabitants.

Though there have been some studies on the classification of fishes, the first modern, scientific method for classifying fishes of the Indian region was the colossal work by Hamilton-Buchanan on the fishes of the Ganges in 1822. A number of workers in the 19th century, like J. McClelland, Col. W. Sykes, T. C. Jerdon, Blyth and Francis Day contributed to the study of fish taxonomy. Of these, Francis Day's (1875–1878) *Fishes of India* (London) and *Fauna of British India* (Vol. I and II) are very relevant and widely referred to even today.

The foundations of modern-day classification of Indian fishes were laid by the studies of these pioneers. In the 20th century, the studies on the taxonomy of fishes in India were carried on to a large extent by scientists working at the Zoological Survey of India (ZSI). One of the greatest ichthyologists of India in the 20th century was Sunder Lal Hora (1920–1955), who paved the way for a number of other scientists at the ZSI, including K. C. Jayaram to continue their studies on the ichthyofauna of the region. A number of publications have come up since the days of Hora, which deal with the taxonomy of the fishes region-wise and family-wise. With as many as 930 species belonging to about 70 families and 280 genera of freshwater fishes found in the Indian region, it would be an immense amount of work to put this information into one comprehensive book. In 1981, K. C. Jayaram first published his *Handbook on the Freshwater Fishes of India, Pakistan, Bangladesh, Burma and Sri Lanka*. It was an instant success and a welcome addition to the available literature since it was the first comprehensive and handy reference volume, which covered almost all freshwater fish fauna in this region. Talwar and Jhingran (1991) published two very good volumes on *Inland Fishes of India and Adjacent Countries* (Oxford and IBH Publishing Co Pvt Ltd, New Delhi). Subsequently, there have been changes in the classification and renaming of a number of taxa and there was a need for an update of these works.

The book under review is a timely addition to the already available publications. It caters to the needs of a wide audience, ranging from graduate and undergraduate students and also researchers who need a manual for the identification and taxonomy of fishes. Though titled as a book on freshwater fishes, it also includes a number of estuarine and brackish water species and some that migrate seasonally from the seas to upstream of rivers. In addition to being a revised version of his earlier handbook, this book has information on work done in recent years which have led to renaming and reclassification of some taxa. The arrangement of keys has been done in a very 'user friendly' manner such that one need not have too much prior experience with fish identification to be able to use it. The features used for classification are mostly external morphological ones (body shape, length, depth, presence or absence of spines, barbels, scales, colour of the species, etc.) such that tedious dissections can be avoided as far as possible. At the same time the latest classification criterion has been used in accordance with international conventions of classification of fish taxa.

For a fresh student of fish biology this book is very easy to start off with, since the author begins right from the point of how to use the keys and goes on to provide brief accounts of the method of collection of fish and their preservation after the collection. A beautiful description on how to take meristic measurements and accounts of various features of the fish specimen that can be recorded follow this. And each of these has in addition to the description very clear diagrams, which make understanding of each feature in the fish very easy. And if a student still needs help with meanings of technical terms used in ichthyology, a glossary is provided at the end of the book where each scientific term is arranged alphabetically, with explanations. Here too, at places some descriptions have been supplemented with diagrams of the features. A systematic index is provided at the very beginning of the book where all the genera described in the book have been arranged according to the conventional method of classification into superclass, class, subclass, division, order, suborder, family and genus. A total of 852 species, belonging to 272 genera in 71 families have been included in this book. Although it covers all important taxa found in the region,