TREATMENT OF AN IVORY-INLAID ANGLO-INDIAN DESK BOOKCASE

By John M. Driggers, Robert D. Mussey, and Suzanne M. Garvin*

At the end of a long narrow exhibit hall at The Peabody Museum stands an impressive Anglo-Indian desk bookcase. Inlaid ivory vines of flowers and leaves flow up and around the dark wood object. The contrast between the ivory inlay and ebony ground heightens the drama. However, when the piece recently arrived from England, the contrast was not nearly so obvious. It was so covered in grime and surface accretions that it was difficult to tell the ivory from the ebony.

Clearly, the most apparent conservation problem was to restore the ivory to its former near-white mellowness. Each of the hundreds of tiny pieces was old, fragile, and porous, and all were delicately engraved. Moreover, it would be necessary to treat each piece individually without damaging the surrounding wood surface, whose finish was in good, though dirty, condition.

Remembering the dictum "Leave alone what you don't understand," we began immediately to study the materials and the problems they presented. An extensive literature survey convinced us that although ivory is a material "foreign" to us as furniture conservators, it is similar to wood in many respects. Not wanting to trust the written word entirely, we consulted several colleagues familiar with the materials, and they not only provided some important practical information but also confirmed and reinforced much of what we had already learned. Simultaneously we conducted our own solvent tests and preliminary cleaning trials. All that we learned not only added to our own knowledge, but also convinced us that we could successfully treat the problems presented by the non-wood materials in this Anglo-Indian desk bookcase.

An Incomplete History of Anglo-Indian Furniture

The history of Anglo-Indian furniture may be the briefest of all regional histories, as little has been published. The paucity of information is remarkable when one considers the over 200-year period of the Anglo-Indian furniture-making enterprise and the amount of furniture produced. Because of this limitation, previous writers on the subject have drawn parallels between the Anglo-Indian textile trade and the Anglo-Chinese furniture trade, both of which are well-documented. And, in fact, all three of these trades were established by the same company, the British East India Company.

Chartered in 1600 by Queen Elizabeth and later rechartered and strengthened by Cromwell in 1657, the British East India Company established a powerful presence on the east coast of India. Headquartered in Calcutta, the primary goal of the company was to make money for its shareholders, which it did throught the sale of raw materials and manufactured goods. In a document dating from about 1700, it is recorded that several artificers were sent out by the East India Company with" great quantities of English patterns to teach the Indians how to manufacture goods to make them vendible in England and the rest of the European markets. After which began the great trade in manufactured goods from the Indies" (Jourdain and Jenyes, 1950, p. 19).

By 1700 the furniture trade was thriving, as evidenced by complaints of the English joiners that" several merchants and others who have procured to be made in London of late years have sent over to the East Indies patterns and models of all forms of cabinet goods and have yearly returned from thence... quantities of cabinet wares, manufactured after the English fashion" (Jourdain & Jenyes, p.20). So great was the volume of this export that the Joiner's Company petitioned against it, maintaining that their trade was "…in great danger of being ruined" (Jourdain and Jenyes, p.20).

*Furniture Conservators, Robert Mussey, Inc., 1415 Hyde Park Avenue, Boston, MA 02138

Perhaps the joiners were engaging in some self-serving exaggeration, but it is true that many craftsmen who could not make a living in England signed up with the East India Company. After their employment contracts expired, several opened their own businesses in India, hiring and training Indian craftsmen. Native furniture makers were most often drawn from the carpenter caste. Known as the "Vadrangis," they imitated the models sent from Europe "with the most exact and servile fidelity" (Gurujal, 1991).

The area around the city ofVishakapatnam in Andra-Pradesh (on the central eastern coast of India) appears to have been a source of some of the finer ivory-inlaid furniture made in the 18th century (Gurujal, 1991; Forbes, 1990). In 1741, a contemporary list of imports from this area listed three "Escritoires of Ebony inlaid with Ivory" for £6, a price that must have made English joiners shiver (Symonds, 1934, p. 116).

One question certain to be asked about a particular Anglo-Indian object is whether it was made by British or Indian craftsmen. Unfortunately, not much light has been shed on this topic, except that Symonds comments while describing an ivory-inlaid bureau that, "The linings and bottoms of the drawers of this piece are fixed with pegs, a typical feature of Indian craftsmen" (Symonds, 1934, p.117).

Description of the Anglo-Indian Desk Bookcase

If Symonds is correct, then a skilled Indian craftsman may have crafted the Peabody Museum piece. Not only are the drawer bottoms pegged with small wooden pegs, but all of the moldings and veneers are joined to the case with pegs. The only nails on the entire piece hold the base molding to the lower case. Other than the use of pegs, the rest of the case is typically British in construction, with a dovetailed case and drawers, all of which have full, thin dust boards between.

In design, the desk bookcase follows the highest art of the craft for the period. The silver-mounted and ivory inlaid padouk desk bookcase is banded overall with ivory foliage on an ebony ground. A double-arched, molded cornice with fine ebony finials stands above beveled mirror glazed doors enclosing five drawers and pigeon holes. The desk has a sloping lid centered by a silver cartouche engraved with the arms of Sir Matthew Decker, an influential director of the East India Company. (A detailed provenance is provided as Attachment A.) The lid encloses a fitted interior of thirteen drawers and a prospect door enclosing an additional three drawers. All pigeon hole drawer fronts are ebony while the secondary wood is teak. The original feet have been replaced with bun feet. Curious and as yet undeciphered imprints on the back boards of the desk show a crown surmounted by the letter "F." Three or four of the imprints are visible; whether these imprints are a stamp of the maker, importer, or owner is unknown.

Pretreatment Condition of the Desk Bookcase

The desk bookcase is believed to be in the most original condition of any known in this genre. The finish was in generally fine condition, and structurally the piece was sound. Some modifications had been made previously, such as the replacement of drawer hardware and possibly lift handles and the addition of bun feet. A portion of the rear section of base molding was missing and the center section of the top shelf in the upper case had been cut away. All other wooden elements were in surprisingly good condition.

The overriding problems with the object concerned the ivory in three major respects. First, most of the ivory was quite dark, covered with a grime-laden, wax and resin build-up. Still another problem of

appearance was caused by deep stains which rendered a few pieces of ivory uniformly medium to dark brown. These stained pieces were primarily near floor level. Whether the stains resulted from splashes of floor cleaning liquids was not clear. Perhaps too these few pieces of ivory were less white to begin with and were placed low on the desk rather than thrown away. A few other pieces of ivory appeared somewhat blanched, showing a whitish efflorescence on the surface. The third problem concerned missing pieces of ivory. Of the hundreds of ivory elements, only 90 were lost, a testament to the excellent quality of the as yet unknown adhesive. However, replacement of these missing elements was critical to the overall aesthetic since the loss of the smallest ivory element on the ebony ground would be immediately noticeable.

The inlaid ivory was approximately 3/32″ thick and showed saw marks on all edges. The ivory was also engraved with what could easily be imagined to be a metal graver, considering the similarity of the cut made by a graver on metal. Once engraved, the cuts were filled with a black resinous material, most of which was still present and quite securely held. Ivory was used for several elements: flower designs, leaves, vines and stringing, as well as fine bird-like figures.

The old saying that "God is in the details" holds true for this object. Certainly it is easy to be mesmerized by the convoluted and undulating pattern of ivory on ebony. It is also easy to see a general left and right pattern to the inlaid ivory. But closer examination reveals that a great deal of thought and planning went into the layout and design of the inlaid ivory. What seems at first chaotic actually turns out to be several repeating patterns of tiny, handcut and hand-engraved pieces of ivory. These patterns are made possible by the fact that there are a limited number of flower and leaf types; there are approximately a dozen different flowers, for example. Depending on the specific location on the piece, different flower or leaf types were used in a unique combination and order to create a pattern. Nothing was left to chance here.

Consonant with the importance of the original owner, drawer and lid hardware are of solid silver, with the family coat of arms engraved on one lid mount. Many bails and backplates were bent from previous abuse. A few projecting backplate tips were broken off and lost, a few had been secured with surface-mounted escutcheon pins. All surfaces were heavily etched from previous use of harsh cleaners or acids.

Door hinges and upper and lower case side handles had extremely heavy accretions and tarnish, so their metals content was unknown until cleaned. Their appearance suggested a patinated bronze or brass. When accretions were removed with dilute thiourea and sulfuric/formic acid solutions, slight traces of what appeared to be silver plating on the brass casting became visible. This remained only in areas most protected from routine abrasive maintenance polishing on bailposts, under shoulders of bailposts, and on door hinges. Due to the extreme degradation of this presumed plating layer, metal surfaces were analyzed by X-ray fluorescence. This revealed clearly that both hinges and side handles were originally silver plated.

Lid and drawer hardware and door hinges were clearly replacements of unknown date. Old wood-fill repairs were visible on both drawer fronts from previous mounting screws, and on the interior of the upper case from previous hinges. Wood repairs were apparently of teak, well matched to original wood. Though the date of these hardware replacements is unknown, it seems possible that they were done very early, possibly when the piece first arrived in England after import from India. Perhaps the original Indian brasses were not judged suitably ostentatious by the owner. Side handles, however, appear to be of the period, no wood repairs were found in these areas.

Ivory—An Introduction

Since the primary problem we faced concerned the ivory, a fairly unfamiliar material, much of our initial research yielded considerable information about ivory. The cultural and historic significance of ivory is certain. For a material that is nothing more than the over-grown incisor tooth of an elephant, its symbolic power as a decorative and utilitarian object is impressive. Ivory has been used to fabricate tools and weapons, to symbolize religion, and to have recorded on its surface events as they occurred. Various cultures have used ivory to create works of art and to demonstrate the power of kingship; others have made tokens from it with which to gamble away the wealth of kings. Furniture, too, has received its share of ivory, adding decorative color and contrast to wood.

Most references to ivory in the literature also mention bone and other substitutes for ivory, such as horn, antler and vegetable "ivory" (for example, tagua nuts). While chemical and physical differences exist between these materials, from a conservation perspective, there are far more similarities than differences. In fact, current literature reflects this fact by using the term "ivory" as a generic-reference term for true ivory and these natural substitutes.

Chemical Composition of Ivory

True ivory is composed of a mixture of inorganic and organic materials. It is known to contain about 55% inorganic material (calcium phosphate 82%, magnesium phosphate 15%, calcium carbonate 2%, calcium fluoride .25%) and about 45% organic collagenous material with small amounts of lipids (Fischer and Bolen, 1955).

Ivory and similar materials can be distinguished by their differing chemical composition. While elephant ivory is composed mostly of calcium phosphate, sometimes referred to as hydroxyapatite, and an organic component of primarily collagen and a small amount of lipids, ivory produced by walrus, hippopotamus and narwhal have slightly different chemical make up (penniman, 1938; Sandford, 1973). Researchers have even differentiated African from Indian elephant ivory on the basis of slightly different ratios of carbon, hydrogen and nitrogen present in the ivories (Rao and Subbaiah, 1983). Bone is easily differentiated from ivory because proportions of its components are not the same. For example, the ratio of phosphate to calcium ions for ivory is about 1.86 to 1.0, whereas the ratio for bone is 2.1 to 1.0 (Armstrong and Snider, 1965).

Physical Structure

The physical structure and simple qualitative identification of ivory has been reported in previous conservation literature, most notably by Jonathan Thornton (1981), which along with other relevant literature is summarized as follows.

The most distinguishing feature of elephant ivory is that in cross-section it shows" a pattern of intersecting arcs," sometimes described as "engine turnings." The arcs radiate from the central core, forming intersecting lines which can be seen only by the naked eye or at low magnification (8-10x) and which disappear at high magnification. Though similar in color, hardness, and translucency, walrus ivory displays a central core which has a rather marbled appearance, surrounded by a smooth, creamy white dentine layer. Because elephant ivory grows from the center out by forming concentric circles, it has a "wood grain" appearance longitudinally. Walrus ivory has virtually no "grain" of any type.

Hippopotamus ivory is the hardest and most opaque of the ivories. Both cross and radial sections show a waxy reflectance similar to that seen in the semi-precious stone "tiger eye." The narwhal tusk is similarly hard, but cross-sections show concentric bands of mineral concentration which are distinct and wavy.

Perhaps the most important distinction, however, is between ivory and bone. The main structural difference between these substances is that bone has a spongy central portion of marrow from which a series of tiny blood vessels extend into the more solid areas of bone. These vessels appear as tiny dark spots, pits, or lines on the surface of bone objects. In radial or tangential sections, an elongated lamellar system bounded by Haversian canals is visible in low to medium magnification.

Probably as important as distinguishing ivory from bone is separating it from synthetics such as celluloid and polymers and from its vegetable look-alikes, various palm nuts such as Phytelephas Macrocarpa (Ivory Nuts), Hyphaene Crinata (Doom Palm Nuts), and Metroxylon Amicarum (Apple Nuts). Longwave ultra-violet light is quite helpful here. For example, ivory, particularly old ivory, fluoresces yellow and mottled, whereas new ivory and bone show a blue-white fluorescence (Majewski, 1973). Vegetable "ivory," however, fluoresces a slight orange tint. Celluloid, used by the Victorians to imitate both the color and longitudinal grain pattern of ivory, does not fluoresce quite as distinctively. However, fine shavings of celluloid will bum rapidly and completely, often with the odor of camphor.

Synthetic materials often exhibit a brilliant fluorescence quite different from natural substances. Thornton also suggests a sniff test if synthetics are suspected whereby a heated needle can assist in producing the peculiar odor of most polymers.

Properties of Ivory

The good news for the wood artifacts conservator is that ivory behaves like wood. But, of course, that's also the bad news. So, while ivory is a fairly familiar material insofar as it has similar properties to wood, it also exhibits many of the same problems inherent in wood. Both were once living tissue growing in a similar pattern of concentric circles around a core. Like wood, ivory is hygroscopic and anisotropic. The movement of moisture in and out of the material causes alternate swelling and shrinkage, not evenly but, as with wood, more in the direction perpendicular to the ivory grain than in the other. Consequently, warping takes place as a result of temperature and moisture change. When subject to prolonged penetration of water, decomposition takes place as the result of the hydrolysis of the organic components. Recent research has shown that changes in relative humidity, as compared with temperature changes, have a particularly deleterious effect on ivory (Lafontaine and Wood, 1982).

Acidic as compared to alkaline conditions also promote deterioration, with the rapid loss of calcium leading to the disintegration of the inorganic framework enmeshed in the organic collagen. Of course, alkalinity above a pH of 9.0 should be avoided as it also promotes the loss of inorganic constituents, though not as rapidly as acidic conditions.

Because ivory has a structure which is made up of tubes radiating from the center of the tusk to the periphery, surface penetration is quite easy. This not only assists the penetration of water, but of organic solvents and chemicals as well, often to the detriment of the ivory. Metal staining of ivory is also a problem because of ivory's porosity. Prolonged contact between iron or brass and ivory causes almost indelible stains. Finally, if ivory has survived the foregoing gauntlet relatively intact, age and sunlight will lead eventually to embrittlement and bleaching.

Cleaning Ivory

To begin our quest for the right way to clean ivory, we used the Getty Conservation Information Network from which we selected references with the keywords, "ivory" and "cleaning." An initial

90 abstracts were found which met this requirement. This list was later reduced by almost half due to irrelevance of some publications, unavailability of some, and no English translation of a few.

The conservation literature contains a fairly limited number of methods for cleaning ivory. Most early literature begins with an aqueous solution of some type, thus disregarding entirely the cautions about the action of water on ivory. Other writers suggest using water sparingly and drying immediately. Still others suggest the use of dilute acids; Plenderleith for example suggests using dilute hydrochloric acid to remove stains and accretions. Recent influential research by Matienzo and Snow has shown that dilute HC1 "drastically alters the surface composition and morphology of ivory and leads to the formation of amino acid salts," making the material even more hygroscopic (1986, p.138).

Even more important, these same researchers tackled the question of the use of solvents, namely, toluene, ethanol, and acetone, as cleaning agents. Here they found that these solvents tend to bring organic matter to the surface by leeching action. The less polar solvent, toluene, was more apt to cause leeching than the more polar ethanol and acetone (Matienzo and Snow, 1986). Unfortunately, these researchers could not conclude from their research whether nonpolar solvents as a rule tend to be more damaging than polar solvents. Several recipes were noted in the literature which called for using Vu1pex soap in mineral spirits, a relatively nonpolar solvent.

From the available literature, it is quite clear that regardless of whether the cleaning system contains water or organic solvents, the essence of safely cleaning ivory is speed--working fast to avoid penetration of the cleaning solution. But our own spot tests clearly showed that no matter how fast we worked, the accumulated surface residues were simply wicked into the porous ivory, leaving an even more permanent discoloration. In attempting to limit penetration, solvent gels were tried with little success. The major problem here was that the gels could not be precisely controlled and located on the often tiny ivory inlays without affecting the surrounding finish. And aqueous systems were even less appealing because of their clear potential for damage to the ivory.

Without clear guidance from the literature, we turned to our colleagues for advice. They confirmed much of what we had learned, sometimes quite pointedly, "Keep water away!" Others suggested that "less is better," "there are no miracle solutions," "try spit," and "all indications are that previous cleaning systems are burning the ivory. " Given the dictum of "do no harm," aqueous and solvent systems were eliminated from consideration because of the many problems they presented and because of our relative unfamiliarity with the material.

We were looking for a cleaning method that was simple, conservative, effective, precise and relatively quick; after all, there were hundreds of small ivory pieces to clean, and the budget was limited. Much of the ivory was recessed slightly below the surface of the wood, and a black resinous material had extruded slightly between the ivory and wood, both causing additional headaches for anyone wanting to clean the ivory. As serendipity would have it, a small area of ivory was trial-scraped with a scalpel, more in an effort to remove some of the surface accretion for solvent testing. The ivory came clean! After further telephone discussions with colleagues and scraping monitored under a stereomicroscope, it was clear that this form of mechanical cleaning met or exceeded our initial criteria. Further experimentation showed that sharp, rather than dull, disposable scalpel blades worked better. More than half of all the inlaid ivory was cleaned this way.

The remainder of the ivory was cleaned with still two other mechanical methods. The first used Pink Pearl erasers made by FaberCastell. Some preliminary experiments with erasers produced disappointing results, since it did not seem to remove accretion effectively; so this method was eliminated early in the process. However, one of the project conservators later recalled an article which mentioned the use of erasers to clean ivory. Perhaps prompted by the tedium of scraping, erasers were tried again and produced results similar to scraping. Not only did the erasers not leave the unnatural shine left by erasers on polished metal, the pace of cleaning improved significantly. However, extra care was needed to keep the somewhat blunt end of the erasers on the ivory and to avoid straying on the adjacent finished wood surfaces. To minimize the problem of straying onto the finish, we obtained the same eraser shaped like pencils, which come in their own plastic holder. We could "sharpen" these, so improving our ability to stay within the line.

A final evolutionary step in mechanical cleaning was taken when we began using "Cratex" resilient abrasive points. Using the "extra fine" grit, these silicon carbide points approximated the abrasiveness of the erasures. Our cleaning efficiency was increased yet again since we were able to mount the points on a mandrel which was then chucked in a variable-speed Dremel grinder. Running at the slowest rate (approximately 5,000 RPMs) and with light pressure, good results were obtained, with no abrasion noted on the surface of the ivory itself. We would recommend that before trying this method, monitored tests be conducted to determine if there is any effect on the ivory. In our case we felt that the waxy buildup on the surface of the ivory may have provided just enough lubrication to prevent bums or abrasions.

Stain Removal

Only a few pieces of ivory had significant stains remaining after cleaning was completed. Again we were quite cautious about the various water-based recipes suggested for stain removal, as well as the acidic and alkaline solutions used in the past. The most conservative approach we considered other than leaving the stained pieces as they were was the possibility of inpainting the stained pieces to more nearly approximate the surrounding ivory. This step was never taken, however, since the curator agreed that though the stained pieces were unsightly, they nevertheless represented a part of the object's history.

Ivory Replacement

Treatment proceeded to the replacement of missing ivory inlay, including floral, leaf, and stringing elements. To return the object to its near original condition, it was necessary to replace these missing pieces. The traditional approach would be to use new or old ivory as replacement material. Contemporary ethical concerns, however, led us to examine other options, most notably synthetic materials. Vegetable nuts such as tagua nuts were eliminated because of their small size and the difficulty they would present in efficiently producing the necessary replacement pieces.

We dealt with still another issue regarding whether it was even appropriate to use original material, since it would "disappear" and simply become another flake in the blizzard of inlaid ivory. Distinguishing the original from the replacement ideally should not be a problem for a conservator or curator later on. We ultimately settled on synthetic "ivory" because of its ready detectability with longwave ultraviolet light. For a brief time we entertained the notion of using paper, cut, colored, and inked to imitate the engraved ivory. In fact, a photocopy machine produced some astoundingly similar copies of some of the loose original ivory. However, the impermanence of the paper and other problems of adhesion doomed this idea only minutes after the copier held out the prospect of mass production.

We were aware that synthetic materials are used to make artificial "scrimshaw." (Scrimshaw is another name for walrus and whale ivory.) Further research led us to three firms in New England which produce this material. Made of polyester resin which is calcium-filled and 95% the weight and density of ivory, the color of the resin material closely approximates the mellow tone of aged ivory.

The polyester resin was custom ordered in sheets approximately 4″ x 5″ and 3/32″ thick, the approximate thickness of the original ivory. A jeweler's saw was used to cut out each missing leaf and flower after patterns produced by the photocopy machine were adhered to the sheet. The vines and strings were produced on a table saw equipped with a fine-toothed veneer-cutting blade. Thin (3/64″) lengths of stringing stock were produced in this manner.

With replacement floral pieces in hand, each was engraved with a graver to approximate the appearance and general character of existing engraving. The engraved lines were then colored with aniline dye in a shellac binder to match the surrounding ivory. It was simply brushed-on, left to dry, and scraped off with a scalpel, leaving the near-black residue in the engraved lines. Occasionally it was necessary to tone the synthetic material to blend with its neighbors; this was done with aniline dyes in a shellac binder.

Though 90 pieces of ivory were missing and 327 were loose, we were amazed that most were still well adhered to the wood and had never been disturbed. Naturally, we wondered what adhesive had been used originally. This material was also used as a filler in the gaps between the ivory inlay and the ebony ground. With the help of Harvard's Center for Conservation and Technical Studies, we decided to analyze and attempt to identify the "wonder" glue. Results from Fourier Transform Infrared (FT-IR) spectroscopy yielded a spectrum for a natural gum, most likely from a tropical plant source. Whereas the water soluble component gave a rough match for gum tragacanth, the insoluble part proved much more interesting. The best match for the resulting absorbance spectrum was for gum arabic and opium. Opium is a gum exuded by the poppy. Probably because of the age of this material, it was not possible to determine finally the exact natural gum, though the thought of working with opium had some appeal. Other conservators working with Eastern decorative arts may want to conduct similar analyses in the future.

Without ready access to an opium supply, we were forced to use a more traditional adhesive: liquid fish glue. Fish glue provided reasonably long working time, offered excellent reversibility, and provided a small measure of adhesive flexibility once cured. Only seven months have passed since completion, but the piece has been moved several times from uncontrolled to controlled storage and, finally, to relatively uncontrolled museum exhibit space. To date, all original ivory and replacement "ivory" pieces are intact and in place.

Treatment of the Metal Hardware

While the ivory presented many challenges, the metal hardware was in some ways no less problematic. Due to the extreme degradation of the silver plating and its importance to overall aesthetics, we decided to replate the hinges and side handles lightly after cleaning. The remaining originally plated areas were coated with Acryloid B-72 resist. This hardware was then lightly replated in an electrolytic bath, leaving it uneven and with an appearance of natural patination and wear. Further patination to blend the replating with solid silver drawer hardware was done with Orasol pigments in "Agateen #2B" cellulose nitrate lacquer.

Tenacious corrosion products on drawer and lid hardware were cleaned with a dilute thiourea/sulfuric/formic acid solution, rinsed, and polished with microalumina in distilled water. Deep pitting from

previous use of harsh cleaners was reduced slightly. All of the hardware was then lacquered with Agateen #2B as a protective coating. Any sections of hardware that were bent and projecting were rebent to a more planar position. The result of the cleaning, replating, and lacquering was to harmonize the appearance of solid silver and silver plated surfaces, leaving them with a sense of wear, but good care.

Brass drawer and door locks were cl~ly relatively recent replacements. One expert consultant suggested they might be of 19th century French manufacture. They have an unusual cross-shaped key post, with matching key. The inscription" GL CNE[* or 41]" was found cast in interior surfaces, but its meaning is unknown.

The precise metal alloy of the engraved coat of arms on the lid was compared to the lid escutcheon with mass spectrometry in order to determine if they were contemporaneous, or one perhaps a later addition. Testing by The Center for Conservation and Technical Studies at Harvard revealed the two to be of identical silver alloy, suggesting identical dates of manufacture.

Acknowlegements

Clearly this project involved many individuals without whose help and advice it would have been impossible. Therefore, the authors would like to thank the following individuals: Richard Renshaw-Beauchamp, Henry Lie, Meg Kraft, Doug Currie, Ros Westmoreland, Carol Snow, Susan O'Dell, David Mathieson, Jonathan Thornton, Robert Walker, Eugene Farrell, Will Phippen, and Cliff Craine.

Special recognition is due to conservation technicians, Tania Wilcke and Leslie Rainer, for their work on the project, and to Crosby Forbes, Curator of Asian Export Art at The Peabody Museum, for his helpful guidance and gentle spirit. Our thanks also to the anonymous Donor who made possible the conservation of this rare object.

Suppliers

Artek (Synthetic Ivory)
PO Box 145
Antrim, NH 03440
603-588-6825

Other synthetic ivory suppliers:
Barlow Inc.
20 Commercial Way
E. Providence, RI 02914
401-438-7925

Onset Bay
PO Box 1142
Onset, MA 02558
508-295-2559

Fisher Scientific (Scalpel handles and blades)
52 Fadem Road
Springfield, NJ 07083

Gesswein (Cratex Abrasive points)
PO Box 3998
Bridgeport, CT 06605
800-243-4466

Charrette (Erasers)
95 Mt. Auburn St.
Cambridge, MA 02138
617-495-0250

ATTACHMENT A

Provenance

Sir Matthew Decker, Bt., (1679-1749). Probably the first owner, he was born in Amsterdam of a Flemish family but was forced to leave the country during Alva's persecution. In 1702 he established himself as a merchant in London becoming an influential director of the East India Company. He was created a baronet by George I on 20 July 1716. He married Henrietta, daughter of Richard Watkins, D.D., rector of Whichford, Warwickshire, and had three daughters. He left the desk bookcase to his daughter,

Catherine, 6th Viscountess Fitzwilliam of the Kingdom of Ireland. She left it to her son, 7th Viscount Fitzwilliam, who is best known by his bequest to Cambridge University, of his collection of books, manuscripts, and dividends from some South Seas annuities enabling a museum to be erected in his name. He died in 1816 leaving the cabinet to his first cousin once removed,

11th Earl of Pembroke (1759-1827). He left the piece to his second wife and widow,

Catherine, 11th Countess of Pembroke (daughter of Simon Romanovitch, 3rd Count Woronzow, Russian Ambassador to the Court of St. James's). She died in 1856 leaving it to her daughter-in-law,

Elizabeth Maude, wife of Sir Hubert Parry, Bt. She died in 1933 leaving it to her daughter,

Dorothea, 1st Baroness Ponsonby of Shulbrede. She died in 1963 leaving it to her son.

2nd Baron Ponsonby of Shulbrede. He died in 1976, leaving it to his widow. It then descended to Lord Ponsonby of Shulbrede, whereupon the desk bookcase was purchased by The Peabody Museum of Salem, Massachusetts.

BIBLIOGRAPHY

Armstrong, W.D. and L. Snider. "Composition and Constitution of Bone." *Clinical Orthro.* 38 (1965), 179-190.

Baer, N.S. and L.J. Majewski. "Ivory and Related Materials: An Annotated Bibliography." *AATA*, (1970),8(2):229-275.

Baer, N., N. Indictor, J. Frantz and B. Appelbaum. "The Effect of High Temperature on Ivory." *Studies in Conservation*. 16: 1-8.

Baer, N.S. "Chemical Investigations on Ancient Near Eastern Archeological Artifacts." *Acheological Chemistry II*. Washington, DC: American Chemical Society, 1978.

Baer, N. S. "Chemical Aspects *of* the Conservation of Archeological Materials." *Archeology Chemistry II*. Washington, DC: American Chemical Society, 1978.

Brown, W.E. and L. W. Schroeder. "Interlayer of Crystalline Octacalcium Phophate and Hydroxytite." *Journal of Physical Chemistry*. 83 (11):1385-1388.

Burack, Benjamin. *Ivory and Its Uses*. Vermont: Charles E. Tuttle Co., 1984.

Canadian Conservation Institute. "Care of Ivory, Bone, Horn, and Antler." *CCI Note No. 6/1*, Ottowa: September, 1983.

Chieffo, Clifford. "Miniatures on Ivory: Their Care and Storage." *Art and Antiques*. Jan/Feb 1983, pp. 42-43.

Cooper, F. "Ivory Discolored by Proximity to Rubber." in *Museum Journal*. 39(1):23.

Edwards, R. and K. De B. Codrington. "The Indian Period of European Furniture." *Apollo*, Feb/April and June/July, 1935.

Falk, Toby. "Inlaid and Ebony Furniture from British India." *Orientations Magazine*, March, 1986.

Fischer, F.G. and H. Bolen. "The Composition *of* Ivory." *Hoppe-Scyler's Zeitshrift fur Psysiologische Chemie*. 302 (1955), 283-285.

Forbes, Crosby. Personal Communication. December, 1990.

Fraser, S. "Notes on the Identification, Dating, and Care of Ivory." *Arts of Asia*. 7(6):43.

Gurujal, Charvonne Hoyle. Personal Communication, March 3, 1991.

Gyermek, S.A. "Conservation of Ethnographic Materials." *Museum News. Technical Supplement*. (1984), 4:1-8.

Hawks, C.A. and S. L. Williams. *Deterioration of Bone and Ivory: An Annotated Bibliography*. Fairbanks: AS Mammologist, May, 1989.

Holiday, Clayton. "The Conservation of Ivory and Bone." *South African Museums Association Bulletin*, (1971), 9:564-574.

Hunger, Fred. "Tagua: The Vegetable Ivory Substitute." *Fine Woodworking*. No. 83, July/Aug 1990, pp. 65-67.

Jenssen, V. "Conservation of Marine Archeological Objects." *Conservation and Museology*. London: Butterworth, 1987, pp. 122-163.

Jourdain, M. and R.S. Jenyes. *Chinese Export Art in the 18th Century*. Middlesex: Spring Books, 1950.

Lafontaine, R. and P. Wood. "The Stablization of Ivory Against Relative Humidity Fluctuations." *Studies in Conservation*, (1982), 27:109-117.

Low, M.J.D., N. Baer and J. Chan. "The Microstructure of Calcined Ivories." *Materials Research Bulletin*. (1982), 15:363-372.

Majewski, L. "On Conservation." *Museum News*. 51(7):10-11, 1973.

Maskell, Alfred. *Ivories*. London: Methuen and Co., 1905.

Matienzo, L.J. and C.E. Snow. "The Chemical Effects of Hydrochloric Acid and Organic Solvents on the Surface of Ivory." *Studies in Conservation*, (1986), 31:133-139.

Nelson, N.B. "Ivory: Its Sources and Uses." *Popular Science Monthly*. (1987), 51:534-539.

Penniman, T.K. *Pictures of Ivory and Other Animal Teeth, Bone, and Antler*. Oxford: University Press, 1952.

Plenderleith, H.J. and A.E.A. Warner. *The Conservation of Antiquities and Works of Art: Treatment, Repair, and Restoration*. London: Oxford University Press, 2nd Ed., 1971.

Rao, S. and K. V. Subbaiah. "Indian Ivory." *Journal of Archeological Chemistry*. (1983), 1,1:1-10.

Rorimer, J.J. "Ivory and Bone." *UV Rays and Their Use in the Examination of Works of Art*. New York: Metropolitan Museum of Art, 1931.

Sanford, Elizabeth. *The Identification and the Working of Ivory*. Unpublished Thesis, Institute of Archeology, London, May, 1973.

Slomann, P. V. "The Indian Period of European Furniture." *Burlington Magazine*, September/October, 1934.

Snow, Carol and Terry Weisser. "The Examination and Treatment of Ivory and Related Materials." *Adhesives and Consolidants*. Preprints of the IIC Paris Congress, September, 1984, pp. 141-145.

St. Aubyn, Fiona, ed. *Ivory: An International History and Illustrated Survey*. New York: Abrams, 1987.

Symonds, R. W. "Furniture from the Indies, III." *Connoisseur*, 94, Iuly 1934.

Thornton, Ionathan. "The Structure of Ivory and Ivory Substitutes." *AIC Preprints*. 1981, pp. 173-181.

Verzar, F. "The Ageing of Collagen." *Scientific American*. April, 1963.

Victoria and Albert Museum. "The Care of Ivory." Number 6: Technical Notes on the Care of Art Objects. London: 1971.

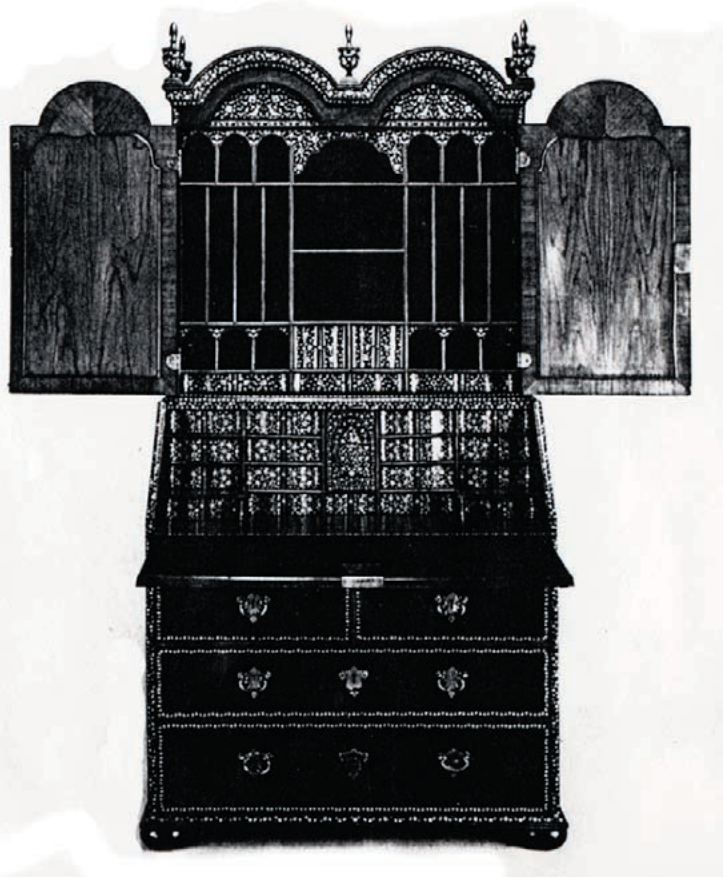
Webb, Marianne. "Care and Treatment of Bone and Ivory." *Ontario Museum Quarterly.* (1982), Iuly:27-28.

Werner, A. E. "The Conservation of Leather, Wood, Bone and Ivory, and Archival Materials." *Conservation of Cultural Property,* 1968, pp. 265-290.

Whitaker, J. "Changes Occurring in Proteins in Alkaline Solution." *Chemical Deterioration of Proteins*. J. Whitaker and M. Fujimaki, (eds.), ACS Symposium Series 123, Washington, DC: American Chemical Society, pp. 145-163.

Williamson, G.C. *The Book of Ivory*. London: Muller, 1938.

Wills, G. *Ivory*. New York: Barnes and Co., 1968.



Anglo-Indian Desk Bookcase

Front, interior, and detail views after treament.
(Photographs by David Bohl)