In this issue

Gems and gemmology

Gems and gemstones have been known to mankind for thousands of years. The varied colours and brilliance of naturally occurring minerals made them attractive for ornamental purposes. With the evolution of advanced techniques for cutting, shaping and polishing gem materials, the gem industry has witnessed an unprecedented growth.

In India, gems have been in use for eons. They were classified under the name *Navaratnas*. These nine gems comprise diamond (*vajra*), pearl (*mukta*, *jalabindu*), ruby (*manikya*), sapphire (*nilam* or *indranil*), emerald (*marakatham*), topaz (*pushparaga*), coral (*pravala*, *vidruma* or *moonga*), cat's eye (*vaidurya*), and Jyacinth (*gomeda*) or zircon (*rahuratna*). These gems are usually set in rings, pendants and head ornaments.

Gemstones are predominantly single crystals. Their special appeal is either their colour or their shape and cut, as well as hardness. Until recent times they came from natural sources (minerals). During the last fifty years or so, most of them have been synthesized in the laboratory, with the same chemical makeup as the natural ones, or as imitation stones. However, the natural gems are highly valued compared to the synthetics. The science and techniques associated with the production of gems – both natural and synthetic – constitute a distinct discipline, namely, gemmology.

C. V. Raman had deep interest and fascination for minerals in general and for diamond in particular. Raman's famous collection of minerals (presently at the Raman Research Institute, Bangalore) contains specimens that he collected from all over the world, for the extraordinary optical phenomena they exhibited. S. Ramaseshan has noted (*Scientific Papers of C. V. Raman* edited by S. Ramaseshan, Indian Academy of Sciences, 1998, vol. IV) that 'the basic facilities had not yet been established. There was as yet no electric power and so he (Raman) had to revert to the use of his old trusted technique of using a beam of sunlight (the technique he had used to discover the Raman Effect) to explore and understand the optics of these substances. . . . He studied a variety of minerals, iridescent potassium chlorate, iridescent shells, feldspars, moonstones, fiery opals, iridescent agates, iridescent calcite, iridescent quartz jadeite, cryptocrystalline quartz, polycrystalline gypsum. . . . It is remarkable how much detailed information he could extract from this simple means of sending a beam of sunlight through the mineral. . .'.

As far as diamond is concerned, G. Venkataraman notes (*Journey into Light*, Penguin Books, 1994): 'Raman's involvement with diamond grew to such an extent that at one stage "every student working with him was engaged in studying one aspect or other of the properties of diamond". So intense was this activity that symposia devoted to diamond were held in 1944 and 1946 with participation only by Raman and his students in Bangalore! A variety of investigations were reported – X-ray diffraction, X-ray topography, birefringence, the Faraday effect, diamagnetic susceptibility, luminescence, phosphorescence, ultraviolet absorption, infrared absorption, thermal expansion, Raman scattering, Brillouin scattering, etc.'

In this issue of *Current Science*, three articles dealing with gems appear in the special section on 'Science of gems'. The article by A. Jayaraman (Carnegie Institute, Washington) provides an overview of natural and synthetic gem materials (**page 1555**). He has addressed several aspects connected with gems, namely gem cutting, their optical properties, the origin of their colours and preparation techniques used in synthetic gems of different kinds.

James E. Shigley (Geological Institute of America, GIA) has underlined the importance of gem testing methods and equipment, and the training necessary for gem identification (**page 1566**). Also he has touched on current research trends in gemmology.

Kurt Nassau (till recently of Bell Laboratories) has dealt with synthetic moissanite, a new man-made gemstone (**page 1572**). The preparation technique, structure-relevant physical properties and suitability of moissanite as a diamond substitute are discussed. He has indicated how closely moissanite resembles diamond to confuse even the trained gem expert. However its birefringence comes to the aid. Nassau has been actively involved in promoting moissanite as a high-class gem material and he is a consultant.

K. R. Rao

A worrisome survival benefit

Nearly a century ago, in a Black with severe anaemia, a Chicago physician James B. Herrick observed 'peculiar elongated sickle-shaped red corpuscles'. Seven years later, V. E. Emmel noted that red blood cells from certain apparently healthy individuals also, in oxygen-deficient conditions would change from their biconcave disc form to the sickle shape. The distorted cells are vulnerable for lysis and red cell destruction leads to anaemia. The birefringent nature of the sickle cells attracted the attention of Linus Pauling. He along with H. A. Itano demonstrated that in sickle cell anaemia the electrophoretic mobility of haemoglobin, the oxygen-carrying substance in the red blood cell, is abnormal. The specific difference in the amino acid sequence in the polypeptide chains of the sickle cell haemoglobin was soon discovered. The three-dimensional model of the haemoglobin molecule was constructed by M. F. Perutz and coworkers in the late 1960s and thus it became possible to observe the effects of amino acid substitution on molecular function. The concept of molecular disease was thus formalized.

Contemporaneous with the discovery of sickle cell anaemia, T. B. Cooley and P. Lee reported another type of anaemia with familial incidence. The patients were from the Mediterranean basin. The name 'thalassaemia' for the disease originated from the Greek word for sea. The primary feature of the disorder was identified to be a decreased rate of synthesis of one or more of haemoglobin polypeptide chains.

M. M. Wintrobe, a renowned haematologist has commented: 'The story of the growth of knowledge of the haemoglobinopathies and thalassaemia provides a fascinating picture illustrating the value of the pursuit of knowledge for its own sake. It reveals the fruits that can be gained if curiosity is aroused and an answer sought to questions that may at the time seem to be of no practical importance, as well as the progress that can be made when the right question is put to a prepared mind.'

The studies on geographic prevalence and the frequency of the abnormal haemoglobin and thalassaemia genes have led to several interesting findings. Eminent among them is the correlation of the prevalence of sickle cell trait in many tribes with endemicity of *falciparum* malaria. The coincidence is often cited as proof for Darwin's theory of natural selection. It appears that the abnormal haemoglobin genes evolved as a selective advantage; the heterozygous individuals are resistant to malaria. Paradoxically, the selective benefit is imperfect. Haemoglobin variants and quantitative disorders of haemoglobin synthesis are associated with chronic anaemia and complications, specially infections. They are indeed major public health problems in many parts of south-east Asia, including India.

R. S. Balgir outlines (**page 1536**) the distribution of the genetic abnormalities and the demands in our country.

C. C. Kartha

CURRENT SCIENCE

SUBMISSION IN ELECTRONIC FORM

Authors who have been informed of acceptance of their manuscripts may send the final version in electronic form on floppy diskette (3.5" preferred; IBM PC format only, *not* Mackintosh). The text of the manuscript only should be supplied as a plain ASCII file with no formatting other than line and paragraph breaks. (WordStar 5.5 or 7.0 and Microsoft Word for Windows 6.0 are acceptable, but ASCII is preferred.) A hard copy of the text, with all typesetting information (italics, bold, mathematical type, superscripts, subscripts, etc.) must accompany the electronic copy. Tables and figures must be supplied only as hard copy. The diskette must be labeled clearly with the following: manuscript number, file name, file information (ASCII or WordStar, version number, etc.).

Text may also be transmitted as ASCII only by e-mail to currsci@ias.ernet.in.

We expect that electronic submission will result in quicker processing for publication.