CHEMICAL ANALYSES
OF
EARLY GLASSES

Robert H. Brill

Volume 1
The Catalogue
CHEMICAL ANALYSES
OF
EARLY GLASSES

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Volume 1
Catalogue of Samples

The Corning Museum of Glass
Corning, New York

1999
VOLUMES 1 AND 2 OF THIS BOOK (THE CATALOGUE AND TABLES OF ANALYSES) GREW OUT OF THE COLLABORATION OF A GREAT MANY PEOPLE, OVER A LONG PERIOD OF TIME. THESE PEOPLE REPRESENTED A WIDE ARRAY OF TALENTS, OCCUPATIONS, AND EXPERIENCE, ALL OF WHICH PLAYED SOME NECESSARY ROLE IN OUR RESEARCH. WE LOOK FORWARD TO CONTINUING OUR COLLABORATION WITH MANY OF THEM IN PREPARING VOLUME 3, WHICH WILL CONTAIN OUR INTERPRETATIONS OF THE DATA REPORTED HERE. WE ARE PLEASED TO THANK THE FOLLOWING GROUPS FOR THEIR CONTRIBUTIONS.

FIRST, THERE ARE THE ANALYSTS. MOST PROMINENT AMONG THEM WERE THE LATE ROBERT H. BELL OF LUCIUS PITKIN, INC. IN LOWER MANHATTAN AND BRANDT A. RISING, ONCE DR. BELL’S CO-WORKER AT LUCIUS PITKIN, AND NOW PRESIDENT OF UMPIRE AND CONTROL SERVICES IN WEST BABYLON, NEW YORK. THEIR ANALYSES ACCOUNT FOR MORE THAN 90 PERCENT OF THOSE REPORTED HERE. THE ELECTRON MICROPROBE ANALYSTS ARE NAMED IN VOLUME 2. OTHER SCIENTISTS AND TECHNICIANS ARE (OR WILL BE) NAMED IN APPROPRIATE SECTIONS THROUGHOUT VOLUMES 1–3 WHERE THEIR WORK IS REPORTED. MOST NOTABLE FOR THE NUMBER OF THEIR CONTRIBUTIONS WERE JOHN F. WOSINSKI, JOHN GEIGER, BRYAN WHEATON, NICK PALIOKASTRITES, ELTON HARRIS, AND AUGUST A. (A²) ERIKSON, ALL OF CORNING GLASS WORKS (NOW CORNING INCORPORATED).

SECOND, THE ARCHAEOLOGISTS AND CURATORS WHO PROVIDED SAMPLES FOR ANALYSIS WERE CLEARLY ESSENTIAL TO THE PROGRAM. WE EXPRESS OUR GRatitude COLLECTIVELY TO THEM HERE AND HAVE MENTIONED EACH OF THEM IN THE CATALOGUE WITHIN THE APPROPRIATE SECTIONS. THIS PROGRAM IS, IN LARGE PART, REALLY THEIR PROGRAM.

THIRD, THERE ARE THE AUTHOR’S CO-WORKERS AT THE CORNING MUSEUM OF GLASS. OVER THE YEARS THEY MUST AMOUNT TO SOME 100 PEOPLE. IT WOULD NOT BE AN EXAGGERATION TO SAY THAT IN SOME WAY OR OTHER, ALMOST ALL OF THOSE PEOPLE HAVE MADE SOME CONTRIBUTION TO THIS WORK. WE THANK THEM, EACH AND EVERY ONE, FOR THEIR HELP, AS WE DO THE TRUSTEES AND OFFICERS OF THE MUSEUM FOR THEIR SUPPORT THROUGH THE YEARS. AMONG THE TRUSTEES, JOSEPH V. NOBLE MUST BE ESPECIALLY THANKED FOR HIS STEADFAST ENCOURAGEMENT AND EXPRESSIONS OF CONFIDENCE.

THE DIRECTORS—THOMAS BUECHNER, PAUL PERROT, DWIGHT LANMON, AND DAVID WHITEHOUSE—ALL PROVIDED HELP AND ADVICE IN A WIDE VARIETY OF WAYS, AS DID THE DEPUTY DIRECTOR, JOHN MARTIN. THE CURATORS, PRIMARILY AXEL VON SALDERN, KENNETH WILSON, SIDNEY GOLDSMITH, JUTTA-ANNETTE PAGE, AND JANE SHADEL SPILLMAN, WERE MAJOR CONTRIBUTORS TO THE AUTHOR’S EDUCATION IN GLASS—IMPERFECT THOUGH THAT REMAINS TO THIS DAY. THE REGISTRAR’S GROUP, PHOTOGRAPHERS, CONSERVATORS, GALLERY STAFF, AND MEMBERS OF THE PUBLICATIONS, INFORMATION TECHNOLOGY, AND ACCOUNTING DEPARTMENTS WERE ALWAYS THERE WHEN HELP WAS NEEDED. AMONG OTHERS, THEY INCLUDED PRISCILLA PRICE, JILL THOMAS-CLARK, BRANDY HAROLD, NICHOLAS WILLIAMS, RAYMOND ERRETT, STEPHEN KOOB, DANIEL HEYER, ADRIAN BAER, CLIFFORD OLMSTEAD, JOSEPH MAIO, THOMAS GIAMBRONE, ANDREW FORTUNE, RICHARD PRICE, AND JACOLYN SAUNDERS. THE MUSEUM’S LIBRARY STAFF, TOO NUMEROUS TO NAME
individually, lent important assistance by ferreting out obscure bits of information and locating hard-to-find references.

Within the Scientific Research Department itself, were the people who had to cope every working day for years with the vagaries of operating an extraordinarily busy program. They were the Department's Secretary/Assistants, a few of whom were Florence White, Linda Randall, Judy (Seal) Snyder, Maxine Smith, and Ruth Sprague. Their work had always entailed performing exacting tasks and shifting abruptly from one project to another, but the demands became intensified during the writing of this book. Mary Townsley, Sherri Seavey, and Colleen Stapleton (presently the Scientific Research Assistant to our Department) did the lion's share of the work in compiling the Catalogue and Tables, while Robyn G. Peterson (of The Rockwell Museum) assisted in editing the Reference Lists and Index.

We also express special thanks for some special help. David Whitehouse, Richard Price, Colleen Stapleton, and Margaret Brill all read parts of Volume 1 and made many valuable suggestions. Ruth Sprague and Jacolyn Saunders worked on the final production of the book. Without their diligence and patience, we could not possibly have met our publication deadline. There were several long-time friends who (although they probably never realized it) strongly influenced the course of our Department's work by the way they conduct their own research and scholarship. They are well exemplified by George Bass, Christine Lilyquist, and James C. Y. Watt.

Finally, there may be another group—the people whose contributions could have been inadvertently overlooked here. Undoubtedly, some will come to mind as soon as this book goes to press. To them I offer my sincere apologies.

For those who will read this book with an editorial eye, we might note that they will find several idiosyncrasies in style. To mention only one, the author often slips from the third person into an editorial we or into the first person. This we have done knowingly, having always chosen that form which seemed most natural for expressing the idea at hand.

So, if all goes well, we'll meet again in Volume 3, with all our findings and reports.

RHB
The Corning Museum of Glass
Corning, New York
September 1998
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INTRODUCTION

In a sense, this book was 39 years in the making. When the author joined The Corning Museum of Glass in February 1960, he was asked by the Director, Thomas Buechner, what he thought his job should be. The reply came easily. The goal should be to learn whatever we could about ancient glass through the use of scientific methods. Where, when, and how was it made? What raw materials were used? What were early factories like?—and how was the glass traded? Happily, Tom Buechner accepted that open-ended premise, as did the directors who followed: Paul Perrot, the author himself, Dwight Lanmon, and David Whitehouse.

The first tool that came to mind for such an undertaking was chemical analysis. Following some words of encouragement from Eugene C. Sullivan, then Honorary Chairman of Corning Glass Works and a good friend of the Museum, the work was soon under way. (Readers should understand that although the Museum receives support from Corning Incorporated—at that time, Corning Glass Works—the Museum is an autonomous, nonprofit, educational institution.)

The program expanded rapidly, building on collaboration with archaeologists and curators all over the world. Without the cooperation of those people—who eventually numbered in the hundreds—the program would never have taken the direction it did. Because the only quantitative analytical methods available at the time required the sacrifice of small samples, we worked almost exclusively with fragment collections. It was (and still is) normally difficult, risky, or unwise to remove samples from intact objects.

In the years that followed, the Scientific Research Department’s program grew in several other directions as well: object examinations, physical property measurements, isotope analyses (lead and oxygen), archaeological field work, documentation of traditional glassmaking in Third World countries, etc. But chemical analysis always remained a fundamental part of the program.

The majority of the glasses analyzed came from ancient and mediaeval sources, although many glasses of later periods were also analyzed, as is evident from the Outline of the Catalogue.

Analyses of various groups of glasses were regularly reported, primarily in journals and proceedings of conferences, and occasionally as appendices to archaeological publications. However, many of the data remained unpublished, and those analyses reported in bibliographically obscure places, such as conference proceedings, never seem to have come to the attention of glass scholars as a whole. Many of the publications have rarely, if ever, been cited in the glass literature. (Fewer than one fourth of the Department’s 140 publications are included in Art and Archaeology Technical Abstracts.) Therefore, it was decided a few years ago that the time had come to bring together in one place all of our most significant results.
The initial plan was to publish an encyclopedia of sorts, containing everything we had learned through our scientific investigations, but it soon became evident that that was impracticable. Something like that might still come about eventually, but for the time being it seemed wiser instead to confine this publication to the findings of chemical analyses, and that is what we have here.

Volumes 1 and 2 consist of only the Catalogue of Samples and Tables of Analyses. This does not make for very interesting reading, but then, they are not meant to be read—they are only meant to be used as reference material, mostly by archaeological chemists. Interpretations of the data will appear in Volume 3, a work already in progress. That, we hope, will be interesting reading, at least for specialists in glass history or archaeological chemistry.

It was decided to send Volumes 1 and 2 of this work to the printer late in 1998, despite the fact that they contain only a catalogue and tables of data. This was done reluctantly because the author feels strongly, for several reasons, that scientific data should not be published without relevant interpretations. In this instance, however, it seems necessary to make an exception. The important thing is to compile all our data in a single place and in a form that will be readily accessible to the scientific community. This will also serve to get the data into the hands of the donors of the samples without further delay. Some have patiently awaited these results for years.

The interpretations of the data will consist of a series of brief reports or "mini-essays". A few examples are appended here as a sign of what is to come. Because our analytical work will continue during the interim, supplementary tables will be added in Volume 3. That volume (or a Volume 4, if necessary) will also contain a compilation of physical properties, observations on experimental melts, and miscellaneous research findings. In the meantime, we remind readers that a good many of the analyses reported here have, in fact, already been discussed in the publications listed in Reference Lists A–D. The references are cited in the corresponding Catalogue entries for the samples.

There are three especially important points to be made at the outset. Two involve methodology, while the third is more conceptual in nature.

Most of the sample groups consist of relatively small numbers of samples. In many cases, only a half-dozen or dozen samples were analyzed from a particular site. The author is fully aware that such small numbers of samples are not statistically sufficient for characterizing the glass found at most archaeological sites—especially large or complex sites where glasses of different dates are found. One must be careful not to try to read too much into the results for small groups of samples. But that does not mean the results are not useful. Although most of the analyses reported here are not intended to be seen as definitive characterizations of the glasses from the sites represented, they nevertheless can serve as guidelines for what to expect if more comprehensive analytical studies are carried out.
There are several reasons why some of the groups contain only small numbers of samples. To begin with, it was not economically feasible for the Museum to conduct larger numbers of analyses. Also, in the earlier years, archaeologists and curators were decidedly hesitant to part with more than a handful of samples for analysis. We often felt lucky to get whatever samples we did manage to get. Moreover, the Museum’s programs were initiated at a time when analytical data on early glasses were sparse. Faced with a choice of whether to concentrate the program on intensive studies of a few sites or to aim at a broader study of fewer samples from more sites, we chose the latter course. We decided there was a greater need for exploring the overall world picture of early glass compositions than there was for conducting comprehensive studies of a few sites. In this connection, we might also add that “analysis for analysis’ sake” may be frowned upon, but we confess to having simply given in to our curiosity on many occasions. This outlook was well put by the late Rutherford (John) Gettens, who once remarked, “If you don’t know what an object is made of, you don’t know what it is.” We agree.

The second methodological point to be raised is that little effort has been made so far to compare our groups of data with one another by statistical calculations. That is obviously a desirable thing to do, but when most of these data were being assembled, the Museum did not have computer facilities for performing the required calculations conveniently. At this stage, it seems most sensible to concentrate on recording observations and comments within the groups studied, and on completing our reports for Volume 3. However, in the very near future, we will be undertaking statistical analyses of the Serçe Limani glasses (especially in connection with all of our other Islamic glass data) and also of our stained glass data. We expect that other researchers may like to undertake statistical analyses of other groups of data reported here, and we encourage them to do so. But we do hope that when conclusions are drawn from such calculations, they will also be supported by a sound understanding of early glassmaking and considerations of historical, archaeological, or other relevant evidence. Without incorporating these additional elements, the results could be seriously misleading.

The conceptual point to be made is that the reader should see this work for what it is, and not as something it is not intended to be. These two volumes are the result of numerous collaborations with individual archaeologists and curators. They are a self-contained compendium of these results only. They are not an attempt to compare our analyses with other analyses reported in the literature.

When the Museum started its Scientific Research program, there were very few workers in the field: Turner, Geilmann, Yamasaki, and Besborodov. Edward Sayre and Ray Smith had just begun their analyses. In addition, there was not much about glass analysis in the literature—only the scattered work reported in Earle Caley’s *Analyses of Ancient Glasses* (Ref. E-11). Consequently, there were not many analyses with which our results could be compared at the time, nor did there seem to be any compelling reasons to do so. In recent years, that picture has changed, and there are now many groups who have carried out analyses. It would certainly be useful for someone to assemble all of
the reliable data in the literature and attempt to develop a grand picture of glass history in terms of chemical compositions. But, for the time being, we must leave it to someone else to undertake that task.

Returning again to what this book is not, it is not a primer in glass studies attempting to explain everything one might want to know about the subject. We expect, instead, that it will be most useful (especially when joined by Volume 3) to those who bring to it some prior knowledge of the subject, be they archaeometrists, archaeologists, curators, glass scientists, chemists, or others who already have at least one foot in the door.
ABOUT THIS CATALOGUE

During the past four decades, the Scientific Research Department of the Museum has collected close to 10,000 artifacts, fragments, and samples of glasses and related materials. These were generally destined for scientific analysis and examination, although some, admittedly, were acquired simply as curios. The vast majority of samples were donated by institutions or individuals scattered throughout 60 some countries. The donors themselves number in the hundreds. Most of the glasses are fragments excavated at archaeological sites; relatively few came from actual museum objects.

About 6,400 of the samples are described in a Master Catalogue kept in the Department, however, as was inevitable in a catalogue put together over such a long period of time, there is great disparity in style and format among the original entries. Some of the descriptions are lengthy and elaborate, while others are short and sketchy. The entries have now been condensed into an abbreviated catalogue. It is this abbreviated catalogue (the AbbCat) that is presented here. The descriptions are deliberately brief and in a more or less consistent style. However, in some cases, consistency has been sacrificed in order to improve intelligibility. The AbbCat—as well as this entire book—is meant to be useful to the reader.

The Master Catalogue will be kept permanently in the Museum, along with the original correspondence and notes related to the samples. All will eventually be archived and, although not elegant in form, will be readily accessible for the foreseeable future—as will the samples themselves.

The donors’ names appear in the subheadings of the catalogue, along with abbreviations designating their affiliations at the time the samples were received. A list of abbreviations for institutions is appended.

Dates and attributions are generally those provided by the donors when the samples were received. No changes were made unless there were compelling reasons for doing so. Undoubtedly, some of the dates will by now be in error, and readers should independently verify the dates entered here to whatever extent is warranted by their own interests. A notable example is the dating of Chinese glasses, which currently depends on typologies that are probably outdated and that might have been inaccurate to begin with. The time has come to draw up a new and reliable chronology for Chinese glass, especially considering the number of glasses presently being excavated in China. Similar situations probably prevail with other types of glasses as well.

For the most part, the donors’ vocabularies have also been incorporated in matters of nomenclature and typology.
Entries referring to objects in the Museum's collection contain accession numbers in the form CMG 00.0.000. RR refers to the Museum's receiving report numbers, while F-000 and Study card refer to information in the registrar's records. A concordance of CMG numbers and sample numbers is also appended, as are concordances with two of the Museum's major publications: Sidney Goldstein's *Pre-Roman and Early Roman Glass in The Corning Museum of Glass* (Ref. E-16) and David Whitehouse's *Roman Glass in The Corning Museum of Glass* (Ref. E-39). In some instances, we have cited these two references simply as SMG and DBW.

Spellings, especially in languages other than English, may not necessarily be accurate and should not be taken as authoritative. We had special difficulties with Vietnamese spellings and with diacritical marks no matter where they arose. Because of the software used, we were not able to include all required diacritics and certain symbols. For example, we could not print an 'i' without a dot in Serge Limani. Therefore, we ask the reader's forgiveness for any inaccuracies and hope they will not prove troublesome. Actually, however, not all of the inaccuracies will have originated with the author. Wherever in doubt, we tended to rely on spellings or other information exactly as provided by the donors of the samples. Unfortunately, these were all too often barely decipherable notations jotted down by hand in the field on those old matchboxes or used film canisters so beloved by a bygone generation of archaeologists.

The fragments and objects described in the catalogue are not illustrated here. Those that have been photographed will be illustrated in Volume 3, accompanying the reports and interpretations.

The Lists of References included here are not comprehensive—nor are they intended to be. The references cited are mainly intended to get the reader started on follow-up research.

An entirely separate catalogue of about 3,500 samples used for lead isotope analyses is not included here. Those samples all bear the prefix Pb-. In the Catalogue of Samples, the common notation (*Same as Pb-0000.*) means that the lead isotope sample Pb-0000 came from the same parent object or fragment described in the entry where it appears. We hope that all of the Museum's lead isotope analyses—carried out in collaboration with the National Institute of Technology in Gaithersburg, Maryland, and the Muroran Institute of Technology in Japan—will be published in a book to follow Volume 3 to the presses a few years hence. Similarly, the designation (*Same as O-00.*) means that the oxygen isotope sample O-00 came from the same parent fragment or material as that described in the entry.

It should be noted, too, that not all of the samples appearing in the AbbCat have been analyzed chemically. Many were used for other types of research, and many are being held in reserve for whatever uses might arise in the future. It seemed wise, however, to include all of the samples in this volume so their descriptions will be available if needed.
BEAD TERMINOLOGY

Bead specialists are very particular, and rightfully so, about the terminology used for classifying their favorite artifacts, whether they (the beads) be treasured heirlooms or everyday specimens. In our Master Catalogue entries, we have not adhered consistently over the years to any one system of terminology that would satisfy the specialists (for example, the system formulated by Horace Beck in Ref. F-18). We hope, however, that the descriptions used here, along with accompanying dimensions, will give a satisfactory idea of what the analyzed beads were like. In any event, the remains of the beads analyzed, or identical examples, will always be available for examination at the Museum. The terms employed should be self-evident for most practical purposes. Several are listed below, along with a scale of sizes.

Curiously, the most difficulty we had was in finding a term to describe what is probably the most ubiquitous shape of all—the torus-shaped bead. Torus sounds pretentious, and while donut may sound inelegant, it does, nonetheless, accurately describe the shape we mean. Therefore, we have opted for inelegance over geometrical correctness, finding some justification in a precedent set by Karlis Karklins (Ref. F-70).

Some descriptive terms used in the entries:

- spherical
- ellipsoidal
- cylindrical (relatively narrow perf.)
- tubular (relatively wide perf.)
- drum-shaped (a short cylinder)
- disk
- collared
- ring or ringlet
- biconical
- melon bead

For "donut" or "donut-shaped" read "toroidal" or "torus-shaped."

perf. = perforation

Scale of approximate sizes for terms describing beads:

These ranges are somewhat larger than the values recommended to us some years ago by Kenneth Kidd and Charles F. Wray (Ref. F-73). In the case of Chinese beads, the dimensions corresponding to each term are biased toward slightly greater values than those shown here.

- very large diam. ≥ 1.5 cm
- large diam. 1–1.5 cm
- medium diam. 6–9 mm
- small diam. 3–5.5 mm
- seed diam. ≤ 2.5 mm

For "diam." read "diameter."
SOME ABBREVIATIONS AND NOTATIONS

The meanings of most of the abbreviations and notations used throughout this book should be immediately obvious to the reader, but some of those most commonly used are listed here.

"As above" means that all information usually contained in an entry regarding provenance, date, source, typology, weathering, etc., can be presumed to be essentially the same as for the preceding entry, except as otherwise noted.

Dimensions are stated as follows:

- l. = length
- t. = thickness
- w. = width
- h. = height
- diam. or d. = diameter
- i.d. = inside diameter
- o.d. = outside diameter
- ~ = approximately

For "gr. dimen." read "greatest dimension".

Dimensions marked "=" are actual measurements; otherwise, dimensions are approximate or somewhat variable. Values are stated to the nearest significant figure. For example, 1.0 mm means 1.0 mm, not 0.9 or 1.1 mm, whereas 1 mm means between 0.5 and 1.4 mm. The ~ sign means approximately.

- crizzl. = crizzled or crizzling
- devit. = devitrified or devitrification
- iri. = iridescent or iridescence
- w. = weathering (From the context, there should be no confusion between w. for weathering and w. for width.)

For colors, the following modifiers are used:

- dk. = dark
- med. = medium
- lt. = light
- p. = pale
- brt. = bright
- v. = very
- em. = emerald
- transp. = transparent
- opq. = opaque
- transl. = translucent
- bl. = bluish
- grn./gr. = greenish
- ylw. = yellowish
- purp. = purple or purplish
- blk. = black

Certain individuals whose names appear frequently in the departmental notes are identified here, as they are in the notes, by their initials. They are:

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<thead>
<tr>
<th>Initials</th>
<th>Full Name</th>
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<tr>
<td>SMG</td>
<td>Sidney M. Goldstein</td>
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<td>DPL</td>
<td>Dwight P. Lanmon</td>
</tr>
<tr>
<td>FRM</td>
<td>Frederick R. Matson</td>
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<td>MRB</td>
<td>Margaret R. Brill</td>
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COLOR TERMINOLOGY

Color is an important feature of glass. Along with transparency and fluid like forms, it is, in fact, one of the defining and most captivating attributes of glass. Nevertheless, we believe it is possible to overclassify glasses by color. As useful as systems like the Munsell color system may be, reliance on them can be misleading by implying that early glassmakers had at their disposal (and under their control) a more complex palette of colors than they actually did. In our view, the palette of colors used by glassmakers in early times was more limited than one might initially think. Thus, we use here a relatively simple terminology for describing colors—one based on the premise that anyone who has handled a lot of early glass will know just what colors the terms are describing, and will know what the inherent colors of the glasses are, regardless of their bulk, their shape, or the conditions under which they are viewed.

We should add, however, that over the years we have measured nearly a hundred transmission spectra of early glasses and experimental glasses. The early glasses are representative of the colors usually encountered in glasses of various historical periods in one's everyday museum experience. The experimental glasses were designed to measure the effects of various colorants in various glass matrices or at varying concentrations. The spectra were measured by Roland French of Corning Glass Works, who also measured a few reflectance spectra. The results will be included in Volume 3. It is our belief that once you become accustomed to working with transmission spectra, you develop a far better eye for color, and a better understanding of what you see.

Our color terminology is given below. For further elaboration, see Refs. A-43, A-55, and A-58.

Transparent Glasses

Aqua
The "natural" color of glass produced by the presence of iron impurities. It does no harm that the term is inexact because this color is variable depending upon the particular redox equilibrium established within any given glass. Just as the colors of bodies of water vary, so does that of iron in glasses. Most often, either bluish or greenish aqua is specified.

Bl. aqua
The equilibrium is displaced more toward the reduced side; ferrous iron (Fe²⁺) is predominant. Think of Mason jars.

Gr. aqua
The equilibrium is not displaced as far toward the reduced side; the ferrous/ferric ratio (Fe²⁺/Fe³⁺) is not as great, even though ferrous iron may still predominate. Think of window glass viewed end-on.

Colorless
Water white, usually achieved in ancient glasses by use of a decolorizer and often coupled with a lower iron content. Think of Achaemenian glass decolorized with antimony or Islamic cut glass decolorized with manganese.
Green
A stronger color than aqua, and often somewhat more yellowish, caused by the addition (usually, but not always, deliberate) of iron. Think of a green ginger ale bottle.

Em. green
Emerald green (or sometimes “bright green”) refers to a sparkling green that is different from the ordinary iron green. It is usually associated with copper in a high-lead glass, although some iron is also often present. (This is not the same as the more yellowish chromium green sometimes found in modern glasses.) Think of Islamic cameo glasses, the San Salvador beads, and certain Mediaeval stained glasses.

Dk. blue
Dark blue is ordinarily reserved here for glasses known to be colored by cobalt (or cobalt in combination with copper). Think of milk of magnesia bottles and eye cups.

Med. blue
Medium blue usually refers to copper blues, but a dilute cobalt blue may sometimes here have inadvertently been called medium blue. Think of an aqueous solution of copper sulfate. Sometimes unusually vivid blue glasses are found. These are likely to be described here as “brt. blue” for bright blue.

Purple
The familiar manganese color; different from violet in that it contains a substantial red component. Think of any amethyst glass. In a few instances we have used an oxymoronic term “orangy purple” for a color we find difficult to describe. Perhaps our eyes were just playing an afterimage trick on us at the time and these glasses might be better described as “amber”—but there seemed to be something unusual about them. (See discussion on p. 295.)

Amber
The warm, orangy color produced by the ferri-sulfide complex. (Although the term carbon amber is a misnomer, it is synonymous with our term amber.) Think of beer bottles.

Olive
A cooler, markedly greener color than amber. Think of green olives and Early American or English wine bottles.

Olive-amber
A color distinguishable in our usage only by comparison with “olive” and “amber”. It is something intermediate between the two—a refinement, but an important one, caused by a combination of ferrous iron with the ferri-sulfide complex. It is the color, in thin section, of many black glasses. Think of so-called “linen presses” and of black bangles and beads from India.

Smoky
The grayish (or less often slightly brownish) tinge sometimes seen in otherwise colorless glass. Think of grisaille or certain Venetian glasses.
Opaque Glasses

The terms used to describe opaque colors have rather obvious meanings. They are characterized by the presence of separate, suspended or dispersed colorant-opacifier phases. For glasses that are not densely opaque, we like the term *turbid*. (Think of muddy water or milky water.) We use:

- White opq. (WO) Think of alabaster.
- Yellow opq. (YO) Think of Naples yellow.*
- Dk. blue opq. (DBO) Think of lapis lazuli.
- Lt. blue opq. (LBO)** Think of turquoise.
- Lt. green opq. (LGO) Think of lettuce.
- Red opq. (RO) For bright red, think of cuprite; for brick red, think of bricks.
- Orange opq. (OO) Think of terra cotta.

* As prepared in our laboratory, PbSnO₃ is a lemon yellow; Pb₂Sb₂O₇ is somewhat more orangy.
** We strongly dislike the use of the term *turquoise* to describe transparent glasses and reserve it exclusively for lt. blue opq. glasses. The mineral, after all, is opaque, not transparent.

Dichroic Glasses

We first used the term *dichroic glass* in connection with the Lycurgus Cup (Ref. A-14), having in mind a very specific meaning. If *dichroic* is defined as “having two colors”, the usage is precise and appropriate, because the Lycurgus Cup and some other glasses like it have two different colors depending upon whether they are viewed by transmitted or reflected light. This usage parallels the word’s usage for describing certain dye solutions (even though the reasons for the two color effects are different). The only other correct usage for the term *dichroic glass*, in our opinion, is for describing the variation in color of another special type of glasses—for example, those containing rare-earth colorants—which show different transmitted colors when viewed by light sources having different color temperatures. (Some examples are our own experimental glasses EYS . . . EYZ.) Such glasses also show different colors when viewed by transmission through different thicknesses. In the latter way, they resemble the dye solutions mentioned above because the different visual perceptions depend upon the human eye’s different thresholds of perception for different wavelengths of visible light. The Lycurgus Effect, on the other hand, results from an entirely different cause: a combination of light-scattering and optical absorption by colloidal metallic particles. (See Ref. A-14.) To repeat, we see these “having two colors” properties as being both valid and suitable uses of the term *dichroic glasses*.

The reason for this long discourse is that of late, a growing number of people seem to have taken a liking to the term *dichroic* and are using it indiscriminately and (in our view) incorrectly to describe various contemporary glasses that they consider interesting and colorful.
WEATHERING

Although ordinary glasses under ordinary circumstances can be regarded as being insoluble in water, they are, in fact, susceptible to very slow chemical attack by both liquid water and atmospheric moisture. The rates of the reactions are such that, at near room temperature, the effects do not usually become apparent to the unaided eye until after many years of exposure. Except under extreme conditions of other variables, the rate of weathering depends primarily upon the availability of water and the glass composition. Some other factors affecting the rate are temperature, pH (and certain other chemical factors), surface defects, and thermal history.

The effects of weathering on historical glasses vary greatly both in the extent of attack and in the physical nature of the weathering products. In this catalogue, the entries for the samples contain only brief descriptions of weathering. The following list gives some idea of the terminology used. Although the types of weathering appearances are so varied, these subjective terms should serve most purposes for readers who have handled much glass.

Unweathered Surface looks like a freshly-made glass, apart from any scratches due to wear or erosion.

Little or no w. No alteration, or minimal alteration, apparent on the surface without magnification.

Lightly w. Surface dulling or weathering products in the form of a scum or film; difficult to distinguish from accretions of foreign matter except for permanent loss of surface gloss.

Moderately w. Weathering products or iridescent layers cover a substantial portion of the surface, but apparent original thickness of weathering products is (or was) thinner than half a millimeter or so. Surface may be pitted.

Heavily w. Weathering crust of the order of one millimeter in thickness, or glass shows overall pitting where some weathering products have been lost.

V. heavily w. Weathering products predominate over remaining glass phase (for thin-walled vessels), or crusts are greater than about one millimeter in thickness. In the most extreme cases, no glass at all remains.
HOW TO USE THIS CATALOGUE

Glasses are grouped here in 19 categories, each corresponding to a broad geographical, chronological, typological, or cultural description. At first these might appear to be a hodgepodge, but the terms and groupings should be familiar to most glass specialists. With a little patience and an open mind, readers should, after a bit of shuffling, be able to locate descriptions of the particular types of glass or particular sites that are of interest to them. Users will do well to spend a few minutes familiarizing themselves with the Catalogue as follows:

1. Look at the Outline to get a feeling for the general scheme of things.

2. Look at the subheadings in the Outline.

3. Note that the entire book is cross-referenced according to Outline headings and subheadings. For example, XII A. in the Catalogue corresponds to XII A. in the Tables of Analyses, and will eventually correspond to XII A. in Volume 3.

If you do not find a glass where you expect it, try to be patient and look elsewhere. For example, if you do not find cage cups, try diatreta; if you do not find Tell el-Amarna, try Amarna. If the Zerek Çamii glass is not under Byzantine, try Stained Glasses. It might be there. The Begram glasses could be under Roman or under Central Asian, depending upon how the author happened to think of them on the day when the decision was made as to where to place them. Some headings refer to techniques rather than to geographical locations or periods. For example, the glass bowls from Anafa also appear under Ribbed Bowls, and the Portland Vase is listed under Cameo Glass in the Roman section. For specific names and places, the Index might also prove useful.

Some terms are used loosely. For example, Roman means what most people think of as the Roman World. Also, Mesopotamian and Near Eastern includes some glasses from Iran, Syria, etc. To some, that may not be satisfying geographically, but it is a broad classification where we thought readers would begin to look if they wanted to find second and first millennium B.C. glasses of other than Egyptian origins.

We did not want the Outline to become unwieldy. Therefore, we elected to keep the headings broad and few in number, even though that may have made them less precise. Consequently, readers are asked not to take the headings too literally. They are not intended to serve as a definitive classification scheme, but only to help guide readers through the descriptions and data. The point is, that in addition to geographical considerations, there are underlying glass traditions or relationships of some sort that tie together the glasses within each of the assigned headings.
Following the glass descriptions are sections that contain other materials. However, some of these materials are mixed in with the glasses themselves because it seemed to us that this is where readers would be most apt to look for them. So the rule is, if it is not where you would have put it, look where you think a well-intentioned author might have put it.

Given only the number of a sample, one cannot easily locate that sample’s description in this Catalogue. However, it is unlikely that readers would have to do that, because they would usually know enough about a sample (its date, general place of origin, etc.) to be able to track it down through the Outline. In the event that someone actually has a sample in hand, they would probably be in the Museum anyway, so they could locate the sample in the department’s Master Catalogue, where the samples are listed in numerical order.

This is the kind of book that cannot be fully indexed in any practical way. If we attempted to do that, the index would overpower the book. Terms such as cullet, iridescence, rim, or blue would have so many entries that the index would be unusable. Therefore, we have elected to include only an Index of Names and Places. The Outline itself is short enough that readers having a feeling for glass history should, with a minimum of fussing, be able to find their way around in it.
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<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
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<tbody>
<tr>
<td>1515</td>
<td>Cored vessel. Lt. blue transp., with threading. (Oxygen isotope analysis performed.)</td>
</tr>
<tr>
<td>1516</td>
<td>Cored vessel. Dk. blue opq., with threading. Used for thermoluminescence expt. (Same as TL-1.)</td>
</tr>
<tr>
<td>1521</td>
<td>Cored vessel. Dk. blue transp., with threading. CMG 59.1.11. (Same as O-1.)</td>
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<tr>
<td>3350</td>
<td>Cane. Dk. blue transp.</td>
</tr>
<tr>
<td>3351</td>
<td>Cane. Dk. blue transp.</td>
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<tr>
<td>3352</td>
<td>Cane. White opq.</td>
</tr>
<tr>
<td>3353</td>
<td>Cane. Yellow opq.</td>
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<tr>
<td>3354</td>
<td>Cane. Lt. green opq.</td>
</tr>
<tr>
<td>3355</td>
<td>Cane. Red opq.</td>
</tr>
<tr>
<td>3356</td>
<td>Cane. Amber.</td>
</tr>
<tr>
<td>3357</td>
<td>Cored vessel. Dk. blue transp., no decoration, whitish core residue remaining, unweathered. UC 22937. (Same as Pb-3357.)</td>
</tr>
<tr>
<td>3358</td>
<td>Cored vessel. Dk. blue transp., with threading, buff-colored core residue remaining, unweathered. UC 22937. (Same as Pb-3358.)</td>
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<td>3359</td>
<td>Cored vessel. Dk. blue transp. with threading, buff-colored core residue remaining, unweathered. UC 22937. (Same as Pb-3359.)</td>
</tr>
<tr>
<td>3360</td>
<td>Cored vessel, rim or base. Dk. blue transp., yellow opq. edging, unweathered on blue, lightly w. on yellow. UC 22937.</td>
</tr>
<tr>
<td>3361</td>
<td>Cored vessel. Dk. blue transp., with threading and scalloping, whitish core residue remaining, lightly w. UC 22937.</td>
</tr>
<tr>
<td>3362</td>
<td>Cored vessel. Lt. blue transp., no decoration, buff-colored core residue remaining, lightly w. UC 22938.</td>
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<tr>
<td>3363</td>
<td>Cored vessel, rim or base. Lt. blue transp., yellow opq. edging, unweathered. UC 22938.</td>
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<tr>
<td>3364</td>
<td>Cored vessel. Lt. blue transp., yellow and white opq. decoration, buff-colored core residue remaining, lightly w. UC 22938.</td>
</tr>
<tr>
<td>3365</td>
<td>Cored vessel, base. Lt. blue opq., white opq. decoration, whitish core residue remaining, unweathered. UC 22938. Sample consists of white opq. from edge.</td>
</tr>
<tr>
<td>3366</td>
<td>Cored vessel, base. Dk. purple, yellow and white opq. decoration with white edging, buff-colored core residue remaining, lightly w. Sample consists of white opq. glass.</td>
</tr>
<tr>
<td>3367</td>
<td>Cored vessel, rim. Dk. blue transp., yellow and white opq. decoration, yellow edging, buff-colored core residue remaining, unweathered. UC 22937.</td>
</tr>
<tr>
<td>3396</td>
<td>Cane. Dk. blue transp. (Same as Pb-3396.)</td>
</tr>
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</table>

3900 Cored vessel, wall. Dk. blue transp., bubbly, whitish core residue remaining, unweathered. MMA M8.

3901 Cored vessel, wall. Dk. blue transp. with white turbid streaks, core residue remaining. MMA M9. Sample consists of dk. blue glass contaminated with streaks.

3902 Cored vessel, wall. Dk. blue opq., core residue scraped away, unweathered. MMA M7.

3903 Cored vessel, wall. Dk. blue opq. with yellow and white opq. bands, slightly scalloped (?), buff-colored residue remaining, unweathered. MMA M23.

3904 Cored vessel, wall. Lt. blue transp., yellow opq. decoration, bubbly with many inclusions, light-colored core residue remaining. MMA M2. Sample consists of lt. blue glass.

3905 Cored vessel, shoulder (?). Lt. blue opq., unweathered. MMA M4.

3907 Cane. Lt. blue opq., unweathered. MMA M1.

3908 Cored vessel, rim. Dk. blue opq. with two white opq., one yellow opq. and one lt. blue opq. band; core residue remaining. MMA M22. Sample consists of white opq. glass.

3910 Cored vessel, rim. Yellow opq., dulled surface. MMA M10. (Same as Pb-1116.)

3911 Cored vessel, rim. Dk. blue opq. with yellow, white, and lt. blue opq. bands, dulled surface. MMA M21. Sample consists of yellow opq. glass. (Same as Pb-1117.)

3913 Cored vessel, shoulder. Purple, with yellow, white, and lt. blue opq. bands, bubbly; fine white core residue with chocolate-brown shredded fibers remaining, unweathered. MMA M25. Sample consists of purple glass.


3904 Cored vessel, wall. Dk. blue transp., bubbly, core residue scraped away, unweathered. MMA L5.

3904 Cored vessel, wall. Dk. blue transp., bubbly; heavy brownish core residue remaining with impressions of shredded fibers and a few fine, rounded inclusions of colored glass. MMA L8. Sample consists of blue glass.

3913 Cored vessel, wall. Lt. blue transp., bubbly, buff-colored core residue remaining. MMA L7.

3914 Cored vessel, rim. Lt. blue transp., with yellow opq. threading; bubbly, orange-peel effect on surface, core residue scraped away, unweathered. MMA L10. Sample consists of blue glass.
3945  Cored vessel, wall. Lt. blue transp., with fine feathered bands of yellow, white, and grn. blue opq.; bubbly, orange-peel effect on surface, core residue scraped away, unweathered. MMA L2. Sample consists of blue glass. (Slight contamination with yellow glass.)

3950  Cored vessel, wall. Purple, with white and yellow opq. looped banding, bubbly, core residue scraped away, pitted. MMA L1.

3952  Cored vessel, wall(?). Greenish turbid, bubbly, possibly a waster or accidentally refired. Either core residue scraped away or glass set up in contact with roughened surface. MMA L9.

3954  Cane. Yellow opq. MMA L15. (Same as Pb-1119.)

3956  Cored vessel, wall. Yellow opq., bubbly, core residue remaining, unweathered. MMA L12. (Same as Pb-1118.)

3957  Cane. Brownish-red opq., tubular elongated bubbles, lightly w. MMA L17.

3958  Cane. Black. MMA L18.

3960  Cullet. Black, bubbly, one flat surface set up in contact with air, traces of brown and reddish earthy material fused in on opposite side; green metallic inclusion near earthy material. MMA L23.

3962  Waste glass. Black, upper surface set up in contact with air, refractory material adhering to lower surface, lightly w. Sample consists of black glass. MMA L24.

3964  Waste glass, poss. cooled in a palette. Grayish-blue opq., very bubbly, reddish-brown refractory material adhering on bottom; flat top, having set up as surface of a puddle, w. scum. MMA L25. Sample consists of blue glass.

3968  Waste glass. Purple material, frothy, sintered, covered with glaze of dk. amber glass, bits of other materials fused to underside, partially devitrified, lightly w. MMA L22. Sample consists of amber glass.


3370  Cored vessel. Dk. blue transp., remains of decoration of unknown color, core residue remaining, moderately w. T200 342.69.

3371  Cored vessel. Lt. blue transp., core residue remaining, moderately w. T200 354.69.

3372  Cored vessel. Lt. blue opq., with threading, heavily w. T200 227/51.

3373  Cored vessel. Lt. blue transp., remains of decoration of unknown color, heavily w. T200 157/7.

3374  Cored vessel. Lt. blue transp., with threading, core residue remaining, moderately–heavily w. T200 273.69. (Same as Pb-1079.)

3400  Bead, roughly spherical, protrusions at each end, with a tool mark. Colorless turbid with streaks of purple and specks of blue; very bubbly, heavily w. Greatest diam. ~1.9 cm. From Smelting Camp No. 2, Area F. TIM II 6H, SF 500.
3401 Bead fragment, ellipsoidal with protrusion. Black glassy phase intermingled with white opq. phase, v. heavily w., with coarse, reddish-tan surface accretion containing grains of colorless transparent crystalline material. D. 1.4 cm, remaining l. 1.9 cm. T200 303/48; 101, Level 152-167. Sample consists of black glass prob. contaminated with white.

3402 As above, brownish accretion.

3403 Cored vessel. Lt. blue opq., with threading, brownish core residue remaining, moderately w. T-200, sample no. 1454.

3404 As above, yellow opq. glass threading. (Same as Pb-1466.)

3405 Cored vessel. Med. blue opq., with threading, brownish core residue remaining, moderately w. T-200, sample no. 1454.

3408 Dripping, irregularly-shaped, but rounded. Lt. grn. opq., heavily w. with some accretion(?). T-200, sample no. 1456. (Same as Pb-1468.)

3409 Cored vessel, rim. Med. blue transp., with threading, heavily w. T-200, 206/56, sample no. 1455.


1229 Fragment of vessel or other object. Lt. blue transp., v. heavily w. with internal shattering. Found among rubble at the tomb of three foreign wives of Tuthmosis III.

I F. MISCELLANEOUS EGYPTIAN


1505 “The Brooklyn Fish,” cored vessel; 18th Dyn. Colorless vessel in the shape of a bolti (Tilapia nilotica) with blue glass dots and yellow opq. lips, moderately w. The Brooklyn Museum of Art no. 37.316E, Abbot Collection. See Refs. A-61 and C-9. (Same as Pb-455.)

534 Large wound bead. Amarna; 14th c. B.C.(?). Yellow opq., unweathered. CMG unaccessioned.

3368 Small bead or piece of raw pigment. Thebes, Palace of Amenhotep III; poss. 18th Dyn. Yellow opq., roughly cylindrical with perforation. D. ~5 mm, l. ~2.8 mm. CMG unaccessioned. (Same as Pb-462.)

3369 Bowl; 15th–14th c. B.C.(?). Lt. blue opq., little or no w. CMG 59.1.8; RWS 1431.

3381 See Section XXVII. Pigments.

3385 Glass from false beard of the gold mask of Tutankhamun. Sample is of grayish w. surface covering dk. blue glass. (See RHB notes of 10/20/76.)

3388 Chip of glass said to have come from an ancient Egyptian glass head. Red, some surface scum. (11/13/90.)
3389 Inlay; prob. 18th Dyn. Dk. blue opq. (S. Goldstein, SLAM.)

I G. LATE OR OF UNCERTAIN DATE

For analyses of nos. 945–3129, see Section VII C. Fustat.

945 Fragment; date uncertain. Purplish amber glass with white spherical devit. stones. Glass is ~10% devit.; individual spheres are ~2–3 mm in diam. (H. Smith, UC.) UC no. 22627.

946 Fragment; date uncertain. Purplish-amber glass with large white devit. stones. (W. T. Chase.) FGA no. 09.906.

3125 Nugget of cullet, once thought to have come from Wadi Natrun but more likely to be from Fustat. Sampled by RHB and S. A. Saleh in the Egyptian Museum, Cairo, 4/25/73. Amber glass with ~40% white spherical devit. stones (3–5 mm diam.). Compare with 945 and 946; also with head in the Egyptian Museum. Sample is ~95% amber glass. See Ref. E-12.

3126 As above, sample is ~80% devit. phase.

3127 Waste glass, Fustat, undated. Grn. aqua, heavily devit. and frothy. Sampled by RHB and S. A. Saleh in the Egyptian Museum, Cairo, 6/19/75. Sample is of devit. zone.

3128 As above, glassy zone.

3129 As above, nugget of cullet. Colorless. SAS-6.

3223 Cast inlay head, prob. mid-7th–5th c. B.C. Brt. red opq., white opq., and blue opq. details; traces of Egyptian blue, heavily w. CMG 55.1.63. See Refs. A-55, E-1, and E-16, pp. 88–89, SMG no. 161 and plate 10. (Same as Pb-1316.)

3255 Miniature mosaic plaque with udjet eye; 3rd–1st c. B.C. Dk. blue opq. background with five other colors. CMG 59.1.96., SMG no. 663, p. 228 and plate 32. See also Refs. A-6, A-7, A-55, C-4, E-1, and E-16. Sample consists of red opq. (Same as Pb-171 and Pb-1078.)

3377 Nugget of cullet. Dk. blue opq., traces of refractory adhering. UC 25037.

3378 Nugget of cullet; probably late. Dk. blue transp. UC 25042.

3379 Nugget of cullet. Colorless, bubbly. UC 25043.

3380 Flat slab or plaque; probably late. Lt. green opq., swirls of bubbles, 1.9 cm thick. UC 24688.

3528 Figure of Bes cast in a mold from crushed glass; date uncertain. Dk. blue opq. glass with remains of white mold material or outer layer of glass. (SMG, CMG.) Not analyzed.
II. MESOPOTAMIAN AND NEAR EASTERN


From rooms in the Mitanni Palace at the top of the tell, ca. 1300 B.C. The rooms also contained tablets with the names of two Mittani kings.

1230 Nugget of cullet. Lt. blue opq., heavily w. No. 1698, HH-42. (Room 5.)

1231 Pendant or plaque. Lt. blue opq., heavily w. Unnumbered.

1232 Pendant top with perforation. Lt. blue opq., heavily w. No. 1554, HH-21.

1233 Glass artifact (or waste?). Dk. amber glass coating flat piece of white, devitrified, opq. glass; both heavily w. No. 1664. (Room 5.) Sample is of amber glass.

1234 As above. Sample is of white, devitrified, opq. glass. XRD shows Na₂0.2Ca0.3Si0₂ phase.

1235 Cored vessel. Dk. blue opq., heavily w., blackened core residue adhering. Original colors of threading indeterminable. No. 2524. (Reception room.)

1236 Fragment of large spherical bead. Whitish opq. glass, heavily w. Original d. ~2.0 cm, perf. ~6 mm. Unnumbered. (Room 7.)

1237 Large spherical bead. Yellowish opq. glass, heavily w. Original d. ~2.2 cm, perf. ~4 mm. No. 1987. (Room 7.)

1238 Blob of waste glass. Colorless glass, rounded, with remains of drawn-off thread protruding from one end, crizzled on one surface, otherwise not badly w.; contains large inclusion of black material. Glass shows some strain in polariscope. Said to be from an undoubted Akkadian context (ca. 2200 B.C.). No. FS 561, reg. no. 7761.

1239 Fragment of bar-shaped or cylindrical object. Grayish opq. material, with thin dark-colored surface. Site locus: Naram-Sin of Agade (ca. 2250 B.C.); context is "5th construction level, counting from top down, in area FS, where there is no material later than ca. 2000 B.C." No. FS-1826. Sample is of body material. Sp. gr. = 2.353. (Ref. F-104, p. 138.)

1240 As above. Sample is of black rim with some white body material.

Glass samples too small for chemical analysis; used for lead isotope analysis.

Pb-2141 Miniature glass plaque containing yellow opq. beaded decoration. Completely w. HH-58. (Room 5 or 7.)

Pb-2142 Fragment of cored vessel with combed decoration. Completely w., original colors indeterminable except for yellow opq. No. 1983; HH-91. (Room 7.)

Pb-2143 Fragment of cored vessel with circular, fused-in, decoration. Completely w., original colors indeterminable except for yellow opq. decoration. No. 1980; HH-63.
Pb-2144 Fragments of fused mosaic glass consisting of yellow and lt. green opq. rods and (poss.) other shapes. Heavily w. Sample consists of yellow opq. glass. HH-224. (Reception room.)


Pb-2146 Medium-sized spherical glass bead. Yellow opq. glass throughout, heavily w. HH-85. Diam. ~1.3 cm, perf. ~2.5 mm. Associated with a smaller yellow opq. bead, No. 1863; HH-41. (Room 5.)

Pb-2151 Flattened lead wire, oval shape, heavily corroded. From mixed Uruk and Early Dynastic fill; no later than ED III, and probably earlier. Late 4th millennium or, more likely, early 3rd millennium B.C. CH 691; reg. no. 2114.

Pb-2152 Lump of gray metal, uncorroded. From Eye Temple platform; conceivably 4th millennium, more likely mid–late 3rd millennium B.C. robber trenches. TP 9; reg. no. 1701.

Pb-2153 Thin metal “plating”, corroded with brownish corrosion products. Late ED III; 2500–2400 B.C. St 85; reg. no. 897.

Pb-2154 Lead wire, heavily corroded. Akkadian or just post-Akkadian; ca. 2200 B.C. FS 1171; reg. no. 1616.

Pb-2155 Lead wire, heavily corroded; same context as glass from Mitanni Palace. From fill in Room 7 (the kitchen); ca. 1400–1300 B.C. HH-4b; reg. no. 1615.


1200 Vessel, “marbled”, probably faience. In three colors, very heavily w. M 100/3, 22-11-IIID. Sample consists of white chalky region.

1201 As above, buff-colored chalky region.

1202 As above, reddish region, somewhat gritty texture.

1203 Vessel, “marbled”, probably faience. In two colors. L 2A. Sample consists of a mixture of white and red regions.

1204 As above, white region only.

1205 As above, red region only.

1206 Cored vessel, rim. Lt. blue opq., with decoration and threading. M 100/1, plate 128 D. (Same as Pb-408.)

1207 Plaque, faience, with colored decoration, impregnated with wax. G 52, 30-2-170D. Sample consists of friable, white faience body material.

1208 As above, yellow decoration.

1209 Disk. Lt. blue opq., heavily w. H-33.

1210 Medallion. Lt. blue opq., heavily w. No cat. no. Similar to 1209.

1211 Thin-walled vessel(?) fragment. White friable body; highly crystalline with rod shaped crystals oriented perpendicular to surfaces. Thin, pebbled, yellowish layer on unweathered convex surface. G 29, 12-1-30.
1212 Large bead. Original color indeterminate, dense material. XRD shows major dolomitic limestone. 29-12-357D.

1213 Disk. Amber, originally polychrome, heavily w., probably somewhat devitrified. 30-2-106. Sample consists of amber glass from interior of main body.

1214 Nugget of cullet. Dk. blue transp., heavily w. C62 27-28. (Oxygen isotope analysis performed.)

1215 Bowl. Colorless, moderately w. 28-11-12D.

1216 Finial. Lt. blue opq. with yellow opq. applied "eyes", heavily w. Sample consists of lt. blue opq. glass. (Same as Pb-1084.)

1217 Cored vessel. Lt. blue transp., heavily w. M/79. Sample consists of blue glass.

1218 Fragment, thin-walled. Colorless, painted (?) and scratched designs, heavily w. No. 3036, 28-12 300. Sample consists of colorless glass.

1219 Cored vessel, large. Lt. blue transp., heavily w. X-1. Sample consists of blue glass.

1220 Cored vessel. Lt. blue transp., heavily w. M100/2. Sample consists of blue glass.

1221 Cored vessel. Lt. blue transp., moderately w. C-22. Sample consists of blue glass.


Mosaic glass fragments

715 Fragment of mosaic glass vessel, prob. a beaker form, ca. 1450–1350 B.C. Built up of circular glass rods arranged end-on in a hexagonal pattern. Chalky white rod, original color indeterminate, heavily w. TR-2605; Site A (Temple Mound) level 2, room 16. UM 65-24-49.

716 As above, turbid blue, moderately w.

717 As above, yellow-green opq., prob. originally red opq., heavily w. TR-255a.

718 As above, heavily w. region. Buff-colored, no glass remains.

719 As above, but from fragment UM 65-24-44. Lead isotope sample Pb-410 came from the same part of the mosaic beaker as no. 719.

Other objects

720 Decorative dot from wall of a cored vessel; just before 1400 B.C. Yellow opq., heavily w. Site A, 1964 (prob. level 2 in slope wash.) TR 207d/e, UM 64-11-50. Temple Courtyard, level 1c.

721 Fragment of flat, somewhat friable tile; ca. 1400–1200 B.C. Exterior is whitish, homogeneous zone 4–6 mm thick; interior is lt. blue opq. glass. Outermost surface has a thin dk. gray crust. Same location as above. Sample is of blue glass. TR 2621, UM 65-24-50; Site A, level 1.

721a As above, whitish zone.
Unknown object. Blue transp. glass with tightly-adhering, grayish surface coating. (Uncatalogued.)

Flat disk with groove. Red opq. with some greenish w. TR 2600, UM 65-24-43. Note: The origin of this sample is in question. It is possible that it came from Hasanlu instead of Rimah.

Note: Lead isotope sample Pb-409 came from the weathered remains of yellow opq. threading on cored vessel TR 3623.

See also Section XXVI I., no. 725.


Fragment of large inlay (?); rounded edge of two intersecting perpendicular surfaces. Brt. blue transp., heavily w. XXIV, PD pit.

Glaze from small faience (?) bead. Yellow opq. Has 57-96; VI-B12.

Pedestal fragment, poss. octagonal section (?). Lt. blue opq., very well melted; heavily w. Gr. dimen. 3.5 cm. XLI 3.5.29. Has 59-741. (Same as O-4.)

Medium spherical bead. Black with white stripe. Apparent diam. 8.5 mm. Has 60-812.

As above, white opq. stripe.

Medium spherical bead. Dk. amber, with white opq. stripe. Apparent diam. 9 mm. Has 60-812.

As above, white opq. stripe.
733 Same object as 708 (Has 64.130), burned edge of fragment.

735 As above, white opq. glass.

736 As above, red opq. glass. (Same as Pb-1074.)

738 Same object as 706 (Has 64.129), lt. blue turbid glass.

739 As above, gritty interior material.

740 Same object as 708. Yellow opq. glass.

5420 Chunk of glass, irregular, poss. preserving rounded edge. Brt. red opq., thick w. crust. From a group of eight beads marked “CC 314.” (Same as Pb-2138.)

5422 Very large rounded bead with flattened ends; poss. some surface decoration. Black, w. to stone-like appearance. Diam. 2.4 cm, l. 1.7 cm, perf. ~4 mm. 1960 season, XXXV 5, 6.

5423 Large donut-shaped bead. Black, with white decoration, heavily w. Diam. 1.4 cm, l. 7 mm, perf. 3 mm. Has 171. Sample consists of black glass.

5424 As above. Sample consists of both black and white glass.

5425 Medium-sized bead. Lt. blue turbid, some w. Diam. 9 mm, l. 8 mm. Has 171.

5426 Large cylindrical bead fragment. Dk. blue transp., lightly w. Preserved dimen.: diam. ~8 mm, l. ~1.0 cm. Has 171.

5427 Very large bead (flattened bee hive shape) ca. 1100–800 B.C. Black, with threading, glass spalls apart readily into small crumbs. Diam. at flattened base ~2.3 cm, l. ~1.2 cm. Q23 3.5.61; Has 62-720. Sample consists of black glass.

5429 Large eye bead; ca. 1100–800 B.C. Black, with (now) white eye. Diam. ~1.5 cm, l. ~1.0 cm. Same location as 5420. Sample consists of black glass.

5430 As above, w. remains of eye decoration.

5431 Very large biconical bead. Black with (now) white feathered decoration, half cone length ~1.8 cm, max. diam. ~1.3 cm, perf. ~7 mm; heavily w. Same location as 5429. Sample consists of black glass.

5432 As above, feathered decoration.

5433 Scalloped, “half-melon” bead. Black with white opq. threading; heavily w. Apparent diam. 1.2 cm. Same location as 5429. Sample consists of black glass.

5434 As above, white opq. threading.

5435 Large glass amulet with elaborate spiraled threading marvered in. "Black" (dk. blue transp.) body with (now) white threading; moderately w. Gr. diam. 3.2 cm. R 24.3.3 120; Has S-95. Sample consists of blue glass.

5436 As above. Sample consists of both black and white glass.

See also Sections XXII A. and XXVI B.

700 Mosaic glass peg-based vase (or “chalice”). Formed from small glass rods, probably arranged end-on around a core in a hexagonal close-packed fashion, possibly held together temporarily with an organic adhesive, and fused into place forming a lozenge pattern. The rods were originally white opq. and lt. blue opq. against a continuous field now having a mottled dk. green and red opq. appearance. The field occupies about 65% of the surface area. From Tomb 45, Trench XXII H. Sample is of dk. green glass scraped from the surface of a white opq. cane.

701 Composite of three whitish or buff-colored canes, heavily w. Diam. of canes ~2.0 mm. Canes are filled with seeds, and relict spheres from seeds, 0.02–0.04 mm in diam.

702 As above, canes of somewhat harder or higher-fired glass. White opq., heavily w.

II F. TCHOGA ZANBIL; ca. 1250–1200 B.C. (CMG.) See SMG, p. 49, no. 7.

3346 Hollow tube with spiraling. Dk. olive amber with white opq., heavily w. CMG 66.1.24(d). Sample consists of amber glass.

3347 As above, white opq. glass.

3348 Another tube with spiraling. Dk. olive amber with white opq., heavily w. Sample consists of amber glass.

3349 As above, white opq. glass.

II G. NIMRUD; 7th c. B.C. (B. Parker, IAL, and J. J. Orchard, BSI; P. Harper, MMA.)

Vessels. (B. Parker, IAL unless otherwise noted.) See Ref. C-5.

545 Hemispherical bowl. Colorless, light frosty iridescence. heavily w. (Same as O-41.)

546 Hemispherical bowl. Colorless, heavily pitted. Heavier wall than 545. (Same as O-42.)

547 Hemispherical bowl. P. greenish, heavily pitted. (Same as O-43.)

548 Hemispherical bowl. Purple, heavily pitted. (Same as O-44.)

3254 Hemispherical bowl. Brt. blue transp., heavily w. (A. von Saldern.)

Inlays and cullet. (J. J. Orchard, BSI, unless otherwise noted.) See Refs. A-19, A-37, and F-106.

200 Chunk of glass, thought to be 6th c. B.C., but some poss. of post-220 B.C. Brt. red opq., heavy green w. crust. From Burnt Palace. Preserves curvature of crucible, upper coating of charcoal or similar charred material. See Refs. A-55, C-2, C-3, C-4, C-5, and F-129. (Same as Pb-90.)

377 Inlay. Dk. blue opq. P. Harper, MMA. (Same as O-3.)

378 Inlay. Lt. green opq. P. Harper, MMA.

1121 Nugget of cullet. Lt. blue opq., heavily w. J. Oates. (Oxygen isotope analysis performed.)
3228 Inlay. Yellow opq., small wing feather, apparently once heavily w., cleaned in field. JJO 1 f-k. (Same as Pb-429.)

3229 Inlay. Dk. blue transp., rosette square, little or no w. ND 10,229.

3230 Inlay. Dk. blue transp., rosette square, little or no w. ND 10,229.

3231 Inlay. Dk. blue opq., wing motif, little or no w. ND 8,081(?). (Same as Pb-1177.)

3232 Inlay. Dk. blue opq., “figure of eight”, little or no w. ND 10,231.

3233 Inlay. Dk. blue opq., rectangular strip, little or no w. ND 12,538. (Same as Pb-1178.)

3234 Inlay. Dk. blue opq., semi-circle, little or no w. ND 12,533. (Same as Pb-1179.)

3235 Inlay. Lt. blue transp., strip, iridescent, moderately w. ND 6,410.

3236 Inlay. Lt. blue transp., round strip, pitted. ND 8,157.

3237 Inlay. Red opq., plain strip, heavily w. ND 6,410.

3239 Disk. Red opq., heavily w. ND 10,246. (Same as Pb-425.)

3241 Inlay. Red opq., human male head, heavily w. ND 10,246. (Same as Pb-451.)

3243 Nugget of cullet. Red opq., heavily w. (Same as Pb-423.)

3245 Inlay. Yellow opq., small wing feather, pitted. ND 10,240. (Same as Pb-429.)

3246 Inlay. Yellow opq., rectangular, lightly w. ND 8,081. (Same as Pb-452.)

3247 Inlay. Yellow opq., irregularly shaped, lightly w. ND 8,081.

3248 Inlay. Yellow opq., irregularly shaped with groove, lightly w.

3250 Fragment of a lion’s head. Soft, white material. JJO 2x. ND 10,264.

See also Section XX A. Nos. 3238, 3240, 3242, and 3244 are weathering products, respectively, of 3237, 3239, 3241, and 3243.

Inlay fills

3249 White fill removed from dk. blue rosette inlay. JJO 4. ND 10,229. V. small sample.

3251 White fill removed from dk. blue rosette inlay. Fort Shalmaneser, Rm. S. 10; ND 8,081. JJO 11. Sample wt. 1.17 mg.

3252 White fill removed from dk. blue roundel inlay of the “millefiori type.” Fort Shalmaneser, Rm. S. 10; ND 8,081. JJO 13. Sample wt. 0.98 mg.

3253 White fill removed from dk. blue inlay. Sample is of white “eyeball” of eye design. Fort Shalmaneser, Rm. S. 10; ND 8,081. JJO 17. Sample wt. 7.35 mg.
Miniature painted plaque, Fort Shalmaneser.

1712 Painted glass plaque, prob. wing-shaped, prob. with lines delineating feathers. Rm. S.W. 37; ND 10,2796. Colorless glass, v. heavily w. Preserves traces of black painted lines and poss. a now buff-colored background paint on one side of original surface. Only a very thin wafer of glass remains in the center of the fragment. Sample is of colorless glass. (Same as Pb-457.)

1710 As above. Five flakes of background paint and/or w. glass surface.

1711 As above, with traces of black pigment.

II H. PERSEPOLIS; ca. 5th c. B.C.

198 Chunk of glass. Brt. red opq., heavy green w. crust. No. PT7 380. From FRM. (Same as Pb-463.)

199 Flat slab, with drilled hole. Brt. red opq., moderately w. No. PT7 379. From FRM. (Same as Pb-464.)

498 Fragment, Achaemenid. Colorless. No further description. From GDW.

1860 Fragment, original shape uncertain. Colorless. From GDW. (Same as O-26.)

II I. GORDION; date uncertain.
(R. Young, UM.)

3393 Vessel wall. P. purple, unweathered. 3202, G 176.

II J. ALTIN TEPE; 8th c. B.C.
(G. Weinberg, UMo.)

3394 Glass fragment, blue transp., pitted.

II K. ULU BURUN SHIPWRECK (KA$); ca. 1300 B.C. (G. Bass, C. Pulak, INA.) All samples are in the Bodrum Museum of Underwater Archaeology. See Refs. F-9, F-11, F-14, and F-15.

5950 Ingot. Dk. blue transp., heavily w. L 241(?). (Same as Pb-3350.)

5951 Ingot. Dk. blue transp., heavily w. L 167. (Same as Pb-3377.)

5952 Ingot. Dk. blue transp., heavily w. Number uncertain. (Same as Pb-3352.)

5954 Ingot. Dk. blue transp., heavily w. From ingot photographed, 9/30/85. (Same as Pb-3354.)

5955 Ingot. Dk. blue transp., heavily w. KW 622. (Same as Pb-3355.)

5956 Ingot. Dk. blue transp., heavily w. KW 34. (Same as Pb-3356.)

5957 Ingot. Dk. blue transp., heavily w. KW 333. (Same as Pb-3378.)

5961 Ingot. Dk. blue transp., heavily w. KW 3576. (Same as Pb-3361.)

5962 Ingot. Dk. blue transp., heavily w. KW 3997(?). Glass is unusually clear and contains fewer bubbles than other ingots. (Same as Pb-3376.)

5963 Ingot. Lt. blue transp., heavily w. KW 3851. (Same as Pb-3363.)

5964 Ingot. Lt. blue transp., heavily w. L 7599. (Same as Pb-3364.)
Ingot. Purple transp., heavily w. KW 3535. (Same as Pb-3368.)

Small fragment of bead; one of a group of small, donut-shaped beads. Others are black or (now) amber colored. Lt. blue transp., v. heavily w. Relict flow lines confirm they were wound. A few black specks thought to be redeposited MnO$_2$ or CoO (?). Ave. apparent diam. ~6 mm, t. ~4 mm, perf. ~3 mm. Number uncertain. (Same as Pb-3369.)

Ram’s head rhyton. Scrapings of glaze(?) from around eye, mouth, and area thought to have been repaired in ancient times. KW 707. Possibly contaminated with consolidant. Received from Cemal Pulak 2/5/91. (Same as Pb-3343.)

Large fragment of ingot. Dk. blue transp., heavily w. KW 1562(?). Examined for flow lines and strain patterns. (Same as Pb-3375.)

Fragment of Mycenaean glass pendant. Dk. blue transp., heavily w. KW 3129. V. small sample. (Same as Pb-3370.)

Large lentoid bead, agate or (more likely) glass. From one of several examples of variegated appearance which disintegrate after excavation. Sample is of white, mushy, interior material. KW 2815.

See also Sections XX B., XXII A., and XXVI B.

### II L. MISCELLANEOUS MESOPOTAMIAN AND NEAR EASTERN

Small bead, described as ovoid or spherical; Cape Gelidonya Wreck; ca. 1250 B.C. Poss. green or aqua, almost completely w. (G. Bass, UM.) See Ref. A-62.


Gold glass bowl; Hellenistic. (Ankara Museum, courtesy G. Weinberg.)

Fragment of cut and engraved bowl, possibly Persian; 5th-4th c. B.C. Colorless transp. glass. (Private collection.)

Massive cut vase, Syria or Assyria; 750–600 B.C. (?). Green with whitish w. crust and black dendrites on interior. CMG 55.1.66. Sample consists of remains from oxygen isotope analysis. See Refs. A-58, C-5, E-1 (p. 37, no. 48), and E-16 (pp. 99–100, no. 196.) (Same as O-92.)

Eagle’s head, cast; Achaemenian or modern. “Black” appearance but thin sections show a p. blue transp. color. Surface is w. and/or chemically etched. Sample is floating fragment from underside near rear.

As above, white material from inside crevice.

As above, transp. or translucent flake of iri. from underside.

As above, white material from beneath unopened crack separating 4999 from glass inside.
III. MYCENAEAN AND IRON AGE

III A. MYCENAEAN; 1400–1250 B.C.
(CMG.) See SMG, pp. 91–98, nos. 168–189.

1858 Amulet. Dk. blue transp., roughly rectangular, with three horizontal reels. CMG 59.1.62a. Original l. ~5–6 cm. (Same as Pb-3385 and O-33.)

3480 Plaque. Dk. blue transp., large, eight-petalled floral design, very bubbly, with some inclusions, lightly w.; blue color is preserved. CMG 76.1.10. Note spherical metallic inclusions, which may be of copper or bronze. (Same as Pb-3380.)

3481 Plaque. Dk. blue transp., medium-sized, eight-petalled floral design, very bubbly, with some inclusions, heavily w. CMG 76.1.14. (Same as Pb-3381.)

3482 Pendant. Dk. blue transp., heavily w. (Same as Pb-3382.)

3483 Plaque. Lt. blue transp., medium-sized, floral design, very bubbly, heavily w. (Same as Pb-3383.)

3484 Pendant. Lt. blue transp., square, heavily w. CMG 59.1.60a. (Same as Pb-3384.)

III B. FRATTESINA; 1000–800 B.C.

3410 Poured slab(?). Dk. blue opq., lightly–moderately w.

3411 Poured slab(?). Lt. blue transp., moderately w.

3412 Poured slab(?). Lt. blue transp. with red opq. regions mainly at surfaces, lightly–moderately w.

3413 Fragment of large, spherical wound bead. Lt. blue transp., lightly–moderately w. Filled with small bubbles. Apparent orig. diam. ~1.8 cm, perf. ~6 mm.

3414 Several small beads. Lt. blue transp., ring-shaped, lightly–moderately w. Diam. 3.5–4.0 mm, ring t. ~0.7 mm.

3415 Several small beads. Red opq., ring-shaped, lightly–moderately w. Some partially oxidized, having blue regions; others having lustrous surfaces.

III C. CHOTIN; 8th–5th c. B.C.

3460 Large flattened, 5-lobed melon bead. Aqua, moderately w. Chotin LX, Brandgrab 39A (or poss. 40A). Dušek (Ref. F-35) p. 75 and plate XXXVI, nos. 28–30; also resembles color plate no. 14 in shape. Diam. ~1.8 cm, t. ~1.0 cm, perf. ~6 mm.

3461 Large eye bead, 4 pairs of eyes. Lt. blue opq. with dk. blue and white opq. eyes, heavily w. Chotin IA, Skelletgrab 115-A. Dušek p. 52 and plate IX, nos. 7–9. Apparent diam. ~1.1 cm, t. ~8 mm, perf. ~6 mm.

3462 Medium eye bead, 4 eyes (now lost). Black frit-like base glass, now heavily w. to brown opq. color. Chotin I-A, Skelletgrab 266. Dušek pp. 67–68 and plate XXIX, no. 2; also numbered 137/54, H 266/54. 2F. Apparent orig. diam. ~9 mm, t. ~6 mm, perf. ~4 mm.
3463 | Large extended biconical bead with feathered decoration and wide perforation. Black frit-like glass with heavy brown w. crust; decoration lost, but weathered grooves remain. Chotin I-A, Skelletgrab 161. Dušek p. 56 and plate XV, no. 4. Orig. l. ~3.7 cm, max. diam. ~1.0 cm, uneven perf. ~3.5 mm.


3465 | Medium donut beads. Dk. blue transp., bubbly, moderately w. (V. similar to 3464, but slightly larger.) Sample consists of two of a group of four. Chotin I-A, Brandgrab 114-A. Dušek p. 84 and plate XLVIII, no. 13.


3467 | Small donut beads. Black frit-like glass with heavy brown w. crust. Sample consists of two of a group of three. (Contains some w. products.) Chotin I-A, Skelletgrab 175A. Dušek pp. 58–59 and plate XIX, no. 6. Diam. ~5 mm, t. ~2 mm, perf. ~3 mm.


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III D. ETRUSCAN

3392 | Northern Italy; mid-7th c. B.C. Bracelet. Dk. green transp. with yellow opq. threading wound on a square-sectioned copper ring. CMG 76.1.33. Sample consists of green glass. See SMG p. 123, no. 256. (Yellow opq. same as Pb-1080.)

5219 | Etruria; 7th–6th c. B.C. Oinochoe, core-formed with pulled and applied prunts. Blue transp., heavily w., with numerous surface fissures and pits. Rim and stem restored. CMG 71.1.6, SMG no. 253, p. 122.

5220 | Tomba Bernardini, Praeneste; 7th c. B.C. Bowl. Colorless. (D. Grose, UMass.)

5221 | Tomb at San Giovenale, 1st mille. B.C. Finial or similar object. Dk. blue transp., with internal shattering. (SwSR, via D. Grose.)
IV. HELLENISTIC. (Also includes some 6th–5th c. B.C.)

IV A. OLYMPIA, Phidias’ Workshop; ca. 450 B.C.
See Ref. F-82.

Note: For analysis and discussion, see Section IV C. Vergina.

18 Small, rounded nugget of glass. Colorless, pitted surface.
( Same as O-5.)

450 As above, another piece.

3395 As above, another piece.


3500 Bipyramidal bead with square cross section. Bl. aqua, heavily w. L. ~2.2 cm, t. ~6 mm. Ref. F-138, plate 76e.

3501 Pendant-like bead. Grn. aqua, moderately w. Plate 77c, main type.

3502 Heart-shaped bead. Bl. aqua, moderately w. H. ~1.8 cm, w. ~2 cm, t. 3 mm, perf. ~2 mm. Plate 76c.

3503 Cullet, or possibly piece with facet cutting(?). Colorless, heavily w.

3504 Flat glass. Colorless, heavily w. Prob. like plate 83a.

3505 Vessel, slightly curved. Colorless, lightly w. Poss. like plate 82b.

3506 Large, wound, spherical bead. Colorless, heavily w. Contains a few black inclusions.

3507 Thick-walled tube with folded tip. Colorless, heavily w. Contains traces of gold leaf under part of fold. Plate 79d.

3508 Cullet. Amber, heavily w.

3509 Thin-walled tube. Amber, glistening, “gold-like” appearance but no gold present; spiraling corrosion grooves, layer of w. products on interior. Probably like plate 84a.

3510 Flat glass. Bright grn. blue, moderately w.

3511 Medium–large melon bead. Dk. blue transp., somewhat deformed in manufacture, moderate–heavily w. Plate 76a.

3512 Nugget of cullet. Dk. blue transp., heavily w., poss. with some dendritic formations in weathering.

3513 Thick-walled tube. Dk. blue transp., moderately w. Plate 84b.

3514 Nugget of cullet. Purple, lightly w.

3515 Glass removed from small palette. White opq. Similar to plate 85.

3516 Nugget of cullet. Yellow opq., light–moderately w.

IV C. VERGINA; ca. 340 B.C.

3750 Inlay, rod-shaped with beveled edges. Colorless, a few small spherical bubbles, moderately w. Contains traces of gold leaf (and possibly silver.) KA no. 1. (Same as Pb-1142.)
3751 Inlay, disk-shaped with ground edges, ground-flat base and convex upper surface. Colorless, one small spherical bubble, apparent diam. 1.5 cm, moderately w. with traces of gold leaf. KA no. 2: “small lens”. (Same as Pb-1144.)

3752 Inlay, flat glass, 2.5 cm square. Colorless, heavily w. with gold attached and heavy layer of bituminous or possibly a charred resinous substance. KA no. 3. Several of these were found in groups of nine squares, each bearing gold ornamentation. (Same as Pb-1146.)

3753 Inlay, large, circular shaped. Color indeterminate, completely w. with no glass remaining. KA no. 4. Similar pieces had a diam. of 3.5 cm.

3754 Inlay, circular, poss. identical in shape to 3753. Colorless, heavily w. with some glass remaining. KA no. 5: “large lens”. (Same as Pb-1145.)

3755 Inlay, “rib-shaped”, w. = 2.0–2.5 cm, t. = 3 mm. Colorless, heavily w. KA no. 6. (Same as Pb-1147.)

IV D. LEFKADIA, The Great Tomb; 2nd c. B.C. (P. Petsas.)

501 Glass fragment. Colorless, moderately w. Note: For analysis and discussion see Section IV C. Vergina.

IV E. MORGANTINA; 3rd–1st c. B.C. (E. Sjöqvist, PUn.)

908 Ribbed bowl. 1st half of 1st c. B.C. or earlier. Colorless. 57-220, I:33K, Zone C, Str. 1.

909 Bowl. 2nd half of 1st c. B.C. Aqua. 57-319, II:1, Str. 1.

910 Bowl. 2nd c. B.C. P. yellowish-olive. 57-647, II:2, Str. 1.

911 Fragment. 2nd c. B.C. Aqua. 57-677. II:2. Rm. 5. Str. 2.

912 Bowl. Late 2nd c. B.C. or later. Aqua. 57-1486, I:17 V, Est. Str. 1.

913 Unguentarium. “Strikingly early.” Amber, with w. scum. 57-1103, II:2E. Cistern A.

914 Plate. Mid-3rd–early 1st c. B.C. Colorless, deep cut grooves. 57-2473, I:15, drain.

915 Bowl. Mid-3rd c. Amber, cut groove. 57-2728, II:2, Str. 2.

916 Juglet. Prob. 3rd–2nd c. B.C. Dk. blue. I:70, Rm. 29, Str. 1.

917 Vessel fragment. Prob. 3rd–2nd c. B.C. Dk. amber, ribbon glass. I:70, Rm. 29, Str. 1.

918 Vessel fragment. Prob. 3rd–2nd c. B.C. Amber. I:70, Rm. 29, Str. 1.

919 Vessel fragment. Prob. 3rd–2nd c. B.C. Colorless, cut groove in rim. I:70, Rm. 29, Str. 1.

920 Vessel fragment. 2nd to mid–1st c. B.C. Aqua, cut groove. 51-62, I:71, HAC, Rm. 11.
IV F. SELEUCIA; date uncertain.  
(G. Weinberg, UMo.)

3391 Heavy-walled bowl. Purple with picked-up blobs of other colors, moderately w. Sample is of purple glass. Note: For analysis and discussion, see Section IV C. Vergina.

IV G. TEL ANAFA; ca. 150–75 B.C.  

5152 As above. P. olive, lightly w. Unnumbered.
5153 As above. Amber, moderately w. Unnumbered.
5154 Fluted bowl. Colorless, black w. crust. TA78.6158b.
5155 As above. Blue opq., lightly w. TA81.G153c.
5156 Ribbed bowl. Colorless, heavily w. TA78.64.
5157 As above. Blue transp., moderately w. TA79.656.
5158 As above. Amber, white w. crust. TA78.65.

IV H. CAST BOWLS, HELLENISTIC AND OTHERS. (D. Grose, UMass.)

5222 Delos, pre-88 B.C. Conical grooved bowl. P. yellow transp.
5223 Delos, pre-88 B.C. Fluted bowl. Dk. blue opq., moderately w.
5225 Jerusalem; date uncertain. Conical grooved bowl, excavated at the Citadel. Colorless, many small spherical bubbles, lightly w.
5226 Jerusalem; date uncertain. Conical grooved bowl, excavated at the City of David. Yellowish green with black w. crust.

See also Sections IV E.–G. and V AB.

IV I. MISCELLANEOUS HELLENISTIC

3770 Medium spherical bead; Hellenistic, provenance unknown. Colorless, internal fractures. Diam. ~1–1.3 cm, w. 0.8–1.2 cm. CMG 55.1.56. See SMG, no. 199. Note: For analysis and discussion see Section IV C. Vergina.


5224 Cetamura di Chianti, 2nd–1st c. B.C. Fragment of cast glass. Colorless, lightly w. (D. Grose, UMass.)
V. ROMAN (ALSO SOME EARLY BYZANTINE)

VA. JALAME; ca. 360 A.D. (RHB.) See Refs. A-43, A-58, C-5, and RHB Field Notes. See also Section XXIV. for Belus River sand and natron.

Jalame, cullet

619 Aqua, moderately w. CMG J65-Z.
620 Green, moderately w. CMG J65-Z.
621 Green, moderately w. CMG J65-Z.
622 Olive, moderately w. CMG J65-Z.
623 Colorless and purple, moderately w. CMG J65-Z. Sample consists of colorless glass only.
624 As above, mostly purple glass.
625 Aqua, slightly w. CMG J64-140.
626 Green, lightly w. CMG J64-140.
627 Olive. CMG J64-140.
628 Purple, lightly w. CMG J64-140.
629 Olive, lightly w. CMG J64-99.
630 Aqua. CMG J64-187.
631 Aqua. CMG J64-113.
632 Aqua, moderately w. CMG J65-AL; Tr. M-1.
633 Aqua, lightly w., refractory adhering. CMG J65-AL; Tr. M-1.
634 Aqua, moderately w. CMG J65-AL; Tr. M-1.
635 Grn. aqua, moderately w. CMG J65-AL, Tr. M-1.
636 Bl. aqua, unweathered. CMG J65-Z.
637 Aqua, lightly w. CMG J65-Z.
638 Aqua, smooth, plane fractured surfaces, unweathered. CMG J65-Z. (Same as O-163.)
639 Aqua, moderately w. CMG J65-Z. (Same as O-164.)
640 Grn. aqua, moderately w., refractory adhering. CMG J65-Z.
641 Green. CMG J65-Z.
642 Grn. aqua, lightly w., refractory adhering. CMG J65-Z.
643 Grn. aqua, slightly w. CMG J65-Z.
644 Olive, lightly w. CMG J65-Z. (Same as O-165.)
645 Olive, moderately w. CMG J65-Z.
646 Olive, lightly w. CMG J65-Z.
647 Olive-amber, lightly w. CMG J65-Z. (Same as O-166.)
648 Purple with colorless streaks. CMG J65-Z. Sample consists of colorless glass only.
649 Purple, lightly w. CMG J65-Z.
810 Purple, slag-like conglomerate adhering. CMG J64-123.
811 Purple, moderately w. CMG J64-156. (Same as O-167.)
812 Purple, refractory adhering. CMG J65-AX.
813 Purple with colorless regions. CMG J64-196. Sample consists of colorless glass only.
814  Aqua, smooth, plane fractured surfaces, unweathered. CMG J65-AP; Tr. A-6, no. 83.

**Jalame, vessels with trailed decoration**

815  Bottle neck. Green, diam. 4.5 cm, lightly w. CMG J64-29.

816  Bottle rim. Green, diam. 6.0 cm, moderately w. Similar to G 155, CMG J64-43. (Same as O-168.)

817  Bottle neck. Grn. aqua, moderately w. Similar to 816. CMG J64-105.

818  Bottle or flask, rim. Aqua, diam. 10.0 cm, moderately w. Similar to R1 f; Tr. M-R.

819  Vessel wall. Colorless with blue trailing, moderately w. CMG J65-AZ, Tr. M-1, no. 7. Sample consists of body glass only.

820  As above, a mixture of a blue and colorless glasses.

821  Pitcher rim. P. green with blue trailing, moderately w. Tr. A-5, no. 42. Sample consists of p. green glass mixed with blue.

822  As above, blue glass only.

**Jalame, small vessels (bases)**

823  Cup or bowl, base. Grn. aqua, lightly w. Tr. A-5, no. 42.

824  Cup or bowl, base. Aqua, pontil mark, moderately w. Tr. A-5, no. 42.

825  Goblet or cup, base and stem. Green, moderately w. CMG J64-114.

826  Goblet or cup, base and stem. Grn. aqua, moderately w. CMG J64-9.

827  Beaker, solid base with part of body, tooled, pontil mark. Green, moderately w. Tr. L. no. 21.

828  Beaker, solid base, tooled, pontil mark. Green, moderately w. Tr. J-6. (Same as O-169.)

829  Beaker, solid base, tooled, pontil mark. Green, lightly w. Tr. A-5, no. 42.

831  Beaker, solid base, tooled, pontil mark. Green, lightly w. CMG J64-8.

**Jalame, large vessels**


833  Bowl, rim and wall. Green, moderately w. Tr. M-1, no. 7.

834  Bowl, rim and wall. Green, lightly w. Tr. J-17.

835  Bowl, rim and wall. Aqua, lightly w. Tr. A-5, no. 42.


**Jalame, small vessels (rims)**


838  Bottle, rim and neck. Green, lightly w. Tr. L, no. 46, west end.


Bowl, rim and wall, thickened horizontal rib below rim. Aqua, lightly w. Tr. J, no. 17.


Bowl, rim and body, wheel abraded decoration below rim. P. green, lightly w. Tr. L, no. 46, west end.

Plate or bowl. Green, lightly w. Tr. L, no. 43, west end. (Same as O-170.)

Dish or plate. Aqua, moderately w. Tr. A-5, no. 39.

Bowl with flat base and tubular base ring. Green, moderately w. Tr. L, no. 21.

Bowl or bottle with tubular base ring. Green, moderately w. Tr. L, no. 21.

Bowl or dish with tubular base ring. Green, moderately w. Tr. M-1, no. 30, north half.

Bowl with tubular base ring. Green, lightly w. Tr. L, no. 46, west end.

Bowl or plate with pontil mark. Aqua, moderately w. Tr. L, no. 12.


Bowl or plate with tubular base ring. Olive, moderately w. Tr. L, no. 2.

Vessel with tubular base ring. Olive, lightly w. Tr. L., no. 12.

Bottle wall. Green, moderately w. Tr. L. no. 21.

Vessel. Colorless, moderately w. CMG J67-N.

Vessel. Purple, heavily w. CMG J65-AJ. Tr. M-1, no. 25.

Vessel. P. purple, heavily w. Tr. M-3. (Same as O-171.)

Vessel. Colorless, heavily w. CMG J64-105.

Bracelet. Dk. blue, moderately w. CMG J64-108.

Bracelet. Black, moderately w. CMG J64-118.

Lamp wall. Aqua, with dk. blue transp. applied blobs, scratched horizontal decoration, moderately w. Sample consists of aqua glass. G 150: CMG T66.

As above, blue glass. (Same as Pb-1188.)

Reference glass JL. Sample consists of powdered mixture of numerous pieces of Jalame glasses.

Waste glass. Dk. blue transp., moderately w. (Same as Pb-1189.)

Drippings and trailings. Lt. blue transp., heavily w. Tr. X-1, no. 136. Original small envelope stamped with no. 563. (Same as Pb-1190.)

Waste glass. Lt. blue transp. with a few patches of accidental red opq., bubbly, heavily w. G 250; CMG Tr. X-1, no. 169.


Inlay plaque. Purple, with inlays of other colors including white opq., fused-in strip decoration, heavily w. G 100; CMG J66.


Cracked-off overblow. P. grn. aqua, heavily w. Tr. L, no. 25.

Jalame, thermoluminescence samples

Note: These fragments were excavated at Jalame early in the evening of July 5, 1964 in very subdued light—the night of the yellow tarantula incident. Since then they have been stored in total darkness. All came from Trench M, except 862 (J65AW) which came from Trench L. The glasses were soaked in a Lymoff solution overnight and rinsed thoroughly, all in subdued light. See Ref. A-58.

Cullet. TL-34.

Cullet. TL-35.

Cullet. TL-36.

Cullet. TL-37.

Cullet. TL-38.

Cullet. TL-39.

Cullet. TL-40.

Cullet. TL-41.

V B. KAFR YASIF; date uncertain.


Kafr Yasil, cullet


Aqua, unweathered.


Aqua, lightly w. K-34, Tr. A.

Green, iri. K-42, Tr. B.

Olive, w. scum. K-2, Tr. A.

Amber, lightly–moderately w. K-7, Tr. B.

Amber, lightly–moderately w. K-8, Tr. B.

Kafr Yasil, vessels

Vessel foot. Aqua, lightly w. K-14, Tr. B.

Vessel foot. Aqua, lightly w. K-38, Tr. B.

Vessel foot. Aqua, lightly w. K-38, Tr. B.


Vessel foot. Aqua, lightly w. K-8, Tr. B.

Vessel wall. Aqua, lightly w. K-20, Tr. B.
3664  Vessel wall. Aqua, moderately w. K-17, Tr. A along east side.

3665  Vessel, prob. base with rippled surface on underside near pontil mark. Aqua, moderately w. K-5, Tr. B.

V C.  BETH SHE’ARIM; 4th–7th c.
See Refs. A-13, A-17, A-58, F-133, and RHB Field Notes 1965–67. (Date may be later according to recent excavations.)

Beth She’arim slab

600  Raspberry-colored glass from near top of core drilled from slab. 9.7 cm from top, moderately devitrified. (Same as O-119.)

601  Lime-colored glass from vein running through core. 15.3 cm from top, heavily devitrified.

602  Raspberry-colored glass from near bottom of core. 31.8 cm from top, moderately devitrified.

603  Homogeneous greenish glass from fractured corner of slab. Most distant point from core, moderately devitrified. (Same as O-118.)

604  White, frothy material in white opq. band at bottom of slab. Removed from piece E2 at depth of 41 cm from top of slab.

605  Tan-colored, fritted material from granular region adjacent to location from which 604 was removed.

606  Similar to no. 600. For 1997 rerun.

609  Gritty or fritted material from side of slab. (BS-12.) Porous texture and gray color.

610  Black material adhering to veined gray material. From core segment F.

611  White frothy material beneath porous layer of 609. Possibly a transition zone in weathering process.

Beth She’arim vessels. (D. Barag, HUJ.) See Ref. F-8.


468  Catacomb XX. Bottle neck(?). Green, with plaster-like coating, heavily w. No. 2b.

469  Catacomb XX. Vessel wall. Bl. aqua, heavily w. No. 2b.

470  Catacomb XX. Goblet(?). Aqua. No. 2h.

V D.  JALAME NEIGHBORS; various dates. See Ref. A-58.


5245 Cullet. V. dk. amber, unweathered, some refractory material adhering. 1897, 3.9.92, SQ-I4, L31, B382.

5246 Cullet. Grn. aqua, with partially melted batch adhering. Sample is of gray frit-like area. 1897, 13.8.92, SQ-G5, L13, B201.

5247 As above. Sample is of intermediate whitish area. (Unnumbered.)

5248 Cullet with much partially reacted batch adhering. Bl. aqua, lightly w. Sample is of porous, tan, partially reacted batch (or refractory material?) 1897, 25.8.92, SQ-F4, L19, B297.


Cave of Horror, Nahal Hever; 135-136. See Ref. F-1. (D. Barag, HUJ.)


3673 Vessel wall. Colorless, crizzled. No. 5.

3674 Bowl. Colorless, lightly w. No. 5.

Tiberias; date uncertain. (RHB.)

612 Roundel. Brt. green.

613 Roundel. Med. blue transp.

614 Roundel. Purple.

615 Cullet. Aqua.

616 Lamp stem. Aqua.

617 Vessel base. Colorless.

618 Vessel (or waste glass?). Colorless.

3676 Tumbler base with deep kick, pontil mark, and mold-blown pattern on wall. Green, pitted.

3677 Vessel or base tip of unguentarium(?) Green, iri.

3678 Lamp stem with three knops preserved. Green, pitted.

3679 Lamp stem with single knop on long stem. Aqua, pitted.

Samariya; 12th-13th c. (G. Weinberg, UMo.)

1550 Cullet with flat upper surface. Aqua. UMo 8; NE part of trench, basket 22, 11/19/67.

1551 Cullet. Aqua, dk. brown streaks, bubbly. UMo 9; NE part of trench, basket 24, 11/20/67.

1552 Cullet with flat upper surface. Blue transp. UMo 5; probably from P13.

Miscellaneous; various dates

3680 Masada; pre-73 (?). Cullet. Olive, heavily devitrified on one surface, lightly w.
3682 Arsuf; date uncertain. Large piece of ancient cullet. Bl. aqua, homogeneous, some seed. (Collected by RHB, 1964.)


302 Vessel base. Amber/purple, unweathered. K-7. (Same as O-46.)

303 Vessel base. Colorless, little or no w. K-8.


305 Dish rim. Amber, little or no w. K-10. Became crizzled when heated. (Same as O-7.)


308 Beaker. Yellow-green, with applied blue blob, little or no w. K-13.

309 Vessel rim. Dk. blue transp., little or no w. K-14.

310 Goblet foot. Green, little or no w. K-15.


312 Vessel, pointed base. Amber, little or no w. K-17.

317-A Vessel base. Green, little or no w. K-23.


3291 Vessel, very thin-walled. Colorless, crizzled.

3292 Bowl rim. Colorless, crizzled.

3293 Vessel, ring base. Colorless, crizzled.

3296 Vessel base with paddling. Olive, little or no w.

3297 Small object, base. Dk. blue transp., w. scum.

3298 Vessel rim, large. Colorless, with dk. blue threading, unweathered. Sample consists of blue glass.

3299 Bottle, top. Green, heavily pitted. Does not appear typical of Karanis finds.


3020 Goblet foot, common type. Green.

3021 Vessel, thick-walled. Colorless, UM 16.

3022 Vessel, common type. Grn. aqua. UM 8.


3026 Vessel, common type. P. green. UM 14.

3027 Vessel, common type. Olive. UM 5.

3028 Vessel. P. amber. UM 18.

3029 Vessel. P. amber. UM 19.

3030 Vessel, thin-walled. Colorless. (Unnumbered.)

3031 Vessel. Colorless. UM 2.

3032 Vessel, common type of rim or foot. Colorless. UM 17.

3033 Flat glass. Colorless. UM 3.

3034 Bowl rim with cut groove; Hellenistic(?). Amber. UM 20.

3035 Vessel. Green. UM 15.

3036 Vessel. Lt. blue transp. (Unnumbered.)

3037 Vessel. Blue transp. UM 12.


3039 Flat glass. White opq. UM 6. (Same as Pb-1010.)

3040 Fragment. Red opq. UM 11. (Same as Pb-1011.)


3047 Rim fragment of another large flat plate; 2nd–1st c. B.C. V. p. grn. aqua, moderately w. Profile not as flat as no. 3046; rim appears to have been pulled up by pincers. Cosa no. C70.620B VI D, E, O 610. Sampled as above.

3048 Rim fragment of a small bowl with an extremely thin wall; prob. 2nd or early 3rd c. Grn. aqua, moderately w., with horizontally elongated bubbles. Unnumbered, excavated in a shop. Sampled as above.

5250 Ribbed bowl; pre-ca. 50/55. Aqua, lightly w. UM 76 (5).

5251 Ribbed bowl, cast with bosses rather than formed ribs. P. green, lightly w. UM 62 (3).

5252 Ribbed bowl, cast, early type. Olive, lightly w. UM 63 (4).

5253 Bowl, cast and linear-cut. Med. purple, moderately w. UM 97 (6).

5254 Bowl, cast and linear-cut. Dk. purple, moderately w. UM 107 (8).

5255 Bowl, cast and linear-cut; pre-25/15 B.C. Med. blue transp., lightly w. UM 100 (7).

5256 Luxury ware, cast; ca. 25/15 B.C. to 40/45 A.D. Brt. blue transp., lightly w. UM 121 (9).

5257 Luxury ware, cast; ca. 25/15 B.C. to 40/45 A.D. Brt. blue transp., lightly w. UM 137 (13).
5258 Luxury ware, cast; pre-40/45 A.D. Bl. aqua, lightly w. UM 125 (10).

5259 Dish, rectangular, cast; pre-50/55 A.D. Em. green, lightly w. UM 127 (11).

5260 Dish, rectangular, cast; pre-25/15 B.C. Green opq., moderately w. UM 147 (14).

5261 Bowl, carinated, cast. White opq., lightly w. UM 149 (15).

5262 Bowl, cast, with overhanging rim; late 1st–early 3rd c. A.D. Colorless, moderately w. UM 165 (16).

5263 Bowl, cast, with overhanging rim; late 1st–early 3rd c. A.D. Colorless, moderately w. UM 169 (17).

5264 Bowl, cast, with overhanging rim; late 1st–early 3rd c. A.D. Colorless, moderately w. UM 191 (18).

5265 Gladiator beaker; late 1st c. A.D. V. pale ylw. green, unweathered. UM 205 (19).

5266 Beaker, Romano-Syrian, inscribed, pre-40/45 A.D. P. aqua, unweathered. UM 207 (20).

5267 Dish, blown; pre-40/45 A.D. Em.(?) green, lightly w. UM 310 (21).

5268 Jar, blown; pre-40/45 A.D. P. purple, moderately w. UM 354 (23).

5269 As above, white opq. blob.

5270 Dish, blown; pre-40/45 A.D. Dk. blue transp., moderately w. UM 311d (22).

5271 Pyxis; pre-25/15 B.C. Dk. blue transp., moderately w. UM 135 (12).

V G. APOLLONIA; date uncertain. (J. Pedley, KM.)

3263 Lamp stem, hollow. Colorless, heavily w.

3264 Lamp stem, hollow. Colorless, heavily w.

3265 Vessel, handle with pad against vessel wall. Colorless, heavily w.

3266 Vessel, poss. wall. P. grn. transp., heavily w. Painted excavation no., partially legible, may read “66 A 75.”

3267 Flat glass, poss. window glass. Colorless, heavily w.

3268 Similar to 3267. Well-formed dendrites.

3269 Cullet. Dark color in bulk, but apparently colorless in thin edges. Plaster or refractory adhering.

See also Section XX C.
V H. **KENCHREAI, OPUS SECTILE PANELS; ca. 360 A.D.** (RHB, D. & D. Thimme.) See Refs. A-19, A-34, B-10, F-64, F-116, and F-117. See also Section XXVI F. for non-glasses.

**Red opaque (all heavily w.)**
- 752 Triangular. K66AL.
- 762 Rectangular. K66AL.
- 764 Rectangular. K66AL.
- 973 Rectangular. K66AL.
- 974 Triangular. K66AL.
- 975 Triangular. K66AL.
- 976 Triangular. K66AL.
- 3060 Irregular. (Same as Pb-465.)
- 3061 Square. (Same as Pb-466.)
- 3062 Rounded. (Same as Pb-467.)
- 3063 Irregular. (Same as Pb-468.)
- 3064 Rounded. (Same as Pb-469.)

**Yellow opaque (lightly–heavily w.)**
- 755 Square.
- 759 Petal-shaped. (Same as Pb-470.)
- 977 Square. K66AM.
- 978 Irregular. K66AM.
- 979 Triangular. K66AM.
- 980 Petal-shaped. K66AM.
- 3065 Irregular.
- 3066 Rounded.

**Green translucent (moderately–heavily w.)**
- 750 Semicircular. Dk. green. (Same as Pb-475.)
- 757 Circular. Lt. green.
- 769 Square. Med. green.
- 981 Rectangular. Lt. green. K66AP.
- 982 Rectangular. Lt. green. K66AP.

**Flesh tones (slightly w.)**
- 754 Partially rounded. (Same as Pb-477.)
- 983 Irregular. K66AO.
- 984 Irregular. K66AO.

**Other colors**
- 758 Dk. blue. Thin outlining arc. Slightly w.
- 766 Purple with white opq. loops. Irregular. Heavily w.
- 3067 Colorless. Rectangular. Moderately w.

See also Section XX H. Nos. 753, 763, 765, 756, and 760 are weathering products, respectively, of 752, 762, 764, 755, and 759.
V I. KENCHREAI, VESSELS AND TESSERAE; various dates.
(RHB, 7/27/79.)

Vessels

773 Vessel fragment, cut. Colorless.


3702 Flat glass. Aqua, bubbly, moderately w. Central section; central E-W wall. From W of 3rd column base.

3703 Flat glass. Aqua, very bubbly, moderately w. Same location as 3702.


3706 Goblet, hollow-edged rim, partially hollow stem with prominent pontil mark. V. p. amber, heavily w. C1304, 5 VII 64.

3707 Goblet, hollow-edged rim, solid stem with prominent pontil mark. Similar to 3706, but squatter, less delicate form. Olive, lightly w. C1285, 6 VII 64.

3708 Bottle, top. Colorless, with purple swirls, lightly w. 1966, Area A, UA-106.

3709 Lamp rim. Olive with blue blob, moderately w. Sample consists of olive glass. KE 2362, GL-207, Rogers no. 103.

3710 Vessel base with radiating molded pattern. Green, moderately w. K 2370, GL-214, C 1070.

3713 Vessel neck. Purple, moderately w. A 1779. SW of narthex.
3728 Bowl, rim, (possibly ribbed), with three shallow cut grooves near rim; rim preserved. Amber, heavily w. KE 68, GL-10.

3729 Ribbed bowl, rim with sharp, narrow, widely-spaced ribs; rim preserved. Dk. blue, lightly–moderately w. Diam. 8 cm. G-63.


Glass

5450 Colorless (pale yellowish or smoky) transp.; thick plate with gold-leaf lettering.

5451 Flat inlay. Lt. blue transl.

5452 Flat inlay. Dk. blue transp.

5453 Border cane. Pinkish transl.

5454 Flat inlay. White opq.

5455 Flattened ribbon inlay. Green transp., joined with yellow opq. (Same as Pb-2126.)

5456 As above, yellow opq. (Same as Pb-2125.)

5457 Flat inlay. Yellow opq. (Same as Pb-2123.)

5458 Flat inlay. Red opq. (Same as Pb-2120.)

5459 Border cane. Red opq. (Same as Pb-2121.)

5460 Flat inlay. Flesh-colored glass. (Same as Pb-2128.)

Non-Glasses

5463 Composite adhesive matrix. Brown resinous material.

5464 As above, smaller fragments.

5465 Resinous portion extracted from above adhesive matrix.

5466 Inorganic portion of adhesive matrix.

Tesserae

774 Colorless.
775 Dk. green transp.
776 Dk. blue transp.
777 Brt. green opq.
778 Yellowish opq.
779 Black.
987 Colorless. K66AF.
988 Colorless. K66AF.
989 Colorless. K66AF.
990 Dk. blue transp. K66AJ. (Same as Pb-1176.)
991 Yellow opq. K66AH.
992 Lt. green opq. K66AI.
994 Dk. green. K66AE.
995 Green with red opq. core. Sample consists of some red opq. glass, contaminated with black residue. K66AE.
996 Green with orange opq. core. Sample consists of orange opq. glass and chalky green w. products. K66AE.
Pottery backing support, possibly a tile or section of a large amphora. Adhesive matrix material still adheres on both sides and along edges.

As above, another example.

As above, another example.

Metallic globule, spherical, coppery-colored. Diam. 0.8 mm. From interior of 5458.

Metallic globule, spherical, coppery-colored. Diam. 0.6 mm. From interior of 5459.

Resin residue from HCl extraction. Lump of friable brown material.

Resin from first CCl₄ extraction. Flakes of shiny dark brown material.

Resin from second CCl₄ extraction. Flakes of shiny dark brown material.

Insoluble residue from two CCl₄ extractions. Sample consists of large grains of material.

Insoluble residue from two CCl₄ extractions. Sample consists of fine powdery material.


Colossal Lydian Structure; ca. 625/620–ca. 550 B.C.; area 5. (C. Greenewalt.)

Vessel fragment or flat glass. Colorless, iri. MMS-1, 7/15/86, area 5, bas 380.

Lump of cullet. Amber, heavily w. with extensive internal shattering. As above, bas 366.

Melon bead. Original color indeterminate, completely w., now whitish. As above, 7/20/86, bas 380.

As above. Yellowish (?) glass. 7/21/86, bas 389.

As above. Green (?) glass.

Stray find, a small fragile, Y-shaped fragment described as “frit”. Unknown material, bas 389.

Tesserae


Green. S-22.

Colorless, with gold. S-22.

Yellow opq. S-30.

Lt. blue transp. S-30.


Black. S-29.

Dk. blue. S-29.

Colorless. S-29.

Small footed cups, Byzantine Shops. (Sampled by RHB and MRB. See Field Notes 8/25–28/62.)

Small footed cup with hollow stem. P. blue, moderately w. S-34.

As above, aqua. S-37.

As above, aqua. S-38A.

As above, dk. green. S-38B. (Same as O-48.)

As above, dk. green. S-39.

As above, aqua. S-36A.
288  As above, aqua. S-36B.  (Same as O-32.)

289  As above, aqua. S-36.

Other glass, various locations

293  Slag. Blue transp.

294  Slag. Black with brown devitrified patches.

598  Cut bowl. Dichroic glass. G63.18; S-59. See RHB field notes and Section V AD.

952  Ribbed bowl. Amber, heavily w.

954  Ribbed bowl. Blue transp.

955  Ribbed bowl. Blue transp., heavily w.

1091  Beaker base. Aqua. S-76. (Same as O-49.)

1092  Flask neck, with threaded decoration. Aqua, heavily w. S-71.

1093  Flat glass. Late period, PN. Yellowish olive, unweathered. T. 3.0 mm. (Same as O-51.)

1094  Flat glass. Late period, PN. Purple, unweathered. T. 1.8 mm. (Same as O-52.)


1099  Bowl with cut rim. Colorless. S-70.


1102  Flat glass. Green. S-77.

1522  Vessel base. Green, very bubbly, lightly w. (A. von Saldern.)

1523  Flat dish, base and handle. Green, moderately w. (A. von Saldern.)

1524  Flask neck. Colorless, thin-walled, with threaded decoration. (A. von Saldern.)

3220  Bracelet. Black with two red opq. bands, oval cross-section, unweathered. S-17. Sample consists of black glass.


3222  Irregular lumps. 7th c. B.C. Red opq., found in a Lydian context, heavily w. with refractory adhering. (J. A. Scott, FAM.) MMSIA, 1982. See Ref. A-55. (Same as Pb-1109.)


352  Foot of thin-walled vessel. Gr. aqua, bubbly, no w.

353  Conical thin-walled vessel with small, coiled foot. P. amber body, turbid green foot, no w. Grave 192A.7.

354  Footed thin-walled beaker(?). Gr. aqua, bubbly, no w.

355  Thin-walled vessel with flaring rim. Gr. aqua, bubbly, no w.


590  Large chunk of cullet. Aqua, iri. (Oxygen isotope analysis performed.) Photographed with Kusadasi PC-B.

591  Large chunk of cullet, refractory(? adhering. Aqua, iri.
1110 Lamp stem. Green.

1111 Drinking vessel, foot and stem. Green.

1112 Vessel base with threaded decoration. Aqua.

1113 Lamp stem, similar to 1110. Dk. green.

1114 As above, aqua.

1115 Thin-walled vessel. Colorless with red opq. marvered and dragged decoration. Sample is of colorless glass.

V N. SEDEINGA; ca. 250–300 A.D.

1720 Footed flute. Blue transp. glass with gilded, enameled, and painted decoration of Nubian figures and animals. No. 230 in the Michela Schiff-Giorgini Collection, University of Pisa; Leclant’s no. WT8c13. Refers to blue glass body of rim fragment lent to CMG in 12/70 for nondestructive, nonsampling examination.

1721 As above. Gilded regions with yellowish-green and red opaque enamels and black organic paint.

1722 As above. Bluish-white blob of enamel.

1725 Vessel, thin-walled, blown, with lightly cut horizontal bands. Colorless, lightly w. (A).

1726 Vessel, blown. Bl. aqua, unweathered. (B).

1727 Vessel, heavy-walled. Aqua, unweathered. (C).

1728 Flat glass, possibly window glass or vessel. Aqua, w. scum. (D).

1729 Bowl with deep-cut, rounded decoration. Colorless, w. scum. (E).

1730 Bowl. Purplish, w. scum. (F).

1731 Vessel, thin-walled. Bl. aqua, unweathered. WT8 C37i; (G).

1732 Gaming piece. Turbid white, bubbly, w. scum. WT8 C16; (H).

1733 Gaming piece (?). Black, lightly w. WT8 C16; (I).

V O. SALONA; 1st–4th c. A.D.

1598 Vessel. Purple, metallic coating on convex surface, (modern?). C. Clairmont, AB-B 6/7, Layer IV.

3000 Vessel. P. aqua.

3001 Vessel. Green.

3002 Vessel. Bl. aqua.

3003 Vessel. Colorless.

3004 Cullet. Dk. green. NM 7; 7.866 AB-B 6&7 L II.

3005 Drippings. Dk. green. NM 6; 7.720 W7B LI.

3006 Vessel foot. Green. NM 2; 7.374.

3007 Vessel. Colorless, with purple streaks. NM 8; 7.9.

3008 Bowl with pincered tip(?). Colorless. NM 3; 7.719.
3009 Goblet base. Colorless, w. scum. NM 5; 7.119.
3010 Vessel wall. P. purple. NM 4:7.850.
3011 Vessel. Amber, pitted. NM 1; 7.73.
3012 Vessel, mold-blown, squared-off corner. Lt. blue opq. NM 1; 7.72.
3013 Flask rim. Aqua. NM 8; 7.149.
3014 Dish. Dk. green. NM 7; 7.152.
3015 Vessel with horizontal cut decoration. P. yellow. NM 6.
3016 Mosaic tessera. Dk. blue. NM 10A.
3017 Mosaic tessera. Green opq. NM.

3058 Flat glass. 400 or earlier. Green, one rounded edge.
3059 Similar to 3058.

1435 Crikvecina; late 3rd c. Vessel rim. Colorless.
1436 As above. Vessel base. Colorless.
1437 As above, 10th–11th c. Fragment. Colorless.
1438 As above. Flat fragment. Aqua.

As above, 12th–13th c. Vessel rim. Colorless.
1440 As above. Bottle fragments. Colorless.
1441 Castle Scepangrad; ca. 1400. Vessel rim. Colorless.
1442 As above. Vessel rim. Colorless with blue threading.
1446 Vessel rim. Colorless.
1447 As above, another example.
1448 Heavy-walled bottle with facets and swirled design. Colorless.


Caerleon; 140–260
1116 Heavy-walled bottle with facets and swirled design. Colorless. Sample No. 2. From building VIII, prob. 3rd c.
1117 Bowl, blown. Unusual color, not like ordinary amethyst. 54.389A, G 82 b. From main lateral drain of civil settlement at beginning of fortress. Date of drain 140–260.
1118 Snake thread vessel, base. Colorless. 54.389A, 491(?). Location as above.
1119 As above, yellow opq. threading (Same as Pb-1067.)
Caerwent; 3rd–4th c

1003 Vessel, deep cut. Colorless. G. Boon, No. 1; 31.78/117.

1004 Vessel, deep cut. Colorless, heavily crizzled. No. 2; 35.119/a.

1005 Vessel, deep cut. Colorless. No. 3; 35.119/b.

1006 Vessel, deep cut. Colorless. No. 4; 62-265.


See also Section V AE.

1035 Vessel, with cold-painted red stripe. Colorless, w. Cat. no. 98.


See also Section XXVIII D.

From F. Anfray, 6/19/61

102 Adulis, 4th–5th c. No. 1.
176 Matara, 4th–5th c. No. 2. (JE.2076.)
177 Yeha. No. 3.
178 Yeha. No. 4.

From A. Tessema, 5/9/73

3180 Matara. Mold-blown vessel. Dk. blue transp., unweathered. Mat. B. A1, No. 2088. (Same as Pb-1198.)

3181 Yeha. Fragment of long hollow bead, square section. Colorless, iri. W. ~6.5 mm, round perf. 3.5 mm. Tomb 4, No. 2167.


3184 As above. Heavy-walled, mold-blown vessel. Amber, unweathered.

3185 As above. Mold-blown vessel. Aqua, unweathered.

3186 As above. Aqua, lightly w.

3187 As above. Vessel rim. Purple transp., lightly w.

3188 Axum. Large cut dish. Dichroic, iri. Axum, 56; Wall, M1. See also Section V AE.


3191 Yeha. Thin-walled, mold-blown vessel. Colorless, iri.


3195 Axum, 4th–5th c. Medium “Indian red” bead fragment. Red opq., porous and moderately w. AX 74. THC VIII-2, north end; from fill over tomb of false door. (H. N. Chittick, BIEA.)
V U. BEGRAM; 1st and/or 3rd c. A.D.

See also Section V AE., nos. 1351 and 1352; and Sections XXI C. and XXVII.

Kabul Museum. (See RHB Field Notes 8/8/68.)


1353 Fragment of glass with wavy applied decoration; poss. 2nd c. Colorless glass, heavily w. Beg-4.

1354 Fragment of blown vessel; poss. 2nd c. Found by Louis Dupree among fragments of glass vessels, but not typical of them in w. appearance. Colorless glass, iri.


Musée National des Arts Asiatiques-Guimet. (F. Tissot. MNAA. 6/21/90.)

6200 Nearly flat fragment. P. aqua, lightly w. Similar to F-55 (1939), no 49.

6201 Fragment of thick-walled object with shallow, molded beading. Colorless, moderately w., some internal cracking.

6202 Fin of a fish (?) built up by trailing. Colorless, moderately w., some internal cracking. Similar to MG 21276 and MG 21838.

6203 Fragment with facet cutting. Colorless, moderately w., some internal cracking. Similar to MG 1 92R4.

6204 Fragment of thick-walled vessel with deep facet cutting. Colorless, moderately w., some internal cracking.

6205 Fragment of handle or decoration. Colorless, lightly w.

6206 Wall fragment of vessel. Colorless, moderately w., internal cracking.

6207 Wall fragment of thin-walled vessel with applied decoration. Colorless, moderately w., internal cracking.

6208 Wall fragment of vessel with facet cutting. Colorless, moderately w., internal cracking. Similar to MG 91979.

6209 Wall fragment, possibly with handle joint. Colorless, lightly w., some internal cracking.

6210 Thin curved handle(?). Colorless, lightly w., some internal cracking. Similar to MG 21424.

6211 Fragment of thin-walled, mold-blown vessel, suggesting grapes. Colorless, lightly w. Painted no. 21846.

6212 Wall fragment of vessel (?) with red opaque inlaid millefiori motif. Colorless, lightly w. A companion fragment contains a green millefiori inlay. No. MG 21867. See Ref. F-54, pp. 171–172 and Ref. F-55, pl. IV.


6214 Rounded fragment with two cut grooves. Colorless, no w. Similar to Ref. F-55, no. 121.
6215 Curved wall fragment of vessel. Med. blue transp., lightly w. Similar to MG 19089.

6216 Fragment of thin-walled vessel with handle joint. Med. blue transp., lightly w.

6217 Fragment of colorless, thin-walled vessel, with double-pincered dk. blue transp. decoration. Heavily w. Similar to MG 19087. Sample consists of blue glass.

6218 Fragment of colorless vessel with large, single-pincered dk. blue transp. decoration. Lightly w. Similar to MG 19087.

6219 Fragment of faceted vessel. Dk. blue transp., lightly w. Similar to MG 19087.

6220 Wall fragment of vessel. Med. blue transp., heavily w.

6221 Heavy applied free-standing trailing. Dk. blue transp., lightly w. Similar to MG 19292 and MG 19094.

6222 Trailed decoration. Colorless (sl. turbid?), lightly w.

6223 Trailed decoration. Colorless (sl. turbid?), moderately w. Similar to MG 21424.

6224 Trailed decoration. Colorless (sl. turbid?), heavily w. Similar to MG 21424.

6225 Eye of a fish(?) Lt. blue opq., lightly w. Similar to MG 19091, also a fish.

6226 Flat millefiori fragment. Dk. green with yellow opq. (?), heavily w. MG 21856. See Refs. F-55, pp. 171–172, and F-54, pl. IV.

6228 Wall fragment of a very thin-walled vessel with traces of gilding. Colorless, some iri. (F. Tissot, 11/22/91.)

6229 Wall fragment of painted vessel. Colorless, moderately w., but with heavy internal cracking. Preserves part of a painted decoration, possibly a clothed arm or leg. (F. Tissot, 11/22/91; no. 29.) Sample consists of colorless glass.

6229w As above, hydration rim of same sample.

V V. CETAMURA DI CHIANTI; dates not specified. (N. de Grummond, UFla.)

5230 Wall fragment of thin-walled vessel. Aqua, unweathered. No. C-76-1667; glass inv. 5.

5231 Rim fragment of bowl with one cut groove on exterior and three on interior. Dk. blue transp., some weathering scum. No. C-76-50; glass inv. 2.

5232 Rim fragment of bowl with thickened edge. Purple transp., little or no w. C-76-1637; glass inv. 7.

V W. CORINTH; Roman. (J. Wiseman, BU.)

3285 Large dripping of waste glass. Industrial site. V. p. green, filled with bubbles. No. 7624.

3286 As above. Chunk of cullet with refractory adhering. Green. No. 7624.

3287 As above. Dk. purple with p. green streaks. Sample is of purple glass. No. 7524A.
3288 As above. Black with slag-like appearance; brittle w. crust. No. 7524B.

V X. CARTHAGE (Bir el Knissia); ca. 575. See Ref. F-126; Hayes nos. refer to those in chap. 12. (S. Stevens, R-MWC.)

5280 Foot of small vessel with pontil mark. Colorless, v. heavily w. with black w. crust. F. R. 6-400; Hayes no. 30.

5281 Rim of vessel with thick coiled foot. Green, w. scum. F. R. 6-263; Hayes no. 39.

5282 Neck of thin-walled vessel. P. yellowish-green; heavily w. F. R. 6-401; Hayes no. 7.

5283 Ringed base of small vessel. P. olive; w. scum. F. R. 6-148; Hayes no. 71.

5284 Base of thin-walled vessel, no pontil mark. Colorless, thick dk. brown/black w. crust and iri. F. R. 6-324; Hayes no. 25.

5285 As above, silvery iri. and brownish w. crust.

5286 Massive base of large vessel with stepped-coil foot. Body of yellowish-green glass, lightly iri.; foot of aqua glass, heavily w. with frosty iri. F. R. 6-256. Sample is of olive base glass.

5287 As above, aqua glass of foot.

5288 Folded foot of a dish(?). Colorless; v. heavily w. with black crust. F. R. 6-106; Hayes no. 18.

5289 As above, silvery iri. and black w. products.

5290 Solid stem of small vessel; late 5th-7th c. type. Colorless; v. heavily w. with black crust. F. R. 6-25; Hayes no. 36.

5291 As above, silvery iri. and black w. products.


5293 As above, a black tessera from the same fragment. Little or no w.

5294 Window glass, long fragment with rounded edge. (L. = 8.5 cm.) Aqua; v. heavily w. F. R. 6-349.

5295 Window glass. Aqua; v. heavily w. F. R. 6-85.

5296 Window glass. Aqua; v. heavily w. F. R. 6-256.

5297 Window glass. P. aqua; v. heavily w. F. R. 6-256.

V Y. ED-DUR; ca. 50 B.C.–80 A.D. (E. Haerinck, UG; courtesy DBW.) See Ref. A-88 in F-143.

6660 Small rim. Aqua, lightly w. BS 1419.

6661 Neck(?) of thin-walled vessel. P. aqua, eroded. BS 1331.

6662 Large solid stem(?) or handle(?). Green, moderately w. BQ 1009.

6663 Small rim, poss. finished by cutting or grinding. Aqua, eroded. BR 862.

6664 Handle or solid stem(?). Green, lightly w. BR 862.
6665  Handle or solid stem(?). Colorless, heavily w. BS 1362.

6666  Vessel wall. Colorless, with thick w. crust. BQ 861.

6667  Vessel neck. Colorless, w. and eroded. BS 1061.

6668  Thin-walled vessel. Colorless, eroded. BR 1000.

6669  Flat glass, poss. from a window. Colorless, moderately—heavily w. BS 1079.

6670  Wall of thin-walled vessel. Lt. blue transp. with white opq. streaks, heavily w. BS 1092.

6671  Ribbed bowl(?). Fragment, poss. containing a shallow rib. Brt. grn. blue, lightly w. or eroded. SM 322.

6672  Vessel wall. Dk. blue, eroded. BR 974.

6673  Vessel wall with molded decoration, poss. in the form of a date(?). Med. blue, eroded. BR 862.

6674  Flattened, thumb latch handle, with remains of thin wall join. Dk. blue opq. on colorless wall, lightly w. and eroded. BS 1367. Sample consists of blue glass.

6675  Handle(?), tapering with longitudinal groove. Dk. blue, lightly—moderately w. BS 1075.

6676  Base and wall portion of large bowl. Purple with thick w. crust. BS 1352.

6677  Ribbed bowl(?), small fragment. P. yellowish green, eroded. AH 170.

6678  Plate fragment with two concentric cut grooves on slightly concave side. White opq., moderately w. Apparent diam. of grooves ~6 cm and 6.5 cm. BQ 806.

6679  Neck(?) of vessel. P. purple, eroded. BS 1448.

6680  Ribbed bowl; preserving top of rib of medium-sized bowl, with squared-off horizontally-cut top of rib. Aqua, eroded. Max. rise of rib ~6 mm, max. w. ~7 mm. BS 1069.

6681  As above, prob. another piece of the same object.

6682  Ribbed bowl; fragment preserving middle of small rib(?). Amber, lightly—moderately w. Max. rise of rib ~3 mm, max. w. ~5 mm. BS 1426.

6683  Ribbed bowl; fragment from near the top of a large rib(?). Dk. blue, with white opq. marbling, moderately w. Max. rise of rib ~4 mm, max. w. ~1.1 cm. BQ 1055. One of several similar fragments, prob. from a single object.

6684  Millefiori fragment. Dark with white opq. dots, eroded. BR 1038.

6685  Millefiori fragment. Lt. blue transp. with several white opq. and a few larger red opq. dots; eroded. BQ 1172.

6686  Vessel wall. Aqua, lightly iri. SM 293.
V Z. NIJMEGEN; 80–100 A.D.
(A. Koster, KU.) See Ref. 1-22.

5170 Fragment of flask. Colorless, lightly w. Grave 1, no. 64.


5172 Fragment of pitcher. Colorless, lightly w., internal cracking. Grave 8, no. 63.


See also nos. 3805 and 3807 in Section V AE.

V AA. PAINTED GLASS; various dates.
(CMG and other sources.)

1734 Vessel with gold leaf, Greek inscription. Colorless. CMG 59.1.279.

1735 Vessel with painted legs of figure. Colorless. CMG 59.1.84; RWS(?) 554.

1736 Vessel. Green glass with yellow, white, blue, and green opq. enamels. CMG 59.1.83; RWS(?) 766. Sample consists of green glass.


1740 Rehovot; 5th c. Thin-walled plate with painted decoration. Colorless, heavily w.

3542 As above, but also containing black and green paint.

See also Sections V S. and V U.

V AB. RIBBED BOWLS; various dates.

Various sources

180 Tongrès, Belgium; 1st c. Aqua. (M. Vanderhoeven.) (Same as O-8.)

951 Murten, Switzerland. Aqua (T. Schwartz.) 61:GE.

952 Sardis. Amber, heavily w. RHB Field Notes no. S-60, 1962. HOB E10, 590–95, * 100.5–99.80; 8/14/60.


955 Sardis. Blue, transp., heavily w.

See also Section V Y. Ed-Dur, nos. 6671, 77, 80–83; and Section V F. Cosa, nos. 5250–52.

Unknown sources. (A. Oliver, MMA.)

3210 Amber.

3211 Olive.

3212 Amber.

3213 Amber.

3214 Grn. aqua.

3215 Amber, with white opq. streaks. Sample consists mainly of amber, but may contain some white.
3216 Vessel rim (may not be a bowl). Aqua, with white opq. streaks. Sample consists of aqua glass with ~5% of white.

3217 As above. Sample consists of purple glass with ~5% of white.

3218 Purple transp., with white opq. streaks. Sample consists of purple glass with ~5% of white.

3219 Dk. blue transp., with white opq. streaks. Sample consists of dk. blue glass with ~5% of white.

Kenchreai. (RHB.)

3722 Aqua, with short, shallow, closely-spaced ribs, moderately w. IM G-63.

3723 Aqua, with long, high, moderately-spaced ribs, (rim preserved), lightly-moderately w. 1966, A, UII, p. 112.

3724 Aqua, with long, high, moderately-spaced ribs, double cut interior groove near base, lightly-moderately w. IM A 1874.

3725 P. aqua, with long, sharp, widely-spaced ribs, moderately w. IM 1966, area A, UA-106.

3726 Amber, with long, high, moderately-spaced ribs, double-cut interior groove near base, GL 1754.

3728 Amber, (poss. ribbed), with three shallow cut grooves near rim (rim preserved), heavily w. IM KE-68, GL-10.

3729 Dk. blue, sharp, narrow, widely-spaced ribs, rim preserved, lightly-moderately w. IM G-63.

V AC. GOLD GLASS; various dates.

2979 Alexander Plate. Colorless, unweathered, lightly acid-etched(?) surfaces. Fragment left over from repair. Cleveland Museum of Art, no. 69.68. (See Ref. D-4.)

2980 As above, second sample.

2981 Vessel, with man riding horse or donkey and inscription. Colorless, iri. w. scum. CMG 54.1.83. Sample consists of small chips of glass removed from jagged edges of upper piece of glass.

2982 Vessel, with Saints Peter and Paul. P. yellowish green, some iri.; MnO_dendrites in some fractures, lightly w. CMG 62.1.20. Sample consists of a floating fragment of the lower piece removed from beneath the right shoulder of St. Paul.

2985 Vessel, with unidentified incised linear design. Colorless, crumbly w., filled with weathering plugs.


CMG Fragment Collection

3780 Male figure, very fine carving. White opq. over dk. blue transp., moderately/heavily w. CMG 66.1.59. See Ref. E-39, no. 67. (Same as Pb-2192.)

3781 Paws of animal, poss. a great cat, thin-walled. White opq. over med.–dk. blue transp., moderately w. CMG 74.1.73b. See Ref. E-39, no. 72.

3782 Floral design with drapery. White opq. over dk. blue transp., moderately w. CMG 74.1.74b.
3783  Floral design, rim fragment. White opq. over turbid blue, moderately–heavily w. CMG 74.1.72b. (Same as Pb-2198.)

3784  Bunch of grapes, rim fragment. White opq. over dk. blue transp., moderately w. CMG 74.1.73a. See Ref. E-39, no. 51. (Same as Pb-2194.)


3786  Large floral motifs, heavy-walled. White opq. over dk. blue transp., w. crust on underside. CMG 59.1.553. See Ref. E-39, no. 69.

3787  “Fleur-de-lis” motif, heavy-walled. White opq. over dk. blue transp., some iri. and w. scum. CMG 59.1.554. See Ref. E-39, no. 44.

3788  Floral motifs and garlands, poss. large plate. White opq. over dk. blue transp. CMG 66.1.67. See Ref. E-39, no. 46.

3789  Fruit and architectural elements. White opq. over lt.–med. blue transp., lightly w. CMG 66.1.58. See Ref. E-39, no. 63.

3790  White opaque over purple, moderately w. CMG 59.1.109. See Ref. E-39, no. 68. (Same as Pb-2196.)

The Portland Vase

3850  Sample of powdered dk. blue glass handed over to RHB by Harrison Hood of Corning Glass Works in the 1960s. Probably originally given to Mr. Hood by W. E. S. Turner, possibly during Turner’s visit to Corning in the 1950s. See Refs. F-113 and F-114.

Others

999  The Morgan Cup; 1st c. CMG 52.1.93. White opq. for XRD. See Refs. A-19 and E-37, no. 3.

1568  Large piece of unfinished cameo glass. White opq. over dk. blue transp. On loan to CMG from John Woodman Higgins Armory, Worcester, Mass. (Study card 990, 11/7/69.) Sample is of blue glass. (Same as Pb-1175.)

1569  As above, white opq. glass. (Same as Pb-2191.)

3793  Skyphos fragment, monochrome with relief-cut figures (not a cameo); 1st c. B.C.–1st c. A.D. Dk. blue transp., lightly pitted. CMG 66.1.207.

3795  Multilayered fragments, with beautifully cut figure and ancillary features; prob. 1st c. A.D. Dk. blue transp. base glass cased with five thin layers proceeding upwards from the blue in this sequence: white opq., “red” opq., lt. green transp., a second white opq., and a second lt. green transp.; moderately w. CMG 62.1.24. Sample consists of dk. blue base glass. (Same as Pb-1133.) See Ref. E-37, no. 8.

3796  As above, white opq. layer.

3797  As above, p. blue transp. zone of red opq. layer.

3798  As above, reddish opq. zone of red opq. layer.

3799  As above, lt. green transp. layer, but somewhat turbid with a few flakes of an opacifier phase. Evenly w. to a buff-colored zone on outermost surface.
3809 Bowl. Green transp. over colorless. Compare to Hunting Bowl from Schaffhausen Museum. (B. Blok, Noordwijk.)

3851 Skyphos. White opq. over dk. blue transp., lightly w. On loan to CMG from previous owner 9/81, now in the J. Paul Getty Museum, their no. 84.AF.85. See Ref. E-37, no. 16.

V AE. DIATRETA; ca. 1st c.(?) and 3rd–4th c.

Colorless glasses


390 Corinth, one of eight fragments, some with remains of an inscription. Colorless, with traces of med. blue transp. at tip of post. Pitted. Inv. no. MF 10821. See Refs. A-9, E-36, and F-59. See also 391 below. (Same as Pb-2060.)

392 Athens, one of six fragments, some with remains of a songbird. Colorless with dk. blue transp. Pitted. Inv. no. G547. See Refs. A-9 and E-36. See also 393 below.

1038 Conimbriga, rim of a cup. Colorless with dk. blue transp. posts, the latter sagged by accidental firing; lightly w. Sample is of colorless glass. Cat. no. 163. (From J. Alarcão, 7/67.) See Ref. F-3. See also 1039 below.

1040 Conimbriga, rim fragment of another cup. Colorless, little or no w. Cat. no. 162. (From J. Alarcão, 7/67.) See Ref. F-3.

1036 Companion piece to 1040. (Same as Pb-2061.)

1037 Another companion piece to 1040.

1120 Trier (Nikolausstrasse), rim fragment. Colorless. Sample is of a single section of ovolo decoration. Rheinisches Landesmuseum Trier, inv. no. 14 588, listed by Harden (Ref. F-59, p. 207, pl. LXIX g) as no. 1696. Given to PNP by R. Wihr, 5/67. Note: There is some possibility that this sample is a post from the Trier Niederemmel diatretum. (See Ref. F-59, pg. 210, no. 9.) Our relevant records were lost in the 1972 flood.

1351 Begram, thought to be from the "Lighthouse Beaker". One of a group of four fragments, another of which appears to contain the base of a post. Colorless, lightly w. Collected by RHB 8/8/68. See Field Notes, Beg-3. See Refs. A-28, F-51, and F-59. (Same as Pb-2072.)

1352 As above, another fragment, possibly from a blown-on portion such as the gunwhales of the small boat or the ledge around the top. Beg-3. (Same as Pb-2073.)

3803 CMG vessel handle, with the head of an animal at the end, preserving diatretum cutting at juncture with body. Colorless with a sl. yellowish tinge, remains of dk. blue transp. cage structure, lightly w. CMG 55.1.143. (Same as Pb-2063.) See also 3804 below.
3805 Nijmegen diatretum, 80-100 A.D. Colorless, much internal shattering poss. caused by burning, moderately w. Excavated from grave in cemetery of Ulpia Noviomagus. Nine other glasses in the 5170 series came from this grave or three other graves of the same date. 3805 (hyd.) indicates hydration layer. (A. Koster, KU, via DBW. See her letter of 6/14/88.) See Ref. E-22.

3806 As above, second portion rinsed repeatedly in acetone and water, separated from w. products under a microscope.

3807 A second sample of the Nijmegen diatretum; from flat inside wall. Colorless with minor internal shattering around edges, and hydration rims on both flat surfaces. Total t. = 1.3 mm; t. of hydration rims = 0.08-0.12 mm. 3807 (hyd.) indicates hydration layer. From A. Koster, KU, via DBW, 9/25/95. (Same as Pb-2062.)

3808 As above. Small fragment of a post. Colorless glass, filled with internal shattering. Coated with consolidant, to which sandy debris adheres. Microscopic examination verified that this was originally a colorless glass just like no. 3807.

Dichroic glasses


3188 Ethiopia, Axum. Large cut dish. Rosy pink by trans., v. sl. greenish back-scattering by refl. Axum, 56, wall, M1. (Given to RHB by A. Tessema, Addis Ababa, 5/9/73.)


3801 As above, w. products.

3390 CMG patera(?) fragment with smoee-like figure peering over rim; unfinished. Acquired in Germany. Pea-soup green by refl., p. bluish by trans. (When heated, a tiny chip acquired the same magenta trans. color as the Lycurgus Cup.) CMG 78.1.17. See Ref. E-39, no. 481.

Colored glasses

387 Benaki. Same object as 388. Med. blue transp. Sampled by RHB, 5/27/87. (Same as Pb-2075.)

391 Corinth. Same object as 390. Lt. blue transp. (Same as Pb-2071.)

393 Athens. Same object as 392. Dk. blue transp.

1039 Conimbriga. Same object as 1038. Dk. blue transp. (Same as Pb-1199.)

3804 CMG. Same object as 3803. Dk. blue transp. (Same as Pb-2074.)

V A F. INDIVIDUAL ROMAN OBJECTS

898 "The Bluefish", 2nd half of 1st c. Cast(?) dish or cover in the form of a fish, with cut features. Dk. blue transp., little w. CMG 67.1.1. See Refs. E-20, no. 25, and E-39, no. 4.

947 The Paris Plate, 3rd–4th c. CMG 55.1.85. Minute flakes of orange-red pigment, approx. 40% contamination with white, buff, and some black. See Refs. E-1 and E-20, no. 149, p. 271.

948 The Paris Plate. Minute flakes of buff-colored pigment, approx. 50% contamination with white ground. (Same as Pb-544.)

949 The Daphne Ewer, end of 3rd c. CMG 55.1.86. Two flakes of paint and iri. from rim of base. Corners contain traces of red paint. See Refs. E-1, and E-20, no. 150, pp. 272–73.


1001 Large beaker with engraved scene of footrace between Hippomenes and Atalanta; late 3rd–4th c. Colorless, little or no w. CMG 66.1.238. See Ref. E-39, no. 402.

2983 Vessel base. Amber. From Venetian reproduction of Disch Cantharus CMG 59.3.38.


3073 Plate, facet-cut; 1st–3rd c. Lt. blue transp., w. scum. CMG 66.1.231. (Same as Pb-1197.)

3517 Lagynos in banded and cameo glass; 3rd–1st c. B.C. Lt. blue opq., white opq., and aqua. CMG 68.1.11. See SMG, no. 281. Sample is of aqua glass.

3523 As above, blue body glass. (Same as Pb-2188.)

3524 As above, white opq. cameo layer. (Same as Pb-2189.)

3769 Ennion jug, Jerusalem, dated to 8th month of Elul, 70 A.D. Signed. Aqua, distorted by heat. (Y. Israeli, 5/82.)

3820 Fragment of cameo glass, dk. blue transp. overlay on colorless base glass. Lightly weathered. Excavated at Kharga Oasis; possibly dating from the 4th c. Sample is of colorless glass. (M. Hill, MMA.)

3821 As above. Sample is of dk. blue glass contaminated with about an equal quantity of colorless glass.

V AG. MISCELLANEOUS ROMAN

800 Athenian Agora, date uncertain. Small chunk of glass adhering to pottery sherd or refractory material. Aqua. From R. R. Holloway via H. Thompson.

802 As above, another lump of aqua glass, blk. w. crust.

807 Gythion, Greece; date uncertain. Base of plate or dish. Bl. aqua. Found on beach rock. (C. Higgins, UCal.)

808 As above, flat glass. Bl. aqua.

809 As above, fragment of thin-walled blown vessel. Colorless.


Roman York

These samples came from fragments found in the Viking levels at York and were originally believed to date from ca. 950. However, they are now said to have come from heavily-disturbed underlying Roman deposits of the late 2nd–early 3rd c. Submitted by P. Addyman, YAT, courtesy J. V. Noble. (See Refs. F-17 and F-65.)

2550 Waste from glass manufacturing site, Coppergate, York. Sample is of once-molten, pale greenish glass between a frothy surface layer and a pot sherd. Some spherical bubbles, slightly iri. No. 1980.7 II 31225-11272.

2551 As above. Individual grains from top surface of batch layer. (0.1–0.3 mm greatest dimen.)

2552 As above, whitish, sintered zone, probably partially-melted batch.

2555 As above, similar to no. 2550, but somewhat larger.

2556 As above, whitish sintered zone, probably partially-melted batch.

2558 As above. Grains of bluish material. This phase is not abundant but seems to be from original batch. May be of mineral origin but in some places looks a bit frothy.

2559 As above. Soft, whitish deposit from beneath protrusion on side of fragment. This may be the remains of a phase related to the alkali.
VI. SASANIAN

VI A. JEZAZIYAT; 2nd–6th c.
(Collected by RHB at suggestion of Robert McC. Adams. See Field Notes of 5/8/67.)

1266 Bottle base. Grn. olive, vertical molded ribs and pontil mark.

1267 Vial (?) base. Lt. green.

1268 Vessel base. Green, eroded surface.

1269 Vessel base. Green.

1270 Vessel wall. Green, eroded surface.

1271 Goblet base with hollow stem. Colorless.

1272 Vessel wall. Colorless, heavily eroded.

1273 Vessel base with vertical ribbing. Colorless, heavily eroded.

1274 Dish, base and wall. Colorless.

1275 Vessel base with pontil mark. Colorless.

1276 Tumbler base. Colorless.

1277 Dish rim. Colorless.

1278 Vessel base with pontil mark. Colorless.

1279 Vessel base, molded pattern on bottom, prob. of “8-lobed rosette”. Colorless.

1280 Dish wall. Colorless.

1281 Vessel base. Green.

1282 Vessel base. Aqua with dk. green applied ring base. Sample consists of aqua glass only.

1283 Vessel wall. Bl. aqua, eroded surface.

1284 Bottle base with traces of vertical-molded ribs. Grn. aqua, eroded surface.

1285 Goblet with solid stem. Bl. aqua, eroded surface.

1286 Cullet. Bl. aqua.

1287 Cullet. Colorless.

1288 Vessel wall. Dk. blue transp., some surface erosion.

1289 Composite of ~50 Jezaziyat fragments crushed together. Reference glass JZ, greenish powder.

VI B. TELL UMM JIRIN; 5th–6th c.
(Collected by RHB at suggestion of Robert McC. Adams. See Field Notes of 5/5/67.)

1260 Vessel base with pontil mark. Dk. green, surface pitting and striations, w. products removed by erosion.

1261 Vessel base. Bl. aqua, w. products removed by erosion.

1262 Vessel base with high kick. Bl. aqua, w. products removed by erosion.

1263 Vessel base, flatter profile than above. Dk. green, w. products removed by erosion.

1264 Vessel base. Colorless, w. products removed by erosion.
VI C. CHOCHE; 3rd–early 5th c.

1241 Vessel wall with cut decoration. Aqua, moderately w. NP-V793.

1242 Vessel wall. Aqua, moderately w. NP-V2430.

1243 Vessel foot. Aqua, moderately w. NP-B1.

1244 Vessel base. Green, lightly w. NP-B4.

1245 Vial base. Green, heavily w. NP-B6.

1246 Vial base. Green, pitted. NP-C398.

1247 Vessel base. Dk. green, heavily w. NP-V272.

1248 Goblet stem. Green, moderate “enamel” w. NP-407.

1249 Stem. Green, heavily w. NP-B3.

1250 Stem. Green, heavily w. NP-B7.

1251 Stem. Green, heavily w. NP-1003.

1252 Vessel, facet-cut. Colorless, heavily w. NP-N2148.

6355 Vessel; Sasanian. Colorless, moderately w.

6356 Vessel; Sasanian. Pinkish, moderately w.

6357 Thick-walled vessel(?); Sasanian. Green, w. scum.

6358 Bowl; Sasanian. Olive amber, heavily w.

6359 Large bowl; Sasanian, west church. Dk. blue, heavily w.

6360 Thin-walled vessel; early Islamic(?). Aqua, lightly w.

6361 Window glass or vessel; Islamic. P. green, heavily w.

6362 Vessel; Islamic. Colorless, heavily w.

6363 Thick-walled vessel; Islamic. Colorless, moderately w.

6364 Thick-walled vessel rim. P. green, heavily w., with bright red paint-like substance on concave surface. (1931–32 excavations.)

6365 As above, the red substance.

6366 Thick plaque or mosaic blank. Red opq., v. heavily w.

6367 Thick plaque or mosaic blank. Yellow opq., heavily w.

VI D. CTESIPHON; Sasanian–Islamic.

5351 Bowl; 3rd–7th c. Colorless, heavily w. MMA 32.150.230.

5352 Bottle; Parthian, Grave I. Aqua, moderately w.

5353 Large bowl; Sasanian, west(?) church. Colorless, heavily w.

5354 Bottle; 3rd–4th c. P. aqua, heavily w.

6355 Vessel; Sasanian. Colorless, moderately w.

6356 Vessel; Sasanian. Pinkish, moderately w.

6357 Thick-walled vessel(?); Sasanian. Green, w. scum.

6358 Bowl; Sasanian. Olive amber, heavily w.

6359 Large bowl; Sasanian, west church. Dk. blue, heavily w.

6360 Thin-walled vessel; early Islamic(?). Aqua, lightly w.

6361 Window glass or vessel; Islamic. P. green, heavily w.

6362 Vessel; Islamic. Colorless, heavily w.

6363 Thick-walled vessel; Islamic. Colorless, moderately w.

6364 Thick-walled vessel rim. P. green, heavily w., with bright red paint-like substance on concave surface. (1931–32 excavations.)

6365 As above, the red substance.

6366 Thick plaque or mosaic blank. Red opq., v. heavily w.

6367 Thick plaque or mosaic blank. Yellow opq., heavily w.

VI E. INDIVIDUAL SASANIAN OBJECTS

1296 Bowl, deeply-cut leaving prominent bosses, typical Sasanian type; prob. 4th–5th c. Colorless, v. heavily w. CMG 61.1.11.
3070 Plate, cut with winged creature. Blue transp., unweathered. (M. Mahboubian.)

3071 Falcon head; said to be Parthian, poss. from Azerbaijan. Amber. CMG 74.1.14. Sample removed from left side of back of neck by RHB and SMG, 4/2/74.


3075 Ewer, with cut decoration; Sasanian. Colorless. CMG 69.1.6. Sample consists of bits of glass left over from restoration after flood.

3077 Cast head; said to be Sasanian. Green transp. glass. (P. Rabenou.) Sample said to come from underside of neck of object in private collection.


VII. ISLAMIC

VII A. NISHAPUR; 9th–10th c. (CMG, unaccessioned.) Nis numbers, etc., were assigned by F. Schuler in the 1950s. See Refs. A-86 and F-76.

Various colors

1030 Rounded knob. Em. green. Nis 003, 004.
3078 Neck and shoulder of heavy-walled cut bottle. Colorless. Nis 001.9.
3080 Vessel fragments. Blue transp. Sample from unnumbered piece thought to be 001.5. (Same as Pb-1196.)
3082 Base of alabastron with facet cutting. Dk. green transp. Imam Zadeh. (From same box as 3081.)
5301 Bottle, poss. molded. Bl. aqua.
5302 Bottle base, poss. molded. P. yellowish green. Nis 008/009.
5303 Rim with threading. P. aqua. Nis 008/009.
5304 Bottle base, molded dimples. Green. Nis 005.
5305 Pincered handle. Green. Nis 001(?).
5306 Bottle base, small, molded scrolls. Green. Nis 005/006.
5307 Bottle base, molded dimples. Green. Nis 005/006.
5308 Bottle base, molded radiating lines. Bl. green. Nis 005/006.
5309 Beaker base, mold blown (thin-walled). P. green, black w. Nis 007/008.
5310 Rim of large flask, nine flattened edges. Bl. green. Nis 007/008.
5327 Molar bottle, cut. P. blue. Nis 003.
5329 Neck fragment, molded lines(?). Blue. Imam Zadeh. Nis 003.
5330 Wall fragment. Dk.blue.
5331 Rim fragment. Blue. Nis 009/010.
5332 Neck of small bottle. Dk. blue.
5333 Neck of small bottle. Dk. blue. Torbabad.
5334 Rim of squat-necked bottle. Dk. blue with w. streaks.
5335 Eye bead; 8th–9th c. Dk. blue transp. with white opq. designs. Sample is of blue glass. (Same as Pb-1129.)
5336 As above, white opq.

Colorless vessels

359 Base(?) fragment, thick, cut. Colorless. Same as Nis 002.11. Used for viscosity determination.
360  Bowl rim; 8th–10th c. Colorless. Imam Zadeh, Ghazi-abad. Nis 002.3. Used for viscosity determination. (Same as O-73.)

452  Bottle neck, cut. V. p. aqua. Nis 012.3. (Same as O-11.)

1824  Beaker base, cut. Colorless. Nis 001/002.

3450  Flat dish; 8th–10th c. Colorless, eroded surface. Nis 003.

5311  Handle with thumb rest. Colorless. Nis 007/008.


5314  Wall fragment, cut. Colorless. Imam Zadeh.

5315  Rim fragment, cut. Colorless. Imam Zadeh.


5319  Beaker base, cut. Colorless. Nis 001.3.

5320  Bottle neck and wall, cut. Colorless. Nis 005.1.

5321  Fragment with deep cutting. Colorless. Torbabad.

5322  Neck fragment, cut. Colorless.

5323  Flattened rim, large. Colorless. Nis 005/006.

5324  Rim fragment, pointed design. Colorless.

5325  Wall fragment, looped design. Colorless.

5326  Neck fragment, two ridges. Colorless. Nis 009/010.

3079  Dish with straight short rim. Colorless. Nis 002.3(?).

VII B. NISHAPUR NEIGHBORS; various dates.
(CMG, unaccessioned.) See Refs. A-86 and F-76.

Hamadan, Islamic

5340  Vessel, dimpled, molded pattern. 10th–11th c. Aqua, some iri.

5341  Vessel with thick base. Green. moderately–heavily w.

5342  Heavy ribbed dish. Dk. grn. blue, moderately w. (V. similar to CMG 54.1.108.)

5343  Large bottle, some traces of cutting. 10th–11th c. Colorless, lightly w.

5344  Vessel base. "Black" (v. dk. purple), surface scum.

5345  Thin-walled vessel. Dk. blue transp., w. scum.

5346  Large bead with millefiori insets. White opq. glass, bubbly, cordy, lightly w. Millefiori consists of white opq., red opq., and green transp. elements. Black lining on perforation with large trapped bubbles.
Other locations, Islamic

358 Gorgan. Large vessel base with pontil. Green. Gor 003.1. Used for viscosity determination. (Same as O-74.)

1032 Ray. Large vessel base. Dk. green. (Not analyzed.)

1033 Ray. Vessel with long, thin neck. Dk. blue, transp. (Not analyzed.)


5350 Gorgan. Vessel base. Dk. blue, moderately w. Gor 001/004.

VII C. FUSTAT; 9th–13th c. (G. Scanlon, AUC.)

Fustat vessels and cullet

3100 Cullet. Colorless with streaks, sl. iri. Sample consists of brownish glass.

3101 Cullet. Aqua, sl. iri.

3102 Vessel neck. Aqua, heavily w. VI-19 Pit H 2 7.55–8.05, 6/21/71.

3103 Vessel neck with cut decoration. Colorless, heavily w. VI-19 Pit H 4.9–6.1.


3106 Vessel base. P. aqua(?), heavily w. VI-19 Pit H 6.1–6.9.

3107 Vessel wall, molded or cut, closely-spaced ribbing. P. aqua, iri. VI-19 Pit H 6.1–6.9.

3108 Vessel rim. Aqua, lightly w. VI-19 Pit H 8.05–8.55.

3109 Vessel, cylindrical interior. Colorless, iri. VI-19 Pit H 8.05–8.55.


3111 Large dish, deep cut; 750–850. Colorless, iri. VI-19 Pit H 6.1–6.9.

3112 Beaker, deep cut. Colorless, iri. VI-19 Pit H 8.05–8.55.

3113 Vessel base with pontil. Purple, heavily w. VI-19 Pit H.

3114 Vessel base with pontil. Dk. green, heavily w. VI-19 Pit H.

3115 Vessel neck. Blue transp., w. scum. XXI-8 Pit U. (Same as Pb-1191.)

3116 Vessel. P. aqua(?), luster glass.

3117 Glass adhering to pottery sherd (or poss. v. heavy glaze?). Dk. blue transp. (Same as Pb-1192.)

Fustat bracelets

3118 Opalescent, bubbly.

3119 Bl. aqua.

3120 Olive, with spiraling white opq. decoration. Sample consists of both dark and white glass.

3121 Red opq.

3122 Yellow opq.

3123 Green opq.

3124 Bl. aqua, with threading. Sample consists of yellow opq. glass.
Fustat miscellaneous

See also Section I G. (nos. 3125–29).

3144 Millepiori fragment, somewhat curved. Polychrome, little or no w. CMG 81.1.45. Sample is of yellow opq. glass.

3145 As above, red opq. glass.

Fustat dichroic; said to be no later than 1088. See Réf. D-9.

3143 Vessel rim. Aqua, with ribbon-like horizontal bands of cream-colored and bluish-gray turbid glass, unweathered. AUC no. 80-9-27, CMG 81.1.42.

VII D. QASR AL-HAYR; Islamic. (H. Salam, FM.)

Vessels

3160 Vessel rim. Aqua, unweathered.

3161 Thin-walled vessel. Aqua, w. scum. QH-2.

3162 Heavy-walled vessel. Aqua, moderately w. QH-3 1K.


3164 Vessel. Colorless, shiny black w. QH-10 13C.

3165 Vessel base with pontil mark. Colorless(?). QH-11.

3166 Vessel. Colorless, heavily w. QH-10 1K.

3167 Flat glass. Amber, iri. QH-7 1K.

3168 Vessel base. Dk. blue transp., moderately w. QH-5 199C or 192C.

3169 Vessel. Yellow-green, iri. QH-15C.

3170 Vessel. Aqua, unweathered. QH-15C.

3171 Vessel. Purple. QH-15C.

Bracelets

3172 Aqua, w. scum.

3173 Green, moderately w.

3174 Black, moderately w.

3175 Black, unweathered.

3176 Bl. aqua, turbid, lightly w.

VII E. SIRAF; 9th–10th c. (Collected by PNP, RHB, 11/30/67; courtesy DBW.)

3200 Cullet.

3201 Vessel. Green.

3202 Vessel. Green.

3203 Vessel base. Colorless, heavily w.

3204 Vessel, heavy-walled. Grn. aqua, w. and eroded.

3205 Similar to 3204.

3206 Waste glass. Amber, heavily w.

3207 Vessel base. Colorless, eroded.

3208 Vessel(?). Turbid white, w.

3209 Vial neck. Dk. blue, lightly w.
VII F. GHUBAYRA; various dates.  
(G. Fehérvári, BIPS.)

3090 Large blown vessel, shallow scratched or cut decoration. Citadel. P. amber, unweathered. One of several samples submitted.

VII G. QSAR-ES-SEGHIR; Islamic.  
(C. Redman, SUNY.)

3303 Vessel, threaded decoration with applied prunt. Colorless, iri. E8N11, 5-2/1.

3304 Vessel rim with vertical pattern-molded ribs. Colorless, bubbly, w. scum. E8N12, 3-6/1.

3305 Vessel wall and rim with threading.

3306 Vessel neck with spiral pattern molding. Colorless, heavily w. E10N14, 4-7/1.

3307 Vessel neck with spiral pattern molding. Colorless, w. scum. E8N11, 4-2/4.

3308 Vessel shoulder. P. green, heavily w. E2N10, 5-10/1.

3309 Wall fragment of blown vessel. P. yellowish, moderately w. E11N10, S7/1.

3310 Wall fragment of blown vessel with dimpled pattern molding. Grn. aqua, w. scum. E11N10, 4-7/2.

3311 Wall or base fragment of blown vessel. Green, very bubbly, little or no w. E8N11, 4-2/2.

3312 Fragment of tubular blown vessel or neck (poss. fluted). Blue transp., little or no w. E13N15, 2-1/1.

3313 Neck(?) of blown vessel. Blue transp., moderately w. E7N11, 3-7/1.

3314 Fragment of tubular vessel or neck, with faint fluting. Purple, moderately–heavily w. E5N11, 1-0/2.

3315 Neck fragment of blown vessel. Olive-amber, little or no w. E8N11, 6-4/1.

3316 Fragment of thin bracelet or bangle. Blue transp., moderate iri. E8N11, 4-2/5.


3318 Small bead. Black material of low density; believed to be jet. D. = 1.0 cm, l. = 7.0 mm, perf. = 2.0 mm.

VII H. SELÇIKLER; Seljuk Period.  
(N. Firatlı, IAM.)

3018 Flat glass. Green, very bubbly, lightly iri.

3019 Flat glass. Colorless, bubbly, lightly w.

VII I. SERÇE LIMANI SHIPWRECK; ca. 1025. (G. Bass, INA.) All samples are in the Bodrum Museum of Underwater Archaeology. See Refs. C-14, D-16, E-7, F-10, F-12, F-13, and F-16.

Most of these glasses are v. heavily w., but the w. products have been eroded away by the scrubbing action of water and sand.


3422 Large jar. Ylw. green. SL 127.
3423 Medium jar. Ylw. green. SL 378.
3424 Large jar. Smoky with purple streaks. SL 378.
3426 Large vessel neck. Smoky with purple streaks. SL 22.
3427 Tumbler, cut double ring. Green. SL 100(?), N3.
3429 Tumbler, cut double ring. P. green. SL 1114, J3.
3430 Tumbler, not cut(?). Colorless. SL 810.
3431 Tumbler, cut ring at base. Colorless. SL T58; 403, N3 W64.
3432 Jar. Smoky, dk. blue transp. thread on edge. SL N3 GL (?).
3434 Bowl. Colorless, dk. blue transp. thread on edges. SL 1279.
3435 Rim and neck. Colorless, dk. blue transp. thread on edge. SL 1676.
3436 Rim and neck. Colorless, red opq. threads. SL 4230546(?).
3438 Base, folded. Olive grn. SL 1297.
3447 Ewer. P. green. SL 993.
3448 Handle. Green. SL Misc.
3449 Lamp. Smoky green. Sample is of applied pad. SL Misc.
3543 As above. Sample is of wall.
3545 Large plate. Colorless, with purple streaks. SL 132, N3 LL4.
3547 Large vessel, sl. kick and pontil. Smoky with purple streaks. SL 1392.
3548 Squat bottle. Purple streaks. SL 1046.
3549 Large dish, pattern-molded (5-star). Green. SL GW 786.
3550 Vessel fragment. P. yellowish.
3551 Vessel fragment. P. yellowish.
3552 Ring. Grn. aqua.
3553 Cullet. Pale green.
3554 Cullet. Smoky.
3556 Vessel base, pattern-molded (7-star, dimpled). Purple. SL 15304, LL.
3557 Vessel base, pattern-molded (5-star, dimpled). Green. SL 723.
3559 Bottle neck with cut decoration. P. green/colorless. SL 1090.
3560 Bottle rim with cut decoration. P. smoky. SL 1023.
3561 Bottle rim with cut decoration. Colorless. SL 1049.
3562 Bottle, thin-walled, high kick. Grn. aqua. SL 154, N4 UR.
3563 Bottle, thin-walled, high kick. Aqua. SL 44, N3.
3564 Bottle, thin-walled, high kick. Aqua. SL 1024.
3568 Large vessel. Aqua. SL 1272.
3569 Neck of flattened bottle. Aqua. SL 7A.
3570 Base, sl. kick. Purple. (No no.)
3572 Bottle rim with cut decoration. Dk. blue transp. SL 986. (Same as Pb-1140.)
3573 Small ewer. Dk. blue transp. SL 1329.
3574 Base, pattern-molded (vertical ribs) with pontil. Dk. blue transp. (No no.)
3575 Vessel fragment with cut decoration. Dk. blue transp. SL 200. (Same as Pb-1141.)
3576 Vessel base, thick-walled, with pontil mark. Em. green. SL 1023. (Same as Pb-1134.)
3577 Molar vessel. Em. green. SL 1217. (Same as Pb-1135.)
3578 Vessel rim, pattern-molded. Em. green. SL GN 480. (Same as Pb-1136.)
3579 Vessel, pattern-molded (5-star). Em. green. SL 219. (Same as Pb-1137.)
3580 Bowl rim with molded eye-like decoration. Colorless, bubbly. SL 132, N3 L44.
3582 Alembic. Aqua. SL 770.
3583 Wick holder. Colorless. SL GW 832D.
3584 Lamp stem, hollow. Green. SL 620, GW 802A.
3586 Small dish. Lt. blue opq. (No no.)
3587 Ring. Green. SL 2122.
3588 Ring. Pale green. SL 2060.
3589 Ring. Green. SL 2044.
3590 Ring. Colorless. SL 2111, N3 UR.
3591 Ring. Colorless. SL 2111, N3 UR.
3592 Ring. Smoky. SL 2111, N3 UR.
3593 Crack off. Green. SL 1061.
3594 Crack off. Smoky. SL 1061.
3595 Crack off. Purple and colorless. (No no.)
3596 Dripping. Green. (No no.)
3597 Dripping. Grn. aqua. (No no.)
3598 Alembic stem(?). Grn. aqua. SL 1090.
3731 Molded base. Colorless. SL 1254.
3732 Marvered gather. Dk. green.
3734 Cullet. Green. SL 1039, 07 LL.
3735 Cullet. Green. SL 1039, 07 LL.
3737 Cullet. Green. SL 1034, NR LR3.
3738 Cullet. Green with purple streaks. SL 1034, NR LR3.
3740 Cullet. Green with refractory adhering. SL 1676, 04 LL3.
3741 Cullet. Smoky. SL 1079, 07 LL.
3742 Cullet. Purple. SL 1079, 07 LL.
3744 Cullet. Dk. blue transp. SL 1636, N6 LR4. (Same as Pb-1139.)
3745 Large glass bead. Originally black, now dk. gray; v. heavily w. and pitted. A small, very thin strip of red opq. glass (originally a threaded decoration?) adheres to the surface. O.d. ~1.6 cm, i.d. ~0.8 cm, w. ~1.0 cm. GW 1033. (C. Pulak, 2/6/90.) Sample is of black glass.
3746 Medium glass bead. Originally black, now dk. gray; v. heavily w. and pitted. Faint remains of red opq. O.d. ~1.1 cm, i.d. ~0.4 cm, w. ~1.0 cm. GW 1034. (C. Pulak, 2/6/90.) Sample is of black glass.
3747 Red glass from 3745. Contains minute droplets of gray metal. (Same as Pb-3291.)
5901 Dish, pattern-molded (multiple star). Grn. aqua. SL GW 856.
5902 Dish, pattern-molded (circle). Colorless. SL GW 288.
5903 Neck with bulge. Smoky, sagged in fire. SL 770.
5904 Lamp. Purple. SL GW 869.
5905 Lamp. Colorless. SL GW 73.
5906 Same as 3445.
5907 Large jar. Grn. aqua. SL 1328.
5908 Large jar. Colorless. SL 898 LR3.
5909 Large dish, pattern-molded (circle) with pontil mark. Pinkish. SL 1993.
5910 Large bottle. Smoky or amber. (No no.)
See also metals in Section XXVI B.

VII J. TAKHT-I-SULAIMAN; mostly Islamic. (J. Kröger, MislK.)
5368 Window glass (Sasanian). Aqua, unweathered.
5369 Large bottle, v. thick-walled. Aqua, heavily w. (Il-khanid type bottle.)
5370 Window (or vessel?). P. aqua, heavily w. (Il-khanid type bottle?)
5371 Thin-walled vessel. Aqua. w. scum.
5373 Vessel(?). P. green, unweathered.
5374 Thin-walled vessel. Colorless, lightly w.
5375 Pattern-molded, thick-walled vessel with honeycomb pattern. Green, unweathered.

5376 Pattern-molded, thin-walled vessel with honeycomb pattern. Med. blue, unweathered.

5377 Vessel, sharply curved. Purple ("sl. orangy"), unweathered.

5378 Vessel. Olive, unweathered.


5380 Vessel, thin-walled. Colorless, with em. green cameo casing; green glass is moderately–heavily w. Sample is of colorless glass.

5381 As above, em. green. (Same as Pb-1110.)

5382 Vessel. Aqua, with em. green cameo casing. Unweathered base glass, green is lightly w. Sample is of aqua glass.

5383 As above, em. green. (Same as Pb-1111.)

5384 Vessel base. Colorless, with med. blue cameo casing, w. scum. Sample is of colorless glass.

5385 As above, blue glass.

5386 Vessel. Colorless, with em. green cameo casing. Sample is of colorless glass.

5387 As above, em. green. (Same as Pb-1030.)

5388 Cameo jug. poss. Iran, ca. 10th c. Restored from fragments. Med. bluish green cameo layer over thin-walled colorless glass, moderately w. CMG 59.1.489. Sample is of colorless glass.

5389 As above, bluish green glass.


5389 Vessel wall, Raqqa; 9th c. Colorless, with amber stain. (A. Haq, Damascus.)

1019 Vessel. Aqua with amber stain. CMG 51.1.145 VI.

1022 Vessel base. Dk. blue transp. with amber stain and yellow opq. stain. CMG 51.1.159. (Same as Pb-1193.)

1023 Vessel wall. Dk. blue transp. with yellow opq. stain and red stain. CMG 51.1.155.

1024 Vessel wall. Dk. blue transp. with dense yellow-orange opq. stain. CMG 51.1.152. (Same as Pb-1194.)

1027 Vessel rim. Olive with red opq. stain and red-stained bands. CMG 51.1.162 IX(?).

1041 Vessel rim. Aqua with amber stain.

1042 Vessel rim. Aqua with amber stain.

1043 Vessel rim. Aqua with strong amber stain, yellowish halation.

1044 Vessel rim. Aqua with strong amber stain.

1045 Vessel base. Aqua with strong amber stain.
1046 Vessel wall. Colorless with amber stain.

1047 Vessel rim. Colorless with amber stain.

1048 Vessel rim. Colorless with amber stain.

1049 Vessel base. Colorless with p. amber stain.

1180 Bowl, with p. yellow stain and some gilding. Heavily restored. On loan to CMG, 1/68. See RHB examination notes, Study card 728.

6640 Vessel fragment, prob. a bowl. Dk. blue with disks of orangy opq. stain on convex surface; and solid dense orange opq. stain on concave surface. Ill. in Ref. A-22, Fig. 3, lower left.

6641 Base fragment of vessel with cut groove on bottom of foot. Turbid grayish-blue with dense orange opq. stain of bold design on interior with purplish background stain and dense orange stain on exterior and base. Groove on base is purplish. Ill. in Ref. A-22, Fig. 3, upper right.

6642 Base fragment of vessel with edge of pontil mark. Bright bluish-green with reddish-orange field on inside and mottled turbid green on outside. Could possibly be a waster.

6643 Vessel fragment. Olive with very dense red opq. stain on slightly concave surface forming a barred design and very dense solid greenish, mottled cover on convex surface. Overall appearance is that of a brilliant red design on a black field. Ill. in Ref. A-22, Fig. 4.

6644 Base fragment of small vessel, with small pontil mark. Olive with brick-red opq. stained hatching on bottom of base and swirled red and purplish gray stained motif on inside.

6645 Thin-walled vessel fragment. P. amber with dense orangy stain on concave surface and turbid bluish dots and lines on convex surface. Bright red by transmission. (Probably from same vessel as a somewhat more elaborately decorated rim fragment.)

6646 Base(? ) fragment of thin-walled vessel. Greenish-aqua with silvery, metallic appearing stained design on interior and some brick-red stain; some overall(? ) reddish stain on exterior. Sample contains both reddish and metallic stain.

6647 As above, silvery metallic stain.

6648 Wall fragment of thin-walled vessel. Colorless with mirror-like stained motif on convex surface and overall mirror-like coating on concave surface. Overall effect is of mirror-like design against purple field.

6649 As above, mirror-like stain, loop designs.

6650 As above, mirror-like stain, solid coating.
Berlin

These samples are included in this section because they are believed to be luster-decorated rather than enameled. (They have not been handled by RHB.) The samples were submitted by J. Kröger, MlsIK. (See his letter of 12/22/95.)

6651 Vessel fragment. Samarra. V. Pale aqua, with traces of yellow opq. and dark stains; unweathered. MlsIK no. 273a. See Ref. F-78, no. 273, pl. VII.

6652 Rim fragment, said to be from Nishapur. Dk. blue transp., with traces of orangy-yellow opq. stain; lightly w.(?). MlsIK no. 1.2/63

6653 Vessel fragment, said to be from Nishapur. V. pale aqua, with traces of orangy-yellow opq. stain; lightly w.(?). MlsIK no. 1.5/63.

6654 Vessel fragments, said to be from Takht-i-Sulaiman. Grn. aqua, with traces of orangy-yellow opq. stain; little or no w.(?). MlsIK no. 1.19/69.

6655 Base fragment of thin-walled vessel, acquired in Cairo. V. pale aqua, with traces of dk. amber stain, unweathered. t ~0.5 mm. MlsIK no. 1.2391.

VII M. AQABA; Abassid. (C. Meyer, Ol.)

5580 Flattened vessel with cut decoration. Shape of fragment suggests that of a small pilgrim flask. Aqua, heavily w. in patches. E8a, RN-1074.

Note: Twelve additional dk. blue samples not yet analyzed.

VII N. QUSEIR AL-QADIM;
Mameluk. (C. Meyer, Ol.)

Sample not yet analyzed.

VII O. SCRATCH-DECORATED GLASS; 9th-10th c. (CMG.)
See Refs. A-74 and A-86.

Uncolored Glasses

6340 Thin-walled bottle with long neck. Checkerboard, floral, rope, and triangular motifs. Heavily restored. Aqua, little or no w. CMG 68.1.1.

6341 Wall fragment of a large cylindrical cup. Arcade motifs. Green, heavily w. CMG. 68.1 60.

6342 Wall fragment. Decoration of uncertain nature. Colorless, heavily w. CMG 51.1.144.

6343 Bottom of a plate, with base and pontil mark. Central four-lobed floret alternating with three-lobed motifs. Colorless, with slight yellowish tinge, lightly w. CMG 58.1.20 (prob. RWS no. 1218).


Blue glasses, CMG, ex-coll. R. W. Smith.

6348  Large cylindrical cup. Cross-hatching and geometric design. Dk. blue, moderately w. Said to have been acquired in Cairo. CMG 55.1.112 (RWS no. 900).

6349  Base fragment of a large plate preserving two (of three?) applied feet. Central seven-lobed floret, with hatching and rope motifs. Dk. blue, moderately w. CMG 55.1.110 (RWS no. 856).

6350  Base fragment of a large plate, without feet. Central floret of eight spiked petals alternating with four-lobed blossoms, with hatching, rope, leaves, and pine cone(?) motifs. Dk. blue, moderately w. CMG 55.1.111 (RWS no. 658).

6351  Rim and wall fragment of a cylindrical cup. Hatched triangles and worm-like motifs. Dk. blue with little or no w. CMG 68.1.59.

6352  Wall fragment of a bowl(?). Elaborate floral motif and poss. the body of a bird. Dk. blue, lightly w. CMG 51.1.111.

6353  Rim and wall fragment of a bowl(?). Stylized foliage and poss. a bird’s head. Dk. blue, moderately w. Poss. same object as above. CMG 51.1.110.

6354  Wall fragment. Hatched circles within a square. Dk. blue, moderately w. CMG 51.1.116.

6355  Rim and wall fragment. Hatched ellipse within pine tree(?) motif. Dk. blue, moderately w. CMG 51.1.115.

6356  Rim fragment of a bowl(?). Hatched triangles below rim. Dk. blue, lightly w. CMG 51.1.117A.

6357  Rim and wall fragment of a bowl(?). Hatched triangles below rim and tree-like(?) motifs. Med. blue, moderately w. CMG 51.1.119.

6358  Wall fragment. Hatched triangles. Med. blue, moderately w. CMG 51.1.11A.

6359  Wall fragment of a bowl(?). Hatching and stylized floral(?) motifs. Med. blue, little or no w. CMG 51.1.112.

6360  Rim and wall fragment of a bowl(?). Hatched triangles below rim and stylized trees(?) in hatched triangles. Dk. blue, unusually clear, no w. CMG 51.1.113.

6361  Flaring rim fragment. Simple triangles above sketchy vertical motifs. Dk. blue, unweathered. CMG unaccessioned; RWS(?) no. 1218-3.

6365  Large fragment of a large plate. Nishapur. Decoration containing five spike-leafed motifs; closely resembles nos. 6349 and 6350. Dk. blue, moderately w. Metropolitan Museum of Art no. 40.170.131. (M. Wypyski, MMA.)

Other colors

6366  Rim and wall fragment. Four-lobed floret, with hatching. V. p. blue, iri. CMG unaccessioned; RWS(?) no. illegible.

6367  Wall fragment. Circle within hatched square. Bl. green, iri. CMG unaccessioned; RWS(?) no. illegible.
6368 Rim and wall fragment. Hatched triangles with checkerboard and vertical row of circles on wall. P. orangy purple, w. scum. CMG unaccessioned; RWS(?) no. 1218-2, G183.1.


VII P. RELIEF-CUT VESSELS

This group consists of relief-cut vessels claimed to be of Islamic origins, but some are suspect. Most are characterized by being rather large, of spectacular types, and very thin-walled. From two private collections.

3089 Relief-cut, very thin-walled Islamic bowl, one of several fragments. Authenticity in question. Colorless glass, evidence of w., if any, removed by heavy cleaning.

3091 Fragment of cameo bowl. P. pink glass over colorless. (6/16/93.) Sample is of colorless glass.

3092 As above, p. pink glass.

3093 Chip from large cover. Probably Mameluk. Purple glass with white opq. threading. (6/16/93.) Sample is of purple glass.

3094 Fragment of rhyton. Authenticity doubtful. Dk. blue coil on colorless glass. (6/16/93.) Sample is of colorless glass.

3095 Chip of colorless glass. Authenticity in question. (7/13/93; A.)

3096 Chip of pink glass. Authenticity in question. (7/13/93; B.)

VII Q. ENAMELED GLASSES

6600 Rim fragment of enameled glass. Colorless (slightly pinkish or orangy) with part of a medallion-like decoration of dk. blue and white opq. enameling, and gilt with red outlining; some surface scum. One of a group purchased by RHB and MRB in Cairo, 8/28/62. Sample is of colorless glass.

6604 Wall fragment of enameled glass. Colorless with dk. blue opq. enamel and gilt fish with red outlining; unweathered. One of a group purchased by RHB and MRB in Cairo, 8/28/62. Sample is of colorless glass.

6608 Fragment of large, thick-walled, enameled glass. Colorless (somewhat smoky) with delicate gilt and red decoration; unweathered. One of two similar fragments purchased by RHB and MRB in Cairo, 8/28/62. Sample is of colorless glass.

6610 Base of small enameled beaker, with heavy foot and pontil mark. Colorless (somewhat smoky) with red enamel inside and gilt lettering outside; unweathered. One of a group purchased by RHB and MRB in Cairo, 8/28/62. Sample is of colorless glass.

6614 Wall fragment of thick-walled, enameled glass. Colorless with dk. blue opq., red opq., white opq., and yellow opq. enamels; unweathered. CMG 51.1.167 XLIX. Sample is of colorless glass.
6620 Wall fragment of enameled glass. Colorless with dense red opq. and white opq. enameled medallion; also gilt and red drawn background; some w. scum. CMG 51.1.167 XXII. Sample is of colorless glass.

6624 Wall fragment of enameled glass. Orangy-purple glass with elaborate gilt, red opq., dk. blue opq., and white opq. enamel decoration and calligraphy; lightly-moderately w. CMG 58.1.21. Sample is of orangy-purple glass.

See also Section XXI D.

VII R. TIMNA, Saudi Arabia, late Islamic(?). (G. van Beck, SI.)

5397 Wall fragment of thick-walled blown vessel. Colorless with dark, shiny w. crust. No. TTI/856.

5398 Wall fragment of thick-walled blown vessel. Green transp., with brownish w. crust. No. TTI/897.

5399 Wall fragment of thick-walled blown vessel. Brt. red opq., with mottled brownish w. crust. No. TTI/896. (Same as Pb-1438.)

VII S. CAESAREA; mostly Early Islamic. (R. Pollak, RCMS.)

This group of samples was submitted for analysis on behalf of A. Raban and at the request of G. Bass (11/13/96).

6900 Chunk of cullet, poss. from a flat ingot; above floor in Byzantine Bath. Dk. blue transp., heavily iri. T. ~2.4 cm, greatest dimen. ~7 cm. Lot no. 2. Str. IX; L. 071.
6911 Flaring rim (?) fragment of large vessel; 12th c. (?). Grn. aqua, pitted and iri. Original diam. ~9 cm. Lot no. 16. Str. III–II; L. 017.

6912 Ring (of the “Serçe Limani type”); 12th c. (late Fatimid). Cracked-off edges with fire-polished aperture. Found in a walled pit with many “rounded fragments and cullet”. Colorless, heavily w. with black skin over iri. Diam. 6.0 cm, aperture diam. 9 mm, t. 0.5–0.9 mm, h. ~1.2 cm. Lot no. 14. Str. III; L. 144.

6913 Base and wall (?) fragment of large, thick-walled vessel; 12th c. Colorless with purplish amber tinge, heavily w. and iri. Same excavation data as no. 6912.

6914 Flat fragment or cullet; 12th c. Colorless, heavily w. Same excavation data as no. 6912.

6915 Neck of small bottle; 12th c. (under Fatimid floor). Distorted by fire. P. aqua, moderately–heavily w. Rim diam. ~1.5 cm, original l. of neck ~5 cm(?). Lot no. 15. Str. III; L. 856.

6916 Rim fragment of bowl; 12th c. (?). Colorless with yellowish tinge, heavily w. and iri. Apparent diam. ~16 cm. Lot no. 17. Str. II; L. 990.

6917 Fragment of cut bottle; 12th c. (?). Colorless, heavily pitted. Lot no. 18. Str. IV–III; L. 830.

6918 Rim fragment of thin-walled vessel; 12th c. (?). Grn. aqua, lightly pitted and iri. T. 0.8–1.5 mm. Same excavation data as no. 6917.

6925 Lump of waste or furnace material; 6th–7th c. (?). Body consists of hard white material contiguous with hard brownish zone and then a friable, porous, ochre-colored material. Lumps of glass are enclosed and contiguous with white phase. Greatest dimen. ~6.5 cm. Lot no. 11. Str. VII; L. 783. Sample is of aqua glass.

6926 As above, white phase.

6927 As above, ochre-colored phase.

6928 Lump of waste or furnace material; 9th–10th c. (?). Black, friable, porous phase (resembling over-fired brick) with contiguous aqua waste glass. Greatest dimen. ~6 cm. Lot no. 10. Str. IV–V, fill under F 783. A rounded fragment of copper was said to have been incorporated in this lump. Sample is of aqua glass.

6929 As above, black porous phase.

6930 Flat piece of waste or furnace material; date uncertain. Friable buff-colored material with once-molten (?) bluish phase attached. Small bits of aqua glass, lightly–moderately w., were in same bag. Lot no. 13. Str. VII(fill); near eastern wharf of inner harbor. Sample is from one of several small bits of glass.

6931 Chunk of waste material with aqua glass intermingled; 6th–7th c. (?). Lot no. 5. Str. VII; L. 112.

6932 Chunk of hardened waste material intermingled with green and olive glass; date uncertain. Lot no. 8. Str. II (fill of grain bin); L. 128.

6933 Nugget of cullet with waste or frit intermingled; date uncertain. Lot no. 9. Str. II; L. 128.
6934 Chunk of hardened waste material with green glass intermingled; date uncertain. Lot no. 23. Str. VIII-V; L. 062.

6935 Chunk of hardened waste or furnace material, with intermingled hard, green (possibly vitreous) phase; date uncertain. Lot no. 7. Str. VII, under F 891; L. 933.

6936 Chunk of black porous material (resembling over-fired brick) with green glass run-down; Crusader trench. Lot no. 12. Str. II; L. 990.

6937 Small flat piece of friable yellowish material with a polycrystalline appearance; 9th-10th c. Lot no. 4. Str. VI-V; L. 690.

6938 Small piece of fritted(?) material; 10th-12th c. (Fatimid). One surface coated with a glassy phase, the other exposing a white crystalline phase that was the interior of the original chunk from which this piece was broken. White phase contains occasional irregular, flat inclusions of a black vitreous phase and penetrating layers of fine-grained salmon-colored particles. Lot no. 6. Str. IV-III; L. 898. Sample is of white material.

VI. INDIVIDUAL ISLAMIC OBJECTS

17 Islamic weight with inscription. "Black," v. heavily w. CMG 59.1 292. (Same as O-72.)

103 Vessel fragment. Raqqa, Iraq, 9th-10th c. A. Hak, no. 4. Spect. anal. showed plant-ash soda-lime with MnO. (Same as O-71.)


1509 Vessel kick, Khalifabad, Khuzistan; prob. 18th c. Red opq. From J. Hansman, 2/6/69. CMG RR 8324, Study card 867.
1819 Mosque lamp. CMG 52.1.86. Sample is of colorless pontil glass. (UV fluorescence matches that of body.)


3076 Bottle with cut decoration. Dk. green transp. CMG 55.1.126.

3099 Large bottle with neck and flat, flaring rim; some wheel-cut decoration. Prob. Iran (poss. Gorgan); prob. 11th c. Lt. blue opq. glass, lightly w. CMG 53.1.8. The bottle was exhibited in Paris in 1961 and returned broken along old breaks and repairs—followed later by the return of its crate and packing materials all carefully wrapped and in excellent condition. The object was repaired, only to be broken again while on exhibition during the 1972 flood. This sample consists of a few non-joining fragments. See Ref. E-3, no. 18, p. 13.

5197 Fragmentary bowl; 10th–11th c. Em. green. CMG 55.1.136, RWS no. 1062. Powdered sample left over from spectrographic analysis done about 1955 by F. Schuler of Corning Glass Works. His analysis was numbered C5384 or C5385, no. 10, but the report was lost in the 1972 flood. (Same as Pb-1138.)

5198 As above, powdered material mixed with graphite by Schuler.

5199 Heshbon; 9th–11th c. Molar flask. Em. green. Sp. gr. ~4.916. Heshbon no. 800. M. Sajadian, AU. (Same as Pb-1112.)

VIII. BYZANTINE

VIII A. SAN MARCO TREASURY;

5600 Cup with "rows of buttons". Colorless. SM no. 7 in CMG series. From a chalice in a silver mount. See Hahnloser no. 58 (Inv. Tesoro 88) in Ref. F-52, where it is described as dating to the 11th c. However, see also von Saldern in Ref. F-135.

5602 Dish with relief-cut decoration. Colorless. SM no. 5 in CMG series. See Hahnloser no. 80 (Inv. Tesoro 143) in Ref. F-52, where it is described as Byzantine, 10th–11th c. However, see also von Saldern in Ref. F-135. This piece is very similar, but not identical, to the hanging lamp no. 24 in Ref. F-23 (Inv. Tesoro 67). There are two samples. One is a tiny chip of colorless glass (greatest dimen. 0.6 mm; wt. ~0.4 mg) which appears to have escaped the pestle when the original sample was ground in the 1950s. The other is a flake of purple glass formed by remelting the powdered remains. The remelting was done in a lampworking flame on platinum foil by ERB on 3/19/95.

5603 Turquoise bowl with cut-out hares, cutting out. Lt. blue opq. SM no. 8 in CMG series. From a bowl in a silver-gilt mount with gold cloisonné enamel and precious stones. See Hahnloser no. 117 (Inv. Tesoro 140) in Ref. F-52. In Ref. F-23 (cat. no. 29) this glass is described as having been made in Iraq or Iran in the 9th–10th c. Extremely small sample; a single flake measuring 0.5 mm square and 0.1 mm thick.

5604 Green bowl. SM no. 9 in CMG series. (Inv. Tesoro 76.) Extremely small sample of powdered glass.

VIII B. BYZANTINE BLUE GLASSES;
12th c. See Refs. F-31 and F-94.

Note: All of these bottles are very similar in form and decoration. They probably were made in the same place at about the same time.


2310 As above, but smaller. Found in mouth of main sewer. Blue transp. glass, also with gilt and enameled decoration. F.C. 503/1. See Refs. E-24, E-25, and F-94.

3278 Corinth; 12th c. (or 14th c.?) Agora SC factory. Blue transp. glass with "painted design." See Ref. F-31. (F. Matson, his no. 24.)

3281 Corinth; 12th c. (or 14th c.?) Agora SC factory. Tall, thin-walled bottle with gilt and enameled decoration. Blue transp. glass. No. 750. (G. Weinberg, UMo.) (Enamel same as Pb-1018.) See Ref. F-31.

3320 Fragment; 12th c. From one of four fragmentary beakers and bottles, CMG 67.1.19A–D. This fragment is CMG 67.1.20C. Blue transp. with traces of gilt and enameled decoration. (Enamel same as Pb-1019 and glass Pb-1058.) See Ref. E-16.
VIII C. ZEREK ÇAMI; ca. 1126.  
(Collected by RHB, 8/21/62.) See Ref. F-95.

See also Section XI A. for stained glass, and XI B. for the Kariye Çamii.

246  Vessel.  Colorless.  (Same as O-66.)

541  Vessel.  P. purplish, lightly w.  
(Same as O-68.)

542  Vessel.  Colorless, with sl. purplish tinge.  (Same as O-69.)

543  Beaker with high kick.  Colorless, heavily w.  (Same as O-67.)

1570  Vessel with folded rim.  Dk. blue transp.

1571  Lamp stem, solid.  Aqua, heavily w.

2500  Vessel, thin-walled.  Colorless, w. scum.  North Vault under Bema, to 3.90 m.

2501  Vessel, thin-walled with pontil mark.  Aqua, w. scum.

2502  Vessel, thin-walled.  Colorless, w. crust.

2503  Vessel rim.  Colorless, w. scum.

VIII D. CYPRUS, Saranda Kolones Castle, Paphos; late 8th–13th c.  

See also Section VIII B., nos. 2309 and 2311.

2305  Lamp.  Aqua, moderately w.  
F.C. 243 A.

2306  Lamp wall.  Aqua, moderately w.  
F.C. 243 B.

2307  Goblet rim.  Yellowish green, unweathered.  F.C. 243 C.

2308  Lamp.  P. yellowish-green, moderately w.  F.C. 243 D.

2310  Bottle, heavy-walled; early 13th c., heavily w.  F.C. 481/2.

2312  Cup with prunts and flaring rim.  Colorless, sl. smoky, heavily w.  
F.C. 530.

2313  Bottle, cylindrical and heavy-walled.  Poss. early 19th c.  Colorless, heavily w.

VIII E. ST. CATHERINE’S MONASTERY, Mt. Sinai; 
date uncertain.  (G. Forsyth, KM.)  
See Refs. F-44 and F-139.

See also Section IX P.

St. Catherine’s Monastery, 8/12/66

960  Fragment of window crown; folded, hollow rim.  P. pink, no w., many elliptical bubbles.  Photo no. 46a.

961  Fragment of window crown; folded, hollow rim.  Colorless, no w.

962  Fragment of vessel rim (?) or thin window crown; rounded rim.  V. p. grn. aqua, no w.; some plaster adhering.  (Same location as 961.)

963  Fragment of flat glass (from window?).  P. purplish or mulberry color, no w.  From Tower window, northwest tower, “closed windows”.  Towers are 6th c. A.D., windows are sometime later, but it is not known how much later.
964  Fragment of window glass, turned-up rim, not folded. Unusual brassy transp. color, no w., v. bubbly. (Same location as 963.)

965  Fragment of window glass(?). Colorless, some w. scum. (Same location as no. 963.)

966  Fragment removed from large piece of purple-streaked, brassy-colored window rim. Not same window as 965, but from same location. Red crayon mark “A”.

967  Wall fragment of large, blown vessel. Bl. aqua, w. scum. From south face of vault “under Cristoforos”. This piece clearly had been embedded in original masonry.

968  Fragment of heavy-walled, cylindrical, mold-blown bottle. Colorless, sl. w. scum. (Several fragments joined together.) Embedded firmly in west wall “under Cristoforos”. (1963.)

969  Iron nail removed 6/24/66 from diagonal strut of roof frame. G in no. 1, 1/7/65. Dated by C¹⁴ to 515 A.D. ± 100 years.

970  Fragment of small, blown, thin-walled vessel. Bl. aqua, no w. From basement of monastery. Undated, from heap of many small bottles, possibly of the type used to sell balm of St. Catherine. This fragment seems identical to a small intact bottle from Forsyth.

St. Anthony’s Monastery, east coast of Red Sea; prob. 11th c.

971  Small fragment of thin, blown glass. Colorless, thin w. crust and soil accretion on convex surface. Similar to pieces inset in carved plaster decoration. Removed from top of roof? (Small sample.)

972  As above, but deep ruby glass. Piece joins plaster fragment, but had become dislodged in transit. Contains small elliptical bubbles with rounded ends. (Small sample.)
## IX. MOSAICS

### IX A. HELLENISTIC AND ROMAN

<table>
<thead>
<tr>
<th>No.</th>
<th>Color</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>473</td>
<td>P. purple transp., black glassy w. crust.</td>
<td>Caesarea; dates uncertain. (D. Barag, HUJ.)</td>
</tr>
<tr>
<td>474</td>
<td>Green opq.</td>
<td></td>
</tr>
<tr>
<td>475</td>
<td>Bl. green turbid.</td>
<td>Achziv; dates uncertain. (D. Barag, HUJ.)</td>
</tr>
<tr>
<td>476</td>
<td>P. amber.</td>
<td></td>
</tr>
<tr>
<td>477</td>
<td>Dk. blue opq.</td>
<td></td>
</tr>
<tr>
<td>478</td>
<td>Lt. green opq.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>No.</th>
<th>Color</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>479</td>
<td>P. amber.</td>
<td>Shavei Zion; 4th-5th c. (D. Barag, HUJ.)</td>
</tr>
<tr>
<td>481</td>
<td>Red opq. (Same as Pb-205.)</td>
<td></td>
</tr>
<tr>
<td>482</td>
<td>Lt. green opq. (Same as Pb-204.)</td>
<td></td>
</tr>
<tr>
<td>483</td>
<td>Blue turbid.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>No.</th>
<th>Color</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>484</td>
<td>Red opq.</td>
<td>Antioch; 2nd-3rd c. (R. Stillwell, PUn.)</td>
</tr>
<tr>
<td>485</td>
<td>Black.</td>
<td>See Ref. A-19</td>
</tr>
<tr>
<td>486</td>
<td>Colorless.</td>
<td></td>
</tr>
<tr>
<td>487</td>
<td>Blue turbid.</td>
<td></td>
</tr>
<tr>
<td>488</td>
<td>Yellow-green opq.</td>
<td></td>
</tr>
</tbody>
</table>

### IX B. HAGIA SOPHIA; dates uncertain.

(W. Gaddoni, IARB.)

<table>
<thead>
<tr>
<th>No.</th>
<th>Color</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>2320</td>
<td>Colorless, without gold.</td>
<td></td>
</tr>
<tr>
<td>2321</td>
<td>Olive with gold leaf, with accretion.</td>
<td></td>
</tr>
<tr>
<td>2322</td>
<td>Olive with gold leaf, with accretion.</td>
<td></td>
</tr>
<tr>
<td>2323</td>
<td>Olive with gold leaf, with accretion.</td>
<td></td>
</tr>
<tr>
<td>2324</td>
<td>Dk. blue transp., bubbly, lightly w.</td>
<td></td>
</tr>
<tr>
<td>2325</td>
<td>Dk. blue opq., bubbly, lightly w.</td>
<td></td>
</tr>
<tr>
<td>2326</td>
<td>Red opq., lightly w.</td>
<td></td>
</tr>
</tbody>
</table>

(R. Van Nice, DO.)

<table>
<thead>
<tr>
<th>No.</th>
<th>Color</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>2772</td>
<td>P. yellow with gold leaf.</td>
<td></td>
</tr>
<tr>
<td>2773</td>
<td>P. yellow with gold leaf.</td>
<td></td>
</tr>
<tr>
<td>2774</td>
<td>P. yellow with gold leaf.</td>
<td></td>
</tr>
<tr>
<td>2775</td>
<td>P. purple with gold leaf.</td>
<td></td>
</tr>
<tr>
<td>2777</td>
<td>P. grn. aqua with silver leaf/foil.</td>
<td></td>
</tr>
<tr>
<td>2778</td>
<td>P. grn. aqua with silver leaf/foil.</td>
<td></td>
</tr>
<tr>
<td>2779</td>
<td>P. yellow with silver leaf/foil.</td>
<td></td>
</tr>
<tr>
<td>2781</td>
<td>Dk. blue transp.</td>
<td></td>
</tr>
<tr>
<td>2782</td>
<td>Dk. blue transp.</td>
<td></td>
</tr>
<tr>
<td>2783</td>
<td>Dk. blue transp.</td>
<td></td>
</tr>
<tr>
<td>2784</td>
<td>Lt. green opq.</td>
<td></td>
</tr>
<tr>
<td>2785</td>
<td>Lt. green opq.</td>
<td></td>
</tr>
<tr>
<td>2786</td>
<td>Red opq.</td>
<td></td>
</tr>
<tr>
<td>2787</td>
<td>Red opq.</td>
<td></td>
</tr>
<tr>
<td>2788</td>
<td>Red opq.</td>
<td></td>
</tr>
</tbody>
</table>
IX C. ISTANBUL, GREAT PALACE; dates uncertain. (W. Gaddoni, IARB.)

2327 Lt. grn. blue opq., lightly w.
2328 White opq., may not be glass.

IX D. RAVENNA, SANTA CROCE; 5th c. (W. Gaddoni, IARB.)

2330 Lt. green turbid, bubbly, w.
2331 White turbid, bubbly, w.
2332 Lt. blue turbid, bubbly, w.

IX E. RAVENNA; dates uncertain. (W. Gaddoni, IARB.)

2333 Colorless with traces of gold, lightly w.
2334 Colorless with traces of gold, lightly w.
2335 Colorless with traces of gold, lightly w.
2336 Amber with gold leaf, lightly w.
2337 Amber with gold leaf, lightly w.
2338 Amber with gold leaf, lightly w.
2339 Amber with gold leaf, lightly w.
2340 Amber with gold leaf, lightly w.
2341 Amber with gold leaf, lightly w.
2342 Bl. aqua with gold leaf, unweathered.
2343 Dk. blue opq., lightly w.
2344 Dk. blue opq., lightly w.

IX F. PARENZO; dates uncertain. (W. Gaddoni, IARB.)

2351 Smoky transp. with gold.
2352 Dk. blue transp., w. scum.
2353 Black, w. scum.
2354 Lt. green opq., lightly w.
2355 Purple turbid, lightly w.
2356 Yellow opq., lightly w.
2357 Yellow opq., lightly w.
2358 Orange opq., w. scum.

IX G. AMPHIPOLIS; 9th–13th c. (W. Gaddoni, IARB.)

2386 Aqua. (May not be a tessera.)
2387 Amber, with gold(?), little or no w.
2388 Lt. blue opq., lightly w.
2389 Dk. blue opq., lightly w.
2390 Lt. green opq., lightly w.
2391 Lt. green opq., lightly w.
<table>
<thead>
<tr>
<th>IX H.</th>
<th>HOSIOS LOUKAS; mid-11th c. A.D. (I. Andreescu, EU.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2790</td>
<td>Colorless with gold.</td>
</tr>
<tr>
<td>2791</td>
<td>Colorless with gold.</td>
</tr>
<tr>
<td>2792</td>
<td>Lt. green opq.</td>
</tr>
<tr>
<td>2793</td>
<td>Lt. bl. green opq.</td>
</tr>
<tr>
<td>2794</td>
<td>Dk. blue opq.</td>
</tr>
<tr>
<td>2795</td>
<td>Dk. purple.</td>
</tr>
<tr>
<td>2796</td>
<td>Red opq.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IX I.</th>
<th>SAN MARCO; 12th c. (A. Gasparetto.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2800</td>
<td>Arcata centrale. Red opq.</td>
</tr>
<tr>
<td>2801</td>
<td>As above. Orange opq.</td>
</tr>
<tr>
<td>2802</td>
<td>Cupola dell’Abside. Lt. blue opq.</td>
</tr>
<tr>
<td>2803</td>
<td>As above. Lt. green opq.</td>
</tr>
<tr>
<td>2804</td>
<td>Tribuna dei Procuratori. Colorless with gold foil, moderately w.</td>
</tr>
<tr>
<td>2805</td>
<td>As above. Colorless with gold leaf.</td>
</tr>
<tr>
<td>2806</td>
<td>As above. Green transp., bubbly.</td>
</tr>
<tr>
<td>2807</td>
<td>As above. Lt. green opq., bubbly.</td>
</tr>
<tr>
<td>2808</td>
<td>As above. Orange opq.</td>
</tr>
<tr>
<td>2809</td>
<td>Muraglione di Fondo dell’ Organo, di Destra. Colorless with gold leaf.</td>
</tr>
<tr>
<td>2810</td>
<td>As above. Amber with gold leaf.</td>
</tr>
<tr>
<td>2811</td>
<td>As above. Lt. blue opq., bubbly.</td>
</tr>
<tr>
<td>2812</td>
<td>As above. Dk. blue opq., bubbly, moderately w.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IX J.</th>
<th>TORCELLO; various dates. (A. Gasparetto.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2813</td>
<td>As above. Purple opq., bubbly lightly w.</td>
</tr>
<tr>
<td>2814</td>
<td>Arcata sopra l’Organo di Sinistra. Colorless with gold leaf.</td>
</tr>
<tr>
<td>2815</td>
<td>As above. Colorless with gold leaf.</td>
</tr>
<tr>
<td>2816</td>
<td>As above. Colorless with purplish streamers and silver leaf/foil.</td>
</tr>
<tr>
<td>2817</td>
<td>As above. Colorless with purplish streaks and silver leaf. Preserves edge of colorless cover glass.</td>
</tr>
<tr>
<td>2818</td>
<td>As above. Purple opq., bubbly.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IX J.</th>
<th>TORCELLO; various dates. (A. Gasparetto.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2819</td>
<td>As above. Purple opq., bubbly.</td>
</tr>
<tr>
<td>2820</td>
<td>As above. Amber with gold leaf.</td>
</tr>
<tr>
<td>2821</td>
<td>As above. Lt. blue opq., bubbly.</td>
</tr>
<tr>
<td>2822</td>
<td>As above. Dk. blue opq., bubbly, moderately w.</td>
</tr>
</tbody>
</table>

| 2823  | As above. Colorless with gold leaf.      |
| 2824  | As above. Colorless with gold leaf.      |
| 2825  | As above. Colorless with gold leaf.      |
| 2826  | As above. Colorless with gold leaf.      |
| 2827  | As above. Colorless with gold leaf.      |
| 2828  | As above. Colorless with gold leaf.      |
| 2829  | As above. Colorless with gold leaf.      |
| 2830  | As above. Colorless with gold leaf.      |
| 2831  | As above. Colorless with gold leaf.      |
| 2832  | As above. Colorless with gold leaf.      |
| 2833  | As above. Colorless with gold leaf.      |
| 2834  | As above. Colorless with gold leaf.      |
| 2835  | As above. Colorless with gold leaf.      |
| 2836  | As above. Colorless with gold leaf.      |
| 2837  | As above. Colorless with gold leaf.      |
| 2838  | As above. Colorless with gold leaf.      |
| 2839  | As above. Colorless with gold leaf.      |
| 2840  | As above. Colorless with gold leaf.      |
| 2841  | As above. Colorless with gold leaf.      |
| 2842  | As above. Colorless with gold leaf.      |
| 2843  | As above. Colorless with gold leaf.      |
| 2844  | As above. Colorless with gold leaf.      |
| 2845  | As above. Colorless with gold leaf.      |
| 2846  | As above. Colorless with gold leaf.      |
| 2847  | As above. Colorless with gold leaf.      |
| 2848  | As above. Colorless with gold leaf.      |
| 2849  | As above. Colorless with gold leaf.      |
| 2850  | As above. Colorless with gold leaf.      |
| 2851  | As above. Colorless with gold leaf.      |
| 2852  | As above. Colorless with gold leaf.      |
| 2853  | As above. Colorless with gold leaf.      |
| 2854  | As above. Colorless with gold leaf.      |
| 2855  | As above. Colorless with gold leaf.      |
| 2856  | As above. Colorless with gold leaf.      |
| 2857  | As above. Colorless with gold leaf.      |
| 2858  | As above. Colorless with gold leaf.      |
| 2859  | As above. Colorless with gold leaf.      |
| 2860  | As above. Colorless with gold leaf.      |
IX K. **SARΑÇHΑΝΕ; dates uncertain.** (R. M. Harrison, UNT.)

2846 Flat glass, poss. an inlay. Green opq., little or no w., roughened on underside. (Same as Pb-1142.)


2848 As above. Colorless with gold foil, lightly pitted. No. 28.

2849 As above. Red opq., moderately w. No. 23.

IX L. **ST. DEMΕTRΙUS, THESSΑΛΩΝΙΚΑ; dates uncertain.** (W. Gaddoni, IARB.)

2360 Smoky with gold, lightly w.

2361 Smoky with gold, lightly w.

2362 Smoky with gold and some red material on bottom, lightly w.

2363 Lt. blue turbid, moderately w.

2364 Lt. blue turbid with dk. blue casing, moderately w.

2365 Dk. blue opq., moderately w. (Same as Pb-1184.)

2366 Dk. blue opq., moderately w. (Same as Pb-1185.)

2367 Lt. green opq., moderately w.

2368 Lt. green opq., moderately w.

2369 Yellow opq., moderately w.

2370 Yellow opq., lightly w.

2371 Yellow opq., lightly w.

2372 Red opq., lightly w.

2373 Red opq., lightly w.

IX M. **ACHEIPOΙΕΤΟΣ, dates uncertain.** (W. Gaddoni, IARB.)

2374 Colorless with gold.

2375 Colorless with gold.

2376 Colorless with gold.

2377 Lt. blue turbid.

2378 P. blue opq.

2379 Dk. blue (contains metallic flake inclusion).

2380 White opq.

2381 Black.

2382 Lt. green opq.

2383 Brt. bl. green opq.

2384 Yellow opq.

2385 Red opq.

IX N. **BOSΡΑ; dates uncertain.** (W. Gaddoni, IARB.)

2392 Colorless (v. p. yellow) with gold, heavily w.

2393 Colorless (v. p. yellow) with gold, heavily w.

2394 Colorless (v. p. yellow) with gold, heavily w.

2395 Black (v. dk. green).

2396 Lt. blue turbid, heavily w.

2397 Yellow green opq.
2398 Yellow opq., lightly w. (Same as Pb-1186.)
2399 Red opq., heavily w. (Same as Pb-1187.)


From the Triumphal Arch (1130)
2700 Colorless with gold, small bubbles.
2701 As above.
2702 P. aqua with gold encased by a thick layer of cover glass.
2703 As above.
2704 As above.
2705 P. yellowish green with gold, bubbly.
2706 Green transp. with bubbles and dk. streaks.
2707 Olive transp. with bubbles and purplish region.
2708 Dk. blue turbid, bubbly.
2709 As above.
2710 Black (v. dk. purple).
2711 Brt. blue turbid.
2712 As above.
2713 Lt. blue opq., bubbly.
2714 Grayish blue turbid, with bubbles and inclusions.
2715 As above.
2716 Greenish blue turbid, bubbly.
2717 As above.
2718 White turbid, with bubbles and inclusions.
2719 White turbid, with bubbles and inclusions.
2720 Greenish yellow opq.
2721 Red opq. with dk. streaks.
2722 As above.
2723 Red opq. with dk. streaks.

From the Semi-dome of the Apse (1130)
2724 P. green with gold encased in colorless layer, quite bubbly.
2725 Yellowish green with traces of gold and raised trailing on surface, large bubbles.
2726 Dk. blue transp.
2727 P. blue transp. with small bubbles.
2728 As above.
2729 Bl. green turbid, bubbly.
2730 As above.
2731 Dk. blue transp., quite bubbly. (Same as Pb-1180.)
2732 Black (green with dk. streaks).
2733 Black (green with dk. streaks).
2734 Lt. blue opq., very bubbly.
2735 As above.
2736 Grayish purple turbid, bubbly. (Same as Pb-1181.)
2737  As above.
2738  Grayish purple turbid, bubbly.
2739  White opq.
2740  Yellow opq. with many inclusions.
2741  As above.
2742  Yellow opq.
2743  Lt. green opq., very bubbly.
2744  Red opq. with gold encased by colorless glass.
2745  Red opq.
2746  As above.

*From the Arch and Apse (?) (1130)*

2747  Pale greenish with gold encased by colorless glass.
2748  As above, but weaker color and gold applied on surface (?)..
2749  Green with gold encased by thick layer of colorless glass.
2750  As above, but thinner casing and lighter color.
2751  Grn. aqua with gold encased by thin layer of colorless glass. Some bubbles.
2752  Colorless with traces of gold on surface, few bubbles.
2753  P. yellowish with gold encased. Some large bubbles.
2754  Green with ruby streaks, bubbly.
2755  Black (dk. purple), many bubbles and inclusions.

2756  Black, many bubbles and inclusions.
2757  Lt. blue turbid, many bubbles and inclusions.
2758  Yellow opq.
2759  Lt. green opq., poor quality.
2760  Red opq. with gold encased by colorless glass.
2761  As above.
2762  Orange opq. with traces of weathering or plaster.
2763  Orange opq.

*From restored area (1715)*

2764  Aqua with gold encased, some bubbles.
2765  White opq. (dense).
2766  White opq. (dense).
2767  Greenish gray opq.
2768  Red opq.
2769  As above.
2770  As above.
2771  As above.
IX P.  ST. CATHERINE'S, MONASTERY, Mt. Sinai; 6th c. (K. Weitzmann, PU) See Refs. F-44 and F-139.

These tesserae were collected at the suggestion of Arthur A. Houghton, Jr., who visited the monastery in the early 1960s(?). They came from the large apse of the church and were dated by Prof. Weitzmann to the 6th c. (See correspondence of 11/8/66.)

254  Colorless with gold.
255  Dk. blue transp.
256  Lt. blue transp.
257  Lt. green opq.
258  Red opq.

See also Section VIII E.

IX Q.  JUTLAND; Viking Age (ca. 720.) (T. Sode, Copenhagen.) See Ref. F-66.

These tesserae are thought to have been used for making beads. They were excavated at the Viking Age trading center near the Ribe River in Jutland in 1990–91. The site is named ASR-9-Posthouse. Most are lightly–moderately w.

2650  Colorless, with traces of gold. No. 411.
2651  Lt. blue turbid. No. 548.
2652  Grayish blue turbid. No. 524.
2653  Dk. blue. No. 207.
2654  Yellowish green opq. No. 485.
2655  White opq. No. 411.
2656  Purplish opq. No. 485.
X. MEDIAEVAL

X A. FARFA; mostly 8th–9th c. and Mediaeval. (D. B. Whitehouse, BSR.) See Refs. E-38, F-100, and F-144.

Vessels; mostly 8th–9th c.

3870 Thin-walled bowl, prunted. Colorless, little or no w. (F3-380 V/31.)

3871 Thin-walled bowl, prunted. Similar to no. 3870, only larger. Colorless, little or no w. (F3-380 V/31.)

3872 Thin-walled bowl, prunted. Green, little or no w. (F3-380 V/31.)

3873 Vessel base. Aqua, slightly iri. (F2-237.)

3874 Vessel wall. Colorless with white opq. "lattimo"-like decoration. (F3-415 V/46.)

3875 Vessel base(?). Dk. blue transp. (F3-322 V/17.)

3876 Flattened rim. Purple. (F3-319 V/15.)

3877 Flattened rim. Purple with white opq. edge. (F3-319 V/15.)

3878 Mosaic tesserae fragments. Lt. green opq.

3879 Mosaic tessera, small, irregularly-shaped. Dk. blue turbid. (F3-390 V/35.)

3880 Footed bowl. Blue, w. scum with some incipient crizzling. (F3-319 V/15.)

3881 Vessel rim with threaded decoration. Colorless, w. scum. (F3-315 V/7.)

3882 Hanging loop of lamp. Aqua, some w. scum. (F3-312 V/4.)

3883 Hanging loop of lamp. Grn. aqua. (F2-206.)

3884 Hanging loop of lamp. White opq. (F2-206.)

3885 Hanging loop of lamp. Green. (F2-206.)

3886 Vessel base. Colorless, some w. scum. (F2-189.)

3887 Vessel rim. Aqua. Heavy black w. (F2-154.)

3888 Foot with hollow edge (or possibly rim). Colorless, bubbly, heavily w. (F3-331 V/21.)

3889 Vessel base. Colorless, w. scum. (F3-334 V/24.)

Tesserae; late 8th or 9th c.


5637 Red opq. (300). TG 357.

5638 Green opq. (300). TG 358.

5639 Bl. green opq. (300). TG 360.

5640 Blue (432). TG 365.

5641 Dk. blue (1286). TG 374.

5642 Lt. blue (1329). TG 386.

5643 Blue (1329). TG 392.

5644 Blue (1329). TG 399.
Window glass; late 8th or 9th c.

5645 Lt. blue (206). TG 472.
5646 Blue (212). TG 474.
5647 Lt. green (1336). TG 483.
5648 Em. green (1337). TG 484.
5649 Lt. blue (1367). TG 485.
5650 P. bl. green (1381). TG 496.
5652 Bl. green (1609). TG 506.
5653 Bl. green (399). TG 399.

Vessel fragments; Medieval and later

5654 Mold-blown (542). TG 632.
5655 Mold-blown (547). TG 635.
5656 Mold-blown (542). TG 636.
5657 Mold-blown (653). TG 678.
5658 Mold-blown (653). TG 679.
5659 Mold-blown (685). TG 707.
5660 Mold-blown (685). TG 710.
5661 Mold-blown (?) (849). TG 768.
5662 Islamic(?); cut (849). TG 775.
5663 Fragment. Lt. green (1136).
5664 Vessel wall. Red opq. (1126).
5665 Fragment. Dk. blue (1036).
5667 Fragment of slag-like material (590).

X B. SAN VINCENZO AL VOLTURNO; 5th–6th c. & 9th c.
(R. Hodges, BSR, courtesy DBW.)

9th-c. workshop

3830 Glass adhering to refractory skin. Blue transp. at surface, p. yellowish at refractory interface. Slightly iri. No. 4066.
3831 Thin layer of glass adhering to crucible(?) sherd. Olive-amber, little or no w. No. 4066.
3832 Tessera. Green opq., bubbly, moderately w. No. 4068.
3833 Tessera. Olive, moderately w. No. 4068.

9th-c. refectory

3834 Window glass. Lt. blue turbid, lightly w. No. 1031.

9th-c. (?) cemetery

3835 Vessel, thin-walled. P. blue transp., lightly w. No. 810.
3836 Vessel, thin-walled. Colorless, lightly w. No. 810.
3837 Window glass. Green transp., lightly w. No. 810.

Late Roman

3838 Vessel, thin-walled. Colorless, lightly w. No. 300.

Probably 5th–6th c.

3839 Vessel base. Aqua, lightly w. No. 43.
3840 Vessel rim. Colorless, lightly w. No. 43.
3841  Vessel, thin-walled. Colorless, moderately w. No. 43.

3842  Vessel, thin-walled. Colorless, lightly w. No. 43.

X C.  PAVIA, Torre Civica; ca. 1100.  
(B. Ward-Perkins.)

Window glass

3865  P. aqua, moderately w. with brown scum.

3866  P. amber, heavily w. with black scum. No. 119.

3867  Bl. aqua, lightly w., several elongated bubbles. (Same as Pb-2117.)

3868  Med.-dk. blue transp. with light w. scum; contains a batch stone. (Same as Pb-2118.)

3869  P. aqua, very heavily w. Thin wafer of glass remains in interior. Weathering crust ~1.0 mm thick on all surfaces. No. 118.

X D.  MONTFORT; Crusader period.  
(H. Nickel, MMA.)

5004  Window glass. Colorless with traces of paint, moderately w.

5011  Window glass. Colorless with black hatching, moderately-heavy w.

5012  Window glass. Colorless with painted hatching, heavy w. scum.

5013  Window glass. Colorless with painted banding, moderate w. scum.

5015  Window glass. Colorless with painted banding, some w. scum.

5016  Window glass(?). Em. green, iri.

5017  Window glass border. Yellowish amber with black and mottled reddish paint, v. heavily w.

5018  Vessel (or poss. window glass). Colorless with red paint or enamel, moderately-heavy w.

5020  Vessel base with flat folded rim, pontil mark, and low kick. Colorless, moderately w.

5024  Prunted beaker. Colorless, moderate w. scum.

5025  Vessel or window(?). Dk. blue transp., moderately w.

5026  Fragment. Dk. blue transp.

5027  Vessel base with rolled hollow rim, pontil mark, and low–moderate kick. Gr. aqua, lightly w.

5029  As above. Colorless with iri.

5030  As above. Smoky with iri.

5032  As above. Gr. aqua with w. scum.

5034  Bottle base with moderately rounded kick. Smoky; thick hard w. scum.

5035  Bottle(?) base, with pontil mark and low rounded kick. Colorless, moderate w. scum.

5037  Neck fragment. Aqua, heavy w. scum. Partially sagged in a fire.

5038  Vessel rim, large, thin-walled. Colorless with applied blue threading, moderate w. scum.
X E. TARQUINIA, Palazzo Vitelleschi; late 14th c.  
(SAEM, courtesy DBW.)

3847 Vessel, probably prunted. Colorless, lightly–moderately w. No. 209; pit 181; 199.

3848 Window or thick-walled vessel(?). Aqua, moderately w. No. 101; pit 181; 230.

3849 Vessel. Blue transp., lightly w. No. 136; Pit G; 45.

X F. CORINTH FACTORY; 14th c.  

Note: All samples are from the SC or NE factory sites. See also Section VIII B., nos. 3278 and 3281.

189 Vessel fragment with prunts. Colorless. (SC.) (Same as O-59.)


191 Vessel fragment. Yellowish green. (SC.)

193 Vessel fragment. Dk. blue. (SC.) (Same as O-62.)

772 Flat rectangular plate. Yellow opq., many inclusions.


901 Waste glass attached to refractory material, said to have been a crucible. Black glass with red streaks. See Ref. E-18.

3270 Vessel fragment(?). Gr. aqua. (NE.)

3271 Dripping. P. green. (NE.)

3272 Waste glass, flattened, showing tool marks. P. gr. aqua. (SC.)

3273 Large dripping. P. olive. (SC.)

3274 Trailing. Green. (NE.)

3275 Trailing. Dk. green. (NE.)

3276 Trailing. Colorless. (NE.)

3277 Cullet. V. p. amber. (NE.)

3279 Cullet. P. purple. (SC.)

3280 Cullet. P. blue transp. (NE.)

3282 Irregular fragment. White opq. Prob. not glass. (SC.)

3283 Waste glass. Green with dark streaks; poss. devitrified. (SC.)

3284 Vessel(?) fragment, irregular shape. Blue opq. (SC.)

3290 Waste glass adhering to refractory. Dk. blue transp., moderately w.

X G. THE WEALD; 14th–17th c.  
(G. Kenyon and E. Wood. These samples were given to RHB on 6/26/68.) See Ref. F-72.

3130 Wephurst, Kirdford; Early Period, not later than 14th c. Flat glass. Grn. aqua, heavily w. GK 21.

3131 Fromes, Chiddingfold; Early Period. Vessel base, thin-walled. Grn. aqua, moderately w. GK 5.

3132 Crouchland, Kirdford; Early Period, ca. 1500. Vessel or waste glass. Grn. aqua, lightly w. GK 12.

3134 Idehurst Copse, South Kirdford; Transitional Period, ca. 1550. Vessel base. Grn. aqua, moderate-heavily w. GK 17.

3135 Glasshouse Lane, Kirdford; Late Period, 1600–18. Vessel. Grn. aqua, lightly w. GK 14.

3136 Brookland Wisborough Green; Late Period, 1600–18. Vessel. Grn. aqua, lightly w. GK 23.

3137 Sidney Wood, Alford; Late Period, 1610–18. Vessel with folded rim. Grn. aqua, lightly w. GK 38.


172 Baudinard. Colorless, v. heavily w.


174 Nans les Pines. Aqua, v. heavily w. IC, level-120.

See also Section XI M.

X I. MISCELLANEOUS MEDIAEVAL

803 Apulia, village of Salpi; 12th–13th c. Fragment of blown vessel or poss. a lamp(?). Red opq., unweathered. (D. Harden, BM.) See Ref. E-18, no. 16.

804 As above, another blown vessel. Red opq., no. 18a.
XI. STAINED GLASS WINDOWS

XI A. ZEREK ÇAMII; ca. 1126.

All samples are v. heavily w. and most contain residual paint. See also Sections VIII C. and XXI A.

132 Aqua.
134 P. amber. (Same as O-64.)
136 P. purple.
137 P. purple. (Same as O-63.)
139 Dk. blue. (Same as Pb-483.)
141 Em. green. (Same as Pb-484.)
143 Dk. blue. (Same as O-10.)
145 Dk. blue.
147 Dk. blue.
1574 Aqua.
1575 Em. green.
1576 Em. green.
1577 Dk. blue.
1578 Dk. blue.
1579 Purple.
1582 P. amber.
2504 Blown fragment, apparent diam. 23 cm. Olive, w. scum.
2505 As above, apparent diam. 30 cm. Dk. blue, moderately w.

XI B. KARIYE ÇAMII; early 12th c.
(A. H. S. Megaw, BSAA.) See Ref. F-95.

All samples are heavily w. and contain residual paint. See also Section XXI B.

149 Dk. blue.
151 “Orangy” purple.
152 Aqua. (Same as O-70.)
154 Amber.
156 Em. green.
1580 Purple.
1581 Colorless.


Jarrow

2450 Bl. aqua. JA73 VW4.
2453 P. bl. aqua. JA73 UZ386.
2454 Bl. aqua. JA69 XT.
2456 Grn. aqua. JA73 UZ372.
2457 Grn. aqua. JA73 UZ431.
2461 Grn. aqua. JA73 UZ53.
2462 Grn. aqua with thin red opq. internal streaks or swirls. JA73 UZ333. (Same as Pb-2080.)
2465 P. grn. aqua with thin red opq. internal streaks or swirls. JA73 UZ64.
2466  P. grn. aqua with thin red opq. internal streaks or swirls. JA73 UZ233.

2467  Em. green. JA73 UZ335.

2468  Amber. JA73 UZ81.

2469  Amber. JA73 UZ219b.

2470  Amber. JA73 UZ275.

2474  P. flat blue. JA69 EW. (Same as Pb-1154.)

2476  Vessel, curved wall fragment. P. flat blue glass, unweathered. JA70 BX. (Same as Pb-1131.)

2477  Brt. blue. JA73 UZ366e. (Same as Pb-2081.)

2479  Brt. blue. JA73 UZ225.

2481  Dk. blue. JA73 SA 1. (Same as Pb-1132.) Poss. a vessel fragment.

2482  P. grn. aqua with red opq. internal streaks or swirls. JA73 UZ18. Sample consists of both colors in approx. original proportions.

2483  Greenish or bluish with red opq. striations throughout. JA73 UZ159.

2484  Colorless with red opq. striations throughout. JA73 UZ384.

3049  Ruby; ruby flashing over grn. aqua base glass. JA73 UZ18. Sample consists of both colors in approx. original proportions.

3050  Dichroic glass. Thin flat-glass fragment, or poss. a vessel fragment. Bluish and cream-colored turbid streaks by reflected light, orangy amber by transmission. JA73 UZ341. (Same as 2485 and Pb-1113.)

3054  Grn. aqua. JA64 PB.

3056  Vessel, curved wall fragment. P. flat blue, moderately w. JA UZ387; described as “Saxon glass.”

Monkwearmouth

2486  P. aqua. MK74 JH.

2487  Bl. aqua. MK64 LZ.

2488  P. flat blue. MK71 HT.

2489  Yellowish amber. MK66 SZ.

3051  Colorless. MK64 YZ.

3052  P. blue. MK64 YZ.

3053  Dk. blue. MK, no no. (Same as Pb-1155.)

3055  Vessel, wall fragment. Brt. blue, little or no w. MK71 HVIII, immediately under SW end of feature 12.

XI D. GLASTONBURY; 9th–10th c.(?). (D. Harden, BM, 12/7/64.)

2050  Aqua, no paint remaining, heavily w. CMG 64.2.20-23.

2051  Colorless, with silver stain and red paint, moderately w. CMG 64.2.20-1.

2052  Colorless, with overall sepia or enamel, moderately w. CMG 64.2.20-9.

2053  Amber, no paint(?), heavily w. CMG 64.2.20-10.

2054  Green, no paint remains, moderately w. CMG 64.2.20-20.
2055  Violet, consisting of "orangy" purple glass cased between two layers of dk. blue; red paint, heavily w. All three layers are of about equal thickness. (Total t. ~2.2 mm.) CMG 64.2.20-24. Sample consists of both glasses in original proportions. (Same as Pb-1153.)

2056  Med. blue, no paint, lightly w. CMG 64.2.20-8.

2057  Dk. blue, possibly some paint, heavily w. CMG 64.2.20-6.

2058  Ruby flashing over colorless glass, some w. scum. CMG 64.2.20-5. Sample consists of both glasses in original proportions.

2059  As above, colorless glass only.

XI E.  CANTERBURY; (M. Caviness, TU, and F. Cole, CC.)

ca. 1200–1225

1151  Aqua, moderately w. No. 128.

1152  Colorless with ruby flashing, heavily pitted. No. 130. Sample consists of ruby glass only.

2024  Same as 1152, colorless glass.

1153  Amber, unweathered. No. 132.

2020  P. aqua, heavily w. No. 141.

1400  Dk. blue, with paint, w.

XI F.  COVENTRY; 13th–14th c.

(B. Hobley, HAGM.)

1154  Aqua, unweathered, with sepia painted lines. Poss. 15th c. No. 134.

1155  Green, lightly w.

1156  Green with ruby flashing, lightly w.

1157  Amber, moderately w.

2010  Green with ruby flashing, moderately w. Sample is of ruby glass.

2011  P. green, moderately w.

2012  Green, heavily w.

2013  Amber, slightly w.

2014  Green with ruby flashing, heavily pitted. Sample is of green glass.

2015  Green with ruby flashing, lightly w. Sample consists of ~75% green and ~25% ruby.

2016  Dk. blue, heavily w.

XI G.  YORK MINSTER; 12th–15th c.

12th c., Window C-33. (P. Newton, UY.)

1400  Green, heavily w.

1402  Dk. blue, with paint, w.
12th c., poss. not York. (J. Hayward, MMA.)

2492 Purple. Little or no w.

2493 Dk. blue. Little or no w., with reddish paint. (Same as Pb-1160.)

12th c. (R. Newton, BGIRA.)

2494 Norman Medallion (Daniel in the Lion's Den), central lancet of the Five Sisters. Dk. blue, light w. scum. No. 268.

2495 As above, with traces of reddish paint. No. 269. (Same as Pb-1057.)

2496 As above. No. 270.

2497 As above, with remains of reddish paint. No. 271. (Same as Pb-1162.)

Late 13th c., Window C-33. (P. Newton, UY.)

1404 P. aqua, pitted.

1406 Green, v. heavily w. Paint has protected glass on one side.

1409 Ruby over colorless base, some pitting. Sample is of ruby glass only.

1414 As above, colorless glass.

Late 13th c., Window C-34. (P. Newton, UY.)

1410 Yellowish, with patterned diaper, heavily w.

1411 As above.

1412 P. aqua, heavily pitted.

Later Periods. (J. Hayward, MMA.)

2490 14th c. Aqua, moderately w., traces of paint.

2491 15th c. Aqua, little or no w., with paint.

XI H. WINCHESTER; ca. 1400. (M. Caviness, TU.)

1158 Colorless, some painting, moderately w. No. 137.

1159 P. green with silver stain, painted, slightly w. No. 138.

2040 P. blue, red paint. One side resurfaced. No. 135.

2041 P. blue, moderately w., some paint. No. 136.

2042 Ruby, now moderately w. to amber, some paint. No. 139.

XI I. ENGLAND (M. Caviness, TU.)

1160 Norwich; 1400–1450. Colorless with red paint, some pitting. No. 140.

2045 Dorchester Abbey; date uncertain. Green, heavily w. No. 142.

2046 As above. P. green, heavily w. (Poss. originally ruby?) No. 141.

XI J. SAINT-MAUR-DES-FOSSÉS; late 13th c. (J. Hayward, MMA.)

Excavated at south side of choir of Abbey Church.

2520 Aqua, some traces of painting, heavily w.

2521 Aqua, cross-hatched painting, heavily w.

2522 Aqua, cross-hatched painting, heavily w.

2523 Colorless, moderately w.

2524 Colorless, some painting, moderately w.
2525 Amber, some painting, heavily w.
2526 Amber, some painting, moderately w.
2527 Purple, some painting, moderately w.
2528 P. purple, some painting, moderately w.
2529 Purple, unpainted, heavily w.
2530 Green, unpainted, moderately w.
2531 Em. green, some painting, lightly w.
2532 Lt. blue, unpainted, heavily w.
2533 Dk. blue, lightly w.
2534 Dk. blue, unpainted, pitted.
2535 Dk. blue, unpainted, heavily w.
2536 Dk. blue, lightly w.
2537 Ruby flashing over aqua glass, moderately w. Sample consists of ruby and aqua glasses in original proportions.
2538 Ruby flashing over green glass, moderately w. Sample consists of ruby and green glasses in original proportions.

XI K. CHARTRES; ca 1225. (CMG.)

526 Cathedral. P. blue, pitted. CMG 60.3.71F. (Same as O-12.)
527 As above. Amber, pitted, painted. CMG 60.3.71L. (Same as O-28.)
528 As above. Ruby flashing over green. CMG 60.3.71L. (Same as O-29.)

2132 As above. Dk. green, heavily w., no paint.
2498 Cathedral, 12th c. Dk. blue, lightly w. From J. M. Bettembourg, who also analyzed this glass. (Same as Pb-1151.)

XI L. ST. VICTOR (Marseilles); 13th c. excavations. (J. Taralon, LMH.)

2150 Gr. aqua, v. heavily w.
2151 Gr. aqua, v. heavily w.
2152 Gr. aqua, heavily w.
2153 Pink (v. p. purple), heavily w.
2154 Olive, heavily w.
2155 Blue, heavily w.
2156 Ruby, v. heavily w.
2157 Ruby, v. heavily w. Ruby flashing over green.

XI M. ROUGIERS; ca. 1400. (G. D. d’Archimbaud. See her corres. of 11/25/61 and 5/15/62.)

175 Rougiers, Chateau; ca. 1400. Colorless with smoky streaks, v. heavily w. Carre 2-2.
2510 Same piece as 175; mounted in resin for SEM layer counting.

See also Section X H.
<table>
<thead>
<tr>
<th>XI N.</th>
<th>AVIGNON; 14th c. (N. Lambert.)</th>
</tr>
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<tbody>
<tr>
<td>1420</td>
<td>Palais des Papes d'Avignon, Salle de theologic. Aqua, moderately w.</td>
</tr>
<tr>
<td>1421</td>
<td>As above. Green, moderately w.</td>
</tr>
<tr>
<td>1422</td>
<td>As above. Dk. amber, heavily w.</td>
</tr>
<tr>
<td>1423</td>
<td>As above. Dk. blue, heavily w.</td>
</tr>
<tr>
<td>1424</td>
<td>As above. Ruby flashing over grn. aqua, moderately w. Sample is of aqua glass only.</td>
</tr>
<tr>
<td>1425</td>
<td>As above. Orangish ruby flashing over grn. aqua, moderately w.</td>
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</tbody>
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<tr>
<th>XI O.</th>
<th>PSALMODI; 13th c. (A. Borg.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2140</td>
<td>Colorless, some detached paint, moderately w. (Grisaille C4 9–10 cm. down.)</td>
</tr>
<tr>
<td>2141</td>
<td>Colorless, heavy w. crust with iri.</td>
</tr>
<tr>
<td>2142</td>
<td>Amber, red paint, moderately w.</td>
</tr>
<tr>
<td>2143</td>
<td>Dk. blue, large stone inclusion, no paint, lightly w.</td>
</tr>
<tr>
<td>2144</td>
<td>Purple, red paint, lightly w.</td>
</tr>
<tr>
<td>2145</td>
<td>Dk. bl. green, no paint, moderately w.</td>
</tr>
<tr>
<td>2146</td>
<td>Ruby flashing over colorless, red paint, lightly w. Sample consists of both glasses in original proportions.</td>
</tr>
<tr>
<td>2147</td>
<td>As above, colorless glass only.</td>
</tr>
<tr>
<td>2148</td>
<td>Ruby; ruby striated layer over green. V. heavily w.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>XI P.</th>
<th>MONT ST. MICHEL (Abbey excavations); 12th c. (J. Taralon and J. M. Bettembourg, LMH.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2110</td>
<td>Med. blue, unpainted, moderately w.</td>
</tr>
<tr>
<td>2111</td>
<td>Dk. green, some paint, moderately w.</td>
</tr>
<tr>
<td>2112</td>
<td>P. green, some paint, moderately w.</td>
</tr>
<tr>
<td>2113</td>
<td>P. green, thick glass, unpainted, moderately w.</td>
</tr>
<tr>
<td>2114</td>
<td>Colorless, unpainted, lightly w.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>XI Q.</th>
<th>ROUEN (St. Ouen); 14th c. (J. Taralon and J. M. Bettembourg, LMH.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2118</td>
<td>Dk. blue, unweathered, unpainted.</td>
</tr>
<tr>
<td>2119</td>
<td>P. green, slight w. scum, red paint.</td>
</tr>
<tr>
<td>2120</td>
<td>P. blue, unweathered, painted.</td>
</tr>
<tr>
<td>2121</td>
<td>Amber, surface scum, some paint.</td>
</tr>
<tr>
<td>2122</td>
<td>Ruby flashing over green, unweathered, unpainted. Sample consists of green glass only.</td>
</tr>
<tr>
<td>2123</td>
<td>As above, ruby glass.</td>
</tr>
<tr>
<td>2124</td>
<td>Ruby flashing over green glass, slightly w., unpainted. Sample consists of green glass only.</td>
</tr>
<tr>
<td>2125</td>
<td>As above, ruby glass. (Ruby is very pale.)</td>
</tr>
<tr>
<td>2126</td>
<td>North Rose window. Amber, lightly w., with separated pits, painted.</td>
</tr>
<tr>
<td>2127</td>
<td>As above. Amber, heavily w. with w. products remaining, some paint.</td>
</tr>
<tr>
<td>Page</td>
<td>Description</td>
</tr>
<tr>
<td>------</td>
<td>-------------</td>
</tr>
<tr>
<td>2128</td>
<td>As above. Med. blue with enamel-like w. on one side, powdery w. products on other, unpainted.</td>
</tr>
<tr>
<td><strong>XI R.</strong></td>
<td><strong>ST. DENIS; 12th c.</strong> (T. Husband, MMA.)</td>
</tr>
<tr>
<td>2610</td>
<td>Green, moderately w., with paint.</td>
</tr>
<tr>
<td>2611</td>
<td>Green, moderately w., with paint.</td>
</tr>
<tr>
<td>2612</td>
<td>P. yellow, moderately w., with paint.</td>
</tr>
<tr>
<td>2613</td>
<td>Purple, moderately w., with paint.</td>
</tr>
<tr>
<td>2614</td>
<td>Dk. blue, lightly w.</td>
</tr>
<tr>
<td>2615</td>
<td>Ruby, lightly w.</td>
</tr>
<tr>
<td>2620</td>
<td>Dk. blue, powdered sample. J. M. Bettembourg, LMH. (Same as Pb-1165.)</td>
</tr>
<tr>
<td>2540</td>
<td>Dk. blue, bubbly, lightly w. AB 3a.</td>
</tr>
<tr>
<td><strong>XI U.</strong></td>
<td><strong>AUGSBURG; Prophets, 1130; and others, 1350.</strong> (G. Frenzel, IGR.)</td>
</tr>
<tr>
<td>2415</td>
<td>Upper part, lettering; 56. Colorless.</td>
</tr>
<tr>
<td>2416</td>
<td>Lower part, lettering; 17. Colorless.</td>
</tr>
<tr>
<td>2418</td>
<td>Upper part, sleeve; 44. P. amber.</td>
</tr>
<tr>
<td>2419</td>
<td>Lower part, border; 7. Purple.</td>
</tr>
<tr>
<td>2420</td>
<td>Lower part, vestment braid; 23. Med. blue. (Same as Pb-1143.)</td>
</tr>
<tr>
<td>2421</td>
<td>Lower part, vestment; 28. Em. green.</td>
</tr>
<tr>
<td>2422</td>
<td>Upper part, bottom; 23. Purple.</td>
</tr>
<tr>
<td>2423</td>
<td>Upper part, sleeve; 51. Ruby layer encased in colorless. Sample consists of ruby and colorless glasses in original proportions.</td>
</tr>
<tr>
<td>2424</td>
<td>&quot;Architecture&quot;, poss. a replacement; 19 or 20(?). Colorless. There is some question about the identification of this fragment.</td>
</tr>
<tr>
<td><strong>XI T.</strong></td>
<td><strong>FRANCE (?) ; late 12th c.</strong> (A. Beale, FAM.)</td>
</tr>
<tr>
<td>2560</td>
<td>Background. Colorless.</td>
</tr>
<tr>
<td>2561</td>
<td>Lower field, background. Colorless.</td>
</tr>
<tr>
<td>2565</td>
<td>Lower field; 83. P. Amber.</td>
</tr>
<tr>
<td>2566</td>
<td>Lower field, red replacement. Black (dk. amber).</td>
</tr>
</tbody>
</table>
2567 Piece no. 25 or 41 combined with no. 79, red foot. Ruby (colorless with two ruby streaks). Sample consists of ruby and colorless glasses in original proportions.

See also nos. 2562, 2563, and 2564 in Section XI AQ.

Daniel Window

See no. 2569 in Section XI AQ.

Throne of Solomon Window, "querhaus"; ca. 1350.

5146 Aqua, moderately w., black paint.
5147 P. green, moderately w., black paint.
5148 Dk. blue, heavily w., black paint (?).
5149 Med. blue, moderately w., black paint.

See also no. 5108 in Section XI AQ.

XI V. NAUMBURG CATHEDRAL; ca. 14th and 15th c. (E. Drachenberg, If D and G. Frenzel, IGR.)

2068 Window n. III, 9b. Colorless, w. scum. No. 2. (E.D.)

2069 Window n. III. Dk. blue transp., lightly w. No. 3. (E.D.)

5128 East Choir, 1350. P. amber, little or no w., black paint. (G.F.)
5129 East Choir, 1350. P. green, little or no w., black paint. (G.F.)

XI W. HALBERSTADT CATHEDRAL; ca. 1400–1435. (E. Drachenberg, If D.)

2070 Johannisfenster. Colorless, moderately w. No. 4.
2071 As above. Dk. green, moderately w.
2072 As above. Med. blue transp., moderately w.

XI X. MAGDEBURG CATHEDRAL, Choir; dates not specified. (E. Drachenberg, If D.)

2074 Colorless, some iri.
2075 Green, some iri.
2076 Purple, moderately w. Sample consists of colorless glass with thin casings of purple on each side. Sample is of both glasses in original proportions.
2077 As above, colorless glass only.
2078 Ruby flashing over colorless, moderately w. Sample consists of ruby and colorless glasses in original proportions.
2079 As above, colorless glass only.

XI Y. ERFURT (E. Drachenberg, If D.)

Augustine Kirche; 1300–1325

2060 Colorless, moderately w.
2061 Aqua.
2062 P. blue, moderately w.
2063 Amber, moderately w.
2064 Colorless, with thin ruby flashing, pitted. Sample consists of ruby and colorless glasses in original proportions.

Erfurt Cathedral; 1375–1400

2065 Colorless, with paint, moderately w. If D n. II, 4d.

2066 Dk. green, w. scum. If D n. II, 3c.

2067 Med. blue, moderately–heavily w. If D n. II, 4d.

XI Z. NÜRNBERG (G. Frenzel, IGR.)

596 St. Sebald; 17th c. Colorless with silver stain.

1165 St. Sebald; 1379–86. P. green, fine pitting. (Same as O-153.)

1166 St. Sebald; 1379–86. P. blue, fine pitting. (Same as O-152.)

1167 St. Sebald; 1379–86. Ruby flashing over green, fine pitting. (Same as O-150.)

1168 St. Sebald; 1379–86. Amber, with paint, moderately w. (Same as O-151.)

1169 St. Sebald; 1480. Amber, lightly w., some paint. (Same as O-161.)

1170 St. Sebald; 17th c. Colorless, silver stain and paint, lightly w.

1171 St. Lorenz, 1476. Colorless with paint, moderately w.

1172 St. Lorenz, 1476. Ruby flashing over p. green, heavily w. (Same as O-156.)

XI AA. ULM MÜNSTER; ca. 1400. (G. Frenzel, IGR.)

1173 Dk. blue, with paint, lightly w.

1174 Ruby flashing over green, heavily w.

1175 Choir window; 1410. Ruby flashing over green, with paint, heavily w. (Same as O-158.)

1176 Choir Window; 1410. Amber, lightly w. (Same as O-159.)

2080 Choir Window; 1410. P. blue, some paint, lightly w. (Same as O-160.)

XI AB. SPEYER DOM; ca. 1170. (G. Frenzel, IGR.)

1177 Ruby flashing over green, moderately w. (Same as O-147.)

1178 Amber, with paint, lightly w. (Same as O-148.)

1520 Green. (Same as O-149.)

XI AC. OPPENHEIM; ca. 1300. (G. Frenzel, IGR.) See Ref. F-96.

1179 P. green, with paint, lightly w.

2412 Green with reddish painted foliage, lightly w. Sagged by firing.

2413 Olive amber with painted foliage, moderately w. Severely sagged by firing.

XI AD. SCHULPFORTA; ca. 1250–1275. (E. Drachenberg, If D.)

2073 N. Rosette. Colorless, lightly w.
XI AE. LAUTENBACH; poss. studio of Peter Hemmels in Strassburg, ca. 1482. (R. Becksmann, Stuttgart 2/5/74.)

2081 Blue, with black damask painted design, some w. scum.

2082 As above, somewhat darker blue.

2083 As above, ruby. Sample consists of p. green base glass only.

2084 As above, same fragment. Sample consists of base glass and ruby flashing.

2085 As above, another fragment. Sample consists of p. green base glass only.

2086 As above, same fragment. Sample consists of base glass and ruby flashing.

2087 Amber, some w. scum.

XI AF. KLOSTER LORSCH, excavated finds; Period II, date not reported. (G. Frenzel, IGR, 10/1/80.)

5112 Green, moderately w.

5113 Green, moderately w.

5114 Ruby, heavily w.

5115 Rim fragment of wide-diameter vessel. Green, moderately w. with brown specks and surface marks similar to those on window glasses above.

XI AG. REGENSBURG; Choir(?), ca. 1300. (G. Frenzel, IGR, 10/1/80.)

5116 P. blue. Lightly w., black paint.

5117 Med. blue. Moderately w., some paint(?).

5118 Amber. Moderately w., some paint.

5119 Purple. Moderately w., some paint(?).

XI AH. FREIBURG MÜNSTER; Konstanz Window, ca. 1300. (G. Frenzel, IGR, 10/1/80.)

5124 Med. blue. Lightly w., some paint.

5125 Purple. Moderately w., black paint.

5126 Ruby. Ruby flashing over colorless. Colorless lightly w., ruby heavily w. Sample consists of both glasses in original proportions.

XI AI. GERMANY; various dates. (G. Frenzel, IGR, 6/28/76 and 10/1/80.)

2441 Landau, ca. 1500. Colorless with black, matte paint, some w.

2442 Kloster Ebsdorf. Med. blue, poss. some paint, heavily w.

2443 W. products of 2442.

2444 As above. Greenish aqua, bubble plane parallel to face, chunky w. products.

2445 W. products of 2444.

2446 As above. Aqua, lightly–moderately w.
2447 W. products of 2446.

5121 Goslar, Marktkirche, Cosmos and Damian Window, ca. 1250. Colorless, lightly w., with paint.

5122 As above. Medium blue, moderately w.

XI AJ. GRATWEIN; 15th c. (E. Frodl-Kraft, IOKB.)

2300 Dk. green. (Same as Pb-1148.)

See also Section XI AQ.

XI AK. ST. LEONHARD, Panel of St. Erhardus; ca. 1340. (J. Hayward, MMA.)

2092 Colorless. SL 6.
2093 P. amber. SL 15.
2094 Amber. SL 20.
2095 Bl. green. SL 23.
2096 Green. SL 24.
2097 Blue. SL 22.
2098 Purple. SL 25.
2099 Ruby flashing over colorless. SL 21. Sample consists of colorless glass only.

XI AL. AUSTRIA; 1330 and 15th c. (E. Frodl-Kraft, IOKB.)

586 Vienna, St. Stephens; 15th c. Green, half circular piece, moderately w., with paint. (Same as O-110.)

587 Rüst, Bürgenland; 15th c. Dk. blue. (Same as O-111.)

588 As above. Purple. (Same as O-112.)


2410 Wiener Neustadt; ca. 1330. Ruby flashing over v. pale green, moderately w.

2411 As above. Em. green layer cased in colorless glass, moderately w.

See also Section XI AQ.

XI AM. BERN; 15th–16th c. (H. Hahnloser, Zurich.)

2170 Münster, Ritterscheibe, s.e. (10-000); 1447. Colorless with painted bands, some iri.

2171 Münster, coat of arms of Adrian II of Bubenberg, e. middle window; 1500–06. Colorless with silver stain and paint, some iri.

2172 Münster, “prob. Ritterscheibe or Acker”, prob. 1447. Colorless with black paint, some w. scum.

2173 As above. Dk. blue glass.

2174 Unknown window; 1500–21. Colorless with painted archways, some iri.

2175 Unknown window; 1500–21. Dk. green over colorless with paint and scratched floral motif. Sample is of colorless base glass.

2176 As above. Green glass with ~20% contamination of colorless.

2180 As above. Green and colorless glasses in original proportions.
2177 Unknown window; 1500–21. Ruby flashing over greenish glass with black paint, some w. scum.

2178 Unknown window. Amber glass with black paint, thick w. scum. (Red crayon mark "#433").

2179 Unknown window. Blue glass with black paint, thick w. scum.

**XI AN. FLORENCE (AND MILAN); 14th–16th c. (G. Marchini, Florence.)**

2160 S. Maria Maddalena dei Pazzi, "ornati"; mid-15th cent. Aqua with silver stain and some black paint, moderately w.

2161 As above. Stigmate di S. Francesco window; late 15th–early 16th c. Colorless, some w., black paint.

2162 As above. S. Lorenzolo; late 15th c. Ruby flashing over greenish, moderately w., some paint. Sample is of greenish glass only.

2163 Or San Michele; 1380–1410. Blue, no w. (except near grozed edges?), no paint. (See Ref. E-10.)

2598 As above, aqua, some paint, lightly w. on one surface, pitted on other side.

2599 As above. Dk. blue transp., lightly w.

2164 Cattedrale, mid-15th c. Colorless, some w. scum, some paint.

2165 Unknown source. Colorless, some w., silver stain and brown or black paint.

2169 Milan, pre-18th c. Ruby flashing over colorless. (D. Ankner, 12/64.) Sample is of colorless glass only.

**XI AO. LÉON; 13th and 15th c.**


**Léon Cathedral**

6000 Colorless with ruby flashing. Sample consists of both glasses in original proportions. W no. 1.

6001 P. amber. W no. 2-1.

6002 P. amber. W no. 2-2.

6003 P. amber. W no. 5-1.

6004 P. amber. W no. 5-2.

6005 Colorless with ruby flashing. Sample consists of both glasses in original proportions. W no. 5-3.

6006 Purple. W no. 5-4C.

6007 Yellow. W no. 7-B.

6008 Dk. blue with dk. purple flashing. Sample consists of both glasses in original proportions. W no. 8.

6009 Green. W no. 9.

6010 Purple. W no. 10.

6011 Purple. W no. 10, second sample.

6012 Dk. blue. W no. 14.

6013 Amber. W no. 15.

6014 Lt. purple. W no. 18.

6015 Green. W no. 21-1.

6016 Dk. blue. W no. 21-2.
Purple. W no. 23.

P. green. W no. 25-1.


P. green. W no. 28.

P. green. W no. 29-1.

Dk. blue. W no. 29-2.

Aqua. W no. 31-B.

**XI AP. BATALHA; 15th–16th c.**
(C. V. da Silva Barros.)

15th–16th c. Aqua, pitted.

Prob. 16th c. Green.

Prob. 15th c. Colorless.

Prob. 16th c. Ruby flashing over green, pitted.

Green glass, no paint, some pitting and scum.

Dk. green consisting of green over colorless glass. Actually three layers: colorless base glass 1.25 mm; v. p. green 0.25 mm; dk. green 0.50 mm. Thin paint with scratched lines, moderate w. scum. Sample consists of all glasses in original proportions.

As above, colorless glass plus some p. green “transition” layer.

Dk. blue, with paint, heavily pitted.

Flesh-colored, no paint, w. scum.

Ruby flashing over greenish glass, some white paint, moderately w. Sample is of both glasses in original proportions.

As above, colorless glass only.

**XI AQ. HIGH-LEAD STAINED GLASSES**

Austrian; 12th–15th c. (E. Frodl-Kraft, IOKB.)

St. Michael i.d. Wachau, Lower Austria; 1300–10. Green, little or no w., white paint. 21.5% PbO. (Same as Pb-480.)

Steyr, town church; ca. 1300. Ornamental border from an unknown monastery in Lower Austria. Dk. green. 24.9% PbO. (Same as Pb-481.)

Graz, Leechkirche; 1300–50. South window II 6b, knight of German order. Dk. green. 24.2% PbO. (Same as Pb-482.)

St. Walpurgis nr. St. Michael, Leoben, Styria; ca. 1290. “Abbot Heinrich”. Green, heavily w. 39.4% PbO.

Gratwein, Stmk. 15th c. Dk. green, lightly w. 35.2% PbO. (Same as Pb-1148.)

German; Augsburg Cathedral, Prophet Windows; 1130. (G. Frenzel, IGR.)


As above. Lower field; 82. Green.

As above. Lower field; 20. Green.


Em. green, recently polished. Fitz no. 286. 30.1% PbO.
German. (E. Drachenburg, If D.)

2066 Erfurt Cathedral; ca. 1370. If D n.II, 3c. Dk. green, heavily w. 27.5% PbO.

2071 Halberstadt Cathedral; 1400–35. Johannisfenster. Dk. green, moderately w. 48.1% PbO.

2075 Magdeburg Cathedral; date uncertain. Brt. green, iri. 27.0% PbO.

German. (G. Frenzel, Nürnberg, and S. Fitz, DM.)

2448 Bücken, Stiftskirche, ca. 1275. Greenish, white paint.

2449 Paint from 2448.

5101 Bücken, Stiftskirche, 1250–75. Dk. green, little or no w.; n. II 5a; Fitz no. 154. Major PbO. Small sample.

5102 As above. Amber, little or no w.; n. II 7c; Fitz no. 155. Major PbO. Small sample.

5103 As above. Green, little or no w.; n. II 4c; Fitz no. 153. Major PbO. Small sample.

5104 Köln, Dom, Obergaden; 1304–15. Dk. green, little or no w. Fitz no. 165. 26.7% PbO.

5105 Soest, St. Patroklus, Restscheiben; 1160–66. Em. green, little or no w. Fitz no. 751. 30.1% PbO. Transmission curve run.

5106 As above, Fitz no. 752. 34.7% PbO.

5107 Karlsruhe Landesmuseum; 1480. Colorless, little or no w. Inv. no. C R300. Fitz no. 175. Major PbO. Small sample.

XI AR. AMERICAN; various dates.

4237 Charleston, S. C.; 1890–93. St. Michael's Church. Window by L. C. Tiffany. Gray transp. (colorless with black casing(?) and interior black striations), some w. scum; crazing or deteriorated paint on one surface. (M. Rambusch, NYC.)

4238 Salt Lake City, Utah; 1906. Cathedral of the Madeleine. Window by Zettler Studio, Munich. Amber, with “frothy” upper surface and matte undersurface, granular powdered glass affixed. (P. Cowley, NYC.)

4239 As above. Small sample of white substance adhering in a few pits.

4240 Boston, Mass; ca. 1902. Trinity Church. Window by John La Farge. Dk. blue with opalescent streaks encased. Surface has deposit of buff or whitish colored substance. (W. Cummings, North Adams, Mass.) Sample is of surface deposit.

4245 As above, dk. blue glass.

4246 Manchester, Mass.; ca. 1883. Emmanuel Church. Window by John La Farge. Colorless, with brownish-amber streaks encased, lightly w. Shows heavy internal shattering, said to resemble that seen on La Farge’s windows in Trinity Church, Boston. Tightly fitted in original caming. (J. Sloan, NYC.)

4247 Pittsburgh; 1879–85. Window by John La Farge. Olive, little or no w. (S. McNally.)

4248 As above. Amber with brt. green transp. and colorless streaks, heavily w. to crizzled appearance with spalling.
As above. Opalescent, little or no w., but much internal cracking said to be spontaneous.

These samples were submitted by David Fraser on 4/14/97. They are from windows made by William J. Bolton during 1844–48, for The Church of St. Ann’s and the Holy Trinity in Brooklyn Heights, NY. They came from the Chancel window.

Fragment from the Crucifixion painting in the tracery section. Colorless glass with black (v. dk. brown) matte paint on one side. Reverse side shows some orange peel pitting with traces of polishing smears. T. ~0.9–1.2 mm. Silver stain did not take on this glass. Fraser sample B. Sample is of colorless glass.

As above. Number refers to black paint.

As above, another (larger) piece of the same glass. Fraser sample A. Sample consists of flakes of crazed silver stain layer which did not take. Opq. pinkish and greenish yellow material.

As above, black matte paint from sample A.

Fragment from the painting of an angel in the second register of the Chancel window. Colorless glass with strong orange-amber stain on highly-polished surface. Other side has black matte paint, with a few specks of foreign substance (a soldering flux?) splattered onto it. Fraser sample C. This glass accepted the stain very well. Sample consists of colorless glass with its v. thin stained zone.

XI AS. MISCELLANEOUS STAINED GLASSES

French; Mediaeval. (J. Taralon, and J.M. Bettembourg, LMH; CMG; also M. Lillich, SU, where noted.)


2101 As above. For w. products, see Section XX E. no. 2201.

2102 As above. For w. products, see Section XX E. no. 2202.

2103 As above. For w. products, see Section XX E. no 2203.

2106 As above, with traces of hatching.

2129 Aube; 15–16th c. Dk. blue, no w. (AU 1.)

2130 As above. Med. blue, w. or chemically etched surface. (AU 3.)

2133 Amiens Cathedral; 13th c. Med. blue, w. scum, painted. (AM 3.)

2134 As above. P. blue, moderately w., painted. (AM 4.)

2135 As above. Dk. blue, w. scum, painted. (AM 11.)

2136 Evreux Cathedral; ca. 1300, Nef. B 135 Evre. P. blue, moderately w. (EV 1.)

2137 As above. P. green, moderately w., painted. (EV 4.)

2138 Brennilis(?), 15th c. Amber, heavily w., painted. (BR.)
2139 Le Mans (cathedral), 16th c. Dk. green, heavily w., some paint. (LM 10.)

2220 St. Urbain de Troyes; 1277. Grisaille, some w. scum, red paint. CMG unaccessioned from Aczet auction.

2221 As above, but more heavily w.

2303 Normandy; ca. 1520–25 (or poss. English; early 19th c.) Half figure of Ezekias and part of Jesse Tree. Colorless, silver-stained, painted; polished on one side, w. scum on other. On permanent loan to CMG from the Buffalo Museum. CMG L3.2.84. (M. Lillich, SU.)

2541 Reims; 1175–1200. Part of halo, central lancet in westernmost bay, south chevet clerestory. Grisaille, layer of w. products on one side.

2542 Troyes Cathedral; 1235–40. Angel wing, third bay from axial, triforium, south choir. Green, w. scum, painted.

2543 As above. Filet border. Med. blue, w. scum, layer of w. products(?) on one side.

2544 Evron (Mayenne); ca. 1320. North choir clerestory, westernmost bay. Thick grisaille, moderately pitted, painted. Preserves grozing.

2620 Saint Denis, Basilica; 12th c. Dk. blue. Small powdered sample. J. M. Bettembourg, LMH. (Same as Pb-1165.)

2621 Notre Dame en Vaux, (Marne); 12th c. Dk. blue, little or no w. J. M. Bettembourg, LMH. (Same as Pb-1166.)

2301 German; ca. 1300. Figure of David in Jesse Tree window. Ruby, some w., painted. MMA 22.25.B. Sample consists of ruby and colorless glasses in original proportions.

2302 As above, Ascension. MMA 22.25.F.

2049 Sandringham, ca. 1860. P. blue, heavily crizzled.
XII. EUROPEAN

XII A. VENICE, vessel fragments from canals; mostly 14th c.
(A. Gasparetto.) See Refs. F-45 and F-132.

Cividale del Friuli (Udine), Piazza Paolo Diacono; 13th–14th c.


4021 Bottle with bulge between neck and shoulder (Kropfflasche). Colorless, black w. crust.

Cividale del Friuli (Udine), Piazza San Francesco; 14th c.


Venetian Lagoon, Argine d'intestadura di Fusina; 1330–1550. (E. Canal, courtesy A. Gasparetto.)

4024 Vessel with molded lozenges. Smoky, lightly crizzl. III/a.

4025 Shell-shaped applied prunt. Sl. smoky, moderately w. III/b.

4026 Goblet with shell-shaped prunts. Colorless with lt. blue opq. thread, iri. III/c.

4027 Prunts on thick wall. Colorless, lightly w. III/d.

4028 Goblet with ribs. Colorless, light iri. III/e.

4029 Ribbed cup. Dk. blue transp., iri. III/f.

4030 Goblet with kick, ribbed trail at edge. Dk. blue transp., iri. III/g. (Same as Pb-1174.)

4031 Inghistera with trumpet-shaped base. Colorless, iri. III/h.

4032 Inghistera. Smoky, w. scum. III/i.

4033 Neck of bottle with folded flat tip. Colorless, lightly w. III/l.

4034 Pattern-molded neck (twisted). Blue transp., lightly w. III/m.

4035 Bottle neck. Colorless, w. scum. III/n.

4036 Tray. Colorless, iri. III/o.

4037 Thick-walled lamp stem or vial. Green, lightly w. III/p.

4038 Large flattened prunt. Bl. green, lightly w. III/q.

Venetian Lagoon, San Leonardo in Fossa Mala; 11th–14th c. (A. Gasparetto.)

2865 Vessel fragment. V. p. greenish, with dk. blue transp. applied thread. No. 1.

2866 Vessel fragment. Colorless. No. 2.

2867 Vessel fragment. Strong bl. aqua. No. 3.

4039 Bottle with bulge between neck and shoulder (Kropfflasche). Olive, lightly w. IV.

Fossa Gradeniga, S. Giuliano. (E. Canal, 1965; courtesy A. Gasparetto.)

4045 Base of thick-walled bottle. Olive, heavily w.
Venetian Lagoon, shipwreck near Malomocco; ca. 15th c. (H. Frost, 9/22/83.)

5120 Nugget of cullet. V. p. green, moderately w. From a wreck said to have been coming from the Levant. Cargo contained "a couple of tons of cullet" and "considerably earlier bronzes".

XII B. TORCELLO

From E. Tabaczynska, PAN

1519 Goblet foot; 6th–7th c. Green. (Same as O-27.)


1611 Flat glass; 1st–4th c. Aqua. No. 1758.

1612 Rim of v. thin-walled vessel; 5th–6th c. Aqua. No. 486.

1613 Fragment sagged by heat; 6th–7th c. Aqua. No. 1897.

1614 Goblet foot; 7th–8th c. Green. No. 484.


1616 Foot; 7th–8th c. Similar to 1614, but sl. different color. Green. No. 1666.

1617 Tessera; 7th–8th c. Dk. blue transp. No. 908.

1618 Foot or stem-bowl joint(?); 8th–10th c. Green. No. 1284.

1619 Fragment sagged by heat; 8th–10th c. Green. No. 1355.

1620 Goblet; 8th–10th c. Green. No. 1318.

1621 Flat folded rim(?); 8th–10th c. Green. No. 1319.

1622 Fragment fused to brick; 10th–13th c. Green. No. 418.


1624 Thin-walled vessel; 14th–17th c. Gr. aqua. No. 48.

1625 Ribbed fragment; 14th–17th c. Amber. No. 108.

Torcello "Rosa 1"; 11th–12th c. (E. Canal, 1979; courtesy A. Gasparetto.)

2861 Thick-walled vessel fragment. Aqua.

2862 Neck fragment of thin-walled vessel. Colorless, with elongated bubbles.

2863 Fragment. Pale olive.

2864 Waste glass. Colorless, with internal shattering.

Piazza della Cattedrale; 14th–19th c.(?) (A. Gasparetto.)

4040 V. thin-walled fragment. P. aqua, lightly w. Strat. II. V/a.

4041 Rim. Sl. smoky, pitted. Strat II. V/b.

4042 Bottle with applied threading. Colorless, w. scum. V/c.

4043 Inghistera. Smoky, lightly w. VI/a.

4044 Tip of vial (or pointed kick?). Aqua, iri. VI/b.

See also Section IX J.
XII C. ROSENBORG CASTLE;
c. 1709. (G. Boesen, RC.) See Refs. B-4, B-12, and F-22.

453 Vase, completely broken in 1923, filigree a reticello, not crizzled. Formerly Inv. no. 581. Similar to Boesen's type 50. Sample is of colorless glass only. (Same as O-13.)

454 As above, but sample also contains some white opq.

455 Stem of broken vase. Colorless, crizzled. Similar to Boesen's type 16. (Same as O-31.)

456 Broken bowl. Turbid. Inv. no. A80. Similar to Boesen's no. 59. (Same as Pb-1000.)


458 "Bead" from candelabrum. Amber, not crizzled. Inv. no. 27-43. Similar to Boesen's types 138 and 139.

459 As above. Ruby, crizzled.

460 As above. Colorless, crizzled.

461 Cut pendant from candelabrum. Colorless, heavily crizzled. Inv. no. 27-43. (Same as Pb-1001.)

4079 Foot of goblet with engraved floral motif. Colorless, crizzled. (A. M. Keblow, DC.)

XII D. GNALIÇ; late 16th c.

These samples are from fragments recovered from a shipwreck off the Dalmatian coast. Gasparetto believed the wreck to be that of the *Gagiana* which went down in 1583. See also Section XXVI.

1764 Roundel of window glass. Colorless with grayish cast, lightly w. Pontil mark preserved and arc of folded rim; original diam. ~15.6 cm. No. 42/645. Petricioli Fig. 22.

1765 Foot and stem of goblet with scratch-engraved designs. Colorless with grayish cast, lightly w. Somewhat similar to Petricioli Fig. 18.

1767 Base of vessel, poss. a bottle or jug. Colorless with remains of lattimo banded decoration, lightly w. Sample is of colorless glass with traces of lattimo. Petricioli Fig. 10 or 16.

1768 Stemmed, thin-walled goblet. Colorless with slight greenish cast, lightly w. Petricioli Fig. 3.

1769 Neck of thin-walled vessel or large vial. Blue transp. with many elongated bubbles, lightly w. Petricioli Fig. 23.

1770 Fragment of neck and body of small vessel, prob. a bottle. Black (v. dk. purple), lightly w. No. G 64. Possibly like Petricioli Fig. 13.

These samples were removed from non-joining fragments of glass vessels broken during the severe earthquake that struck the surroundings of Naples on 11/23/80. A selection of broken vessels was made by RHB with R. Causa, L. Morozzi, and T. Fittipaldi on 6/25/81. The fragments were shipped to Corning where they were repaired by Raymond Errett, the Museum’s conservator, and then returned to Naples. The restored glasses are presently on exhibition. The attributions are from data provided by the museums.

4080  Lamp in the shape of a unicorn (or lion), with blue front legs. Murano, late 16th c. Colorless, slightly slippery to the touch. No. 10.

4081  Goblet with knopped wrythen stem and blue applied wings. Murano, 17th c. Colorless glass, slippery to the touch. No. 9.

4082  Vase, crackle glass with gold decoration. Murano, late 16th–early 17th c. Colorless (slightly smoky?) glass, not slippery to the touch. No. 1.

4083  Goblet, a reticello glass. Murano, late 16th–early 17th c. Sample is of bowl of goblet, with some white opq., not slippery to the touch. No. 2. (See no. 4090.)

4084  Bowl, a retortoli glass, with two handles. Murano, 17th c. Colorless, not slippery to the touch. No. 3.

4085  Dish, a retortoli glass. Murano, 17th c. Colorless glass from ring base, slightly slippery to the touch. No. 4.

4086  Bowl with blue threads and two handles. Façon de Venise, late 16th–early 17th c. Sample is of colorless glass, slippery to the touch. No. 7.

4087  As above, rim sample containing some white opq. glass.


4089  “Guttrolf”, with three flattened knops and blue threads around the goblet. Façon de Venise. Belgium, late 16th–early 17th c. Sample is of once colorless or smoky, but now slightly pinkish, glass. Badly crizzled with internal cracking. No. 5.

4090  Sample of fragments of foot of vessel enclosed with no. 4083. These fragments show blue fluorescence. They are quite different from the bowl of the goblet, and probably do not belong. Sample is of colorless glass with some white opq. threads, slightly slippery to the touch. (Same as Pb-2223.)

XII F. FLORENCE (APPARATUS); 17th c. (T. B. Settle.)

4053  Thin-walled vessel with threading. Colorless, with incipient crizzling.

4054  Large, thin-walled vessel with vertical ribbing and folded-over rim. Sl. turbid, colorless, with incipient crizzling.

4055  Vessel cover with 10 raised and pincered ribs, threaded decoration. Colorless, with incipient crizzling.
XII G. BENIALI, SPAIN; 14th–mid-16th c. (K. Butzer, UCal.)

5091 Thin-walled vessel. P. aqua, moderately–heavily w. A2 B8.
5092 Vessel. Colorless, bubbly, w. scum. 82 K-2.
5093 Vessel. Amber, moderately w. Same location as above.
5094 Thick-walled vessel. Black, unweathered, but heavily scratched.


4061 Tumbler, rim; Bohemia, ca. 1730. Colorless, traces of amber resin removed. CMG 65.3.76.

XII. MISCELLANEOUS EUROPEAN

See Refs. B-4 and B-12.

449 Wine glass; France, ca. 1750. Bucket bowl, solid baluster stem, conical foot with pontil mark. Now pink (originally colorless), heavily crizzled. (J. Barrelet.) See Ref. B-4. (Same as O-75.)
1498 Wine glass; France, ca. 1725–50. Funnel bowl, hollow baluster stem, shallow conical foot with pontil mark. Colorless, heavily crizzled. Sample is of uncrizzled glass.
1499 As above, crizzled layer.
4012 Large table; Russia, Imperial Glassworks; ca. 1806. Sample is a floating fragment of the spiraled amber base. CMG 74.3.129. For a companion piece in the Pavlosk Palace, see Refs. E-2 and E-28.
4047 Dragon stem goblet; from earlier group of Müller pieces. Colorless, with faint pink tinge. I 10b. (H. Ricke, KmD.)
4048 Goblet; France, late 17th–early 18th c. Colorless, thin-walled with patterned bowl and patterned hollow stem. CMG 58.3.173.
4049 Dragon-stem goblet, made by R. Bichweiler for C. H. F. Müller of Hamburg; ca. 1870. Colorless, with colored threading, thin casing of aqua on one surface. CMG 59.3.47. Sampled for colorless glass under a microscope.

4050 France; ca. 1850. Cover glass from Clandet stereograph of a lady. Colorless; crizzled, with microcrystalline deposits. EH 700173. (A. Swann, EH.)

4051 France; ca. 1850. Cover glass from Cromer “amateur” of a young man Colorless; poss. with incipient crizzling and microcrystalline deposits. EH 7616859.

4065 Cruet stand, one side broken away and missing. Thought to be France or Netherlands, 18th c., but a similar complete set (CMG 60.3.62) is described as coming from Spain or France. Cylindrical mold-blown cup with four floral motifs, six-ribbed handle and shell-motif thumb rest. Colorless, unweathered. CMG RR 12054, 3/3/75.

4069 Cover of dish. France; 18th c. Colorless glass with pink surface, heavily crizzled. Shallow pattern-molded ribs radiate from solid handle down to hollow folded rim. CMG 56.3.43a. Diam. 16.2 cm, h. 6.2 cm. Extensively repaired.


4141 As above, the other glass. H. 13.2 cm.

4142 Wine glass; France, mid-18th c. Straight-sided bowl, hollow inverted baluster stem, flat foot with pontil mark. Colorless, moderately crizzled. H. 15.5 cm. CMG RR 12054, 3/3/75.


4144 As above, the other glass. H. 12.5 cm.

4146 Decanter; France, mid-18th c. Straight-sided, long-necked, thick-walled with engraved stylized foliate decoration. Now pink (originally colorless), heavily crizzled. Base diam. 7.2 cm, h. ~17.2 cm. CMG RR 12054, 3/3/75.

5000 Nevers; 18th c. Crèche figure, a lamp-worked arm. White opq. CMG 55.3.145. (A. Fehrenbacher.)

6628 Enameled flask; prob. Venetian, prob. late 15th c. Tall flask with two handles on shoulders. Dk. purple glass, some wear, lt. w. on some enamels. Heavily decorated with two enameled portrait medallions, and an overabundance of white opq. and brt. green opq. dots applied over gilt tracery. CMG RR 2556, 3/11/97. Sample consists of chips of colorless pontil glass.
6629  As above, dk. purple glass. (Not sampled.)

6630  As above, covered with gilt. (Not sampled.)

6631  As above, dense white opq. enameled dot. (Not sampled.)

6632  As above, dense white opq. of portrait with black paint. (Not sampled.)

6633  As above, brt. grn opq. enameled dot containing numerous stones and bubbles. (Not sampled.)


6638  Goblet; prob. Netherlands or France, 17th c. V. thin-walled vessel with inverted hollow balluster. Colorless with yellowish tint, sl. crizzl. Sample consists of thin chip left over from 1958 breakage. CMG 53.3.22.

See also Section XVIII H., nos. 1642 and 4075.

XII J. PAPERWEIGHTS

4052  Clichy, said to be “boracic glass”. Colorless. (P. Hollister.)


4071  Clichy, France; ca. 1845–55. Colorless. F 1220c. (A. Greenblatt.)

4072  Baccarat, France; 1848. (Signed.) Colorless, with some white opq. filigree. F 1223. (E. Pancake.)
XIII. INDIAN; various dates.

XIII A. ALAMGIRPUR; dates uncertain.
421 Bead. Colorless. (AGR, no. 105, 23/4/59; xxi'–xxii', 4'–4" [6].)
422 Greenish powder. Either decomp. or frit. (AGR, no. 169, 30/4/59; xxiii'–xxiv', 3'–10". Pit 3 S.B. [1].)

XIII B. BRAHMAGIRI; various dates.
424 Megalithic Culture, 1st–2nd c. Cane. Light blue transp. glass. (Br. Z1, 3/3/47; O-III, 3'–8" [2].) (Same as 0-84.)
425 Megalithic Culture II. Bangle. Black glass. (Br. 21 26, 7/3/47; IV–VII [4].)
426 Andhara Culture III, 50-300. Bangle. Dark glass. (Br. 21 22, 6/3/47; vii'–ix' [2].)

XIII C. HASTINAPUR; various dates.
See B. B. Lal in Ref. F-77.

Period V, 2nd c. B.C.–2nd c. A.D. (?) or ca. 1150.
428 Rim fragment. Aqua. (No. 62, 7/12/50; I'–D' [7].)
429 Flat fragment of blown glass. Aqua, very bubbly. (No. 47, 2/12/50; c'–o'–4" x 8'–3" 3' 11" [7].)
430 Fragment of blown glass. Aqua, very bubbly, unweathered. (No. 714, 10/2/51; lxxxv'–vi' [5].) (Same as O-85.)

431 Rim fragment. Turbid bl. green glass. (No. 803, 22/2/51, lx'–lxx' [5].) (Same as O-17.)

Period III, 600–300 B.C.
432 Vessel fragment. Black, with one flat polished surface. (No. 628, 3/2/57, lviii–lix [33].)
433 Lump of waste glass. Aqua, moderately w. (No. 737 lvii'–lix' [34].) (Same as O-86.)
600–300 B.C. (S. B. K. Thapar, ODGAI.)

2903 Vessel. V. dk. olive amber. (HST-I, no. 1242. D1-16.3.52, XLVIII–L 25′. 11′ B.S. 33). Closely resembles no. 2901, although said to be from a different site. See Section XIII I.

XIII D. SAR DHERI; dates uncertain.
434 Bangle. Black, unweathered. (SD[A], no. 201, I.) (Same as O-87.)
435 Bangle. Black, unweathered. (SD[A], no. 272, II.)
436 Small bead, wound. Turbid blue. (SD[A], no. 519, III.) No sample remains.
437 Bangle. Black, unweathered. (SD[A], no. 694, IV.)
438 Bangle. Black. (SD[A], no. 782, V.)

6300 Small nugget of cullet. Aqua, with incipient crizzling. (Same as Pb-2285.)

6301 Small chip. P. olive, unweathered.

6302 Waste glass. Green, v. seedy; some w. scum. (Same as Pb-2289.)

6303 Drawn tube. Dk. blue, some w. scum. (Same as Pb-2286.)

6304 Large, thick trailing of drawn cane. Dk. blue, moderately w. (Same as Pb-2287.)

6305 Flat fragment of cullet. Dk. blue, with incipient crizzling. (Same as Pb-2288.)

6306 Fragment of a large flat dish with cut grooves. Light blue opq., lightly w. Refs. F-19 and F-141, Fig. 6.8. (Same as Pb-2295.)

6307 Bead fragment, medium-sized, rounded. Reddish-purple transp., heavily chipped and eroded.

6308 Fragment, poss. a rounded vessel wall, prob. blown. V. dk. purple, moderately w.

6309 Small nugget of cullet. V. dk. violet, some w. scum.

6310 Thick trailing of drawn cane. Black, some w. scum.

6311 Nugget of cullet. Black (v. dk. olive), poss. some incipient crizzling.

6312 Waste fragment of drawn tube. Yellow opq., lightly w. (Same as Pb-2290.)

6313 Waste or cullet. Yellow opq. (mustardy), lightly w. Contains a few minute, spherical, metallic globules, probably of lead. (Same as Pb-2291.)

6314 Waste fragment of drawn tube. Yellow opq., heavily w. (Same as Pb-2292.)

6315 Waste fragment of drawn tube. Lt. green opq., moderately w. (Same as Pb-2293.)

6316 Small waste fragment or cullet. Orange opq., little or no w. (Same as Pb-2294.)

6317 Fragment of drawn tube. Red opq., some w. scum. Contains knot formed around small stones, poss. quartz crystals. (Same as Pb-2297.)

6318 Fragment of waste or vessel wall(?). Brownish-red opq., some w. scum.

6319 Nugget of cullet. Red opq., some w. scum. (D. = 2.490 g/cc.)

6320 Nugget of waste or cullet. Red opq., some w. scum. (Somewhat more orange than 6319.)

6321 Nugget of cullet. Dk. blue transp., v. bubbly, moderately w. (Same as Pb-2296.)


200 B.C.-200 A.D.

1051 Bead, near spherical, hand-perf. Lt. green opq. glass, with many bubbles, moderately w. Diam. ~8 mm. vdS no. 1.

1052 Medium-sized bead, flattened into disk, hand-perf. Aqua, lightly w. L. ~1.2 cm, w. ~1.0 cm, t. ~2 mm. vdS no. 2.

1053 Bead, cornerless cube. Green opq. vdS no. 3.

1054 Biconical bead, wound. Blue transp., lightly w. Diam. 8.5 mm, l. 4 mm, perf. 1.5 mm. vdS no. 4.

1055 Small, square folded bead. Blue with white opq. band throughout. Apparent orig. l. ~8 mm, t. ~4 mm. vdS no. 5.

1056 Small, near-spherical bead, wound. Blue transp., lightly w. Diam. 8 mm, perf. 2 mm. vdS no. 6.

1057 Small elliptical bead, wound. Black with red spirals, unweathered. L. ~1.0 cm, diam. 6.5 mm. vdS no. 7.

1060 Flattened collared bead; "Indian-red". Red opq., lightly w. L. 1.1 cm, t. 4.5 mm, perf. 2 mm. vdS no. 10.

1060G Collared bead, similar to 1060. Green opq. vdS no. 10.

1061 Tubular bead, drawn; with knot. Red opq., moderately w. Preserved l. 8 mm, diam. 3.5 mm, thin deformed perf. vdS no. 11.


1063 Seed bead. Orange opq., moderately w. vdS no. 13.


1062 Medium bead, drawn, “Indian red.” Red opq., heavily w. Diam. ~6 mm, l. ~4 mm, perf. ~1.5 mm. vdS no. 12.

XIII I. RUPAR, PUNJAB. (S. B. K. Thapar, ODGAI.)

2900 Bangle. 1000-700 B.C. V. dk. olive, filled with elongated spiraling bubbles. RPR-2 No. 1099.

2901 Vessel. 600-200 B.C. V. dk. olive amber with a few very small bubbles. RPR-2. No. 1267.

2902 Ring(?). 200 B.C.-600 A.D. Brownish dk. purple filled with elongated, spiraling bubbles. RPR-1.
XIII J. VANKALI, SRI LANKA; ca. 1200–1250. (J. Carswell, OL)

2970 Bangle. Black, unweathered.
2971 Bangle. Black, unweathered.
2973 Cullet. Black, unweathered.

XIII K. MISCELLANEOUS INDIAN

Reh Glass

These samples of cullet were collected at the “one-ingredient glass furnace” located on the outskirts of Jalesar. The furnace produced glass used for pottery glazing. It was abandoned “a year ago” by the family who operated it. They then moved away from Jalesar. The furnace was recorded on videotape by RHB and Andy Billeci on 10/23/87. A few knock-offs of similar glass were found just outside the furnace. A larger factory was located about 100 ft. away. See also reh in Section XXIV B. See Ref. F-21.

4150 Chunk of cullet. Grn. aqua transp., slightly iri. with some spherical bubbles.
4151 Chunk of cullet. Bl. green turbid, no apparent w.
4152 Chunk of cullet. Green turbid, no apparent w. Refractory adhering to one surface.

Mirrored Glass

4158 Large fragment of mirrored blown glass of the sort once used for abhala bharat (embroidered mirror work) and for reflective wall inlays such as those in the palace at Amber. Mostly thin-walled (~0.8–1.5 mm) somewhat bubbly, green glass with highly-reflective metallic coating when viewed through the glass. Silvery, rather thick metallic coating on convex side has an uneven texture, and appears to have set up against the glass from a molten state. Apparent radius of curvature >15 cm. Acquired in Bandmer for RHB by Dr. A. N. Jha. Poss. made in Kapadvanj. Rec’d at CMG 6/3/98. Sample is of green glass.

4159 As above, metallic coating. Sampled from four different fragments.

Other

6800 Talisman in a domed architectural shape, bearing five registers of inscription in a cursive script. Includes the Hajira year 977 (1588–89). Two drilled holes through the top edge (for suspension) do not quite meet. Turbid greenish glass, bubbly, with wear but no apparent w. Some graved characters are filled with a fine-grained, whitish phase that is in close contact with the glass beneath it. In places, a fine black phase overlies the glass and the whitish phase. A few burst spherical bubbles on the surface are filled with a soft, brownish material, possibly beeswax. L. across base = 3.2 cm, h. = 4.4 cm. Acquired with a fitted silver box. CMG 95.6.16.

6801 As above, minute sample of whitish phase removed for x-ray diffraction.
XIV. CENTRAL ASIAN


See also Section V U. Begram.

Snake Cave, Aq Kupruk I; 300–400 A.D. (Early Iron Age.)

442 Rim fragment. Cut 2e: 001. 7/16/62.

1356 Goblet or lamp stem. P. yellowish-green glass, heavily weathered. Cut 6r, 7s (1/2): 300. 8/28/65.


1360 Hollow rim of vessel. "Colorless" with blue transp. threaded decoration, heavily w. May be suitable for layer counting. Cut 6r: 200. 8/24/65.

1361 Thin-walled vessel. Colorless, heavily w. Same location as above.

1362 Very small bit of glass (or glaze dislodged from flat surface). Dk. blue. Cut 6q: 0–?. 8/16/65.

Snake Cave, Aq Kupruk I; 500–600 A.D. (Later Iron Age.)

441 Small fragment. Dk. green. Cut 1a: 50–100. 7/14/62.


Snake Cave, Aq Kupruk I; pre-13th c. (Early Islamic.)

1359 Small fragment. Aqua, little or no w. Cut 1a: 0–20. 7/13/62.

1360 Rim fragment. Dk. bl. green transp., little or no w. Same location as above.

Horse Cave, Aq Kupruk II; pre-13th c. (Early Islamic.)

1367 Small fragment. P. green with brownish streaks, no w. Cut 1a: 0–50. 7/2/65.

Hazer Gusfand; Early Islamic(?)

1365 Base fragment. Olive green, little or no w. Cut 3i: 30. 7/2/66.

Qala Bist; 7th–13th c. (6/60.)

6050 Large thin-walled vessel. Bl. aqua, w. scum.

6051 Small thin-walled vessel. Gr. aqua, very seedy, lightly w.

6052 Rim fragment, thin-walled vessel. Amber, lightly w.

Shotur Tepe (n. of Mazar-i-Sharif; 7th–13th c. (11/59.)

6053 Vessel. Colorless, heavily w.

6054 Vessel. Aqua, moderately w.
6055 Pattern-molded vessel. P. blue, moderately w.

Shahr-i-Banu (n. of Tashkurghan); 7th–13th c. (11/59.)

6056 Base of large thick-walled vessel. Aqua, heavily w.

6057 Base of large thick-walled vessel. Grn. aqua, heavily w.

6058 Base of large thick-walled vessel. P. grn. aqua, heavily w.

6059 Base of thick-walled bottle. Green, heavily w.

6060 Vessel base. Colorless, moderately w.

6061 Vessel base(?) with molded radial ribs. Colorless, but solarized or with purplish cast, heavily w.

6062 Vessel. Brt. blue, heavily w.

6063 Rim. Colorless with blue rim and threaded decoration, moderately w. Sample is of colorless glass with slight contamination of blue glass.

6064 As above, blue glass with some colorless wall glass.

6065 Rim, with threaded decoration. Grn. blue wall and threads of same color, moderately w.

6066 Bracelet. Turbid yellowish glass with lt. green transp., spiraled in, little or no w. Sample consists of both glasses in original proportions.

6067 Rim or base and wall fragment. Black, little or no w.

Zarkashan (between Mukur and Karistu; ~95 km SE of Ghazni.)

1368 Base of small, thick-walled vessel with pontil mark and high kick, uncovered during road building excavation, poss. associated with burials nearby. Close to Wertime NGS Expedition Site no. 6B. Sasanian or Islamic (?). Green, moderately w. Given to RHB by Russian engineer Meseryakov. See RHB field notes pp. 45 and 61 for 8/11/68.

1369 As above. Base of large, thin-walled vessel with pontil mark and high kick. Colorless (p. yellowish), moderately–heavily w.

Bamiyan/Chakhcharan, 10th–11th c. See Ref. F-74.

6114 Bottle, thin-walled and free blown, onion-shaped base with long tapering neck, remains of cross-hatched (and possibly figurative) painted decoration. Broken and poorly restored. Dk. blue transp. glass, v. heavily w. Said to have come from Bamiyan or Chakhcharan. Acquired by RHB in Herat 7/23/93. H. ~15.5 cm, d. at base ~4.5 cm, d. at shoulder of body ~8.3 cm, h. of neck ~9 cm. (For paint sample, see Section XXID., no. 6148.)

6115 Small round vessel with wide, flaring mouth and pontil. Herat (or Chakhcharan?) region, date unknown, but certainly ancient. H. ~2 cm. Colorless glass with thick black w. crust. One of a group of eight similar small round vessels acquired by RHB from Sultan Hamidi, Herat, 7/23/93.
XIV B. OTHER CENTRAL ASIAN

Kucha Oasis, Xinjiang, 6th-7th c.

6110 Fragment of medium-sized bead, "nutshell" shape, possibly with shallow longitudinal grooving. Colorless, bubbly, moderately w. Given to RHB by E. Lubo-Lesnitchenko, Leningrad, 7/5/89. From a string of beads excavated by Oldenburg (or Koslov?) in 1905. (Now on exhibition in the Hermitage Museum.)


6119 Vessel with facet cutting; Sasanian type. Green, little or no w., but eroded. MG 23736 (P. 595).

6120 Vessel with large applied prunt. Green, little or no w., but eroded. MG 23737 (P. 647).

Qoch homa (Kucha District), Xinjiang; poss. Islamic. (As above.) Excavated by P. Pelliot, 1906.

6121 Rim of large pattern-molded vessel. Green, little or no w., but eroded. MG 24048 (P. 460).

Hazar-tam or Saqal-tam (nr. Khan-Oi, Kashgar), Xinjiang; prob. Roman or Sasanian. (As above.) Excavated by P. Pelliot, 1906.

6122 Rim of a thin-walled vessel. Aqua, little or no w., but eroded. Bubbly. (P. 885, 25/9/1906.)

6123 Rim of a thin-walled vessel. Bl. green, little or no w., but eroded. Bubbly. Unnumbered.

6124 Wall of a thin-walled, pattern-molded object. P. pink, lightly w., but eroded. Unnumbered.

6125 Vessel (or lamp?) with applied and trailed prunt. P. olive, eroded.

6126 Wall fragment of vessel with threaded decoration. P. olive with orangy-amber threads. Bubbly. Little or no w., but eroded.

6126a As above, amber glass.

6127 Rim (?) fragment of three hollow threads. Olive, moderately w.

6128 Top of an ear ornament (?) or stem. Orangy-amber, streaky, little or no w., but eroded. MG 23806 (P. 889).

6129 Fragment of an ear ornament (?) or stem. Green, lightly w. and eroded.

Qizil ("Ming-Oi"), Xinjiang; 4th-5th c. (M. Yaldiz, MIndK, courtesy J. Kröger, MIslK.) See Ref. F-134.


6132 Rim fragment, showing top register of facet-cut disks; Sasanian type. Colorless, moderately w. MIslK III 7686b. From same location as above.
Lou Lan, Xinjiang; various dates.
Excavated by Sven Hedin, 1903.

Note: The parent objects from which these samples came were examined by RHB and Håkan Wahlquist in Stockholm on 7/14/95. The samples were taken by Lars Erik Barkman. FME accession numbers and numbers from plate cited in Ref. F-26 (where known) are recorded in entries.

6810 Base or wall fragment of thin-walled vessel. Colorless (sl. smoky), eroded overall. T. ~1.5 mm. 1903.26.259A, no. 34.

6811 Foot fragment of small vessel. Colorless, some w. scum. Steep rise in profile. 1903.26.260A.

6812 Foot fragment of small vessel. Colorless, traces of w. scum. Flatter rise than no. 6810. 1903.26.260B.

6813 Foot fragment of small vessel. Colorless with sl. olive tinge. Flat profile. 1903.26.260C.

6814 Vessel fragment, flat ground surfaces, “split” into two layers with sand trapped in crevice. Colorless (sl. smoky). 1903.26.260D.

6815 As above, with ground and polished(?) surfaces. Poss. from same object as no. 6814. 1903.26.260I.

6816 As above, poss. from same object as nos. 6814 and 6815. 1903.26.260J.

6817 Wall fragment of vessel, with “nipt diamond waies” effect. Colorless, eroded. T. varies between 1 and 2 mm. 1903.26.260E.

6818 Neck fragment of vessel. P. green, eroded. 1903.26.260G.

6819 Wall(?) fragment of v. thin walled vessel. Completely colorless. Poss. with threaded design; raised portions eroded, wall well preserved. 1903.26.260K.

6820 P. blue transp. chip. 1903.26.253A.

6821 P. blue transp. chip. 1903.26.253B.

6822 Colorless chip. 1903.26.253C.

6823 Colorless (sl. smoky) chip. 1903.26.253D.

6824 Green transl. chip; filled with minute bubbles. 1903.26.253E.

6825 Green transl. chip; minute elongated bubbles. 1903.26.253F.

6826 P. blue transp. chip. 1903.26.253G.

6827 P. blue transp. chip. 1903.26.257A.

Apartak, Uzbekistan; 4th–5th c.

6111 Small round bead. Med. blue transp., moderately w. Mound no. 3. Given to RHB by A. Abdurazakov, Samarkand, 7/13/89.

6112 Fragments of small thin-walled, cylindrical bead. Blue transp., heavily w.

6113 Small ellipsoidal bead. Aqua, v. heavily w., little glass remains.
Pendjikent, Tajikistan; 8th–9th c.
(B. Marshak and V. Raspopova, HM, 4/13/93.)
See Ref. F-90.

6250 Flask with trailed and pincered decoration on sides and molded and/or trailed face on flattened side. Colorless (or p. amber?) with black w. crust. H. ~10 cm. No. 55-1-21.

6251 Fragment of bowl with vertical ribs. P. grn. blue transp. No. 70-XXIV-19; 71-XXIV-7/17; Fig. V-6.

6252 Base of bottle with trailed zigzag decoration around side. Yellowish amber(?) with black w. scum. No. 57-III-12.

6253 Base of bottle with horizontal spiraling, threaded decoration. Colorless, v. heavily w. No. 79-XXIII-8; Fig. XV-10.

6254 Base of bottle with large zigzags of applied decoration. Colorless, with black w. crust. No. 82-XXV-4.

6255 Shoulder and neck fragment of bottle with pincered spiraling, threaded decoration. P. grn. aqua, heavily w. No. 71-XXIV-8; Fig. XIV 3.

6256 Neck fragment of bottle with applied ring decoration. Aqua, with iri. No. 64-XIX-2.

6257 Base fragment of bottle(?) with heavy, applied, zigzag decoration. Colorless, with black w. crust. No. 57-III-11.

6258 Fragment of “Sasanian cut bowl”. Colorless, no apparent w. on sample. No. 75-XXVIII-4; Fig. I-1.

6259 Fragment of unidentified type. Colorless, with black w. crust. No. 81-XXV-3.

Gansu(?); undated. (CMG Study card F-2595, 5/97.)

6274 One of a pair of objects submitted for examination. The pair comprises a hollow, flaring cylindrical piece with relief-carved animals and other decorations and a footed goblet with similar decorations. The two objects are joining parts sawed from a single vase. The foot of the goblet is a marriage of the narrow-mouthed top of the original vessel with what appears to be the base of that same vessel. At least parts of the decoration (the animals) appear to have been cut in modern times. Original vase (h. ~20.6 cm) prob. had a Chinese meiping shape. Lt. blue turbid glass with applied artificial weathering products. Number designates the glass itself.

6275 As above, white friable “weathering products” with ochre (water color?) tint applied to surface. In places the material is tamped or rubbed onto the glass over recent chips.

Xinjiang; Sasanian(?). (8/14/98.)

7015 Chip of small cup with facet-like cutting. Colorless, w. scum. Xinjiang Prov. Reminiscent of piece excavated by Sir Aurel Stein. (Same as Pb-3449.)
Contents of a Buddhist Reliquary; no provenance, undated.

These samples came from an assortment of objects found in a small, dark blue bottle lent to the Museum for examination. The bottle was covered with metal foil wired loosely in place. The foil was “gilded” with bronzing paint and was embossed. The gilding had been scratched, exposing a white gesso-like material beneath it. The glass itself was blown and bore a pontil mark. It was heavily-scratched but not weathered.

6100 Sample of “gilded” metal snipped from edge of foil cover.

6101 Snippet of folded gray metal.

6102 Snippet of cross-shaped metal foil.

6103 A coin, possibly Kushan, with a horse-mounted figure on the obverse, and a standing(?) figure on the reverse.

6105 Elongated lump of friable, whitish, porous, material. Poss. bone or coral(?).

6106 Tubular bead(?) of friable, terracotta or faience-like material. L. ~1.7 cm, diam. varies between 3 and 4 mm, perf. ~1.5 mm.

6107 Metallic spiraled tube with narrow hollow perforation. Prob. machine-made, poss. by winding wire around a core which was later removed.
XV. FAR EASTERN, INCLUDING SOUTHEAST ASIA

XV A. CHINA

Note: Many of the Chinese objects are published in Refs. A-44, A-70, A-71, C-18, and C-19, under the numbers listed here. The original catalogue numbers are given in parentheses following the entries. Most of the samples were either selected from the collection of the Royal Ontario Museum by D. Dohrenwend and the author, or are in The CMG. In addition to the three references cited above, see also Refs. A-64, A-72, A-76, A-80, A-83, A-84, C-11, C-13, C-17, C-23, E-29, F-111, F-118, and F-119.

Many of the samples are illustrated in Ref. A-67; a few appear in the other references above.

Early Periods

05 Bi, 4th–3rd c. B.C. Colorless, heavily w. CMG 51.6.567. (3330, Pb-1005.)

06 As above, w. products. (3331, Pb-1006.)

07 Bi, 4th–3rd c. B.C. Turbid green, lightly w. CMG 51.6.548. (Pb-1007.)

08 See 3229 below.

48 Flattened bar, uncertain date. White opal with red swirls, moderately w. Opal appears to have been struck. CMG Study cards 1313a and b. Sample is of white glass. (3332.)

49 As above, red opq. (3333.)

50 Eye bead fragment, 4th–3rd c. B.C., possibly from Jincun near Luoyang. Dk. blue transp. with white opq. glass decoration, moderately w. L. 1.7 cm, diam. 1.7 cm. CMG 51.6.549B. Sample is of blue glass. (3334, Pb-1550.) See also nos. 5780–82.

51 Large bead, Han(?). Lt. blue transp., apparently undecorated, heavily w. Diam. 2.5 cm. CMG 67.6.2. (3342, Pb-1551.)

52 Eye bead, 4th–3rd c. B.C. Dk. blue transp. with yellowish and white opq. glass decoration. V. lightly w. L. 1.8 cm, diam. 1.8 cm. CMG 672. Sample is of blue glass. (3335, Pb-1552.) See also nos. 5783–85.

53 As above, yellowish region. (Pb-1553.)

54 Eye bead, 4th–3rd c. B.C. Dk. blue transp. with whitish and yellowish decoration, moderately w. L. 2.3 cm, diam. 2.4 cm, perf. 8 mm. CMG 671. Sample is of blue glass. (3336, Pb-1554.) See also no. 5779.

57 Glass fish, flat with incised decoration, probably Han. White opq. glass, moderately w. CMG 51.7.3. (3338, Pb-1557.)

59 Glass cicada, Han. Greenish, heavily w. (R. J. Gettens, FGA.) FGA SC-543. (240, Pb-1559.)

64 Glass cicada, Han. Turbid white, heavily w. CMG 51.6.558. (3341, Pb-1564.)

66 Eye bead, 4th–3rd c. B.C. Lt. blue turbid glaze over frit-like body material, moderately w. (L. Biek, BC.) MS 706 B/2454. (5862.)
68 Eye bead, 4th–3rd c. B.C. (?). Lt. blue transp., moderately w. (L. Biek, BC.) C95317. Sp. gr. = 3.27. (5867, Pb-1568.)


73 Crescent with eye decoration, 4th–1st c. B.C. Dark glass, heavily w. ROM 933.12.167. (5808, Pb-1573.)

74 Plaque with running animal, 2nd–1st c. B.C. (?) Turbid p. green, heavily w. ROM 930.21.215. (5833.)

75 Cylindrical bead, date uncertain. Somewhat turbid colorless, lightly w. ROM 960.241.231. (5813.)

76 Eye bead, 5th–1st c. B.C. (Medium-sized.) Blue(?) with yellowish decoration, heavily w. ROM 933.x84.1. Sample is of yellow. (5816, Pb-1576.)

77 Glazed bead, 4th–1st c. B.C. Frit-like body with w. green glaze, “S” and circle decoration. L. ~2.2 cm. ROM 933.84.11. (5826, Pb-1577.)

78 Eye bead, 4th–1st c. B.C. (Large.) “Black” glass with inlay eyes and aqua glass remaining in some places; double bands of dotted lines once containing a white phase; moderately–heavily w. Sample is of black glass. ROM 933.84.7. (5818, Pb-1578.)

79 As above aqua glass. (5819, Pb-1579.)

80 Bi, broken and repaired, 3rd c. B.C. Slightly turbid(?) p. green, heavily w. ROM 971.144.4. (5830, Pb-1580.)

82 Ear spool, Han. “Black,” heavily w. ROM 933.84.13. (5832, Pb-1582.)

83 Plaque with dragon, 2nd–1st c. B.C. Turbid colorless, heavily w. ROM 933.23.340. (5835, Pb-1583.)

84 Cicada, Han. Turbid p. greenish glass, heavily w. ROM 930 x 170.9. (5837, Pb-1584.)

86 Vessel fragment with eye motifs, 4th–1st c. B.C. Lt. blue glass with applied dots of same color set over white and brownish fritted liners; moderately w., filled with bubbles. Underside may contain traces of resinous material. ROM 933.58.5. Compare to 3345 below, which appears to be from same object. (5842, Pb-1586.)

89 Barrel-shaped bead, 4th–1st c. B.C. reddish-brown body (original color indeterminate) with applied eyes of lt. blue transl. glass, heavily w. ROM 933.12.165. (5848, Pb-1589.)

90 Eye bead, 4th–1st c. B.C. Friable gray body of pumice-like appearance; glazed surface with dotted decoration of indeterminate original color, heavily w. Sample is of body material. Emission spect. showed glaze to contain some lead. ROM 960.241.248. (5851, Pb-1590.) See also 5851.

91 Eye bead, 5th–1st c. B.C. Med. blue body, eye decoration missing, heavily w. ROM 933.84.3. (5852, Pb-1591.)

92 Bead, 5th–1st c. B.C. Greenish-blue, heavily w. Might once have contained eye decoration or might have been faceted. ROM 933.84.4. (5854, Pb-1592.)
93  Small bead, 4th–1st c. B.C. Black, probably once contained eye decoration; heavily w. ROM 933 x 84.5. (5855, Pb-1593.)

94  Eye bead, 4th–1st c. B.C. Friable terra cotta (?) body, black glazed surface, traces of green fill (probably glass), and white liner remain, also dotted whitish decorations, heavily w. Sample is of black glaze. ROM 933 x 84.6. (5856, Pb-1594.)

95  Cube-shaped bead with raised eye decorations at each corner, 4th–1st c. B.C. Colorless with blue eyes; heavily w. ROM 933 x 84.8. (5858, Pb-1595.)

3329  Sword terminal, Han Dynasty. V. heavy, colorless glass with powdery white w. products. CMG 62.6.15. Sample is of w. products. A sample of the glass itself was used for Pb-1009. Qual. spect. shows PbO ~2.5% and BaO ~0.4%. See Refs. C-11 and C-18.

3345  Beaker-shaped vessel made up from fragments bearing eye motifs; prob. 4th–1st c. B.C. Lt. blue glass with applied dots (lt. blue and black) over white and brownish fritted liners; moderately w., filled with bubbles. Inside retains core (?) residue. On loan to CMG from Eskanazi, Ltd., 1990. Compare to CMG 86 above, which appears to be from same object. (Same as Pb-2021.)


3383  As above, large glass animal. White opq., lightly w. (?) Sp. gr. = 3.85. From Shi Meiguang, his no. WH-66-2. See Ref. E-29.

3384  Bi, Han Dynasty. White opq. glass, heavily w. with brownish w. products. From J. Twilley (6/27/93) on behalf of A. Leeper. Diam. = 15.9 cm. Sample is of w. products removed during second stage of cleaning. (Same as Pb-2340.)

5779  Same bead as no. 54 (3336). Sample is of friable, yellowish decoration.

5780  Same bead as no. 50 (3334). Sample is of dk. blue transp. eye decoration. For electron microprobe analysis.

5781  As above, adjacent white opq. region.

5782  As above, adjacent med. blue region.

5783  Same bead as no. 52 (3335). Sample is of dk. blue glass. For electron microprobe analysis.

5784  As above, adjacent (v. small) yellowish, bubbly region.

5785  As above, separate v. small chip of yellowish region.

5851  Same as no. 90.

5892  Rectangular plaque from a “glass suit”; prob. Western Han Dyn. From a group consisting of 35 plaques with various raised decorations, pierced in four corners. Motifs suggest clouds, dragons or octopi, etc. Colorless turbid glass, heavily w. 5.6 x 4.3 cm, 2.0–2.8 mm thick. Sample consists of glass and w. products. From P. Singer. (Same as Pb-2028.)
6788 Glass tiger; prob. modern. Turbid white glass formed in the round by drawing and pinching. Eyes and ears added as colored glass dots, pontil mark on belly, thin colored threads wound around body. L. ~6.2 cm. Covered with white coating over which brownish soil has been applied. Submitted for examination by Robyn Turner, 8/21/97. Number refers to glass.

6789 As above, the white coating.

6790 Small axe head with cut or molded, highly-stylized motifs on each side. Prob. China, date uncertain. Bright green glass with one large, ellipsoidal bubble, many smaller bubbles, and a few metallic inclusions. Said to have once contained w. products. H. 3.9 cm, max. w. 3.5 cm, max. t. near horizontal perforation 9 mm. Sample consists of green glass, but may also contain a minute metallic inclusion. CMG Study card F-2548. Sp. gr. = 3.802. (Same as Pb-3420.)

6791 As above, traces of white w. products. (Same as Pb-3421.)

6792 Small, writhing dragon with smaller second creature. China, said by owner to be Han Dyn. Cut from a single piece. Turbid white glass or stone with w. products(?) and some silt. L. 5.2 cm. CMG Study card F-2549. Sp. gr. = 2.934.

6793 As above, sample consists of w. products. (Same as Pb-3422.)

6794 Flat plaque of mythical animal (poss. a tortoise?) with cut designs on top and bottom, drilled hole near middle. China, said by owner to be Eastern Zhou Dyn. Turbid yellowish color with apricot-colored zone near bottom edge; swirling flow marks throughout, apparently etched by preferential w. Design stands in sharp relief, poss. as result of w. Top edge has “rim” containing well-formed quartz crystals. Material uncertain, but has macro features resembling those seen in geodes, agate, and other natural materials. Sample consists of yellowish body material. CMG Study card F-2550. Sp. gr. = 2.576. (Same as Pb-3423.)

7014 Bi, Han Dyn. Turbid white glass, heavily w., buff colored accretion. Chipped on edge. O.d. = 7.9 cm, i.d. = 3.5 cm. CMG, ex-coll. J. Strauss. (Same as Pb-3448.)

Middle Periods

65 Small bead, Tang. Amber or olive, unweathered. (L. Biek, BC.) 1-1938-7. (5861.)


1581 Glass hairpin, 15th–16th c. Lt. blue opq., lightly iri. in places. ROM 960.241.230. (5831, Pb-1581.)

1585 Hairpin head, molded relief design, 7th–9th c. Somewhat turbid colorless, moderately w. ROM 930.170.3. (5840, Pb-1585.)

1588 Small Buddha, 7th–8th c. Lt. green opq., moderately w. ROM 925.26.367L. (5846, Pb-1588.)

1596 Large bowl, Tang–Ming. Said to be from tomb in temple grounds at Luoyang. Colorless with brownish substance and rough grayish white deposit on parts of interior. ROM 923.24.163. (5860, Pb-1596.)

3343 Fish, Tang. Em. green, moderately w. CMG 51.6.550. Density = 2.563 g/cc.

4110 Small pieces of “carved” glass; date uncertain. White opq. (P. Goodman courtesy D. Blair, CMG RR 14212.) Sp. gr. of one piece = 3.386.

4120 Footed bowl; Tang or (more likely) somewhat later. Lt. blue opq. moderately w. with iri. patches. MMA no. 3-EGY 23.9. (C. Lilyquist and R. Koestler, MMA.) (Same as Pb-2020.)

5801 Bracelet, 7th–9th c. Colorless, lightly w. ROM 921.21.355A.


5805 Cicada pendant, 8th–12th c. Colorless, lightly w. ROM 930.170.5.

5811 Peach, 10th–14th c. V. p. greenish, slightly turbid glass, moderately w. ROM 933 x 84.12.

5839 Hairpin head, 7th–9th c. White opq. glass, lightly w. ROM 960.241.233.

5841 Cicada fragment, molded, 7th–9th c. Turbid colorless, lightly w. ROM 960.241.247.

5844 Wound and lobed fragment of uncertain use and date. Lt. blue transp. with white opq. swirls, moderately w. ROM 918.21.913.

5872 Glass head of a Bodhisattva. Date uncertain; various scholars have dated it from as early as the Tang/Sung Dynasties until modern times. Cast, possibly from a stone prototype, in heterogeneous white opq. glass, with many voids, and three types of surface accretion. Opacified with CaF, and NaF. (C. and M. Macht, then on loan to the Cincinnati Art Museum.)

5874 Large, shallow bowl with scratch-engraved dragons and floral motifs. Prob. Qing Dyn., poss. Kangxi Era. Colorless, v. heavily crizzl. CMG 58.6.5. Sample consists of crizzl. layer. (Same as Pb-2359.)

Famensi

5886 Famensi, placed in crypt of temple in or before 874 A.D. Fragment of a vessel, probably resembling Famensi FD5 032, a thin-walled, straight-sided cup with an interior ridge surrounding the kick. P. yellowish glass, lightly w. From Shi Meiguang, Research Institute of Building Materials, Beijing, who also analyzed this fragment. See RHB Field Notes Sept. 12, 1990 and Refs. A-71, A-74, and A-80.

Late Periods

1560 Large bead, prob. early 20th c., acquired in China. Poss. made in China but more likely imported from Europe. Brt. green transp., colored with uranium, unweathered. CMG 51.6.246. (4100, Pb-1560.)
1561  "Peking glass" bracelet, faceted, 19th–early 20th c. Dk. blue transp., incipient crizzling. CMG unaccessioned. (4108, Pb-1561.)

1562  Bottle, 18th–19thc. Dk. blue transp., crizzled with surface spalling away. (A. von Saldern, MKuG.) (4111, Pb-1562.)

1563  Glass Buddha, mold cast with engraved details, 17th–19th c., prob. Thailand. Gray transp. glass with loose, brownish accretion. CMG 56.6.10. See Ref. E-17. (5870, Pb-1563.)

1570  Guan Yin, Sung–Ming. Slightly turbid colorless, some light w. or crizzling. ROM 922.20.80A. (5802, Pb-1570.)

4105  Bracelet, "Peking glass"; late 19th–early 20th c. Yellowish amber containing metallic flakes of gold, or more likely, a band of copper aventurine.

4106  As above. Brt. blue transp. with metallic flakes.

4107  As above. Brt. blue transp. with metallic flakes.

4108  Same as 1561.

4109  As above. Dk. blue transp. with metallic flakes.

4111  Same as 1562 and Pb-1562.

4112  Cameo vessel, poss. 19th c. Dk. blue transp. over white opq. (Submitted by R. Clague.) Sample is of white opq. glass. (Same as Pb-1566.)

4113  As above, blue glass. (Same as Pb-1567.)

5871  Large glass Buddha, prob. 19th c. Acquired in Thailand. Green (slightly yellowish), with traces of gilding, little or no w. (T. Phu, NYC.) CMG loan L137.6.85. Density = 2.470 g/cc; ref. index = 1.504.

5879  Flask with inside-painted decoration, China, prob. 19th c. Decoration shows birds, fish, flowers, and Chinese characters. Colorless, spalled, with internal cracking. Said to have collapsed while being handled. Eretz Israel Museum no. 107763. From G. Jacobson, 8/13/92.

5890  Souvenir glass horse; China, 1980–85. Lt. blue opq. Flameworked, with applied legs; shaped by pincering. Small pontil mark on belly. H. ~0.38 hands. Purchased in China by ERB. Sample is of broken tail.

Chinese Jewelry, etc.; ca. 1910. (CMG.)

4100  String of large "uncarved" beads, with drilled perforations. Brt. green (uranium). Diam. 2.9 cm, perf. 4 mm. CMG 51.6.246. Ave. sp. gr. = 2.80. (Same as 1560.)

4101  Same string as no. 4100. Brt. green (uranium). Diam. 2.9 cm, perf. 4 mm.

4102  String of small "carved" beads with drilled perforations. Colorless. CMG 51.6.250(?).

4103  Same string as no. 4102. Purple.

4104  String of small "uncarved" spherical beads with drilled perforations. Med. blue transp. with axially-elongated bubbles. Diam. 1.0 cm, perf. 1.2 mm. CMG 51.6.267. Sp. gr. = 2.44.
Chinese Cup

5770 Glass cup from China, prob. Eastern Han Dyn. Example of type of cups and bowls with horizontal notched-ridge decoration. Bl. aqua transp. glass with turning marks, chatter marks, and knotty cords; no w. remaining. On loan from C. Shangraw on behalf of owner, W. H. Shorenstein. CMG RR 18904; Study card F-2497, 12/16/94. See extensive RHB examination notes, report of 2/95, and Refs. A-83 and C-24. (Same as Pb-2331.)

5771 As above, flakes of foreign material adhering to base. Green transl. color with impression of a “grain” running across one surface. Shape conforms perfectly along interface with pitted glass surface beneath it. Poss. corrosion products of a copper or bronze object in contact with the cup during burial in a tomb. Unaffected by ethanol and acetone; chars to black material upon being heated in a crucible in an alcohol lamp flame. (Same as Pb-2330.)

5772 As above. Another part of the adhering material. Surface is darker, with nearly spherical, black nodules, but green transl. color on contact surface with glass. Also conforms perfectly to surface of pitted glass beneath it. Microscopic examination shows the undersurface of the flake of this material bears an impression of the turning marks on the glass.

5773 As above. Loosely-adhering silt from inside cup. Finely-divided, salmon-colored.

Chinese Beads

3386 Same bead as 6386.

3387 Same bead as 6387.

6386 Medium-sized bead. Han or Sung Dynasty, said to be from a tomb in Jiangsu; one of about 175 similar beads. Shapes within the group are variable, but most are drum-like with well-rounded edges, although generally misshapened. Dk. blue transp.; drawn, fire-polished and somewhat flattened; longitudinal bubble chains, with many inclusions, lightly w. No fluorescence under LW or SW ultraviolet. D. = 6.0 mm, l. = 6.5 mm, off-center perf. = 2.3 mm. Sp. gr. = 2.304. (Same as Pb-2346.)

6387 Small-sized bead. As above, one of a different string of about 175 similar beads said to have been found in the same tomb. Same comment on shapes applies. Med. blue transp.; drawn and fire-polished, longitudinal bubble chains, with many inclusions, lightly w. Strong yellowish-green fluorescence under LW ultraviolet. D. = 4.0 mm, l. = 2.5 mm, off-center perf. = 1.8 mm. Sp. gr. = 2.135. (Same as Pb-2347.)

6388 Similar to 6387, strong yellowish-green fl. (Same as Pb-2348.)

6389 Similar to 6387, strong yellowish-green fl. (Same as Pb-2349.)
6390 Similar to 6387, but no fl. (Same as Pb-2350.)

6391 Similar to 6387, but no fl. (Same as Pb-2351.)

6510 Large, rounded bead, prob. Han(?). Lt. blue opq. glass with black swirls around edge. Heavily w. to white opq., but black swirls remain. D. = 1.5 cm, t. = 8 mm, sharply-formed perf. = 6 mm. Similar to CMG 93.6.5, except the latter is only lightly w. Sample is of lt. blue glass. Sp. gr. = 4.24. (Same as Pb-2339.)

6511 As above, sample is of black swirl. Contains several minute blobs of suspended metal similar to 6512.

6512 Minute metallic blob suspended inside chip of 6511. Diam. < 0.1 mm. One of several similar blobs.

Miscellaneous Early and Middle Periods

These samples are from a group of small Chinese objects and beads donated to the department by Simon Kwan of Hong Kong. All are without provenance. They were received on 5/26/95 and 4/8/96. The attributions were provided by Mr. Kwan.

6700 Small glass inlay or half bead(?), thought to be Han Dyn. Rectangular face; thin, lenticular shape (plano-convex) in cross-section. Dk. blue transp. glass with moderately thick brownish w. crust. Ir. underneath. Face measures 1.69 x 1.35 cm, section 2.0 mm thick in center, curving to sharp edges. Glass rises slightly in menisci around all edges of flat surface. Associated with terra cotta molds. (Same as Pb-2357.)

6701 As above, another example. (Same as Pb-2358.)

6702 As above. A similar piece, but having two longitudinal grooves ~2.5 mm wide on flat surface. Rests in terra cotta mold with two approx. matching grooves on its upper surface. Mold measures 2.7 x 2.1 x 0.85 cm. Sample is of dk. blue glass.

6703 As above, a similar piece with grooves; still in place, apparently as sagged into mold.

6704 A mold, very similar to 6705. This mold is the one into which glass 6703 is sagged. See also nos. 90 and 5851.

6705 Mold for glass inlay, China, thought to be Han Dyn. Tablet-shaped, open mold for shaping small rectangular inlays with shallow lenticular cross-sections. Two longitudinal grooves match shape of glass inlays nos. 6702 and 6703. Gritty texture, salmon-colored, with micaceous (?) flecks. Upper edges contain traces of grayish coating, possibly the remains of a parting agent. Sample consists of salmon-colored body material.

6706 As above, grayish coating.

6707 Another example of a mold or prototype. Biconical with cylindrical opening at one end. Diam. 1.97 cm., h. 0.9 cm.

6709 Another example. Similar to 6707, but with a circular "pedestal". Diam. of pedestal 3.2 cm, overall h. 1.6 cm.
6711 Another example. Similar to 6709, but rivet-shaped with hollow cylindrical extension. Diam. of pedestal or head 1.9 cm, o.d. of extension 0.6 cm., overall h. 2.4 cm.

6720 Cicada, Han Dyn. P. green turbid, some w. patches. L. 5.3 cm, w. 2.6 cm. SK 12. (Same as Pb-3450.)

6721 Cicada, Han Dyn. White opq., w. spots. Tail shortened. L. 4.0 cm, w. 2.9 cm. SK 11. (Same as Pb-3451.)

6722 Cicada, Han Dyn. Turbid white stone, buff-colored w. Carved in high relief. L. 4.3 cm, w. 2.2 cm, t. 1.3 cm. SK 13. (Same as Pb-3452.)

6723 Rectangular plaque, Han Dyn. Incised design on one surface. Poss. a garment ornament. Turbid white, moderately w. L. 5.5 cm, w. 4.1 cm, t. 4.0 mm. SK 9. (Same as Pb-3453.)

6724 Ear spool, Han Dyn. Med. blue transp., crizzled. L. 2.0 cm, base diam. 1.3 cm. SK 5. (Same as Pb-3454.)

6725 Ear spool, Han Dyn. Dk. blue transp., little or no w. L. 1.7 cm, base diam. 1.3 cm. SK 5. (Same as Pb-3455.)

6726 Ear spool, Han Dyn. Lt. greenish-blue turbid, v. heavily w. One of a pair. L. 3.7 cm, base diam. 1.4 cm. SK 6.

6727 Hexagonal rod, Han Dyn. Dk. greenish blue, v. heavily w. One of a group of four. L. 2.9 cm, w. 6.0 mm. SK 14. (Same as Pb-3456.)

6728 Octagonal bar, Han Dyn. Greenish blue opq., heavily w. One of a group of four. L. 3.1 cm, w. 1.1 cm. SK 15.

6729 String of tubular beads. W. Zhou (?) or Warring States. Beads are of various colors although many must originally have been blue. There is one large, flattened, blue bead. L. ~1-1.4 cm, diam. ~6 mm, perf. ~3 mm. SK 18. Sample is of lightly w. bead which is dk. blue throughout. (Similar to Pb-3457.)

6730 As above. A somewhat more w. bead, with porous lt. blue glaze over a tan body. (Similar to Pb-3458.)

6731 As above. A somewhat w. bead, with a porous blue glaze over a fritted gray body.

6732 As above. A porous bead, tan throughout.

6733 As above. Another bead similar to no. 6732.

6734 Bi-conical beads, Warring States. Lt. blue turbid, v. heavily w. L. 1.1 cm, diam. 8 mm; straight perf., diam. 1.5 mm. SK 4. (Same as Pb-3459.)

6735 Large tubular bead, Han Dyn. Lt. blue turbid, v. heavily w. L. 1.2 cm, diam. 8 mm, perf. 2 mm. SK 6.

6736 Eye bead (spherical), Warring States. Porous fritted body surrounding terra cotta tubular core. Surface is of lt. blue glass with 29 eyes standing in relief. Eyes consist of lt. blue glass centered on yellowish disks. One of three. Diam. 1.7 cm, perf. 4 mm. SK 22. Sample is of blue glasses in eyes. (Same as Pb-3475.)

6737 As above, yellowish disk. (Same as Pb-3460.)

6738 As above, gray fritted body material.

6739 As above, terra-cotta tubular core.
6740 Eye bead (ellipsoidal), Warring States. Dk. blue bead with 8 shallow composite eyes. Eyes are now buff-colored; originally lt. blue transp. and white opq. L. 1.5 cm, diam. 1.3 cm, perf. 3.8 mm. SK 1. Sample is of dk. blue glass.

6741 As above, an eye containing lt. blue transp. and white opq. glasses; heavily w.

6742 Eye bead (ellipsoidal), Warring States. Dk. green glass with 9 shallow composite eyes. Eyes consist of dark and white opq. glass. Heavily w. L. 1.3 cm, diam. 1.6 cm, perf. 5 mm. SK 1. Sample consists of dk. green glass. (Same as Pb-3461.)

6743 As above, an eye containing both colors of glass with base glass adhering; heavily w.

6744 Small eye bead, Warring States. Lt. blue transp. with blue, white and yellowish eyes. Moderately w. L. 1 cm, diam. 1.1 cm. SK 1. Sample consists of blue glass with some white opq. streaks.

6745 As above, turbid yellow glass. (Same as Pb-3462.)

6746 Small eye bead, Warring States. Black with protruding white eyes (original color indeterminate). Also contains several very small dots of now white glass in lines. L. 7 mm, diam. 9 mm, perf. 4.5 mm. SK 1. Sample consists of black glass.

6747 As above, heavily w. protruding eyes. Some lt. blue glass remains.

6748 Small eye bead, Warring States. Med. blue transp. with shallow composite eyes. Eyes are of blue and white opq. glass. L. 8 mm, diam. 1.2 cm, perf. 4 mm. SK 1. Sample consists of blue glass.

6749 As above, an eye containing both colors of glass.

6750 Medium-sized eye bead, prob. Warring States. Gray fritted body, with tubular terra-cotta core. Thin grayish-blue coating with protruding eyes. Eyes consist of lt. blue opq. glass on white opq. disks. One of a group of 12. Glass is lightly w. L. 1.1 cm, diam. 1.6 cm, perf. 3 mm. SK 8. Sample consists of blue glass from eye, with some white opq.

6751 As above, white opq. glass.

6752 As above, gray fritted body material.

6753 As above, tubular terra-cotta core.

6754 Rectangular eye bead, Warring States. Turbid white glass with 8 lt. blue opq. glass eyes on corners, lightly w. L. 1.6 cm, w. 1.1 cm, perf. 4.5 mm. SK 25. Sample consists of white opq. glass. (Same as Pb-3463.)

6755 As above, lt. blue opq. eye. (Same as Pb-3464.)

6756 As above, porous white phase beneath blue eyes.

6757 Small drawn bead, Han Dyn. Med. blue transp., little or no w. One of a group of three. L. 6 mm, diam. 8 mm, perf. 3 mm. SK 3. (Same as Pb-3470.)
6768 Small drawn bead, Han Dyn. Dk. blue transp., little or no w. One of four beads. L. 4.5 mm, w. 6.0 mm, perf. 2.2 mm. SK 3. (Same as Pb-3471.)

6769 Small drawn bead, Han Dyn. Purple transp., little or no w. One of four beads. L. 5 mm, w. 4 mm, perf. 1.4 mm. SK 3. (Same as Pb-3472.)

6770 Small drawn bead, Warring States. V. p. blue, little or no w. One of a pair. L. 4 mm, diam. 4.7 mm, perf. 0.8 mm. SK 1. (Same as Pb-3473.)

6771 String of small beads, Han Dyn. Lt. bluish-green, very heavily w. String contains 199 beads, many of which are joined as groups of 2, 3, or 4. Diam. ~4.5 mm, perf. ~2.5 mm. SK 2. Sample consists of 10 individual beads.

6772 String of medium-sized beads, Han Dyn. Emerald green, heavily w. String consists of 153 donut-shaped beads. The green beads range in diam. from ~0.6 to 1.6 cm. There are several black spacer beads and one large central bluish-green turbid bead as made up. SK 19. Sample consists of 6 green beads. (Same as Pb-3465.)

6773 String of melon beads, Han Dyn. Yellow transp. with very thick enamel-like w. crusts. String consists of 118 beads. L. ~6 mm, diam. ~9 mm, perf. ~3.8 mm. SK 20. Sample consists of yellow glass from three beads. (Same as Pb-3466.)

6774 As above, buff-colored, enamel-like w. products removed from 4 beads.

6775 Small ring of glass (or bangle), Tang Dyn. or Six Dynasties (?). Med. blue transp., heavily w. with iri. Diam. of ring 4.9 cm; section of glass 3.5–5 mm. SK 7. (Same as Pb-3474.)

6776 Circular disk or gaming piece (small qi), Tang Dyn. or later. Turbid white glass with friable ivory-colored w. crust. Diam. 2.2 cm, t. 5 mm.

6777 Hairpin fragment, Song–Yuan Dyn. Lt. blue turbid rod, moderately w. Fragmentary l. ~9.8 cm, diam. 5–6 mm. SK 23.

6778 Hairpin fragment, Song–Yuan Dyn. Turbid purple, moderately w. Fragmentary l. ~8.8 cm, diam. ~7 mm. SK 23.

6779 Hairpin, Song Dyn. Straight rod drawn to beaded tip. Lt. blue opq., unweathered. L. 14.1 cm, diam. 5 mm.

6780 Hairpin, Ming Dyn.(?). Thick nail-like pin with heavy rounded head and drawn to a rounded point. Turbid white glass with thick brownish w. crust. L. 6.5 cm, max. diam. of head 1.2 cm, diam. of rod-like body ~7 mm. SK 17. (Same as Pb-3467.)

6781 Rectangular belt fittings, Ming Dyn. Turbid white with moderate w. and iri. One of two identical pieces, flat with some beveled edges. L. 5.1 cm, w. 3.7 cm, t. 7 mm. SK 21.

6782 Octagonal bar of Chinese purple, Han Dyn. Sintered, purple, little or no w. L. 2.2 cm, w. 7 mm. SK 16. (Same as Pb-3468.)

6783 Octagonal bar of Chinese purple, Han Dyn. Sintered, purple, little or no w. L. 4.0 cm, w. 9.5 mm. SK 16. (Same as Pb-3469.)
Non-Glasses

5847 Curved rod with spiraling, poss. from a bracelet; 6th–4th c. B.C. or later. Thought to be nephrite. ROM 933 x 84.14.

5880 Figure of a crouching (not crashing) boar with incised decoration; 3rd–4th c. Whitish stone with glaze and/or coating of altered stone, possibly produced by heating. Sp. gr. = 2.690. Now in collection of MMA.

5881 Small figure of a pig. Buff-colored w. surface over dense white body. CMG, Strauss no. A18; tag F.87.


5883 As above, sample removed directly from surface of pig. A-2.

5884 Bi, China, prob. Han. Flakes of friable white material recovered from package wrappings. Unknown material. B-1. Source as above.

5885 As above, minute sample removed directly from surface of bi. B-2.

7013 Carved Chinese pig, prob. Han Dyn. Coarse, white granular material with tan accretion in crevices on surface. Two painted eyes may be modern. Appears to have been previously sampled. L. 4.2 cm, h. 2.1 cm. CMG, ex-coll. J. Strauss, Strauss no. A18.

Note: See also Chinese Blue and Chinese Purple in Section XXIII C.

XV B. JAPAN; various dates.

Note: Some spellings may be inaccurate, as they were transcribed from a third party's flooded, handwritten labels.

208 Fragment of thin-walled, sake cup with two mold-blown eight-petaled chrysanthemum motifs; Edo Period, poss. Genroku Era (1688–1703), prob. from Nagasaki. P. bluish green glass, filled with disk-shaped bubbles. The object itself must have incipient crizzling because the analytical sample stored separately for some thirty years is crizzled. Said to have come from the mummy of Kuroda Tsunamasu (1659–1711). CMG 62.6.14. Blair J-15. See Refs. A-84, C-24, F-75, and examination notes by S. Koob. For similar objects see Ref. F-5. (Same as Pb-2390.)

440 Hollow bracelet, date uncertain, poss. 20th c. Dk. bluish-purple, no w. CMG 63.6.64. (D. Blair.)

6195 Shusenda Tomb, Abe, Hosaki, Nishi-takatsuki-son, Akaiwa-gun, Okayama Pref.; 4th c. or poss. a little later. Medium-sized nearly spherical bead (marudama). P. blue transp., highly-polished, little or no w. O.d. ~1.1 cm, l. ~1 cm, perf. ~2 mm. CMG 62.6.7III. See D. Blair, Ref. E-8, p. 361, plates 55–57.

6196 As above, a slightly smaller amber bead. Little or no w.

6197 As above, two of six small drawn beads (kodama) with ends ground flat. Lt. blue, slightly turbid, some surface erosion. Turbidity due to bubbles. L. ~2 mm, d. ~3 mm., perf. ~1 mm.
6198  Nara, 8th c. Medium-sized, flattened sphere bead. Dk. blue transp., surface erosion. L. ~4 mm, diam. 7–9 mm, perf. ~1 mm. Blair J-2.

6199  Higashi-Karube, Karube-son, Akaiwa-gun, Okayama Pref.; 250–650. Medium-sized, nearly spherical bead. Dk. blue transp., little or no w. L. ~4 mm, d. ~6 mm, perf. ~0.8 mm. Blair J-1.


6150  Tahori, Uichanggun, tomb (from basket beneath coffin); 1st c. B.C. Small wound bead, donut shaped. Em. green, heavily w. with black crust. L 1. 53.0% PbO. (Same as Pb-2300.)


6152  As above. Medium wound bead, donut shaped. Dk. green transp., moderately w. L 2-86-2. (Very similar to 6151.) 72.4% PbO. (Same as Pb-2301.)

6153  As above. Large drawn bead, cylindrical. Blue opq., lightly w. L 2-86-3. 37.5% PbO. (Same as Pb-2301.)

6154  As above. Large drawn bead, tapered slightly, ground to rectangular section. P. green transp., little or no w. L 2-87-1. (Same as Pb-2316.)

6155  Choyangdong, Kyungju, tomb; 1st c. Small drawn beads. Dk. blue transp., lightly w. L 3. (Two identical beads combined for sample.)


6157  As above. Medium, cylindrical drawn bead. Med. blue transp., moderately w. L 4-2.

6158  Hwangnamdong, Kyungju, Great Tomb No. 98 (The Queen’s Tomb); 5th c. Carved object. Said to be jade. Transp. amber color. L 11. (Same as Pb-2320.)


6160  Hwangodong, Kyungju, tomb; 5th–6th c. Medium-sized spherical bead. Dk. blue transp., lightly w. L 13. (One of two joining fragments.)

6161  Dukchonri, Wolsung, kiln site; 6th c. (?). Chunk of cullet or waste glass. Dk. green opq., somewhat frothy, some w. scum. L 16.

6162  Iksan, Miruk Temple, beneath stupa; 7th c. or earlier. Lump of heavy, brownish turbid glass, heavily w. on surface. L 17. 72.2% PbO. (Same as Pb-2311.)

6163  Tomb of King Muryung; ca. 523. Medium-sized drawn bead (nearly spherical). Muddy yellow opq., moderately w. L 4 mm, w. 4 mm. wide perf. L 14.

6164  As above. Fragment. Orange transp., little or no w. L 14.
6165  As above. Small drawn bead. Med. blue transp., little or no w. D. 3 mm, w. 1.2 mm, perf. 1.5 mm. L 14.

6166  As above. V. small seed bead. Orange opq., little or no w. D. 1.8 mm. L 14. (Same as Pb-2317.)

6167  As above. Green turbid, little or no w. D. 3 mm. L 14. (Same as Pb-2318.)

6168  As above. Yellow turbid, little or no w. D. 1.0 mm. L 14. (Same as Pb-2319.)

6169  As above. Black, little or no w. D. 1.2 mm. L 14.

6170  Yangdong, Kimhai; 2nd–3rd c. Small, short, drawn bead. Med. blue, lightly w. D. 2.5 mm, l. 1.9 mm, perf. 1.8 mm. L 5.


6173  As above, but from a different tomb. Small, short, drawn bead with flattened ends. Med. blue, moderately w. D. 3.5 mm, l. 1.8 mm, perf. approx. 2 mm. L 7-2.


6175  As above. Dk. blue transp., moderately w. E-II-2. L 10-2.

6176  Dogaedong, Changwon, Tomb no. 22.; 4th–5th c. Medium-sized, short, drawn bead, with sides flattened to form almost square cross-section; ends ground flat. Dk. blue transp., heavily w. W. 5 mm, l. 2.5 mm, perf. 2.0 mm. L 8-1-1.


6178  Dugoodong, Pusan; 6th c. Medium-sized, short, drawn bead. Med. blue transp., lightly w. D. 4.5 mm, l. 2.5 mm, perf. 1.3 mm. L 19.

6179  No provenance, from Taepyongyang Museum. Seed beads. Dk. blue, little or no w. L 18. 4.12% PbO. I-S. Lee, 8/18/88. (Same as Pb-2302.)


6188  Small beads, spherical with indentations; date uncertain: Chosun Dynasty, 14th c. or later. P. amber, unweathered. Removed from the chin strap of a gentleman’s hat. Collected by D. Blair. CMG 61.6.3.

6189  Mineral conglomerate, Bongdam-dong, Hwasunggun, Kyunggido, Korea. Described as coming from a “lead-zinc-barite” mine. Specimen consists of two well-crystallized phases growing in close contact. One appears to be galena, the other is a white phase. Sample is of white phase. I-S. Lee, 8/18/88.

6191 As above, fragment of a large round bead. Lt. blue transp., lightly w. Blair K-2. (Same as Pb-2304.)

6192 As above, fragment of a large bead, poss. cylindrical with impressed or tooled longitudinal grooves. P. blue turbid, lightly w. Blair K-3.

6193 As above, fragment of a medium-sized (?) rounded bead. Colorless, lightly w. Blair K-4. (Same as Pb-2305.)

6194 As above, probably same source but box label lost in flood. Small wound bead with protruding tips as if from a coil. P. olive, moderately w. and worn. D. ~5 mm, w. ~1.5 mm, perf. ~1.5 mm. Blair K-5.

XV D. INDONESIA (INCLUDING SUMATRA, JAVA, BALI, AND KALIMANTAN).


2910 Small drawn seed beads. Colorless. Samples consists of six complete beads. (McK 8.75.)

2911 Medium-sized drawn beads. Black. Samples consists of six complete beads. (McK 8.75.)

2912 Small drawn seed beads. Black. Sample consists of ten complete beads. (McK 8.75.)

2913 Medium-sized drawn beads. Yellow opq. (muddy, turbid). Sample consists of six beads. (McK 8.75.)

2914 Small drawn seed beads. Yellow opq. (muddy, turbid). Sample consists of ten complete beads. (McK 8.75.)

2915 Small drawn seed beads. Grayish, yellowish, amber. Sample consists of fourteen complete beads. (McK 8.75.)

2916 Small drawn seed beads. Bluish-green turbid. Sample consists of fourteen complete beads of the most transp. examples. (McK 8.75.)

2917 Small drawn (mutisalah) seed beads. Red opq. Sample consists of fourteen complete beads. (McK 8.75.) H25 (or 425?), 18/8/74. Lapangan Sekolah.

2918 Medium-sized (mutisalah) seed beads. Red and orangish-red opq. Sample consists of ten complete beads. (McK 8.75.) Lapangan Sekolah.

2919 Disk-shaped (mutisalah) wound beads. Red opq. Sample consists of two complete beads. Diam. ~8 mm, t. ~2 mm, perf. ~2 mm. (McK 8.75.)


2923 Base of vessel with pontil mark. Smoky with striations, moderately w. KC04, location 1. 1974–76.


2925 Neck and shoulder of small bottle. Colorless, moderately w. KC03, location 1.

2926 Bangle fragment. White opq., lightly w. S1.T4.E0.60, 22/2/76. (Same as Pb-2076.)

2927 Large barrel-shaped bead. Yellowish turbid, surface w. (Same as Pb-2077.)

2928 Spherical bead. Dense yellow opq., unweathered. Same lot as above. (Same as Pb-2078.)

2940 Base of small bottle (?) with molded vertical ribs and shallow pontil mark. Grn. aqua, bubbly, with “waxy”, eroded surface.

2941 Base of bottle (?) with concentric molded rings; shows beginning of molded pattern on sides and shallow pontil mark. Grn. aqua with some bubbles, moderately w., KC78, location 3.

2942 Base of small vessel with molded, dimpled design on sides and shallow, pointed kick. Dk. green with few bubbles, moderately pitted and eroded. Location 3.

2943 Base of small vessel with molded pattern on side and pontil mark. P. amber glass with some bubbles, lightly w. Location 1, Trench 1, .070; 2/3/75.

2944 Base of small vessel, apparently not molded, with shallow, pointed kick. Green, bubbly, with iri. and w. scum. Location 1.

2945 Base of small vessel with pontil mark. P. amber with some bubbles, moderately w. with white w. products. Location 1.


2947 Rim of thin-walled vessel. Bl. aqua, bubbly, some elongated bubbles, lightly w. and eroded. Location 1.

2948 Rim of thin-walled vessel. Colorless, bubbly, lightly w. and eroded. Location 1.

2949 Rim of thin-walled vessel. P. yellowish, bubbly, lightly w. and eroded. (1-01-E), Inv. 0.60; 1/5/76.

2950 Rim of thin-walled vessel. Top leads into shoulder which tapers inward, shoulder lightly pattern-molded. V. p. yellowish, bubbly, lightly w. and eroded.

2951 Rim of thin-walled vessel. Rim is thickened and squared off in profile and differs slightly from others in this group. Colorless, heavily w. Location 1, Trench 5; 13/7/75.

2952 Wall of very thin-walled, prunted vessel, prob. a beaker. Colorless with iri. and some erosion. Fragment joins two other larger pieces. Location 1.

2953 Wall of thin-walled vessel with wheel-abraded grooves and cross-hatching. Colorless with light iri. Location 1.
2954 Wall of thin-walled vessel. Dk. amber with some bubbles, light w. scum. Resembles many other fragments in this collection. Location 1.

2955 Wall of tapered bottle with vertical ribbing. Dk. brownish amber, moderately w. (1-01-E), Inv. 0.60; 1/5/76.

2956 Base with deep kick, heavy, rolled-over edge, and pontil mark. Colorless with a few large bubbles, heavy iri. Traces of body glass joining the base appear to have been broken off uniformly as if grozed intentionally.

2957 Rim of thin-walled vessel. Colorless with applied blue ring. Sample is of p. blue glass with elongated bubbles, heavily w. and iri.

2958 As above, colorless glass.

2959 Fragment of thin-walled vessel, poss. with molded design. Dk. blue transp. with heavy w. scum.

See also Section XXVI B. Miscellaneous Metals, no. 2909.


6550 Pincered base fragment of vessel. Dk. blue transp., lightly w. No. LBT/P/[illeg.]


6556 Rim and wall fragment resembling Roman ribbed bowl. P. bl. aqua, somewhat turbid glass with numerous large, horizontally-elongated bubbles and several dark streaks. McK. no. 1. (Found immediately west of Candi Gumpung on path to Candi Gedong.)

6557 As above. A somewhat similar specimen found in front of Candi Kedaton. McK. no. 21.

6558 As above. Base fragment. Smoky glass with two purplish streaks, little w., but wear marks on bottom. McK. no. 7.

6559 As above. Flared rim fragment. Green, lightly w. McK. no. 4.

6560 As above. Rim fragment with deep vertical ribs approaching edge. Brt. blue transp., moderately w. McK. no. 2.

6561 As above. Wall fragment. P. yellowish, moderately w., with numerous spherical bubbles. McK. no. 16.

6562 As above. Small nugget of slag or waste with many seed beads fused together. Black, with a few patches of red opq., moderately w. Preserves flattened surface with relict seed bead forms. McK. no. 9.
6563 Oval base fragment of a tall, thin-walled bottle with pontil mark. Found with Ming blue and white stonewares. Yellowish green glass, some w. scum, several bubbles and one large flat blister. Reconstructed bottle: H. ~23.5 cm, w. ~11.5 cm, with long, thin neck described as collared or onion shaped. (Found upstream from Jambi.) Sample courtesy Mr. Abu Ridho, formerly of the National Museum, Jakarta.


6565 Bangle fragment with triangular section. Dk. blue, lightly w. Apparent original i.d. ~5.5 cm, thickness ~7 mm. Found at foot of Bukit Selindung (White Sand location). Similar to bangles found inside bronze kettle drums. Probably prehistoric, but disturbed upper level contains Yuan/Qing ceramics. Samples courtesy Mr. Hartati of the Musium Negeri Kalimantan Barat. (Same as Pb-2500.)

6566 As above, another example. (Same as Pb-2501.)

6567 Bukit Selindung (Hidden Valley location.) A bead found inside one of a pair of bronze kettle drums of the Dongson Heger Type 1. Large spherical bead. Black glass, eroded surface. D. ~1.3 cm. (Same as Pb-2502.)

6568 As above. Medium spherical bead. P. purp. transp., heavily w. D. ~4 mm, l. ~3 mm. (Same as Pb-2503.)

6569 As above. Medium spherical bead. Red opq., heavily w. D. ~4 mm, l. ~3 mm. (Same as Pb-2504.)

South Sumatra: Kotamadya Palembang. Kambang Unglen; prob. 14th–16th c. (E. Edwards McKinnon.)

6570 Chunk of cullet or waste from possible glassworking site. (From near a brick floor covered with fine riverine sand.) Dk. greenish blue transp., lightly w. McK. no. 17(?)

6571 As above, chunk of red opq. waste glass, moderately w. McK. no. 19.

6571a As above, blue-banded zone.

6572 As above, large “false gold-glass”, ellipsoidal bead. Yellowish amber glass over silver(? foil, moderately w. in places, longitudinal bubbles. D. ~1.2 cm, l. ~1.3 cm, perf. ~3 mm.

6573 As above, a similarly shaped and sized bead. Med. blue transp., surface erosion, longitudinal bubbles.

6574 As above. Half of a long, biconical, polychrome bead. Lt. green opq. glass with red opq. and white opq. longitudinal spirals, heavily w. D. at middle ~7 mm, d. at end ~5 mm, l. (half of original) ~1.7 cm, perf. ~2 mm. Sample is of green glass.

6574a As above, blue glass.

6575 As above, white opq. glass.

6576 As above, red opq. glass.

6577 As above, yellow opq. glass.

6578 As above. Large cylindrical bead. Black glass with straight longitudinal surface bands of white opq. glass. D. ~9 mm, l. ~9 mm, perf. ~2 mm. Sample is of black glass.

6579 As above, white opq. glass.
6580 As above. Medium drum-shaped bead. Orange opq., moderately w. D. ~8 mm, l. ~6 mm, perf. ~2 mm.

6581 As above. Tubular bead. Red opq., lightly w. L. ~1.2 cm, d. ~2.8 mm, moderate perf.

6582 As above. Medium-sized polychrome bead. White opq. glass with longitudinal beads of green transp., yellow opq., and white opq., little or no w. D. ~8 mm, l. ~7 mm, perf. ~1.1 mm.

South Sumatra: Kab. Ogan Komering Ilir; Air Sugihen; poss. 6th–7th c. (E. Edwards McKinnon.)

6583 As above, green transp. glass.

6584 As above, yellow opq. glass.

6585 As above, red opq. glass.

6588 Tubular bead fragment. P. yellow opq., lightly w. L. ~1.1 cm, d. ~2.8 mm, wide perf.

6588a As above, a flake of yellow opacifier.

6589 Fragment of large melon bead. P. green turbid glass, lightly w. Original d. ~1.0 cm, l. ~9 mm, perf. ~2.5 mm.

South Sumatra: Kab. Ogan Komering Ilir; Air Sugihen; poss. 6th–7th c. (E. Edwards McKinnon.)

6590 Nearly flat fragment with millefiori inlay on v. slightly convex surface. Dk. blue transp. glass with floral design; yellow, red, and white opq. bullseye surrounded by short, radiating, alternating bands of white opq. and dk. blue transp. bands. D. of floral motif ~1.2 cm. Sample is of dk. blue glass field.


6591 As above, white opq. glass. Not yet analyzed.

6592 As above, yellow opq. glass. Not yet analyzed.

6593 As above, red opq. glass. Not yet analyzed.

6598 Tubular bead fragment. P. yellow opq., lightly w. L. ~1.1 cm, d. ~2.8 mm, wide perf.

6598a As above, a flake of yellow opacifier.

2930 Medium-sized rectangular bead. Greenish-blue trans., worn. L. 1.3 cm, t. 6 mm, perf. 1 mm.

2931 Large cylindrical bead. Yellow opq L. 1.7 cm, diam. 5.5 mm, perf. 1 mm.

2932 Medium-sized cylindrical bead. Red opq. L. 6 mm, diam. 5 mm, perf. 1 mm.

2933 Medium-sized drawn bead. Terra-cotta colored. Diam. ~5 mm.

2934 Medium-sized, near-spherical bead. Black, worn, ends ground flat. Diam. 9 mm.

West Java: Kab. Serang. Banten Girang; ca. 9th–16th c. (E. Edwards McKinnon.)

2920 Large, “scalloped” bead. Blue opq., probably stone. From NW corner of settlement. (12/6/83.)


6520 Split fragment of medium-sized cylindrical bead. Grayish green turbid base glass cased with red opq. L. ~7 mm, d. ~6 mm, narrow perf. Sample is of grayish green glass.

6521 As above, red opq. glass.
6522 Fragment of medium-sized donut bead. Yellow opq. glass, lightly w. D. ~7 mm, l. ~5 mm, perf. ~1 mm. West Java: Kab. Karawang, Buni complex; early 1st millennium. (E. Edwards McKinnon.)

6526 Fragment of large biconical bead with hexagonal cross-section. Med. blue transp., moderately–heavily w. L. ~2 cm, w. ~1.7 cm, uneven perf. Bali: Gilimanuk; prehistoric. (E. Edwards McKinnon.)

6540 Short cylindrical bead. Dk. blue transp., moderately w. D. ~6 mm, l. ~5 mm, perf. ~1 mm. Sector XXXIX.

6541 Short cylindrical yellow opq. bead, moderately w. D. ~5 mm, l. ~4 mm, perf. ~1.2 mm. Sector XLI.

6542 Small drawn seed bead. Lt. blue turbid glass, moderately w., v. bubbly. D. ~2.7 mm, l. ~1.2 mm, perf. ~1 mm. Sector XXXIX.

6543 Small red opq. bead, moderately w. D. ~4.2 mm, l. ~4 mm, perf. ~0.8 mm.

6544 Bali, no further provenance; said to be pre-1600 (?). Small, ellipsoidal bead with lozenge-shaped cross section. Ruby glass, unweathered. From W. G. N. van der Sleen 10 or 11/67. vds no. 22. L. 4.5 mm, w. 4.0–5.3 mm, perf. 1.5 mm. (Same as CMG 1072.)

6545 Other sites; various dates. (E. Edwards McKinnon.)

2935 Aceh: Lhoksuemawa. Samudera-Pasai; 13th–16th c. Rim of vessel. Turbid blue with two yellow opq. threads, lightly w. (2/75.)

2936 As above. Decorated bangle. Black with green opq. and white opq. decoration. Sample consists of black glass. (2/75.)

2937 As above. Decorated bangle. Yellow opq. with red opq. and white opq. decoration. Sample consists of yellow opq. glass.

2938 As above. Decorated bangle. Black with yellow opq. and red opq. decoration. Sample consists of black glass. (2/75.)

2939 South Sumatra: Palembang. Lebak Keranji; 14th–16th c. Cylindrical beads, coarsely made. Brick-red opq. glass. Average l. 1.2 cm, average diam. 3 mm.

2960 North Sumatra: Kab. Langkat, Kec. Hamparan Perak, Kota Rentang; 12th–16th c. Base of small vessel. Base is flat, solid, with raised foot ring and v. shallow pontil mark. Dk. blue turbid glass with many fine bubbles, little or no w. Found with fragment of jade bracelet. (1971.)

2962 Aceh: Kab. Aceh Utara, Kec. Matangkuli. Matangkuli. Thin-walled bowl, cracked, with part of rim missing. P. green with somewhat turbid "waxy" appearance, many fine waxy bubbles, a few large bubbles, and several black inclusions. Pontil mark contains some yellow opq. glass. Paper label says: "Found with blue and white wares. Therefore probably 15th c. (1973)". The appearance of this glass is very much like that of 2964 and it could well have the same origin.

2963 As above. Minute sample of yellow opq. glass from pontil mark. No chemical analysis. (Same as Pb-2079.)

2964 Aceh: Kab. Aceh Utara, Kec. Matangkuli. Matangkuli. Small aeolipile-like blown glass object. Turbid green with "waxy" feeling, little or no w. Thought to be contemporaneous with no. 2962.

2965 South Sumatra: Palembang, Talang Kikim (Seberang); prob. 8th-9th c. Base and wall of blown vessel with protruding pontil mark. P. olive, moderately w.

2968 As above. Rim of a thin-walled blown bowl(?). V. p. yellowish green with small spherical seed. A surface find, but found in association with Chinese ceramic sherds of the 10th c.

2969 As above. Rim of thin-walled blown bowl(?). Purple with small spherical seed, unweathered. Found with 2968.

South Sumatra: Kotamadya Palembang. Kambang Unglen; prob. 14th-16th c. (P. Manguin, IPPAN.)

2880 Nugget of cullet. Aqua, lightly w.

2881 As above. Nugget of waste glass. Grn. blue transp., moderately w.

2882 As above. Nugget of waste glass, consisting of numerous beads fused together. Bright red opq., moderately w.

2883 As above. Fragment of large bead with wide perf. Grn. blue transp., lightly w.

2884 As above. Medium drum-shaped bead. Med. blue transp., lightly w. One of two similar fragments.

2885 As above. Spherical bead with drilled perf., glass or rock crystal(?). Colorless, some surface spalling.

2886 As above. Large spherical(?) eye bead, stone or devit. glass(?). Dark surface over gray-buff interior.

2887 As above. Rim of small vessel, thick with narrow mouth. Brt. green transp. moderately w., internal cracking.

2888 As above. Vessel fragment, poss. distorted by accidental firing. Med. blue transp., moderately w.

2889 As above. Flaring rim fragment. Purple, moderately w.

2890 As above. Cullet or possibly fragment of a large vessel. Purple, lightly w.

South Sumatra: Palembang, Talang Kikim (Seberang); prob. mostly 8th-10th c. (P. Manguin, IPPAN.)

2891 Nugget of cullet. P. aqua, lightly w.

2892 As above. Colorless, lightly w., some devit.
2893  As above. Green transp., lightly w., rounded by firing.
2894  As above. Med. blue transp., moderately w. Some internal cracking.
2895  As above. Brownish purple, lightly w.
2896  As above. Medium-sized cylindrical bead. Lt. blue transp., lightly w.
2897  As above. Medium-sized, drawn cylindrical bead. Black interior with thin orange opq. casing, lightly w. Sample consists of black glass.
2898  As above, orange glass. (Not yet analyzed.)
2899  As above. Distorted bi-colored pad, probably for making cased beads. Green opq. with colorless casing, lightly w. Sample consists of green glass.

**XV E. SARAWAK; date uncertain.**
(T. Harrisson, SarM.)

*Various sites*

503  Large wound spherical bead. Lt. blue transp., bubbly, little or no w. Diam. ~1.2 cm. A-1.
504  Large spherical bead. Brt. blue transp., little or no w. A-2.
518  Small bead(?). Lt. blue transp., little or no w. B-4.
523  Large bracelet with some ground surfaces. P. green transp., lightly w. or eroded. C-5.

592  Tiny glass elephant, Bukit Maras, Santubong, Sarawak River Delta excavations; apparently 700–1100. Green transp. From context containing Indian artifacts.

5540  Large “Indian red” bead. Brick-red opq., lightly w., heavy wear. Nearly spherical, with ground ends. Diam. 1.2 cm. (Same as Pb-2085.)
5541  Large cylindrical bead. Lt. blue opq., moderate wear. L. ~1.2 cm, diam. 1.1 cm, perf. 2.2 mm.
5542  Large cylindrical bead, slightly flattened. White opq. glass (or poss. stone?), moderate wear. L. 1.8 cm, diam. 1.0 cm, perf. 3 mm.

*Kenyah bark-coat (or hat?)*

These small beads came from a coarsely-woven garment decorated with thousands of brightly colored beads strung onto surface cords. Most, if not all, are drawn beads. The garment was also decorated with various types of small, corroded brass or bronze bells, and a few small, sectioned cowrie shells. CMG Study card no. 418 or 419.

5610  Small short-cylinder beads (two combined). Lt. blue turbid. D. ~3 mm, l. ~3 mm, wide perfs.
5611  Small short-cylinder or donut beads (five combined). Dk. blue transp. D. ~3–4 mm, l. ~2–3 mm, variable perfs.
5612  As above, another group of six.
5613  Small short-cylinder beads (three combined). V. dk. purple. D. ~3 mm, l. ~3 mm, variable perfs.
5614 Small short-cylinder or donut beads (three combined). Dk.-med. blue transp. with numerous faint, thin, longitudinal white opq. stripes. D. ~3 mm, l. ~2 mm, medium perfs.

5615 As above, another group of three.

5616 Medium short-cylinder beads (four combined). Dense white opq. D. ~3-4 mm, l. ~3 mm, medium perfs.

5617 As above, a group of somewhat smaller beads (eight combined). Dense white opq. Smallest: d. ~2.5 mm, l. ~2 mm, medium perfs.

5618 Small short-cylinder beads (four combined). Yellow opq. D. ~3 mm, l. ~2.5 mm, medium perf.

5619 As above, a group of somewhat smaller beads (six combined). Yellow opq. Smallest: d. ~2 mm, l. ~2 mm, medium perf.

5620 Small short-cylinder beads (six combined). Red opq. casing over colorless core. D. ~2.5-4 mm, l. ~2-3 mm, medium to wide perfs. Sample is of red opq. casing.

5621 As above, colorless core.

5622 Small short-cylinder beads (two combined). Pink transp. casing over white opq. core. Pink glass shows extensive internal cracking. D. ~3.5 mm, l. ~3 mm. Sample is of pink casing.

5623 As above, white opq. core.

5624 Medium donut beads (two combined). Ruby casing over yellow opq. D. ~6 mm, l. ~4 mm, medium perf. Sample is of ruby glass.

5625 As above, yellow opq. core.

5626 Small donut beads (one of four). Black, light material, possibly jet(?). D. ~3 mm, l. ~2.3 mm, small-medium perf.

XV F. THAILAND


2986 Long square bead (Beck type IX. D. 2b), medium-large sized. V. p. aqua, moderately w. IAL no. 6895.

2987 Long hexagonal bead, large sized. P. aqua, moderately w. IAL no. 3410.

2988 Standard square bead (Beck type IX. C. 2f), medium-sized. Colorless, moderately w. IAL no. 5674.

2989 As above. Colorless, moderately w. IAL no. 5681.

2990 As above. V. p. amber, moderately w. IAL no. 1430.

2991 Spherical bead, medium-sized. Colorless, heavily w. IAL no. 804.

2992 Donut bead, medium-sized. Green transp., moderately w. IAL no. 3043.

2993 Short drawn bead. Bluish green transp., lightly w. IAL no. 4434.

2994 Seed bead. Dk. blue transp., lightly w. IAL no. 3858.

2995 Seed bead. Red opq., moderately w. IAL no. 6072.

2996 Seed bead. Black, lightly w. IAL no. 6171.

2974 Seed bead. Lt. blue transp., moderately w. IAL no. 3843.
2975  Seed bead. Red opq., lightly w. IAL no. 6076.

2976  Seed bead. Red opq., lightly w. IAL no. 6089.

Ban Chieng; dates uncertain


1942  Medium-sized biconical bead. Bl. green transp., lightly w. and eroded. From Piriya Krairiksh, “Thai Fine Arts Dept”.

1943  Large biconical bead, said to be 1st c. B.C. Dk. blue turbid, lightly w. and eroded. Purchased by DPL in Bangkok, 1/89.

Khuan Luk Pat, Khlong Thon District, Drabi Prov.; 1st c. B.C.–2nd c. A.D. (4/6/93.)

1946  Small drawn bead. Lt. blue transp., worn or eroded. L. 3.0 mm, d. 4.3 mm, perf. 1.3 mm.

1947  Small drawn bead. Dk. blue transp., fractured, worn or eroded. L. 3.8 mm, d. 5.2 mm, perf. 0.6 mm.

1948  Small drawn bead. Yellow opq., worn or eroded. L. 3.5 mm, d. 5.0 mm, perf. 0.8 mm.

1949  Small drawn bead. Orange opq., heavily w. to terra-cotta-like appearance. L. 2.8 mm, d. 3.6 mm, perf. 1.1 mm.

XV G. VIETNAM; various dates.

These samples were collected by Prof. Benedek in Jan. and Feb. 1994 in the company of the late Dr. Nguyen Truyen Ky, who provided the dates. The locations are given in the sequence: village, municipality, district, province. Most of the glasses are at least moderately eroded, and many of the wound beads have a reddish residue of parting agent on the surfaces of the perforations. Spellings and diacritics here are as provided by Prof. Benedek.

Óc Eo, Trung Son, Vong Thê, Thoai Son, Tinh An; poss. 1st millennium B.C.

This site measures about 14 x 12 m and is in a vegetable patch in front of a small bamboo shelter. It is located in a vast rice field which stretches to the Mekong River some 20 km away.

Site 1a

6425  Small drawn beads. Red opq., lightly w. and/or eroded. Sample is of six beads combined. D. ~2.5 mm, l. ~2 mm, perf. ~1 mm.

6426  As above, six other red beads.

6427  As above, another six red beads.

6428  As above, six thin-yellow opq. beads. (Similar to Pb-3430, Pb-3431, and Pb-3432.)

6429  As above, six lt. blue transp. beads.

6430  As above, another six lt. blue transp. beads.

6431  As above, five somewhat larger black beads.
Site 1b

6440 Nugget of waste glass. Greenish blue transp., w. and heavily eroded.

6441 Nugget of cullet, preserving flat surface as if from the top of a crucible melt. Brt. blue transp., moderately w. and eroded.

6442 Medium-sized biconical bead. Colorless, turbid, heavily w. Max. d. 9 mm, l. 6 mm, tapered perf.

6443 Ellipsoidal bead with square section. P. green, moderately w. Apparent original l. ~1.6 cm, t.~5 mm.

6444 Medium–large bead fragment, prob. a flattened sphere. Brt. blue transp., moderately w.

6445 Medium-sized cylindrical bead with rounded edges. P. yellow opq., contains metallic inclusions, moderately w. D. ~7 mm, l. ~6 mm, perf. ~1 mm. (Same as Pb-3433.)

6446 Medium-sized round, partially-deformed bead. Lt. grn. opq., moderately w. D. 6 mm, l. 6 mm.

6447 Medium–large melon bead with cut grooves, prob. rock crystal. Drilled perforations from opposing sides do not meet. Abrasive and/or drilled material remains embedded in perforations.

6448 Medium-sized round bead. Black, heavily worn and eroded surface. D. ~1.0 cm, l. ~8 mm, perf. misshapened.

6449 Medium-sized flattened, collared bead. Med. blue opq., worn and eroded surface. L. 1.1 cm, t. 5 mm and 9 mm, distorted perf. 1.2–1.8 mm.

Lam Son, Lộc Châu, Bao Lộc, Lâm Đồng.
(2/23/94.)

These beads were excavated by N. T. Ky on 1/12/94. They were found on the neck of a skeleton of a member of the Ma tribe. They are thought to date from the 16th–18th c.

Site 2

6460 Medium-sized round (wound?) bead. Colorless, two large stones, moderately w. D. 7 mm, l. 6 mm, perf. 3.5 mm.

6461 As above, slightly larger, with pronounced pull-off threads on each end.

6462 Large round wound bead, sl. flattened on one side. Grn. blue transp., heavily w. D. 1.3 cm, l. 1.1 cm, perf. 2.5 mm.

6463 Medium-sized round, wound bead, pull-off threads on each end. Bluish green, moderately w. D. 8 mm, l. 7 mm, perf. 3 mm.

6464 Medium-sized round, wound bead; one of a pair once joined at their ends around one quarter of the perf. Green transp., lightly–moderately w. D. 9 mm, l. 6 mm, perf. 4–5 mm.

6465 Medium-sized round, wound bead, pull-off thread on one end. Similar to those above. Amber glass, lightly–moderately w. D. 8 mm, l. 8 mm, perf. 2.5 mm.

6466 Medium-sized wound, donut bead, pull-off thread on one end; one of a pair jointed at their ends. (The other is more nearly round.) P. blue transp., lightly w. D. 8 mm, l. 5 mm, perf. 3 mm.
6467 Medium-sized round, wound bead. Lt. blue opq., lightly w. D. 8 mm, l. 7 mm, perf. 1.0 mm.

6468 Small round, wound bead, pull-off thread on one end. White opq., lightly w. D. 5 mm, l. 4 mm, perf. 1.0 mm.

6469 Small round bead. Brt. red opq., little or no w. D. 4 mm, l. 4 mm, perf. 1.0 mm.

Làng Vac, Nghia Dan, Nghệ An. (2/23/94.)

Site 3

6420 Earring or bracelet fragment, flat; date not given. Green transp. glass with ground surface(?). Flat triangular section. Grave no. 45. Excavated in 1981. Original i.d. ~5 cm, o.d. ~8 cm, t. at i.d. 5.5 mm. No. LV01.

6421 As above, a fragment with thicker triangular section. Grayish blue transp. glass with crizzl. surface. Original i.d. ~8 cm, o.d. ~9 cm, t. at i.d. 1.45 cm. No. LV31 N4M95(?).

Thi Xa, Lào Cai. (2/23/94.)

These beads were among artifacts found in a bronze drum which rolled out of a sandy embankment of the Ha River in 1993. N. T. Ky believed they date from about the 1st c. The drum also contained earrings, bracelets, shin ornaments, and bronze axes.

Site 4

6475 Seed bead. Dk. blue transp., little or no w. D. 2 mm, l. 1.5 mm, perf. 0.8 mm. (Same as Pb-3440.)

6476 Seed bead. Red opq., little or no w. D. 2 mm, l. 2 mm, perf. 1.0 mm. (Same as Pb-3441.)

6477 Small bead. Yellow opq., lightly w. D. 4 mm, l. 2 mm, perf. 1.0 mm. (Same as Pb-3437.)

6478 Small, cylindrical bead with sharp edges. Material unknown; apparently a copper-containing mineral or corroded copper. Lt. green opq. D. 3 mm, l. 1.5 mm, perf. 1.0 mm.

6479 Small bead. Yellow opq., lightly w. D. 4 mm, l. 2 mm, perf. 1.0 mm. (Same as Pb-3437.)

6480 Medium-sized, round, drawn bead. P. aqua, crazed surface. D. 7 mm, l. 5 mm, perf. 2–3 mm.

6481 Small, cylindirical, drawn bead. Bl. aqua, turbid, lightly w. D. 4 mm, l. 3 mm, perf. 2 mm.

6482 Small–medium, round, mineral bead. P. amethyst with plane containing small greenish-black crystals. D. 5.5 mm, l. 4.5 mm, drilled(?) perf. 0.7 mm.

Lac Xuan, Don Duong, Lam Dong. (2/23/94.)

These artifacts were excavated on 1/12/94. They came from graves of the K’Ho and Ru tribes. N. T. Ky dated them as 16th–17th c.

Site 6

6450 Medium-sized, round, wound bead. Aqua, moderately w., pull-off thread on one end. D. 8 mm, l. 5.5 mm, perf. 3.0 mm.

6451 Medium-sized, round, wound bead. Lt. blue opq., little or no w. D. 7 mm, l. 5 mm, perf. 1.5 mm.
6452 Medium-sized, round, wound bead. White opq., pull-off thread on one end, little or no w. D. 7 mm, l. 5 mm, perf. 2.0 mm.

6453 Medium-sized, ellipsoidal, wound bead. Dk. blue transp., pull-off threads(?) on both ends, little or no w. D. 7.0 mm, l. 9.5 mm, perf. 2.0 mm.

6454 Medium-sized, ellipsoidal, wound bead. White opq., little or no w. D. 6.0 mm, l. 8.0 mm, perf. 1.3 mm. (Same as Pb-3438.)

6455 Medium-sized, wound, donut bead. Black (v. dk. olive), heavily w., v. bubbly. D. 8.7 mm, l. 4.0 mm, off-center perf. 3.5 mm.

6456 Small, round, wound bead. Pink transp., lightly w., v. bubbly. D. 4 mm, l. 2 mm, perf. 1.0 mm.

6457 Small, cylindrical, drawn bead. Brt. red opq. casing over red transl. core, no w.; ground on both ends. D. 3 mm, l. 3 mm, perf. 0.8 mm. Sample is of brt. red glass.

6458 As above, more orangy core.

6459 Small, drawn, donut bead. Black (v. dk. olive?), lightly w.(?). D. 3 mm, l. 1.5 mm, perf. 1.0 mm.

6460 Small, drawn, donut bead. White opq., lightly w. D. 4.0 mm, l. 2.0 mm, perf. 1.2 mm. (Same as Pb-3439.)

6461 As above, another white opq. bead.

6462 Small, drawn, donut bead. Yellow opq., little or no w. D. 2.3 mm, l. 1.7 mm, perf. 0.7–1.0 mm. (Same as Pb-3434.)

6468 Small, drawn, donut bead. Lt. green opq., lightly w. D. ~2.5 mm, l. ~1.2 mm, perf. ~0.7 mm. (Same as Pb-3435.)

6489 V. small seed bead. P. blue turbid, little or no w. D. 1.4 mm.

6490 V. small seed bead. Dk. blue opq., little or no w. D. 1.2 mm.

6491 V. small seed bead. Lt. blue opq., little or no w. D. 0.8 mm.

6492 V. small seed bead. White opq., little or no w. D. 1.1 mm.

6493 V. small seed bead. Yellow opq., little or no w. D. 0.9 mm. (Same as Pb-3436.)

6494 V. small seed bead. Lt. green opq., little or no w. D. 1.1 mm.

6495 V. small seed bead. Red opq., little or no w. D. 1.0 mm.

Ma Yuong, Duc Pho, Pho Thanh, Quang Ngai. (1/17/94.)

Excavated by N. T. Ky and D. Benedek 1/17/94. Two test trenches yielded no glass but one white ceramic bead believed to be from the Sa Huyinh culture was found.

Site 7

6499 Fragment of cylindrical bead. Soft white, mineral, poss. with remains of a glaze or burnish. Diam. 7 mm, l. 4 mm, drilled perf. 2.5–3.0 mm.
XV H. PHILIPPINES (Botel Tobago, etc.); various dates. (D. Benedek, UGa.) See Ref. C-19.

5536 Barrel-shaped bead, medium-sized P. yellowish with silver foil sandwiched in to give gold foil appearance; surface pitting, some wear. Sample contains glass and foil in original proportions. (Same as Pb-2082.)

5537 Wound bead, medium-sized; prob. modern. Brt. red (coral-like) opq., little w. but some wear.

5538 Drawn beads, small. Lt. blue opq. (Same as Pb-2083.)

5539 "Indian red" bead, small. Orange opq., little w., much wear. (Same as Pb-2084.)

XV I. TIBET. (Includes glasses and minerals.)

3344 Medium-sized, flattened elliptical bead; date uncertain, poss. "Peking glass". Dk. blue transp., no w., but worn. (Purchased by ERB at The Barkhor, Lhasa, 9/30/90.)

3852 Tzi bead. Barrel-shaped. Made either of turbid brownish agate with white etched decoration; or, of whitish translucent chalcedony with brown-stained decoration and also white etched decoration. Botryoidal appearance on surface, with some very minute orange inclusions. Surface is worn and eroded. ERB collection. Sample consists of brownish stone chipped from edge of perforation. L. 3.15 cm, diam. 1.8-2.0 cm, perf. -1.5 mm. See note on terminology below. (Same as O-301.)

3853 As above. Sample consists of white opaque material comprising an etched band of decoration at the dark end of the bead.

3854 Spherical bead, poss. siliceous, with six wide and evenly-spaced dark-stained sectors running parallel to drilled perforation. Interior is tan-colored and shows a faintly layered structure. Dark surface staining has not penetrated far into the interior. Sample consists of tan-colored interior material. (Same as O-302.)

3855 Same as 3854, but sample contains approximately 15% of dark-colored zone at and just beneath surface.

3859 Tzi bead, modern, purchased in Delhi 11/3/87. "Black" glass (v. dk. amber) with yellowish white eyes and bands. Modern, one of four identical specimens. Barrel-shaped; l. 1.6 cm, diam. 1.1 cm, perf. 1.0 mm.

3860 Tibetan tzi bead; old, but undated. White opq. mineral with dark, wavy bands and circular bands on surface. Oval, slightly flattened; l. 2.0 cm, w. 1.5 cm, t. 1.1 cm, perf. 1.9 mm. Drilled from both ends but perfs. do not line up perfectly. Old break had caused loss of 20% of bead. Fracture shows that brownish color extends ~1.5 mm into turbid white body. Surface was polished, but is now worn and shows fissures outlining botryoidal elements characteristic of chalcedony. Both white and dark bands are filled with minute ellipsoidal inclusions, the largest of which are ~0.3 mm long. Their orange color is reminiscent of the color of aqueous ferric chloride solutions. Lent by Valrae Reynolds on 10/19/81. Newark Museum collection, unnumbered. Sample is of white translucent body material. (Same as O-300.)
3861 As above. Sample of brownish band material.

3864 Experimental chip of chalcedony etched with soda in laboratory. See lab notes of 11/3/83 in JFW/Gradient Furnace files. A polished plate of carnelian was painted with a paste consisting of *osnam* plant ash (CMG 1304), with a little gum arabic, in water. The paint was dried and the plaque heated in a gradient furnace for 30 minutes. On this plate, the glaze spread and whitened parts of the surface. This sample consists of whitened material removed from the region heated at 900°C. (Expt. 6-A; no. III.)

4162 Plastic *tsi* bead. White 3-eyed decoration on black field; black throughout. Both phases yield very quickly to a hot pin, and burn away easily in an alcohol flame. Density = 2.341 g/cc.

Note: There is much confusion about the spelling of the word for these beads. We have been advised by Tibetologists that *gZi* is the best transcription and *Zi* is the best phonetic version. *dZi* has become the most widespread spelling in North American bead circles, but we have used *tsi* here simply out of habit and because that is the way we were first introduced to the word.

XV J. MISCELLANEOUS ASIAN

1069 Indonesia; probably before 1600. Bead, red opq. vds no. 19. From W. G. N. van der Sleen. (See Ref. F-131.)

6500 Tibetan prayer beads, undated. String of 108 beads, each consisting of circular bone (?) disks with approx. 21 bright red opq. and lt. blue opq. seed beads embedded around edges in brown wax. Diam. of disks ~1.5 cm. Purchased by RHB in Dunhuang street bazaar, 10/6/93. Sample is of lt. blue opq. glass.

6501 As above, brt. red opq. glass.

6502 Wax dissected from between two disks.
XVI. AFRICAN


5522 Cylindrical, drawn bead; 900–1500. Yellow with red and white stripes. 8 x 12 mm. SF 217; Ji81.

5525 Vessel fragment; 900–1500. Green, moderately w. SF 79; 81LXS, level 10.

5526 Cylindrical bead with eight horizontal grooves; 900–1500. Blue transp. 5 x 6 mm. SF 1; LRF-1, J-j, LXN, level 1.

5527 Small drawn(?) bead; 900–1500. Lt. blue opq. 4 x 5 mm. SF 573; LRF-202, n81, LXN, L.24.

5528 Donut-shaped bead, ground flat on ends; 300–800. Blue transp. with squared-off swirls surrounding perf. Diam. 1.1 cm. SF 907; LRF-314, Jj81, LXN, level 38.

5529 Fragment of round bead; 300–800. Blue transp. 8 x 13 mm. SF 1031; LRF-338, Ji81, LXS, L.68. (Same as Pb-1144.)

5530 Fragment of wound(?) bead; ca. 250 B.C.–50 A.D. Blue transp. glass with sphericalized bubbles and some stones. Apparent original diam. approx. 1.4 cm. SF 1100; LRF-365. 81CTR, level 37.

5531 Button or bead; 900–1500. Green. Apparent original diam. approx. 1.6 cm. SF 151; LRF-62, n81, LXS, level 19.

XVI B. KUMADZULO, SOUTHERN ZAMBIA; ca. 7th c. (J. O. Vogel, LM.)

1082 Flat glass. Green transp., bubbly, one side has orange peel surface. Block III, House 3, 16” depth within collapsed wall of hut.


These beads were submitted by Thurstan Shaw. See his letters of 1961 and 4/1/67. The beads are identified by his classifications (Types A–Z) as published in Ref. F-121. The majority of the beads submitted seem to be drawn beads, but there are exceptions. They were excavated at Igbo Richard, Igbo Isaiah, and Igbo Jonah. The dating is uncertain, but is discussed in the reference cited. Shaw makes the general remark that the beads are “... about a thousand years old”.


1078 Medium–large, short-cylinder bead. Turbid blue. M2. (I.R. 362.) D. ~7 mm, l. ~3.8 mm. Similar example remains.

1079 Medium, short-barrel bead. Green transp. P1. (I.R. 224.) D. ~7 mm, l. ~4 mm.

1080 Medium, short-cylinder or barrel bead. Yellow opq. L1. (I.R. 362.) D. ~7 mm, l. ~6 mm.
1081 Medium, cylinder bead. Red opq. with four longitudinal white opq. and blue stripes. X. (I.R. 224.) D. ~5 mm, l. ~5 mm. Sample consists of red glass.

5550 Small, wound seed bead. Yellow opq., coryd with spherical seed, moderately w. L3. (I.R. 362.) Sp. gr. = 2.55. (Same as Pb-1062.)

5551 Wound seed bead. Olive transp. S. (I.R. 224.) Sp. gr. = 2.510. O.d. ~2 mm, i.d. ~0.7 mm, t. ~1.3 mm.

5552 Seed bead, poss. wound. Lt. blue opq. M5. (I.R. 362.)

5553 Small, drawn bead. Lt. blue opq. M4. (I.R. 362.) D. ~3.5 mm, l. ~2.2 mm.

5554 Medium, short-cylinder, drawn bead. Turbid blue. M3. (I.R. 362.) D. ~6 mm, l. ~3 mm.


5556 Small, short-barrel, drawn bead. Dk. blue transp. N2. (I.I. or I.R.) D. ~3.5 mm, l. ~2.5 mm.

5557 Medium, short-barrel, drawn bead. Dk. blue transp. N1. (I.I. 51.) D. ~6.2 mm, l. ~4.5 mm.

5558 Seed bead, drawn. Colorless, cased with ruby. V. (T.R. 224.4.)

5559 Seed bead, drawn. Yellow opq. T. (I.R. 423.)

5560 Seed bead, drawn. Red opq. V. (I.R. 43.)

5561 Very small bead, probably wound. Blue transp. with yellow opq. and red opq. spiraling on surface. H2. (I.I. 51.) D. ~3.3 mm, l. ~2.8 mm. Sample is of blue glass.

5562 As above, yellow glass.

5563 As above, red glass.

5564 Small bead, poss. wound(?). Lt. blue opq. with three applied red opq. on yellow opq. eye decorations. Eyes consist of red chips pressed into softened yellow dots, which are not very well fused to the body itself. J1. (I.I. 252.) D. ~3.5 mm, l. ~3.5 mm. Sample is of blue glass.

5565 As above, yellow glass.

5566 As above, red glass.

XVI D. SOMALIA


4615 Rim of shallow bowl. Dk. green opq. with white opq. twisted decoration; some black dendrites on eroded, but only slightly w. surfaces.

4616 Flattened cane. Red opq., little or no w.

From a beach just north of Mogadishu; surface finds collected 1961–63; date uncertain. From B. Lukas, Fond du Lac, WI. (5/21/95.)

5160 Medium, round, wound bead fragment. Bl. green opq., moderately w. L. ~8 mm, d. ~8 mm, perf. ~2 mm.

5161 Small, disk-shaped, wound bead. Grn. blue transp., moderately w. D. 7 mm, t. ~2 mm, perf. ~1.5 mm.
Small, drawn seed beads. A group of five. Aqua, eroded. D. ~1.5–2.0 mm.

Small, round, drawn beads. Dk. blue transp., eroded. A group of four. D. 3–4 mm, t. 1–1.8 mm, perf. ~0.8 mm.

Small, drawn bead fragment. Yellow opq., eroded. D. ~5 mm, t. ~3 mm, perf. ~1 mm.

Small, drawn seed beads. Yellow turbid or opq., eroded. A group of five. D. 1.5–3 mm, t. 1–2 mm., perfs. variable.

Small, round drawn beads. Red opq., eroded. A group of seven beads and fragments. D. 1.5–3 mm, t. ~2 mm, perfs. variable.

Small, round, drawn(?) beads. Black, eroded. A group of three. D. 2–3 mm, t. 1–2 mm, perfs. variable.

Fragment of a small ringlet bead; prob. drawn. Strong aqua, eroded. D. ~4 mm, t. 1–2 mm (variable), perf. ~1 mm.

XVI E. DHLO-DHLO RUINS, ZIMBABWE. (J. O. Vogel, LM.)

Small drawn cylindrical bead; 600–1000. Lt. blue.

Fragment of bottle glass; ca. 1700.

XVI F. SUDAN AND EGYPT; dates uncertain. (V. Haynes, UA.) See Refs. F-60 and F-61.

Selima Oasis, Sudan

Note: This oasis is located on the Darb el Arba’in, an ancient caravan route connecting central Sudan and Assyut. It was a major slaving route in the 18th and 19th centuries and possibly much earlier. It is ~220 km WSW of Wadi Halfa.

Medium, donut-shaped, wound bead; crudely made. Poss. of regional manufacture. Lt. blue turbid, unweathered. Diam. 7 mm, t. 4 mm, perf. 2 mm.

Medium, cylindrical bead. White opq. with colorless casing, unweathered but with internal shattering. Diam. 8 mm, t. 8 mm, perf. 2 mm.

Medium, cylindrical, drawn bead. Med. blue transp., unweathered, moderate wear. Diam. 7 mm, t. 6 mm, perf. 3 mm. (Same as Pb-1473.)

Medium, drawn bead with square cross section. Green transp. with red opq. casing, unweathered, moderate wear. W. 6 mm, t. 7 mm, perf. 2.5 mm.

V. large wound bead, fragment; crudely made. Blue turbid, heavily eroded and worn. Poss. of regional manufacture. Diam 2 cm, t. 8 mm, perf. 5 mm.

As above, yellow opq. (Same as Pb-1471.)

As above, lt. green opq. Diam. 2 cm, t. 1.1 cm, perf. 7 mm. (Same as Pb-1472.)
Bir Kiseiba, Egypt

Note: Bir Kiseiba is a remote watering place in southern Egypt. It is ~160 km NNE of Selima Oasis.

5518 V. large wound bead, fragment; crudely made. Yellow opq., heavily eroded and worn. Indistinguishable in appearance from Selima Oasis beads. Diam. 2 cm, t. 1.2 cm, perf. 6 mm. (Same as Pb-1474.)

5519 As above, lt. green opq. (Same as Pb-1475.)


400–800

1064 Flattened wound disk bead. Red opq., lightly w. Diam. 5.5 mm, t. 2.0 mm, tapered perf. vdS no. 14.

1065Y Flattened disk bead. Yellow opq., little or no w. Diam. 7.0 mm, t. 2 mm, perf. 1.6 mm. vdS no. 15.

1065B Small wound bead. Black, lightly w. Diam. 5.0 mm, t. 3 mm, perf. 0.6 mm. vdS no. 15.

800–1600

1066 Small wound beads. Red opq., v. heavily w. Diam. 4 mm, t. 2.5 mm, perf. 1.0 mm. vdS no. 16.

1067 Small drawn, donut-shaped beads. Yellow opq., v. heavily w. Diam. 5 mm, t. 3 mm, perf. 0.8 mm. vdS no. 17.

1068 Small drawn, donut-shaped beads. Bl. green, moderately w. Diam. 4.5 mm, t. 2.5 mm, perf. 1.0 mm. vdS no. 18.

XVI H. MAPUNGUBWE, S. AFRICA; late 17th–early 18th c. (I. Perlman and D. Clark, LBL.) See Ref. F-32.

2030 Small oblate bead. Yellow opq. D. ~2.0 mm. Map D2. (Ex. 7, no. 1, skeleton 14.)

2031 Small oblate bead. Green opq. D. ~3.0 mm. Map D4. (As above.)

2032 Small oblate bead. Lt. blue opq. D. ~3.0 mm. Map A5. (S. Limpopo Rock Shelter.)

2033 Small oblate bead. Pink opq. D. ~3.0 mm. Map A2. (As above.)

XVI I. ELMINA

This group consists mainly of beads excavated at Elmina (provided by C. DeCorse of Syracuse University) along with a few beads acquired in West Africa for The CMG by A. Lamb. The selection was made by Prof. DeCorse and RHB on 12/20/95. See Ref. F-35.

5680 Large, ellipsoidal, wound bead. P. blue transp., moderately w. L. 1.5 cm, d. 1.1 cm, perf. 3.0 mm. Elmina type 54.

5681 Medium, round, wound bead, with sl. flattened ends. Colorless, heavily w. D. 9 mm, l. ~7.5 mm, perf. (sl. distorted) ~3 mm. Elmina type 40.

5682 Medium, drum-shaped, wound bead. Yellow opq., heavily w. One of two examples. D. ~7 mm, l. ~5 mm, distorted perf. tapers 2–3 mm. Elmina type 5.
5683 Large, round, wound bead, with flattened ends. Yellow opq., moderately w. with black skin on surface. D ~1.7 cm, l. ~1.1 cm, perf. tapers 4–6 mm. Elmina type 443.

5684 Large, drawn, tubular bead, with pentagonal(?) cross section and cracked-off ends. P. blue transp., moderately w. L. ~1.4 cm, w. ~8 mm, perf. 4.0 mm. Elmina type 70.

5685 Large drawn bead; sl. flattened and curved, prob. by heat. Indentations on one flattened side, both ends originally ground flat. Has appearance of having been worn. Med. blue, turbid glass. Greenish opalescence seen by transmission prob. caused by devit. So-called “dichroic” color, as applied to African beads. L. ~1.8 cm, w. varies from 4–7 mm, perf. varies from 1.5–2.5 mm. Elmina type 131.

5686 Large drawn bead, with square cross section and cracked-off ends. Dk. blue, moderately w. L. ~2.4 cm, w. 7–8 mm, slightly distorted perf. ~4.9 mm. Elmina type 379.

5687 Large tubular bead, with lapidary grinding(?); rounded, roughly triangular cross section. Grn. aqua, moderately–heavily w. L. ~1.8 cm, max. w. 7.5 mm, narrow, off-center perf. 1.3 mm. Elmina type 174.

5688 Long tubular bead, somewhat bent. Dk. green, moderately–heavily w. Poss. accidentally fired. Glass is noticeably dense. L. 3.25 cm, d. 4.0 mm, perf. 1.3 mm. Elmina type 99.

5693 Large wound bead from waist string, kano type. Poss. Dutch, poss. 18th c. Lt. green opq., lightly w. L. ~1 cm, d. 1.7 cm, perf. ~6 mm. CMG 70.3.104.

5694 Large wound bead from wrist band, kano type. Poss. Dutch, poss. 18th c. Med. blue opq., lightly w. L. ~1.2 cm, d. ~1.5 cm, perf. ~4 mm. CMG 70.3.105.

5695 Large wound bead, flattened into pentagonal cross section, with flattened ends. Turbid white, lightly w. but worn. L. 2.3 cm, max. w. 1.2 cm, perf. 4.2 mm. CMG 73.3.388.

5696 Large wound bead, flattened into pentagonal cross section, with flattened ends. P. blue, sl. turbid; lightly w. but worn. L. 2.4 cm, max. w. 1.4 cm, perf. ~4.8 mm. CMG 71.3.66.

5697 Fragment of large tubular bead. So-called “dichroic” color, as applied to African beads. Med. blue turbid glass, sl. opalescent greenish by transmission; unweathered, but worn, some glass missing from longitudinal break. L. 1.3 cm, apparent original d. ~8.5 mm, perf. 2–3 mm. CMG 71.3.34H.

5698 Large tubular bead, both ends ground flat. So-called “dichroic” color, as applied to African beads. Med. blue turbid glass, orangy-amber opalescence by transmission, unweathered but worn. L. 1.7 cm, d. 7.2 mm, perf. 1.8 mm. CMG 71.3.34F; one of a group of seven.

5699 As above, another example. Somewhat smaller, greenish opalescence.
XVII. NEW WORLD AND CARIBBEAN

XVII A. SAN SALVADOR AND RELATED GLASSES


5710 Fragment of small, wire-wound bead. Brt. green transp., heavily pitted, cordy, with some spherical seed. Cords follow winding pattern; winding thread pull-off. Matches varieties VIDle and VIDlf of Smith and Good, and nos. 105 and 106 in Fig. 7 of their publication. See Ref. F-122. Excavated 6/84. (Same as Pb-1485.)

5711 As above. Brt. green transp. N10 E6, 20–30 cm; excavated 7/83. (Same as Pb-1486.)

5712 As above, but intact. Brt. green transp. N4 E6, 20–30 cm; excavated 7/5/83. SS 9, no. 884.

5713 As above, intact. Brt. green transp. N10 E10, 10–20 cm. SS 9, no. 318.

5714 As above, intact. Brt. green transp. N8 E8, 10–20 cm; excavated 6/22/84. Found with shell bead.

5715 As above, intact, except for gap in ring, poss. broken just after manufacture. Brt. green transp. N6 W12, 0–1 cm.; excavated 6/20/84. SS 9, no. 292.

5716 As above, intact. P. yellowish amber. N8 E6, 20–30 cm., south end; excavated 7/4/83.

Other Sources. See Refs. A-49 and A-52.

5700 Nueva Cadiz; 1515–45. Small wire-wound bead. Brt. green transp., little or no w. Some spherical seeds, winding thread pull-off. Identical to 5710 except for lack of w. Provided by C. Fairbanks, UFla; excavated by J. Goggin and J. M. Cruxent in 1954. Trench 9, section 4–6 m, 0–15 cm. (Same as Pb-1487.)

5720 Sinu area, Colombia. As above. Brt. green transp., fragment. (M. Smith, UFla.) No. 187. (Same as Pb-1488.)

5721 As above, except yellow opq. (Same as Pb-1489.)

5730 Peru, as above, brt. green transp. No. 197-3. (Same as Pb-1490.)

5550 Igbo-Ukwu, Nigeria. As above, yellow opq. (T. Shaw, UI.) See Ref. F-121, plate 5. (Same as Pb-1062.)

XVII B. FILIGRANO (LATTICINO)

4091 En Bas Saline, near Cap Hatien, Haiti; ca. 1500. Believed to be either Venetian or Spanish. Small fragment of vessel; colorless wall, colorless vertical(?) filigrano rib containing eight straight white opq. threads. EB5 1984/Unit 7 7162/FS no. 3774. (K. Deagan, UFla.) See Refs. A-49 and F-33. (Same as Pb-2220.)

4092 As above, white opq. threads.

4093 Porto Bello Trail, Panama, 17th c. Prob. Venetian. Fragment of vessel; colorless wall with white opq. cased colorless, vertical filigrano rib. CMG 83.3.47. Sample consists of colorless wall glass only.

4094 As above, white opq. rib casing. (Pb-2221.)
Porto Bello Trail, Panama, 17th c. Prob. Venetian. Fragment of vessel; colorless wall with white opaq. ornate filigrano spiraling and straight white opaq. bands. CMG 83.3.48. Sample consists of colorless glass only.

As above, white opaq. (Same as Pb-2222.)

Porto Bello Trail, Panama, 17th c. Prob. Venetian. Knop of vessel. Colorless with twelve white opaq. vertical stripes. CMG 83.3.43. There are also some stripes on the inside of the piece. Sample consists of colorless and white opaq. glass in approx. original proportions.

Miscellaneous

Engraved tumbler, poss. Continental; prob. 18th c. From the wreck of an inbound Spanish ship in the Bahia de Samaná off Miches. Among the finds was a coin, poss. of Phillip V, marked 171x. Colorless, moderately w., covered with calcareous marine growth.

XVII D. PORT ROYAL; pre-1692.
(R. Marx.)

Wine bottle base, onion-shaped. Dk. olive, v. thick w. crust. Submerged since 1692. See Refs. A-1, A-2, A-6, and A-7. Layer counting sample PR-1. (Same as O-15.) For w. crust see no. 8 in Section XX F.

Wine bottle, olive, heavily pitted. Oxygen isotope analyses performed on both glass from interior and from pitted surface.

Another wine bottle base, similar to no. 7, but with an exceptionally heavy w. crust ~5 mm thick. Label lost in 1972 Corning flood, but also thought to have come from Port Royal and been submerged since 1692. Olive grn. glass with amber-colored, transl., markedly laminated w. crust. Sample is of green glass. For w. crust see no. 5137 in Section XX F.
XVII E. PEDRO REEF WRECK, JAMAICA; poss. 1692 or 1731. (J. Parrent, TAM, courtesy R. Wiegandt.)


5131 As above, yellow fluorescence.

5132 As above, bronzy fluorescence.

5133 As above, bronzy fluorescence.

5134 As above, intermediate between yellow and bronzy fluorescence.

5135 As above, yellow fluorescence, but unlike above. Only a single specimen was found. Overall appearance somewhat different from the group as a whole.

XVII F. MISCELLANEOUS NEW WORLD

Mexico, S. Maria Maquixeo Bajo; 1520–82. (C. Kolb, PSU.)

4015 Vessel fragment, with thickened rim. Colorless, heavily w. TC-8:3 (8048). 40N/10W, level 2.


Nueva Cadiz; mostly 1515–45. (Excavated by J. Goggin and J. Cruxent; courtesy C. Fairbanks, UFla.) For types, see Ref. F-122.

5700 Seed bead. Em. green, no w. See Section XVII A.

5701 Large tubular bead with square section. P. yellow, transp., black w. crust. From excavation 5, house floor. Similar to type 33. L. 3.3 cm, t. 5 mm, perf. 2 mm.

5702 As above, trench 3. L. ~3.5 cm, t. 6 mm, perf. 2 mm.

5703 Twisted or spiraled four-sided bead. Dk. blue transp., black w. crust. Similar to type 57. L. 4.5 cm, t. 6 mm, perf. 3 mm.

5704 As above, lighter blue color. Excavation 5, house floor. L. ~3 cm, t. 7 mm, perf. 2.5 mm.

5705 Similar to above, but much thinner wall. Dk. blue transp., w. state uncertain. Trench 3. L. ~3 cm, t. 4 mm, perf. 2.5 mm.

5706 As above. Colorless, with lt. blue opq. and white opq. casings, lightly iri. Similar to type 70, but not as wide. Sample consists of three colors in original proportions. L. ~5 cm, t. 5 mm, perf. 1.5 mm.

5707 Tubular bead with square section. Colorless, with lt. blue opq. and white opq. casings, v. heavily w. Similar to Type 51. Sample consists of colorless glass with some traces of blue and white. L. ~5 cm, t. 5 mm, perf. 1.8 mm.

Peru; undated. (C. Fairbanks, UFla.) For types see Ref. F-122.

5718 Small corner-faceted bead. Colorless, no w. but burnished from use. Somewhat similar to type 49. L. ~6 mm, t. ~5 mm, perf. 1.5 mm.

5719 Small tubular bead with square section. White opq. sandwiched in dk. blue transp. Similar to type 44. L. ~6 mm, t. ~3 mm, perf. ~1.2 mm.
Uruguay; prob. late 17th–18th c. (A. Köncke Miranda, NHM.)

5735 Medium-sized wound bead. Yellow transp., v. heavily pitted. Found on a shipwreck site along with fragments of large, thick-walled, black bottles. D. = 4.96 g/cc. Diam. 8 mm. (Same as Pb-1480.)

5736 As above, another yellow transp. bead.

5737 As above, fragment of a large bead. Black, v. hard, eroded. D. = 2.776 g/cc.

5738 As above, fragment of a large, thick-walled bottle. Olive, heavily w.
XVIII. AMERICAN


Colorless

337 Disk-shaped fragment. After 1785, before 1790. AS 67. (Same as O-78.)

339 Knop(?). After 1785, before 1790. AS 94. (Same as O-79.)

344 Rim fragment, internal shattering. After 1785, before 1790. AS 107.


570 Goblet stem. Ca. 1790. AS 153B. Fig. 39; no. 15.

571 Hollow stopper. Ca. 1790. AS 125C. Fig. 39, no. 22.

572 Handle(?) fragment. Topsoil. AS 135. Fig. 40, no. 23.

4281 Solid stopper. Topsoil. AS 163A. Fig. 39, no. 23.

4282 Handle with pincered decoration. Ca. 1790. AS 125B. Fig. 39, no. 28.

Purple

347 Thin fragment. After 1785, before 1790. AS 94. (Same as O-81.)

348 Rim fragment. After 1785, before 1790. AS 94.


Blue

349 Heavy-walled fragment, blue streaks. Badly disturbed (level or excavator?). AS 113.

363 Fragment. Structure 1A, at mouth of furnace; unstratified.

1821 Fragment. Structure 1A, at mouth of furnace; unstratified.

Green or aqua

342 Window-glass(?) fragment. Unstratified.

356 Knock-off. Topsoil. AS 1. Used for viscosity determination. (Same as O-77.)

361 Nugget of cullet. Structure 1A; probably disturbed. AS 35.

365 Thin-walled, flat fragment. Trench 1, east segment, burnt layer; possibly as late as 1795. AS 33.

Amber

345 Thin-walled fragment. Probably disturbed. AS 105.

High-Lead

4283 Stem base. Colorless. Topsoil. AS 185. Fig. 39, no. 12.

366 Blown fragment. Colorless. AS 25. West of Unit 1A; unstratified.

573 Molded fragment. Aqua. Topsoil. AS 179. Fig. 40, no. 27.

4284 Tumbler base, molded pattern. Aqua. Topsoil. AS 127. Fig. 40, no. 14.
343 Bottle (?) fragment. Olive. Up to ca. 1795. AS 71. (Same as O-80.)

346 Window glass or flat vessel fragment. Amber. Up to ca. 1795. AS 120.


XVIII B. EARLY AMERICAN, RELATED TO AMELUNG. (CMG Collection or on loan.)

Colorless, pontil glass samples


552 Goblet. CMG 50.4.49.

553 Repold Tumbler. CMG 55.4.281. (Same as O-82.)

554 Miller Bowl. On loan from A. Miller.

555 Tobias and Angel Tumbler. CMG 55.4.37.

556 Stenger Flask. CMG 55.4.277.

557 Trisler Goblet, 1793.

558 Tumbler, unmarked. CMG 50.4.51. (Same as O-83.)

559 Goblet. CMG 55.4.42.

560 Firing glass with gilt decoration. CMG 50.4.52.

561 Firing glass with engraved Masonic decoration. CMG 55.4.38.

574 Firing glass with gilt decoration; German. CMG 60.3.55.

576 Checkered diamond flask. CMG 50.4.54.

577 John Reynolds Tumbler. CMG 55.4.48a.

578 Firing glass with cutting on rim. CMG 50.4.58.


Winterthur

4200 Trailing, rounded shape with pincer marks. Gr. Aqua, iri. CW-1.

4201 Nugget of cullet. Green, iri. CW-4.

4203 “Slag,” Colorless with many bubbles and internal fractures. CW-6.

4204 Nugget of cullet. Green, iri. CW-7.


4209 Nugget of cullet. Bl. green, CW-29.

CMG Unaccessioned

4210 Bottle base. Black.

4211 Bottle base. Black.

4212 Bottle neck(?). Olive.

4213 Bottle fragment. Green.

4214 Bottle fragment. Lt. green.

4215 Nugget of cullet. Green.

4216 Bottle base. Black.
XVIII D. AMERICAN PRESSED
GLASS; 19th c.

Sandwich. (CMG, from McKearin estate.)

1630 Rim, petal and loop motif. Lt. blue, crizzled. No. 500 (?).
1631 Candleholder socket. Lt. blue opq.
1632 Sugar bowl. Grayish-white opq.
1633 Lacy miniature tureen cover. Colorless opalescent.
1634 Lacy miniature tureen base. Yellow transp. (uranium).
1635 Dolphin candleholder. Greenish yellow transp. (uranium).
1636 Crucifix candleholder. Turbid green (uranium).
1637 Dolphin candleholder. Lavender opq.
1638 Miniature pitcher. Colorless.
1639 Curtain-pin. Colorless opalescent.
1640 Bear head. Turbid colorless, with many large stones.
1641 Bear (not bare) bottom. Lt. blue opq. Pressed mark “X BASIN PHILADA”.

Sandwich. (D. Kershaw, SHS.)

1650 “Christmas” salt; pat. 12/25/1887. P. yellow (uranium).
1651 Shallow plate (or poss. a bowl?), oak leaf pattern. Colorless. Similar to CMG 50.4.190, 59.4.82, or 68.4.153.
1652 Boat form salt dish. Dk. blue transp. Similar to CMG 68.4.125.
1653 Sugar bowl, Gothic Arch pattern. Turbid blue. Similar to CMG 68.4.128.

Sandwich. (K. and R. Wakefield, Sand.)

1670 Decanter neck and rim. Colorless.
1671 Decanter base and wall. Colorless.
1672 Salt(?). Colorless. Paper label reads ”GII-18. note rare foot.”
1673 Wall fragment with molded design. Colorless.
1674 Base(?). Colorless.
1675 Rim and wall of large celery(?). Colorless.
1677 Hollow stopper. Colorless.
1678 Solid stopper. Colorless.
1679 Fragment. Purple.

CMG, Louise Esterly Collection. See Ref. E-30.

1650 Candleholder, peacock eye pattern. Colorless. Similar to CMG 68.4.512.
1651 Shallow plate (or poss. a bowl?), oak leaf pattern. Colorless. Similar to CMG 50.4.190, 59.4.82, or 68.4.153.
1652 Boat form salt dish. Dk. blue transp. Similar to CMG 68.4.125.
1653 Sugar bowl, Gothic Arch pattern. Turbid blue. Similar to CMG 68.4.128.
Miscellaneous

1648 Base of dolphin candleholder. Sl. turbid green (uranium). One of two similar objects sent to The Museum in connection with the exhibition of Jim Rose’s glass.

1665 Base of dolphin candleholder; 1867–80. Dk. blue transp. Said to have been excavated at the site of the Mt. Washington Glass Works. Similar to CMG 68.4.11A.

1667 Pittsburgh. Sample submitted by Lowell Inness, 6/6/73. Sample is of colorless glass.

1668 As above. Sample is of white opq. glass with ~30% contamination of colorless glass.

XVIII E. BLOWN THREE-MOLD

Authentic BTM; early 19th c. For x-ray fluorescence analyses of several samples see Ref. A-30.

1462 Footed celery. Colorless, pontil glass. CMG 50.4.121b.

1463 Large footed bowl. Colorless with dk. blue rim. CMG 55.4.209.

1482 Pitcher. Colorless. Winterthur no. 64.883. From DPL, 6/22/70.

Mutzer BTM: 1920s–30s (dPWM) and other fakes (dPWM and CMG).

1453 Small pitcher. Colorless with dk. blue transp. handle, pontil glass. Winterthur no. 59.3277. DPW, 10/69.

1454 Small pitcher. P. purple. Winterthur no. 59.3105. DPW, 10/69.

1455 Small footed bowl. Dk. blue transp., pontil glass. Winterthur no. 59.3284. DPW, 10/69.

1458 Pitcher. P. purple. CMG 55.4.205.

1460 Footed bowl. Dk. blue transp., pontil glass. CMG 55.4.208a.

1489 Stopper from a questionable decanter. Colorless. Winterthur no. 59. 3194b (866).

1490 As above. Dk. blue transp. Winterthur no. 70.343b.


1492 Diamond-daisy bowl, poss. a fake. Dk. blue transp., pontil glass. CMG 55.4.75a. Sampled by DPL, 11/19/71.

XVIII F. LABRADOR, Basque glass from Red Bay; 1540–1610.
(J. Tuck, MUN, courtesy E. Smith.)


5752 Carafe or flask. Aqua. No. 1470.

5753 Foot with filigrano decoration. Colorless. No. 3963.


5755 Foot of knopped wine glass. Colorless, heavily crizzl. No. 5886.


5757 Foot and stem of knopped wine glass. Colorless. No. 16487.
These samples (except for no. 4) were submitted for analysis by Mr. N. Luccketti of Jamestown Recovery, APVA on 12/4/96. They are thought to date from the 1608/09 operations at the Jamestown Glasshouse. See also no. 1823 in Section XIX A.


4221 Fragment of window glass. Grn. aqua, heavily w. and pitted. T. 1.5–2.0 mm, no apparent curvature on thickened, fire-polished edge. JR2G.

4222 Glass bead (Nueva Cadiz type). Tubular and hollow with square cross section. L. 2.0 cm, w. 3 mm, elliptical perf. ~1.5 mm. JR69E, 471-JR.

4223 Piece of glassmaking(?) slag or chunk of vitrified brick. Overall black color. Rounded surfaces with vitreous coating over frothy interior; very heterogeneous; some surface impressions that resemble wood grain. Greatest dimen. ~7.5 cm. JR104B.

4224 Waste glass adhering to crucible fragment. Dk. green transp.; moderately w. Crucible is grayish color with fine-textured body, and thin layer of glass rundown on underside. JR3BT. Sample is of green glass.

4225 As above, sample of crucible body.

XVIII H. MISCELLANEOUS AMERICAN

502 Wine bottle base, tall with moderate kick; thought to be American, 1750–1800. Dk. olive, heavily w. Wa-18. (C. Fairbanks, UF.) Used for ceramming experiment to duplicate Réaumur porcelain. See also 4290 below.

906 Fragment of Tiffany Favrile bowl; 1900–20. Pattern-molded golden iri. Marked LCT, 2018 on base. (Mrs. J. Dorflinger.)

907 As above, XRF of metallic coating.


1642 Paperweight, Sandwich. Red floral design against speckled blue and white background. Sample is of colorless crown glass. (CMG, McKearin estate.)

1669 Punch bowl, cut; Libbey, 1904. Colorless. TMA46.27. (W. Hutton, TMA.)

4288 Glass "bullet" or bullseye; turn of the century. From iron grillwork in the patio skylights of the Elms, Newport, R.I. Cast circular slug of glass with scalloped edge on top. Now p. purplish, prob. a solarized colorless glass; worn but unweathered. Diam. at top of scalloped edge ~2¼ in, diam. of base ~1 7/8 in, thickness 1 7/16 in. Submitted by C. Genga, PSNC, 3/12/96, with inquiry regarding the source of the color.

4289 As above, a similar example.

4290 Portion of a wine bottle used for ceramming experiment. Heated at 920°C for 29 hrs. by Dr. A. A. Erickson. (R1-336; 5/23/64). Resulting material was highly devitrified, buff-colored, and showed evidence of shrinkage. See also 502 above.

4299 "Envelope No. 3", a small flat piece of sagged glass. Made by P. Hoyt, prob. 1976. Colorless glass, with white surface devit. on underside. glass had disintegrated due to internal shattering by 1982. Polariscope examination did not show excessive strain. CMG 79.4.128.
XIX. MISCELLANEOUS GLASSES

XIX A. GENERAL

472 Fake gold glass imitating Roman type. Actually a lens from a modern pair of eyeglasses. (D. Barag, HUJ.)

1337 Herat, factory of Fayzullah. Fragment of blue transp. glass, poss. a knockoff. See RHB Field Notes of 8/17/68.

1338 As above. Large piece of blue transp. cullet preserving the shape of a crucible.

1355 As above. Large, round, blue transp. bead from string purchased in shop.

1823 Small bottle, Jamestown, Va., reproduction of early Jamestown glass; 1971. Green, crizzled. Said to have started weeping a few days after it was made. (J. Haskett, CNHP.) See Ref. B-4.

1829 Large chunk of red opq. glass. Found in Florida. S. Auth, Newark Museum, Acc. no. 1353.

1449 Venetian boat, date uncertain. Lead glass. On loan to CMG from G. Bonetti. (Study card no. 1172.)

3455 Glass dog, thought to be European, said to be 4th cent. B.C. Dk. blue glass with white opaque and orangy-yellow opaque threading. On loan from owner, CMG F 2359. No sample of glass was removed.

3456 As above. Scrapings of friable, whitish coating on blue glass. Removed from four locations.

3457 As above. Scrapings of whitish material with some buff-colored accretion. Removed from rear left leg at joint between blue glass and threading.

4013 Bottle fragment from wreck of “The Amsterdam.” Given to RHB by M. Bimson of the British Museum, who has counted layers on this glass.

4050 Daguerreotype glass. Colorless, crizzled. (A. Swann, EH.)

4051 As above, another example. Colorless, crizzled.

4066 Vessel(?) fragment, possibly a waster, found at Leith factory (near Edinburgh); early 19th c. Dichroic: blue turbidity by refl., amber by trans. Contains minute, definitely lath-like, devit. phase. Dichroism due to devit. (G. Scott, Edinburgh, 4/24/92.)


5048 Fragment of glass recovered from the site of a domestic bombing in New Jersey. Blue transp. glass bearing raised lettering: (...) ING’S... TEN...” [?] There are patches of reddish-brown cuprite on one surface, along with a puckered and wrinkled metallic oxide film. The glass was heavily distorted by a conflagration. Sampled by RHB and Detective Sergeant Casimer Smerecki on 2/27/84. From Smerecki Glass A. Details are in permanent files of the Scientific Research Dept. of the Museum. (See RHB notes and correspondence of Feb., Mar., and Apr., 1984.)
As above, sample of a different fragment, Smerecki’s Glass C. Dk. blue transp. glass. Prob. from a large, thick-walled container; poss. the neck of a jug. No signs of heat deformation. The glass is somewhat heterogeneous, with streaks of dk. blue and colorless glass running through a matrix of med. blue glass.

Boy’s face, cast in high relief with some cutting. Date and provenance uncertain, but poss. Roman or 17th–18th c. White opq. glass fused to a mottled dk. blue, purple, etc. glass base which has been ground flat. Ample remains of old glue on several surfaces. Consists of a fragment given to DBW for examination and analysis (9/20/96.) Sample is of dense white opq. glass.

As above, mixed dk. blue and purple base glass.

Broken pendant from chandelier. Said to be Italian, early 19th c. Purchased in Paris in the early 1970s. Colorless, feels very light in weight. One of six pieces sent for examination by the owner, Mrs. F. C. Pearce of Santa Fe, N. M., on 2/12/98. n = 1.516.

Piece of experimental modern glass submitted by L. Gorelick.


Experimental glass; melted Dec., 1943. (A. Werner, CGW.) UO$_3$ = 5.3%.

Sample of brownish, lumpy powder received from Franz Kirchheimer on 3/13/64. Sealed in small glass tube with red sealing wax at each end. Handwritten paper label reads, “glass mixture with uranium”. Sample tube, sealing wax and lettering are all the same as on tube containing sample 408. This is prob. Manley’s unmelted batch prepared for a glass melt just prior to 1912.

As above. Sample of rounded brownish glass bead. Probably an experimental melt made by J. J. Manley and/or E. G. Lewis in 1912 as an attempt to duplicate their analysis of the Cape Posilipo tessera. See Refs. A-10, A-11, E-11, and F-88.

Candlestick, prob. Boston and Sandwich Glass Co.; 1850–60. Brt. yellow, showing brilliant green fluorescence. UO$_3$ = 0.61%.

Footed beaker, French or Bohemian; 1875–1900. Brt. greenish-yellow, showing brilliant green fluorescence. UO$_3$ = 0.44%.

Wineglass, Steuben “Topaz”; 1925–28. Yellowish amber, showing green fluorescence. UO$_3$ = 2.5%.

Commercial tubing; Osram, Berlin, pre-Jan. 1939. Lt. yellow. (L. Navias, courtesy R. Fleischer, GE.) UO$_3$ = 1.21%.

XIX C. FLAMEWORKER’S CANE.


As above, white opq.

As above, brt. red opq.
XX. WEATHERING PRODUCTS

XX A. NIMRUD GLASSES

Nimrud glasses; 7th c. B.C.  (J. J. Orchard, BSI.)  
See Ref. A-37.

3238 Red opq. glass 3237. (See Section II G.) Green material.

3240 Red opq. glass 3239. Green material.  
(Same as Pb-426.)

3242 Red opq. glass 3241. Green material.

3244 Red opq. glass 3243. Green material.  
(Same as Pb-424.)

Ft. Shalmaneser glasses; 7th c. B.C.  

1710 Buff-colored w. products from no. 1712. May also contain traces of background paint. (Same as Pb-543.)

1711 As above. W. products with some black pigment. (Used for hot-stage microscope experiment.)

XX B. ULU BURUN (KA§) GLASSES; ca. 1300 B.C.  
(G. Bass, C. Pulak, INA.)

5959 Ingot. Variegated, heavily w. KW 507.

5960 Ingot. Turbid green, heavily w. KW 383.


5966 As above, another bead.

5970 As above, another bead.

5994 Ingot. Lt. blue transp., heavily w. Sample is from chunk of lt. green opq. w. products. KW 3851.

5995 Ingot. Lt. blue transp., heavily w. Sample is of brownish, leathery w. products. KW 8118.

5996 Ingot. Purple, heavily w. Sample is of purplish transl. w. products. KW 3535.

XX C. APOLLONIA GLASSES; date uncertain. (J. Pedley, KM.)

3270 Mixture of weathering crusts scraped from nos. 3263–69 during sampling. (Excludes 3266.)

XX D. CARTHAGE (BIR EL KNISSIA) GLASSES; ca. 575. (S. Stevens, R-MWC.)

5285 Silvery iri. and brownish w. crust from no. 5284.

5289 Silvery iri. and black w. crust from no. 5288.

5291 Silvery iri. and black w. crust from no. 5290.

XX E. STAINED GLASSES

Augsburg Prophets; 1130.  (G. Frenzel, IGR.)

2430 David Window. DAV/O. I-R(?).

2431 As above. White. DAV/U.

2432 As above. Blue (R). DAV/U.

2433 As above. Rovi., (R).

2434 As above. White (R). DAV/O.

2435 Hoseas Window. Yellow (R). HO/U.
2436  As above. Blue. HO/U.
2437  As above. White (R). HO/U.
2438  As above. Red (R). HO/U.
2439  Daniel Window. Yellow (R). DA/O.
2440  Regensburg Dom, Prophet F (F.33).

**Canterbury Cathedral: West Window, 12th c.**

2690  Sample of weathering crust from exterior of first panel on the exterior viewer's left in bottom register of the West Window. Sampled by RHB and F. Cole, 9/21/71.

2691  As above, from another panel towards the right.

*French stained glass; poss. Bourges; 1225–50. (CMG.)*

2200  From fragment of greenish glass, no. 2100.
2201  From fragment of greenish glass, no. 2101.
2202  From fragment of greenish glass, no. 2102.
2203  From fragment of greenish glass, no. 2103.

**German stained glasses**

See Section XI A1., nos. 2443, 2445, and 2447.

**XX F. PORT ROYAL GLASS; pre-1692.** (R. Marx.)

8  From glass wine bottle, no. 7. See Section XVII D. (Same as O-8.)

5137  From glass wine bottle, no. 5136. See Section XVII D.

**XX G. WEATHERING EXPERIMENTS.** Ref. A-81.

These samples are from Chamber IX, one of a series of desiccator jars used for weathering experiments set up in 1972. This jar contained one pound of sodium bisulfite and a separate beaker with 80 ml of distilled water. Small plates of experimental glasses duplicating Mediaeval compositions were placed in the jar on 3/31/72. The glasses were photographed and examined (without opening the jar) in 9/72, 9/75, and 9/78. These samples were taken when the jar was first opened on 7/22/94.

4790  White crust scraped from sawed edge of glass VS. (K₂O:CaO:SiO₂.)

4791  Microcrystals brushed from three surfaces of glass VZ. (K₂O:CaO with 10% CuO.)

4792  Powdery white microcrystals from thick, white scaly edge of glass QR. (Nürnberg type.)

4793  White, leathery remains of completely altered glass FF. (K₂O:CaO:SiO₂ with 6.9% MgO, 3.9% P₂O₅, and 3.0% CuO.)

4794  As above, black surface crust.

4798  Yellowish crusty material from altered original surface of sodium bisulfite.
As above, peculiar white, waxy, layered or tooth-like clumps found on surface of sodium bisulfite.

XX H. KENCHREAL, OPUS SECTILE

753 W. products from 752 (red opq.).
763 W. products from 762 (red opq.).
765 W. products from 764 (red opq.).
756 W. products from 755 (yellow opq.).
760 W. products from 759 (yellow opq.).
767 Grayish black w. product of glass of unknown original color. (No glass remains.)
768 Black, shiny w. product of glass of unknown original color. (No glass remains.)

XX I. CRIZZLING LAYERS

These samples are surface layers removed from crizzled glasses. They are to be used for refractive index determinations. See Refs. B-3, B-4, B-12, and Sections XII C., XII I., XVIII D., XVIII H., and XIX A.

4756 Crizzled layer from no. 1050, a French wine glass, ca. 1650. V. p. pink color. A Na₂O:(CaO):SiO₂ glass.
4758 Crizzled layer from no. 1823, a reproduction of an early Jamestown bottle made in 1971. Green; said to have begun weeping a few days after it was made. This piece was immersed in water for 25 years and 6 days. When removed from the water the glass was lightly iri. The crizzling was induced by heating the hydrated glass at 112°–120°C. Heavy crizzling developed after 5 minutes (or less). The crizzled layers are ~40–45μ thick.
5874 Large, shallow bowl with scratch-engraved dragons and floral motifs. Prob. Qing Dyn., poss. Kangxi Era. Colorless, v. heavily crizzl. CMG 58.6.5. Sample consists of crizzl. layer. (Same as Pb-2359.)

XX J. MISCELLANEOUS

394 Small bead, described as ovoid or spherical; Cape Gelidonya Wreck; ca. 1250 B.C. Poss. green or aqua, almost completely w. (G. Bass, UM.) See Ref. A-62.
6229w Begram, hydration rim of no. 6229. See Section V U.
4300 Mixture of weathering products from several glass fragments excavated at an underwater site in Maine. The materials are of various colors and some are vitreous in appearance. From Kenneth Morris of the Maine State Museum. (See his letters of 5/23/78 and 6/27/78.)
XXI. PAINTS, ENAMELS, ETC.

Some similar materials are listed with their parent objects (i.e., The Paris Plate and Daphne Ewer) and some pigments are in Section XXVII.

XXI A. ZEREK ÇAMII; ca. 1126.

142 Paint from no. 141 (em. green).

144 Spongy black paint from no. 143 (dk. blue).

146 Spongy black paint from no. 145 (dk. blue).

148 Paint, poss. two colors, from no. 147 (dk. blue).

XXI B. KARIYE ÇAMII; early 12th c.

150 Paint from no. 149 (dk. blue).

(Same as Pb-185.)

153 Paint from no. 152 (p. green).

155 Paint from no. 154 (amber).

XXI C. BEGRAM; 1st or 3rd c.

6230 Brick-red paint from no. 6229.

6231 Grayish-blue paint from no. 6229.

6232 Pink paint from no. 6229.

6233 Whitish paint from no. 6229.

6234 Yellowish paint from no. 6229.

See also Section XXVII.

XXI D. ISLAMIC

6148 Painted decoration on Sasanian or Islamic bottle. (See Section XIV A., no. 6114.) Said to have come from Bamiyan or Chakhcharan. Sample is of brownish paint adhering to w. crust; from base of neck. Acquired by RHB in Herat, 7/23/93.

6600 Rim fragment of Islamic enameled glass. Colorless (slightly pinkish or orangy) glass with part of a medallion-like decoration of dk. blue and white opq. enameling with gilt and red outlining; some surface scum. One of a group purchased by RHB and MRB in Cairo, 8/28/62. Sample is of colorless glass.

6601 As above, blue enamel.

6602 As above, dense white opq. enamel with scattered black surface pits.

6603 As above, red outlining.

6604 Wall fragment of Islamic enameled glass. Colorless with dk. blue opq. enamel and gilt fish with red outlining, unweathered. One of a group purchased by RHB and MRB in Cairo, 8/28/62. Sample is of colorless glass.

6605 As above, blue enamel.

6608 Fragment of large, thick-walled, enameled Islamic glass. Colorless (somewhat smoky) glass with delicate gilt and red decoration; unweathered. One of two similar fragments purchased by RHB and MRB in Cairo, 8/28/62. Sample is of colorless glass.
6610 Base of small Islamic beaker, with heavy foot and prominent pontil mark. Colorless (somewhat smoky) glass with red enamel backing on inside and gilt lettering on outside; unweathered. D. of base 3.6 cm. Purchased by RHB and MRB in Cairo, 8/28/62. Sample is of colorless glass.

6614 Wall fragment of thick-walled, Islamic glass. Colorless glass with dk. blue opq., red opq., white opq., and yellow opq. enamels; unweathered. CMG 51.1.167 XLIX. Sample is of colorless glass.

6615 As above, dk. blue enamel.

6616 As above, red opq. enamel.

6617 As above, white opq. enamel.

6618 As above, yellow opq. enamel.

6620 Wall fragment of Islamic enameled glass. Colorless glass with dense red opq. and white opq. enameled medallion; also gilt and red drawn background; some w. scum. CMG 51.1.167 XXII. Sample is of colorless glass.

6621 As above, red opq. enamel.

6622 As above, white opq. enamel.

6624 Wall fragment of Islamic enameled glass. Orangy-purple glass with elaborate gilt, red opq., dk. blue opq., and white opq. enamel decoration and calligraphy; lightly–moderately w. CMG 58.1.21. Sample is of orangy-purple glass.

6625 As above, dk. blue opq. enamel.

6626 As above, red opq. enamel.

6627 As above, white opq. enamel.

XXI E. CHINESE CLOISONNÉ ENAMELS

These samples were submitted by John Twilley of the Los Angeles County Museum of Art on behalf of Arthur Leeper who is the owner of the object from which the samples came. Twilley’s chemical analyses are reported in Ref. F-130. Lead isotope data are reported in Ref. C-24.


Pb-2361 As above, lt. blue enamel. Pb content major.

Pb-2362 As above, dk. blue enamel. Pb content major.

Pb-2363 As above, white enamel. Pb content major.

Pb-2364 As above, yellow opq. enamel. Pb-Sn yellow; Pb content major or minor.

Pb-2365 As above, red opq. enamel. Pb content major.

Pb-2366 Solder meniscus between cloisons. (A “silver solder”; Cu:Ag apparently with some Pb.)
XXI F. FLORENTINE ENAMELS

6635  Enamed cross, Florentine, 15th c. Minute chips of med. bluish green transp. enamel. Some contamination with PVA consolidant dating from the 1950s(?) and a few specks of foreign matter. From S. Weintraub, 3/23/82. His note bears the number 1917.

6636  As above, chips of purple transp. enamel. One chip shows that the green and purple phases were originally fused to one another.
XXII. FAIENCE AND SIMILAR MATERIALS

XXII A. EGYPTIAN, NEAR EASTERN, AND OTHER

Note: Some samples are entered under site or type categories (i.e. Nuzi, etc.).

Glassy Faience

336 Egypt; late 8th–mid 7th c. B.C. Shawabti, glassy faience. Lt. blue, hard and dense. CMG 59.1.585. (SMG no. 830, pp. 277–78.)


1951 Stična (then Yugoslavia); 650–500 B.C. Glassy faience. Small dish(?) with remains of inset eye decoration. Now lt. blue, porous, heavily w. Sample is of lt. bluebody material. (P. Wells, Pbd.) (Same as Pb-1082.)

3327 Egypt; reign of Amenhotep III. Pedestal with hieroglyphics. Glassy faience. Blue. (SMG, CMG.)

See also Section II B.

Hasanlu Honeycomb Ware; 1000–800 B.C. (R. Dyson, UM.)

372 Vessel composed of polychrome rods fired into place, forming a honeycomb-like pattern. Each consists of a gray faience core surrounded by a colored piping of white, red, or blue. Has 59.3.3. Sample is of gray core material.

372w As above, white piping.

373 As above, red piping.

374 As above, blue piping.

374a As above, yellow piping. (Same as Pb-1075.)

713 Bead. Yellow faience. Has S-170; Q23, 8.5.43; summer, ‘63. (Same as Pb-413.)


4700 Small, roughly spherical wad of terra-cotta-like material, evidently shaped by fingertips; poss. lightly fired. D. ~5.0 mm. Overall buff color, occasional microclusters of white evaporated (?) salts. One of hundreds, or perhaps a few thousand, found at Lisht.

4701 As above.

4702 As above, containing microscopic flecks of a purplish phase.

4703 As above, containing a “cap” of crushed glass or sand, and resin(?).

4704 As above.

4715 As above, but shaped like a disk bead. Diam. 1.1 cm, perf. 2.5 mm.

4716 As above, but flat with slight curvature.

4716m Speck of orange-amber inclusion from 4716.

4717 As above, flattened with black MnO₂ dendrites on surface.

4718 As above, with flecks of material opaque to x-rays.
4719  As above, with three lt. blue glass or faience beads embedded in surface. Bead diams. ~2.5 mm, perf. ~1.0 mm.


4730  Small cylindrical bead. Faience, light blue transp. glaze over buff-colored body. From a collar which belonged to a woman, Senebisy mastaba 763. MMA 08.200.30. (Type from rows 1, 3, 4, and 7.)

4731  As above. Faience, now yellowish transp. glaze over buff-colored body. (Type from rows 1, 3, 5, and 7.)

4732  As above. Composite material of colorless transp. grains in brownish matrix. Note possible grinding or polishing grooves on surface. (Type from row 6.)

4733  As above. Homogeneous green transp. material, drilled perf. (Type from rows 1, 3, 5, and 7.)

4734  As above. Composite material of bluish, opalescent grains in brownish matrix, drilled perf. (?). (Type from rows 1, 3, 5, and 7.)

4735  As above. Small flat plaque, part of one of the falcon terminals. Composite of blue grains, fused together or embedded in a matrix.

4736  Small cylindrical bead. Faience-like frit. Black surface glaze over black fritted glass body, little or no weathering. From the Glaze Factory. MMA 22.1.1656b. See Ref. A-77, p. 16. Diam. 3 mm, l. 6 mm, perf. 1.2 mm.

4737  As above. Medium-sized cylindrical bead. Faience-like frit. Black surface glaze over black fritted glass body, little or no weathering. Diam. 7 mm, l. 1.7 cm, perf. 2.7 mm. MMA no. 22.1.1656c.

Ulu Burun (Kaş) Shipwreck; ca. 1300 B.C. (G. Bass, C. Pulak, INA.)

5978  Very small donut-shaped faience beads, embedded in calcareous marine growth. Buff-colored remains of white might be weathered glaze. KW 76.

5979  As above, except tubular.

Tell Fara-In. (Collected by RHB, See Field Notes of 7/1/66.)

1395  Lump of frit from slag piles.

1396  Lump of fine-grained, hard frit (TF-2).

1397  Grains of loose frit (TF-1).

1398  Loose, large-grained frit (TF-3).

Tyre faience factory; ca. 1500 B.C. (P. Bikai.) See Ref. A-38.

3150  Fragments of v. small faience beads. Orangy red, porous and friable. IC-6D; areas 2, 4, and 7; stratum XIV.

3151  As above, white friable material from workshop table. IC-6D; area 1; stratum XVI.

3152  As above, gray powdery material from floor associated with work table. Same context.

3153  As above, reddish material underlying no. 3151.
Bactria(?); said by previous owner to be 3rd millennium B.C. See Refs. C-23 and also F-4 for similar beads.

5875 Faience bead in the shape of a duck. Whitish, porous, fine-grained body with w. remains of grn. blue glaze. From same group as CMG 93.7.1. Sample consists of glaze with much body material. (Same as Pb-2054.)

5876 As above, another in the shape of a duck.

5877 As above, an incurved biconical bead, with perforation (not of the hollow nut-shell type). Whitish, porous, fine-grained body with w. remains of blue glaze. From same group as CMG 93.7.1. Sample consists of glaze with much body material. (Same as Pb-2055.)

XXII B. ISLAMIC

Fustat; 9th-13th c. (RHB, see Field Notes of 5/2/73.) See Ref. A-80.

3140 Large faience bead, one of several blue-glazed beads with red body; embedded in original conglomerate of waster material of faience made by Wulff technique. Conglomerate consists of cementation material and small pottery sherd.

3141 As above. Interstitial material; largely dk. green vitreous phase.

3142 As above. Gray interstitial material between pottery interface and vitreous phase.

XXII C. MODERN

Qom; modern. See Ref. A-80.

4760 Donkey bead, Qom, 1956–60. Brt. blue transp. glaze over white body. Glaze thicker on one side than others. Diam. ~2 cm, perf. ~8 mm. Purchased by RHB at UN Headquarters building, NYC.

4761 As above, three similar beads. Sample is of blue glaze.

4762 As above. Sample is of white body material.

3223 Small sculpted head. Dense core, with thick faience-like coating, and remains of glaze on surface. Heavily w. surface. Sample is of blue fill in incised left check.

3324 As above, scrapings of “faience-like” region. Whitish material with chalky consistency.

3325 As above, tiny chips of gray “core” material.

3326 As above, dark-colored fill at bottom of drilled hole in chin.
XXIII. EGYPTIAN BLUE AND SIMILAR MATERIALS

XXIII A. EGYPTIAN

Amarna; 18th Dynasty. (B. Adams, UC.)

1862 Powdered sample. Lt. blue. UC 25039.

1863 Friable, porous lump. Dk. blue with white inclusions. UC 24686.

1864 Small, friable lumps. Slightly greenish blue. UC 25041.

1865 Small, friable lumps. Distinctly greenish color. UC 25044.

1866 Porous lump with rounded surface, poss. preserving shape of vessel in which it was formed. UC 24685.

1867 Irregular lump, darker blue than above. UC 25040.

1868 Large flat piece. Dk. blue, somewhat harder than others. UC 24684.

1872 Flat object. Gray-blue, fine-grained and v. hard. (J. Cooney, Bkln.)

Other Egyptian Sources. (J. Cooney, Bkln and S. A. Saleh, EM.)

1870 Palace of Amenhotep III. Lump. Dk. blue, hard.

1871 As above. Lump. Med. blue, friable.

1873 As above. Fragment of rather thin-walled, rounded vessel. Gray-blue, fine-grained and v. hard.

1874 Memphis; Roman period. Dish.

1896 Cake. Dk. blue, porous and hard. Saleh no. CHRO-EF. (S. A. Saleh, EM.)

1897 As above. Round lump. Dk. blue, porous.

1898 As above. Very large bead (?). Lt. blue, porous and hard.

1899 As above. Bracelet. Med. blue, porous and friable.

XXIII B. OTHERS

1399 Springhead, Kent; 2nd-3rd c. Small pellet. (D. Charlesworth and J. Shepherd.)

1861 See 1893 below.

1875 Nuzi; 15th c. B.C. Horn-shaped piece. Lt. blue, fine-grained and hard.

1876 Nimrud, Fort Shalmaneser; 7th c. B.C. Large lump. Lt. blue, porous and hard. ND8199. (J. J. Orchard, BSI.) See also 1900 ff. below.

1877 Nuzi, Temple area; 15th c. B.C. Shaped like cylinder seal. Lt. blue, chalky.

1878 As above. Long, ellipsoidal bead. Lt. blue and friable. L. ~1.8 cm, t. at center 4 mm, t. at ends 2 mm, perf. 1 mm. No. 30-2-116.

1879 As above, large “mace-like” object. Core is v. hard with vitreous appearance. No. 27-28, A23, 12/5.


1881 As above. “Pedestal-like” fragment. A19368; PT1-57, [illeg.]. Lt. blue, fine-grained and hard.
1884 Hasanlu; 1000–800 B.C. Very small segmented bead. Lt. blue, v. friable. Diam. ~3 mm, l. ~2.5 mm, perf. ~1 mm. Has 59-173. (R. Dyson, UM.)

1885 As above. Has 60-499 XL 4 3 56.

1886 As above. Large spherical bead. Dk. blue, vitreous. Diam. 2.0 cm, perf. 3 mm.

1889 Spain, exact source unknown; prob. Roman. Clusters of pellets similar to 1890. Med. blue, friable. (V. Hibbs, HSA.)

1890 Syracuse, Sicily; Roman. Cluster of pellets recovered from a shipwreck. (L. Casson and P. Gargallo.)

1891 Sardis. Large lump. Lt. blue, porous but hard. (SMG.)

1892 As above. Lump. Dk. blue, friable. (G. M. A. Hanfmann.)

1893 Rhodes, Kakouli bead factory; Hellenistic. Powder scraped from deposit adhering to interior of pot sherd. AK-2. (RHB, 11/14/67.)

1861 As above, a lump. Grayish blue.

1894 Mycenae; 13th c. B.C. Small lump. Lt. blue, friable. Gamma 33-10. (W. Taylour, BSAA.)

1895 As above. Gamma MB/w 232.

1900 Nimrud, Ft. Shalmaneser, Room SW 11/12; 7th c. B.C. Button-based cup. Lt. blue, fine-grained. ND 12, 541. (J. J. Orchard, BSI.)

1901 As above. Lump. Lt. blue, somewhat friable. ND 8, 199. Exact find-spot uncertain.

1902 As above. Another lump, also ND 8, 199.

1903 As above. Another lump, also ND 8, 199. Grn. blue, friable.

1905 As above. Another lump, also ND 8, 199. Distinctly different greenish color than above, friable.


5790 Synthetic preparation. Mix BN, 48 hours at 1035°C, with two intermediate crushings. Mixture of blue and purple transparent crystals picked out under microscope.

5791 As above, except heated at 1080°C. Material is much harder and contains mostly blue phase with little or no purple.

5792 Synthetic preparation. Mix BO, 48 hours at 1080°C, with two intermediate crushings. Dk. blue frit. Contains blue transp. crystals with some purple.

5793 As above, except heated at 1135°C. Dk. blue frit. Contains blue transp. crystals with some reddish-brown grains (prob. Cu$_2$O).

5799 Sintered and molded bar. Prob. Han Dyn. Light purple appearance in bulk. (D. Dohrenwend, ROM.) No. 82FAE44. (Same as Pb-1597.)

Cylindrical bead, terra cotta with powdery, bright blue coating on surface; prob. Han. D. 9 mm, l. 2.6 cm, perf. 2 mm. Sample consists of blue material. XRD shows presence of Chinese blue. Lent for sampling by P. Singer. See Refs. A-71 and C-19. (Same as Pb-2004.)

Octagonal bar of Chinese purple, Han Dyn. Sintered, purple, little or no w. L. 2.2 cm, w. 7 mm. SK 16. (Same as Pb-3468.)

Octagonal bar of Chinese purple, Han Dyn. Sintered, purple, little or no w. L. 4.0 cm, w. 9.5 mm. SK 16. (Same as Pb-3469.)

XXIII D. EGYPTIAN BLUE ANALOGUES.

See Ref. A-80.

Note: Over the years, the Museum has prepared many lots of Egyptian blue starting with different batch compositions and heating them under varying conditions. They are generally coded in the Scientific Research Department's DH, DI, DQ, and GF series of experimental melts. In collaboration with Dr. August A. Erickson, several chemical analogues of Egyptian blue were prepared in 1963. In these materials, various metals were substituted stoichiometrically for copper. The batches were melted to glasses at 1400°C, usually with the addition of approx. 5% by weight of Na$_2$O to serve as a flux. The resulting glasses were then reheated at ~450°C to produce devitrification phases in hopes of obtaining compounds analogous to CuO.CaO.4SiO$_2$.

(The above procedure produces well-formed crystals in the case of CuO.CaO.4SiO$_2$.) Most of the files, XRD patterns, and several of the samples relating to the analogues were lost in the 1972 flood.

DHE NiO.CaO.4SiO$_2$. Devitrified to lt. green opq. mass.

DHF MnO$_2$.CaO.4SiO$_2$. Dk. brown glass that devitrified to hard purple mass.

DHG ZnO.CaO.4SiO$_2$. Colorless glass that developed thick, white surface devitrification phases.

DMD TiO$_2$.CaO.4SiO$_2$. Samples lost in flood.

DME Cr$_2$O$_3$.CaO.4SiO$_2$. Black glass.

DMF Fe$_2$O$_3$.CaO.4SiO$_2$. Black glass that devitrified to stony green and brown phases.

DMG FeO.CaO.4SiO$_2$. Black glass that devitrified to very hard grn. gray mass.

DMH CoO.CaO.4SiO$_2$. Dk. blue glass that devitrified to gray sintered mass with thick lavender vitreous phase on surfaces.

DQC Cu$_2$O.CaO.4SiO$_2$. (Melted in red. atm.) Red opq. glass that devitrified to fine-grained, chocolate brown phase.

DQD V$_2$O$_5$.CaO.4SiO$_2$. (Melted in oxid. atm.) Did not melt; sintered to dk. gray frit.
XXIV. RAW MATERIALS, ETC.

XXIV A. SANDS AND QUARTZITE

Egypt

320  Bacchias. Desert sand drifted against foundation of ruined building. Yellow, fine. Collected by RHB and Z. Hanna. See Field Notes of 9/25/62. (Same as O-124.)

321  As above. From dune ~200 m east of ruins. Yellow, not as fine as above.


668  Sand from nearby source of 667. ZH Xb.

669  Sand from near El Fasda. Sl. greenish. ZH Xc.

670  Sand from near Beny Salama. Greenish. ZH Xd.

671  Sand from west of Lake El-Zaagig ZH Xe.

672  Sand from west of Razuniya Lake. ZH Xf.

1298  Amarna. Fragment of a pebble thought by Petrie to have been used as support for glassmaking crucible. White quartzite with greenish glaze on parts of surface. Somewhat altered, probably by heating. Given to RHB by B. Adams, UC, 12/8/69; sample L in RHB notebook. See Ref. F-128. Sample is of white body. (Oxygen isotope analysis performed.)

1299  As above, glaze.

Belus River Beach, etc. See Refs. A-58 and C-5.

Note: Most of the Belus River sand samples were collected by RHB and JFW on 7/10/65 along the beach adjacent to the present-day mouth of the River Na'am south of Akko. (A few were collected in 1964 and 1966.) The samples were taken from various profile features on three typical dunes. The location of the dunes is about as close as one can now identify as the location specified by Josephus, Strabo, and Pliny. (See Refs. A-58, C-5, F-67, F-109, and RHB Field Notes.)

673  Belus River beach. Dune no. 1; near center, top. J65D.

674  As above. Dune no. 2; fine, drifted sand, leeward surface; upper level, 15–30 cm from top. J65E. (Same as O-206Q and O-206C.)

675  As above. Lower level, 2–20 cm from bottom. J65F.

676  As above. Crown of dune where sand was shifting rapidly; syncline. J65G.

677  As above. Anticline. J65H.
As above. Windward edge; moist, packed sand 0–20 cm below active top. J65I.

As above. Dune no. 3; fine, drifted sand from center-top of leeward surface. J65J. (Same as O-207Q and O-207C.)

As above. Black sand from windswept, flat surface of berm. J65K.

Belus River beach. Mixture of samples of fine, drifted sand collected at several locations about 400 m south of the river mouth. J64B, 7/4/64.

Belus River beach. Sand from near railroad bridge and large “rotunda”. 1966, Site 6, sample 3; 7/11/66.

Yellowish sand from “inland” dune 6–7 km south of Akko. J64A.


As above, Bag no. 2. (Same as O-208Q and O-208C.)

As above, Bag no. 3.

Shavei-Zion. Coarse beach sand. J65BR.


Note: These samples were collected by RHB and G. de Guichen of ICCROM on 6/26/81. The samples came from four locations south of the river mouth between Castel Volturno and Cumae. In addition, one sample came from north of the river mouth. Each is a composite of four to six smaller samples of the cleanest, driest, finest sand that could be found at each location. The beaches were very dirty and the water, presumably, was badly polluted. See RHB Field Notes for 6/26/81.

Spiaggia Miramar (Marina di Lago di Patria). Coarse, dark sand from near water’s edge. Field sample No. 1.

Licola Mare. From public beach ~500 m north of intersection of road following canal. Coarse, dark sand. No. 2.

As above. From beach in front of Cafe Graeco [sic] at end of paved road ~2 km south of above intersection. Coarse, dark sand ~20 cm below surface. No. 3.

As above. Fine, lighter-colored sand from surface. No. 4.

Volturno River mouth, south bank at small lighthouse. Coarse, black sand found in large surface pocket. No. 5.

As above. Coarse, light-colored sand. No. 6.

Aeneas’ Landing resort between Gaeta and Sperlonga. Fine, yellowish beach sand at base of cliff just south of bathing cabanas. No. 7.

As above, a similar sample. No. 8.
4558 Licola Mare. Lumps of rounded pumice from same beach as nos. 4552 and 4553.

India

4547 Mortandi, at border of Auroville, Pondicherry. One of several small, flat, coarse-grained pebbles coated with orangy accretion when received. Given to RHB by E. M. Stern, New Delhi, 3/4/86.

4548 As above. Ousteri (lake area) Pondicherry. One of several small flat pebbles.

4549 As above. Large, irregularly-shaped piece of a mineral. Colorless, probably transparent beneath eroded surface “varnish”.

Other Sources

3138 Lodsworth Common, Surrey. White sand poss. used at the Wealdon factories, particularly the Graffham glasshouse. Sample A, Haslemere Museum. (G. Kenyon.) See Ref. F-72.

3139 Hambledon Common, Surrey. White sand poss. used at the Chiddingfold and more northerly factories. Sample B. As above.

4450 Berkley Spring, W. Va., Pennsylvania Glass Sand Co.; 200-mesh Supercil. (A. A. Erickson, CGW.)

4451 Loch Aline, Argyllshire, Scotland. Beach sand for glassmaking. (A. Ramage, courtesy SMG.)

4452 Lamu, Kenya. Sand from large dunes. (Collected by ERB, 7/9/75.)

4453 Sand in which nodules (4454) were found.

4454 Timna, Negev, B. Rothenberg’s “Mine no. 3.” One of many small, round nodules of somewhat purplish color, with a surface appearance resembling desert varnish. (Collected by RHB and FRM. See RHB Field Notes for 7/13/66.)

4457 Temple, New Hampshire glass factory site. Dk. brown sand from first cut in parking area across from entry. Mixture of six samplings near top of cut. (Collected by RHB and F. Gorman. See RHB Field Notes for 10/14/75.)

4458 As above, from second cut 100 m in direction of Peterborough.

4459 As above. Cleaner, yellowish sand.

4460 Sand from w. shore of Nagog Pond nr. Acton, Mass. (F. Gorman, BU.)

4461 As above. Sand from south shore.

4462 Sanibel Island, Fla.; gulf shore at foot of Jamaica Drive. Clean, hard-packed, fine, white beach sand; combined from several smaller samplings. (Collected by RHB, 1/15/76.)

4465 As above. Very fine beach sand drifted by near-gale winds.

4466 Ocean City, N. J. White beach sand. (Collected by RHB about 7/20/71.)

4467 As above. Black, windswept, hard-packed sand adjacent to 4466.
4471  Gobi Desert sand, nr. Dunhuang. Fine, drifted yellowish sand from flats near road approx. 30 km SW of Dunhuang on road to Yangguan. Composite of seven smaller samples taken among camelthorn. (Collected by RHB and ERB, 9/19/84.) See also plant ash no. 4419.

4472  Yangguan. Fragments of decrepitating outcroppings of rock. Black surface and reddish interior; surfaces resemble desert varnish. (Collected by RHB and ERB, 9/19/84.)

4476  Tibet, Yarlung Tsangpo. Sand from large dunes in foothills near south bank of river, between Tsethang and Gongkar (King’s Playground). Brownish in bulk appearance, but individual grains vary widely in color, ranging from predominant colorless transparent, though yellowish, to black with red, green, etc. (Collected by RHB and ERB, 10/22/95.)

4478  Doñana, Spain. Sand from top of large inland dunes. (Collected by RHB, 9/20/85.)

4479  As above. Lumps of hard, dried-out soil in which plant sample no. 4416 was growing.

4770  Herat River, dry part of riverbed. Quartzite pebble to have been used for glassmaking. (Collected by RHB, Saifullah and Saidullah, 9/12/77.) As pictured in The Glassmakers of Herat.

XXIV B. ALKALIS (NATRON, etc.) See Refs. A-58 and F-57.

323  Natron, Wadi Natrun. From interior of heap said to be ~10 years old. (Collected by RHB and Z. Hanna, 9/30/62.)

324  Clump of gray salts, Wadi Natrun. From edge of lake. Source as above.

325  As above, clump of pink salts.

326  As above, cake of pink salts.

655  Natron, from a cache of materials and paraphernalia left over from the embalming of the mummy of Tutankhamun. Fine, white powder from a finely woven white bag. C<sub>14</sub> shows 1430 B.C. ± 120. (RHB collection.) (Same as O-201.)

656  As above. Buff-colored, granular material from a coarsely-woven bag. C<sub>14</sub> shows 1160 B.C. ± 155.

657  As above. White, fine-grained material from a coarsely-woven bag. C<sub>14</sub> shows 900 B.C. ± 150.

657b  As above, coarsely-woven bag. C<sub>14</sub> shows 1090 B.C. ± 125.

658  As above. Buff-colored, granular material from a coarsely-woven bag. C<sub>14</sub> shows 1030 B.C. ± 125. (Same as O-200.)

661  Wadi Natrun, Lake El-Bida (second lake from north). Salt deposit. No.IIb. C<sub>14</sub> date 1200 AD ± 150. (Z. Hanna, AUC.) See Ref. F-57. (Same as O-202.)

662  As above. Lake El-Zaagig (third lake). No. IIIc. C<sub>14</sub> date recent. (Same as O-203.)
<table>
<thead>
<tr>
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<th>Description</th>
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<tbody>
<tr>
<td>663</td>
<td>As above. Lake El-Zugm (fourth lake). No. IVa.</td>
</tr>
<tr>
<td>664</td>
<td>As above. Lake Abu-Gabara (fifth lake). Underwater. No. V. C¹⁴ date recent. (Same as O-204.)</td>
</tr>
<tr>
<td>665</td>
<td>As above. Lake El-Fasda (last lake to south). Salts on surface. No. VIIIa. C¹⁴ date recent. (Same as O-205.)</td>
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<tr>
<td>666</td>
<td>As above. Limestone used in present-day glass factory. No. XII.</td>
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<tr>
<td>4436</td>
<td>Lake Abiata, Ethiopia. White crusted salts from shore. (Collected by RHB, 5/10/73.)</td>
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<tr>
<td>4437</td>
<td>Ngorongoro Crater, Tanzania. White crusted salts from lake shore. (Collected by RHB and ERB, 7/2/75.)</td>
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<tr>
<td>4438</td>
<td>As above, but some soil mixed in.</td>
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<tr>
<td>4440</td>
<td>Reh. Efflorescent salts from a field approx. 12 km SE of Shikohabad. (Collected by RHB, R. K. Paliwal, and A. Billeci, 3/14/86.) Recorded on videotape.</td>
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<tr>
<td>4441</td>
<td>White salts recrystallized from filtrate of water extraction of above.</td>
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<tr>
<td>4442</td>
<td>Insoluble residue from above extraction. Contains some shreds of grass-like vegetable matter and silt.</td>
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<tr>
<td>4443</td>
<td>Glass formed by heating a sample of reh (no. 4440). Amber transp. Heated at 1100°C for 2 hours by J. F. Wosinski, 7/11/86.</td>
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<tr>
<td>4444</td>
<td>Impure reh from a field between Firozabad and Manpuri. Compact, gray, silt-like material, unlike no. 4440. (Collected by RHB, R. K. Paliwal, and A. Billeci, 10/24/87.)</td>
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<tr>
<td>4455</td>
<td>Ereko, Wamba, Kenya. Red earth used by warriors to color their bodies. (Collected by RHB and ERB, 6/26/75. Purchased, not scraped from warriors' bodies.)</td>
</tr>
<tr>
<td>4563</td>
<td>Dakhla Oasis, Western Desert. Pinkish crystalline salts described as alum and said to have been a source of cobalt used in Egypt. Our XRD shows (Mg,Fe)Al₆(SO₄)₄·22H₂O and our spectrographic analysis shows approx. 0.3% CoO. A. Kaczmarczyk, TU. (See Refs. A-77 and F-69.)</td>
</tr>
<tr>
<td>4564</td>
<td>As above. Heated 24 hrs. at 97°C. Apparent loss of water = 30.4%.</td>
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**XXIV C. ALKALIS (PLANT ASHES)**


**Note:** The following samples vary widely. Some are plants, some are ashes prepared from the corresponding plants, and some are plant ashes purchased in bazaars. Ashes prepared in our laboratory were usually slowly burned, then calcined, most often between 700°–900°C for 1–4 hours. The descriptions have been entered in forms believed to be most helpful for the reader, not necessarily in forms designed for consistency. Spellings follow local variants used by the donors. If a chemical analysis has been performed, it can be presumed to have been on the ashes of the plant described.

<table>
<thead>
<tr>
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<tr>
<td>650</td>
<td>Turkey, shoreline of Açı Göl. A shrub common to sulfate lakes (i.e., those near Cihanbeyli.) ~25 cm high. Small twigs, some with spongy pods. (M. Walsh, AID, 2/16/64.)</td>
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<tr>
<td>651</td>
<td>As above. Fluffy material shaken loose from the twigs.</td>
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</tbody>
</table>
652 Wadi Natrun. A common desert bush. (0.7-1.0 m high.) Sample no. Xla. (Z. Hanna, AUC, 10/14/64.)

653 Cairo-Alexandria highway, -74 km s. of Alex. Twigs from a common desert plant. Thickest twigs, no foliage. (Collected by RHB and Z. Hanna, 9/30/62.)

654 Acre Bay. Seaweed. Partially ashed at Technion, Haifa. (Collected by RHB, PNP, and N. Travlou, 7/9/64.)


1301 As above. *Osmun*, matted twigs. Nos. 409392, 126, and 137.


1305 As above. "Calcined potash", a hard, compact chunk of gray material. Nos. 409395, 140, and 129.

1320 Belus River beach. Twigs of plant growing near the Village of Napoleon. Sample no. 4. (Collected by RHB, 7/11/66, during Belus River beach survey.)

1323 Caesarea. Tamarisk-like plant in dunes. Collected, as above.

1324 Jezaziyat, Iraq. Desert plant. (Collected by RHB, 5/5/67.)

1325 Knightons, Surrey. Bracken at edge of woods near glass factory excavated by Eric Wood. Sample ashed by G. Shaw of Pilkington. (Collected by RHB and G. Kenyon, 6/26/68. See Ref. F-72.)

1326 Baghdad *souq. Chinan* plant, stems and pieces. Dried and chopped. The plant was used for washing clothes, etc. (Purchased by J. J. Orchard, 2/69.)

1328 As above. Fine, white *nura* powder. A calcined material also used for washing clothes, etc.

1330 Kandahar, Afghanistan. Large cakes of gray, cinder-like *tezab* from a soap shop. (Purchased by RHB, 8/13/68.)

1331 Herat glass factory, Afghanistan. *Ishghar* used at factory of Fayzullah who said that it "comes from the mountains where it flows out of the fire like water". (Collected by RHB. See Field Notes of 8/13/68.)

1332 As above, another lump.

1380 Qasr Al-Hayr, Sharqi, Syria. *Chinan* plants: a common desert plant said to be used for making *kali*. Woody stems and foliage. Yielded a light-colored, friable ash. (H. Salam and O. Grabar, HU.)

1381 As above. *Keli* prepared by local workers from the type of plant described.

1382 As above. *Keli*, "from the mosque". Hard, porous, gray chunks. Said to date from 700.

4400 *Shinan* plant. Source now unknown, thought to be Iraq. Stems and small debris. Original label lost in flood, but sample wrapped in Arabic language newspaper with English title "Sheherazade, 11 November, 1963".

4401 Ash of 4400.

4403 Ash of 4402.


4405 Ash of 4404.

4406 Temple, New Hampshire glass factory site. Ferns adjacent to furnace area. Approx. 35 fronds were cut just above the soil line. Air dried matter yielded 6.6% of a dk. gray, feathery ash. R 1-1383, 11/6-10/75. (Collected by RHB, 10/14/75.)

4413 Palermo, Sicily. Charred stems and debris (including relict spikes) of *Salsola kali* plant. From growth near beach at Foro Italico, not far from Mount Pellegrino. Refired by J. F. Wosinski at 900°C for 1 hr. (F. D'Angelo, courtesy DBW.)

4414 El Parque Nacional de Doñana, Spain. One of two species of *Salicornia* found in the park. From a dense growth of plants, approx. 1 m tall. Fleshy green with short yellow spikes. From the *marisma* region a few km in from the beach along the road on the west bank of the Guadalquivir River. The flats are said to be flooded about three months of the year. (Collected by RHB, 9/20/85.)

4415 Ash of 4414. Final firing at 800°C for 1 hr.

4416 As above, the other species of *Salicornia*. From patchy growths, approx. 50 cm tall. Thinner stems than 4414, pronounced purplish color near the tips when viewed in clumps.

4417 Ash of 4416. Final firing 900°C for 1 hr.

4418 Gobi Desert, approx. 30 km 5W of Dunhuang on road to Yangguan. Camelthorn growing in sand flats. See also no. 4471. (Collected by RHB and ERB, 9/19/84.)

4419 Ash of 4418. Final firing at 800°C for 1 hr.

Note: The following series of samples had also been analyzed by O. Rye, who donated portions of his samples to the Museum. (See Ref. F-115.) Our repeat analyses are reported here.

4420 Pakistan, Bahawalpur. First grade plant ash (*ghar*) purchased from Miam Ollah Baksh. Ashes of *Haloxylon recurvum* plant growing in Cholistan Desert. Light gray, slag-like material. R 71/457. See also 4405 above. (O. Rye, ANU.)

4421 As above. Second grade quality, containing unburned carbon. R 71/458.

4422 As above. Third grade quality, containing still more unburned carbon. R 71/459.

4423 Multan. Sintered plant ash as purchased in the *souq* by potters who use it for glazing. Gray, slag-like material containing some unburned carbon. R 71/440.

4425 As above. Ash of the *sajji* plant later to be refined in water. Gray and whitish slag-like material. SI 410, 665A.

4426 "Potash" crystals refired from *ghar*. Said to be used in glazing. White, caked material. SI 410, 665B.


4429 As above. Refired to friable, heterogeneous lump. R 71/432.

4432 Dera Ismail Khan. *Ghar* used for making bread ovens (*tanur*), after being mixed with other ingredients. Black, slag-like material with whitish surface. R 71/57.


Note: The following samples were submitted by A. Abdurazakov, 7/13/89.

4445 Uzbekistan. *Salsola crassi*. Small stems with foliage and pod debris.

4446 Ashes of 4445. Final firing at 800°C for 1 hr.

4447 Samarkand. Alkali used by tile glazers. Hard, dk. gray lumps. Final firing at 800°C for 1 hr. to remove unburned carbon.

4448 Uzbekistan. Plant ashes. Black powder containing many relict stems.

4449 As above, refired at 750°C for 1 hr. Note: The following samples are of tree ashes. The ashes were obtained by D. B. Roll of Green Mountain College, Poultney, Vt. in 1981. After burning, the wood ashes were fired in an electric kiln at 1260°C. All the ash samples are fluffy gray powders. Samples of soils in which the trees grew are also included, as are glasses prepared from some of the ashes. See Ref. E-27.

4565 An equal-volume mixture of nos. 4570–4575, and 4576 to be used for a glass melt.

4570 Beechwood tree A (~44 years old). General ash.

4571 As above, twigs.

4572 As above, limbs.

4573 As above, trunk logs.

4574 As above, bark.

4575 As above, heartwood.

4576 Beechwood tree B (~32 years old). General ash.

4577 Beechwood tree C (~35 years old). General ash.

4578 Oak tree.

4579 Birch and maple combined.

4566 Soil between trees A and B, 3 in. depth.

4567 As above, 24 in. depth.

4568 Tree C, 3 in. depth.

4569 As above, 24 in. depth.
Experimental glass melted from 100 g. of plant ash no. 4565 plus 50 g. of high-purity sand; 1400°C, 4 hrs. Yielded an amber glass. Batch approximates that given by Theophilus. J. F. Wosinski melt Q-246, 4/12/82.

As above, using plant ash no. 4579; 1400°C, 4 hrs. Yielded a purplish glass. Q-247.

Tibet, Yarlung Tsangpo. A small abundant desert shrub growing in the sand dunes on the south side of the Tsangpo River between Gongkar and Tsethang. Plants occur in clumps, approx. 50 cm. tall. Closely-spaced, spike-like, slightly curving leaves (up to approx. 2.2 cm in length) grow from thin stems. Purplish flowers going to seed still remained on some specimens when collected. Loss of water ~34% after 20 hrs. at 67°C. See photographs and videotapes. Collected by RHB and ERB 10/22/95. Same location as sand sample no. 4476.

Ashes of 4580. Burned and calcined at 800°C for 4 hrs. by JFW, 1/18/96.

As above, a different species of plant. Resembles camel-thorn. Woody stems are approx. 4 mm in diam., longest thorns are approx. 3.5 cm long. See photographs and videotapes. Collected by RHB and ERB 10/22/95, adjacent to no. 4580.

Ashes of 4582. Burned and calcined at 800°C for 4 hrs. by JFW, 1/18/96. Loss of water ~6.2% after 20 hrs. at 67°C. Yield of ash ~1.4%.

North Sea kelp. (S. Manning, UD.)

These plant samples were collected by Sue Topping on 4/15/87 near Jarrow. The varieties collected were: saw wrack (*Fucus serratus*), bladder wrack (*Fucus vesiculosus*), and egg or knotted wrack (*Ascophyllum*). No glaswort was found. The wet seaweed was weighed, hung out to dry for one week, then reweighed. The dried seaweed was heated at 780°C for 18 hours and sent to Corning, where the ashes were refired at 900°C for 1 hour. The losses in weight varied from 0.75 to 2.17% of the starting material. The refiring was carried out by W. F. Arnold and JFW. The yields reported are relative to the wet seaweed.

Ash of knotted wrack, Whitburn. Grayish mass, some consolidation and granulation. Yield ~8%.

Ash of saw wrack, Whitburn. Dk. gray, some sintering. Yield ~11%.

Ash of saw wrack, South Shields. Dk. gray mass, some consolidation and sintering. Yield > 7%.

Ash of bladder wrack, Jarrow. Brownish granular material, very little sintering. Yield ~18%.

Ash of bladder wrack, Whitburn. Gray mass, well-sintered. Yield > 13%.

Ash of bladder wrack, South Shields. Lt. gray, consolidated and well-sintered. Yield > 7%.

Note: Consolidated = collapsed into a single lump. Sintered = hardened into irregular forms, but not collapsed. Granulated = no general sintering; more like fluffy material or maintaining botanical shapes.
**XXIV D. SOILS, BATCHES, ETC.**

*Sardis, Bin Tepe; Lydian.*

689 Soil from tunnel leading into the mound. From gray band. Sample D. (Collected by RHB, 1964.)

690 As above. From reddish band. Sample E.


691 Fine, white, powdery silt accumulated by wind action over a few days. From west wall of Red Room. Represents natural soil found in similar pockets all over the site. J65BA. (“Red Room” is a nickname for the remains of what is believed to have been a furnace structure.)

692 As above, from several other pockets.

693 From grit bed in Red Room. Thought to have been beneath the furnace. Band I, orangy. Small, hard chunks and powder. (See RHB field notes for 1964.)

694 As above. Band II, brick red.

695 As above. Band III, purplish red.

699 Yellowish clay from beneath rock just outside south wall of Red Room. Fine, silt-like texture.

**Açi Göl, Turkey. (Collected by RHB, 4/17/81.)**

Note: Açi Göl is a lake approx. 65 km east of Denizli. These samples came from a thick crust of salts covering the surface of the shallow water on the eastern shore of the lake. There is a small factory at the site. The nearest village is Basmakçı. This is not the same as the large factory located near the western tip of the lake at Çardak.

4590 White, powdery surface salts. (0–1 cm depth.)

4591 Fine, crystalline hydrated salts. (1–5 cm depth.)

4592 Large, wet crystals. (5–11 cm depth.)

4593 Wet, blackish clay layer. (11–13 cm depth.)

4594 Bottom, wet, tan clay layer. (13 cm and deeper.)

4595 Another location nearby. Fine, crystalline hydrated salts. (Upper layer.)

4596 As above. (Lower layer.)

4597 Residue of evaporation of lake water in contact with salts.

4598 Fluffy, white residue from last portion of lake water to evaporate.

4599 Pammukale. Fine, white paste from a large basin in the midst of the salt formations.
Sang-i-safid (white stone). A pebble of the sort used for glassmaking. (Given to RHB by Shahmomet.)

Glass batch or colorant. Brick-red powder. (Given to RHB by Fayzullah.)

Mess (copper?), a colorant for blue glass. Said to come from USSR. (Given to RHB by Fayzullah.)

Sang-i-safid. Pulverized white powder. (Given to RHB by Fayzullah.)

XXIV E. CALCAREOUS MATERIALS

Shells, Sanibel Island, Fla. (Collected by RHB 1/74, 1/76, and 1/89.)

Cat's paw (Plicatula gibbosa).

White bivalve resembling skimmer clam.

One thick-walled, white wing shell.

Two thick-walled, white, squat wing shells.

Small scallop shell. Greatest dimen. 2.7 cm. Tip and halfway through main body is moderately strong orange color. From there out, color is either a v. p. orange or, at the rim, white. Sample is of orange region.

As above, white edge.

Scallop shell. Greatest dimen. 2.9 cm. Brownish and orange patches on white field. Sample is of orange-brown material only.

As above, white background.

Scallop shell. Greatest dimen. 2.3 cm. Strong orange overall (white interior). Color is that of an orange pectin.

Scallop shell. Greatest dimen. 3.1 cm. Dk. purple patches on white field. Sample is of purple region.

As above, white field.

Cochina. Greatest dimen. 1.5 cm. P. yellow.

Cochina. Greatest dimen. 1.5 cm. Strong reddish-brownish central portion, yellow rim.

Fragment of Junonia. Greatest dimen. 3.7 cm. Strong brownish spots on white field. Concave surface is white. Sample is of brown material.

Scallop shell. Greatest dimen. 2.6 cm. Strong orange overall (white interior). Color is that of an orange pectin. Very similar to no. 4487. Collected 1/85.

Scallop shell. Greatest dimen. 2.7 cm. Dark and white patches on orange field (pale orange interior). Collected 1/89.

Sand dollar (poss. Echinarachnius parma). Greatest dimen. 7.5 cm. Collected 1/89.


Limestone bed rock, from near olive press. Represents local white limestone. J66DD.

Architectural white block from south of Red Room. J66DE.
4322 Calcined white block from north wall of Red Room.

4323 Fine-grained, white phase removed from five inclusions of Band II of the grit bed of Red Room. (See no. 694 above.)

4325 Sample removed from no. 4320. Heated in gradient furnace at 1335–1370°C for 24 hrs.

4326 Gritty material from Band I (orangy layer) of Red Room.

**XXIV F. CARBONATE HYDRATION EXPERIMENT.** See Ref. B-12.

These samples are from the results of a long-term experiment conducted to study the uptake of atmospheric moisture by various carbonates. Weighed quantities of anhydrous reagent-grade carbonates were placed in Pyrex® crystallizing dishes, and then in an enamel tray with a stainless steel gauze cover. The tray was kept in the author’s office, exposed to ambient room conditions. The temperature and relative humidity were monitored and the dishes reweighed from time to time. At the time of weighing, the samples were lightly stirred. The point of the experiment was to see how the weights of the carbonates changed with changing RH.

The carbonates used were sodium carbonate, potassium carbonate, calcium carbonate, and a sample of 18th-Dynasty Egyptian natron (CMG no. 658). The experiment was started on October 1, 1980 for the first three carbonates. The natron was started on July 26, 1982. The experiment is still in progress as this book goes to press.

The RH varied widely from winter lows of 10–15%, to early autumn highs of 65–69%. However, these extremes occurred mainly during the first ten years of the experiment when the Museum’s climate control system was quite ineffective. Since then—except for occasional high and low excursions during periods of construction—the humidity has been fairly stable at about 40–50%.

The weight of the potassium carbonate tended to follow the RH trends quite sensitively; the sodium carbonate rose to an essentially constant level; the calcium carbonate showed virtually no response; the natron (which was probably partially hydrated to begin with) showed little change. The potassium carbonate underwent a marked physical change varying from a slightly crusty texture, to a crystalline sludge, to an almost entirely liquid phase with the salt having almost completely dissolved in its own water of crystallization. During the later years of the experiment it turned into small, crystalline masses.

4764 Potassium carbonate; exposed to ambient office conditions 17 yrs., 6 mos., 4 wks. Sample is of white, crusty, crystalline clumps. Wt. of sample removed from dish = 0.28 g.

4765 Sodium carbonate; exposed to ambient office conditions 17 yrs., 6 mos., 4 wks. Sample is of somewhat clumpy white powder. Wt. of sample removed from dish = 0.25 g.

4766 Calcium carbonate; exposed to ambient office conditions 17 yrs., 6 mos., 4 wks. Sample is of white fluffy powder. Wt. of sample removed from dish = 0.34 g.
Natron; 18th-Dynasty Egyptian. Same as no. 658. Exposed to ambient office conditions 15 yrs., 9 mos. Sample is of small buff-colored clumps collected so as to avoid contamination with fibrous material. Wt. of sample removed from dish = 0.17 g.
XXV. NATURAL GLASSES

Artifacts

252  "Cellular" bead, Knossos; Late Minoan, 1550–1400 B.C. Colorless, frothy, glassy material, rounded form, as if shaped aerodynamically. Perhaps a piece of pumice, but possibly also has applied bands of decoration on blackened surface. Deposit LA 83; RR 61/254. (M. S. F. Hood, BSAA.)

Obsidian artifact fragments; Prehistoric.
(R. Braidwood, UCh via M. Walsh.)

443  Diyarbakir, Turkey. Color unrecorded. P-56/2.
444  As above.
445  As above.
446  Siirt, Turkey. Color unrecorded. S-63/7.
447  As above.
448  As above.
3525  Amarna.
4800  Tel Arpachiyah (nr. Mosul), Iraq. Gray.
4801  As above. Gray.
4802  As above. Gray.
4803  As above. Gray.
4830  Tepe Sarab (nr. Kermanshah), Iran. Dk. gray.
4831  As above. Dk. gray.
4832  As above. Dk. gray.
4833  As above. Dk. gray.

Naturally Occurring

903  Small fragment of a possible meteorite. Found near Lawrenceville, Pa. by M. Perry. Said to have fallen 4/28/66 in a field near her house. Sample consists of black powder scraped from surface. Fragment was later identified by E. Henderson as fossilized wood (marcasite).

904 & 905  As above, specks of bright vein with metallic appearance.

4410  Mt. St. Helens. Volcanic ash from ~8 mi. SW of peak. Sample consists of two phases. The more abundant is gray; the other is black. Sample contains both in original proportions. (Collected by J. Sheldon, 6/30/80.)

4411  As above, gray phase only.
4412  As above, black phase only.

4456  Fulgurite, said to have come from sand bank near Kinshasa, Zaire. CMG Study card no. 1398. (J. Philippe, Liège.)

4890  Libyan desert glass. Sl. yellowish transp. glass with many irregularly-shaped "bubbles". Surface sculpted and eroded to waxy-satiny texture; some grains of sand in brownish material in surface indentations may have been trapped there while glass was hot. (I. Friedman, USGS.)
XXVI. NON-GLASSES

Note: Some samples are entered under site or type categories (i.e., Hasanlu, Tibet, faience, etc.)

XXVI A. MINERALS

1291 Jezaziyat, Iraq. Lump of black mineral found at site with glass.

4780 Remingtonite, Yimen mine in Yunnan or Jinchuan mine in Gansu; a hydrated cobalt carbonate mineral. Specimen is a soft, dark material having a black, lustrous sheen where cut by diamond saw. (Hu Xigeng, Changsha.)

4781 Hokutolite, Hokuto, Taiwan; a lead-bearing barite. Specimen is a rather soft, quite dense, tan-colored polycrystalline mineral. Purchased from Ward's Scientific in Rochester 1/85. (Same as Pb-2050.)


4789 Large piece of stibnite. Specimen weighs ~12 lb. Consists of a fine-grained, lustrous, crystalline mass with very few apparent impurities. Original label bearing source identification has been misplaced. Used for gradient furnace experiments. (Same as Pb-1979.)

5937 Farinjal, Afghanistan. Metallurgical site thought to have been worked from 300–1200. Ore-bearing rock. Mineral phase is black with fine-grained, lustrous crystals. Spect. anal. shows major Pb and Ca; 0.008% Ag. Collected by RHB 8/6/68; NGS site no. 4. (Same as Pb-837.) See also Section XXVI E, no. 5936.

5938 As above; a similar specimen. (Same as Pb-838.)

5939 As above; a similar specimen. (Same as Pb-839.)

6149 Badakhshan, Afghanistan. Large, dark blue specimen of lapis lazuli containing veins of pyrites.

6189 Mineral conglomerate, Bongdam Sambo, Kyunggido, Korea. Described as coming from a “lead-zinc-barite” mine. Specimen consists of two well-crystallized phases growing in close contact. One appears to be galena, the other is a white phase. Sample is of white phase. (In-Sook Lee, 8/18/88.)

XXVI B. METALS


4691 Bronze “D-ring”. Bronze, with greenish gray corrosion patina. Rounded with straight shank. Beveled corners formed by mold seams create diamond-shaped cross-sections in most parts; possibly finished by filing. Maximum diam. across rounded portion 3.9 cm, l. of straight shank 2.7 cm, t. varies from 2.5–4.0 mm. (Same as Pb-1493.)
4692 Bronze shoe(?) buckle. Bronze with dark greenish-gray corrosion patina. Rounded with single straight overlapping shank and triangular slot. No keep attached, and no wear where it would have been attached at shank. Appears to have been molded and possibly finished by filing. L. across shank 2.0 cm. (Same as Pb-1492.)

4693 Coin. Billon blanca of Henry IV of Castile (1454–74). Heavily corroded on all surfaces, original struck impressions barely legible in places, possibly deliberately defaced. Segment broken or snipped out before burial. (Same as Pb-1494.)

Ulu Burun (Ka§) Shipwreck; ca. 1300 B.C. (G. Bass, IN.A.) All samples are in the Bodrum Museum of Underwater Archaeology. See Refs. D-11, F-9, F-14, and F-15.

4779 Tin ingot. (No Kw no.)

5912 Fishing net weight. Kw 268. (Same as Pb-3312.)

5913 As above. Kw 280. (Same as Pb-3313.)

5914 As above. Kw 319. (Same as Pb-3314.)

5915 As above. Kw 328. (Same as Pb-3315.)

5918 As above. Kw 368. (Same as Pb-3318.)

5920 As above. Kw 454. (Same as Pb-3320.)

5922 As above. Kw 499. (Same as Pb-3322.)

5924 As above. Kw 525. (Same as Pb-3324.)

5926 As above. Kw 541. (Same as Pb-3326.)

5928 As above. Kw 557. (Same as Pb-3328.)

5929 As above. Kw 617. (Same as Pb-3329.)

5971 Lump of yellow material thought to be orpiment.

5980 Copper ox-hide ingot. (No Kw no.)

5981 Frog weight. Copper:lead alloy. Kw 220. (Same as Pb-3302.)

5982 Jug. Tin. Kw 313. (Same as Pb-3348.)

5983 Whistle. Tin. Kw 419. (Same as Pb-3349.)


5985 Shepherd or animal weight. Lead. Kw 582. (Same as Pb-3305.)

5986 Black material. Kw 611.

5987 Bar, copper:silver alloy. Kw 670.

5988 Bar, copper:silver alloy. Kw 1030.


5990 Copper(?) ox-hide ingot. Black magnetic lumps containing Fe$_3$O$_4$. Kw 187. (Same as Pb-3351.)

5991 Tin:lead alloy. No. 653. (Same as Pb-3360.)

5992 Copper(?) ox-hide ingot. Black magnetic lumps containing Fe$_3$O$_4$. Kw 185(AN).
<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5940</td>
<td>Copper ingot. W9-27. (Same as Pb-3240.)</td>
</tr>
<tr>
<td>5941</td>
<td>As above, T-357. (Same as Pb-3241.)</td>
</tr>
<tr>
<td>5942</td>
<td>As above, 388. (Same as Pb-3242.)</td>
</tr>
<tr>
<td>5943</td>
<td>As above, X-419. (Same as Pb-3243.)</td>
</tr>
<tr>
<td>5944</td>
<td>As above, VX-427. (Same as Pb-3244.)</td>
</tr>
<tr>
<td>5945</td>
<td>As above, 428. (Same as Pb-3245.)</td>
</tr>
<tr>
<td>5946</td>
<td>As above, +434. (Same as Pb-3246.)</td>
</tr>
<tr>
<td>5947</td>
<td>As above, 437. (Same as Pb-3247.)</td>
</tr>
<tr>
<td>5948</td>
<td>Ingot. Tin:lead alloy. G no. 16.</td>
</tr>
<tr>
<td>5949</td>
<td>Ingot. Tin:lead alloy. G no. 22.</td>
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<tr>
<td>5944</td>
<td>As above, VX-427. (Same as Pb-3244.)</td>
</tr>
<tr>
<td>5945</td>
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</table>

Serçe Limani Shipwreck; ca. 1025. (G. Bass, IN.A. 7/26/89) All samples are in the Bodrum Museum of Underwater Archaeology. See Refs. D-12, F-12, and F-16.

<table>
<thead>
<tr>
<th>Item</th>
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</tr>
</thead>
<tbody>
<tr>
<td>6080</td>
<td>Rim of large round pan. GW 971. (Same as Pb-3280.)</td>
</tr>
<tr>
<td>6081</td>
<td>Base of tray(?), GW 451. (Same as Pb-3281.)</td>
</tr>
<tr>
<td>6082</td>
<td>Unknown type of object. GW 459. (Same as Pb-3282.)</td>
</tr>
<tr>
<td>6083</td>
<td>Rim of deep rectangular pan. GW 972. (Same as Pb-3283.)</td>
</tr>
<tr>
<td>6084</td>
<td>Side of pyxis. GW 313. (Same as Pb-1771.)</td>
</tr>
<tr>
<td>6085</td>
<td>Side of pot. GW 977. (Same as Pb-3285.)</td>
</tr>
<tr>
<td>6086</td>
<td>Side of bucket(?). GW 970. (Same as Pb-3286.)</td>
</tr>
</tbody>
</table>

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<tr>
<td>6087</td>
<td>Side of bucket. GW 969. (Same as Pb-3287.)</td>
</tr>
<tr>
<td>6088</td>
<td>Side of bucket with inscription. GW 55. (Same as Pb-1770.)</td>
</tr>
<tr>
<td>6089</td>
<td>As above, handle of bucket. GW 55. (Same as Pb-3289.)</td>
</tr>
<tr>
<td>6090</td>
<td>Wall under cup handle. GW 166. (Same as Pb-3290.)</td>
</tr>
<tr>
<td>6091SL</td>
<td>Bronze barrel lock. No. 1326. (Same as Pb-1745.)</td>
</tr>
<tr>
<td>6694</td>
<td>Metal ring, corrosion products only. Single black speck. GW 1021 (1380-04-LR4). Submitted by G. Bass for possible identification of original metal. See his letter of 2/15/95. (Same as Pb-3294.)</td>
</tr>
<tr>
<td>6695</td>
<td>As above, another ring. Small black specks. GW 1023 (282-L5-UR 1/2). (Same as Pb-3295.)</td>
</tr>
<tr>
<td>6696</td>
<td>As above, another ring. Single tiny gray speck. GW 1024 (282-L5-UR 1/2). (Same as Pb-3296.)</td>
</tr>
<tr>
<td>6697</td>
<td>As above, another ring. Flat black fragment. GW 1028 (1372-04-LR4). (Same as Pb-3297.)</td>
</tr>
<tr>
<td>6698</td>
<td>As above, another ring. Gray flake. GW 1029 (360-04-LR 3/4). (Same as Pb-3298.)</td>
</tr>
<tr>
<td>6699</td>
<td>Iron inset from ring. Black material with crystalline(?) inclusion or adhesive. GW 1030 (1289-04-LR). (Same as Pb-3299.)</td>
</tr>
</tbody>
</table>
Central Asian Metals; dates uncertain

These samples were removed from objects and fragments acquired by RHB in Herat on 7/23/93. All are said to have come from Bamiyan or Chakhcharan. See Ref. C-23.

6070 Brass stirrup with incised decoration and some copper inlay work. Patinated and somewhat corroded; one raised ridge along bottom. H. 12.1 cm. (Same as Pb-2200.)

6071 Another brass stirrup with different incised decoration and some copper inlay work. Patinated and somewhat corroded; three ridges along bottom. One side broken and poorly repaired. H. 12.3 cm. (Same as Pb-2201.)

6072 Brass spoon with incised decoration on bowl; long, pick-like handle. Patinated and corroded. L. 16.3 cm. (Same as Pb-2202.)

6091 Small, three-legged bronze cosmetic container. Patinated. H. 5.9 cm. (Same as Pb-2203.)

6092 Small, three-legged bronze cosmetic container. Heavily corroded. H. 6.4 cm. See also 4561 for the contents of this vessel. (Same as Pb-2204.)

6093 Vertical brass socket for lamp with stylized (?) Chinese characters around bulbous waist. Patinated. Key slot in bottom. H. 5.3 cm. (Same as Pb-2205.)

6094 Top of bronze lamp with long wick holder and bird on loop handle. Heavily corroded. H. 9.3 cm., l. 10.8 cm excluding bird’s tail. (Same as Pb-2206.)

6095 Standing bronze bird with cat’s head, hooves, and short tail. Moderately corroded. H. 5.0 cm. (Same as Pb-2207.)

6096 Bowl of light-colored metal, with turned decorative grooves on interior. Heavily corroded. One of a nest of about 10 such bowls. Diam. 10.1 cm, h. 4.4 cm. (Same as Pb-2208.)

6097 As above, a somewhat larger example. Diam. 12.6 cm, h. 5.6 cm.

6098 Brass kohl applicator with bird on top. Heavily corroded. H. 11.6 cm. (Same as Pb-2209.)

6099 Bronze kohl applicator with bird on top. Patinated, but rubbed clean in places. H. 5.1 cm. (Same as Pb-2210.)

Miscellaneous Metals

375 Hasanlu; ca. 1000–850 B.C. Bronze bead. XL-4.3.56; 60-499.

376 As above. Metallic bead; ca. 900 B.C.

2908 Small molded lead juglet with embossed decoration and handle (or poss. a mold prototype?). Iran, Gorgan, prob. 12th–13th c. H. 4.9 cm. (Same as Pb-20).

2909 Sumatra, Kota Cina; prob. 12th–14th c. Metal ingot, pyramidal in shape, with four curved rising edges and flat, truncated top. Base ~6.7 cm square, h. ~5.4 cm, wt. ~700 g. Silvery metal with black corrosion products on roughened surfaces. A large sample had been removed from one corner when received. From E. McKinnon, see his correspondence of 1980. (Same as Pb-2086.)
4751 One of two minute metallic flakes inside chip of blue transp. glass (no. 391) from tip of post of Corinth diatretum. There are no streamers of color emanating from flakes, therefore they are more likely scale dislodged from a tool than residues of glass colorant.

4777 Tell al-Rimah; ca. 1500 B.C. Small metallic ingot, probably lead or a lead alloy. Site A (temple mound) level 2, 1964. T. Carter, UM. (Same as Pb-203.)

4778 Metallic mirror coating from glass plaque; ancient, but of uncertain date. Consists of two glass plates with painted floral design and encased mirror coating. (A. Wolkenberg.)

5997 Metal mold for pattern-molded glass, with Arabic inscription, "Uthman b. Abu Nasr". Islamic, 9th–12th c. Brass. CMG 86.7.15. See Ref. E-31. (Same as Pb-2119.)

5998 As above. Brownish material with green corrosion products adhering to silicone rubber impression.

XXVI C. COINS


4742 Blanca of Henry IV of Castile; minted 1471–74. Billon; Segovia mint. Same type of coin as CMG 4693 excavated at San Salvador. (Same as Pb-1442.)

4743 As above, Toledo. (Same as Pb-1443.)

4744 As above, Cuenca(?). (Same as Pb-1444.)

4745 As above, Seville. (Same as Pb-1445.)

4746 As above, Segovia. (Same as Pb-1446.)

4747 As above, Toledo. (Same as Pb-1447.)

4748 As above, Burgos. (Same as Pb-1448.)

4749 As above, Avila. (Same as Pb-1449.)

4750 As above, Cuenca. (Same as Pb-1450.)

XXVI D. POTTERY

Gordion; Hittite-Phrygian. (R. Young, UM 12/11/59.)

82–88 Sherds of various types.

Jalame; ca. 365. (CMG and UMo. excavations.) See Ref. A-58.

870 Combed ware, gray body, tan surface.

871 Combed ware, gray sandwiching cream zone.

872 Combed ware, gray body, cream surface.

873 Combed ware, gray-tan body, gray surface.

874 Combed ware, salmon.

875 Combed ware, salmon.

876 Salmon, sandwiching cream.

877 Salmon, sandwiching thin cream.

878 Combed ware, cream body, tan surface.
879 Flat tile, cream.
880 Combed ware, porous.
881 Handle, porous, brick-red.
882 Combed ware, friable, brick-red, tan surface.
883 Pseudo terra sigillata, hard, brick-red.
884 Combed ware, tan body, salmon surface.
885 Lightly combed ware, gray body, tan-salmon surface.
886 Combed ware, gray body, brick-red surface.
887 Smooth walled, dark gray, salmon surface.
888 Combed ware, gray body, tan and salmon surfaces.
889 Handle, gray body, tan-cream surface.
891 Large chunk of red stone. J65BE.

Beth She'arim; 2nd–4th c.

892 Sherd with white painted stripes. Sample scraped from unpainted region after removing the outermost surface (BS 65; AB-13).
893 As above, sample scraped from white painted stripe.
894 Combed ware, salmon, gray-fired outer surface and (grayish) white painted design. Sample removed from salmon colored fabric.
895 As above, sample scraped from gray fired surface.
896 As above, sample scraped from white painted regions.


4695 San Salvador, Indian pottery sherd. Similar to 4694.
4696 San Salvador, Indian pottery sherd. Similar to 4694.
4697 San Salvador, European pottery sherd. Example of melado ware. Wall fragment, salmon-colored with honey-colored glaze on one side. Found in same context as Indian wares. N4 E6, 10–20 cm, 6/6/83. (Same as Pb-1495.)
4698 San Salvador, European pottery sherd. White-glazed ware (“majolica”). Small sherd, grayish with thick, dull white glaze. Found in same context as Indian wares. N6 E6, 10–20 cm, 6/13/83. (Same as Pb-1496.)
4699 Convent of San Nicolas, Santo Domingo, Dominican Republic. European pottery sherd. Example of Columbia Plain ware. Fragment of a plate, cream-colored with white enamel glaze. Similar in appearance to 4698. From The Hispanic Society of America, no. LE 1036; Cruxent Donation, 1974. Submitted by Isadora Rose-de Viejo. An identical plate is illustrated by Goggin. See Ref. A-49. (Same as Pb-1499.)
Drake’s Bay, California; ca. 1600. (A. Treganza.)

921 Porcelain; probably Chinese. Body material.

922 As above, white glaze.

923 As above, white and blue glaze.

Mathew’s Manor, Va. (I. Noel-Hume, CW.)

924 Bowl, body sherd, soft buff ware. Body material. WS 22.

925 As above, transp. glaze.

926 As above, with black and blue decoration.

927 Shallow dish, rim fragment, gray stoneware. Gray body material. WS 1.

928 As above, white glaze contaminated with ~30% body material.

929 As above, blue and white glaze.

930 Porcelain cup or small bowl, lower body fragment. Of indisputable Chinese origin. WS 17. Body material.

Beth She’arim Slab, 4th–7th c. (?) (CMG and UMo excavations.) See Refs. A-13, A-17, and A-58.

600 Raspberry-colored glass from drilled core sample, 7.5–12 cm below upper surface. Heavily devitrified.

601 As above, greenish glass. 15–16 cm below surface. Heavily devitrified.

602 As above, raspberry-colored glass. 30–40 cm below surface. Heavily devitrified.

603 Greenish glass from front left corner of slab. Heavily devitrified. BS-14.

604 White frothy material in white opq. band at bottom of slab. 41 cm from upper surface. E2.

605 Tan-colored, fritted, granular region. From E2 adjacent to 604. Represents partially reacted batch.

609 Gritty or fritted material (probably a w. product) from side of slab. Porous with gray color. BS-12.

610 Chip of black material adhering to gray material; mixed in with core segment F.

611 Chip of white frothy material beneath porous layer of 609.

Farinjal, Afghanistan; 300–1200. See Ref. C-23.

6400 Farinjal, Afghanistan. Metallurgical site thought to have been worked from 300–1200. Glazed pottery sherd. Green glaze over white slip on salmon-colored body; glazed on both sides. Collected by RHB 8/6/68; NGS Site No. 4. 30–50% PbO. (Same as Pb-841.)

6401 As above. Bluish green glaze on salmon-colored body; glazed on both sides. 30–50% PbO. (Same as Pb-842.)

6402 As above. Green glaze on salmon-colored body; glazed on one side only. 1–3% PbO. (Same as Pb-843.)

6403 As above. Bluish glaze on thick buff-colored body; glazed on concave side only. 0.03–0.1% PbO. (Same as Pb-844.)

6404 As above. White glaze on thick buff-colored body; glazed on concave side only. 30–50% PbO. (Same as Pb-845.)
6405 As above. Rim fragment. White glaze with dark blue, cloud-like decoration on soft light gray body. Poss. made in Iran in imitation of Chinese porcelain. Said by DBW to be common near Kandahar. 0.03–0.1% PbO. (Same as Pb-846.)

6406 As above, a body fragment. White glaze on one surface, mainly dark blue on other. Poss. made in Iran in imitation of Chinese porcelain. 0.01–0.03% PbO. (Same as Pb-847.)

Bamiyan, uncertain dates. (Purchased in Herat by RHB, 7/22/93.)

6410 Pottery vessel fragment, head of Buddha(?). Said to be from Bamiyan. Salmon-colored body with cream-colored slip on exterior; features painted in dark brown. Sample is of cream-colored slip.

6411 As above, chocolate brown slip or paint from concave interior.

6412 As above, another sherd, hollow head and face preserved, remains of shallow basin and rim attached directly above. Cream-colored slip, features painted in dark brown. Sample is of cream-colored slip.

6413 As above, chocolate brown slip or paint from back of ear.

6414 As above, a third hollow head and face, with part of vessel opening preserved above. Cream-colored slip; features painted in dark brown. Sample is of cream-colored slip.

XXVI E. METALLURGICAL SLAGS


5394 Beer Ora, south end of the Timna Valley, Israel. One of some 2000 slabs of black slag from copper smelting operations. Prob. 2nd c. Semicircular slab with hole near center, ~60 cm long. Collected by RHB and FRM, 7/13/66, following directions provided by B. Rothenberg.

5936 Farinjal, Afghanistan. Metallurgical site thought to have been worked from 300–1200; possibly reworked in 1940s. Large nugget of vitreous slag. Black (v. dk. olive). Collected by RHB 8/6/68; NGS site no. 4. (Same as Pb-840.) See also Section XXVI A., nos. 5937-39.
XXVI F. KENCHREAI PANELS; 4th c.


790 As above, single grain from K66L.

791 As above, but a different translucent phase from K66L. (Accounts for ~10% of inorganic phases.)

794 White marble grains from CCl₄ extraction.

795 Gray marble grains from CCl₄ extraction.

796 Sample of “green fill”. Type of background fill that seems to have been tamped into place on many panels. From panel labeled Stack V, 3 B. The material has a leathery exterior coating believed to be largely a consolidant applied shortly after excavation. The interior is a friable material having a microscopic appearance resembling crushed p. aqua transp. glass. Sampled by RH6 7/11/95 at the Isthmia Museum. See Ref. B-10.

797 As above, similar samples from panels labeled Stack VIII, 2 and 3.

798 Powdery residue recovered from four extractions of a portion of no. 796 with acetone (total vol. ~200 ml). Residue consists of 99+% of crushed, angular glassy phase having p. grn. aqua and p. bl. aqua transp. appearance under magnification, and greenish opq. appearance in bulk. The material also contains numerous small, amber “relict bubbles” of the sort frequently seen in w. glasses. Yield ~2.1 g.

799 Loose powdery material removed from bursting “pillow” of weathered opus sectile glass on panel.

XXVI G. COPPER ACETATE

These samples are from the results of an experiment conducted to learn if copper acetate—a water soluble copper salt—can be prepared by a simple process from materials available to early Egyptian or Near Eastern technologists. In separate beakers, 100 ml of white vinegar was poured onto 2.0 g each of powdered cupric oxide and basic cupric carbonate. These compounds were used to simulate copper scale and crushed malachite. Similar experiments were conducted with glacial acetic acid.

Within 30–45 min., the vinegar had begun to react with both compounds, as evidenced by the appearance of blue colors. The supernatant liquids were twice poured off and replenished each time with another 100 ml of vinegar. After a total of 42 hrs. the collected liquids were allowed to evaporate at room temperature in evaporating dishes.

In each case the evaporation yielded well-formed, greenish blue, monoclinic crystals, the largest of which measured 8 mm in greatest dimension. Both experiments yielded in excess of 2.0 g of crystalline products, but the carbonate appeared more reactive than the oxide. The experiments employing glacial acetic acid reacted much more quickly and yielded very fine crystals upon evaporation. The experiments were carried out 6/21–23/83.

4774 Large, well-formed, monoclinic crystals obtained from the reaction of basic cupric carbonate and white vinegar. Greenish blue.
4775  As above. Slightly smaller crystals, but of identical appearance. From the reaction of cupric oxide and white vinegar.

4776  As above. Fine crystals, but of identical morphology. From the reaction of basic cupric carbonate and glacial acetic acid.

4771  Large, well-formed, dk. blue monoclinic crystals obtained from a repeat of the 6/83 experiment described above. These came from the 72-hr. reaction of 200 ml of distilled white vinegar with 1.00 g of cupric oxide. The evaporation was complete after 7 days, 16 hrs. at ~31°C. The yield was ~0.48 g of crystals. Some of the original cupric oxide remained as a black residue in the original jar which had been replenished to a total volume of 450 ml of vinegar. See RHB notes of 5/97.

XXVI H. VESSEL CONTENTS

Note: See also nos. 6237 and 1119 in Section XXVII.

1653  Vessel contents. Oily contents “... found in a fragment of a conical lamp at Karanis”; 4th c. or later. The oily liquid was given to RHB by Donald Harden sometime before 1972. It consists of a colorless, somewhat viscous (aqueous?) fluid in an ampoule with a sealed glass tip. The liquid contains droplets of an immiscible, more viscous, dk. amber fluid, and clots of a whitish, waxy(?) material. See undated corres. from D. B. Harden, and Refs. F-58 (pp. 155, Karanis group 26/BS 2D) and F-29. Sample is of colorless liquid.

1654  As above, dk. amber fluid.

1655  As above, whitish material.

1656  Vessel contents. Black, friable material with granular (prob. inorganic) inclusions. From a blown glass medicine(?) bottle; prob. 16th–18th c. Newark Museum no. 50.1671. From S. Auth, 1975.


1658  Vessel contents. Brownish, friable material, preserving a solidified appearance of a frothy, but very viscous, liquid. From an 18th-Dyn. Egyptian cored vessel. CMG 55.1.60; SMG no. 13, p. 54, and pl. 2.
1659 Vessel contents. Brownish material with a waxy or greasy texture and flakes of a black phase. From a church lamp in the Agora in Athens; 6th c. The lamp also contained a wick float. Agora no. G-168. Collected by RHB at the Agora.

1660 Vessel contents. Material consists of two major phases: a whitish waxy substance coated with a buff-colored material; and a black material. From a glass flask; Rhineland, 3rd c., thought to have been found at Steinbach, Ardennes. CMG 53.1.104.

1661 Vessel contents. A black material removed during repair. From an 18th-Dyn. Egyptian cored vessel. CMG 71.1.3; SMG no. 14, p. 55, pl. 3. While sampling the material, a small beetle was found embedded in it.

1662 As above, contents adhering to core material residue.

1663 Vessel contents. The material consists of two immiscible phases, one an amber-colored, viscous phase, the other a colorless (aqueous?) phase. From an Eastern Mediterranean cored vessel, prob. 6th–4th c. B.C. Newark Museum, no. 50.1353; on loan to The CMG, Study card 798. The sample was obtained with a hypodermic needle inserted through the ancient intact seal. Sample is of the first material to drain out.

1664 As above. Largest fraction (35 ml) obtained by seven-week drainage following withdrawal of no. 1663. Sample is a brown, oily liquid.

1665 As above. Last fraction (~4 ml).


1667 From same vessel as nos. 1683–85. Sample is of semisolid contents remaining after the oily liquid had drained out. This is a mixture of brown oily phase, small inclusions of a whitish material having a waxy or soapy texture, and shreds and fibers of black vegetable matter. A few insect parts might be included and there are a few orange-coated grains typical of the core residue of these vessels. (Sampled April, 1972).

4540 Vessel contents. From the bottom of a double unguentarium; Roman, no provenance, ca. 4th c. Dk. gray compacted material, containing coarsely crushed galena. Given to D. B. Whitehouse for analysis by J. Lawson, 10/93. (Same as Pb-1367.)


4542 Vessel contents. Finely-divided black material compacted into a small flake adhering to the inside of a palm-column flask fragment. Egypt, late 18th–19th Dyn. CMG 58.1.17; SMG no. 25, p. 60, and pl. 9.

4561 Fluffy gray powder, the contents of a small cosmetic container said to be from Bamiyan or Chakhcharan. See no. 6092. Probably consists of a mixture of original contents, soil, and corrosion products. Contains a minor portion of fine black mineral(?) grains.
XXVI I. OTHER MATERIALS

725 Tell Al-Rimah. Fragments of a rock crystal artifact resembling the narrow neck of a vessel with two horizontal ridges. 8th–7th c. B.C. (?) Elaborately turned and highly-polished on exterior, with part of a drilled vertical and ground concave throat(?) on the inside. Perfectly colorless. A roughly drilled horizontal hole might have held a hook for support. L. ~2.7 cm, t. ~3.0 mm, app. diam. of larger ridge ~1.7 cm, diam. of drilled hole 2.8 mm. UM-65-24-42. From T. A. Carter, 2/27/70. Used for polariscopic exam., sp. gr. determination.

1290 Tell Umm Jirin, Iraq. Yellow aggregate material, from large piles or markers. Porous, somewhat frothy, possibly pellet-like in places. Collected by RHB 5/5/67.

1762 Gnašic shipwreck, 16th c. Chunks of dense, crystalline, dark red mineral described as cinnabar. See Section XII D.

1763 As above. Cone-shaped chunk of dense, whitish material with gray and yellowish-brown stains. Described as carbonate of lead.

2969x Elongated, twisted piece of unidentified material. Kota Cina; surface find. Thought to be a piece of glassmaking waste. Dissolves completely in conc. HCl with effervescence. This appears to be a fragment of a shell, poss. a whelk or cone.

4559 Heshbon; date uncertain, but assumed to be ancient. A nugget of material mistaken for glass. Black, lustrous material showing laminar striations and conchoidal fracture. Softens readily to the touch of a hot needle. Poss. jet. Heshbon, Area B, 1976. Given to RHB by SMG on 5/22/79.

4560 Black powder, said to be used as kohl. Purchased by RHB at Sikh Temple in Delhi, 11/1/97. Strongly aromatic with camphor-like odor.

4562 Black powder called surma, said to be used as eye cosmetic or medicine. Purchased by RHB in Samarkand, 7/13/89.

4610 Egypt, the tomb of Neferwptah at Hawara; 12th Dyn. A mixture of resin and pulverized galena. From the large alabaster jar no. 28 in the tomb. See Ref. F-41. Given to RHB by Zaki Iskander (4/21/73) who believed that the material was used as a medication. (Same as Pb-1364.)

4611 Natural gum, said to have come from Darfur; modern. Given to RHB and FRM by potters at the Amin Gabana factory, Khartoum. Described as smakh; used when mixed with water, red lead, and a frit ("braks", pronunciation resembles "borax"), as a glaze. See RHB Field Notes for 5/7/73.

4720 Carved square dish with four compartments. Afghanistan, date uncertain. Probably steatite. Purchased by RHB in Herat, 7/22/93.
4768  Surface sample of weathered stone from 18th(?) century stone sculpture in open courtyard of the Hotel Los Reyes Catolicos, Santiago de Compostela. Blackened nodules over somewhat friable buff-colored stone. Collected by RHB, 6/19/94.

4769  As above, interior stone.

6324  Arikamedu, poss. Roman. Rundown on interior surface of large, burnished, salmon-colored, sherd. Friable, gray body with laminar structure, whitish surface. Sample no. 1. (V. Begley, UM, via DBW, 7/92.)

6325  As above, the pottery sherd.

6326  As above, sherd no. 2.

6327  As above, lump of frothy, black material, with orangy surface accretion. Sample no. 3.

Wood F.  As above, another slat from the same crate.

Resin F.  Sample of rosin collected by dissolving away the inorganic phases of a composite sample of the panel “resinous plaster” using warm, dilute HCl.

Kerenia Shipwreck, ca. 300 B.C.  Samples submitted by M. Katzev, INA, 5/23/70.

1695  Lining resin attached to amphora sherd. Katzev no. 6.

1699  Lining resin detached from an amphora. One surface retains the contour of the amphora surface, the other shows an impression of plant matter that might have been part of a stopper.

The Athenian Agora; ca. 420 B.C.—ca. 128. Sampled by RHB with the guidance of Virginia Grace, 8/8/70. For further details see RHB Field Notes for that date.

1690  Resin from inside base of a Mendean jar, ca. 420–400 B.C. Agora no. P26383. Jar was of a dull red, micaceous clay, with buff-colored surface. From a well north of the Nymphaion, Q 15:2, 4/54. See Ref. F-127.

1691  Resin from a smear inside the base of a jar, somewhat later than no. 1690, from higher level in same well. Agora no. P26339. Jar was of a red, micaceous clay. Q 15:2, 4/54.

1692  Powdery resin scraped from smeared interior of an inscribed amphora, 2nd quarter of 2nd c., poss. 128. Agora no. P7583. Amphora was of red clay, with a hole in the shoulder. From a well at 64/K8, 4/27/36. See Ref. F-112.

_Constanța; Romania; 1st–5th c. From M. Bucovălă, MaC, 3/14/73. See Ref. F-110._

4603  Lumps of resin from amphora no. 47.

4604  As above, amphora no. 48.

4605  As above, amphora no. 65. Lieberman-Storch test gave "violet-rose" color.

4606  As above, amphora no. 79.

4607  As above, amphora no. 83. Lieberman-Storch test gave "dusty-rose" color.

_Beth She'arim; prob. 4th–9th c._

BS '65; AB-1. Small piece of charred wood excavated from beneath the Beth She'arim slab. See RHB Field Notes for 7/21/65.

BS '66; E-17. Small sample of charcoal excavated from beneath the Beth She'arim slab. Tucked between two stone blocks of the tank bottom; 80 cm from front of slab, –8 cm beneath bottom of white frothy zone. See RHB Field Notes for 7/8/66.

_Ancient Egyptian natron; 18th Dyn._

See Section XXIV B., samples 655, 656, 657, 657b, 658, 661, 662, 664, and 665.
XXVII. PIGMENTS

Bamiyan wall paintings; ca. 7th–9th c.

6140 Blue pigment applied to grass-reinforced mud plaster. From wall painting in niche near top of large Buddha. BAM-I. Collected by RHB on 8/6/68. Sample is heavily contaminated with whitish ground (gypsum) and mud plaster. (Same as Pb-2042.)

6141 As above, red pigment. BAM-3 (Red). Heavily contaminated. (Same as Pb-2043.)

6142 As above, white pigment. (Same as Pb-2044.) Sample not yet taken.

6143 As above, blue and white pigments. BAM-1 (Scraps). Sample used for XRD.

Begram

6227 Fragment of pink material, probably a pigment. From double-walled vessel. See Ref. F-54, pp. 166–167; and Ref. F-55, pl. IIIg. (Same as Pb-2244.)

6235 Flakes of paint or fill from a glass fragment. Pink pigment. (M. Tissot, MNAA, 11/22/91.)

6236 As above, grayish-tan paint(?) covering pink pigment.

6237 White fill from between layers of a double-walled glass. There is a pink phase between the fill and a piece of glass on which it is supported; and some possibility that white lead pigment might also be present. (M. Tissot, 11/22/91.) Some contamination with pink phase and soil(?). (Same as Pb-2243.)

Egypt

1199 Rose madder from Egypt. Contents of small, blown glass jar with gauze and wadded grass stopper. From Cemetery VIII at Tebtunis; Late Roman. Pink, friable lumps of powdery material. On loan from University of California. Study card no. 802. See also CMG 6227 from Begram. (Same as Pb-2246.)

3381 Egypt; 18th Dyn. Piece of brownish orange material, probably a pigment. Waxy matrix which softens to the touch of a hot needle, with finely-divided inorganic phases. Very similar in appearance to a carved head on the base of an object from the tomb of Tutankhamun. See alabaster unguent jar, with a lion: exhibition catalogue no. 16 (Ref. F-6); Cairo no. 62119; Carter no. 211. The head of “an Asiatic” is there described as “red stone”. UC 24691.

6040 Insoluble residue remaining after ethanol extraction of sample 3381 on spot plate. Consists of finely-divided white material with specks of orange opaque phase. (Same as Pb-2245.)

6041 As above. Speck of orange opaque phase isolated from 6040.

6042 As above. Gummy residue remaining after evaporation of ethanol extract.
Tibet

These samples were removed from a group of six small tsakali "paintings" on canvas or a similar fabric. The paintings (measuring ~10 x 12 cm) are in poor condition, having considerable losses of paint and surface contamination. The reverse-sides are matted and contain a silty ground. The paintings depict various animals and deities. The predominant colors are blue, grayish blue, red, and a pink flesh tone. There may also be a buff-colored ground underlying the colors. The pieces are of uncertain date, but do not appear to be new. Purchased by RHB and ERB in Shigatse, 10/24/95.

6508 Painting of a chalice. Sample is of bright blue pigment, apparently a crushed mineral or glass. It is somewhat contaminated with a purplish surface coating.

6509 Painting of a Boddhisatvah(?). Sample is of blue pigment, apparently a crushed mineral or glass. It is somewhat contaminated with a purplish surface coating.
XXVIII. SUPPLEMENT

XXVIII A. AQUILEIA; 1st c. B.C.–4th c.
(C. Moretti, 3/98.)

These fragments were submitted for analysis by Cesare Moretti of S. Vito al Tagliamento, Italy, on 3/11/98. All are undated surface finds thought by Mr. Moretti to have been made in Aquileia between the 1st c. B.C. and the 4th c.

6950 Fragment of ribbon glass bowl. Colorless with encased dk. blue transp., white opq., yellow opq., and red opq. ribbons, and also one minute bit of aqua; moderately w. Moretti A. Sample is of colorless matrix glass.

6951 As above, dk. blue transp. region.

6952 As above, white opq. region.

6953 As above, yellow opq. region.

6954 As above, red opq. region.

6955 As above, aqua bit.

6956 Ribbed bowl, dk. blue transp. with white opq. swirls; lightly w. Moretti B.

6957 Large ribbed bowl, dk. blue transp.; little or no w. Moretti C.

6958 Ribbed bowl, purple with white opq. swirls; little or no w. Moretti D.

6959 Ribbed bowl, amber; little or no w. Moretti E.

6960 Small vessel, bl. aqua; moderately w. Moretti F.

6961 Base of small vessel, p. bl. aqua; little or no w. Moretti G.

6962 Thin-walled vessel, lt. blue transp.; moderately w. Moretti H.

6963 Cup or small container, purple, lightly w. Moretti I.

6964 Small plate. Olive, no w. Moretti L. (May not be ancient?)

6965 Mosaic tessera. Red opq., little or no w. Moretti M.

6966 Mosaic tessera. Med. blue opq., little or no w.

6967 Mosaic tessera. Dk. blue opq., little or no w.

6968 Mosaic tessera. Dk. green opq., lightly w.

XXVIII B. CHANDELIERS

English and/or Irish

6880 Candelabrum, Irish or English, ca. 1785; one of a pair. Both pieces were damaged during the 1972 Corning flood. The existing piece was made up from surviving parts of both originals. The candelabrum holds two candles in sockets on two arms. Two other arms hold canopies. A central shaft (topped with a star finial) rises from a heavy urn base. The piece is decorated with festoons of pear drops. Colorless glass, with three rare dark blue canopies and p. amber drops. No apparent crizzl. H. = 90.5 cm. CMG 50.2.23. See Ref. F-123. Sample is from colorless socket.

6881 As above, a colorless pear drop.

6882 As above, a similar drop.


6892 One of a pair of faceted, octagonal jewels attached by wire hooks, each with an opposing hook. English, ca. 1840-50. Colorless, lightly crizzl. L. (across sides) ~2.4 cm, t. ~1.3 cm.

6893 Faceted pear drop with wire hook. English, ca. 1850-60. Colorless, v. lightly crizzl. L. = 5.5 cm, max. w. = 2.7 cm, t. = 1.8 cm.

Venetian

These samples are from a disassembled chandelier made by Salviati & C., ca. 1870. The piece contains six candle arms decorated with blown and tooled scrolls, multicolored flowers, chains, and pendants. Smoky glass with white opq., yellow opq., lt. blue opq., and some pink transp. embellishments. Poss. incipient crizzl. on a few pieces. CMG 98.3.8. Sampled with the help of J.-A. Page.

6894 Colorless (smoky?) chain link made from spiraled cane.

6895 Cased flower petal. Sample consists of colorless base glass.

6896 As above, pink transp. swirl.

6897 As above, turbid white casing.

XXVIII C. CHEVRON BEADS; dates uncertain. (Submitted by B. Graham, KSU, 5/8/98.)

Entries by Colleen P. Stapleton.

6850 Seven-layered chevron bead fragment, poss. 17th c., no provenance. Sequence of layers from exterior to perf.: dk. blue transp., white opq., red opq., white opq., aqua, white opq., aqua. White opq. contains flakes of white opacifier phase, visible with low-powered magnification. Little or no w. L. 1.0 cm, d. 1.0 cm, perf. approx. 2 mm. Sample is of dk. blue transp.

6851 As above, red opq.

6852 As above, aqua.

6853 As above, white opq.

6854 As above, flake of white opacifier phase in 6853.

6855 Four-layered chevron bead fragment, poss. 17th c. (?), no provenance. Sequence of colors from exterior to perf.: dk. blue transp., white opq., red opq., white opq. No w. L. 7 mm, d. 7 mm, perf. 2 mm. Sample is of dk. blue transp.

6856 As above, white opq.

6857 As above, red opq.

6858 Four-layered chevron bead fragment, poss. 17th c. (?), no provenance. Sequence of colors from exterior to perf.: grn. aqua, white opq., red opq., white opq. Little or no w. L. 4 mm, d. 7 mm, perf. 2 mm. Sample is of grn. aqua.

6859 As above, white opq.

6860 As above, red opq.
6861 Five-layered chevron bead fragment with yellow opq. stripes on exterior; known as “yellow jacket”. Poss. 17th c. (?), no provenance. Sequence of colors from exterior to perf.: yellow opq., black, red opq., white opq. No w. L. 1.7 cm, w. 7 mm, perf. 1 mm. Sample is of yellow opq. stripe.

6862 As above, black.

6863 As above, white opq.

6864 As above, red opq.

6875 As above, another fragment of same vessel (?). Ax 93, B 757.

6975 Fragment of cased glass; shape of object unknown. Dk. blue transp. cased onto colorless base glass (or vice versa?), lightly w. T. of blue = 1.2 mm; colorless = 2.3 mm. Ax 93, B 27. Sample is of blue glass.

6976 Wall fragment of a small vessel(?). Yellow opq., moderately w.

6977 As above, colorless glass.

6978 Flat clumps of friable material believed to be remains of inlays; embedded in soil or plaster. Apparently heavily w.; no evidence of glassy phases remains. Ax 96, B 1739.

XXVIII D. ETHIOPIA (Axum); 1st–7th c. From 1993–97 excavations. For details, see original labels accompanying fragments. (M. Harlow, BIEA and D. Phillipson, MAA; 6/3/98.) See Ref. F-97.

See also Section V T.

Tomb of the Brick Arches; late 3rd–early 4th c.

6970 Vessel fragment, v. thin-walled, mold-blown in bubble-like pattern. Colorless, little or no w. T. ~0.3 mm. Ax 93, B 333.

6971 V. thin-walled, curved fragment. Colorless, no w. May be modern. Ax 95, B 1719.

6972 Fragment of footed flute. Purple, little or no w. Ax 95, B 1664.

6973 Fragment of v. thin blown glass; shape unknown, but large radius of curvature. Purple, no w. T. ~0.2 mm. Ax 95, B 1577.

6974 Fragment of pattern-molded goblet. Dk. blue transp. with some w. scum. Ax 94, B 1396.

6979 Flat clumps of friable material believed to be remains of inlays; embedded in soil or plaster. Apparently heavily w.; no evidence of glassy phases remains. Ax 96, B 1739.

Mausoleum; late 3rd–early 4th c.

6980 Two small inlays, one circular, the other square. Dk. blue transp., heavily w. D. ~1.1 cm, t. ~1 mm; other piece ~6 mm square, t. ~0.8 mm. Ax 94, M 195.

6981 Fragment of shattered vessel(?). Dk. blue transp., moderately w.

Domestic Site; 4th–6th c.

6982 Fragment of large (?) vessel. Colorless, lightly w. Ax 96, D 839.

6983 Fragment of thin-walled blown vessel. Aqua, moderately w.

6984 Fragment of pattern-molded goblet(?). Aqua, lightly w.
6985 Fragment of blown glass. Purple, little or no w. Ax 95, D 336.

6986 Fragment of vessel. Lt. blue transp., moderately w. Appears to have been bubbly and poorly melted. Ax 96, D 680.

6987 Ear plug(?) poss. fashioned from a broken goblet stem or similar fragment; drum-shaped with some grozed edges. Dk. blue transp., moderately w. Ax 95, D 980. (V. small sample.)

City Site; 5th–6th c.

6990 Fragment of thin-walled blown vessel. Aqua, iri. Ax 96, K 170.

6991 Fragment of beaker or lamp. P. olive with dk. blue applied blobs, lightly w. Ax 96, K 256.

6992 As above, poss. the same object.

6993 Fragment of blown object. Colorless glass with applied dk. blue decoration, no w. Exceptionally clear and colorless. Ax 96, K 257.

6994 Fragment of an adult-sized bangle. Black (dk. olive), worn and moderately w. Ax 96, K 161.

6995 Chunk of broken molded glass having flat sides and squared-off corners; poss. an ingot. Red opq., lightly w. Preserved l. ~3 cm, w. ~1.8 cm. Ax 96, K 220. (Same as Pb-2132.)

East Tomb; late 3rd–early 4th c.

6996 Fragment of thick-walled blown vessel. Strong bl. aqua, lightly w. Ax 93, E2(1).

Beads

7000 Medium ellipsoidal drawn bead. Colorless, with pinkish cast near surface, some traces of gold leaf at one end, moderately w. L. 1.0 cm, d. 8 mm, perf. 1.8–2.0 mm. Ax 94, B 1349.

7001 Large cornerless bead. Dk. green, lightly w. Several elongated bubbles (~10:1) parallel to perf. Preserved l. ~1.5 cm, w. 9.5 mm, perf. ~5.5 mm. Ax 95, D 398.

7002 Medium biconical bead with hexagonal section. Colorless, heavily pitted. A few elongated bubbles (4:1) parallel to perf. L. 8.0 mm, d. 8.5 mm, perf. 3.0 mm. Ax 94, M 439.

7003 As above, aqua, heavily pitted. A few elongated bubbles parallel to perf. Ax 95, B-1590.

7004 As above, amber, heavily pitted. A few elongated bubbles parallel to perf. Ax 95, M 624.

7005 As above, dk. blue, heavily w. Swirled patterns doubling back on themselves along surface. Several elongated bubbles (~6:1) following swirl lines. (Sl. smaller than other beads.) Ax 95, M 624.

7006 As above, lt. blue opq., moderately w. Ax 94, B 1248.

7007 As above, red opq., moderately w. Ax 93, B 140.
7008 Seed bead, lt. blue opq.
Ax 94, M 407.

7009 Seed bead, yellow opq.
Ax 94, B 1156. (Same as Pb-2133.)

7010 Seed bead, lt. green opq.
Ax 93, B 137. (Same as Pb-2134.)

7011 Seed bead, red opq. (One of three.)
Ax 94, M 429. (Same as Pb-2135.)

XXVIII E. METHONE SARCOPHAGI
SHIPWRECK; 2nd–3rd c.
See Ref. C-5. (P. Throckmorton, 4/65.)

1512 Flattened rim fragment of large vessel, poss. a cinerary urn (?).
Grn. aqua, pitted and encrusted with marine growth. Apparent diam. ~16 cm. Labeled M-7-19. (Oxygen isotope analysis performed.)

1513 Rim or base fragment of thin-walled vessel. Colorless, pitted and eroded. Apparent diam. 4.5 cm.

1514 Fragment of thin flat glass, poss. window glass. Colorless, pitted and eroded. Several shallow concentric w. channels on each side, poss. relict polishing marks. Gr. dimen. = 5.7 cm, t. = 0.8–1.2 mm.
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DO    Dumbarton Oaks, Center for Byzantine Studies, Washington, D.C.  105
dPWM  Henry Francis du Pont Winterthur Museum, Winterthur, Del.  189, 191, 192
EES   Egypt Exploration Society, London  67
EH    Eastman House, Rochester, N.Y.  138, 194
EHer  English Heritage, Portsmouth  100
EM    Egyptian Museum, Cairo  205
EU    Emory University, Atlanta, Ga.  107
FAM   Fogg Art Museum, Cambridge, Mass.  67, 123
FGA   Freer Gallery of Art, Washington, D.C.  36, 150
FME   Folkens Museum Etnografiska, Stockholm  147
GCI   The Getty Conservation Institute, Marina del Rey, Calif.  128
GE    General Electric, Schenectady, N.Y.  195
HAGM  Herbert Art Gallery and Museum, Coventry  119
HM    Hermitage Museum, St. Petersburg  148
HSA   Hispanic Society of America, New York City  206, 227
HU    Harvard University, Cambridge, Mass.  213
HUC   Hebrew Union College, Los Angeles  232
HUJ   Hebrew University of Jerusalem  58, 59, 75, 105, 194
IAA   Israel Antiquities Authority, Jerusalem  58
IAL   Institute of Archaeology, London  45, 172
IAM   Istanbul Archaeological Museum  89
IA-M  Institute for Archaeo-Metallurgy, London  37
IARB  Istituto di Antichità Ravennati e Bizantine, Ravenna  105, 106, 108
IdA   Istituto di Archeologia, Turin  83
IdNR  Istituto di Norvegia in Roma  109
IfD   Institut für Denkmalpflege, Berlin  124, 125, 130

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Concordance with SMG Numbers

Sidney M. Goldstein, *Pre-Roman and Early Roman Glass in The Corning Museum of Glass.* (Ref. E-16)

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REFERENCES
INTRODUCTION

These Lists of References are not intended to be a comprehensive bibliography on
the subject of this book. Instead they are almost entirely references relating specifically
to the samples in the Catalogue and the discussions that will follow in Volume 3. Some
of the references were supplied by the sample donors and the author did not actually
see them.

Many of the author’s own publications are in rather obscure sources or have long
been out of print. Readers who have difficulty locating them are encouraged to contact
The Rakow Library of the Museum. For the most part, items are listed chronologically
within Lists A–D, although, because of the way the lists were compiled for internal use,
some items fall out of sequence. To correct that problem now would wreak havoc in
the rest of the department’s files. Not all of the author’s publications in Lists A–D are
called in the text, but they are listed here for the sake of completeness, since no such
lists have been published elsewhere.

The references have been sorted as follows, although there is considerable
overlapping of material among those included in Lists A–D.

(Refs. A- ...) REFERENCE LIST A
Publications by the author dealing primarily with
glass research.

(Refs. B- ...) REFERENCE LIST B
Publications by the author dealing primarily with
conservation.

(Refs. C- ...) REFERENCE LIST C
Publications by the author dealing primarily with
lead isotope research on glass and other materials.

(Refs. D- ...) REFERENCE LIST D
Miscellaneous publications by the author,
including also publications in press or in
preparation.

(Refs. E- ...) REFERENCE LIST E
Publications by The Corning Museum of Glass.

(Refs. F- ...) REFERENCE LIST F
All other publications.
REFERENCE LIST A

GLASS STUDIES


A-36 See A-66.


REFERENCE LIST B

CONSERVATION STUDIES


B-12 R. H. Brill, B. Hanson, and P. M. Fenn, "Some Miscellaneous Thoughts on Crizzling," Proceedings of the XVIIIth International Congress on Glass, San Francisco, July 1998. (These proceedings were issued as a CD-ROM but printed copies are available from the author.)
REFERENCE LIST C

LEAD ISOTOPE STUDIES


OTHER


D-14 R. H. Brill, "Chemical Analyses of Some Glasses from the Rhodes Factory." (Awaiting publication.)

D-15 R. H. Brill, "Radiocarbon Dates for Some Materials Related to Research in Ancient Glass." Unpublished manuscript, April 1970. (Contains results for natron, textiles, resins, plaster, various woods, etc.)

REFERENCE LIST E

PUBLICATIONS OF THE CORNING MUSEUM OF GLASS

E-1 Anon., Glass from the Ancient World: The Ray Winfield Smith Collection, 1957.


E-3 Anon., Persian Glass, A Tribute to Persia, a Special Exhibition, Spring-Summer 1972.


GENERAL REFERENCES


F-31 G. R. Davidson (Weinberg), Corinth, the Minor Objects, Princeton, American School of Classical Studies at Athens, 1952, v. 12, p. 115, fig. 14, and plate 58.


F-36 C. Delacour, “Redécouvrir les verres du trésor de Bégram,” Arts Asiatiques, v. 48, 1993, pp. 53-71, and pl. 96.


F-41 N. Farag and Z. Iskander, The Discovery of Nefertaptah, Cairo, Antiquities Department of Egypt, 1971, pp. 95-99 and 111-115, pl. XXIX-b, and fig. 27.


F-54 P. Hamelin, "Matériaux pour servir a l'étude des verreries de Begram," Cahiers de Byrsa, v. 3, 1953, pp. 121-128, and pls. I-XIV.


F-79 In-Sook Lee, "Analytical Study of Ancient Glass in Korea," Komunkwa (Korean Antiquity), no. 34, Korean Association of University Museums, June 1989, pp. 79–95. (In Korean with English summary.)

F-80 In-Sook Lee, "Ancient Glass Trade in Korea," Papers of the British Association for Korean Studies.


F-90 B. L. Marshak and V. I. Raspopova, "A Hunting Scene from Panjikent," *Bulletin of the Asian Institute*, v. 4, 1990, pp. 77-94. See also the same authors' forthcoming book on the site.


F-137 J. C. Y. Watt, "Marbled Ware of the Tang and Song Periods," in *Festschrift Commemorating the 77th Birthday of Professor Tsugio Mikami*, Tokyo, 1985, pp. 69-77.


THE AUTHOR’S BOOKSHELF

The preceding Lists A–F provide references to help readers locate information relating specifically to the glasses in the Catalogue, but no comprehensive bibliography on the subject of the book is included. In place of such a bibliography we will list in Volume 3 many of the books and journal articles that have found their way to the author’s bookshelf over the years. Like most bookshelves, these contain items of widely varying quality and reliability. Some we know to be excellent and can certainly provide help to readers; others are of marginal value; still others have rested untouched since they were first placed on the shelves.
EXAMPLES
OF
REPORTS
NOTES ON REPORTS

As was mentioned above, this volume contains only catalogue descriptions, and Volume 2 contains only tables of data. Discussions of the findings will appear in Volume 3 in the form of what are presently being called Site Reports. In order to give some feeling for what these reports will be like, a few preliminary examples are included here.

The contents of most entries are self-evident, but a word of explanation is required regarding the shorthand notation used for describing compositions. The first characters identify the compositional family of the glasses. At present, for example, NaCa + + refers to a soda-lime glass (i.e., the Na₂O:CaO:SiO₂ family) having high K₂O and high MgO. NaCa − − refers to a soda-lime with low K₂O and low MgO. In text discussions, we refer to these—somewhat loosely—as plant-ash soda glasses or natron-type glasses, respectively. KCa (high CaO) refers to a potash-lime glass (i.e., one in the K₂O:CaO:SiO₂ family), in this case, a glass having an unusually high lime content. Potash-lime glasses are often referred to—again, somewhat loosely, but readily understood in context—as potash glasses. Similarly, PbBa refers to glasses in the PbO:BaO:SiO₂ system, and KPb to glasses in the K₂O:PbO:SiO₂ system. (K, Na) indicates a mixed alkali glass.

The definitions of high and low K₂O and MgO glasses, as applied to soda-limes, are rather arbitrary. In general, however, low K₂O and low MgO glasses contain about 0.5 to 1.5 wt. percent of these oxides. If the levels are greater than about 1.5%, the glasses would usually be considered high K₂O or high MgO soda-limes.

Following the glass family identification, information is given regarding noteworthy chemical features, fining agents, decolorizers (usually Mn or Sb), and, in some cases, colorants or opacifiers. However, colorants are not mentioned unless they differ from those usually understood to have been used routinely by glassmakers of the times and places under discussion.

The Other Exp’ts/Notes box lists additional experiments, analyses, measurements, or examinations. They include x-ray diffraction (x), physical property measurements (p), transmission spectra (T), lead or oxygen isotope analyses (Pb, O), microscopic examinations (m), radiography (r), etc.

Many of the reports will also be accompanied by graphical representations of the data.

Relevant illustrations for the four examples included here will appear in Volume 3.
II B. NUZI

(n=12)

Published in part.

Series: 1200

Description:

Nuzi was located in Assyria, east of the Tigris, at the foot of the Zagros Mountains. There is a tendency to see the glass found there as an archetype of early Mesopotamian glass in the way Amarna plays that role for Egyptian glass. The glass was excavated primarily in Level II under the direction of R. F. S. Starr between 1927 and 1931 (Ref. F-124). Textual evidence currently speaks for a mid-13th century B.C. destruction of that level (Ref. F-125). Dan Barag has studied both the glass and the archaeological evidence (Ref. A-23) and has concluded that the glasses date between the second half of the 15th century and, perhaps, the beginning of the 14th century B.C. The most familiar types are the light blue opaque star pendants and cored vessels, but numerous other small objects were found, as well as nuggets of cullet. In general, the glasses discussed here were all very heavily weathered—so much so, that it was impossible to sample any but the largest fragments where some unaltered glass still survived in the interiors. Two marbled (or marbleized) vessels were also found at Nuzi. They have received considerable well-deserved attention.

In addition to the glasses analyzed, numerous other fragments and materials were examined.

Dates: ca. 1450–1350(? B.C.

Sample nos.:

I. Early glasses: 1209, 10, 13–17, 19–21a
II. Natron-type: 1218
III. Marbled faience: 1200-05, 07, 08
IV. Weathering products: 1206, 08
V. Other: 1211, 12
See also Sec. XXIII., nos. 1875, 77–79.

Compositions:

I. NaCa ++ ; blue transp., Cu only; blue opq., Cu+Ca,Sb,0, (10)
II. NaCa – – ; natron-type, Sb. (Verified by rerun 10/12/83.) (1)
III. XRD shows major qtz.
IV. XRD shows Pb,Sb,0, (8)
V. XRD shows calcite and some magnesite.

Other Exp'ts/Notes: Pb, m, x, core residues

Source: E. Wright, SM; 2/17/66.

Refs.: A-18, A-19, A-77, C-5, C-6, C-22, E-5, E-6, F-124, F-125

Dates analyzed: 10/69, 12/77, 10/83, 12/89
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File used: MNuzi. (n=10)
Samples used: 1209, 1210, 1213-17, 1219-21.

Discussion:

I. Nuzi Glass

Ten samples were used to calculate a mean composition representative of Nuzi glass. Eight of these were blue glasses, all colored with copper and without cobalt. The light blue opaque glasses were truly beautiful materials: dense, homogeneous, strongly colored glasses, resembling some found at other Mesopotamian and Iranian sites such as Rimah, Hasanlu, and (although considerably later) Nimrud. The examples we analyzed were all colored with copper and opacified with calcium antimonate. The transparent blues contain no antimony and no tin. The lack of tin implies that the copper was not introduced as some ingredient derived from bronze—it must have been derived from copper metal or from some copper-bearing mineral.

The K$_2$O* and MgO* levels of the Nuzi glasses typify early Mesopotamian glasses made from soda in the form of plant ashes. This composition was destined to become the hallmark of glasses of that region, and in extension all throughout Central Asia, for nearly two thousand years. (See Refs. A-27, A-63, and A-86.) In fact, that same tradition—the use of plant ash soda and quartzite pebbles—survived into the 1970s at the small glass factory in Herat. (See Ref. A-39 and the film The Glassmakers of Herat, The Corning Museum of Glass, 1979.) The accompanying graphs show the similarity of the Nuzi glasses and some from Tell Brak.

The reduced compositions of the Nuzi glasses differ from those of Amarnan and other Egyptian glasses. The most obvious difference is that the Nuzi glasses have somewhat lower soda contents, but a noticeable difference also shows up in the K$_2$O* and MgO* levels. The Amarna and Malkata glasses have relatively low potassium contents for their soda contents when compared to Nuzi glasses. The differences, where they occur, must reflect differences between the alkali batch materials used. Interestingly, many of the Pre-Malkata glasses (Ref. A-77) do not differ from the Nuzi glasses in this respect. One Pre-Malkata glass (Ref. A-77, p. 63, Pb-2184) had lead isotope ratios falling within the Mesopotamian field.

II. A Natron-Type Glass

A single sample of the Nuzi glasses analyzed turned out to be a natron-based glass. This piece (no. 1218) was clearly an intrusion. It is a fragment of a thin-walled, blown Roman vessel with shallow-cut horizontal grooves. It appears to contain minute traces of painted decoration.
III. Marbled Faience

The findings reported here are for samples from two polychrome, marbled (or marbleized) vessels. Through a combination of microscopic examinations, spectrographic analyses, and X-ray diffraction, it was established that both vessels are properly described as faience or glassy faience. Although the surfaces are now weathered and faded, it is still obvious that they must once have been very colorful. They now show three colors at the surface: white, beige, and dull red. The colors run through the thickness of the wall to the interior. All are highly crystalline, containing probably 85% or more quartz with some calcite. The beige regions contain some lead and antimony, and still show diffraction patterns for traces of Pb$_2$Sb$_2$O$_r$. (The colorant could have been added either as the raw pigment or as powdered yellow opaque glass.) The beige regions must once have been yellow. The dull red regions show the same quartz base, but with iron in the form of hematite (α-Fe$_2$O$_3$) added as a red colorant. Although the surfaces are now porous, that could just be the result of weathering, and the original surfaces might have been fire-polished.

Marbled vessels of this sort could have been made by first pressing together doughlike layers or wads of different colored, unfired faience mixes so as to form multilayered sandwiches. These could then have been flattened, rolled into swirling or spiraling patterns, sliced, assembled on a core, and then fired to consolidate them into a vessel. Depending upon the firing conditions (and whether or not some glazing agent was employed), the surface of the vessel could have become fire-polished. As in the regular core-forming technique, the friable core would have been scraped out. By incorporating bits of colored glass, or by using powdered glass in some of the starting mixes, glassy zones having the chemical composition of a glass would have become part of the finished vessels. It might be stretching a point, but such a procedure could be seen as a precursor of the ribbon glass and millefiori techniques that were to come into use centuries later throughout the ancient world.

There are two close parallels to the Nuzi marbled faience vessels. One is a marbleized goblet from the tomb of the three foreign wives of Thutmose III in the Wadi Qirud. (That object is in The Metropolitan Museum of Art; MMA 26.7.1175.) It is on the basis of the similarities to the Nuzi vessels—both technical and stylistic—that the Wadi Qirud goblet is believed to have been an import into Egypt. (The subject is discussed in detail by Christine Lilyquist in Ref. A-77.) The most significant technological difference between the Wadi Qirud goblet and the Nuzi vessels is that the former contains a few small regions of dark blue and light blue glass, and seems either to have been fired a little higher (or a little longer) or to be less weathered.

The other parallel is a beaker base excavated at Susa and now in the Louvre Museum (MAO S 1241). Lamm had tentatively assigned the piece an Islamic date, but with a query as to whether it might have been earlier. The material is so strikingly similar to the Nuzi vessels that it is difficult to believe that it is not contemporaneous with them. (For a detailed discussion, see Ref. A-77.)

The appearance of these faience vessels is strongly reminiscent of certain Tang and Song Dynasty marbled ceramics found in China. Although we have not actually handled any of the latter, many of them were evidently made—some 2,000 years later—by a very similar method. James Watt has published descriptions of these wares, known as jiaotai, along with comments on how they were made. (See Ref. F-137.)
IV. Weathering Products

Three samples came from fragments of cored vessels or faience that were so heavily weathered that little or no original material remained (nos. 1206, 1208, and 1209). As is almost always the case, however, for fragments such as these, the various colors weathered to different surface appearances. Because the weathering of glass starts at the surface and works its way inward, the outermost surface of the weathered glass was once the outermost surface of the original glass, and the weathered surface often retains the pattern of any decoration, although not usually in the same colors.

Microscopic examination of the cored-vessel fragments revealed flakes of the unweathered yellow pigment that had originally colored the yellow opaque regions. The same regions stand out prominently on radiographs of the fragments because the residual lead is still radiopaque.

The yellow regions on the fragments were used for lead isotope analyses, which showed that the three glasses contained typical Type M lead—the type characteristic of Mesopotamian lead-containing artifacts. (See Refs. C-4, C-5, C-6, C-9, C-15, C-16, and C-22.) This is very compelling evidence of their Mesopotamian origins, because Type M leads are distinctly different from those found in Egyptian made artifacts and materials.

Microscopic examination of the core residues on the several Nuzi cored-vessel fragments studied showed that they have the fine, silt like textures characteristic of Mesopotamian cored-vessels. These differ markedly from those adhering to Amarna cored vessels. The latter are coarser-grained and generally less homogeneous. (See Ref. A-18.) Some Mesopotamian core residues contain relict fibrous plant material, as do the Egyptian core residues, but, in addition, Mesopotamian residues sometimes also contain traces of bituminous substances.

V. Other

Numerous other pieces of glass, faience, and Egyptian blue were also examined and analyzed. A few samples were found to be minerals. Four analyses of Egyptian blue are reported in Section XXIII. One large bead from Nuzi (no. 1212) was found to be a hard, dense natural stone. X-ray diffraction showed that calcite is the major phase with accessory dolomite and magnesite.

One small and curious fragment (no. 1211) seems to have come from a delicate, thin-walled vessel (t. = 2.0 mm). The fragment has a thin, pale yellowish layer on its convex surface, and a fine granular texture on the interior surface. The body is highly crystalline with a pronounced crystal orientation perpendicular to the walls. (The appearance is much like that of a glass devitrified by surface nucleation.) The granular texture is caused by the ends of the rod like crystals. X-ray diffraction produced a strong pattern for calcite, and two semiquantitative spectrographic analyses showed that calcium is the only major metallic element present in the body material.

It is difficult to know what to make of this fragment. Because it contains at most 1% silica, it could not have come from a glass or any ordinary kind of faience. For the moment, our best guess is that this is made from "Egyptian alabaster". Puzzlers like this are great fun to deal with and bring to mind all sorts of questions.
NUZI GLASSES

$(n=12)$

\[ \text{% CaO}^* \]

\[ \text{% Na}_2\text{O}^* \]

\[ \text{% K}_2\text{O}^* \]

\[ \text{% MgO}^* \]

$\text{Nuzi01.a}$

$\text{Nuzi02.a}$

283
NUZI AND TELL BRAK GLASSES

Circles = Nuzi
Crosses = Tell Brak

NUZI AND TELL BRAK GLASSES

Circles = Nuzi
Crosses = Tell Brak

% Na₂O* vs % CaO*

% K₂O* vs % MgO*
Kenchreai, one of the ports of ancient Corinth, is located on the Saronic Gulf, about 12 km across the isthmus from the city itself. It was mentioned by Pausanias as the location of a sanctuary of Isis. The site was situated near the water’s edge and extended inland and up along the slopes of a hill running parallel to the shore. During the mid- to late-1960s, the site was excavated by the University of Chicago and Indiana University, under the direction of Robert Scranton.

The focus of the site was a small apsidal building (The Fountain Court) jutting out into the water, its floor submerged to a depth of about a meter. It was filled with gravelly debris. That structure was flanked on one side by another room which, until late in the 1964 season, had attracted most of the excavators’ attention owing to the remains of wooden furniture, ivories, and other small finds uncovered there—including numerous fragments of both ordinary and luxury glass vessels. At that point, however, Prof. Scranton, in clearing the fill around the inside of the apsidal walls, came upon the first group of what were ultimately to number 104 opus sectile panels stacked in nine groups around the walls of the room. The panels were to prove to be one of the most important archaeological discoveries of glass ever made—and also, quite probably, the subject of the most difficult glass excavation, archaeologically, ever undertaken.

The panels—some square, some rectangular—measured between 30 cm and about 2 m in greatest dimension. They were constructed from fragments of amphoras or tiles held together with a strong, tough matrix made of a mixture of rosin and pulverized marble. Into this matrix, while it was hot and softened, were embedded flat pieces of brightly colored glasses. Most were monochrome and opaque, but many were millefiori components. The matrix itself was an interesting material technically—a combination of an organic and an inorganic material that was soft and pliant when hot, but strong enough upon cooling to support the considerable weight of the pieces of pottery backing material it held together. Moreover, although obviously never intended to do so, it withstood submersion in saline water for sixteen centuries.

The glass pieces embedded in the matrix formed pictorial and geometric designs. Three of the most important panels show half life-sized figures of Homer, Plato, and Theophrastos—striking renderings, considering the simplicity of the technique employed. Each figure (in a panel of its own) was composed of a few dozen pieces of monochrome glasses. The glasses, being the...
least durable of the materials used, had, for the most part, become heavily-weathered and looked very different—in their muted colors—than when they were new. Because of the limited palette of about eight colors available to the artists, the panels must have originally been quite gaudy—more like colored comic strips than like paintings. But if that is so, they should be likened to the cartoonist’s craft at its very best, for the face of Homer (depicted as being sighted) is a powerful caricature, presaging those familiar Byzantine depictions of Christ that were executed in mosaics with an economy of harsh and forceful lines. Plato is portrayed entirely differently, with a rounded softness that expresses an air of contemplation.

The other pictorial panels show buildings, plants, fish, and birds of the Nile. Occasional human figures are included, such as one of a fisherman casting a net. The Nilotic character of the subjects is unmistakable and one is strongly tempted to connect that with Pausanias’ comment that there was a sanctuary of Isis at Kenchreai. Current thinking departs somewhat from that view. Prof. Richard Rothaus, for example, sees the building as just a nymphaeum, an alternative raised (as Rothaus is quick to point out) by Prof. Scranton himself.

Scranton concluded that the panels were frieze decorations for a room, now destroyed, adjacent to the Fountain Court where they were found. It seems still unresolved as to whether the panels were awaiting installation, or whether they had already been installed and removed for some reason. In any event, Scranton believed the panels were submerged as a consequence of the second of two powerful earthquakes that devastated the region in 365 and 375 A.D. Apparently the land subsided and the building at the water’s edge was inundated. It stayed so for 1600 years.

During the seasons between 1965 and 1968, with the combined help of sandbagging and continuous pumping, the water level was reduced to a few inches so that excavation could proceed. The major problem was that the stacks of panels were fragile, although very heavy. This was compounded by the fact that the panels were arranged in pairs, face-to-face, and had become “welded” together into waterlogged masses, so it was always difficult—and often impossible—to know which panels were the most important. Working with a small team and facing tight deadlines (because the panels were at risk of being looted or destroyed) the excavation took on the urgency of a salvage operation. But by 1968, the last few stacks of panels had been lifted. Some had been rinsed relatively free of salt, and transported to safe-keeping. Unfortunately, what was intended to have been temporary storage grew into long-term storage that was to prove harmful to many of the panels.

In the years that followed, despite repeated efforts, it was never possible to obtain the funding required to mount the extensive and complicated conservation campaign the panels deserved. What evolved then, was a four-fold approach. Prof. Scranton wisely mounted a concerted effort at the thorough documentation of the panels. This resulted in the team’s major publication (Ref. F-64), which included Leila Ibrahim’s catalogue and art historical interpretation. Meanwhile, with something like a triage process, the dozen or so most important panels were treated, some by Babis Deilakes in Nafplion, and some by Danae (Hadjilazarou) Thimme. Seven pieces of less importance, but representative of the problems involved, were brought to Corning for treatment. This was not without its own ironic twist. The panels arrived in Corning Oct. 9, 1971, only to be inundated again a few months later, this time by the 1972 flood that struck Corning on June 23. But the panels were used to that sort of thing, and suffered no further damage. After applying various experimental treatments, the panels were returned to Greece. Today they are on exhibition in the Isthmia Museum along with several of the important panels treated by Mr. Deilakes and Mrs. Thimme.
The rest of the panels, which had received only minimal treatment, are also stored at the museum, but most of them, sad to say, are in very poor shape, some beyond realistic hope of restoration to an exhibitable state. Given their extremely precarious condition when recovered, the diversity of materials so intimately connected, and the fact that the excavators and conservators could not see what they were working with until the pieces had been separated, some losses were, for all practical purposes, inevitable.

The world of glass owes Prof. Scranton and Leila Ibrahim a great debt of gratitude for having had the foresight to carry out such an excellent and thorough documentation of these remarkable panels while it could still be done.

During July 10–12, 1995, on the initiative of Prof. Richard Rothaus (and with partial funding by the Kress Foundation), a team of three persons examined all the panels. The team consisted of Danae Thimme, Stephen P. Koob, and the author. The objective was limited to surveying the panels and classifying them according to a priority system. Based solely on condition (not on historical importance), the individual pieces were judged to be: (1) in need of prompt treatment; (2) in need of treatment; or (3) sufficiently stable that they could await treatment. The findings and recommendations are reported in Ref. B-10. In general, intervention proved valuable, for the pieces that had been superficially cleaned and consolidated remain, for the most part, stable; those that the excavators had not been able to rinse, and that had not been treated, have since been broken up by salt efflorescence, or have had their glass weathering products disintegrate. With proper cleaning and treatment, many fragments should be restorable to exhibitable condition—but it will be a slow and expensive process.

Until the panels were discovered at Kenchreai, only scattered teasers of opus sectile in glass were known. Some scholars might have guessed that room scale examples had existed, but the evidence was so scarce, that much was often made over even a single bird or a few bits of millefiori flowers. An interesting parallel, the Thomas Panel, came to light in 1986 (Ref. A-54 and Section V J.).

**Dates:** Site inundated by earthquake of 375 A.D. Panels placed in Fountain Court prior to that, probably ca. 370. [Robert Scranton.]

**Sample nos.:**

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<td>I.</td>
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<td>III.</td>
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Compositions:

I. NaCa -- ; Pb$_2$Sb$_2$O$_7$; PbSnO$_3$; Ca$_2$Sb$_2$O$_7$; SnO$_2$; Sb(5).
II. NaCa ++ ; PbO ~ 1.1%, CuO ~ 2.9%.
III. See text.
IV. NaCa -- ; PbSnO$_3$; Ca$_2$Sb$_2$O$_7$; Sb(5); SnO$_2$.
V. NaCa -- ; Mn(9), Sb(1 DBT); PbSnO$_3$; 995(RO) may be ++, low Pb; 993 marble.

Mean Compositions:

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Discussion:

The Kenchreai opus sectile glasses have been thoroughly studied. Thirty four examples of representative colors were analyzed chemically, and lead isotope analyses were run.

The numerous other examinations included x-ray diffraction for colorant-opacifier identification; x-ray fluorescence of weathered glasses to determine their original colors;
reflectance spectra measurements; preparation of synthetic glasses for determinations of physical properties; electron microprobe mapping of opacifier flakes; radiography; petrographic examination of the pottery backings; and analyses of the resin in the matrix. (Coincidentally, that turned out to be rosin, the same material that was being tapped from pine trees only a few hundred meters from where the panels were recovered. This was said to have been destined for use in resinating wines.) Because the results and their interpretations have been published at some length (Refs. A-34) we shall report here only some of the most significant findings.

The opus sectile glasses, somewhat surprisingly, fell into two distinct groups. All colors except the red opaques are natron-type glasses; the red opaques analyzed (9 samples) are all plant-ash type soda-limes. This indicates that the red opaques were made in a different place than the other glasses, which is consistent with the lead isotope analyses. The red opaques contain a type of lead we have found in other artifacts associated with Constantinople. The other colors contain a different isotopic type of lead, one that we have found in glasses and other materials from around the Levant and Egypt. The chemical differences show up clearly in the graphs that follow.

It is worth mentioning, too, that the flesh-colored glasses in the opus sectile panels are much better preserved than the other colors. This is probably due to their higher lime contents. For once, chemistry seems to have acted in the archaeologist's favor, because these unusual glasses are the central parts of the most important elements of the designs. The flesh color is actually quite rare. It might have been achieved in this instance by striking a small amount of colloidal silver and gold in the same way that dichroic diatreta were colored. The three flesh-colored glasses analyzed all contain enough silver and gold for this to happen. The other colors do not. There is a possibility, though, that the flesh color was produced by the combined effect of a white opacifier (SnO₂) and a redox-controlled equilibrium between iron and manganese. One of our experimental melts (EZW) prepared that way produced a glass with a flesh color closely matching that of the Kenchreai glasses.

The opus sectile glasses are very heterogeneous, even by the standards of ancient glass. This is frequently the case with colored opaque glasses, not so much as a consequence of poor melting, but more because they were repeatedly mixed and reworked. The glasses are filled with bubbles, batch stones, devitrification crystals, metallic scale, and spherical globules of once-molten metals (usually lead).

Both tin and antimony varieties of yellow and of white opacifiers were found. Curiously, flakes of the yellow tin pigment, PbSnO₃, were found in the same glass as the white antimony pigment, Ca₃Sb₂O₆. Perhaps this is an example of glasses from two different sources having been recycled together.

The millefiori components were used to build up details such as fish scales, flowers, and bird feathers. This places the panels firmly in the realm of glass art; the effects could not have been achieved, for example, with shaped bits of colored stones. Thus, the panels are a product of the pyrotechnological arts, not simply lapidary art. There is a certain temptation to see the Kenchreai panels as distant forerunners of stained glass windows, but the separation in time is so great, and the effect so different, that that temptation is probably best resisted.
The wheel-turned amphoras or tiles used for support are petrographically uniform, so they could have been made in one region. Three ceramic experts—Frederick Matson, Marie Farnsworth, and John Wosinski—agreed on that. Dr. Farnsworth added that they definitely did not resemble Corinthian coarsewares, making it very unlikely that the panels were assembled near Kenchreai, although no one ever seemed to have thought that was likely anyway.

Radiocarbon dates were determined for the wood of the packing crates that enclosed the panels (a hard pine common all around the Mediterranean) and for resin extracted from the matrix material. To our knowledge, this was the first time that pine resins had ever been dated. Several control experiments were done on ancient resins from amphoras donated by Virginia Grace, Michael Katzev, Zaki Iskander, and M. Bucovala. The dating was done by James Buckley of Teledyne Isotopes.

In addition to the opus sectile glasses, 22 glass vessel fragments and 7 mosaic tesserae were also analyzed.

The vessel fragments are all natron-type soda-limes, although they are sharply separated by their magnesia contents, one group containing about three times as much MgO as the other. (See graphs.) The latter consist of three pieces of flat glass (presumably window glass?), two little footed goblets, a base with a radiating molded pattern, and an olive-colored lamp with an applied blue blob. All seven contain manganese. The other group (15 samples) is composed of somewhat more luxurious vessels: 7 ribbed bowls, 4 other vessel fragments, and 4 pieces of colorless cut glass. (The colorless glasses, one of which preserves beautifully cut circles and facets, may represent only 2 or 3 objects because it possible that some fragments came from a single object.) The colorless glasses are distinguishable from the others by their slightly lower soda and, especially, by the fact that they contain antimony instead of manganese. This is an example of a situation where it would be interesting to run oxygen isotope analyses.

The ribbed bowls provide a good lesson in the color chemistry of ancient glasses. Their basic compositions form a tight group. No. 3729 is a dark blue transparent glass colored with cobalt. The four aqua glasses are all slightly different tints. No. 3723, with the lowest MnO content, has the bluest tint. The only two of the ribbed bowls that do not contain manganese are both amber. Lacking the oxidizing effect of manganese, some of the iron in the glass was converted to the strongly coloring ferri-sulfide chromophore responsible for the amber color. (A reducing agent might also have been added.)

One of the graphs shows that although both the vessel glasses and the opus sectile glasses (other than the red opaques) are natron-type soda-limes, they are not identical to one another compositionally. This can be seen best where the data are plotted on the same graphs. For example, the MgO* values of the natron-type opus sectile glasses lie between those for the two types of vessel compositions.

The tesserae (found loose in the same room as the opus sectile panels) are also natron-type glasses that contain manganese. The one possible exception is the red opaque tessera, which may be a plant-ash soda glass. This sample was so small that only a spectrographic analysis could be run. If this is true, then it would be the same situation as with the opus sectile glasses and the interpretation should probably be similar. The tesserae are slightly different than the opus sectile and vessels glasses, being somewhat higher in soda and slightly lower in lime. The dark blue transparent tessera is a cobalt glass containing both antimony and manganese.
A group of 58 colorless tesserae were examined under a microscope. A large majority of them were pitted only on two opposing surfaces, while the other four surfaces, which showed conchoidal fracture patterns, were generally unweathered or had only traces of light iridescence. The thicknesses, measured between the opposing pitted surfaces, ranged from about 6.5 to 8.0 mm. (Most were between 7.0 and 7.5 mm.) Originally, we believed the difference between the extents of weathering might have resulted from the pitted surfaces having been ground or polished, but that seems not to have been the case, because two tesserae were found that had a rounded side. They clearly were from the edges of flat pieces of glass from which the tesserae had been made. In both cases, the pitting extended continuously from the pitted flat surfaces around the rounded edge which would have been unlikely to have been ground. Perhaps the difference in weathering is connected in some way with residual strain in the original surfaces that was not present in the fractured surfaces. That could be related, in turn, to reheating associated with the casing of the gold leaf.

Two of the 58 cubes retained traces of gold leaf still sandwiched between the main colorless body glass and the thin casing of colorless glass. The casing measured 0.6–0.7 mm in thickness and the body glass 7.2–7.5 mm. Both of the upper surfaces—that of the casing and that of the body glass which had been in contact with the gold leaf—were heavily pitted. The fractured surfaces were only lightly iridescent. Because these two cubes showed a proclivity towards splitting along the sandwich interface, it is likely that other cubes among those examined had also split and lost their gold leaf. One cannot tell how many of the 58 might originally have been gold glass.
KENCHREAI GLASSES (Opus sectile)

Circles = various colors
Squares = red opa.
(n=32)

KENCHREAI GLASSES (Opus sectile)

Circles = various colors
Squares = red opa.
(n=32)
KENCHREAI GLASSES (Natron-based)

Circles = opus sectile
Triangles = type 1 vessels
Crosses = type 2 vessels
(n=45)

KENCHREAI GLASSES (Natron-based)

Circles = opus sectile
Triangles = type 1 vessels
Crosses = type 2 vessels
(n=45)
The Glastonbury fragments analyzed here are interesting because of their early dates. They are "firmly ascribed", in Donald Harden’s words, to the 9th–10th c. The glasses preserve the remains of painted designs even though all but a few are very heavily weathered. Furnace remains and crucible fragments related to glassworking were also uncovered at the site.

**Dates:** 9th–10th c. (?) 

**Sample nos.:**  
I. 2050, 53–55, 57  
II. 2051, 52, 58, 59  
III. 2056 

**Compositions:**  
I. KCa.  
II. (KNa)?; high CaO.  
III. NaCa + –; dk. blue: Co, some Cu; Sb, Mn. 

**Mean Compositions:**

<table>
<thead>
<tr>
<th></th>
<th>I. Glastonbury</th>
<th>II. Glastonbury</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(\bar{x})</td>
<td>(s)</td>
</tr>
<tr>
<td>SiO(_2)*d</td>
<td>56.6</td>
<td>60.0</td>
</tr>
<tr>
<td>Na,O*</td>
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<tr>
<td>CaO*</td>
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<td>15.6</td>
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<tr>
<td>K,O*</td>
<td>9.35</td>
<td>12.3</td>
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<tr>
<td>Mg,O*</td>
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<td>6.61</td>
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<tr>
<td>Al,O(_2)*</td>
<td>0.96</td>
<td>1.82</td>
</tr>
<tr>
<td>Fe,O(_2)*</td>
<td>0.19</td>
<td>0.99</td>
</tr>
</tbody>
</table>

File used: MGlstbyb.  
Sample nos. 2050, 2053, 2054, 2055, and 2057.  

File used: MGlstbya.  
Sample nos. 2051, 2052, 2058, and 2059.

**Other Exp’ts/Notes:**  
Pb, T  

**Source:** D. Harden, BM; 12/7/64.  

**Dates analyzed:** 5/72, 3/94
Discussion:

The analyses revealed three different types of glasses. The first group has five typical Mediaeval potash-lime glasses having rather high MgO contents. They are interesting mainly because they are early examples of that type of composition which was to become prevalent in the centuries that followed. A second group, this of four glasses, is interesting because its members are on the borderline of being mixed-alkali glasses. Ordinarily, we would view glasses with only 3-4% Na$_2$O* as being potash glasses with soda impurities. However, because the K$_2$O* values themselves are so low, averaging only 4.95%, the Na$_2$O:K$_2$O ratio is about 0.65 and it therefore seems best to describe this group as mixed alkalis. They also have very high lime contents. (See Refs. A-75 and A-81.)

The differences in composition (confirmed by repeat analyses) are reflected in the nature of the samples. The more ordinary potash-lime glasses are all rather common colors while the four mixed-alkali glasses are clearly special. One is a ruby glass, another contains a silver stain, and the third bears an overall sepia wash. (Nos. 2058 and 2059 are from a single fragment, one with the ruby flashing and one without it.) The mixed-alkali glasses might be thought of as specialty glasses. The glass having a silver stain casts some doubt on the dating because the 9th-10th century would be very early for that technique. Possibly the mixed-alkali glasses are actually later. We wonder if they could have been made from barilla or, conceivably, from kelp.

No. 2055 is noteworthy in that it is an “orangy-purple” glass cased between two layers of dark blue cobalt glass. Table XI D. in Volume 2 shows three analyses for a fragment of this glass. The first is an overall analysis of the glass by Dr. Rising. His sample consisted of both colors of glass in their original proportions. Two additional electron microprobe analyses by David Lange of the Department of Earth and Planetary Sciences at Harvard University are also reported. One is an average of the two dark blue layers and the other is for the purple glass. These analyses were part of a major project Mr. Lange conducted in collaboration with the Museum.

Because cobalt glasses absorb strongly in the red region (they have a small transmission peak near 560 m$\mu$) the blue layers apparently act effectively as a filter, absorbing much of the red light usually transmitted by purple manganese-containing glasses. The fragment therefore presents a rather flat violet color noticeably unlike the more common purple of oxidized manganese. The transmission spectrum of the fragment as a whole is quite complex with a significant peak near 560 m$\mu$, which may account for what we described as an “orangy” tinge.

A single example of dark blue glass proved to be a soda-lime colored with cobalt and containing antimony. Thus it joins the ranks—chemically—of those unusual 12th-century soda glasses occasionally found in windows in Britain and on the Continent. As has been pointed out elsewhere (for example, Ref. A-40) there is reason to believe that these glasses were imported from easterly sources before cobalt deposits were discovered (or before they were exploited) in Western Europe. A lead isotope analysis of the present Glastonbury sample (Pb-1153) placed it right among the leads of 12th-century dark blue soda glasses whose cobalt could have come from Iran or possibly Turkey. (However, because of the overlapping effect, there might be other ancient mining regions that could have supplied the same isotopic type of lead.)

The accompanying graphs illustrate the differences among the Glastonbury glasses analyzed. One graph shows the K$_2$O* and CaO* contents replotted against a background of approximately 320 other stained glasses from 40 locations in England and on the Continent. (See also Refs. A-75 and A-81.)
GLASTONBURY

Circles = Glastonbury (n=10)
Dots = ~320 st. glasses
from 40 locations
(7th-16th c.)
### XII E. NAPLES

(\(n=10\))

<table>
<thead>
<tr>
<th>Description:</th>
<th>Files: ANaples, ANaples1, ANaples2</th>
</tr>
</thead>
<tbody>
<tr>
<td>On Nov. 23, 1980, a severe earthquake, registering 6.8 on the Richter scale, struck a widespread area in southern Italy causing enormous destruction and loss of life. The epicenter was located about 80 km east of Naples where damage to the artistic and architectural heritage was described as &quot;appalling.&quot; In Naples itself, the damage could have been much worse. Even so, numerous works of art suffered and glass objects were broken in some museums.</td>
<td>Series: 4080</td>
</tr>
</tbody>
</table>

Remembering that many sister institutions had come to their aid after the disastrous 1972 flood in Corning, The Corning Museum of Glass offered help to the Neapolitan museums. On June 25, 1981, fifteen broken objects from the National Museum of San Martino and the National Gallery of Capodimonte were selected by Raffaello Causa, Luisa Morozzi, Teodoro Fittipaldi, and the author. Subsequently they were sent to Corning where ten of the objects were repaired by the Museum's conservator, Raymond Errett, with the help of Richard Kerschner, then an intern at the Museum. The remaining five glasses were so badly broken that nothing could be done with them.

All the glasses were returned to Italy in the fall of 1983 and are presently on exhibition. Professor Causa sent a special letter of commendation to Mr. Errett on behalf of the museums and the Neapolitan people.

For all but one of the glasses there were small non-joining fragments which could not be fit into the restored vessels. Therefore, with permission from the Italian museums, small samples of the objects were retained for chemical analysis.

| Dates: 16th–17th c. |  |
| Sample nos.: |  |
| I. Murano; except 4088 Spain(?): 4080, 82–84, 88 (5) |  |
| II. Façon de Venise (2); 4081 Murano(?): 4081, 86, 89 (3) |  |
| III. Unknown: 4090 (1) |  |
| IV. Murano(?): 4085 (1) |  |

| Compositions: |  |
| I. NaCa ++; Mn; CaO = 8–10.6%. | Not slippery to the touch (or only slightly so). |
| II. NaCa + –; Mn; CaO = 2–4%. | All are crizzled or hazed and slippery. |
| III. II + PbO; no Mn; WO has Pb and As. | Slippery. (Blue fluorescence under UV.) |
| IV. KPbSi; no Mn; As = 0.20%. | Slightly slippery. |

| Other Exp'ts/Notes: |  |
| e (4090), Pb |  |

| Source: R. Causa, L. Morozzi, T. Fittipaldi; NGC, NMSM; 6/25/83. |  |
| Refs.: A-42, B-3, B-4 |  |

| Dates analyzed: 12/81, 11/83 |  |
Mean Compositions:

<table>
<thead>
<tr>
<th></th>
<th>I. Murano</th>
<th></th>
<th>II. Façon de Venise</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>r</td>
<td>s</td>
<td>r.d.</td>
</tr>
<tr>
<td>SiO₂*</td>
<td>64.1</td>
<td>67.8</td>
<td>71.5</td>
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<tr>
<td>Na₂O*</td>
<td>13.7</td>
<td>15.5</td>
<td>17.2</td>
</tr>
<tr>
<td>CaO*</td>
<td>8.16</td>
<td>9.45</td>
<td>10.7</td>
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<tr>
<td>K₂O*</td>
<td>1.37</td>
<td>3.13</td>
<td>4.88</td>
</tr>
<tr>
<td>MgO*</td>
<td>1.70</td>
<td>2.94</td>
<td>4.18</td>
</tr>
<tr>
<td>Al₂O₃*</td>
<td>0.70</td>
<td>0.92</td>
<td>1.14</td>
</tr>
<tr>
<td>Fe₂O₃*</td>
<td>0.28</td>
<td>0.32</td>
<td>0.36</td>
</tr>
</tbody>
</table>

File used: M Naples1 (n=4)  
Sample nos. 4080, 4082, 4083, and 4088.

File used: M Naples2 (n=3)  
Sample nos. 4081, 4086, and 4089.

Discussion:

The analyses fall into two groups of soda-limes, the main difference being in the levels of lime. The first four glasses contain sufficient lime to be stable. However, the other group of three all have less than 5% CaO and would be expected to be susceptible to crizzling. (See Refs. B-3, B-4, and B-12.) This is born out by the fact that no. 4089 is heavily crizzled with internal cracking and the other two glasses are slippery to the touch.

One persistent problem in the study of Venetian glass is that of being unable to distinguish between glass made in Venice and so-called façon de Venise glass. The glasses are often so similar in appearance that they can be considered indistinguishable on that basis. Moreover, the glasses were traded so widely that their discovery in some particular region—the Lowlands or Spain, for example—does not necessarily mean they were made there.

There has always been a hope that chemical analysis would be of help in distinguishing between Venetian and otherwise similar objects. The difficulty, of course, has been that most of the glasses surviving in collections are intact and cannot be sampled for analysis without disfiguring them or subjecting them to undue risks of breakage. Thus one presently has to rely either on fragments or broken vessels for samples. (We regard it as dangerous to analyze glasses of this period by any method that would subject them to a vacuum or low-RH environment.)

The vessel fragments analyzed here proved of special value because they came with some sort of attributions. Two of the crizzled, low-lime glasses were said to be façon de Venise and the other was said to have come from Murano. Four of the stabilized glasses were said to be from Murano, while the fifth was attributed to Spain.

One of the two lead-containing glasses is no. 4085. It proved to be a potash-lead-silica glass, raising doubts about its presumed 17th century origin.

The other lead-containing glass (no. 4090) is from the broken foot of a vessel of unknown origin. An electron microprobe analysis by Stephen S. C. Tong showed that the particles of white opacifier in the white threads contain lead and arsenic. The opacifier appears to be 3Pb₃(AsO₄)₂·PbO, because the analyzed PbO and As₂O₃ percentages (PbO:As₂O₃ ratio = 3.13) correspond closely to that molecular formula (PbO:As₂O₃ ratio = 3.24).
NAPLES

Circles = crizzled
Squares = not crizzled
Triangles = crizzled glasses from elsewhere

% CaO*  

% Na₂O* + % K₂O*
OXYGEN ISOTOPE ANALYSES OF EARLY GLASSES
OXYGEN ISOTOPE ANALYSES OF EARLY GLASSES
R. H. Brill, R. N. Clayton, T. K. Mayeda, and C. P. Stapleton

INTRODUCTION

Isotopes are atoms of the same chemical element that differ slightly from one another in mass. For instance, there are four stable isotopes of lead, $^{204}\text{Pb}$, $^{206}\text{Pb}$, $^{207}\text{Pb}$, and $^{208}\text{Pb}$, having, respectively, approximate masses of 204, 206, 207, and 208 atomic mass units; and there are three isotopes of oxygen, $^{16}\text{O}$, $^{17}\text{O}$, and $^{18}\text{O}$, having masses of 16, 17, and 18. The isotopic composition of most elements is uniform throughout nature. That is to say, occurrences of a particular element in different places or in different chemical forms usually contain the same relative proportions of that element's isotopes. There are, however, some notable exceptions, and wherever they arise they are invariably of interest to physical scientists. The example most familiar to archaeologists is the variation in the proportion of $^{14}\text{C}$ in the carbon present in archaeological objects. This variation constitutes the basis of radiocarbon dating.

Oxygen is another of those elements whose isotopic composition varies according to where and how it occurs in nature. Unlike the $^{12}\text{C}-^{13}\text{C}$ relationship, which involves the decay of a radioactive species and leads directly to a dating method, the research reported here with oxygen does not involve radioactive decay in the same way, and is not aimed at developing a direct dating method for archaeological finds. In the case of oxygen, physical and chemical fractionation processes are responsible for the isotopic variations. This application is aimed at the classification of early glasses and the characterization (to some extent) of the batch materials from which they were made.

The analyses reported here were performed by Robert N. Clayton and Toshiko K. Mayeda in 1964–1972. Most of the results were reported in three earlier publications (Refs. A-20, A-58, and C-5) but never seem to have attracted the attention we believe they deserve. Therefore, the findings are being published again here in a slightly revised form, with an addendum. Colleen Stapleton has overseen the revision of the text and recompilation of the data.

In the authors' opinion, oxygen isotope analyses hold great promise for investigating glass problems that cannot be resolved by chemical analyses alone. We plan to revive this research in the near future, taking advantage of both the analytical data reported here in Volumes 1 and 2 and the resultant advances in our understanding of early glassmaking.

OXYGEN ISOTOPES IN ANCIENT GLASSES

The two isotopes of oxygen of interest here are $^{16}\text{O}$ and $^{18}\text{O}$. The heavier isotope, $^{18}\text{O}$, accounts for only one out of about every 500 atoms of oxygen occurring in nature.
Because the difference in mass of two atomic mass units is a rather large percentage of the masses 16 and 18, and because oxygen occurs in forms which readily interchange with one another (such as liquid water, ice, water vapor, and atmospheric oxygen), it is especially susceptible to fractionation effects. Consequently, the $^{18}$O contents of various occurrences of oxygen often differ considerably from one another. By convention, the $^{18}$O content is usually expressed in terms of $\delta$, the deviation in parts per thousand of the $^{18}$O content of the sample of interest from that of an accepted standard, designated standard mean ocean water (SMOW). Thus, the $^{18}$O content of standard mean ocean water has by definition a value of zero on the scale of $\delta$ values. Substances having a positive $\delta$ value have an excess of $^{18}$O over the standard, while those with negative values are deficient in $^{18}$O. Some typical ranges of $\delta$ are shown in Table 1.

<table>
<thead>
<tr>
<th>Occurrence</th>
<th>Typical Range of $\delta$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meteoric waters (rain, snow, lakes, rivers, etc.)</td>
<td>-45 to 0</td>
</tr>
<tr>
<td>SMOW</td>
<td>0</td>
</tr>
<tr>
<td>Igneous rocks</td>
<td>-5 to +15</td>
</tr>
<tr>
<td>Detrital sedimentary quartz (sands)</td>
<td>+8 to +15</td>
</tr>
<tr>
<td>Quartzite</td>
<td>+9 to +15</td>
</tr>
<tr>
<td>Chert</td>
<td>+20 to +35</td>
</tr>
<tr>
<td>Marine limestones</td>
<td>+20 to +30</td>
</tr>
<tr>
<td>Shell hash</td>
<td>+27 to +30</td>
</tr>
<tr>
<td>Natron</td>
<td>+38 to +41</td>
</tr>
<tr>
<td>Atmospheric oxygen</td>
<td>+23.5</td>
</tr>
</tbody>
</table>

$^{18}$O contents of many natural minerals have been measured for geochemical purposes. In the late 1960s, Prof. Clayton and Mrs. Mayeda (of the Enrico Fermi Institute, University of Chicago) devised a method for determining $^{18}$O contents in silicate and carbonate rocks and minerals. Realizing that many of the raw materials of which glasses are made differ from one another in their $^{18}$O contents, and that oxygen is actually the most abundant element in glasses (accounting for some 45 to 50% by weight of the glass), one of the authors (RHB) postulated that the $^{18}$O contents of the glasses themselves might reflect the $^{18}$O contents of the ingredients from which they were made.

The $^{18}$O contents of a series of 84 man-made glasses, spanning some 34 centuries and coming from widely separated provenances, were determined in order to see what range of $\delta$ values they would show. All of these determinations were made by Clayton and Mayeda using the same techniques employed for their studies of rocks and minerals. The data are reported in Table 2 and plotted in Figure 1. As can be seen in Figure 1, the $\delta$ values for many of these glasses vary markedly from one another. Thus the prospects seem promising for developing a scheme for classifying early glasses on
the basis of their $^{18}$O contents in a manner similar to that based on chemical analyses. The oxygen isotope studies provide an essentially independent means of classification—although chemical analyses could eventually enter into more refined calculations used for identifying batch materials.

Before attempting to apply this reasoning, however, the validity of at least one important assumption had to be investigated. Since melting conditions, even within an individual early glass factory, probably changed from day to day, it was crucial to know to just what extent melting temperatures and melting times affect the $^{18}$O contents of glasses prepared from the same raw materials, under different conditions. In order to evaluate these effects, $^{18}$O contents were determined for six selected glassmaking ingredients. These ingredients were then used in different combinations to prepare four glass batches. The glass batches represented two chemical compositions, but four different combinations of isotopic compositions. Portions of each of these batches were then melted at different temperatures and soaked at elevated temperatures for different times. The temperatures used were 1200°C or 1300°C, and 1600°C. The holding times (after initial melting) were 2, 16, or 24 hours. The results of the $^{18}$O determinations on the resulting 16 glasses were most encouraging. With the exception of one glass, which yielded a slightly spurious result, it was found that only the isotopic composition of the original ingredients affected the δ values of the final glasses. Variations in the melting times and temperatures within the limits chosen had little measurable effect. Equally encouraging was the observation that the experimentally determined isotopic compositions of the oxygen in the glasses agree well with predicted values calculated by treating δ as a simple additive property. Moreover, the small deviations from the calculated values were diminished when fractionation effects were considered. The agreement of the corrected values ($\delta_{\text{calc}}$) is within the limits of experimental error, as is shown in Table 2.

While it is true that these experiments included only two chemical compositions and a few sets of melting conditions, these results nevertheless can be taken as evidence that the $^{18}$O contents of glasses made in early times must depend primarily on the $^{18}$O make-up of the raw materials used, and that differences in melting conditions between different factories using the same materials would not have had an important effect on the values we determine for samples of these glasses today. Consequently, $^{18}$O determinations should prove to be a valuable index for classifying early glasses, and the resulting classifications should reflect differences and similarities not only between the nature of the raw materials used in different factories but perhaps also between the specific geographical origins of those raw materials. However, a few qualifications become evident immediately.

Different combinations of entirely different raw materials can produce glasses with identical $^{18}$O contents. For example, the samples O-37, O-151, and O-79 are of widely disparate origins but have, within experimental error, the same δ values. Also, it is unlikely that there will be many cases where it will be possible to pin down the exact sources of raw materials used for making particular early glasses, despite the fact that
one such instance to be cited below may belie this. Classification schemes are, nevertheless, still of value because when particular archaeological or historical questions arise, they can often be answered simply on the basis of whether groups of objects are similar or different. In other words, the relationships between the δ values for different glasses are useful even though we may not know exactly what differences in the ingredients have produced these relationships. The usefulness of oxygen isotope determinations may be enhanced by this aspect of diagnosis because values of δ apparently can be used to distinguish between glasses that are, for practical purposes, indistinguishable by their chemical compositions. This is illustrated by glasses O-11, O-71, O-72, and O-74. Based on their chemical compositions, these four glasses are technologically indistinguishable, being the products of one glassmaking tradition, the Islamic technology that used plant ashes as sources of alkali. The δ values of O-11, O-72, and O-74 are close, suggesting in this instance that the glasses may be considered as one group, while O-71 stands apart. In this case, we happen to expect this result because the odd glass was excavated in Syria and two of the other three in Iran. This example additionally illustrates another potential application for this technique. The similarity in isotopic compositions between O-72, Islamic but of unknown provenance, and O-11 and O-74, both with known findspots, points to an Iranian origin for O-72. In fact, it suggests that these three glasses were manufactured from raw materials of closely related sources, completely different from those used to make the glass of O-71.

It is clear that weathering can have a drastic effect on the 18O content of a glass. Sample O-15 is from a wine bottle recovered from beneath the sea at Port Royal, Jamaica. It is known to have been submerged in sea water from at least as early as 1692 until it was excavated in 1959. The effects of weathering are obvious, for the glass bears a thick weathering crust (as much as 3 mm thick in some places) consisting of leached glass. The leaching of the glass involves an opening up of the glass network structure and makes the body of the glass susceptible to extensive ion exchange reactions. Thus, one expects to find that the 18O content of the weathered remains of the glass might differ from that of the glass itself. This proved to be true. The δ value for a sample of the unweathered glass removed from the body of the object is 13.15, while the sample of the weathering crust (O-16) has a δ value of 28.11. In the case of this glass, the alteration was obvious and the isotope effect was anticipated beforehand. In sampling all of the other glasses studied, special efforts were made to avoid including any of the weathered portions of the glasses. Only intact, unweathered glass was used.

We cannot as yet, however, say for sure that these data are entirely free of variability due to weathering effects. There are types of glasses which, although they remain glassy and intact, show certain properties suggesting that they may have taken up moisture and might, therefore, have undergone some oxygen exchange.

The findings reported in Figure 1 have been plotted in a rather arbitrary way. What we intend to illustrate is the variation in 18O contents among these glasses of disparate age, provenance, and chemical composition. Strictly speaking, only one coordinate was really needed to present this variation. A simple scale, like that of a thermometer, of δ
values would have sufficed. But in order to organize the results and make them more readable, a second coordinate, time, was used to spread out the data and to facilitate making comparisons between those glasses which most logically should be compared with one another. We have gone a bit further in Figure 2 by enclosing groups of related samples within rectangles.

A consideration of the chemical composition of most early glasses leads to the conclusion that most of the oxygen in the glasses was probably contributed by the principal silica-bearing ingredient. After writing out equations that treat δ as a simple additive property, it seems that δ for the glass could almost be treated as δ for the silica-introducing ingredient (sand, for example) modified by the δ values of other ingredients. Rather large variations in δ for the alkali, lime, and minor ingredients are required to account for differences as great as those observed among the glasses we have studied so far. A rough calculation shows that two glasses of identical soda-lime-silica composition, both of which are prepared with silica having a δ of 14, but different sodium carbonates with δ values of 30 and 10, would yield, respectively, glasses with δ values of about 15.5 and 13.5. We expect, therefore, that most of the variations seen in the glasses studied reside in variations among the primary silica ingredients.

Among the glasses studied were five fragments of cullet excavated at the site of the ancient glass factory at Jalame in western Galilee. (See Ref. A-58.) The factory appears to have operated in the third quarter of the fourth century. Four of the δ values of the glasses (O-163, O-165, O-167, and O-168) agree very well with one another, and the δ value of the fifth glass, O-170, seems to be just a little greater. Chemical analyses had been run for three of these samples (see Section V A.), and thus it was possible to examine these data in light of assumptions about the possible raw materials.

Because of the location of the Jalame factory, it seems very likely that the source of the silica used for this glass was sand from the dunes near the mouth of the Belus River, which is only about 24 km away. (Actually, there is good reason to believe that the glass itself was not made as a material at Jalame but that it might have been made elsewhere and then been brought there to be resoftened and formed into vessels. Even so, Belus River beach sand is still the most likely source of silica for glass factories located in this region.) We had calculated earlier that the Belus River beach sand contains just about the proper amount of lime in the form of shell hash to account for the lime content of early glasses from this region. We believe that this sand was used along with natron to make a two-ingredient soda-lime-silica glass without requiring a separate addition of a lime-bearing ingredient.

If it is assumed that Belus River beach sand was used for making the Jalame glasses, that fixes δ for the silica at 10.93 and δ for the lime at 29.02. These values are the experimentally determined mean values for the quartz and CaCO₃-bearing fractions of two samples (O-206 and O-207) of sand collected from the dunes at the mouth of the Belus River. (See Table 1.) The remaining choice—an important one—was that of the δ
value for the soda portion. Since we have no other values for suitable ancient alkali sources, we selected a value of 39.77, the mean of experimentally determined values for two samples of modern natron (O-203 and O-205) from Wadi Natrun in Egypt. This is a reasonable choice because natron from Egypt is the most likely source of alkali to have been used for the Jalame glasses, as was demonstrated by chemical calculations. (See Ref. A-58.)

In any case, by assuming an additive relationship and the experimentally determined $\delta$ values of the presumed ingredients, $\delta$ was calculated for glasses having the analyzed chemical compositions of the Jalame glasses. The results are in excellent agreement with the analyzed values for the ancient Jalame glasses. Corrections for fractionation occurring during melting were applied in a second calculation, and the agreement was even closer.

This calculation strongly supports the hypothesis that the Jalame glasses were manufactured from ingredients closely resembling the Belus River beach sand, with its attendant shell hash, and an alkali source having an $^{18}O$ content closely resembling that of the two modern samples of natron. It will be interesting to compare the results of similar calculations using $\delta$ values for various other glasses and likely batch materials.

It will already have been noted from the figures that there is one group of five glasses, those from Nimrud, which are very different from any of the others studied. These glasses date from the seventh century B.C. The $\delta$ values for these glasses must represent a glassmaking tradition that made use of some particular raw materials. This is not to say, of course, that this isotope composition is necessarily unique to Nimrud glasses. It is possible (indeed, probable) that this just happens to be the only example that we have encountered so far. The agreement between the glasses is all the more remarkable because they represent two (or possibly three) very different types of glass objects. Three of the samples (O-41, O-43, and O-44) are fragments of hemispherical bowls found at Nimrud. The others are an inlay (O-3) from one of the famous ivory inlay plaques and a piece of light blue opaque cullet (CMG analysis number 1121) which might or might not have been associated with the manufacture of the inlay glasses. The Nimrud glasses also seem to have higher alumina contents than most of the glasses analyzed (see Section II G.), which suggests, independently, that they might have been made with some unusual silica batch material.

There are several other interesting relationships—both differences and similarities—that exist among the glasses plotted in Figure 1. However, we will resist the temptation to speculate on them now, and instead await the results of additional oxygen isotope analyses we hope to perform in the near future. The chemical analyses reported here in Volumes 1 and 2 will help us plan that research. They provide a basis for extending the broad survey of $\delta$ values, and also raise specific questions that might be answered by oxygen isotope analysis.
We have also investigated some ancient pottery. Only four sherds were analyzed, but they differ considerably from one another, with δ values ranging from 16 to 23. The sherds came from Jericho, Athens, Amarna, and Caerleon. Since pottery does not consist of a one-phase system, as most ancient glasses do, the study of pottery would probably be complicated by the fact that the oxygen is distributed among different mineralogical phases in the sherds. Additional complications could arise from the possible presence of weathered zones. (Perhaps this difficulty could be overcome by separating the phases before analysis.) Nevertheless, it would seem worthwhile to explore the possibilities of developing classification schemes for pottery.

The potential for exploratory studies extends well beyond just glass and pottery. Various other silicate-based systems come to mind, such as faience, Egyptian blue, Chinese blue and purple, enamels, and porcelains—along with their presumed raw materials. As was demonstrated above, analyses of raw materials greatly augment the value of oxygen isotope data. Another pet project we have in mind is the determination of $^{18}O$ contents of Tibetan tzi beads to complement what we have already learned about them from other investigations. (See Section XV I.)

Apart from classification schemes, oxygen isotope analyses might prove useful for authentication purposes. It could be that the slow weathering or corrosion reactions acting on ancient materials over centuries might, under some circumstances, result in fractionation effects that would show up only in authentic weathering products. Such fractionation might not accompany the much faster processes used to artificially age fakes and forgeries. The weathering crust on the Port Royal wine bottle reminds us that dramatic changes in oxygen isotope ratios can accompany the weathering of some glasses. (In fact, might some similar effects be true for elements other than oxygen? Would it, for example, be worth looking into the isotopic composition of copper in ancient bronze corrosion products to see how they compare with the uncorroded metals?)

PROSPECTS FOR FUTURE RESEARCH

Over the past three decades or so, our understanding of the history of glass has advanced greatly. To a significant extent, that advance has been helped along by scientific investigations, as is evidenced by our growing library of chemical analyses. Oxygen isotope analysis offers a new, essentially independent, technique to complement chemical analysis and other laboratory research.

Despite the advances that have been made, we are still pursuing today some of the most fundamental archaeological and historical questions that concern early glass. Beyond technological questions that obviously call for scientific answers, there are
questions that touch upon such topics as the discovery of glass, its early trade patterns, and the transfer of knowledge and culture that often accompanied the transport of material goods in the past. Laboratory analyses frequently are helpful in investigating these questions as well.

The transport of glass, it might be added, was sometimes over remarkably long distances and sometimes connected far-flung civilizations. Consider, for example, the cullet and glass ingots discovered on ancient shipwrecks and the glass objects that traveled along the Silk Road. The origins of some of the Silk Road glasses are identifiable by simple typology, but others, such as the pieces from the Famensi, are enigmatic. In cases where there is any ambiguity of origin, oxygen isotope analyses could strengthen or negate those arguments based on chemical analyses alone.

It is fair to say that there is scarcely a sample among the 84 glasses plotted in Figure 1 that does not suggest some sort of follow-up research using oxygen isotope analysis. Whether they are Egyptian or Mesopotamian glasses, Roman or Islamic, Mediaeval stained glass windows, or Early American glasses, each one carries with it some unanswered questions that we would like to investigate. For example: Where were the earliest glasses found in Egypt actually made? When was natron first used as a raw material? How are the Ulu Burun finds and the glass of Egypt and the Mycenaean World related? Where were diatreta made, and were they all made at about the same time? Where was the Serçe Limani cargo coming from? Were stained glass windows made near their cathedral sites from local materials, or was the glass brought in from factories elsewhere? Were the high-boron glasses from Aphrodisias made in the same place as the Zerek Çamii windows? How is it possible to distinguish between Venetian and façon de Venise glasses—one of the most vexing problems in European glass studies? And what of the glasses we associate with India—those high-alumina, low-lime types and the potash-silica types—that seem to have spread out all over Asia? Venturing beyond the present work: What were the relationships among the ancient glasses of China, Japan, and Korea? We are still trying to straighten them out as to which glasses were made where, what they were made from, and how they were traded.

It seems likely to us that wherever there is something to be learned from chemical analyses of glasses, there will likewise be something to be learned from oxygen isotope analyses.
# TABLE 2
Oxygen Isotope Samples and Their δ Values

**GLASSES**

<table>
<thead>
<tr>
<th>Oxygen isotope number</th>
<th>CMG analysis number</th>
<th>Section if in catalogue</th>
<th>Description</th>
<th>δ*</th>
</tr>
</thead>
<tbody>
<tr>
<td>O-1</td>
<td>1521*</td>
<td>I A.</td>
<td>Amarna, ca. 1348–1335 B.C., cored vessel, dk. blue with threading.</td>
<td>16.89</td>
</tr>
<tr>
<td>O-2</td>
<td>406W*</td>
<td>II L.</td>
<td>Mesopotamia, 13th c. B.C., cored vessel, amber.</td>
<td>16.31</td>
</tr>
<tr>
<td>O-3</td>
<td>377(∗)</td>
<td>II G.</td>
<td>Nimrud, 7th c. B.C., inlay, dk. blue opq.</td>
<td>21.63</td>
</tr>
<tr>
<td>O-4</td>
<td>367*</td>
<td>II D.</td>
<td>Hasanlu, ca. 1100–800 B.C., pedestal frag., lt. bl. opq.</td>
<td>14.38</td>
</tr>
<tr>
<td>O-5</td>
<td>3395*</td>
<td>IV A.</td>
<td>Olympia, ca. 450 B.C., rounded nugget, colorless. (Same as CMG nos. 18 &amp; 450.)</td>
<td>16.74</td>
</tr>
<tr>
<td>O-6</td>
<td>451*</td>
<td></td>
<td>Beth She'arim, 300–350, vessel, aqua.</td>
<td>15.84</td>
</tr>
<tr>
<td>O-7</td>
<td>305*</td>
<td>V E.</td>
<td>Karanis, ca. 150 or ca. 450, dish rim, amber.</td>
<td>14.98</td>
</tr>
<tr>
<td>O-8</td>
<td>180*</td>
<td>V AB.</td>
<td>Tongrès, 1st c., ribbed bowl, aqua.</td>
<td>16.37</td>
</tr>
<tr>
<td>O-9</td>
<td>187</td>
<td></td>
<td>Corinth, 12th or 14th c., frag., olive green.</td>
<td></td>
</tr>
<tr>
<td>O-10</td>
<td>143*</td>
<td>XI A.</td>
<td>Zerek Çamii, ca. 1126, stained glass window, dk. blue.</td>
<td>15.41</td>
</tr>
<tr>
<td>O-11</td>
<td>452*</td>
<td>VII A.</td>
<td>Nishapur, 9th-10th c., bottle neck, v. p. aqua.</td>
<td>12.05</td>
</tr>
<tr>
<td>O-12</td>
<td>526*</td>
<td>XI K.</td>
<td>Chartres Cathedral, ca. 1225, stained glass window, p. blue.</td>
<td>13.56</td>
</tr>
<tr>
<td>O-13</td>
<td>453(∗)</td>
<td>XII C.</td>
<td>Venetian, ca. 1700, <em>filigrano</em> vase, colorless.</td>
<td>13.25</td>
</tr>
<tr>
<td>O-15</td>
<td>7*</td>
<td>XVII D.</td>
<td>Port Royal, pre-1692, wine bottle base, dk. olive.</td>
<td>13.15</td>
</tr>
<tr>
<td>O-17</td>
<td>431*</td>
<td>XIII C.</td>
<td>Hastinapur, rim frag., turbid bl. green.</td>
<td></td>
</tr>
<tr>
<td>O-26</td>
<td>1860*</td>
<td>II H.</td>
<td>Persepolis, ca. 5th c. B.C., frag., colorless.</td>
<td>18.34</td>
</tr>
<tr>
<td>O-27</td>
<td>1519*</td>
<td>XII B.</td>
<td>Torcello, 6th–7th c., goblet foot, green.</td>
<td>14.48</td>
</tr>
<tr>
<td>O-28</td>
<td>527*</td>
<td>XI K.</td>
<td>Chartres Cathedral, ca. 1225, stained glass window, amber.</td>
<td>13.37</td>
</tr>
</tbody>
</table>

* quantitative chemical analysis completed, or known from manufacturer.
(∗) emission spectrographic analysis only.
** published data.

\[ δ = \left( \frac{^{18}O / ^{16}O}_{\text{sample}} - 1 \right) \times 1000 \]

311
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<th>No.</th>
<th>Code</th>
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<th>Location</th>
<th>Type</th>
<th>Shape</th>
<th>Color</th>
<th>Dimensions</th>
<th>Notes</th>
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</thead>
<tbody>
<tr>
<td>O-29</td>
<td>528*</td>
<td>XI K.</td>
<td>As above, ruby flashing over green.</td>
<td></td>
<td></td>
<td></td>
<td>13.95 **</td>
<td></td>
</tr>
<tr>
<td>O-30</td>
<td>1828*</td>
<td>Egyptian, 18th Dyn., cane, dk. blue.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>17.46 **</td>
<td></td>
</tr>
<tr>
<td>O-31</td>
<td>455*</td>
<td>XII C.</td>
<td>Rosenborg Castle, ca. 1709, vase stem, colorless.</td>
<td></td>
<td></td>
<td></td>
<td>13.33 **</td>
<td></td>
</tr>
<tr>
<td>O-32</td>
<td>288*</td>
<td>V K.</td>
<td>Sardis, 6th–7th c., footed cup, aqua.</td>
<td></td>
<td></td>
<td></td>
<td>16.14 **</td>
<td></td>
</tr>
<tr>
<td>O-33</td>
<td>1858*</td>
<td>III A.</td>
<td>Mycenae (?), 1400–1250 B.C., amulet, dk. blue.</td>
<td></td>
<td></td>
<td></td>
<td>15.91 **</td>
<td></td>
</tr>
<tr>
<td>O-34</td>
<td>1859*</td>
<td></td>
<td>As above.</td>
<td></td>
<td></td>
<td></td>
<td>16.35 **</td>
<td></td>
</tr>
<tr>
<td>O-35</td>
<td>537(*)</td>
<td></td>
<td>Amarna, 18th Dyn., cane, lt. blue opq.</td>
<td></td>
<td></td>
<td></td>
<td>15.30 **</td>
<td></td>
</tr>
<tr>
<td>O-36</td>
<td>538(*)</td>
<td></td>
<td>As above, white opq. cane.</td>
<td></td>
<td></td>
<td></td>
<td>15.19 **</td>
<td></td>
</tr>
<tr>
<td>O-37</td>
<td>530(*)</td>
<td></td>
<td>As above, yellow opq. cane.</td>
<td></td>
<td></td>
<td></td>
<td>15.12 **</td>
<td></td>
</tr>
<tr>
<td>O-38</td>
<td>539</td>
<td></td>
<td>As above, green opq. cane.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>O-39</td>
<td>529(*)</td>
<td></td>
<td>As above, red opq. lump.</td>
<td></td>
<td></td>
<td></td>
<td>15.68</td>
<td></td>
</tr>
<tr>
<td>O-40</td>
<td>550</td>
<td>II D.</td>
<td>Hasanlu, ca. 1100–800 B.C., bead (?) frag., lt. blue turbid.</td>
<td></td>
<td></td>
<td></td>
<td>14.26 **</td>
<td></td>
</tr>
<tr>
<td>O-41</td>
<td>545*</td>
<td>II G.</td>
<td>Nimrud, 7th c. B.C., bowl, colorless.</td>
<td></td>
<td></td>
<td></td>
<td>22.62 **</td>
<td></td>
</tr>
<tr>
<td>O-42</td>
<td>546*</td>
<td>II G.</td>
<td>As above, colorless.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>O-43</td>
<td>547*</td>
<td>II G.</td>
<td>As above, p. greenish.</td>
<td></td>
<td></td>
<td></td>
<td>22.35 **</td>
<td></td>
</tr>
<tr>
<td>O-44</td>
<td>548*</td>
<td>II G.</td>
<td>As above, purple.</td>
<td></td>
<td></td>
<td></td>
<td>22.61 **</td>
<td></td>
</tr>
<tr>
<td>O-46</td>
<td>302*</td>
<td>V E.</td>
<td>Karanis, ca. 150 or ca. 450, vessel base, amber/purple.</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>O-47</td>
<td>318</td>
<td></td>
<td>Karanis, ca. 150 or ca. 450, vessel, green.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>O-49</td>
<td>1091*</td>
<td>V K.</td>
<td>As above, late Roman–early Byzantine, beaker base, aqua.</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>O-50</td>
<td></td>
<td></td>
<td>Sardis, late Roman–early Byzantine, ribbed bowl, dk. blue.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>O-51</td>
<td>1093*</td>
<td>V K.</td>
<td>Sardis, Late Period, PN, flat glass, yellowish olive.</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>O-52</td>
<td>1094*</td>
<td>V K.</td>
<td>As above, purple.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>O-53</td>
<td>259</td>
<td></td>
<td>Macquenoise, Belgium, 4th c., vessel, colorless.</td>
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<td></td>
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<tr>
<td>O-54</td>
<td>260</td>
<td></td>
<td>As above, 2nd–3rd c., frag., dk. green.</td>
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<tr>
<td>O-55</td>
<td>261</td>
<td></td>
<td>As above, 5th–6th c., vessel, colorless.</td>
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<tr>
<td>O-56</td>
<td>264</td>
<td></td>
<td>As above, 15th–16th c., vessel rim frag., lt. green.</td>
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<td>No.</td>
<td>Code</td>
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<tr>
<td>O-57</td>
<td>268</td>
<td>As above, vessel, dk. green.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>O-58</td>
<td>540(*)</td>
<td>Glastonbury, 9th-10th c.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>O-59</td>
<td>189*</td>
<td>X F. Corinth factory, 12-14th c., vessel frag., colorless.</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>O-60</td>
<td>185</td>
<td>As above, green.</td>
<td></td>
<td></td>
<td></td>
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<td>O-61</td>
<td>187</td>
<td>As above, amber.</td>
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<td>O-62</td>
<td>193*</td>
<td>X F. As above, dk. blue.</td>
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<td>O-63</td>
<td>137*</td>
<td>XI A. Zerek Çami, ca. 1126, stained glass window, p. purple.</td>
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<td>O-64</td>
<td>134*</td>
<td>XI A. As above, p. amber.</td>
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<td>O-66</td>
<td>246*</td>
<td>VIII C. As above, vessel, colorless. 16.20 **</td>
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<td>O-67</td>
<td>543*</td>
<td>VIII C. As above, beaker, colorless. 12.87 **</td>
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<td>O-68</td>
<td>541*</td>
<td>VIII C. As above, vessel, p. purplish.</td>
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<tr>
<td>O-69</td>
<td>542*</td>
<td>VIII C. As above, colorless with sl. purplish tinge. 12.18 **</td>
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<td>O-70</td>
<td>152*</td>
<td>XI B. Kariye Çami, early 12th c., stained glass window, aqua.</td>
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<td>O-71</td>
<td>103(*)</td>
<td>VII U. Raqqa, 9th-10th c., vessel frag., aqua. 15.78 **</td>
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<td>O-72</td>
<td>17*</td>
<td>VII U. Islamic weight, 10th-11th c., black. 11.83 **</td>
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<td>O-73</td>
<td>360*</td>
<td>V K. Sardis, 8th-10th c., bowl rim frag., colorless.</td>
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<td>O-74</td>
<td>358*</td>
<td>VII B. Gorgan, 10th-11th c., vessel, green. 11.49 **</td>
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<td>O-75</td>
<td>449*</td>
<td>XII I. France, ca. 1750, wine glass stem, pink (originally colorless).</td>
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<td>O-77</td>
<td>356*</td>
<td>XVIII A. Amelung, 1785-1790, knockoff, green. 13.94 **</td>
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<td>337*</td>
<td>XVIII A. As above, frag., colorless.</td>
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<td>O-79</td>
<td>339*</td>
<td>XVIII A. As above, knop(?), colorless. 15.07 **</td>
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<td>O-80</td>
<td>343*</td>
<td>XVIII A. As above, bottle(?) frag., olive. 13.50 **</td>
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<td>O-81</td>
<td>347*</td>
<td>XVIII A. As above, frag., purple.</td>
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<td>O-82</td>
<td>553(*)</td>
<td>XVIII B. American, ca. 1792, Repold Tumbler, colorless. 15.12 **</td>
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<td>O-83</td>
<td>558(*)</td>
<td>XVIII B. American, tumbler, colorless.</td>
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<td>O-84</td>
<td>424*</td>
<td>XIII B. Brahmagiri, ca. 1st-2nd c., cane, lt. blue transp. 15.53 **</td>
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<td>O-85</td>
<td>430*</td>
<td>XIII C. Hastinapur, 2nd c. B.C.-2nd c. (?) or ca. 1150, frag., aqua. 14.51 **</td>
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<td>O-86</td>
<td>433*</td>
<td>XIII C. As above, 600-300 B.C., waste glass, aqua. 15.55 **</td>
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<td>O-87</td>
<td>434*</td>
<td>XIII D.</td>
<td>Sar Dheri, bangle, black.</td>
<td>14.33</td>
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<td>O-88</td>
<td>235</td>
<td>Russia, prob. Mediaeval, green.</td>
<td>12.61</td>
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<td>O-89</td>
<td>236</td>
<td>Russia, prob. Mediaeval, p. yellow transp.</td>
<td>12.51</td>
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<td>O-90</td>
<td>237</td>
<td>Russia, prob. Mediaeval, blue.</td>
<td>15.51</td>
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<td>O-91</td>
<td>238</td>
<td>Russia, prob. Mediaeval, colorless.</td>
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<td>O-92</td>
<td>4990</td>
<td>II L.</td>
<td>Near East, 750–600 B.C., massive cut vase. CMG 55.1.66.</td>
<td>15.20</td>
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<td></td>
<td>Pompeii, prob. 1st c., p. greenish.</td>
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<tr>
<td>O-93</td>
<td></td>
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<td>As above, p. greenish.</td>
<td>15.84</td>
<td>**</td>
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<td>O-94</td>
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<td>As above, p. greenish.</td>
<td>15.45</td>
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<td>O-95</td>
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<td>As above, 1st c. or earlier(?), colorless.</td>
<td>15.87</td>
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<tr>
<td>O-96</td>
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<td></td>
<td>Castra Praetoria, 1st–2nd c., colorless.</td>
<td>15.87</td>
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<td>O-97</td>
<td></td>
<td></td>
<td>As above, greenish.</td>
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<td>O-98</td>
<td></td>
<td></td>
<td>As above, colorless.</td>
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<td>O-99</td>
<td></td>
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<td>As above, amber.</td>
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<td>O-100</td>
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<td></td>
<td>St. Peter’s Basilica, Constantinian, aqua.</td>
<td>15.58</td>
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<td>(Ex-coll. RWS.) Samples O-101–O-107 were provided by R. W. Smith and E. V. Sayre.</td>
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<td>O-101</td>
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<td>As above, colorless.</td>
<td>15.44</td>
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<tr>
<td>O-102</td>
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<td></td>
<td>As above, aqua.</td>
<td>15.84</td>
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<td>O-103</td>
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<td>Andernach, Rhineland, 4th c., aqua.</td>
<td>16.09</td>
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<td>O-104</td>
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<td>As above, aqua.</td>
<td>16.04</td>
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<td>O-105</td>
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<td>Remagen, Rhineland, 4th c., colorless.</td>
<td>15.59</td>
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<td>O-106</td>
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<td>Rhens, Rhineland, 4th c., aqua.</td>
<td>15.83</td>
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<td>O-107</td>
<td>584(*)</td>
<td>585(*)</td>
<td>Stift Heiligenkreuz, Austria, ca. 1250, aqua.</td>
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<td>O-108</td>
<td></td>
<td>XI AL.</td>
<td>Austria, 14th–15th c., em. green.</td>
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<td>O-109</td>
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<td>XI AL.</td>
<td>St. Stephens, Vienna, 15th c., stained glass window, green.</td>
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<td>O-110</td>
<td>587*</td>
<td>588*</td>
<td>Rüst, Burgenland, 15th c., stained glass window, dk. blue.</td>
<td>14.39</td>
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<tr>
<td>O-111</td>
<td></td>
<td>XI AL.</td>
<td>As above, purple.</td>
<td>11.88</td>
<td>**</td>
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<td>O-112</td>
<td>583*</td>
<td>V C.</td>
<td>Beth She’arim, 4th–7th c. (?), glass slab, greenish.</td>
<td>13.35</td>
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</table>
O-119  600*  V C.  As above, raspberry.  14.16  **
O-147  1177*  XI AB.  Speyer Dom, ca. 1170, stained glass window, ruby flashing over green.  13.29
O-148  1178*  XI AB.  As above, amber.  12.42  **
O-149  1520*  XI AB.  As above, green.  12.27  **
O-150  1167*  XI Z.  St. Sebald, Nürnberg, 1379–1386, stained glass window, ruby flashing over green.  14.02  **
O-151  1168*  XI Z.  As above, amber.  14.87  **
O-152  1166*  XI Z.  As above, p. blue.  14.86  **
O-153  1165*  XI Z.  As above, p. green.  14.88  **
O-154  As above, p. purple with painted loops.
O-155  As above, blue.
O-156  1172*  XI Z.  As above, ruby flashing over p. green.
O-157  As above, blue.
O-158  1175*  XI AA.  Choir window, Ulm Münster, 1410, stained glass window, ruby flashing over green.
O-159  1176*  XI AA.  As above, amber.
O-160  2080*  XI AA.  As above, blue.
O-161  1169*  XI Z.  St. Sebald, Nürnberg, 1480, stained glass window, amber.
O-162  St. Lorenz, Nürnberg, 1590, stained glass window, colorless(?).
\[\delta_{\text{calc}} = 14.34\]  ***
O-164  639*  V A.  As above, aqua.
O-165  644*  V A.  As above, olive.  14.64  **
\[\delta_{\text{calc}} = 14.13\]  ***
O-166  647*  V A.  As above, olive-amber.
O-167  811*  V A.  As above, purple.  14.40  **
O-168  816*  V A.  As above, bottle rim, green.  14.07  **
\[\delta_{\text{calc}} = 14.24\]  ***

*** The following fractionation effects were assumed:
in melts: \(\delta_{\text{CO}_2} - \delta_{\text{melt}} = 3.0\),
for dolomite: \(\delta_{\text{CO}_2} - \delta_{\text{dol}} = 4.0\).
\(\delta_{\text{K}_2\text{O}} = \delta_{\text{Na}_2\text{O}}; \delta_{\text{MgO}} = \delta_{\text{CaO}}; \delta_{\text{Fe}_2\text{O}_3} = 15.0\).
O-169  828*  V A.  As above, beaker, green.
O-170  844*  V A.  As above, base of plate or bowl, green.  15.17  **
O-171  857*  V A.  As above, vessel, p. purple.
O-172  Beth She'arim slab, sample of glass remaining after vacuum furnace removal of CO₂ for radiocarbon study.  13.96
590*  V M.  Aphrodisias, 6th–7th c., cullet, aqua.  Sample from interior.  23.4
590  V M.  As above. Sample from exterior.  23.5
1512  Methone Sarcophagi shipwreck, 2nd–3rd c., urn(?), grn. aqua. Sample from interior.  16.0
1512  As above. Sample from exterior.  16.1
9(*)  Port Royal, wine bottle. Sample from interior. (PR-2.)  13.9
9  As above. Sample from pitted surface.  14.5
1121*  II G.  Nimrud, 7th c. B.C., nugget of cullet, lt. bl. opq.  22.0  **
1214*  II B.  Nuzi, ca. 1450–1350 B.C., cullet, dk blue.  19.1  **
1515*  I A.  Amarna, ca. 1348–1335 B.C., cored vessel, lt. blue transp.  16.0  **

WEATHERING PRODUCTS

<table>
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<tr>
<th>Oxygen isotope number</th>
<th>CMG analysis number</th>
<th>Section if in catalogue</th>
<th>Description</th>
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<tr>
<td>O-16</td>
<td>8</td>
<td>XX F.</td>
<td>Port Royal, 1692 or earlier, wine bottle, dk. green; weathering crust from base of O-15.</td>
<td>28.11 **</td>
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<td>O-45</td>
<td>549(*)</td>
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<td>Nimrud, 7th c. B.C. Crumbly green w. products, poss. layered.</td>
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<tr>
<td>O-65</td>
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<td>Zerek Çamii, ca. 1126, stained glass window, amber; weathering crust from O-64.</td>
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<tr>
<td>O-76</td>
<td>233(*)</td>
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<td>France, ca. 1750, wine glass stem, pink (originally colorless). Crizzled surface.</td>
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<td>Oxygen isotope number</td>
<td>CMG analysis number</td>
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<td>O-14</td>
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<td>Wadi Natrun, modern natron.</td>
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<td>O-120</td>
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<td>Dawson and Dobson, Union of South Africa, African sand.</td>
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<td>O-121</td>
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<td>International Minerals Co., Spruce Pine, N. C., Kona low-iron sand.</td>
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<td>Penna. Glass Sand Corp., Mill Creek, Ok., Oklahoma No. 1 dry sand.</td>
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<td>O-123</td>
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<td>Penna. Glass Sand Corp., Mapleton, Pa., Keystone No. 1 dry sand, Oriskany quartzite.</td>
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<td>O-124 320(*)</td>
<td>XXIV A.</td>
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<td>Bacchias, Egypt, drifted desert sand, fine.</td>
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<td>Solvay, N. Y., modern soda ash by Solvay Process.</td>
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<td>FMC, Green River, Wyo., modern natural soda ash.</td>
<td>13.63</td>
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<td>National Lime and Stone Co., Gibbonsburg, Oh., dolomitic limestone.</td>
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<td>Diamond Alkali, Co., Painesville, Ohio, precipitated calcium carbonate.</td>
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<td>Hooker Chemical Co., Niagara Falls, N. Y., potassium carbonate.</td>
<td>7.24</td>
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<td>O-146</td>
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<td>Acre, sand. Sand sample A, July 4, 1964.</td>
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<td>O-200 658*</td>
<td>XXIV B.</td>
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<td>Embalming material leftover from Tutankhamen’s burial; natron, granular, buff. (Contains chloride.)</td>
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<td>O-201 655*</td>
<td>XXIV B.</td>
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<td>As above; fine, white. (Contains chloride.)</td>
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<td>O-202 661*</td>
<td>XXIV B.</td>
<td></td>
<td>Wadi Natrun, salt deposit.</td>
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<td>O-203 662*</td>
<td>XXIV B.</td>
<td></td>
<td>As above.</td>
<td>38.81</td>
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<td>O-204 664*</td>
<td>XXIV B.</td>
<td></td>
<td>As above, underwater.</td>
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<td>O-205 665*</td>
<td>XXIV B.</td>
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<td>As above, salts on surface.</td>
<td>40.73</td>
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<tr>
<td>O-206Q 674*</td>
<td>XXIV A.</td>
<td></td>
<td>Belus River beach, dune no. 2, drifted sand, fine. Quartz fraction.</td>
<td>10.88</td>
</tr>
<tr>
<td>Sample Code</td>
<td>Code</td>
<td>A. Section</td>
<td>Description</td>
<td>Percentage</td>
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<tr>
<td>O-206C</td>
<td>674*</td>
<td>XXIV A.</td>
<td>As above. Carbonate fraction</td>
<td>28.80</td>
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<tr>
<td>O-207Q</td>
<td>679*</td>
<td>XXIV A.</td>
<td>As above, dune no. 3. Quartz fraction</td>
<td>10.97</td>
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<tr>
<td>O-207C</td>
<td>679*</td>
<td>XXIV A.</td>
<td>As above. Carbonate fraction</td>
<td>29.24</td>
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<tr>
<td>O-208Q</td>
<td>684*</td>
<td>XXIV A.</td>
<td>Caesarea, dune sand. Quartz fraction</td>
<td>11.20</td>
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<tr>
<td>O-208C</td>
<td>684*</td>
<td>XXIV A.</td>
<td>As above. Carbonate fraction</td>
<td>27.73</td>
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<tr>
<td>O-220</td>
<td></td>
<td></td>
<td>Sampled from O-120</td>
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<td>O-223</td>
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<td></td>
<td>Sampled from O-123</td>
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<td>O-226</td>
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<td></td>
<td>Sampled from O-126</td>
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<td>O-227</td>
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<td></td>
<td>Sampled from O-127</td>
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<tr>
<td>O-228</td>
<td></td>
<td></td>
<td>Sampled from O-128</td>
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<tr>
<td>O-229</td>
<td></td>
<td></td>
<td>Sampled from O-129</td>
<td></td>
</tr>
<tr>
<td>1298(*)</td>
<td></td>
<td>XXIV A.</td>
<td>Amarna, 18th Dyn., crucible support(?), quartzite pebble</td>
<td>19.2</td>
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### EXPERIMENTAL MELTS

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<th>Description</th>
<th>$\delta$</th>
<th>$\delta_{\text{calc}}^\dagger$</th>
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<tr>
<td>O-130</td>
<td>Batch for glass DTH, unmelted.</td>
<td>13.18</td>
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</tr>
<tr>
<td>O-132</td>
<td>Glass DTH, melted for 2 hours at 1200°C.</td>
<td>11.70</td>
<td></td>
</tr>
<tr>
<td>O-133</td>
<td>As above, melted for 16 hours at 1200°C.</td>
<td>11.64</td>
<td></td>
</tr>
<tr>
<td>O-134</td>
<td>As above, melted for 2 hours at 1600°C.</td>
<td>11.36</td>
<td></td>
</tr>
<tr>
<td>O-135</td>
<td>As above, melted for 16 hours at 1600°C.</td>
<td>11.56</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Average of 4 DTH melts.</td>
<td>11.57</td>
<td>11.55</td>
</tr>
<tr>
<td>O-131</td>
<td>Batch for glass DTI, unmelted.</td>
<td>12.17</td>
<td></td>
</tr>
<tr>
<td>O-136</td>
<td>Glass DTI, melted for 2 hours at 1300°C.</td>
<td>11.64</td>
<td></td>
</tr>
<tr>
<td>O-137</td>
<td>As above, melted for 16 hours at 1300°C.</td>
<td>11.24</td>
<td></td>
</tr>
<tr>
<td>O-138</td>
<td>As above, melted for 2 hours at 1600°C.</td>
<td>11.64</td>
<td></td>
</tr>
<tr>
<td>O-139</td>
<td>As above, melted for 16 hours at 1600°C.</td>
<td>11.58</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Average of 4 DTI melts.</td>
<td>11.54</td>
<td>11.47</td>
</tr>
<tr>
<td>O-230</td>
<td>Batch for glass EXY, unmelted.</td>
<td>9.71</td>
<td></td>
</tr>
<tr>
<td>O-232</td>
<td>Glass EXY, melted for 2 hours at 1200°C.</td>
<td>9.01</td>
<td></td>
</tr>
<tr>
<td>O-233</td>
<td>As above, melted for 24 hours at 1200°C.</td>
<td>9.01</td>
<td></td>
</tr>
<tr>
<td>O-234</td>
<td>As above, melted for 2 hours at 1600°C.</td>
<td>9.14</td>
<td></td>
</tr>
<tr>
<td>O-235</td>
<td>As above, melted for 24 hours at 1600°C.</td>
<td>(Anomalous result, not included in average.)</td>
<td>10.11</td>
</tr>
<tr>
<td></td>
<td>Average of 3 EXY melts.</td>
<td>9.05</td>
<td>9.01</td>
</tr>
<tr>
<td>O-231</td>
<td>Batch for glass EXZ, unmelted.</td>
<td>15.64</td>
<td></td>
</tr>
<tr>
<td>O-236</td>
<td>Glass EXZ, melted for 2 hours at 1200°C.</td>
<td>13.98</td>
<td></td>
</tr>
<tr>
<td>O-237</td>
<td>As above, melted for 24 hours at 1200°C.</td>
<td>13.94</td>
<td></td>
</tr>
<tr>
<td>O-238</td>
<td>As above, melted for 2 hours at 1600°C.</td>
<td>14.04</td>
<td></td>
</tr>
<tr>
<td>O-239</td>
<td>As above, melted for 24 hours at 1600°C.</td>
<td>14.01</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Average of 4 EXZ melts.</td>
<td>14.00</td>
<td>14.15</td>
</tr>
<tr>
<td></td>
<td>Glass DGU, control sample.</td>
<td>12.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Glass DGU, hydrolyzed sample.</td>
<td>12.9</td>
<td></td>
</tr>
</tbody>
</table>

$^\dagger$ The following fractionation effects were assumed:

- in melts: $\delta_{\text{CO}_2} - \delta_{\text{melt}} = 3.0$,
- for dolomite: $\delta_{\text{CO}_2} - \delta_{\text{dol}} = 4.0$. 

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### POTTERY

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<tr>
<th>Oxygen isotope number</th>
<th>Description</th>
<th>δ</th>
</tr>
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<tbody>
<tr>
<td>O-18</td>
<td>Sardis, 6th c. B.C., Lydian, painted sherd.</td>
<td></td>
</tr>
<tr>
<td>O-19</td>
<td>Jericho, 2900-2700 B.C., sherd.</td>
<td>22.30</td>
</tr>
<tr>
<td>O-20</td>
<td>Petra, 10 B.C. -70 A.D., Nabataean, sherd.</td>
<td></td>
</tr>
<tr>
<td>O-21</td>
<td>Caerleon, 1st-2nd c., Roman, sherd.</td>
<td>15.94</td>
</tr>
<tr>
<td>O-22</td>
<td>Athens, 11th-10th c. B.C., Protogeometric, sherd.</td>
<td></td>
</tr>
<tr>
<td>O-23</td>
<td>Athens, 5th c. B.C., red figure pottery, sherd.</td>
<td>18.57</td>
</tr>
<tr>
<td>O-24</td>
<td>Gordion, Hittite Period, sherd.</td>
<td></td>
</tr>
<tr>
<td>O-25</td>
<td>Amarna, 18th Dyn., fired clay, faience mold.</td>
<td>15.94</td>
</tr>
</tbody>
</table>
Figure 1. Oxygen isotope data (δ) for 84 glasses arranged according to dates. The glasses span almost the entire history of glassmaking. Column of squares at right shows data for various batch ingredients—some modern and some representing ingredients used in ancient times. All data are from the accompanying table. (Note the difference in scale between the two parts of the diagram.)

Circles = glasses
Squares = batch ingredients
Triangle = weathered glass
Figure 2. Summary of oxygen isotope data for 84 glasses. Rectangles enclose glasses having a common provenance. Broken lines connect groups of similar provenance but different chemical compositions. Individual letters are single samples. Parentheses indicate number of glasses in rectangles.

18th Dyn. = 18th Dynasty Egyptian glasses (7).
Note that two dark blue glasses colored with cobalt differ from the others.
Amer. = Amelung or related American glasses (4).
Aphr. = Aphrodisias (2); B$_2$O$_3$ = -1.0%.
BS = Beth She'arim slab (3).
Chrt. = Chartres, st. glass windows (3).
Has. = Hasanlu, bead and small object (2).
India = Beads and vessels (4). (One may be ca. 1150.)
Islam. = Islamic; plant-ash (3). Natron-type (1) lies above others.
Jalame = Glasses referred to in text (5).
M = Mesopotamian vessel.
Mc = Near Eastern, massive cut vessel.
Myc. = Mycenaean amulets (2), unknown provenance.
N = Nuzi, cullet.
Nimrud = Bowls and inlays (5).

O = Olympia, Phidias' workshop.
P = Persepolis, fragment.
PR = Port Royal, wine bottles (3).
Q = Quartzite pebble, Amarna workshop.
Russia = Fragments, uncertain dates (3).
Rust = St. glass windows (2); chemical comps. differ.
S = Sardis, vessel.
Speyer = St. glass windows (3).
T = Torcello, vessel.
Various "Roman" = Vessel fragments; Italy, M. East, Rhineland (15). Some contain Mn, some Sb.
Venice = Venice (1) and Rosenborg Palace (1).
ZC = Zerek Çamii vessel glasses (2); B$_2$O$_3$ = -0.02%.
ZC B$_2$O$_3$ = Zerek Çamii vessel glass (1) and st. glass (1); B$_2$O$_3$ = -0.15%.
$\Delta$ = Port Royal bottle, w. crust.
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