5000 Years of Gemmology

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The English term 'gemmology' did not appear until the early nineteenth century and its earliest use appears to be by John Pinkerton in his book *Petralogy* published in 1811. However, Pinkerton sounds like a very unpleasant man – he was accused of racism, forgery and bullying – and it is reassuring that the subject itself long pre-dates his involvement. Indeed, one of the earliest encouragements for young people to study gemstones can be found in the Karma Sutra, an Indian text of the 2nd century A.D., better known for the encouragement of other skills.

Gemstones had been admired, worn and traded from very early times. For example, beads and pendants of the beautiful green mineral variscite were worn in Stone Age Western Europe. The choice of gems was in theory limited by the availability of abrasives, but sand and flint will abrade or cut minerals up to and including a hardness of 7 on the Mohs' Scale, and both are abundant.

Gem knowledge was limited to that required to buy, trade and sell gems profitably and fairly, and gems were mainly judged on colour and, when used in gold or silver jewellery, were used as blocks of colour. So while lapis lazuli was highly prized in ancient Egypt – and was being brought there by trade as early as 3000 B.C. - the famous jewellery buried with the Pharaoh Tutankhamun (who died in about 1340 B.C.) contained as much dark blue glass as real lapis lazuli. Distinguishing between gems of similar colour was only important when there was a significant difference in value. The problem is that we have very little evidence about values in ancient times.

In the West, things seem to have changed about the time Alexander the Great conquered what had until then been the Persian Empire. This opened up trade, and gem materials new to European jewellery, such as pearl, emerald and garnet, began to be available.

The period of Alexander the Great, around 330 B.C., is also the period from which we begin to find information about the ancients' scientific understanding of gems. How much this is due to the inquisitiveness and enthusiasm of Greeks, such as Theophrastus who made the first known reference to the phenomenon of pyroelectricity in tourmaline, and how much to earlier Egyptian and Persian knowledge that now fell into Greek hands, is uncertain. But the science was there and knowledge was increasing. The Roman writer Pliny the Elder (died A.D. 79), for example, wrote a considerable amount about gemstones and in many ways set the standard for later works. For example, he recognised the importance of crystal shape, a precursor to modern crystallography, described the hardness of diamond and the relative softness of peridot, and explained how to distinguish true gems from their glass imitations.

Fig. 1 The Roman author Pliny described the shape of a diamond crystal. This late Roman ring (about A.D. 275) contains a piece of rock crystal cut to imitate a diamond crystal.

Following the fall of the Roman Empire in the 4th and 5th centuries A.D., gemmological knowledge in the West became little more than increasingly garbled repeats of what Pliny and other Romans had said. However, after the rise of Islam in the 7th century A.D., Arab scientists studied and built on Greek, Roman and other ancient texts. It is among Arab writers that we find some of the oldest surviving observations and explanations that matured in our understanding of the physical and optical properties of gems. They considered such things as the laws of refraction, dispersion and specific gravity; Al-Biruni listed the specific gravity of several gems with remarkable accuracy. The earliest known description of magnification, such a vital part of gemmology, can be found in Ibn al-Haytham's Book of Optics (11th century A.D.).

By the twelfth century in Europe, there was increasing contact with the Arab world, increasing trade in eastern gem products and a corresponding rebirth of scientific interest. Arab texts were translated into Latin, such as Ibn al-Haytham's Book of Optics, with the result that within a few generations in Europe we have descriptions of magnifying glasses and spectacles, and the latter begin to appear in painted portraits.

Further East, Indian scholars were also considering scientific aspects of gemmology, describing hardness and colour. One fourteenth-century Indian scholar, Pheru, explains that good gemmologists "are well versed in the theory and practice and are experienced." However, "Those who fix a high price for an inferior gem or a low price for a superior gem, due to arrogance or avarice, will become lepers."

With the worldwide political changes in the fifteenth and sixteenth centuries, including the conquests of Genghis Khan, the Arab conquest of northern India, the European discovery of America, and the European discovery of the sea route to the Indian Ocean and the east, there was a huge growth in the assimilation, absorption and dissemination of global knowledge.

In seventeenth century Europe, Sir Isaac Newton described refraction and double refraction and Sir Francis Bacon wished that microscopes could be developed that would allow examination of the 'irregularities of gems'. However, these were scientists; those buying and selling gems were still reliant on their own and the trade's experience, and there is little evidence that they concerned themselves much with the science. Good experience with colour was essential, but when tests were needed, hardness was a very important determinator. Thus yellow sapphire could be distinguished from the less valuable yellow topaz on the basis of its hardness. Hardness was also the most usual test for a diamond.

Scientists were interested in gemmology for the sake of science; jewellers and gem dealers were only interested in gemmology to the extent that it affected their profits. Distinguishing yellow sapphire from yellow topaz was important because there was a big difference in price. Distinguishing a pale ruby from a pink topaz was unimportant because there was little monetary difference between them. However, through the eighteenth and nineteenth centuries there were new gem sources being discovered, better gem imitations being developed, and a growing middle class who wished to buy jewellery. Even experienced jewellers were caught out. As John Mawe (1764 – 1829) said: "It is only, therefore, by a careful comparative examination of Gems, that the Jeweller, or the Amateur, can be certain of their genuineness; and, considering the value of these substances individually, and the vast sums that are vested in them collectively, it is really surprising to observe the gross mistakes committed in this respect, by those, who from interest, and from a familiar acquaintance with them, ought to be the least likely to fall into error. Not only one Species is both bought and sold for another, as Tourmaline for Emerald, Garnet for Ruby, Aquamarine for Topaz; but the fraudulent compositions of itinerant dealers, such as Doublets, Pastes, &c. too frequently pass current for the genuine produce of the Mine."

Luckily equipment was improving and becoming more widely available, such as the microscope, refractometer and spectrometer. For example, in 1834 Sir David Brewster wrote what is probably the earliest scientific description of the internal characteristics of gemstones as seen through a microscope. Brewster also explained the advantages of immersion when studying gems with a microscope. In addition, there was now the small but useful dichroscope, which, as the great gemmologist Max Bauer said, "should be in the hand of every one who buys or sells precious stones".

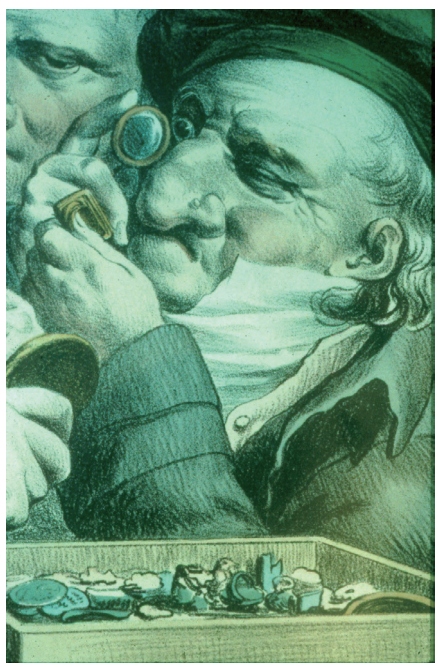

Fig. 2 The use of magnification was unusual in the gem and jewellery trade before the 18th century - when this satirical print was produced.

By the early twentieth century, there were standard textbooks on gemmology – including Max Bauer's *Precious Stones*

and Herbert Smith's *Gem Stones* – and new, advanced but relatively inexpensive equipment - such as Herbert Smith's little refractometer introduced in 1905. There were also new 'threats' to the established jewellery industry including synthetic rubies and Japanese cultured pearls. When the British retail jewellers discussed the increasing amount of knowledge required by the trade in general, and the problems of synthetic rubies in particular, there was really only one answer: gemmological courses and qualifications. Once this had been agreed, a 'scientific' gemmologist was needed to provide advice and who better to turn to than Herbert Smith, then curator at the British Museum of Natural History. The meeting at which the National Association of Goldsmiths (the British trade association for retail jewellers) decided to set up a Gemmological Committee to develop gemmological courses and qualifications took place one hundred years ago in 1908. The Gemmological Committee eventually matured into the Gemmological Association (Gem-A), and the qualification became the Gemmological Diploma, the graduates of which have been eligible for election to Fellowship of the Gemmological Association – FGA – since 1931.

Fig. 3 Advertisement for the Herbert Smith refractometer. Introduced in 1905, this piece of equipment made the refractometer more available to the gem industry.

So Gem-A's celebration of One Hundred Years of Gemmological Education this year looks back to that historic establishment of gem courses, which, in turn, derive from thousands of years of global gem experience, examination and enthusiasm. 2008 also saw the re-introduction of the Herbert Smith Lecture, in memory of one of the great founding fathers of gemmology for the jewellery industry. This 2008 Herbert Smith lecture was held in Hong Kong as a mark of respect to the region that has played such a prominent part in the more recent history of Gem-A's educational development.

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