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THE KOH-I-NOOR DIAMOND AND ITS GLASS REPLICA AT THE CRYSTAL PALACE EXHIBITION

DENA K. TARSHIS

A SHOWCASE of modern technological and scientific advancements, the Great Exhibition of the Works of Industry of All Nations (also known as the "Great National Exhibition") opened in London on May 1, 1851. Twenty-six acres in Hyde Park were devoted to about 100,000 displays of natural history, industry, and decorative arts (both handcrafted and manufactured). The host nation claimed half of that space for its use. Already recognized by mid-century as the world's political superpower, England was enjoying unprecedented prosperity, and it now wanted to seize this opportunity to establish itself as "the workshop to the world." The enthusiastic involvement of Prince Albert in all stages of planning, as well as the sponsorship of the Royal Society of the Arts, indicates the significance of the event.

About a quarter of a million people flocked to the exposition on opening day alone, and the total number of visitors reached six million by October 11, 1851. For one shilling, a visitor could see such diverse items as Gould's collection of mounted hummingbirds, Colt's repeating pistol, artificial limbs, McCormick's reaper, and the Koh-i-Noor diamond, the newest addition to the British crown jewels (Fig. 1). Queen Victoria had worn this gem to the opening ceremonies, and later she allowed it to be displayed at the exhibition.

But many of the most enduring images the spectators carried home with them were of extraordinary examples of glassmaking. The building in which the displays were housed was itself a de facto exhibit, and it became the exposition's trademark. The commission to select an architect for this project had rejected 233 plans before choosing the unsolicited submission of Joseph Paxton (1801–1865). Drawing on his experience in planning the conservatory at Chatsworth for the duke of Devonshire, Paxton designed a glass and iron structure, the first ever on such a large scale (1,850 by 408 feet, or 564 by 124 meters). It was prefabricated and then assembled at its Hyde Park site—all in seven months!

That such a fragile material as glass could be used as the predominant element in the construction of a building of such magnitude (its 294,000 panes enclosed 99,000 square feet—almost 23 acres—of floor space) was mind-boggling. In fact, the astronomer royal had asserted that it could not stand. Paxton's design and its execution perfectly embodied the spirit of the Industrial Revolution that the exhibition celebrated. The glittering glass hall was dubbed the "Crystal Palace" by *Punch*,[1] and to this day

1. Douglas Jerrold in *Punch*, v. 19, November 2, 1850, p. 183.

FIG. 1. *Country visitors to the Crystal Palace Exhibition, after a collotype. (Center for Biomedical Communications)*

the 1851 international trade fair is commonly referred to as the "Crystal Palace Exhibition" (Fig. 2).

The northern central gallery of the Crystal Palace was devoted to Section III, Class 24, of the exposition: glassworks. The sixth of the seven subdivisions within this class was "flint glass, or crystal,"[2] and it seemed to dominate the gallery. One of its most notable exhibits was the 27-foot-high "Great Crystal Fountain," fashioned from four tons of pure glass by F. & C. Osler of Birmingham. But the real "gem" of the glass exhibit was to be found adjacent to Osler's fountain, in the display of Apsley Pellatt & Co. of the Falcon Glass Works.[3]

By mid-century, Apsley Pellatt (1791–1863) was already a name to be reckoned with in the world of glass (Fig. 3). In 1819, he had been awarded a patent (no. 4424) for "crystallo ceramie," his refinement of the 18th-century Bohemian technique of cameo encrustation.[4] Twelve years later, he was granted a second patent (no. 6091), in two parts, for his methods of pressing glass and enclosing sulphides in glass. In the

2. *Exhibition M.D.CCC.LI. Official Catalogue Presented by Her Majesty's Commissioners for the Exhibition M.D.CCC.LI. to William Cotton, Esquire*, London: William Clowes and Sons, 1851, p. 697. The seven subdivisions were as follows: (a) window glass, including sheet glass, crown glass, and colored sheet glass; (b) painted and other kinds of ornamental window glass; (c) cast plate glass; (d) bottle glass; (e) glass for chemical and philosophical apparatus; (f) flint glass, or crystal, with or without lead, white, colored, and ornamental for table vases, etc.; and (g) optical glass, flint and crown.

3. The Falcon Glass Works had components at several locations in London: Holland Street, Blackfriars; 58 Baker Street; and Portman Square.

4. Pellatt expounded on his process in *Memoir on the Origin, Progress, and Improvement of Glass Manufactures: Including an Account of the Patent Crystallo Ceramie, or Glass Incrustations*, London: B. J. Haldsworth, 1821.

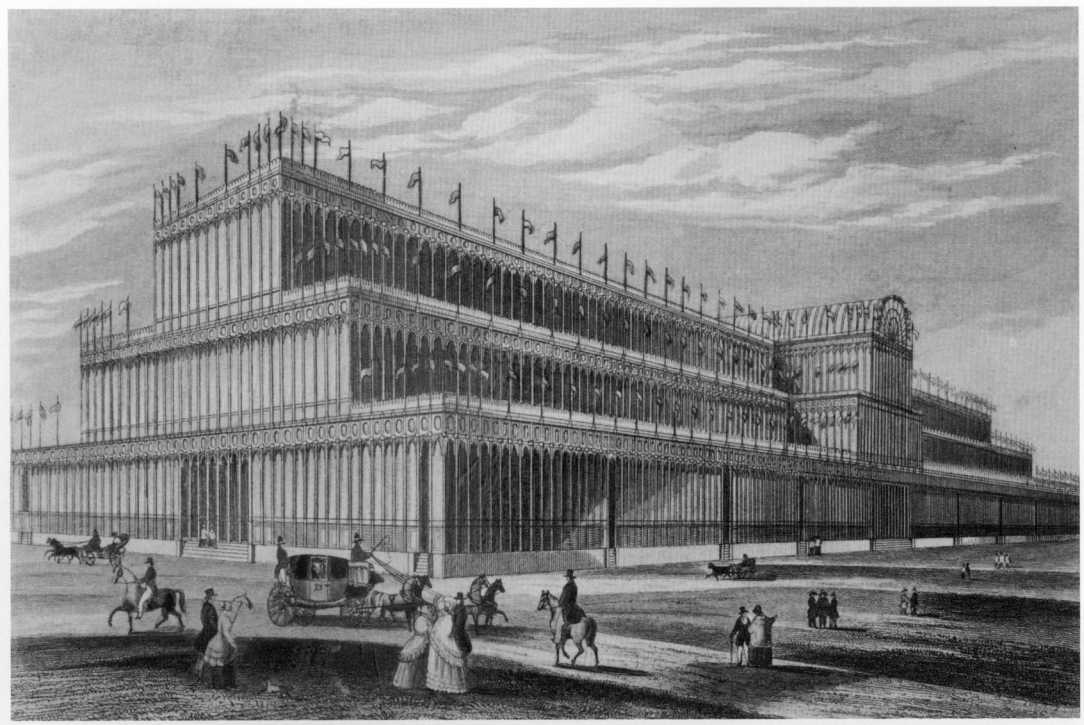

FIG. 2. *The Crystal Palace, Hyde Park, 1851. Collection of the Juliette K. and Leonard S. Rakow Research Library of The Corning Museum of Glass.*

decade preceding the Crystal Palace Exhibition, Pellatt and his brother Frederick (1807–1874) were jointly awarded a patent (no. 10669) for their architectural glass applications, which dealt with casting, colored designs on sheets, skylights, and roofing. Apsley Pellatt's reputation was further enhanced by the publication in 1849 of his *Curiosities of Glass Making: Details of the Process and Production of Ancient and Modern Ornamental Glass Manufacture*.[5] Moreover, his great interest in the chemistry of glass had led to an exchange of letters with the Frenchman Aimé Gabriel d'Artigues and their subsequent formation of a circle of correspondents who were studying that subject.

Pellatt was also an astute businessman. He had been a middleman in the marketing of Wedgwood ceramics, amassing in the process a fine personal collection of works by Josiah Wedgwood (1730–1795) and by the Wedgwood and Bentley partnership. In addition, he had wisely placed advertisements for his Falcon Glass Works (Fig. 4) products, in the form of an abridged illustrated price list, in the serial edition of Charles Dickens's *Nicholas Nickleby*.[6] And when, after considerable controversy, the Glass Excise Tax was lifted in 1845, we can assume that Apsley Pellatt would have been ready to take full advantage of the change. The tax had been based on the weight of the glass, and Pellatt was an expert in the creation, decoration, and marketing of lead crystal, a heavy glass. Apparently his technical abilities were equaled by his confidence in them, for in 1847 he declared that "if any British engraver of ad-

5. This book was published in London by David Bogue.

6. Published in London by Chapman and Hall, part 8, November 1838. See Hugh Wakefield, *Nineteenth Century British Glass*, London: Faber & Faber, 1982, p. 33.

FIG. 3. *Apsley Pellatt IV.*

equate skills should propose to make an exact copy of the Portland vase in glass, this firm [the Falcon Glass Works] would undertake the manufacture of the vessel."[7]

According to Pellatt's own illustrated catalog of his displays[8] and the official catalogs of the Crystal Palace Exhibition,[9] his wares on display there included chandeliers, candelabra, dessert services, Anglo-Venetian gilded and frosted glass, engraved vases, medical glass, cameo encrustations, porcelain, and flint glass. These catalogs also showed that the works of Pellatt, Osler, and the other English glass exhibitors—such as Bacchus, Harris Rice & Co. of Birmingham, and the Stourbridge firms of Davis, Greathead & Green and W. H. P. Richardson & Co.—reflected the prevailing artistic tendencies of that time. Ironically, as England was harnessing the energy of coal and steam to fuel its headlong rush into the modern technological age (a transformation clearly mirrored in the Crystal Palace itself), practitioners of the decorative arts were using these same newly mastered powers to create icons to the past. The "Victorian style" was, to a large degree, an unabashed homage to the cultures of ancient Greece, Rome, and even Egypt, and to the exotic but "backward" Orient. The archeological discoveries of the late 18th and early 19th centuries, as well as an expanding trade with the

7. W. Mankowitz, *The Portland Vase and the Wedgwood Copies*, London: A. Deutsch, 1952, pp. 46–47; Paul Jokelson and Dena K. Tarshis, *Cameo Incrustation: The Great Sulphide Show*, Corning, New York: The Corning Museum of Glass, and Santa Cruz, California: Paperweight Press, 1988, p. 2. The ancient Portland Vase, now housed in the British Museum, was purchased by the duke of Portland in 1786 for 1,800 guineas. The celebrity of the vase had already inspired the eminent gem engraver Giovanni Pichler (1734–1791) to take a plaster of Paris mold of the vase at Rome. That perfect mold enabled James Tassie (1735–1799) to make 60 plaster and gum casts of the vase (see Kenneth Painter and David Whitehouse, "The History of the Portland Vase," *Journal of Glass Studies*, v. 32, 1990, pp. 38–40). Josiah Wedgwood thought there would also be a market in England for quality ceramic copies. Pellatt attempted to secure sole rights to the production and marketing of these replicas. The Bohemian Franz Zach and the Englishmen John Northwood and Joseph Locke also made glass replicas of this vase.

8. Apsley Pellatt & Co., *Explanatory Catalogue of Models & Specimens Illustrative of the Manufacture of Flint Glass Contributed to the Great Exhibition of All Nations*, London, 1851.

9. *Exhibition M.D.CCC.LI. Official Catalogue* [note 2], pp. 695–696. The standard account of the exhibition is *Great Exhibition, 1851: Official Descriptive and Illustrated Catalogue*, 3 vv. and supplementary v., London, 1851. For other descriptions, see *Great Exhibition, 1851: Official Catalogue*, 1-v. edition, London, 1851; *Great Exhibition, 1851: Popular Guide*, London, 1851; *Great Exhibition, 1851: Reports of the Commissioners*, London, 1852; R. Hunt, *Hunt's Hand-Book to the Official Catalogues . . . of the Great Exhibition*, 2 vv., London, 1851; J. Timbs, *The Year Book of Facts. Extra Volumes: The Great Exhibition of 1851*, London, 1851; C. R. Fay, *The Great Exhibition of 1851*, Cambridge, 1951 (which offers an economic study of the exhibition); Y. Ffrench, *The Great Exhibition 1851*, London, 1950; and Dickenson Brothers, *Dickenson's Comprehensive Pictures of the Great Exhibition from the Originals Painted for H.R.H. Prince Albert*, 2 vv., London, 1854 (which contains 55 colored lithographs after the original paintings housed at Windsor Castle).

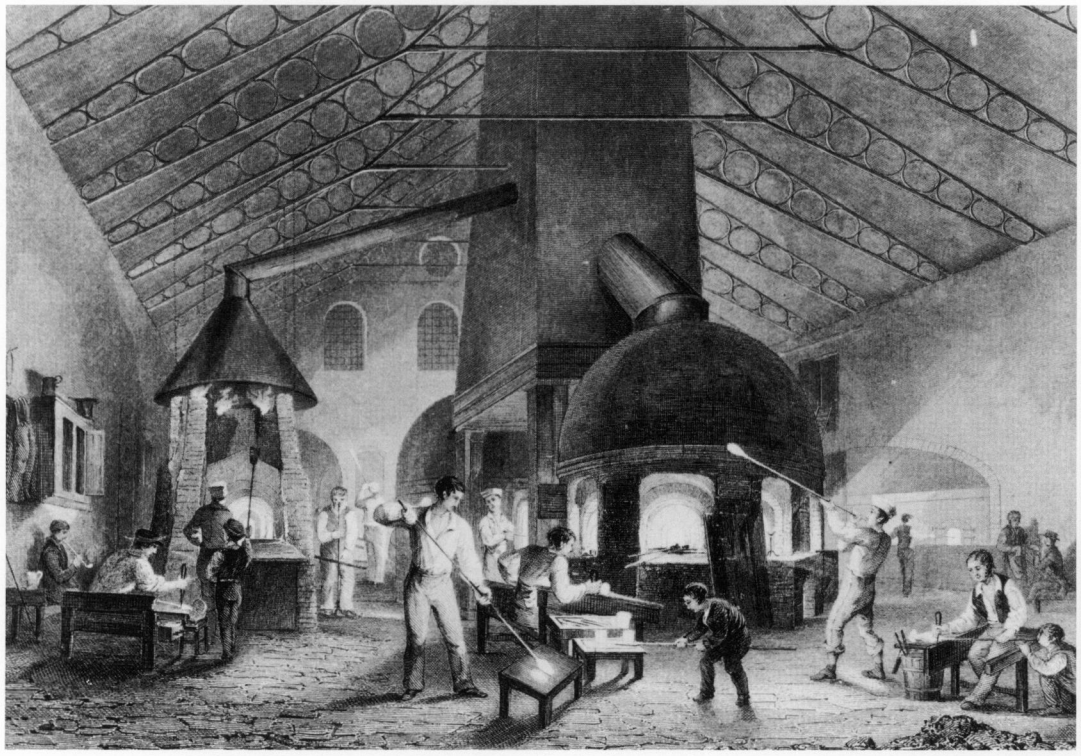

FIG. 4. *Interior of the Falcon Glass House, Holland Street, Blackfriars. (Center for Biomedical Communications)*

Far East, provided a repertory of images for this "new" esthetic.[10] Pellatt's own *Curiosities of Glass Making* and his stature in his field went a long way toward establishing revivalism as the leitmotif of the glass industry, which was very much in evidence at the Crystal Palace Exhibition.

The seeming dichotomy in the impulses of the age actually merged perfectly in two of the star displays at the exposition: Queen Victoria's Koh-i-Noor diamond (Fig. 5) and Apsley Pellatt's flint glass replica of it.

The history of the Koh-i-Noor diamond is largely conjectural. Some have contended that it was discovered about 3000 B.C.,[11] and that it was used as the third eye of a statue of Shiva (with its attendant curse on any but a woman or a goddess who dared to wear it). Others have suggested that it is the remarkable diamond from the Kollur mine of the Krishna River that was presented to the Mogul emperor Shah Jahan in 1656, or a cutting from the Great Mogul diamond that was described by the noted French jewel trader Jean-Baptiste Tavernier in 1665 as part of the Imperial Cabinet of Delhi.

The diamond is generally believed to have been among the valuables seized by Nadir Shah when he conquered Delhi in 1739. In fact, Nadir Shah is credited with naming it "Koh-i-Noor" (Mountain of Light). Most histories also

10. This esthetic was legitimized by Thomas Hope (1769–1831), an arbiter elegantiae of early 19th-century England, in his *Household Furniture and Interior Decoration* (1807).

11. Jack Ogden, an expert on ancient jewelry, asserts that the diamond is of relatively recent origin. See his *Jewellery of the Ancient World*, New York: Trefoil Books Ltd., reprinted by Rizzoli, 1982, p. 95.

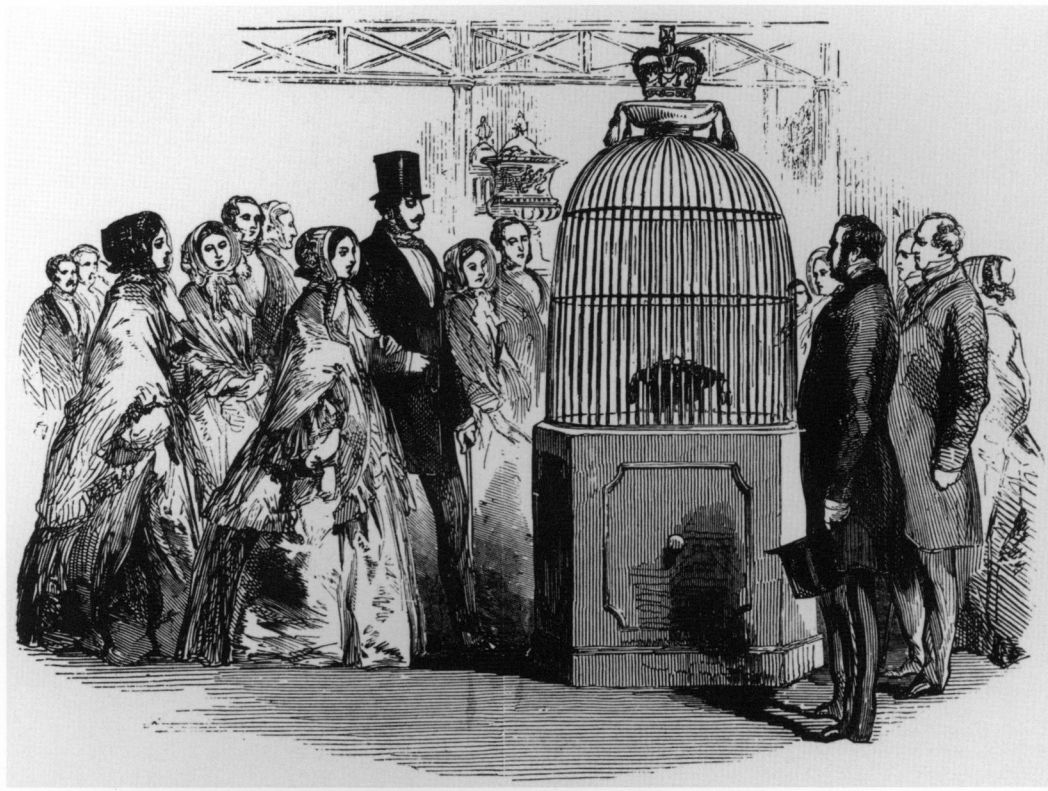

FIG. 5. *Queen Victoria and Prince Albert inspecting the Koh-i-Noor diamond exhibit, after a collotype. (Center for Biomedical Communications)*

number Ranjit Singh (1780–1839), the so-called Lion of the Punjab and founder of the Sikh kingdom, among its owners. When the British annexed the Punjab in 1849, deposing his young son Dhulip Singh (1837–1893), the British East India Company, as the de facto civil authority, came to own the Koh-i-Noor diamond. In commemoration of its 250th anniversary, the company decided to present the magnificent gem to Queen Victoria. Dispatched to Bombay and then, on April 6, 1850, to Portsmouth on H.M.S. *Medea*, the diamond was finally delivered to the queen on July 3, 1850.

At the 1851 exhibition, the Koh-i-Noor was displayed in the southern central gallery of the Crystal Palace (in Class 23, "Works in Precious Metals, Jewellery, Etc."). It was housed in a Cinquecento-style jewel case that had been specially designed for it by L. Gruner. The 186-1/16-carat gemstone was in its original irregular rosette Indian cut, which had probably been executed around 1530. This featured numerous facets below a broad-cleavage surface, with a second, smaller-cleavage surface on one side (Fig. 6). In addition to its weight, its most notable attributes were its flawlessness and color. A sea of spectators was attracted by the diamond's antiquity, its sanguinary and romantically murky Far Eastern provenance, and its value as tangible proof of Britain's wealth and ever-expanding control of the Indian subcontinent (Fig. 7).

Even at this time, Queen Victoria and Prince Albert were aware that the crude cutting of the diamond probably suppressed rather than enhanced its brilliance. Moreover, several little

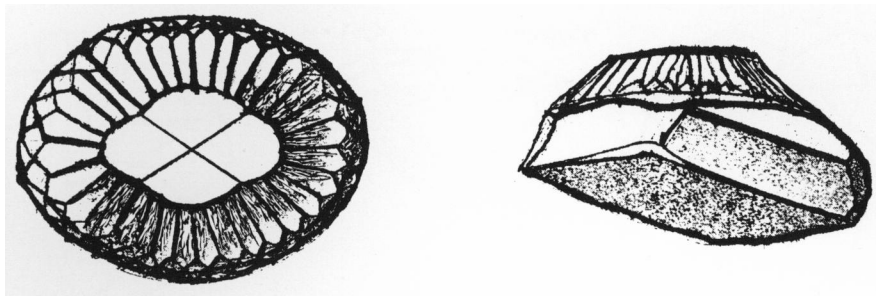

FIG. 6. *The Koh-i-Noor diamond, Hindu cut. (Rendering by Dr. Julius Tarshis)*

FIG. 7. *Viewing the Koh-i-Noor diamond, a cartoon by the proprietors of* Punch. *(Center for Biomedical Communications)*

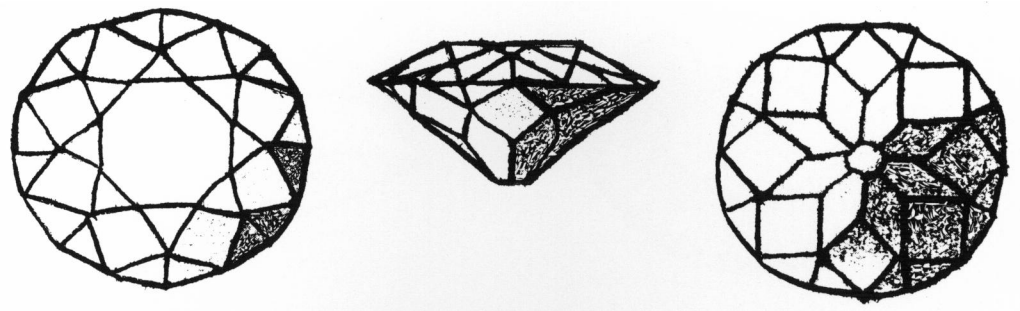

FIG. 8. *Later (1852) recutting of the Koh-i-Noor diamond, 106 1/16 carats. (Rendering by Dr. Julius Tarshis)*

"clarity characteristics"[12] were observed in the gem—as is common in large diamonds—and experts thought its color could be improved.[13] So, on the advice of Sir David Brewster (1781–1861), a Scottish physicist and expert in optics, Victoria and Albert ordered that the stone be recut in 1852. Under the egis of the firm of Robert Garrard of London, the crown jewelers, the expert diamond cutter Mr. Voorsanger and his colleague Mr. Fedder, both of the Coster firm in Amsterdam, reshaped the diamond into a regularly cut brilliant with 58 facets. In the shaping of a gem, the potential improvement in luster must be balanced against the loss of carat weight. The recutting of the Koh-i-Noor, which took more than 450 hours, reduced the diamond's weight by 80 carats—to 106 1/16 carats (Fig. 8).

Commentators were virtually unanimous, however, in their praise of Apsley Pellatt's flint glass replica of the original Koh-i-Noor. Pellatt's "diamond," which was faceted exactly like the gem then on display, also rivaled it in brilliancy (Fig. 9). George Virtue, author of several contemporaneous reports of the Crystal Palace Exhibition, lauded the flint glass jewel,[14] and another writer went even further, asserting that if Pellatt's replica "had been placed on the velvet cushion, surrounded by an iron railing and attended by a reverential policeman, it would have received a much larger meed of public wonder and approbation than the real eastern gem."[15]

Judging from the domed box that was specially made for Pellatt's flint glass "diamond," this replica was treated almost as royally as the queen's jewel itself. The exterior of the box (Fig. 10) displayed, in gilding, the exhibition's circular registration code.[16] Inside was a white satin-lined lid, with the name "Apsley Pellatt & Co., London" encircling the royal coat of arms at the center.[17] Since the queen's arms could not be used without her permission, their presence on the interior of the lid indicates that

12. This term is used by the Gemological Institute of America.

13. For a history of the diamond authorized by Queen Victoria, see Edwin W. Streeter, *The Great Diamonds of the World: Their History and Romance*, London: George Bell & Sons, 1882, facsimile reprint by Gryphon Books, 1971, pp. 131–133.

14. George Virtue, *The Crystal Palace Exhibition Illustrated Catalogue, London 1851. An Unabridged Republication of the Art-Journal Special Issue. With a New Introduction by John Gloat, F.A.S.*, New York: Dover, 1970.

15. John Tallis, *History and Description of the Crystal Palace*, London: John Tallis & Co., 1851, v. 1, p. 81.

16. The registration code reads (clockwise from top): "III [Class III], PL [1851], 4 [day of month], 3 [parcel number, of group 3, registration of design], 1 [July]." I am grateful to Christina Prescott-Walker and Kevin L. Tierney of Sotheby's, New York, for their assistance in this identification.

17. For a description of the royal coat of arms, see Peter Townsend, ed., *Burke's Peerage*, 103rd ed., London: Burke's Peerage Ltd., 1963, p. xxxviii.

FIG. 9. *Glass replica of the Koh-i-Noor diamond. (Photo: Nicholas L. Williams)*

FIG. 10. *Exterior of fitted case with English registry marks. (Photo: Nicholas L. Williams)*

Pellatt must have had royal permission to duplicate the Koh-i-Noor. The glass replica rested in the fitted blue-velvet-lined body of the box (Fig. 11).

Although the degree of Apsley Pellatt's success in duplicating a diamond may have been unprecedented, the use of glass in creating *faux*

FIG. 11. *Glass Koh-i-Noor in its fitted case, revealing the royal coat of arms and the manufacturer's name. (Photo: Nicholas L. Williams)*

jewels had a very long history indeed. Pliny the Elder, for example, alludes in numerous passages to the existence of imitations of precious stones made either by staining rock crystal or by using colored glass.[18] The Romans also learned to make and manipulate glass for similar purposes, and as the centuries passed, the art continued to be refined. The concurrent refinement of lapidary skills, especially in Europe, resulted in ever more sophisticated *faux* gems.

18. E.g., *Historia naturalis* 37.79, 98, 112, 117, 128, and 196.

Among English glassmakers, George Ravenscroft (1618–1681) might be considered the rock upon which Pellatt built. Ravenscroft, who had received a patent in March 1674 for a "crystalline glass resembling rock crystal," had set the standard for the British glass industry of his time. Experts conjecture that the "recipe" for his patented heavy glass combined roasted and crushed flints, red lead oxide, tartar, borax, and saltpeter.[19] The lead oxide was used as an additive to the fluxing element. Not only was Ravenscroft's flint glass more durable than Venetian glass, but it was also composed of raw materials native to England.

In duplicating a diamond, flint glass was the material of choice. Although it is only half as hard as a diamond, flint glass is noted for its lucidity. In addition, while many precious stones are doubly refracting, diamonds—like glass—are singly refracting and not dichroic. When light rays strike a singly refracting crystal, whether natural or synthetic, they are intensified. The lapidary's careful cutting and faceting of such crystals capitalizes on that property to produce the characteristic brilliance for which the diamond is so highly prized.

Nevertheless, in order to replicate a gemstone, the glassmaker has to deal with four classes of flaws to which glass is prone: (1) batch stones (e.g., unmelted grains of quartz), refractory stones (bits of material broken away from the walls of the tanks or pots in which the glass is produced), and devitrification stones (crystals formed when the glass is held at an elevated temperature for a prolonged period); (2) bubbles and "seeds" (very small, almost imperceptible bubbles); (3) chemical inhomogeneity (visible as cords or "waviness"); and (4) inclusions (stray bits of foreign material).[20] In addition, a conchoidal fracture is commonly present at the edge of the girdle of faceted glass. Moreover, flint glass, despite its wonderful translucence, is not—at least in Ravenscroft's formulation—colorless. As long as traces of iron are present, the glass would have had a greenish tinge, unless it was decolorized.

Apsley Pellatt's formula for "highly pellucid and transparent flint glass," presented in his *Curiosities of Glass Making*,[21] offered a solution to this problem:

carbonate of potash	1 cwt[22]
red lead or Litharge	2 cwt
sand washed and "burnt"	3 cwt
saltpeter	14 to 28 lbs.
oxide of manganese	4 to 12 oz.

Ravenscroft, of course, had known that the large proportion of lead oxide increased the density and brilliancy of the glass, but as Pellatt explained in his illustrated catalog for the 1851 exhibition, manganese oxide proved to be the golden key.[23] It holds a great quantity of oxygen, which may be slowly released during fusion to prevent the deoxidation of the other materials. The result is colorless glass. But the quality and careful treatment of the other raw materials were also essential to the glassmaker's success. For example, a very important consideration was the purity of the sand that was added to the semimolten mixture to improve its ductility. The best British sand came from Alum Bay on the Isle of Wight or from Aylesbury in Buckinghamshire. Before it was used, it had to be washed and carefully dried to keep it free from carbonaceous matter, which could taint the finished product.[24] An inferior glass could also result if a poorly constructed

19. Hugh Tait, *Five Thousand Years of Glass*, London: British Museum, 1995, pp. 182–184.

20. I wish to thank Dr. Robert H. Brill, research scientist at The Corning Museum of Glass, for his help in describing these flaws in glass.

21. Page 34.

22. "Cwt" is the abbreviation for hundredweight, a unit of avoirdupois weight equivalent to 100 pounds in the United States and 112 pounds in England.

23. Apsley Pellatt & Co. [note 8].

24. *Exhibition M.D.CCC.LI. Official Catalogue* [note 2], p. 702.

furnace or insufficient fuel delivered inconstant heat during the glassmaking process. As Pellatt so aptly demonstrated at the Crystal Palace Exhibition, he and the other English glassmakers conquered all of these difficulties to produce flint glass of exceptional quality.

The Koh-i-Noor diamond is of the caliber of the Orloff diamond (known since the early 18th century) and the Cullinan I diamond (discovered in 1905), and, like them, it deserves its place as a crown jewel. Perhaps Apsley Pellatt's replica could be termed the crown jewel of the British glass industry. Moreover, as a specimen of the purest and most beautifully cut flint glass, it affords an excellent opportunity to observe the different properties of glass and diamonds. Like the Koh-i-Noor diamond, the flint glass replica was completely colorless. Due to its excellent cutting, it also acted as a prism, in a manner that rivaled the gem itself. However, the glass version was deficient in specific gravity, and it could not quite match the wondrous power of radiating light possessed by the real Koh-i-Noor, a diamond that was said to have a commercial value equal to half of Britain's national budget at the time of the Crystal Palace Exhibition.

The Koh-i-Noor diamond and Apsley Pellatt's flint glass replica offer a microcosmic picture of England in 1851: its romance with antiquity, pride in its prosperity and burgeoning political power, and faith in the Industrial Revolution to make the nation "the workshop to the world." Probably none of us can fully grasp the excitement generated by the Crystal Palace Exhibition, but by better understanding the obstacles that Pellatt overcame in producing his flint glass gem, we can perhaps begin to sense the pervasive ambition and energy of his times. That his "diamond" still evokes wonder in this cynical age may, finally, be the best measure of his success.[25]

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25. Pellatt's replica of the Koh-i-Noor diamond is on loan to The Corning Museum of Glass.