THE STUDY OF ANCIENT TERRITORIES

CHERSONESOS
&
METAPONTO

2003 FIELD REPORT

THE INSTITUTE OF CLASSICAL ARCHAEOLOGY
THE UNIVERSITY OF TEXAS AT AUSTIN
This Report
is dedicated
to the memory of
Lucy Shoe Meritt
1906–2003

Archaeologist, teacher, patron, friend

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Front cover: The central part of the "Church Mosaic" on the grounds of the Preserve Museum
(approximately 3.5m²). This image, from July 2003, is a composite of 10 photographs by
Shawn Ross, processed in Photoshop by Adela Sobotkova. (See related article, p. 31.)
THE INSTITUTE OF CLASSICAL ARCHAEOLOGY

MISSION
The Institute of Classical Archaeology (ICA) is an Organized Research Unit of The University of Texas at Austin. In order to study, document, and preserve sites, monuments, and artifacts of past life for present and future generations, we conduct archaeological fieldwork and training in ancient Greek rural territories on the Black Sea and the Mediterranean. We engage in interdisciplinary research and publication and provide technical assistance and expertise for cultural heritage management.

RESEARCH FOCUS
ICA’s research focuses primarily on the *chorai*, or agricultural territories, that surrounded and supported ancient Greek colonial cities. Our two primary sites of research are the chora of Metaponto on the southern coast of Italy and the chora of Chersonesos on the northern coast of the Black Sea in Crimea, Ukraine. Both settings offer remarkably well-preserved ancient rural landscapes, once densely occupied by farmers and still containing abundant evidence of their homes, burial grounds, and places of worship. Because their locations were strategically important, they also contain archaeological remains from the Roman through Byzantine eras. Through its research, ICA contributes to a fuller understanding of the settlement, economy, and culture of this previously neglected rural dimension of early western civilization. Metaponto and Chersonesos provide a unique chance to compare rural chorai at opposite ends of the colonial Greek world, as well as a valuable opportunity to train students, foster exchanges, and generate international collaboration and good will.

ADJUNCT ORGANIZATIONS
The Center for the Study of Ancient Territories (U.S.A.), *Pidtrymka Chersonesu* (Ukraine), and the *Centro di Agroarcheologia Pantanello* (Italy) are nonprofit organizations founded to support the mission and goals of ICA. Their special focus is expanding international cooperation for ICA’s projects and ensuring cultural awareness and compliance with local laws.
Over the last five years, the Institute of Classical Archaeology has developed into a truly global research project. This growth springs from advances in technology that have enhanced and eased the gathering, study, and communication of data, and, most especially, from the generous support of the Packard Humanities Institute, as well as our long-time donors. While the Institute’s primary staff is based in Austin much of the year, activity by collaborators in Ukraine, Italy, England and other parts of the globe continues year round.

While a number of new projects were initiated in 2003, the major focus was on three goals: the definitive publication of the Metaponto survey (covering the area between the Bradano and Basento Rivers), preparation for the nomination of Chersonesos to the UNESCO World Heritage List, and the publication of Crimean Chersonesos, the first English language book on the rich history and treasures of the National Preserve. These major undertakings would not have been possible without the skills and rich diversity of talent of ICA’s team members and the unwavering support they extend to each other in all endeavors. As director, it is gratifying to see the hard work of previous years produce such a talented and able group, as well as an international collaboration that is producing significant accomplishments. The results of our shared enterprise can be seen not only in research, publication, and conservation, but also in the growth of the professionals involved and the trust established among them.

**Metaponto**

**Publication of the Field Survey Results**

ICA made substantial progress in 2003 towards the definitive publication of the intensive field survey of the chora between the Bradano and Basento Rivers, the first of two projected volumes. Albert Prieto, working in Austin, has finished revising the chapters covering the chora’s geology and geomorphology and composing the chapter on the methodologies employed in the survey since its inception over 20 years ago. At the same time his various collaborators around the world have completed the chapters on the black gloss, Roman, and post-Roman pottery. The chapters on greyware pottery, coarse ware, cooking ware, transport amphorae, and terracotta figurines are expected in the spring of 2004.

The survey between Bradano and Basento, which began in 1981, has identified more than 600 archaeological sites. Over 16,000 diagnostic ceramic fragments and other objects, an average of 25 per site, have been collected and stored in the Metaponto Museum and ICA’s laboratory in Metaponto, the Banca. Analysis of these fragments began early in the survey, but it was not until the year 2000 that funding from the Packard Humanities Institute allowed the ICA team to carry out a detailed study of these materials and, ultimately, to establish an accurate and comprehensive typology and chronology of this large collection. While the dates of the survey artifacts range from the Neolithic (ca. 5000 BC) to Medieval (ca. 1200 AD), the great majority belongs to the period of Greek colonization (700–200 BC), representing the countryside and its changing settlement patterns in great detail during the five centuries that Greek civilization transformed southern Italy into “Magna Graecia.”

Of particular importance for the chronology of settlement is the study of the black gloss pottery, found at nearly every site surveyed in the chora. The study of this large body of artifacts was completed in 2003 by a skilled team of pottery specialists working in the Banca. Each sherd was considered and classified, with representative types drawn and photographed for illustration in the publication, and finally entered into a sophisticated database that accounts for every artifact from all historical periods recovered in the survey.

While this database is perhaps the most comprehensive of any compiled on Greek settlements, the stage is set for a further advance in our research: the integration of the database into a Geographic Information System (GIS) of the Metapontine chora. This powerful analytical tool has been employed in the sciences for a decade or more, but only now has the ICA team been able
to realize its great promise for the study of ancient history. GIS software, able to analyze many thousands of cases simultaneously, has helped the team answer questions about settlement that previously were too difficult and impractical to attempt. It is a perfect match for the large amount of data gathered by intensive archaeological field survey.

**Fieldwork (August–October 2003)**
A full seven-week survey campaign was carried out in late summer and early fall between the Basento and Cavone Rivers as part of the ongoing (1992–present) effort to compare settlement patterns in the two halves of the ancient territory (see Albert Prieto’s report, p. 71). After an absence of more than ten years, Cesare D’Annibale once again lent his inimitable leadership talents and natural feel for the landscape to the survey project, and the results show that his abilities have not diminished in the interim: several kilometers of unexplored territory were walked, and over a hundred new sites added to ICA’s already impressive total of 830 (Bradano-Basento-Cavone). Albert Prieto, co-leader of this year’s survey, brought much-needed technological expertise in GIS and GPS that nicely complements Cesare’s long stride and sharp eye. Cesare and Albert, ICA’s survey “dream team,” will finish the Basento-Cavone transect in coming seasons so that work on the second volume of the definitive survey publication can begin as soon as possible.

A long-standing goal of ICA has been the exploration of surface survey sites using non-intrusive ground-penetrating technology such as magnetometry. We realized the start of this project in August 2003 when a team of specialists led by ICA’s Dan Davis and Albert Prieto investigated four sites in different localities across the territory. The results bode well for such work in the future while simultaneously reminding us that sites are disappearing forever at a rapid pace under the action of plow and bulldozer. Dan’s report appears on p. 76.

The analysis of human remains from burials in the chora and city, begun in 1985 by Prof. Maciej and Dr. Renata Henneberg, has continued at regular intervals. In 2003, the Hennebergs and their student, Rebecca Hepworth, returned to apply a technique they have developed enabling them to evaluate multiple pathologies evidenced by deformations of normal skull structure. A brief summary of their work appeared in a 2003 ICA publication, *Living off the Chora: Diet and Nutrition at Metaponto*. This volume also contains contributions from four other ICA staff and collaborators on the theme of tastes and food in the ancient world, delivered at a special symposium at Matera organized by the Region of Basilicata.

Renovations of the buildings of the Azienda Pantanello—made available to ICA’s Centro di Agroarcheologia through the generosity of the Region of Basilicata—were completed in 2003. Researchers, who have been visiting Pantanello regularly since the Centro was established in 1999, now have a tranquil place to work in the heart of the chora. The buildings have computer facilities, a modest but useful library, heating and air conditioning, a serviceable kitchen, and upgraded plumbing. It is now a comfortable and useful home away from home, as Rosetta Torraco reports on p. 81.

**Chersonesos**
A dozen years have passed since I first visited the ancient site of Chersonesos and its chora on the northern coast of the Black Sea. 2003 marked the tenth year that ICA has carried out field work there in an ever more significant involvement with one of the world’s great archaeological...
treasures. Chersonesos has been for almost two centuries a magnet for students of ancient history, archaeology, and art, but Cold War politics made it totally inaccessible to foreigners and even to Soviet citizens until 1992. The relationship between the University of Texas and the National Preserve of Tauric Chersonesos (the Preserve) is one of the oldest post-Cold War cultural collaborations on Ukrainian soil between archaeologists and other “culture workers” from abroad and those of the now-independent country of Ukraine. This international collaboration has been successful from the start as Chersonesos and its home city of Sevastopol have emerged from isolation.

The chora of the Greek colony of Chersonesos was the object of the earliest joint projects among the National Preserve, ICA, and the Center for the Study of Ancient Territories. Their scope has grown to include every aspect of the archaeology and history of this remarkable place. The dream of an archaeological park has been nurtured for years by the Preserve staff and city government. Because of the involvement of the Packard Humanities Institute, that dream is becoming reality. The Ukrainian government has expressed a strong desire to have Chersonesos listed on UNESCO’s World Heritage List where it rightfully belongs. Progress toward that goal has become another strong bond that unifies the efforts of ICA and the Preserve.

The World Heritage nomination will provide direction and a clear set of guidelines for the preservation and conservation of Chersonesos’ monuments. In May of 2003 the National Preserve hosted a UNESCO delegation of experts from around the world accompanied by officials of the Ukrainian Ministries of Foreign Affairs and Culture. All the while, support was being built through the media and behind the scenes. A group devoted to our goal, including international figures in cultural heritage management such as Professor Henry Cleere (previously World Heritage coordinator with ICOMOS), was formed. Some, not surprisingly, had never heard of Chersonesos or been aware of its uniqueness, and one of the first challenges has been to raise public awareness of the value of the site both abroad and within Ukraine.

Crimean Chersonesos
The publication of Crimean Chersonesos, City, Chora, Museum and Environs, a handsomely illustrated, authoritative, and original guide by the Preserve, ICA and other collaborators, was published in 2003 and has been well received. The volume has opened the site for the first time in almost a century to readers and potential visitors outside Ukraine and Russia. In every sense this book was the product of intensive teamwork between Chersonesos and Austin. The texts of contributions were composed in English or Russian and translated into both languages, then compared, critiqued, revised, and retranslated. The numerous full-color images were researched, processed, and imaginatively laid out to produce a book with which we are all very pleased.

Cultural Resource Management Plan (CRM)
World Heritage monuments are strictly held to universal standards of conservation and management. Even at sites that have suffered damage as a result of natural or human interference, it is important to demonstrate that a coordinated, long-term conservation program is in place. The required management plan outlines methods of site management that maintain the authenticity and integrity of the monuments while ensuring public access to the site. An accurate and detailed site plan—of the ancient city and its territory (the chora)—must either exist or be created before the site can be considered by UNESCO. For Chersonesos, neither the progress of conservation nor the site plan met the international standards expected. The agenda for 2003 was to begin development of a management plan that would
fit the special circumstances of Chersonesos while meeting local, national, and international requirements. The plan for Chersonesos will likely serve as the standard for future sites in Ukraine. A working group consisting of representatives of the Preserve, the Ministries of Culture and Foreign Affairs, the city government of Sevastopol, and ICA and its affiliates was established, and in 2003 productive discussions were begun.

A significant achievement of the working group has been an understanding with the Sevastopol city authorities that land for the Archaeological Park of the Chora, in addition to that already deeded to the Preserve, definitely will be available for that purpose; specifically some 160 hectares (nearly 400 acres) of pristine ancient landscape with remarkably well preserved ancient farms in the area known as Ukharina Balka. In 2004 we hope to see the fruition of these initiatives.

A fundamental practical advance is represented by the preparation, begun in June 2003, of the first unified plan of the ancient city. This project has been well described by Jessica Trelogan, the topography team leader, in her report in this volume. This is no ordinary plan, but involves a GIS (Geographic Information System) with all the potential that such a program incorporates. The creation of this multidimensional map is being coordinated with the digitizing of the complete Preserve archives started the previous year by the Megarica teams of the Preserve and ICA, and sponsored, as much at Chersonesos, by the Packard Humanities Institute. The integration of Megarica and of the documentation of conservation throughout the city and chora is unique and will be highly useful. At any point on the GIS plan of the city, a complete report on the history of excavation and conservation can be summoned up with a mouse click.

A need of the Preserve for study and preservation of artifacts in a modern facility was recognized early on and will be met by the construction of the Packard Laboratory, begun in 2003 on the site of Fondi 4, a rapidly deteriorating 19th century monastic bath house that the Preserve had inherited and was using as a storage depot. Work on this very welcomed improvement was delayed by an archaeological excavation under one end of the monastic building, as required by the city’s architects. What seemed at first to be an impediment to progress became an exciting bonus as all three principal periods–Greek, Roman, and Medieval–of the ancient city’s development, including a major section of the 4th century BC city wall, whose presence was previously unsuspected, were exposed. This significant testimony of the ancient city’s growth will be protected by the design of the laboratory. The excavation, carried out by the chief archaeologist of the city, Stanislav Ryzhov, in collaboration with ICA, is the subject of a report here by Ryzhov and Olga Andreeva on the medieval pottery.

Scientific Publication

Publication of excavations in the chora and city by the joint teams of the Preserve and ICA has been planned from the beginning. The first such project, begun in 1994, is a study of the unique series of grave monuments from the Tower of Zeno. These constitute perhaps the fullest evidence for the use of color in Greek painting of the late Classical and early Hellenistic period to have survived from ancient times. In 2000 an international team was formed, led initially by Joseph C. Carter and now by Dr. Richard Posamentir of the German Archaeological Institute in Istanbul. Ukrainian and U.S. specialists in architecture, the chemistry of color, and epigraphy round out the team. This work has been the subject of interim progress reports in previous annual reports.

Pottery, both locally made and imported, is the major category of evidence (supplemented by abundant coins and stamped amphora handles) at Chersonesos.
for the date and principal functions of sites. Dr. Andrei Opait, a specialist on Black Sea ceramics, is currently researching these pieces for ICA. A sample of his approach to this material appears on pages 57–60. Also contributing to the pottery studies in 2003 were Denis Zhuravlev of State Historical Museum of Moscow, Valerio Caldesi Valeri of the Department of Classics at the University of Texas, and apprentice assistants. The focus in 2003 was the pottery from the excavation of the Greek farmhouse Site 151, excavated 1994–1996 in the area of the future archaeological park. Other materials, including the large-scale terracotta figures from this site, were catalogued and described by J.C. Carter and Antonia Shevchenko with photographs by Chris Williams. Further progress on the documenting of the pottery is being made by Dr. Amy Papalexandrou in Austin and by Dr. Opait working in Toronto during the winter months.

**Archives and Library Conservation Program**

The Megarica team is scanning rare books, letters, plans, photographs, and other documents (currently conserved in the library and archives, many only single copies) and notes of the pioneer archaeologists of the 19th and early 20th century, as well as the more recent annual site reports, illustrated with photographs and plans numbering in the hundreds. These efforts will preserve them for future generations and also serve as an aid to the Preserve staff and students of the site. The originals themselves, beginning in 2003, are now the object of a massive rescue operation orchestrated by librarian Lucy Grinenko, head archivist Nonna Krasovskaya, and ICA’s resourceful Glenn Mack. (See his report on p. 39.)

**A Long-term Approach to Conservation**

The subject of the first three contributions to this report reflect the urgency of the single greatest problem that the National Preserve confronts and must resolve, not only to qualify for the UNESCO nomination but also simply to survive.

The failure thus far to deal with the conservation of excavated sites in a timely fashion, while understandable considering the economic circumstances of Ukraine, has created an enormous backlog of deteriorating ancient structures in the city and its territory. By the same economic rationale, excavation should have been curtailed, but it has not. The conservation projects funded by the Ministry of Culture at present are on an ad hoc basis, often poorly timed and coordinated, and staffed by private firms that have their own particular ways of doing things. The costs, relatively speaking, are high. The task of developing standard procedures for a continuous and consistent program of conservation is a responsibility now being undertaken by the National Preserve and its Deputy Director for Conservation, Larissa Sedikova. In 2003, professional conservators under the direction of British expert Chris Cleere began a variety of conservation initiatives to assist the Preserve in its efforts. The aims were to identify the most pressing problems, to test locally available and inexpensive materials for the work, and to train local labor, so that, ultimately, the conservation team will consist of local people who would be employed from April through October, if not year around, on a permanent basis. This will give a boost to the local economy and lead to a sustained effort. Cleere and his team have shown unusual sensitivity to local conditions and local experts and have been remarkably successful in organizing a practicable program in just one season.
The principal projects of the joint conservation team working on monuments in 2003 were the southeast quarter of the ancient city near the main cistern, and a newly-discovered and interesting cistern, last used as a prison (with graffito inscriptions of the 13th century). At the latter site, the team arrested the fall of the inscribed plaster walls. Preliminary studies were made of the exceptionally fine mosaic from the church outside the city walls in Quarantine Bay, in preparation to moving it to safer permanent quarters. In the chora, work continued on the farmhouses of Ukharina Balka and at Bezymyannaya. The long-term goal is to create an integrated team and a set of standard conservation procedures both for the city and its chora.

**Pidtrymka Chersonesu**

*Pidtrymka Chersonesu* (PC) is a Ukrainian non-profit created to ensure that ICA’s financial assistance to the Preserve complies with Ukrainian law and to act as a liaison and advisory body to the Preserve’s director and staff. PC’s director, Taissa Bushnell continues, skillfully and gracefully, to guide its activities. In 2003 these included: overseeing the many complexities of constructing the Packard Laboratory, which will be the Preserve’s first modern storage facility and conservation lab; coordinating on-going dialogue with the Preserve and international experts to design and implement improved conservation and management plans; and, in general, assisting the Preserve in its efforts to become a UNESCO World Heritage site. The above efforts are being developed in close collaboration with all parties who have a legal or vested interest in the Preserve. Because Chersonesos is a designated National Preserve and because of its potential role in the progress of Sevastopol’s economy as it moves from its military-industrial past to a future with tourism and information science leading the way, the interested parties range from government ministries in Kyiv to Sevastopol city planners to Preserve staff. The ongoing efforts of *Pidtrymka Chersonesu* will, we believe, have a positive effect on the future of Sevastopol and Ukraine.

**In Appreciation**

It would be impossible to adequately acknowledge the extraordinary sponsorship by the Packard Humanities Institute. This support has made it possible for ICA and its collaborators to pursue and publish broad areas of research, expanding the limits of traditional archaeology. Because of this sponsorship, ICA has been able to reach out to and involve professionals and students from around the world, to their benefit and that of world culture in general.

Much gratitude is due also to the Brown Foundation, the Dougherty Foundation, the Rachael and Ben Vaughan Foundation, the Liss Foundation, the Martel Foundation, and the Trust for Mutual Understanding. These contributions over the last thirty years have given us help and encouragement and ensured our continuing work.

To these and to old friends who have favored us with their vital and uninterrupted support, we send heart-felt thanks and a promise to continue working to justify your trust in us.

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Figure 5. Grant Nelsestuen, Julian van Rensburg, and Leo Carter prepare mortar for conservation at the city site.
Plate I. Part of the Chersonesos defensive wall, the largest standing monument of classical antiquity on the Black Sea. The Tower of Zeno is at center right.
Plate II. On the site of old Fondi 4, preparation is made for the Packard Conservation Laboratory. In this view, looking north, workers pour the basement level floor while archaeologists (at right) excavate a portion of the ancient city wall. (July, 2003)
The site of Chersonesos and its surrounding chora represent a huge conservation challenge. The city has approximately fifteen acres of exposed archaeological structures and the chora contains many more. The exposed archaeology is under threat from nearly all imaginable forces, and most of the unearthed sites are threatened by uncontrolled development.

In 2003, the approach to conserving the excavated structures of the ancient city of Chersonesos and in the surrounding chora underwent a fundamental change. Previously, conservation resources were focused on individual structures, where large monuments were seen as specific entities within the site and treated independently of the surrounding, less-imposing archaeology. Varying conservation treatments have in the past been implemented that, while addressing specific problems of loss and deterioration, have lead to inconsistent treatment across the site. This in turn makes distinguishing original material from new, in some cases, practically impossible.

Less imposing structures, once stabilized after excavation, received treatment only as part of a maintenance program based on repair rather than preventative conservation.

This approach to maintenance has lead to wide variations in quality, effectiveness and aesthetic, that confuse and mislead those wishing to appreciate the site as a complete entity.

Our intention now is to prioritize conservation based on the condition and stability of structures irrespective of their perceived value. Treatments are being designed which will use a palette of locally available materials and which will incorporate standardized application techniques across the site.

The objective of the conservation team in 2003 was to become familiar with the site, to identify the types and extent of active deterioration occurring, to source suitable local materials, and to begin tests of application suitability.

Once the parameters of the problem are understood, it will be possible to develop a time-efficient method whereby the present condition of the site can be accurately surveyed and recorded. This information will act as a baseline from which, through ongoing monitoring, quantitative data concerning the true present condition and the rate of deterioration can be gathered.

Once the situation is fully understood, the aim will be to produce a conservation plan for the City and chora based on the reality of the problem rather than relying on subjective opinion. The ongoing survey and monitoring program will allow the plan to be constantly updated as new problem areas arise. As the recording method will be designed to monitor the entire site on a continuing basis, the effectiveness of conservation treatments within the site’s various micro climates can be assessed and modified as required.

The conservation of the City and sites in the chora will involve the application of hundreds of tons of conservation materials and a consistent supply of high quality raw material will be required for their manufacture. The raw materials will need to be readily available and easily transportable to the site.

The availability of these raw materials, above all else, influences the design of conservation materials. It is relatively easy, in a laboratory, to design a conservation treatment that fulfills the requirements of an application. If however the application of that treatment requires the transportation of expensive raw materials from far away, it is of little use.

As the conservation work at Chersonesos will continue indefinitely, the same materials will always be required. So it is obvious that materials need to be as inexpensive as possible, available locally, and the skills needed to apply treatments easily learned. In this way, whoever is responsible for the site will be able to continue to implement the conservation plan into the future.
The underlying philosophy of the conservation team is simplicity of design and application and the transference of skills to those who have ultimate responsibility for the site.

In many of the larger structures the level and type of deterioration occurring falls outside the field of conservation and requires the input of a structural engineer to identify the current level of risk to the structures. Such a survey has been carried out and the data is now ready to be incorporated into data that will be collected during the condition survey.

Following an initial visit by the conservation team in the late summer of 2002, the project began in the late spring of 2003 and expanded during the excavation season of June and July.

The original aim of the conservation team for 2003 was to familiarize themselves with the site, to begin determining a method for assessing the site, to look for materials and, it was hoped, to carry out some trials of materials.

Due to the high degree of professionalism shown by the conservators involved, the physical effort of all those who undertook the work, and the cooperation and trust given by the staff of the National Preserve, these aims were exceeded. The accomplishments included:

• Locating guaranteed supplies of all the materials necessary for conserving the site.
• Undertaking initial tests on possible conservation mortars, to the extent that time allowed.
• Large test areas in both the City and chora were identified, cleaned and conserved.
• A method of surveying and monitoring the site was designed, tested and initiated.
• A method of recording conservation work in a time frame that would not hinder work was designed, tested and implemented.
• A structural survey of the large monuments was completed.
• An emergency conservation project was completed at a cistern containing valuable early wall plaster.
• A conservation plan to save the “Church Mosaic” was designed and implemented.
• The viability of a project to conserve the Hellenistic stelai was discussed and tests carried out as to possible method for removal of biological contamination.
• The condition of the museum collection, both on display and in storage, was assessed.
• The object conservation resources available at the site were assessed and discussed with the staff of the National Preserve.

**Sourcing Of Conservation Materials**

The constituent materials of conservation mortars—lime, sand, crushed brick and crushed stone—are abundant and not inherently expensive. The majority of the purchase cost for such materials is due to the cost of transportation. It was therefore the aim of the conservation team to source these materials as close to the Preserve as possible.

Figure 1. Basalt fibers, produced in Ukraine, were added to mortar as reinforcing material.
possible, looking first in Sevastopol, then Crimea, then Ukraine as a whole and then at imports from neighboring countries which have established trade links with Ukraine.

A source of high quality lime was found in Balaklava, as was a source of crushed stone. Unfortunately all sand produced in Crimea is beach sand and therefore inherently contaminated with salt. Clean sand, however, is regularly imported in bulk from another region of Ukraine and should remain abundantly available.

A source of crushed brick proved elusive. Fired bricks are available, but not locally produced, so waste from their manufacture is unavailable. For the purpose of mortar tests the team therefore crushed bricks by hand.

Along with standard ingredients mentioned above, the conservation team wanted to test additives to the mortar mixes in case the limited variation of raw materials available would not produce a satisfactory option.

We decided that a possible source of cement, along with a fibrous material that could be used to reinforce a mortar should be researched. At this stage polymer additives were rejected as being inherently expensive and susceptible to UV degradation, so were not included in the initial round of testing.

The locally available cement is extremely dark grey in color and has a high salt content, so it was rejected as inappropriate. White cement is not manufactured in Ukraine, but is available as a Turkish import. It is likely that this source will continue, at least until a higher grade Ukrainian product is available, so the material was included in the test mortars.

Historically, fibers have been added to mortars and plasters to reinforce the structure. This principle has been adopted by the conservation profession and while many fibers have been successfully used, in reality they all do the same job. Good results have been produced in Italy using polypropylene fibers, a material that is readily available in bulk and inexpensive. It was therefore decided to try to source such a fiber in the Ukraine.

Along with additives for mortars, the other high-tech material required was a geo-textile. A geo-textile is a non-biodegradable, water permeable membrane that cannot be penetrated by plant roots. The textile is used in the reburial of ancient floors, allowing water free passage, while eliminating root damage of delicate structures.

After much searching a manufacturer of basalt fiber products was located in Ukraine (Fig. 1). While they do not produce a suitable membrane, they are exclusive manufactures of mineral fibers and woven netting that appeared to be a perfect candidate as reinforcement in the conservation treatments that were being proposed.

Exhaustive research showed that geo-textile is not manufactured in Ukraine. The team turned to a product available as an import from Turkey.

This search for suitable materials has been beneficial. We now have local suppliers of all the materials required to undertake site conservation, with the unexpected bonus of finding a new technology, unique to Ukraine, which could be beneficial to conservation as a whole.

**Testing of Materials**

As suitable materials were identified, samples were obtained and test samples of mortar prepared. The tests were aimed at identifying a mortar that was both suitable for the environment on the site and aesthetically pleasing.

Examination of the original mortars on the site showed there to be a high proportion of lime in the mix, sand and/or crushed limestone, and crushed brick/tile.

Initial test samples were therefore manufactured from only these materials, plus the inclusion of white cement to act as a baseline from which to assess the samples.

<table>
<thead>
<tr>
<th>Sample Number</th>
<th>Lime</th>
<th>Sand</th>
<th>Limestone</th>
<th>Brick</th>
<th>Cement</th>
</tr>
</thead>
<tbody>
<tr>
<td>One</td>
<td>1.0 Part</td>
<td>1.5 Parts</td>
<td>1.5 Parts</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Two</td>
<td>1.0 Part + 0.5*</td>
<td>1 Part</td>
<td>1.0 Part</td>
<td>1 Part</td>
<td>–</td>
</tr>
<tr>
<td>Three</td>
<td>0.5 Part</td>
<td>1.5 Parts</td>
<td>1.5 Parts</td>
<td>–</td>
<td>0.5 Part</td>
</tr>
<tr>
<td>Four</td>
<td>0 Parts</td>
<td>1.5 Parts</td>
<td>1.5 Parts</td>
<td>–</td>
<td>1.0 Part**</td>
</tr>
</tbody>
</table>

Table 1. Mortar mix trials.

*Extra lime was added to produce a workable mortar
**Water was added to produce a workable mortar
Figure 2. Conservation tests at Bezymyannaya with types of wall capping indicated.
As a starting point mortars were based on a proportion of one part lime to three parts aggregate. If this proportion did not produce a usable mortar, lime was added until the correct workability was achieved. [See Table 1 for initial mortars produced.]

The samples were prepared, covered and allowed to dry slowly over a three day period. The samples were then left in the ambient atmosphere for a period of one week to allow further carbonation of the lime to occur.

To assess the performance of the mortars, the samples were placed in individual dishes in a small amount of water and exposed to freeze/thaw cycling by repeatedly placing them in a freezer.

Due to the limited cure time available, the test to which the samples were exposed was too aggressive and after only two cycles all the lime samples had disintegrated. Ideally the samples should have been given a longer period before testing to allow carbonization of the lime to progress further, but due to the necessity to produce a usable material for the coming season, it was necessary to make an educated guess as to the most appropriate composition.

The samples containing cement performed well and it was decided that Sample #3 (containing both lime and cement) should progress to application on the site.

Sample #4 was not considered, as a pure cement mortar is far too hard for use on archaeological material. The aim of the project is to produce a mortar that will hold the original material in its correct position for a reasonable length of time, yet deteriorate preferentially to the original material, the mortar then being replaced as part of continuing maintenance. The cement-based sample was only included as a baseline against which to compare the performance of the other samples.

While testing had been too aggressive for the samples, some conclusions could be drawn as to the performance of the materials. Brick had been included as a possible source of Pozzolan (naturally occurring cement), yet the sample containing brick showed no greater resilience than those without. While the carbonation of lime is a slow reaction, the deposition of silicates is swift (as demonstrated by the cement based-samples). It was therefore concluded that the amount of silicate deposited by the brick was too low to be of any practical benefit and, given the problem of no reliable local source, it was decided that brick should not be included in the samples tested on the structures.

The samples chosen for further testing were therefore the 1 part lime : 1.5 parts stone : 1.5 parts sand mortar and the 1 part lime : 0.5 part cement : 1.5 parts stone : 1.5 parts sand mortar. (The sample with cement was chosen because it had survived the testing, yet remained soft enough to be applicable; the lime base mortar because, given a long enough carbonation period, it should perform adequately.)

At this point the source of basalt fibers was identified and a sample obtained. The fibers were cut into 10cm lengths and added to the selected mortars to see if they could be easily incorporated into the mix without clumping.

The fibers worked well and it was decided that they should be incorporated into the future test regime. Being pure silica and chemically inert there was
no reason for the fibers to be detrimental to the set of the mortar and could only improve both resilience and strength.

Addition of the fibers also has the beneficial effect of acting as a “modern marker.” As the lime mortars are based on ancient technology and made entirely of local material there is a possibility that at some future time it could be possible to mistake weathered conservation mortars for original material. The presence of the fibers makes ancient and modern materials easily distinguishable in the field without the need for any specialized equipment.

We selected four mortar types for site application: the two types mentioned above, both with and without the addition of the basalt fibers.

These mortars would be tested both as pointing materials on wall elevations and as capping material on truncated wall tops.

**In Situ Conservation Tests**

Following the mortar selection process, tests were carried out on structures in both the city and at Bezmyannaya in the chora. The tests were duplicated to evaluate the selected materials in both the coastal and inland environment.

A conservation mortar is a sacrificial application that protects the original material while preferentially deteriorating. Maintenance of the conservation mortar is an integral part of the conservation process. The aim of the testing was to produce a conservation mortar that would last for a reasonable amount of time, while requiring a minimal level of maintenance.

Testing on ancient structures was therefore justifiable, as none of the mortar compositions selected was strong enough to cause damage to the original material that would require mechanical removal. The reason for the testing was to evaluate which of the mortars was capable of maintaining its structural integrity without the need for repair for an acceptable period (approximately four years). Unsuitable mortars will fail before the time limit and will be replaced with the successful candidate without the original material being affected.

The selection of test areas was based on the relative rate of deterioration. While all of the excavated structures require treatment, most structures have been exposed for a prolonged period and have deteriorated to a relatively stable condition.

The newly excavated areas of the site are rapidly deteriorating due to the dramatic change of environment from being unearthed. These areas contain the most vulnerable structures and were therefore chosen as the test areas, as here the largest amount of archaeological material could be saved.

In the city, the area adjacent to the large Byzantine cistern, and in the chora, the structures at Bezmyannaya, were selected as test areas since they were newly excavated, vulnerable, and typical of the problems occurring (Fig. 3 & 4).

Within the selected areas, independent structures on a scale consistent with the available resources were identified and cleared of vegetation and wind-blown debris.

An order of treatment was designed to give the most time-effective method of application:

• Cleaning of structures
• Application of mortar to elevations
• Application of capping to truncated structures
• Cleaning of floor surfaces
• Partial reburying of floor surfaces

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Figure 4. Site of conservation tests at Bezmyannaya.
Cleaning of structures was achieved by mechanical removal of soil and plant material, followed by flushing of deep joints and voids with water and finally removal of dust with pressurized air.

A high level of cleaning is crucial to the success of the application, as good adhesion between the mortar and the substrate is vital to eliminate future ingress of water into the structure.

To increase the productivity of the conservation team and achieve a higher standard of work, it was decided that the cleaning process should be mechanized. To this end a large water tank, compressor, water pump, hose and airlines were obtained. With this equipment, the cleaning time for a one meter length of wall, by one person, fell from one day to less than one hour. The resultant level of cleaning was much improved, as using a water hose with an abundant water supply is a far more attractive proposition than carrying heavy buckets from a tap.

As far as was practically possible all soil was removed from between the stones that comprised the structures. Clay particles contained in the soil swell and contract depending on water content, and this movement will disrupt the bond between the mortar and the substrate. Once the bond is destroyed, water can penetrate the resultant crack. Here, the freeze-thaw cycle leads to pulverization of the mortar and substrate, resulting in the total loss of structural integrity.

After cleaning, structures were allowed to dry prior to the application of mortars. At this stage floor layers were not cleaned as the debris covering them acted as a protective layer while work on the elevations and wall tops was carried out.

Each test area was divided into four approximately-equal sections, one for each of the test mortars. These areas were then subdivided into equal halves, one of which would have basalt fibers added to the mortar and basalt netting beneath the capping layer, the other half receiving only mortar (Fig. 2 & 5).

Bulk mixing of the mortars was initially carried out by hand, but this proved overly time-consuming, resulting in frequent application of small batches of mortar. To achieve optimum productivity (and eliminate a labor-intensive operation), we obtained an electric cement mixer. With slight adaptation of the machine and a small increase in the amount of lime in the mix, a mortar far more consistent than the hand-mixed material was achieved in a fraction of the time by fewer people.

The mortar was systematically applied to small sections of the wall using pointing tools specifically designed for the task. The substrate was lightly wetted prior to application to assist adhesion while avoiding an increase in the water content of the mortar. The visible surface of the mortar was tooled smooth and the completed section immediately covered with wet burlap and plastic sheeting to reduce evaporation and increase the time available for carbonation of the lime matrix (Fig. 6).

The applied mortars were gradually allowed to dry over a three day period with frequent inspections, at which time any shrinkage cracks were retooled to produce a continuous surface.

When designing a conservation treatment such as that required at Chersonesos, functionality is not the only consideration. The most effective mortar application is one that fully fills the gap between stones and is finished to a smooth polished finish. Unfortunately the perfect finish results in an
aesthetic disaster. A wall treated in this fashion will bear more resemblance to a modern garden wall than an ancient structure that may have once been rendered, plastered or colored.

It is therefore necessary to sacrifice a degree of functionality to achieve an aesthetically acceptable result. When the conserved structure is viewed, it should appear to be untreated. The eye should be drawn to the original material and not to the modern addition. To achieve this objective two approaches can be taken: alteration of the applied surface and/or alteration of the color of the mortar.

Adaptation of a mortar color is a risky proposition. Moreover, there was a limited variety of raw materials available for coloring at Chersonesos so variation of the natural color of the mortar by selection of the ingredients was ruled out.

The only other alternatives are to add a color to the mortar surface or add pigments to the mortar mix. Neither of these options is advisable: Mortars will always suffer continual surface erosion, and if only the top few millimeters are pigmented, the subsurface material will start to become visible almost as soon as the application is complete. The treatment will very quickly look tired and require continuous and extensive maintenance.

The addition of pigments to a mortar mix is also fraught with problems. Continuity of proportion is practically impossible to maintain, and variation in rates of moisture evaporation at the initial cure can carry varying amounts of pigment to the surface, resulting in a patchy appearance.

The conservation team therefore decided that the mortar should remain its natural off-white color, but to avoid the “garden wall” effect the surface would be modified.

Initial tests in texturing the surface were unsatisfactory as an overly artificial effect was produced. It was therefore decided that the cured mortar surface should be distressed mechanically. The result was successful, both in terms of texture and the ability of the surface to retain dirt, which softened the color. How this will affect the long-term viability of the mortar will only become obvious in time (Fig. 7).

In some areas, missing masonry jeopardized the stability of the structures. Here it was necessary to add new stone. Where introduction of new material was required, the pointing mortar application was not textured, producing a visible demarcation between original and added material. Monitoring of this mortar variation will continue, as weathering of the mortar may erode this visual variation and could cause confusion later.

There was little variation in ease of application of the various mortars, the addition of basalt fibers having little effect. However, where fibers were either exposed on the worked surface or revealed during surface modification they did detract from the visual aesthetic. We discovered that these fibers could be removed easily by passing a flame across the surface.

Following completion of the mortar application on the elevations of the structures, capping of the walls was undertaken.

Capping is a difficult treatment to carry out successfully. The surviving ancient structures are incomplete entities, the truncated remains of walls that originally stood to a higher level, normally surmounted by roof timbers. At no time did the surviving material have a layer of mortar laid across the surviving upper surface.

Figure 6. Lime mortar being applied and finished to a City wall.
It is therefore necessary to reduce the visual impact of the capping as much as possible, while maintaining its function of physically securing the remaining material and shedding water down the elevations rather than pooling on the top surface or penetrating the internal structure.

To this end a layer of mortar was laid across the top surface of the structures to produce a continuous contoured layer that was shaped to shed water. The layer was designed to surround the tops of exposed stones rather than obscure them.

Distressing the surface of the capping mortar was not undertaken, first, to avoid the risk of the ingress of water into the mortar through the fractured surface and second, that by being a completely artificial addition to the ancient structure, the finish should be consistent with the modern structural additions rather than the textured pointing that replaces a lost ancient material.

Even though great care was taken to minimize the aesthetic impact of the capping, the result was still overwhelming with the exposed stones of the top surface appearing to float in a sea of mortar.

To break up the visual impact of the areas of smooth mortar, large aggregate of the same stone included in the mortar mix were added. Before the mortar cured, the exposed surfaces of the large aggregate were washed clean. The large aggregate greatly improved the texture and aesthetic of the capping and was adopted in all the test areas (Fig. 8).

Cleaning of the exposed aggregate was time consuming and tedious. It was obvious that cleaning could not realistically be adopted as part of the treatment; instead it was decided to leave the capping over the winter season to see if the aggregate would weather clean.

Once the mortar application to the structures was complete, protection of the ancient floor layers commenced. The debris layer was removed and geo-textile laid across the floors and up the walls to a height of approximately twenty centimeters. Where the contours of the floor were too pronounced for the geo-textile to cover, sand was placed in the depression to bring the level up to that of the floor. The geo-textile then was covered with pea gravel to a depth of approximately twenty-five centimeters.

In some areas the test sites abutted unexcavated archaeology, where the excavated structures continued into the exposed sections. In order to avoid erosion of the soil in these areas, it was decided that the sections should be stabilized.

Stabilization was achieved by digging a trench approximately fifty centimeters wide (parallel to the edge of the section), thirty centimeters deep, and thirty centimeters wide. Geo-textile was draped over the exposed soil section and anchored into the trench with large stones. More large stones were heaped against the section until it was completely buried and a natural slope achieved (Fig. 9).
The site conservation project of 2003 was a success by all measures. The required materials were all sourced locally. The raw materials produced workable mortars that could be prepared in bulk and were easily applied to the structures. The areas selected for treatment were completed within the time available and the finished result met our expectations.

The test areas were examined at the end of the year, all the mortars were still in place and biological colonization had been reduced to an acceptable level. The test areas will now be left exposed to the elements over the winter months to see how the materials stand up to freeze and thaw cycles (Fig.10).

The test areas will again be examined in the spring of 2004 and, based on the results obtained, a system of site conservation for the ancient structures can be designed.

Surveying and Monitoring of the Site
The aim of the site conservation tests is to find suitable materials that can be used at Chersonesos. Once the treatment is established it becomes necessary to establish the order in which structures on the site should be treated. Once the priorities of treatment are known, a long-term plan and strategy for conservation can be developed and implemented.

In establishing treatment priorities, the traditional approach involves an inspection of the site by qualified personnel who render their judgement on the steps needed to correct deterioration. While this approach ensures structures most in danger will receive treatment, it does not establish the important rate of deterioration. For this, a different approach is needed.

Without quantitative data it is not possible to understand the rate of deterioration of individual structures. A structure that has been exposed and unconserved for one hundred years will be suffering from a greater degree of deterioration than an unconserved structure exposed for only a few months. Yet the recently excavated structure will be deteriorating far faster than one exposed for a long period.

In order to retain the largest volume of information for the archaeological record, the recently excavated material must be given a higher priority for conservation, as a greater volume of information will be retained by its treatment.

The aim of the survey is to collect quantitative data regarding the level of deterioration of all structures on the site. By periodically surveying the level of deterioration, the variation in the data will reveal the rate at which the individual structures are deteriorating, irrespective of their current condition.

A survey such as this will gather a vast amount of raw data. It was the aim of the team in 2003 to determine a method of survey that is time efficient.
to a degree that the required volume of data can be collected and processed in a one month period by a relatively small team.

To this end, the GIS was utilized to produce a grid across the site and to design a check form which would allow each grid square to be assessed in approximately ten minutes.

To collate the data and render it easily accessible, manipulated and displayed, a database linked to the GIS was designed that would allow the results of the survey to be displayed as interactive computer-generated images. (Details of the GIS survey can be found on p. 33)

**Recording of Conservation Work**

Modern conservation practice requires that the exact condition of any structure be recorded prior to any treatment being carried out. The normal recording methods employed are written descriptions backed up by drawings and photographic records.

In a project the size of Chersonesos, the established recording methods are inappropriate as the time required to record the site would be so great and require such large resources that the time delay prior to the commencement of treatment would render the condition record out of date.

To deal with this problem the conservation team again turned to the GIS. The GIS will contain a geographically corrected base map over which the survey grid will be laid. The entire site is in the process of being surveyed into the GIS and this record will be utilized for conservation recording.

Digital images of both before and after conservation treatments can be linked to the GIS with their exact position and orientation recorded. The treatments undertaken can be linked to the exact location of their use and, if required, written notes can be added.

By digitizing the conservation recording, the process can be undertaken at rates that will not impede the actual conservation process. In the tests of the procedure, the areas chosen for the conservation trials were fully recorded (both pre- and post-treatment) by the GIS team in a matter of minutes (Fig. 11).

Recalling conservation records in the GIS is a simple matter of clicking an icon on the base map to bring up all images, drawings, and records.

**Structural Survey**

Deterioration in some of the larger structures on the site is causing problems of instability on a scale that is outside the realm of conservation (Fig. 12). These structures were therefore examined by a member of the conservation team who is a qualified structural engineer. Recommendations were made as to how the structural problems should be addressed and a monitoring program initiated in order to quantify the speed at which structural integrity is being lost. The results of the monitoring over a one year period will allow for a plan of structural intervention to be designed and implemented. (Details of the structural survey can be found on p. 25)

**Additional Projects**

During the 2003 season, the conservation team undertook numerous tours of the site to familiarize themselves with the scale and complexity of the project. While the aim of the project was to establish a survey method and undertake test applications of materials, it was obvious that some structures were in such a critical state of deterioration that if immediate action was not taken, little of these structures would remain to survey. It was therefore decided that two emergency conservation treatments should be initiated without delay: first, at the site of a Byzantine Cistern in the grounds of the Cathedral, and second on the “Church mosaic” displayed in the garden of the museum.

**Conservation of the Byzantine Cistern**

The Byzantine cistern is approximately four meters square in plan by approximately six meters deep. The cistern is cut into the bedrock and in some places built up with tile to produce a level top surface. The entire inner surface was lined...
with plaster that remained almost intact until excavation. Originally topped by a vaulted roof (collapsed in antiquity) supported on two columns (still in situ) the cistern was first used for water storage, then as a prison and finally as a trash pit (Fig. 13).

In the intervening period between excavation, in fall 2002, and inspection by the conservation team, in June 2004, the cistern had suffered massive loss of plaster from the walls due to the ingress of ground water between the plaster and the stone substrate.

Total loss could be measured in meters squared and further large areas were detached and in imminent danger of collapse.

The loss of plaster had commenced at ground level and was continuing down the walls in the classic pattern of detachment. At the time of examination the progress of loss was beginning to threaten ancient graffiti scratched into the wall by the unfortunate inmates when the cistern was used as a prison. Without intervention, this unique historical evidence would be lost, so the team decided to begin conservation immediately.

Options for the conservation of the cistern—ranging from the erection of a protective cover and environmental control to reburial—were discussed and evaluated with the Preserve staff, but in the end the original use, location and dimensions of the structure dictated the conservation approach adopted.

The structure was originally designed to accumulate water and, due to its position in the topography, this was still the case. To stop the ingress of water from the surface or through the surrounding rock, complicated drainage equipment would need to be installed.

Even if the ingress of water could be stopped, a cover would need to be erected to shed rain water. The cover would result in the creation of a micro-climate within the structure that would lead to an increase in biological colonization which would in turn damage the structure. It would therefore become necessary to control the environment within the structure.

The cistern is six meters deep and all the graffiti is located in the lower two meters of the structure. To allow this material to be viewed, permanent access to the floor of the cistern would be needed.

Given the resources available at the site and the time available, any ideas of permanent display were soon dismissed and the option of reburial became the only realistic option.
Before reburial could be undertaken, it was necessary for the vulnerable plaster to be stabilized so the reburial process and eventual re-excavation would in itself not cause further damage.

When undertaking reburial one is trying to recreate the conditions that existed prior to the original excavation. It is ill-advised to carry out treatments that would dramatically alter any of the parameters of that environment, such as permeability and soil density.

The following conservation treatment was therefore designed and implemented:

• Clearing of debris from the bottom of the cistern.
• Lifting and removal of detached plaster fragments from the floor of the cistern.
• Covering of floor with layer of soft sand.
• Examination and recording of lower meter of plaster to establish areas of detachment from substrate.
• Drilling of small holes through areas of detached plaster into substrate, utilizing small areas of surface loss so as not to damage original surface (Fig. 14).
• Fixing of stainless steel anchors between plaster and substrate using epoxy resin (Fig. 15).
• Introduction of lightweight lime-based mortar into voids.

One the lowest layers of plaster was recorded and treated, and the detached plaster fragments previously removed from the floor were wrapped in geo-textile and placed in groups approximating their original positions (Fig. 16).

Rolls of geo-textile were placed adjacent to the walls and a layer of soft clean sand placed between the plaster and the geo-textile. Spoil from the excavation was then replaced in the centre of the cistern, the geo-textile rolled further up the wall and more sand placed between the plaster and the wall and again more spoil replaced into the centre of the cistern. This process was then repeated until the conserved layer of plaster was buried and a new working platform created.

One meter layers of plaster were then treated and the reburial repeated until the level of the fill reached the original ground layer (Fig. 17).

Further spoil was then added to produce a dome above the structure both to compensate for future settlement of the fill and to act as a watershed.

The conservation treatment applied to the cistern was a response to an emergency situation using the materials and resources at hand. Hopefully the plaster and unique graffiti is now protected. Ideally the treatment would have been tested and its potential impact assessed in greater detail. The cistern project clearly demonstrates the need for conservation and excavation to be closely associated, so that discoveries can be preserved in as close to the excavated condition as possible as soon as the excavation finishes.

Conservation of the “Church Mosaic”

The second, additional project was the conservation of this mosaic on the museum grounds.

The mosaic had been lifted in sections from a basilica outside the city, backed with concrete and placed on a raised earthen plinth, under trees in the museum garden.

One of the lowest layers of plaster was recorded and treated, and the detached plaster fragments previously removed from the floor were wrapped in geo-textile and placed in groups approximating their original positions (Fig. 16).

Figure 14. Holes through damaged plaster were drilled for attachment of stabilizing pins.

Figure 15. Stainless steel anchor pins are inserted into drilled holes.
The backing was inappropriate for an exterior environment and method of display, and was actively deteriorating. Failure of the backing was leading to loss of the original material and the method of display was allowing contamination by soluble salts.

We decided to take immediate action. To this end, the condition of the mosaic was recorded and plans were made to protect the surface over the winter.

Removal of the mosaic to storage was not possible, for without prior stabilization the action of moving could cause serious loss of original material. We therefore decided that cleaning tests should be undertaken and possible facing materials located.

In 2004 the condition of the mosaic will again be assessed and compared to the previous year in order to determine the rate of decay. Facing materials will be applied and the panels stabilized so that removal to safe storage can be accomplished.

Once the mosaic is safe, more appropriate backing methods for the panels will be researched, along with the possibility of a more suitable display context. (Further information on the survey and cleaning of the mosaic can be found on p. 31)

Conservation of the Hellenistic Stelai
The large collection of Hellenistic stelai now assembled in the museum at Chersonesos have been recovered from the site over the last century. Most had been reused as building material in antiquity, resulting in fragmentation and varying levels of surface deterioration, depending on their orientation and position in the structures.

After recovery, the well-preserved polychrome stelai were stored within the museum buildings. The remainder, fragmented and unpainted, were used to decorate the museum gardens, where they either remained exposed or became re-buried.

The variation in use, reuse and exposure to the elements in antiquity and the subsequent variation in storage context since recovery have lead to extreme variations in the level of preservation of the original surfaces.

The stelai that became reburied are heavily contaminated with soil and biological contamination. Those that remained above ground are covered with a thick layer of biological growth (lichens and mosses). The contamination renders the surfaces unreadable and is causing ongoing deterioration of the relatively porous stone surface.

Figure 16. Detached plaster fragments were wrapped in geo-textile at base of cistern.

Figure 17. The cistern being backfilled. Note the protective geo-textile around the walls.
In the 2003 season discussions took place regarding the feasibility of cleaning and reconstruction of the stelai. It was decided to undertake tests exploring the feasibility of a conservation project. Cleaning tests showed that even the most contaminated surfaces could be cleaned to a level that would allow reconstruction of the stelai. On the basis of these tests a treatment was designed and the project will commence in the 2004 season (Fig. 18).

The aim of the proposed treatment is:
- to remove the contamination from the original worked surfaces while retaining and identifying any traces of original decoration.
- to clean the fragments to a level that will give a continuity of aesthetic to reconstructed stelai.
- to determine the correct assemblage and orientation of fragments within original artifacts and subsequently reconstruct the objects so that they can be given a correct typology and are available for academic study.

Assessment of the Condition of the Museum Collection, Both on Display and in Storage

During the season of 2003 the conservation team had a great deal of contact with the conservators staff at the Preserve. The Preserve conservators voiced their concerns regarding the standard of storage and the lack of conservation resources at their disposal. The conservation team were shown the storage facilities which were indeed well below the standard required for such an important and extensive collection.

There are currently about 200,000 objects in storage and, in the view of the conservation team, none could safely be described as secure. This unique resource is in jeopardy due to the dilapidated condition of the buildings, shelving, and packaging of the objects (Fig. 19).

Updating the objects storage facilities of the Preserve is a massive undertaking, but one that is well worth the effort. Unlike most museums world-wide, the collection at Chersonesos is fully accessible. The accession record is complete and the Preserve staff can locate all of the objects.

A project on the scale required is extremely complex and must be well thought out if time and resources are not to be wasted. It is the aim of the conservation team in 2004 to have a team of experts in collections-care from the Museum of London visit the Museum and undertake a condition survey of the stores. From this survey a strategy will be developed by which the stores can be updated, the objects repackaged, and the collection systematically brought up to a standard where its future is secure.

Conservation Resources at the Site

Along with the dire condition of the storage facilities at the site, the Preserve conservators noted the lack of conservation equipment and materials at their disposal. The lack of resources...
seriously hinders the choice of treatment available to them, resulting in compromises of treatment selections.

The Preserve conservators have a vast amount of material to process each year and this is added to by the ICA-Preserve excavations. It is therefore the intention, in 2004, to bring conservators and equipment to process and treat the finds from the ICA-Preserve excavations to a recognized international standard.

Having both western and eastern-trained conservators working at the site will be highly beneficial, as both schools of conservation have developed differing techniques and treatments. The exchange of knowledge will be of great value to all involved.

Conclusion
2003 was a productive year with results that exceeded the expectations of the conservation team.

The scale of the conservation project required at Chersonesos is immense, and in the 2003 season its real parameters became apparent. During the season, methods of survey, recording, treatment, and planning were not only discussed and proposed, but tested and implemented to a degree that a long-term conservation plan for the Preserve can be drawn up and initiated by the beginning of 2005.

The success of the 2003 season is wholly due to the individuals involved: the volunteers, both Ukrainian and international, who, with no previous experience, laboured relentlessly in less than comfortable conditions to produce superb results; the staff of the Preserve, who, with no knowledge of our capabilities, supported our effort and made the project possible and achievable through their notable levels of cooperation, trust and support; Professor Joseph Carter and the ICA team who allowed us the opportunity to work on the project and helped us surmount logistic, linguistic, and cultural problems; and, not least, The Packard Humanities Institute whose funding made the project possible.
The conservation survey system currently being developed as a tool to establish the overall condition of the excavated structures at the city site is based on data collected by conservators. The conservators assess the structures from the perspective of the level of intervention required to maintain the material fabric at its current level of preservation.

The structural stability of the large monuments, in particular the defensive walls, is of paramount importance, but the assessment of this is beyond the expertise of the conservation team. So alongside the formally structured conservation survey it was decided that a more traditional-style structural survey should be undertaken by a specialist in the field on what is a relatively small number of large structures.

To this end Semih Ercan, a structural engineer qualified in architectural conservation, undertook a structural survey of the site and identified problems (mainly in the eastern defensive walls) that are outside the normal scope of conservation.

Recommendations for both the short and long-term remedy of these problems were made. The short-term recommendations aim to monitor and make the structures safe, while the long-term recommendations aim to provide a permanent solution to the underlying problems.

The recommendations made as a result of the structural survey are specific to structural stability and so do not address problems that would be highlighted by the conservation survey (degraded mortar applications, wall capping, etc.).

It is proposed that the structural survey be repeated each year in order both to monitor the success of any interventions and to detect any emerging problems before they become critical.

The structural survey will run parallel to the conservation survey and monitoring program. All details of problems and treatments carried out as a result of the structural survey will be added to the GIS in order to produce a record of interventions instigated and to gauge the effectiveness of specific treatment choices.

Survey Results and Proposed Intervention

As a result of the survey, the following structures were identified as suffering from deterioration that could potentially lead to structural failure. Each problem was discussed and long and short-term solutions proposed. A summary follows.

The Greek Gate

Problem

Corrosion and fatigue of iron I-beams (Fig 2).

[Short-term solution]

Center points of the bottom section of each of the five I-beams should be monitored to see if the downward deflection of the beams is continuing.

[Long-term solution]

Replacement of the I-beams with beams manufactured from non-corrosive material. In order for this to be accomplished, it will be necessary to dismantle the entire top of the structure, including the Byzantine arch. When this is undertaken, new stone blocks should be installed as roofing material directly above the I-beams.

Figure 1. The increase in volume of the iron I-beams due to corrosion has generated phenomenal pressure, resulting in failure of the stone blocks.
Large cracks have occurred on the inner walls of the gate due to excessive point loading, resulting in detachment of some sections.

[Short-term solution]
The detached fragments should be monitored to see if movement is continuing.

[Long-term solution]
The cracks should be pinned using corrosion-free dowels in order to reconnect the detached fragments. Glass or carbon-fiber rods embedded in epoxy grout would be suitable for this purpose.

The ashlar block supporting the last I-beam on the west side of the gate is seriously cracked as a result of the loading of the beam. It is very likely that the crack will lead to failure of the block, which in turn may lead to a partial collapse of the gate (Fig. 1).

[Short-term solution]
A temporary wooden or iron support should be placed below the west end of the I-beam to alleviate the problem.

[Long-term solution]
The crack should be consolidated by pinning, using corrosion-free rods embedded in epoxy grout.

Some of the blocks and fragments of stones above the I-beams are unstable and could fall, resulting in injury. One ashlar block is particularly unstable and could fall if measures are not taken to stabilize the area.

The unstable blocks should be stabilized by using wood or stone wedges set in mortar.

Byzantine Arch

Excessive material loss of the walls supporting both sides of the arch may cause partial collapse (Fig. 2).

The gaps on the supporting walls should be filled with stone and mortar in order to restore structural continuity.

The lack of contact between the arch blocks as a result of erosion of the stone and mortar may lead to a partial collapse of the arch.

The joints between the arch blocks should be deep filled with new mortar in order to obtain a better load transfer within the structure of the arch.

The rubble walls on either side of the arch are in a weakened state, which will lead to loss of material.

Rubble walls should be consolidated with new mortar pointing and capping.

Curtain Wall 16

Four of the blocks at the top of the ashlar wall just before tomb 1013 are about to collapse due to the loss of the blocks below (Fig. 3).

[Short-term solution]
Wooden supports should be placed below these blocks in order to secure them in place.

[Long-term solution]
The blocks should be supported by a mortared rubble mix faced with stone veneer, textured to match the original material.

Along the entire length of wall 16, the exposed rubble core is in danger of collapse due to the loss of the ashlar facing blocks. The rubble wall behind...
Tombs 1013 and 1014 is in a critical state. If nothing is done, large areas of this rubble wall will soon collapse.

New rows of ashlar blocks (2–4 rows) should be added to secure the rubble core. The gap between the rubble wall and the new blocks should be filled with mortar and the remaining visible parts of the rubble wall should be re-pointed.

The second lintel in the opening of Tomb 1014 is unstable due to stone erosion on the left-hand support.

The left support of the lintel has to be strengthened by filling the missing areas with a stone and mortar mix.

On the north side of the wall, there are several gaps in the lowest row that are creating weakness in the structure.

The gaps should be filled with a mortar and rubble mix to re-establish stability.

Proteichisma 16

The collapse at the outer face of the rubble wall has weakened the structure of the wall and further collapse is likely (Fig. 4).

The collapsed area should be rebuilt.

The lower half towards the end of the rubble wall is in a bad state due to loss of mortar and collapse of the outer section.

The collapsed part of the rubble wall should be rebuilt. Re-pointing the joints with new mortar will consolidate the rest of the wall.

Figure 4. Loss of supporting material has left the top layer of blocks in a precarious condition. Unless stabilized, further blocks will fall.

Tower XV

The rubble wall at the top of the tower is likely to collapse due to loss of cohesion (Fig. 5).

Re-point the rubble wall.

The iron beams erected on both sides of the tower to tie the walls together have failed due to corrosion and loose material.

Figure 5. Proteichisma 16: if not treated, the collapse will continue and accelerate.

Figure 6. The exposed core of Tower XV is unstable and could collapse.
Figure 8. Subsidence has lead to severe vertical cracking, resulting in loss of original material.

The iron beams on both sides of the tower now serve no function and can be removed to avoid further corrosion damage to the walls.

Four iron beams, used as lintels in the window opening on the north side of the tower, have weakened due to corrosion thereby reducing their carrying capacity.

As removal is not practical, it is better to fill the window opening with a rubble mortar mix leaving the beams in situ. The fill should be faced with thin veneer blocks, textured to match the original material.

Curtain Wall 17

The large hole in the rubble wall has created a dangerous structure. Although the area appears stable, the loss of material will continue until the top section collapses (Fig 8).

It is better to fill this hole with a new rubble wall that will stabilize the area and avoid further loss.

Proteichisma 17

As a result of a partial collapse of the outer side, the beginning of the wall is in bad condition.

A thin rubble wall should be built to secure the large rough blocks that are currently unsupported.

Curtain Wall 18

A small part of the wall, on the northwestern side, is in danger due to a gap between the rough blocks.

The gap should be filled with rubble mortar mix to stabilize the area.

Curtain Wall 19

It is obvious that the beginning of the wall has sunk due to differential settlements. (Fig 9)

[Short-term solution]

Sections of the wall should be monitored to check if settlement is continuing.

[Long-term solution]

A channel should be cut at the base of the wall and lined with clay to drain the water away from the wall and out through the arched gate.

An area at the end of the wall (where stelai blocks have been reused as fill) is in danger of collapse due to the loss of the outer ashlars blocks.

It is not possible to remove the stelai blocks unless the upper part of the wall is dismantled.

To secure the area, the gaps in this section should be filled with a rubble mortar mix and then faced with a thin veneer of new carved ashlars blocks.

The two rows of rough blocks used along the length of the wall have created a weakness due to the lack of cohesion between the original and new material.

Fill the cavities with new mortar.

At the point halfway along the wall where the style of the masonry changes, the lower part of the wall that supports the ashlars blocks is in a weakened state as a result of mortar loss.

Re-pointing with mortar will consolidate the lower part of the wall.

Halfway along the northeastern side of the wall, there is a critical area where gaps have resulted from excessive stone deterioration.
The gaps should be filled with a rubble mortar mix to stabilize the area.

On the northeastern side of the wall, near the arched gate, the rubble wall is unstable due to excessive material loss.

The area should be stabilized by filling the gaps with a rubble mortar mix and re-pointing the joints.

**Proteichisma 19**

The lower part of the wall, from the beginning to the halfway point where it turns a corner, is in bad condition due to loss of mortar between the rubble blocks.

All the joints should be re-pointed.

Halfway along the wall’s length is a tomb opening where two iron beams, supported on concrete columns at the center and both ends, have been used as lintels. This area is in bad condition due to deterioration of the concrete and corrosion of the iron.

It would be preferable to fill the opening with a rubble and mortar mix and to hide the beams and concrete behind a curtain wall of new veneer blocks textured to match the original material.

**Tower XVII (Tower of Zeno)**

A corner of the tower is in bad condition as a result of excessive erosion of the blocks in the lower courses. (Fig. 9)

The gaps should be filled by rubble mortar mix to stabilize the area.

At the end of the tower, the aslar wall is weakening due to loss of mortar between the blocks.

Figure 9. The Tower of Zeno has multiple problems, including eroded support blocks and unstable adjoining walls.

Figure 10. The remaining rubble core of the eastern wall is not suffering from any structural problems from previous intervention or inappropriate restoration, but will continue eroding if not stabilized
Re-pointing of the ashlar blocks with new mortar will better distribute the load of the material above.

At the end of the tower, the last section of rubble wall, currently supported by an iron beam, is unstable due to partial collapse of the material below. Partially dismantle the overhanging rubble wall so the corroded iron beam can be safely removed. The remaining rubble wall should be pointed with a new mortar to stabilize the area.

**Curtain Wall 20**

The exposed rubble core, above the ashlar courses, in the first section of the wall is unstable as a result of material loss in the lower wall. The collapsed part of the rubble wall should be re-built to stabilize the area and the remaining area re-pointed with new mortar.

The rubble wall below the ashlar is in an unstable state, which has led to the ashlar blocks above being deflected outwards.

The rubble wall should be consolidated by re-pointing with new mortar.

**Proteichisma 20**

A small area of the wall not previously pointed is in a weakened state.

The pointing should be completed.

**Eastern Defensive Wall**

The eastern wall has been left very much to its own resources with no interventions or restoration on the scale seen at the western defense walls. As a result, serious problems are much less evident. This is not to say that the wall is stable, as very little of the original ashlar outer surface still exists and the remaining exposed core will continue to erode. No specific measures need to be undertaken beyond mortar application to stabilize the remaining rubble core. (Fig. 10)

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**Conclusion**

There are a large number of structural problems occurring across the site, for the most part the result of inappropriate earlier conservation or restoration interventions. The most obvious have been picked up in the structural survey, and more will become evident as the structural and conservation surveys are repeated and the data compared.

The resolution of these problems will require complicated and expensive solutions. To be successful, the root causes of the problems must be fully understood.

Short-term solutions have been proposed and will be instigated to give breathing space which will allow a monitoring program to be established. This monitoring will generate the data required to fully understand the elements of deterioration acting on the structures.

With this understanding, it will be possible to design treatments that, unlike previous interventions, will produce long-term solutions.
The mosaic originally came from a small, cross-shaped church outside the city walls of Chersonesos, built in the late 4th century AD. A memorial was erected above the remains of this basilica sometime between the 5th and 6th centuries. This later building had the typical cruciform plan, with no eastern apse, and an entrance at the terminus of each of the four cross arms. It was a centrally planned church with the altar located precisely in the middle. In the second quarter of the 6th century, the church was remodeled to a more conventional plan with a synthronon, an altar, and a diakonikon or sacristy added. This church became known as the burial place of Pope Martin I, who died in exile in Chersonesos in AD 655 and whose sepulchre was a center of pilgrimage.

The mosaic floor was the main adornment of the church, which was also decorated with multicolored fresco paintings and polychrome glass mosaic.

The floor is in the form of a cross, with west, north and south arms radiating from a central panel. The decoration on the north arm is composed of geometric patterns with various repeating motifs. In the west arm is a series of medallions featuring birds, fish, fruits, flowering branches and other natural elements. The medallions continue in the central panel which surround a central rectangular motif with a kantharos and peacocks. The southern arm loosely repeats this motif, but within a circular boarder. (See front cover.)

The mosaic is made of white Prokonnesian marble, marmorized limestone, black sand stone, yellow Sarmatian limestone, and smalt. In addition to the original material, later repairs, composed of monochrome tesserae, are evident. In 1953, the mosaic floor was divided into panels, lifted, backed with reinforced concrete and transferred to the courtyard of the Museum.

**Condition of the Mosaic**

The first and most evident problem the mosaic faces is vegetative colonization and moss growth both between the constituent panels of the mosaic and across the upper tesselated layer, composed of both the tesserae and mortar filling of the interstices between them. Botanical colonization has resulted from high humidity and litter of decomposed leaves from the vegetation around and above the mosaic. Colonization eventually leads to the tesserae surfaces becoming completely obscured or blackened and results in erosion of the tesserae surfaces through root penetration. All areas of original tesserae are covered with vegetation and moss, while areas of contemporary repair are less affected by this problem.

*Figure 1. Chris Cleere at the mosaic on the museum grounds, prior to the beginning of restoration measures, July 2003.*
A second related problem is the result of the deterioration of the modern iron-reinforced concrete backing which is actively widening cracks within the mosaic structure and causing the loss of the tessellatum layer. The iron reinforcing bars have expanded as a result of corrosion and have inevitably fractured the concrete structure along with the tessellatum layer. Cracks are currently evident across the entire mosaic floor.

Differential settling resulting in the further loss of the mosaic’s tesserae is also occurring within the structure, due both to the deterioration of the concrete backing and to the settling and erosion of the substructure underneath the mosaic.

Unsupervised visitors to the Museum grounds often walk on the mosaic, causing physical stress to the support structure, surface abrasion, and dislocation and loss of the tesserae.

Method of Recording
In order to undertake a survey based on repeatable quantitative data (and as part of the ICA conservation team’s strategy to integrate all aspects of conservation recording into the GIS), points across the mosaic and digital photographs were geo-referenced onto the base map. Areas of deterioration were manually recorded onto an enlarged image of the mosaic and the data added to the GIS. A query of the GIS surface area percentages presented the following statistics:

- 47% of the mosaic is affected by moss growth;
- 23% of the mosaic consists of previous restoration efforts;
- 20% of the mosaic is unaffected by any form of active deterioration;
- 10% represents a combination of small values including settling, guano, loose tesserae, loss of tessellatum layer and the differential setting.

Proposed Treatment
In 2004 the mosaic is to undergo remedial stabilization prior to being lifted and transported to storage. Once in a stable environment, conservation and re-backing is to be carried out prior to exhibition in a more appropriate location on the Museum grounds.

Before remedial conservation work can be undertaken, non-destructive cleaning and facing methods need to be developed. The tessellatum layer needs to be cleaned of dirt and vegetation prior to the adhesion of a facing material to avoid the permanent attachment of contaminants to the original material. Due to the time constraints of the limited site visit in 2003, it was only possible to undertake one type of cleaning test.

Cleaning Test
A Plyno GV6 Conservation Steam cleaner was used to clean a small area of the mosaic floor. It was soon discovered that water condensing from the cleaner obscured the surface being worked on and cleaning had to be undertaken in a systematic pattern to avoid a varied result. White and yellow tesserae showed a distinct improvement after cleaning, while it was difficult to observe any improvement in the black and red tesserae. This was further evidence of the need for a systematic approach to achieve a consistent level of cleaning.

Moss and penetrated dirt were not easily removed; therefore each area to be treated was repeatedly cleaned until contamination was removed. As the cleaner produces steam under pressure, care was taken during the cleaning process to avoid delamination of the top surface of the tesserae. The top surfaces of the white tesserae in the areas of old repairs and the yellow tesserae of the original areas are fragile and would be easily detached if the cleaning process was too rigorously employed, hence the need for multiple, less aggressive passes of the cleaner.

Conservation Plan for 2004 Season
The condition of the Church mosaic is to be recorded again in 2004 using GIS/Spatial analysis in order to compare any changes in condition within the intervening period. Facing tests on the mosaic surface will also be undertaken in order ascertain the level of intervention required to lift the mosaic panels without exposing the tessellatum layer to further damages.
The Chersonesos Geographic Information System (GIS) continues to evolve as the scope of ICA’s activity broadens. As the geographical and chronological focus of ICA’s research aims has expanded—since 2001—to include sites within the ancient city, and as site conservation and management have become a major part of our work in both city and chora, the GIS has become a key organizational tool, bringing together a multitude of different projects underway at Chersonesos. In 2003, the GIS was considerably expanded both geographically, to include the city center, and in terms of application, as a tool for the protection and long-term management of the site.

Although over a third of the ancient city at Chersonesos has been excavated during the site’s long history of archaeological activity, no single map base exists within which to integrate this work. The most up-to-date general plan of the ancient city center, in fact, was created in 1958. Massive amounts of excavation and a considerable amount of modern building works (most significantly the restoration of the church of St. Volodimyr and related infrastructure) have been carried out since then, but the general map of the site has not been updated. This has already proven a major obstacle for archaeologists trying to understand the development of the ancient city as an integrated whole. Likewise, if a sensible plan for site conservation and management is to be carried out, a map of the entire 45 hectare extent of the site—including current excavations, conservation work completed to date, and standing modern architecture—is of the highest priority. Moreover, if a long-term approach is to be used in the management and research agendas at Chersonesos, the site plan must be easily and frequently updated.

A GIS is especially well-suited to solving this type of data management crisis, and also has great potential as a powerful analytical tool. One of the major advantages to using a GIS as opposed to working with flat paper or even scanned (raster) images, is that each point, line, and polygon on the map can contain essentially unlimited amounts of attribute information (structure types, dates, excavators, etc.) or links to other types of digital data (such as photographs or written reports). Various vector layers can then be turned on or off according to these attributes (to show, for example, just the ancient structures on site), or can be queried to answer more complex questions (to highlight, for example, all ancient structures excavated since 1999 that have not been conserved).

This application of GIS for the conservation and management of Chersonesos shows exciting potential not just for managing the large amount of data related to the site, but also for answering the question of why particular areas of the site may be suffering more than others.

Our objective in 2003 was to expand the GIS to include the city center, to assess its potential to facilitate the conservation and management plans underway, and to consider its long-term viability as a research and management tool for the Preserve and its collaborators. To that end, a team of eight students and professionals was assembled during the summer season to begin the task of updating the general site plan and mapping base for the city, to assess the needs of potential users, to develop methods for conservation...
recording and monitoring, and to begin the training of museum staff in these methods and use of the GIS software. (Fig. 1)

Base Map Creation
Fundamental to a GIS is a mapping base that provides the framework within which all spatial data can be integrated into a single, consistent coordinate system. This is a serious challenge at Chersonesos because of the site’s strategic military position (near the Russian and Ukrainian naval bases of Sevastopol). For this reason, accurate large scale maps of the region are unavailable for civilians, as is the use of global positioning systems (GPS) equipment. Without access to geographic coordinates from maps or GPS, this control must be provided by (relatively time consuming) terrestrial survey in the field. Thus, the majority of the GIS team’s labor in 2003 was devoted to obtaining quality geometric control and the creation of a digital base map based on a local arbitrary coordinate system.

A network of permanent and semi-permanent benchmarks was established throughout the site and surveyed relative to each other using two total stations. These benchmarks can be used in future seasons as reference points for localized survey so that on-going excavations, conservation, and modern building works can be easily tied into the base map and incorporated into the GIS. In the future (assuming security concerns become relaxed enough to allow the use of GPS equipment at the site), we will be able to collect real-world positions for the benchmarks and easily transform all the digital spatial data to a global coordinate system.

The use of existing maps in the Preserve archives helped speed the creation of the base map considerably. One map in particular, created in 1958 at a scale of 1:500, was especially useful (Figure 2). Extensive ground control checks in the field confirmed its accuracy and quality, but, because of the map’s early date, many gaps must be filled in before it is completely updated. Scanning this enormous map (which, when completely unfolded, was too large to fit inside our workspace) was a time-consuming challenge, but saved weeks of fieldwork. Once scanned, the individual pieces were georeferenced via tie points established during the control survey, mosaicked together, and then digitized into vector layers (Fig. 3). We had hoped to use other more recent archival plans from excavation reports to fill in the remaining gaps, but due to the varying scales and quality of the available plans, we eventually decided that this would be accomplished more efficiently and accurately by total station survey.

Priority areas to be mapped in 2003 were chosen based on the conservation team’s program of work for the season. The areas to be conserved during June and July were mapped in detail before conservation began. In addition, a large portion (approximately six ancient city blocks) of the site was surveyed. It will likely take two more seasons
of dedicated survey to complete the base map for the entire area of the ancient city (Fig. 4).

Assessment of User Needs
In order to benefit the largest number of people conducting research and managing the site, one of our principal concerns from the outset of this project was to assess the needs of potential users and to develop the GIS in close consultation with them. On-going discussions with the joint ICA-NPTC team and periodic presentations of our results throughout the season proved invaluable to that end and helped highlight a number of important issues that would not have otherwise occurred to us.

Discussions with Larissa Sedikova and Stanislav Ryzhov were especially enlightening in relation to the fundamental requirements of the system from an archaeological and conservation perspective. They not only helped to highlight priority areas of the site for mapping and recording, but they also provided extremely useful feedback on the short- and long-term potential of the system to be maintained and used by the Preserve. Input from Nonna Krasovskaya, Head Archivist at the Preserve, was also enormously helpful. In addition to constantly tracking down existing archival maps and plans for us, she provided important insight into reconstructing the history of excavations at Chersonesos and the possibilities of incorporating that history into the GIS.

A priority for the 2003 season was to support the conservation and site management efforts already underway, so we worked closely with the conservation team to develop a system that could be of immediate use to them in the field, as well as useful for long-term monitoring of the site. Thanks to their input, we were able to make informed and fundamental decisions about how to structure the spatial database, what type of information to include in it, and to develop a set of recording methods that would meet their needs while remaining efficient enough not to hinder their progress.

Recording Methods and the Conservation Survey
In close consultation with the conservation team and Preserve staff, we developed a three-tiered system: 1) to record the process of conservation in the field; 2) to assess the general conditions of the site; and 3) to establish long-term monitoring of the site's conditions. Because of the extensive size of the ancient city and the vast areas of standing architecture to be assessed and conserved, our primary concerns were that the system be assessed and conserved, our primary concerns were that the system be assessed and conserved, our primary concerns were that the system be assessed and conserved, our primary concerns were that the system be assessed and conserved, our primary concerns were that the system be assessed and conserved, our primary concerns were that the system be assessed and conserved, our primary concerns were that the system be assessed and conserved, our primary concerns were that the system be assessed and conserved, our primary concerns were that the system be assessed and conserved, our primary concerns were that the system be assessed and conserved, our primary concerns were that the system be assessed and conserved, our primary concerns were that the system be assessed and conserved, our primary concerns were that the system be 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In order to record the conservation process, a system was developed for linking digital photographs of each structure before and after conservation with the corresponding walls as mapped within the GIS. A mapping convention was established for representing each wall by a set of three lines—one for each face and one for capping—with the associated photograph linked to the corresponding feature on the map (Fig. 5). This allows the user a quick visual reference for the treatments undertaken. By clicking on individual wall faces on the digital map, photographs of their state pre- and post-conservation can be viewed on screen. As this information can be rapidly collected in the field, the conservators are able to examine pre-conservation photographs to ensure that any material removed during the conservation process is replaced in exactly the same position.

During the 2004 season, a database will also be developed for conservation treatment types that can be linked to the GIS, allowing spatially-based queries of specific treatment types and their long term success. This may help shed light on some of the underlying causes of deterioration and the appropriate treatments for specific areas of the site.

To support the conservation team’s goal to objectively assess and prioritize areas of the site for future conservation, a system of surveying and monitoring the general conditions of the site was designed and tested. An arbitrary 10x10 meter grid was established over the site, to which information relating to the general condition of structures within each square will be linked. A method of scoring was developed according to a number of criteria relating to the condition of individual structures within these 10 meter squares. The results will be recorded on score cards, and then entered into the GIS (Fig. 6). Spatially-based queries can thus be made of areas

Figure 4. Overview of the base map completed to date. Areas mapped in the field using the total station are indicated by grey areas and arrows; the remainder was digitized from the 1958 archival map.
that are in highest need of conservation, enabling an efficient and relatively objective method of prioritizing conservation efforts. In addition, effects of spatially-dependent factors such as wind abrasion, salt damage, and high concentrations of visitors can be assessed, and appropriate treatments devised. The initial site-wide survey will be completed in 2004 and will be repeated annually. A more generalized set of criteria was developed for weekly walk-over surveys intended as a means of monitoring the site for high risk areas in need of immediate attention.

**Training**

In addition to a number of seminar-style presentations for the Preserve and ICA staff, on-going discussions indicated a great deal of interest among the Preserve staff in learning and adopting the recording methods and in using the GIS as a tool for facilitating work at NPTC. Viktor Samoilenko, a member of the permanent NPTC staff, was trained in the use of the total station and GIS software (Fig. 7). Since the end of the 2003 season, he has continued working throughout the year, collecting and scanning archival plans along with the Megarika team, and has continued taking pre- and post-conservation digital photographs in areas being conserved, integrating them into the GIS. It is hoped that he will continue working with us in 2004, and that he can pass on the skills that he has learned to other NPTC staff.

**Conclusions**

Thanks to the professionalism and enthusiasm of the survey and GIS team, 2003 was an highly productive season. While much work remains to be done before the base map of the city is complete, the framework is now in place to do so with relative ease. Judging by the experiences and the time scales observed during the 2003 season, we expect that the majority of the northern, eastern, and western areas of the site will be completed in 2004, leaving only the area of the port region to be completed during the 2005 season. Likewise, because of the hard work that went into refining recording methods and mapping conventions, the framework is in now place to carry out the recording efficiently and objectively. Thanks in large part to the input and collaboration of the Preserve staff, the GIS appears to be robust and flexible enough to meet the needs of multiple users as well as streamlined and user-friendly enough to be easily maintained by the Preserve for long-term use.

Figure 5. Area of the large water reservoir conserved in 2003. Photographs of the indicated wall pre- and post-conservation are linked to the corresponding wall faces within the GIS.
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Date Surveyed:  
Surveyed by (initials):

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Figure 6. The Conservation Conditions Survey form.

Figure 7. Alessandro Rizzo, Viktor Samoilenko (foreground, left), and Alexander Makovics (background, right) map one of the ancient city blocks in the northern section of Chersonesos.
Information technology priorities for 2003 focused on preservation and conservation in the museum archives and library in preparation for creating an archaeological park in Chersonesos at the level of a UNESCO World Heritage site. The publication of *Crimean Chersonesos: City, Chora, Museum, and Environs* marked the highlight for the year’s communications efforts, presenting the treasures and potential of the site to a western audience. Almost two years in the making with four dozen collaborators worldwide, *Crimean Chersonesos* vividly illustrates the remarkable efforts, personnel, and resources of the National Preserve of Tauric Chersonesos. In addition to our publication achievements, ICA’s major preservation projects include the development of a “Preservation Needs Assessment of the Archives and Library” and the continuation of the Megarica digitization and database project.

The Preserve holdings include archaeological field reports, maps, drawings, plans, photographs, illustrations, albums, drafts, diaries, and books collected by the Museum since the first excavation in 1827. These materials not only record the history and archaeology of the site, but also add to the understanding of archaeology’s development as a scientific endeavor in Eastern Europe. The ultimate aim of this digitization project is to place this large and valuable body of information in a unified, accessible, cross-referenced database.

The Preserve’s resources include:
- Library, holding 30,000 volumes on archaeology, history, and the humanities, half of which are rare or extremely rare.
- Archives, containing
  - 3,000 stitched field notes from excavations dating to 1888
  - 80,000 negatives, including 7,000 glass plates from the 19th century
  - 10,000 drawings, illustrations, plans, prints, and engravings
- Fondi, or storage areas, with 250,000 archaeological artifacts and accompanying documentation.

**Preservation**
ICA’s archival and library preservation projects encompass all the activities that prolong the existence of the Museum’s cultural property. This includes minimizing chemical and physical deterioration and damage, as well as preventing loss of information content—through disaster planning and remediation, control of the environment, program policy and planning, conservation treatment and repair, and reformatting of deteriorated material. Conservation, in archival parlance, refers most specifically to the treatment of damaged materials, including examination of the structure, materials, and condition of materials, as well as documentation of before and after treatment, both written and photographic.

**Preservation Needs Assessment**
As an outgrowth of the Megarica project to digitally preserve the Archive and Library collections, it was determined that the holdings required improved housing, storage, and conservation. During the 2003 summer season, head librarian Lucy Grinenko and Holly Robertson, from Conservation Studies at the UT School of Information, developed a “Preservation Needs Assessment,” which outlined priority projects and began the formal record-keeping process for the conservation of documents. Additionally, Holly and Olga Kondyuk located Russian resources on the latest preservation techniques and theory, and surveyed the Library and Archives to improve storage and general conditions.

**New Housing for Archival Materials**
The archival collection of Koskyushko-Valyuzhinich, the first director of the Chersonesos Museum (1876–1907), was overhauled in 2003. His archive documents the progress of the excavations, and includes field notes, correspondence, photographs, and items sent to the Hermitage Museum in St. Petersburg. Many of the documents are damaged from years of handling and vertical storage in book format. Holly placed the photographs in clear, inert Melinex sleeves and re-housed them in labeled document folders.
and boxes. Nonna Krasovskaya, the head archivist, continues the work on other collections.

**Book Repair**
Holly laid the groundwork for a modest, much-needed book and paper conservation laboratory. She instructed Olga in basic book architecture, structure, and repair. Together they practiced a variety of reversible repair methods and book-enclosure construction techniques on a dozen volumes in dire condition. Holly also worked with the head librarian to create a “book condition form” to document evident damage and needed repairs. Armed with acid- and lignin-free boxes, inert polypropylene photograph sleeves, Japanese paper, and wheat starch paste, Holly and Olga began preservation measures on some of the more rare and valued holdings, especially the Kostsyushko collection.

**Glass Plate Negatives**
Starting in 2001, the author began working with the Preserve Archives staff to clean, scan, and conserve the collection of over 7,000 glass plate negative photographs dating back to the 1880s. To date, almost 1,000 have been scanned in high resolution digital format. Holly re-housed approximately 1,300 glass plate negatives in acid-free envelopes. The entire process of cleaning, conserving, re-housing, and scanning the glass-plate negatives should be complete by the end of next year.

**Megarica Digitization and Database Project**
Megarica is a ground-breaking technological and preservation project designed to protect and digitally copy the priceless materials from the National Preserve archives, library, and fondi. It is hoped it will serve as a model for other museums in Ukraine. Megarica’s primary preservation activity is digitization, which includes scanning and creating image files from Preserve documents and artifacts. The digital files will serve as a resource along with the original material. During 2003, over 300 field reports have been scanned, amounting to roughly 21,000 files. These files have been coded, placed in a searchable database, and archived on DVD. The ultimate aim of digitization is to construct a unified and cross-referencing database, reduce the wear on the originals, and allow scholars to quickly locate relevant and inter-related documents. During the initial phase of preservation (2000–2002), technology was introduced into the Museum and the staff was
trained in its use. Now, the Museum personnel routinely assists in improving the housing, storage, and conservation of the historical documents and artifacts. The archives, library, and fondi have also created digital card catalogs, and now enter new acquisitions directly into a computer database, thus replacing laborious paper forms.

Publications

Crimean Chersonesos and all of ICA’s publications are now being distributed worldwide through Oxbow Books and David Brown Book Company (www.oxbowbooks.com). In 2003, ICA also published Ukrainian and Russian versions of the Development Plan for the Chora of Chersonesos, which were shared with planners and decision-makers at the city, regional, and national levels in Ukraine. ICA has been working with the University of Kyiv-Mohyla Academy to produce a new supplemental series entitled Archaeology in Ukraine. The main objectives of the publication are to bring the research of Ukrainian archaeologists and of other nations working in Ukraine to an international audience and to highlight recent discoveries and advances in Ukrainian archaeology. The journal will also provide a forum for fresh ideas and new developments in archaeological methodology. We are also pursuing a plan to include selected articles from Arkheologiya, the journal of the Institute of Archaeology of the Ukrainian National Academy of Sciences. In other areas, ICA published the Archaeology Field Dictionary, an English-Russian-English handbook compiled by Nikita Khrapunov for use in excavation and conservation work. Research and editing continues by ICA scholars and collaborators on Chersonesan Studies, bringing to light the most significant work on the ancient city and its chora.

Based on reports by Lucy Grinenko, Nonna Krasovskaya, Alexander Semenov, Andrei Kondyuk, Aleksei Romanov, Dmitri Krivonos, Holly Robertson, and Olga Kondyuk

Figure 3. Andrei Kondyuk scans a map from the archives.

Figure 4. Glenn Mack checks signature sheets of Crimean Chersonesos. At right, the finished product.
Plan of Insula XXXVI

Chersonesos
Insula XXXVI
2003
(original scale 1 : 50)

Plan of Insula XXXVI
Insula XXXVI was excavated in connection with the construction at the site of Fondi 4 on the grounds of the Preserve of Tauric Chersonesos, conducted jointly by the Preserve and the Institute of Classical Archaeology at Austin. The Packard Humanities Institute has generously financed the archaeological research, as well as construction of the laboratory building.

The archaeological research in Insula XXXVI was jointly directed by Stanislav Ryzhov, head of the Preserve Architectural and Archaeological Department, and Prof. Joseph Carter, Director of ICA. The Preserve staff and students from Russian universities, the city of Kharkiv, the US, and Italy assisted in the excavation work. Ceramics analysis was jointly carried out by Olga Andreeva, Preserve senior staff scientist, and Professor Andrei Opait of ICA. Preserve conservators I. Shvedova, O. Demjanova, Yu. Ryzhova, and N. Kulevaja restored the archaeological material, which consisted of metal, bone, and glass. Site drawings were made by P. Peresvetov and sketches of the finds were made by O. Malinovskaya and student volunteers.

Figure 1. Insula XXXVI excavation, July 2003. View looking east.
The archaeological results and materials from the site, divided by period, will be published by Professor J. Carter (Hellenistic), A. Opait (Roman and Early Medieval), and O. Andreeva (Medieval).

Fondi 4, which until 2002 housed part of the Preserve’s collection, was part of the mid-19th century monastery. Its basement was designed for food storage and as a bathhouse for the monks.

Since the opening of the Museum in 1925, the structure was used both as housing for staff and for storing archaeological material, including the valuable painted Greek stelae. The basic structure of the building was found to be unsound in 2000, and plans were made to demolish it and replace it with a new laboratory and storage facility. As the walls on the Fondi’s northern end (which had no cellar below) were removed, evidence of earlier building activity was revealed and the archaeological team was called upon to investigate. (Fig. 1).

The latest of the ancient phases of construction below the Fondi, termed Insula XXXVI, dates from the medieval period (10th–13th centuries) and includes walls filled with earth and small stones. The exterior and interior wall surfaces had been plastered, though the plaster had peeled off, leaving only lime mortar near the walls.

Walls dating from the medieval period are 1–3, 5–7, 9, 12, 13, 15, 18 (see plan, p. 42). The walls belonged to a large residential structure located in the northeastern part of Insula XXXVI. Six rooms were identified. Unfortunately only two, rooms 1 and 6, were preserved well enough to be properly called rooms. The rest were almost completely ruined, with only wall 1 and small wall sections 2–3 and 6–7 preserved. (See plan, p. 42)

Room 1 (4.5 x 3 m), situated in the northeastern corner of the Insula, had double walls made of large stones set dry (without mortar), reinforced with small stones and earth. The dirt floor was covered with a burnt layer up to 1 cm thick, found to contain amphorae fragments dating from the 13th century.

Room 6 is situated in the northwestern corner of the excavation site. Like room 1, it sides with cross street 12. It is much smaller than room 1, measuring 3 x 2.75 m. Judging by the remains of 3 steps at the northeastern wall, the room was accessed from cross street 12, and the level of the dirt floor was lower than that of the street.

Excavation of the burnt layer produced some notable artifacts such as fragments of seven amphorae, a large section of a bronze lampadophorion, and an icon with both sides decorated in relief. (Such icons, along with crosses, were worn under clothes next to the skin.) The icon (5.5 x 3.5 x 0.5 cm), judging by the iconography, might be John the Evangelist sitting on a rock. He is shown looking upward where an eye of God or the pointing finger of God can be seen. The other face of the icon bears an image of a standing figure, possibly the archangel Michael holding a staff in his left hand (Plate IVg). Unfortunately, the icon’s state of preservation leaves some doubt about the identification of the figures depicted.

The lampadophorion is a remarkable and rare find. It was made from a bronze strip about 5 cm wide and 2.4 m long. The lampadophorion’s central part was bow-shaped. Along its length were small cups with upright pins meant for affixing candles (Fig. 2). Two bronze supports, shaped as hands grasping spears, were uncovered on the floor nearby (Fig. 3). Until restoration is complete, the relation of the hands to the larger structure will remain

Figure 2. Bronze lampadophorion from the burn layer of Room 6.
conjectural. It is only clear that it comes from some cult structure, the remains of which may be discovered if the excavation were to be expanded. The time of manufacture is also uncertain. The ceramic material discovered in room 6 permits us only to judge the date of the building’s destruction in the third quarter of the 13th century, so the lampadophorion must be earlier.

A well, more than 10 m deep, was found in the southeastern part of the excavation site. The material discovered in the well dates to an earlier period of the site’s existence, the 9th–10th century. Although the time of its construction is unknown, the well was filled in during the late 10th century. The excavation of the well was stopped due to rising ground water.

This area probably served as the courtyard of a medieval manor with a cellar in its eastern end. Sometime after the 10th century, wall 1 was built over the cellar. The backfill of the cellar (partly excavated) contained materials dating from the 6th–7th c.

Among the material remains is a fragment of a marble dish (Fig. 4), a type commonly used in church services. A light-clay amphora discovered under the floor of room 2 belongs to the same period (Fig. 5). It was filled with crushed ceramics used to make mortar. Such mortar was usually applied when constructing fish-salting cisterns.

Remains of walls 4 and 8 date from the Roman Period, the 1st–4th c AD. One to two preserved rows of masonry are joined with clay mortar. The walls rest on bedrock. This layer was also found to contain archaeological material dating back to the first centuries AD.

Layers of the Hellenistic period were revealed in a loamy stratum 10–20 cm thick lying directly on the bedrock. They were mostly preserved at cross-

![Figure 3. Lampadophorion support.](image)

![Figure 4. Marble basin fragment from Room 2.](image)

![Figure 5. Fragmentary amphora from Room 2.](image)
Figure 6. Wall 20, north side of Street 12, corner of pre-existing cremation burial.

Figure 7. Wall 20 detail.

Figure 8. The *lampadophorion* during excavation in Room 6.
street 12 (Figs. 6–8). The Hellenistic layers were also partly traced under the 13th century floor of room 6, which yielded fragments of Hellenistic period ceramics and fragments of two terracotta figurines. One of the figures represents the upper torso of a female draped in a folding chiton; the left hand of the figure is grasping a fluted kantharos (Fig. 9). The only preserved part of the second is a female head, probably Persephone, in diadem (Fig. 10 a & b).

Walls 10, 11, and 15 of room 5 belonged to a house of the same period situated on the southern side of the transverse street (or stenopos) 12. The walls are built of rusticated masonry blocks of various size, none more than 0.6 m thick. Room 5 itself is almost square in shape, 6 x 5.7 m. (The measurements are approximate since the southern wall of room 5 was destroyed during construction of the 19th-century bath house.) Part of the pavement made of flat limestone slabs has been preserved near the northeastern wall of the room. Three cuttings in the rock, meant to hold pithoi, were discovered inside the room; the remains of one pithos were found lying near the room’s southern wall.

Wall 20 (5.5 m long), made of rusticated limestone blocks, was uncovered on the northern side of street 12 (Fig. 6 & 7). Only three courses (1.35 m of its height) were preserved. The wall rests on a rough stone foundation cut into the loamy soil above the bedrock. Four well-worked limestone slabs belonged to a grave monument ruined during construction of this wall. The structure of the slabs is identical to that of the grave stelai discovered elsewhere at Chersonesos.

Traces of cremation were revealed nearby on the loamy stratum to the northeast of the monument (Fig. 8). The remains of a funerary pyre, as well as the monument itself, were disturbed by the foundation of the rusticated wall 20. The preserved part of the pyre is only 0.7–0.9 m in diameter. It was overlapped by loamy soil dug out of the foundation trench for wall 20. The remains of the pyre contained badly burnt, small pieces of bones, 8 small cobbler’s nails (1.5 cm long), and fragments of black-gloss ware (kylikes, fish plates, pinakes, etc.). In addition to this material, five fragments of a closed red-figure vessel were recovered from the
Figures 11a and 11b. Detail of the stratigraphy of the northeastern corner of the site, over Street 12, with drains 1–3 indicated in the lower illustration.
pyre (Fig. 12). Such vessels have analogies among the ceramics of the late 5th century BC. Most of the material discovered in the pyre dates to the first half of the 4th century BC.

The discovery of the monument and traces of the pyre indicate that before the first half of the 4th century BC (and the construction of the transverse street), this area functioned as a necropolis of early Chersonesos.

R.H Leper was the first to discover the necropolis in 1913–1914. He wrote in his report: "The most important and unexpected discoveries are a group of ancient burials with terra-cottas and burials of children in amphorae found almost in the center of the cloister's territory. They are situated between and near the ancient walls made of well-worked rusticated slabs laid dry, which were uncovered near the cloister's greenhouse."

Wall 20, unearthed in 2003, represents the continuation of the walls discovered by R.H. Leper. At present the type of structure they belonged to is not known. Possibly some public building was erected here, in the center of Chersonesos, after the first half of the 4th century BC. Its southern wall faced cross street 12.

Could the newly-discovered wall 20 have been a city defensive wall? It is possible, but it should be noted that the bottom course of the wall is laid flat, while the courses above it were placed vertically, on their narrow sides, in contrast to other fortification walls of this period.

It is possible that a defensive wall protecting the early polis from the west was erected somewhere nearby. The necropolis was arranged outside the defensive wall, on the gentle slope of a gully located here in ancient times. Evidently, the burials discovered by G. Belov on the northern shore of Chersonesos in 1935–36 belonged to this necropolis.

The results of the 2003 excavations have shown that the boundary of the early city was located near the site under study. Expansion of the city's territory in the second half of the 4th century BC caused abandonment of the necropolis and the inclusion of its remains within the city limits. Apparently, the layout of the city's grid plan and construction in the newly-annexed area occurred simultaneously. Remains of rusticated walls on the southern and northern sides of street 12 confirm this conclusion.
Figure 12. Red-figured pottery from the cremation pyre. Street 12 passed over this burial in the early Hellenistic Period. Scale 1:1

Figure 13. Fragmentary ionic capital in limestone, Hellenistic period. Sporadic find. Scale 1:2
Plate III. Insula XXXVI excavation, looking northwest across the courtyard, late July 2003. (See related article, p. 43)
Plate IV. A sample of objects from the 2003 excavation of the Packard Laboratory site, Insula XXXVI. (All objects 1:2 except IVg, 1:1)

A. Red figure pottery fragment, 4th century BC.
B. Black gloss handle with satyr head, 4th century BC.
C. Latin painted inscription, AD 2nd century.
D. Greco-Roman stamped loom weight.
E. Prehistoric stone fertility figurine.
F. Stamped amphora handle with ship’s prow, Hellenistic period.
G. Bronze icon, possibly depicting the archangel Michael, medieval period.
H. Amphora neck with dipinto, AD 4th century, Heraklean production.
I – K. Glazed painted pottery, late medieval period.
The archaeological excavation at the site of the new laboratory and former monastic bath house produced 8500 artifacts, including ceramics, coins, and objects made of metal, glass, bone, marble, and limestone. The multiple layers of the site contained finds ranging from the 4th century BC to the 13th century AD. Analysis of these objects confirms the continuity of life in this part of the site, trace the changes that took place, and illuminate the cultural and commercial ties of Chersonesos with the ancient and medieval worlds.

Ceramics represented approximately 95% of the finds. As the vessels were badly fragmented, the first task was to sort and classify them, and then attempt a reconstruction of a small portion. It was then possible to produce drawings of complete or almost complete profiles of the vessels. Finally, all material was registered in field inventory lists. The most important, rare, and provocative finds were assigned to the collection of display-quality artifacts of the National Preserve of Tauric Chersonesos for storage and eventual exhibition.

Approximately one third of the ceramics belong to the medieval period (8th–11th and 11th–13th centuries AD). The material was divided into groups according to shape and function: pithoi, amphorae, cooking ware and tableware. Amphorae and tableware constituted the largest group. Tableware included both glazed and unglazed vessels.

The amphorae of two medieval periods—Middle Byzantine (8th–10th centuries) and Late Byzantine (11th–13th centuries)—were characterized by a reduced range of shape and function, though there was little duplication of shapes. The variety of glazed wares was noteworthy.

Two main types of amphorae predominate among the 8th–11th century range. The first is known as “Prichernomorsky (Black Sea Regional).” Abundant finds of this amphora type in the north Black Sea region and the discovery of pottery workshops for their production in the Western Crimea and Chersonesos testify to their local origin. At the same time, the area of Prichernomorsky amphora distribution goes far beyond the territory of Taurica and southern Crimea, occurring in great number in the settlements of the Sea of Azov region, the Don River region, at the ancient settlements of Saltov, as well as in the Slavic settlements of the Middle Don River region.

The transformation of Chersonesos into a regional center and a change in its commercial connections resulted from a financial crisis in the Byzantine Empire during the 7th–8th centuries, and from the decline of the traditional ties with the centers of Asia Minor. The Empire’s recovery in the late 9th century brought renewed economic life to Chersonesos. The city reestablished its contacts with the center of the Byzantine Empire, as evidenced by the finds of amphorae manufactured in the workshops of the Sea of Marmara (type 1 according to N. Gunzenin’s classification) and in the vicinity of Nicaea (Gunzenin type 2). The second type of amphora includes flat-bottomed and flat-handled vessels, which are more properly called jugs (Fig. 1a). The interior surface of many of them is coated with a resinous substance. Possibly these vessels were used as containers for transportation of mineral oil, which was used both for household needs and military purposes. They are dated to the 9th–11th centuries and occur in many centers of the Black Sea region and in Sarkel, on the Don River. The presumed center of their manufacture is on the Taman and Kerch Peninsulas, with their associated oil production regions. These jugs, as well as the type 1 amphora, were not stamped, but sometimes were marked by graffiti. Most of the vessels of this type (around 2000 items) excavated on the site in 2003 were discovered in the backfill of the well near cross street (or stenopoio) 13. Fragments in various states of preservation were uncovered throughout the entire 10 meter depth of the well. It is clear that the well was filled in all at once, probably during the siege and capture of Chersonesos by Prince Vladimir of Kyiv in AD 988–989. In addition to the jugs, other finds—some tableware and two coins—support this late 10th century date. One coin is attributed to the reign of the Emperor Basil I (AD 867–886), the other possibly dates from the time of Emperor Roman I (AD 920–944).
Small pots with one or two handles are characteristic of Chersonesan tableware throughout the medieval period. As a rule, they have a rounded body and a flat bottom, and many samples have finger impressions on the handle. Numerous finds of similar vessels in the layers of the 9th to the first half of 11th centuries make this a useful chronological guide. Discovery of such pots in the well supports the late 10th century date.

Small one-handled jugs, 6–7 cm high, with a rim diameter of 3–4 cm form another class of red-clay tableware for this period. An almost complete vessel of the type (with handle broken off) was also discovered in the well. It is possible that such jugs served as children’s toys.

Important ceramic material of the Middle Byzantine period included several types of imported white-clay glazed vessels, termed “Glazed White ware II–III” by Hayes (J.W. Hayes, Excavations at Sarachane in Istanbul: The Pottery. Princeton., 1992. Vol. 2). This group is scarce in comparison to other containers such as amphorae. Despite the small size of the fragments, bowls, plates, small bowls, and double-handled beakers have been identified. Types 1, 2, 3, 13, and 14 of the Glazed White ware II classification could be distinguished.

There are examples decorated with dark or red glaze on the walls and the rim. Some fragments preserve stamped patterns, including a cross within a circle, a bird in profile with a wing on its back, and multi-petal rosette (Fig. 1c). A vessel coated with dark-green glaze decorated with a geometric pattern in the sgraffito technique is noteworthy (Fig. 1b). The horizontal pattern of the decoration proves its origin was Constantinople. Though the vessel was badly fragmented, it probably had two handles. The morphology of rims and feet and the types of stamps on these vessels find their closest parallels in the pottery of Constantinople and Sarachane from the middle and late 10th century.

An additional group of white-clay glazed ceramics, analogous to Glazed White ware II–III, consists of pottery decorated with polychrome painting under a thin layer of transparent glaze (Middle Byzantine Polychrome Ware). It is represented only by three small fragments. Such vessels rarely occur in Chersoneso, and they are as a rule quite fragmented. Their usual decoration is an intricate pattern painted with narrow lines.

Fragments of two multi-tiered lamps of glazed white clay (lustra) were discovered along with these vessels. Such lamps regularly occur in the 10th century layers of Chersonosos.

Because the uppermost layers of the site were badly disturbed, little ceramic material of the Late Byzantine period was recovered. Nevertheless, even this small quantity gives us an idea of the vessels used in 13th century Chersonesos.

The amphora finds were fewer than for the previous period, consisting of two main types. The majority of finds come from Room 6, with the amphora fragments lying on the floor in the burned layer. Preliminary restoration resulted in three almost complete amphorae and four partial ones.

The amphorae of the first type are represented by large round-bottomed vessels with a broad grooved body, short narrow neck, and massive, arcuated handles. Fragments of three amphorae of this kind were uncovered lying on the floor, and two of them were successfully joined to form an almost complete shape. Some studies have placed production centers of these vessels on the shore of the Sea of Marmara, and trace their development from the amphorae of the previous period (Gunzenin type 4). Other studies associate them with the imperial capital at Trapezus. Excavations have ascertained more than once that in Chersonesos these amphorae were used as storage containers for grain and small fish (khamsa). The same amphorae were used in other settlements of Taurica in south western Crimea. They were rather widespread beyond Chersonesos, in the cities of the Don, Dniepr, and Danube River regions, in the central Balkan Mountains, and in Asia Minor. They are also known on Cyprus.

Graffiti often appear on the walls and the handles of this type of amphora. They are scratched on our vessels, too. As a rule, these are letters or pictographs. The walls of one of the amphorae bear several scratched pentagrams. Pentagram-like signs are known from Greek and ancient Russian graffiti, where they were used to mark tiles and bricks. The handle of an analogous amphora has round impressions arranged crosswise, scratched on still-wet-clay with a sharp instrument.

This form of container was used along with a new one, which had clear-cut local features. These are large flat-bottomed vessels often occurring in layers dating from the 13th–14th centuries, but unknown outside the territory of southwestern
Figure 1. Types of pottery from the site: A) Flat-bottom amphorae; B) Green glazed white ware with incised decoration, Middle Byzantine; C) Impressed white ware.

Figure 2. Examples of Zeuxippos Ware.
Taurica. Fragments of four amphorae of the type were lying on the floor of Room 6 together with other types; only one could be restored. Amphorae of this type were frequently decorated with a pattern of small channels, cuts, and raised borders. One of the samples discovered is decorated with a raised border applied lengthwise and crossed by cuts. The walls of these amphorae sometimes also bear graffiti consisting of letters or symbols. Besides amphorae, the site produced tableware of a Late Byzantine Chersonesan type: the neck of a red-clay jar with glazed surface and fragments of glazed white clay and red clay ceramics.

The 13th century destruction layer is notable for a combination of white and red clay vessels of various shapes. Fancy ceramics of this period differed from glazed products of the 9th–11th centuries, not only in the form and function of these red-clay vessels, but also in decorative technique. White clay dishes with raised stamped images were replaced by dishes with underglaze decoration depicting animals, birds, and mythical creatures, covered with a green glaze and a brown contour line. A.L.Yakobson compared the white-clay painted vessels with analogous finds from Constantinople and Corinth, dating them to the late 11th–12th centuries. They were certainly still current in Chersonesos as late as the 13th century.

Byzantine glazed red clay ceramics spread in the 11th–12th centuries. Again we come across a new decorative concept: the incising of ornament and subject images, known as the *sgraffito* technique. Yakobson argued that local mass production of glazed red clay ware decorated in this manner developed in the 12th and, especially, in the 13th centuries. The inhabitants of Chersonesos simultaneously used local and imported crockery. It is certain that imported glazed red-clay goods, known as Zeuxippos Ware (Fig. 2), were expensive. For this reason they were never thrown out if broken, but always repaired. In fact, many fragments of imported pottery have preserved traces of ancient mending.

The fragmented character of the red clay glazed vessels does not permit a reconstruction of the decoration in full, so we can speak about them only hypothetically, judging by analogies. However, despite the poor degree of preservation, we can get an idea of the vessels' shape, character and colors of the glaze coating, stylistic peculiarities, and technique of the decorative pattern.

Monochrome Zeuxippos Ware pottery was plentiful on the site. The typical horizontal arrangement of decoration underlying a variety of ornamentation is believed to be characteristic of the potters of the capital, Constantinople. The main elements used are geometric motifs: spirals, triangles, nets, concentric circles, and wavy lines. The style and technique of one of the fragments is similar to that of the dishes with figural images (Fig 2).

Some fragments belong to thick-walled dishes decorated with serpents and grape clusters, engraved in broad lines. These dishes are also monochrome, covered with yellow glaze over white slip. Yakobson believed these were imported from the Byzantine centers, but they were most widely represented in Greece—in Corinth, Thebes, and Sparta.

Red clay glazed polychrome ceramics with various complex images in the *sgraffito* technique were locally produced. Vessels of this group are dated to the 13th century. The site produced only one jug fragment.

This analysis of ceramic material from this important excavation has revealed much about the economy and artisanship of the city in its life as a Greek colony, a Roman outpost, and a regional center of the Byzantine empire. In its later phase, throughout the 9th–13th centuries, Chersonesos kept traditional ties with many Byzantine cities. These connections, however, were not restricted solely to Constantinople, but covered other centers of Taurica and towns of the former Khazar Khanate. This material reflects the growing influence of Chersonesos as a regional center of the late medieval period.
Hellenistic Ceramic Storage Containers

Hellenistic ceramic storage containers comprise one of the most well represented ceramic categories discovered at site 151. This is due not only to the economic character of the farm itself, but also to the physical and formal nature of this type of ceramics. The economic activities which took place at site 151 were probably centered on wine production, although we cannot rule out the possibility of grain processing as well. Careful analysis of these ceramic containers in fact allows us to discern a combination of these activities.

Three main types of storage containers have been recorded at site 151. These include pithoi, vats, and bins. The pithoi were, by definition, receptacles for the preservation of wine over a certain period of time before the liquid was transferred to amphoras. The vats, by virtue of their short bodies and large mouths, were probably used for processing the must before it was relocated into the pithoi. A serious question arises, however, concerning the use of two pithoi and one vat which were repaired with lead rivets, a method well known in the Greek world (Fig. 1). Were these riveted containers able to hold liquid or were they only re-used for storage of solid products such as grain?

Few of the pithoi fragments found at site 151 were decorated. Only a hand-made container and one pithos displayed 2–3mm raised ribs on the exterior surface (inventory no. 3).

In addition to the pithoi, storage bins were also found, although in smaller quantities. These consisted of only three examples, two of which are Hellenistic and one probably Roman in date. They were intended to store grain for a limited period of time (probably two or three months) and served as intermediate containers for the storage of those grains which had been removed from pithoi (or storing pits) before being processed. The relative dearth of these particular containers suggests that the agricultural activity which took place at this farm was limited.

Pithoi

These large, ovoid storage vessels typically have a large mouth which can be easily covered by means of a ceramic or stone lid. They are well known throughout the ancient world, having spread gradually westward from the Middle East. An example of a complete pithos from the store room of the Chersonesos Museum serves as a representative example (Fig. 2). Pithoi were typically present in every Greek farm of the Chersonesan chora, where a special room was often reserved for them. Unfortunately, no container at site 151 was discovered completely intact. Only rims were found, a fortuitous discovery as these diagnostic pieces can provide important information concerning the place of manufacture. Additional information can be gleaned from the analysis of fabric, since many inclusions found in amphora fabrics were also used to make the paste of pithoi.
Origin
As mentioned above, some of these pithoi bear stamps which indicate the precise place of manufacture. Analysis of these combined features allows us to determine with certainty the place of origin of many storage containers. We have found, for example, that the pithoi discovered at site 151 were either local or imported from the southern coast of the Black Sea, mainly from Herakleia. Further, the lack of Sinopean imports is remarkable. It distinguishes site 151 from other farms such as that excavated by Ščeglov at Kalos Limen, where ten Sinopean pithoi were found. It seems probable that Herakleia was still a significant export center during the last quarter of the fourth century BC, when the farm at site 151 seems to have been built.

Local containers from Chersonesos (inventory nos. 1 & 2) are characterized by massive rectangular rims, which are slightly convex on top and concave on the interior so as to receive a lid. Traces of soot found on the internal side of the rims are significant: It may be that the lids were sealed with mud, which was later fired in order to render it impermeable. The consistency of rim diameters among the three pithoi discovered at site 151 seem to suggest a consistent capacity of the vessels.

Fragments of three more pithoi (inventory nos. 3, 4, & 7) can be assigned to Herakleia according to their fabric and morphology. The best parallels are found in two stamped Herakleian rim fragments discovered at the city of Chersonesos. The fabric of one pithos (inventory no. 3) seems to place it in the southern Black Sea coastal area, probably also a Herakleian workshop. However, its anvil-shaped rim with large concavity on the interior (to receive a lid) is unique.

Capacity
Some of the pithoi discovered in Chersonesos or on the farms of its chora bear graffiti, either on top or on the side of the large rims (Fig. 3).

Nikolaenko calculated the capacity of a Sinopean pithos with a large rim (75cm) and body (max. diameter 130cm) and found a maximum capacity of 1065±50 dm³. She compared it with the marks inscribed on its rim and discovered that the unit of measurement could belong to a Sinopean amphora with a capacity of approximately 21.1–23.3 liters. However, we do not know if the same unit of measurement was used for the Chersonesan or Herakleian pithoi.

Shawn Ross calculated the capacity of a Chersonesan pithos deposited in the store rooms of the Chersonesos museum. Its rim diameter of 67cm and maximum diameter of 115cm yielded a capacity about 850 dm³. A simple comparison of the capacities indicated by Sinopean pithoi with those of Herakleian and Chersonesan pithoi seems to indicate a significant difference between the first group, with capacities ranging from 48 to 55 units, and the second assemblage with capacities between 31 and 42 units.

Regarding those graffiti which indicate variable capacities of 8, 10, or 23 units, we can be certain that they do not belong to vats since the latter sometimes have rims shaped like those from pithoi.

As a working hypothesis, I suggest a proportional correspondence between the rim diameter and the capacity of the pithoi. Further, we can divide the pithoi into three groups: 1) large pithoi, with rim diameters of 70–80cm and capacities of 1000–1100 dm³; 2) medium pithoi, with rim diameters of 60–70cm and capacities of 850–900 dm³; and 3) small pithoi, with rim diameters of 50–60cm and capacities of 700–750 dm³. If this hypothesis is correct, it seems likely that most of the pithoi discovered at site 151 would fall into the second and third categories, with a minimum storing capacity varying between 4500–5000 liters. This capacity of production seems, in fact, to be in complete accord with the reduced dimensions of the farm. This relation between storage capacity and farm size is an interesting hypothesis which deserves to be verified.

Figure 3. Graffito from a pithos rim (catalog no. 7) found at site 151.
Catalog of Pithos Fragments

Inv. no. 1
Contexts 12, 15, 74
Preserved upper body
Dimensions: D of rim: 52; preserved H: 18; wall thickness: 2.3
Condition: Mended with lead clamp; some lead remaining. Traces of soot on internal side of rim.

Inv. no. 2
Contexts 1, 20, 66
Preserved upper body
Dimensions: D of rim: 52; preserved H: 20; wall thickness: 2.1
Condition: Mended with lead clamp; some lead remaining.

Inv. no. 3
Contexts 53, 74, 78
Preserved upper body
Dimensions: D of rim: 52; preserved H: 18; wall thickness: 2.6
Condition: Traces of soot on interior of rim. Raised rib decoration on exterior of body, ca. 2–3mm.

Inv. no. 4
Contexts 2, 16, 48
Preserved upper body
Dimensions: D of rim: 66; preserved H: 12; wall thickness: 3.2

Inv. no. 5
Contexts 6, 58, 77
Preserved upper body
Dimensions: D of rim: 58; wall thickness: 2.2
Condition: Mend holes on body sherd, lead remaining in one.

Inv. no. 7
Contexts 1, 16, 49
Preserved upper body
Dimensions: D of rim: 64; preserved H: 7; wall thickness: 2.2
Condition: Numerical indication of the container capacity on top of the rim (Fig. 3).

Vats

The type of container considered here to be a “vat” looks much like the lower three-quarters of a pithos. As mentioned above, its rim resembles that of a pithos but with reduced dimensions. It also differs in that it terminates in a massive discoid base and has two large side handles. The latter probably played a decorative rather than functional role. Vaults have been found in almost every Chersonesan farm and so were in common usage in the vicinity. An example from the Museum at Chersonesos is representative of the type (Fig. 4).

Catalog of Vat Fragments

Inv. no. 6
Context 107, East Courtyard
Preserved fragment of upper part of body
Dimensions: D of rim: 76; preserved H: 9.5; wall thickness: 2

Inv. no. 8
Contexts 49, 52, 61
Preserved fragment of upper body
Dimensions: D of rim: 67; preserved H: 18; wall thickness: 2.2
Condition: One mend hole with lead; another without.

Inv. no. 9
Contexts 1, 16, 75
Preserved fragment of upper body
Dimensions: D of rim: 46; preserved H: 8; wall thickness: 1.3

Inv. no. 10
Contexts 73, 81, 90, Courtyard
Preserved fragment of upper body
Dimensions: Preserved H: 10; wall thickness: 1.3

Inv. no. 12
Context 194, Room 1
Preserved fragment of upper body
Dimensions: D of rim: 61; preserved H: 23; wall thickness: 2.2
Storage Bins

This category of containers from site 151 was probably used for storing agricultural products such as cereals. It is possible that these vessels were used for short-term storage, while pithoi were reserved for longer-term storage. The storage bin is characterized by an ovoid body and a narrowed mouth, but is otherwise similar in linear dimensions to pithoi, with a short vertical rim and flat base. Two handles parallel to the rim are attached to the upper part of the body and play a more or less functional role. (There are bins which had handles perpendicular to the rim.) At site 151 only two rim fragments can be assigned to storage bins, one of them being certainly Hellenistic, the other one probably dated to the Roman period. The Hellenistic bin seems to come from a south Pontic workshop, perhaps Herakleia, while the container of Roman period comes from an unassigned southern or eastern Pontic center.

The best parallels for the Hellenistic bin were found at Panskoye. This container had an estimated height of ca. 55 cm, maximum diameter of ca. 40 cm, rim diameter of 19 cm, base diameter of 20 cm, and wall thickness of 1.2–1.4 cm. Another completely preserved bin, which is on display in the Chersonesan museum, has larger dimensions: the rim diameter is 23 cm, maximum diameter is 56 cm, base diameter is 21 cm, and height is 65 cm (Fig. 5).

Catalog of Storage Bin Fragments

Inv. no. 60
Context 33, Room 3
Preserved fragment of rim
Dimensions: D of rim: 29;
preserved H: 2.5; wall thickness: 1.1
Fabric: Herakleian

Inv. no. 11
Contexts 35, 79
Preserved fragment of rim
Dimensions: D of rim: 19;
preserved H: 6; wall thickness: 1.1
The lithic material in this study came from four excavation seasons (1997, 1998, 2000, and 2002) at Bezymyannaya, located on a strategic hill in the Heraklean Peninsula within the ancient territory of Chersonesos. The site has been important from ancient times and figured prominently in the Crimean War (1853–1856) and World War II. Until now, very little was known of its prehistoric phases. This study is a first step in evaluating the Neolithic stone industry on Bezymyannaya (approximately 6000–3000 BC).

The analytical method used is based on that developed by Dr. M. Moscoloni in his study of the tools of Cava Giacometti, Italy, a site occupied from the Late Neolithic to the Bronze Age periods (Cazzella A., Moscoloni M., 1994). This method was also used in the analysis of the Copper Age settlement stone tools at Conelle D’Arcevia (Moscoloni, M. and E. La Rosa, 2003).

Due to the limited quantity of lithic artifacts recovered at Bezymyannaya, the typological variety of the tools was relatively small. The data collected, therefore, here has been placed in a database which can be further expanded when excavation resumes.

The basic analysis of lithic tools rests first on their use, which can be categorized as follows:
1. Longitudinal-motion tools; tip is used and retouched: end-scrapers (Fig. 1A–B).
2. Transverse-motion (cutting) tools: side-scrapers (Fig. 1H); denticulated flakes (Fig. 1I); bladelets (Fig. 1J); blades (Fig. 1K).
3. Engraving tools, classified according to tips: a. lateral burin (Fig. 1C). b. atypical borers, pointed but shorter than the burin (Fig. 1D).
4. Rotary motion tools, with sharpened tips for perforating purposes: borers (Fig. 1E–G).
5. Perforating tools, with sharpened tips for penetrating purposes: points (Fig. 1L–M).
6. Composite tools: tools combining two or more basic tool types (Fig. 1N–O).
7. Arrowpoints (Fig. 1P–Q).
8. Tools of unknown use and function: retouched flakes, notched flakes.

The analysis next uses visual evaluation to consider the artifact’s raw material, first noting the color and natural characteristics of the artifact. Then the fragmentation is classified (as proximal, medial, distal, lateral, and/or indeterminate) and the lacuna or missing areas are noted (proximal, distal, right, and/or left).

The technological categories include the following determinations: the quantity of cortex (the “rind” or the rough weathered surface of chert); the analysis of the artifact type (flakes, blades, bladelets, etc.); the analysis of the section, of the butt (part of the striking platform, detached from the core by the blow of the striker); and the retouch (the shaping, sculpting, or otherwise transforming a product into a tool by removing small flakes from the edges and faces).

From the lithic industry of Bezymyannaya, we analysed 138 tools and 64 cores (the block of raw material from which flakes, blades or bladelets are detached—see Fig. 1T, U). The highest quantity of material (100 tools and 54 cores) came from the campaign of 2000.

Technological, dimensional and typological data were transformed first into percentages to normalize their presence, then compared with the graphics in order to highlight the trend of the different characteristics.

**Raw materials**
The lithic industry in Bezymyannaya made greatest use of a grey color chert (63 artifacts or 45.6%), followed by black chert (31 or 22.4%), green chert (24 or 17.3%), and light yellow chert (2 or 1.4%). [The nosed end-scraper tool (Fig. 1A) is of obsidian.]

The tools are mostly whole (103 or 74.6%) and often have encrustation on the surface (76 or 41%), pseudo-retouch (63 or 34%) and a number (44 or 23.7%) were patinated, probably due to the presence of acidity in the soil.

The fragments are mainly medians as the tips are easily broken. This data is confirmed by the gaps that once again are mainly present in the distal and proximal areas.
Technology and typometry
In the majority of artifacts the cortex has been removed (81 or 58.6%) or is preserved only in small parts (36 or 26%). The butt is often removed in retouching (71 or 57.7%); the simple form of platform type, or plain butt was found in moderate quantity (37 or 30%). The prevalence of triangular shapes (61 or 46.5%) and trapezoidal shapes (43 or 32.8%) indicate a particular technique of stone-tool manufacture.
In the typometric analysis, only whole tools have been considered.
Regarding the stone artifacts’ length, the greatest number of examples fall in the ranges of 21–25 mm (27 or 24.3%), 26–30 mm (23 or 20.7%),

Figure 1. Lithic material from Bezymyannaya, 1997, 2000.
A–B: Longitudinal-motion tools (end scrapers)
C–D: Engraving tools
E–G: Rotary-motion tools (borers)
H–K: Transverse-motion tools (side scrapers)
L–M: Perforating tools
N–O: Composite tools, combining two or more basic tool types
P–Q: Arrow points (unfinished)
R–S: Precussive tools
T–U: Cores from which tools were made
and 31–35 mm. (23 or 20.7%). Regarding width, a more homogeneous distribution of dimensions is noted—though not a normal statistical distribution within a classic bell curve—with the main peak in the 21–25 mm range (41 or 30.8%), followed by a second peak in the 16–20 mm (28 or 21%) and then by two peaks in the 26–30 mm (19 or 14.2%) and 11–15 mm (18 or 13.5%). The tools are mainly found with a thickness included in the 6–10 mm range (50 or 36.2%) and 11–15 mm range (43 or 31.1%).

In Bezymyannaya’s stone-tool industry, the tendency seems to have been that of producing fairly small tools with a greater control of the width, a dimension that was probably considered important for the object’s handle.

**Typology**

The most numerous typological groups are those with cutting motion (28 or 20.2%) and those used to engrave (24 or 17.3%); the tools of uncertain use follow with fairly similar percentages (21 or 15.2%), tools used to perforate (18 or 13%), those tools used with longitudinal motion (15 or 10.8%) and composite tools (15 or 10.8%).

The last tools are those with rotary motion (11 or 7.9%) and a small quantity of unfinished arrowheads (6 or 4.3%).

Side-scrapers (11 or 39.2%) and denticulated flakes (9 or 32.1%), prevail among the cutting motion tools; the few blades (3 or 10.7%) and bladelets (5 or 17.8%) present have been retouched, while only one is a denticulated bladelet. The most numerous technological group within the engraving tools is that of lateral burin (12 or 50%) with burin’s blow mainly adjacent to the tip (14 or 82.3%).

Among tools of uncertain use, there is a prevalence of retouched flakes (15 or 71.4%).

Within the longitudinal motion tools, the most numerous is the carinated or ridged type, together with the carinated end-scrappers with narrow end (6 or 40%), and large end (4 or 26.6%). Among the composite tools, nine out of sixteen are short borers associated with another type.

Among the rotary motion tools, the most numerous type is also the short borers (9 or 75%).

The small quantity of unfinished arrowheads consists of two unfinished arrowheads, a small and big one, and two fragments (distal and proximal ends).

The highest quantity of retouching is distal (44 or 25.7%), mainly present in three groups of tools: those used with longitudinal motion, those used with rotary motion, and those used to perforate. There is no evidence of specific preference in the choice of right edge (32 or 18.7%) or left edge (32 or 16.3%) retouching.

The high percentage of retouching whose orientation was not determined (35 or 20.4%) is related to the large number of removed butts. Without the butts, it is impossible to determine the orientation of the tool.

**Cores**

The presence of cores in the Bezymyannaya lithic industry is large compared to the totality of tools. They are mainly of chert (52 or 81.2%) with a small percentage of obsidian (10 or 15.6%). The cores of black chert (30 or 46.8%) and those of grey chert (27 or 42.1%) are about equally numerous. Tools are predominately of grey chert (63 or 45.6%), nearly twice the number of black chert (31 or 22.4%). Such a large quantity of black chert cores could indicate that they were consumed at a lower rate, with a consequent lesser presence of tools of this color discarded and ultimately recovered.

Alteration of the artifacts by natural forces are as follows: encrustation (38 or 46.9%); pseudoretouch (23 or 28.3%) and patination (20 or 27.6%).

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Figure 2. Precursor with two striking platforms.
These are in the main pyramidal cores (21 or 32.8%), and cores with one striking platform (the surface where the blow fell) (16 or 25%). The numerous core residuals (19 or 29.6%) indicate a tendency to use completely the raw material, perhaps because chert was scarce.

Blades
Smaller blades and bladelets are little represented among the tools recovered. Instead, their manufacture is evidenced by the large quantity of cores with mixed detachments (flakes, blades and bladelets) and in the pyramidal cores (detachment of blades and bladelets).

Percussors
There were thirteen percussors (used to strike and shape the raw material), mostly from the 1998 excavation. Traces of percussion (crushing and abrasion) are present on eight artifacts; in three percussors an area has been eliminated, probably to facilitate attachment to a handle (Fig. 1S). One core with two striking platforms has been reused as a percussor (Fig. 1R, Fig. 2).

Conclusions
Even though the size of lithic industry found during the Bezymyannaya’s excavation campaigns is not large, it is still possible to draw some interesting conclusions from analysis of the material.

First, it is important to underline the discovery, in small quantities, of obsidian, a vitreous volcanic rock that first appeared in the Neolithic period. The spread of obsidian far from its source indicates movement of trade and exchange.

In the Neolithic, there was an increase in the production of blades and bladelets, but this is not the case at Bezymyannaya. There was, instead, a prevalence of flakes. The blades present are well made and carefully retouched, similar to those found in other Neolithic contexts. On the contrary, several blades and bladelet detachments are present in the cores with a prevalence of pyramidal cores, diagnostic elements for the production of these artifact types with a direct percussion technique. Their absence from the assemblage could therefore be the result of a failure to recover them during excavation.

In the typology, there is a prevalence of side-scrapers and denticulated flakes (longitudinal motion tools), which are often found in good quantities in Neolithic contexts (in Italy, for example), and are generally connected to activities such as scraping bones, butchering, etc. The burins (engraving tools), on the contrary, are uncommon in Italian Neolithic sites. Perhaps one of the activities utilizing these tools—whittling wood—could have been practiced in Bezymyannaya. The Neolithic is characterized by the production of arrowheads related to hunting activities. They are documented here by unfinished arrowheads.

It is important to remember that only by using microscopy (for use-wear analysis) is it possible to interpret the correct function of these tools. The functional-typology is nonetheless a fairly reliable indicator of activities performed at the site and therefore for the interpretation of the site type (hunting camp, home base, etc.).

At Bezymyannaya, as in other sites with clearly-established lithic industries, there are retouched flakes that cannot be classified, the “tools of uncertain use.” These may have been used in the manufacturing process or perhaps were discarded as faulty midway through their working. Another possibility is that they were “expedients,” or tools quickly and crudely made for limited use. Lastly, of course, their uncertain status could result from the limitations of our interpretive analysis. A point to be underlined once more is the noteworthy quantity of the cores. This could suggest the presence of lithic industry production, where the cores are greatly exploited, perhaps because of the difficulties encountered in finding the raw material.

Bezymyannaya has been occupied since prehistory, thanks to its strategic hilltop position. As shown by the lithic material, its occupation probably began in the Neolithic period. Future recovery of associated prehistoric ceramics would be an important element in the chronological classification of this group of small tools.

With future campaigns perhaps it will be possible to analyze and deepen the knowledge of Bezymyannaya’s prehistoric context, thus far only suggested by the analysis of its lithics industry.
The nonprofit organization, Pidtrymka Chersonesu (PC), was created in July 2001 by the Institute of Classical Archaeology. Through it, ICA has been able to fulfill one of the goals indicated in its mission statement: “to provide technical assistance and expertise for cultural heritage management” to the National Preserve of Tauric Chersonesos. As an organization registered in the city of Sevastopol, PC has a twofold responsibility: to ensure that ICA’s financial assistance to the Preserve complies with local Ukrainian law, and to act as an advisory body to the Preserve’s director and staff in areas relating to archaeological site management. For over two years PC has been a constant and efficient conduit between ICA and the Preserve. The organization has benefited tremendously from the expertise of the members of its advisory council: former US ambassador to Ukraine William Green Miller and Ludmila Panova, head of the economic department at the Sevastopol city administration. Ms. Panova, who has recently joined PC, brings a wealth of knowledge about the local economy and advises us on matters regarding the city government. PC’s management board (Joseph C. Carter, chairman, Jessica Trelogan and Taissa Bushnell, members) consults regularly on all issues concerning ICA’s activities at Chersonesos. All financial and technical transactions are managed by Lex-Service, a legal and auditing firm in Sevastopol.

Some projects undertaken by the two-year-old organization have already begun to reap substantial rewards. Internet access at the Preserve, installed and maintained by PC, has become an integral component of daily work and—in conjunction with extensive computer training also funded through PC—has empowered the Preserve staff with technical skills in their respective duties. People who switched on a computer for the first time two years ago are now confidently and ably using specialized software programs and doing research on the Internet to explore new professional opportunities. Computer literacy and other essential tools would otherwise have been impossible in view of the Preserve’s limited budget.

The Packard Laboratory

PC’s major project in 2003 was the construction of the Preserve’s first modern storage facility and conservation laboratory, financed by the Packard Humanities Institute. After an intensive review of possible local contractors, a three-way contract was signed in April 2003 by Leonid Marchenko for the Preserve, Taissa Bushnell for PC, and the Sevastopol branch of Krymrestauratsiya, a buildings construction and restoration firm based in Simferopol. The architectural and engineering plans for the new building (located on the footprint of a former 19th century bathhouse once part of the monastery complex that existed on the territory of Chersonesos) were created by Llano Design, Austin, in collaboration with Nikolai Andrushchenko of the State Institute of Urban Architecture, Kyiv. The plan was then revised by Ludmila Dukareva, our architect in Sevastopol, to comply with stringent local seismological regulations. An independent engineer, Alexandr Levitskiy, was employed to ensure budgetary and schedule efficiency.

Partial demolition of the 19th century structure and new construction began immediately. As might be expected at Chersonesos, an ancient city laid out on a regular street grid, we soon uncovered archaeological structures during excavations to enlarge the 19th century basement. (A report detailing the associated archaeological excavations and spectacular finds is included in another chapter in this annual report.) Architectural and engineering plans needed to be revised yet again in view of this discovery. The new plans have integrated archaeology and modern building into one harmonious whole with an iron-beamed cantilevered floor extending over the archaeological structures, which will be illuminated and visible from the laboratory interior.

Upon completion, the storage spaces of the building will be fitted with environmental monitoring devices and proper shelving for safe and efficient collections care and management. On a personal note, the experience of constructing a large-scale, multi-story building through all the
stages from finding a contractor, going through all the architectural, engineering, and legal reviews, finding innovative solutions to architectural complexities, and attempting to remain on time and within budget is a difficult task in any context, let alone an archaeological preserve in a foreign country. PC is indebted to many people whose painstaking work has contributed to what promises to be a first-rate finds store and laboratory.

Archaeological Site Management
PC is in continuous dialogue with Leonid Marchenko, general director of the Preserve, and staff members in the development and implementation of various long-term plans. Both the Preserve and PC believe in developing holistic strategies to address issues relating to the management and conservation of the site. To this end we have invited the expertise of colleagues in archaeological conservation and world heritage management. A conservation plan is being written by Chris Cleere (Cleere Conservation Limited, London) and Larissa Sedikova, head of conservation at the Preserve. This, together with a plan for the presentation of the ancient city of Chersonesos (currently being written by the author as partial fulfillment of a Master’s degree in the management of archaeological sites at the Institute of Archaeology, University College London) will be integrated and developed into one far-reaching management plan for the site by Dr. Henry Cleere, former World Heritage Coordinator of ICOMOS (International Council on Monuments and Sites). All the above-mentioned plans will be developed in close collaboration with the Preserve, as well as other parties who have a legal relationship or a vested interest in the Preserve (national and local governments, the local community in Sevastopol, regional tourist authorities, scholarly organizations), as per current principles in cultural heritage management.

World Heritage Nomination
On May 21–23 Professor Carter, Dr. Cleere, Leonid Marchenko, and Ms. Bushnell took part in a regional seminar of the World Heritage Centre, held near Yalta, on the harmonization of the national Tentative Lists of the Black Sea countries. The seminar delegates visited Chersonesos as part of their itinerary and had the opportunity to view the progress made by the Preserve in its bid for World Heritage inscription. Chersonesos is currently on Ukraine’s Tentative List for nomination. PC will continue to advise the Preserve and invite experts in the field of archaeological heritage management to conclude a successful nomination.

PC’s assistance to the Preserve in the form of archaeological site management cannot be more timely in view of the fact that Sevastopol is currently developing a city master plan which will focus on tourism as the future basis of its economy. This shift from a Cold War military-

Figure 1. Fondi 4, just prior to razing, looking north. The former monastic bath was structurally unsound and beyond salvaging.
industrial complex to a tourism-based economy will have major implications for Chersoneso if contemporary trends in the tourism industry, one of the largest and fastest growing global industries, continue. Cultural tourism on a massive scale presents archaeological sites with both great opportunities, in terms of revenue and education, as well as grave threats to their conservation. Rising visitor numbers necessitate proper management mechanisms, not only to withstand the pressure of thousands of feet walking on delicate pathways, but also to provide good services to enhance the visitor experience and growing expectations of tourists. PC considers one of its goals to help the Preserve achieve effective sustainable management of the site so that Chersoneso can reach its potential of being a world heritage site able to provide an excellent experience for its visitors, be they tourists, scholars, or local families on a day out.

Figure 2. With the old structure gone, construction begins on the Packard Laboratory. (Northeast view)
2003 Chersonesos group photographs. Top: the survey team; middle: the conservation team; bottom: the entire crew in front of Dacha 2, late July.
METAPONTO

Plate V. Basilicata
Plate VI. (Top) Aerial photograph of the chora of Metaponto indicating plots surveyed and sites documented between the Basento and Cavone rivers, 1992–2003 (see next article). (Bottom) Site 829. Superimposed views of magnetic contour plots (60m² overall). The tall, thin signal spike in the foreground is likely a modern iron object buried just below the surface (see article, p. 78).
2003 Field Campaign
For six weeks in September and October an ICA team continued the archaeological field survey of the Metapontino, the twelfth field campaign since the survey began in 1981. With the results from the Bradano–Basento transect now being prepared for publication, this year’s fieldwork concentrated exclusively on the Basento–Cavone transect created under the direction of Jon Morter in 1992 (Fig. 1). Cesare D’Annibale (Parks Canada), leader of the Bradano–Basento survey effort (1981–1990), returned to the Metapontino to co-direct the 2003 field campaign with the author.

The Basento–Cavone area proved difficult to access in 1992–1994, and the situation has not improved in the intervening decade. Compared to the Bradano–Basento transect, the Basento–Cavone transect is more populous, developed, and physically fragmented. The town of Marconia, founded during the Fascist land-reclamation project of the 1930s to bring agricultural laborers closer to the fields they worked, now sprawls over almost a quarter of the transect. The presence of a few large estates and farms (the Azienda Incoronata and Masserie San Teodoro Vecchio and Nuovo, for example) and myriad tiny private properties prevents the crew from working intensively in a given locality for more than three or four days. Most of the fields are still planted in the same cultivations as a decade ago, so that visibility conditions have also failed to change: the fields that could not be studied ten years ago because of standing wheat are still inaccessible today for the same reason. Thus much time is devoted to hunting for un-walked fields across localities, “filling in” the survey transect one small piece at a time.

Further complication arises from the pervasive heavy mechanical interventions all across the marine terraces between Basento and Cavone. Bulldozers, hydraulic excavators, and dump trucks were common sights in the area a decade ago, and they are equally active today, carving out paths for roadways (Fig. 2), leveling fields for cultivation, and removing soil for sale to farmers. The unfortunate side effect of these practices is the destruction of dozens of archaeological sites. The former presence

Figure 1. Map of the chora of Metaponto indicating ICA survey zones.
of tombs is often indicated by only one or two telltale sherds left behind (such as fragments of black-gloss or red-figure pouring and drinking vessels). Ancient farmhouses are tougher to eradicate, as the meager remains of this scooped-out example in the Feroleto locality testify (Fig. 3). It had been spared complete destruction by its marginal position, partially obscured in a modern stand of trees.

Despite these difficulties, the survey crew managed to explore significant portions of several archaeologically rich localities including Incoronata, Fronte San Pietro, il Salice, il Casone/lOvile, Fosso del Lavandaio, San Basilio, and Feroleto, as well as several fields on the lowest slopes of the Cavone River valley. A total of 2.83 km$^2$ of new coverage was added, bringing the overall coverage to-date to 11.5 km$^2$ (out of 33 km$^2$ bounded by the transect; (Plate VI, top). To the total of 210 sites documented in previous seasons were added 110 new sites, while ten known sites were revisited. Thus the Metaponto survey has documented a total of 939 sites between Bradano and Cavone and stands to reach beyond 1000 in its next season.

Among the most interesting areas investigated in 2003 are the azienda agricola (commercial farm) at Incoronata, the marine terraces overlooking the Lavandaio stream, and the locality centered on the Norman castle of San Basilio. Despite decades of deep plowing, the fields of the azienda agricola at Incoronata overlooking the Basento valley still contain significant concentrations of Iron Age indigenous artifacts (Fig. 4), the remnants of habitations (huts), and tombs. There are also many Greek tombs on these terraces, both at the edges and in the interior (the presence of Greek farmhouses, however, is minimal). Although one small group of two to four previously undisturbed tile tombs was noted in the cut of a new irrigation trench, most are already in advanced stages of dissipation and artifact dispersal, including the tomb which produced this highly unusual bronze instrument-handle terminating in an elegant duck head (Fig. 5).

The valley of the Lavandaio stream and the surrounding terraces, on the contrary, were densely populated with Greek farmhouses and tombs. The 2001 field survey campaign ended here with the discovery of a large farmhouse and possible kiln in the valley, Site 829 (the subject of a magnetic gradiometer survey this year, as reported by Dan Davis in this volume). Immediately north of Site 829, on the terrace edge overlooking the valley, was discovered one of the largest sites ever encountered in the Metaponto field survey: a scatter from a Greek residential structure covering approximately 3000 m$^2$ and producing the third largest collection of diagnostic artifacts made by ICA between the Bradano and Cavone (Fig. 6). This site (876) also produced several fragments of terracotta architectural revetments, terracotta figurines, and heavy terracotta basins (for mixing and grinding foodstuffs and other household tasks), as well as fragmentary grinding stones (for milling grain) and large quantities of cooking, storage, and coarse (table) ware fragments. More than a farmhouse, this was probably a villa, the residence of a local notable whose property was concentrated in the vicinity of the Lavandaio.
In the lower end of the Lavandaio valley, the survey crew had to peer through the “haze” of medieval and modern artifacts and structures surrounding the castle of San Basilio to identify signs of earlier activity. The most intriguing such sign was a wash of Archaic Greek artifacts—including votive miniature vessels and black-gloss Ionic cups—tumbling down a heavily eroded, macchia-covered slope (Fig. 7). The artifacts from this site (867) indicate the existence of a Greek sanctuary, which was probably attached to an extinct spring gushing from the slope. Several artifacts in the assemblage have clay fabrics and decorative techniques reminiscent of Mycenaean-era pottery, suggesting a Greek presence contact—even if only transitory—in this part of the Metapontino in the Bronze Age. If more evidence of Mycenaean activity can be found at Site 867 in future seasons, it may prove an important companion to the Mycenaean Greek site further inland, on the marine terraces overlooking the Basento River at Termitito, excavated by the Metaponto Museum two decades ago.

The 2003 field season also saw a refinement in field techniques following the advances made in 2000–2001 (see articles by Prieto in The Study of Ancient Territories 2000 and Thompson in The Study of Ancient Territories 2001). The survey’s Global Positioning System capability, which permits rapid and highly precise mapping of sites and plots, was dramatically expanded with the addition of two new portable Trimble receivers, a Geo-XT and Pathfinder Pocket, to complement the backpack-mounted Pathfinder Pro XRS introduced in 2001. The Geo-XT is in fact a rugged handheld PDA-type computer equipped with small color display screen and Windows® CE operating system. The Pathfinder Pocket is a hands-free receiver which lacks a user interface (keyboard, screen, etc.) but can be attached to a PDA or tablet computer running a mobile operating system (like the Geo-XT) or full Windows®. A rugged iX104 tablet computer running Windows® XP was purchased from Xplore Technologies of Austin for use with both Pathfinder models. ESRI™ ArcPad® mobile GIS software was installed on both the Geo-XT and iX104 for field mapping.

As a result, the well-worn paper maps, veterans of numerous field seasons, were retired at Pantanello. All primary map-based operations performed in the field (plot boundary mapping, site positioning, prior survey plotting, distance and direction calculations, etc.) were combined in a single digital platform which could not only capture new data but also display data from prior seasons in color, reducing the number of unwanted revisits to known sites and plots (a chronic problem in the survey given the fragmentary nature of prior coverage between Basento and Cavone, the changes in field boundaries in the intervening decades since the maps were drafted, and the difficulty of identifying small properties on large maps). Both new units can also display scanned and geo-referenced aerial photographs, topographic maps, and other GIS data (geomorphology, hydrology, etc.).

Figure 4. Iron Age ceramic artifacts recovered from Site 840.
Descriptive information for plots and sites was still recorded in notebooks this year (for later transcription into database files), but it is possible that by the next field season the mobile GIS software will be able to directly accommodate this information, too, making the workflow entirely digital. Already this new method saves hours of tedious map-tracing, pacing, and calculation. The iX104’s fully functional operating system, which puts the power of a desktop machine into a tablet format, also allows the field crew to access descriptive and quantitative information recorded in previous seasons (site notes, artifact types and counts, etc.) transcribed into database files, eliminating the dilemma of either carrying cumbersome photocopies of notes into the field to help identify known sites, or leaving them at base where they cannot be consulted until the end of the day’s fieldwork. In effect, the entire Metaponto survey project can now be accessed and updated in real time through a single digital device.

Survey Volume
By the final stage of the field campaign, in late September, Prof. Carter and many of the principle ICA researchers were present at Metaponto to study materials and attend conferences, including Vincenzo Cracolici (black gloss pottery), Cesare D’Annibale (prehistoric, Greek coarse ware), Smadar Gabrieli (cooking ware), Marsha Robbins (Greek and Roman transport amphorae), Erminia Lapadula (ceramics, Roman to late medieval), Richard Fletcher (creator of the artifact database), Eloisa Vittoria (black gloss and greyware pottery, Greek coarse wares),

Figure 5. Bronze handle from Site 832.

Figure 6. A majority of the 389 black-gloss fragments recovered from Site 876.
Cesare Raho (graphic illustration), and the author (survey methodology, settlement pattern analysis). Rebecca Miller, who is studying the terracotta figurines from both the survey and the Pantanello Sanctuary excavations, worked at Metaponto earlier in the summer.

Accordingly, the opportunity was taken to host an impromptu meeting at Pantanello to discuss preliminary issues of data organization and presentation for the forthcoming first volume on the Metaponto field survey, *The Chora of Metaponto: Archaeological Field Survey I. Bradano to Basento*. The four-hour meeting produced many useful suggestions and served as the prelude to a formal week-long seminar to be held at Pantanello in September 2004, in which the first draft of the survey volume will be discussed and critiqued by the assembled contributors and a panel of experts in archaeological field survey in Mediterranean countries.

![Figure 7. Mycenaean and Archaic Greek ceramic fragments recovered from Site 867](image)
Figure 1. The chora of Metaponto.

Figure 2. Italian and ICA excavations at Incoronata greca. The grid in the upper right represents the 2003 gradiometer survey.
The use of magnetometers for detecting buried archaeological features has a long and illustrious history in Italy. During the 1960s, the Archaeological Prospection Section of the Lerici Foundation (Sezione Prospezioni Archeologiche della Fondazione M.M. Lerice del Politecnico di Milano) employed this newly invented instrument first at the ancient site of Sybaris with outstanding success, then at nearby Metaponto. Here, from 1968–1971, R.E. Linington used a proton magnetometer to conduct a wide-area magnetometer survey of the ancient city, revealing the Hippodamian street plan, temples, kilns, and agora, all without turning a spade. The quality of survey work at both Sybaris and Metaponto, and the sheer amount of interpretive data collected, set the standard for future magnetic surveys.

Today, as a result of great strides in technology and computing, the magnetometer is one of many geophysical survey instruments that produce images of buried features. Others include ground-penetrating radar (GPR), which sends waves of electromagnetic energy into the ground and measures reflections of varying densities, and the soil resistivity meter (SRM), which detects changes in soil porosity caused by human alterations. Despite the proliferation of these and other instruments, the magnetometer (and its offshoot the gradiometer) remain the mainstay of archaeological prospection. The instrument consists of two, vertically-aligned sensors and a small onboard computer for collecting readings. As the surveyor walks a pre-established grid, the sensors constantly measure the earth’s magnetic field and detect fluctuations caused by buried features. These fluctuations have three main causes: 1) the presence of iron artifacts; 2) the presence of thermally-altered materials such as ceramics, bricks, and hearths, which retain a certain amount of “thermoremanence,” or remnant iron, from the firing process; and 3) the differences in the amount of naturally occurring magnetic minerals in soils caused by human alterations, such as pits, ditches, and roads. Building stones, particularly limestones, are generally magnetically neutral, and therefore appear as useful intrusions, or discontinuities, in gradiometer data.

In August of 2003, the author and Albert Prieto of ICA, with the help of two Danish volunteers, Bjørn Lovén and Karen Christiensen, added to Lerici’s early efforts by conducting a series of gradiometer surveys in the chora of Metaponto. The wealth of surface artifact scatters in the chora has long presented an attractive prospect for discovering what lies below the surface. In addition, it was hoped that multiple gradiometer surveys might aid in quantifying how much damage modern plowing has wrought on the archaeological landscape.

The first of three areas surveyed was the northeast spur of Incoronata grea, a combined indigenous and colonial Greek settlement from the 8th to 6th centuries BC (Fig. 1). The site is situated atop a marine terrace overlooking the Basento valley. Italian excavations began here under Dinu Adamesteanu in 1971 and continued for over two decades under Professor Orlandini of Milan University. In 1977–1978, a team from ICA excavated several trenches on the southeast spur, uncovering numerous pits containing indigenous, colonial, or mixed deposits of 8th and 7th century date. They also discovered a rectangular structure, as well as the remains of a small sanctuary dating to the first half of the 6th century BC.

On the nearby flat-topped northeastern spur overlooking the Basento valley itself, only a few small exploratory trenches were opened. Despite a surface densely covered with ceramic sherds, none of the trenches revealed any significant traces of architecture. Since this large area (2,700 m²) was a likely candidate for ancient buried features, we spent three days surveying here (Fig. 2). After processing the gradiometer data, we were able to discern several interesting features, including several large pits (possibly hut foundations or refuse pits), numerous intense magnetic spikes (which could have been ancient iron artifacts or modern debris), two elliptical structures (perhaps early hut foundations), and faint remains of rectilinear structures (Fig. 3). Unfortunately, the high signal-to-noise ratio caused by the density of ceramics on the surface would allow us to make only very tentative identifications. This area is certainly worthy of further investigation.
Our second survey concentrated on Site 327, a small pottery and tile scatter located in the fertile uplands between the Basento and Bradano River valleys, 6 km west-northwest of Metaponto. The ceramics date from the 4th to 3rd centuries BC, roughly contemporary to the 4th century BC farmhouse site at Ponte Fabrizio, 500 m to the north. The site was first detected and recorded during field survey in 1982 and then re-surveyed in 2001. In the intervening 19 years, the actual number of ceramics visible on the surface declined by nearly 44%. Adjacent fields had been recently plowed, which probably explains the marked decrease in visible evidence. We were not optimistic about finding buried structures, a sentiment which proved realistic after processing the data. Although we detected a low ceramic “noise” throughout the site, evidence of buried foundations eluded us; the gradiometer detected no linear features whatsoever. The plow, it would appear, did its job well.

The final survey concentrated on Site 829, a surface artifact scatter located in a fallow field southwest of Metaponto along a tributary of the Cavone River. Surrounded on two sides by terraces full of clay deposits, the site was first discovered and recorded during the 2001 field survey (Fig. 1 & 4). In addition to the surface ceramics of Classical and Hellenistic date, the site is littered with river cobbles of various sizes, large tile fragments, and large lumps of vitrified clay (ceramic slag).

We discovered buried building foundations during the first morning of surveying, and over the course of the next two days—the last scheduled days of the season, of course—we widened our survey area to 60 m x 60 m to reveal a large rectangular structure (40 m x 27 m) with obvious interior divisions (Plate IV, bottom). The immense size of Area A (486 m²), with interior walls apparent only near the southeast foundation, makes interpretation difficult, as does the site’s intense ceramic noise. If it was a covered structure, the space would certainly have been subdivided to provide roof support. Judging from surface finds, the roof would have been tiled. Perhaps the interior wall foundations have since disappeared. If it was an enclosure, say for animals or a small garden, then an extension, termed Area B, may be assumed to be the actual domestic structure.

Area B (7 m x 23 m) is defined by the extension of Area A’s southeast foundation wall and what appears to be another foundation wall (a weak linear anomaly) separating it from the “courtyard.” This corridor space may have been subdivided, but traces of foundations perpendicular to the outer SE wall are difficult to distinguish from the background noise.

We named Area C (15 m x 22 m) the “courtyard” because it appears to be bordered on three sides by well-defined foundation walls. It contains a host of intense magnetic anomalies that peak above the ceramic noise, the largest of which is quite wide and off center. By virtue of the number of surface ceramics concentrated in this area, as well as tile

Figure 3. Magnetic shaded relief plot of Incoronata greca. The black circles indicate intense magnetic spikes caused by buried iron objects (ancient and modern); white circles denote pits and ditches; white circles with “E” indicate apparent elliptical structures; white lines represent buried linear structures, possibly foundation walls. The dark parallel lines are tire tracks, probably of a tractor.
fragments and highly-magnetic lumps of vitrified clay, this largest anomaly appears to represent a kiln. Its neighboring anomalies may be smaller kilns or concentrations of ceramic debris such as kiln wasters.

Area D on the northwest side of the courtyard appears to have communicated somehow with Area A. Likewise with Area E, whose western border fades into the field of pottery noise.

The resolution of Site 829’s gradiometer image is sufficient to make some preliminary observations and to fit it into the archaeological context of other farmhouses, both within the chora and at other Greek sites of the Classical and Hellenistic periods.

The first aspect to point out is the large size of the structure:

Area A: 486 m$^2$
Area B: 161 m$^2$
Area C: 330 m$^2$
Total: 977 m$^2$

Within the chora of Metaponto, this is certainly the largest rural structure documented to date. Throughout the Mediterranean of the Classical and Hellenistic periods, it numbers among the largest. Up to this time, the largest farmhouse in the chora from the 4th century BC was excavated at Fattoria Stefan. This farmhouse occupies some 192 m$^2$ and could easily fit within Area A on our plan. If we range farther afield in time for comparisons, we find a late Hellenistic pastas (or corridor) farmhouse at Sant’Angelo Nuovo, which measures 11.9 m x 22.5 m (268 m$^2$), and a 4th century AD Roman rural dwelling at San Biagio, which measures 17.7 m x 17.7 (313 m$^2$). The only rural structure in the area that approaches the size of Site 829 is the Roman villa at Termitito. It dates from the Late Republican period to the 4th century AD and measures 30 m x 40 m, an estimated 1,200 m$^2$.

Only in Sicily and on the Greek mainland do we find contemporary houses of comparable size. Two colonial Greek houses at Camarina, “Jurato” and “Capodicasa” in Sicily both dating to the 5th century BC, enclose 600 m$^2$ and 437 m$^2$ respectively. Like Site 829, their large courtyards are located on the northern side. Southeast of Athens at Palaia Kopraisia, two large Classical farmhouses with towers, but without kilns, were discovered. One enclosed an area of about 1,200 m$^2$, the other 700 m$^2$. Both had courtyards facing westward.

Figure 4. Site 829 during the 2001 field survey. The maquis covers thick beds of clay on this and other nearby marine terraces. Surface artifacts include (left to right) large and small lumps of vitrified clay (kiln slag), river cobbles, and ceramic sherds.
None of the house sites just mentioned had kilns, although within the chora of Metaponto there are a number of farmhouse sites that did. The farmhouse at Termitto had one, as did the 6th century BC farmhouse at Cugno del Pero and the indigenous settlement at Tolve. A kiln was discovered near the farmhouse at Sant’ Angelo Vecchio, and a tile kiln appears to have served several farmhouses in the neighborhood of the pastas house at Sant’ Angelo Nuovo. The large 4th century BC farmhouse at Cappa d’Amore, still unpublished, had a well-preserved kiln located some 30 m away. It is of the cylindrical updraft type, a regular shape for ancient Greek kilns.

To our knowledge, however, none of these cited examples of farmhouses included a kiln placed within the enclosure. This seems to make sense: kiln fires can burn above 900 degrees centigrade. Dangers from heat and embers come immediately to mind. However, ethnographic research in Tunisia, for example, has shown that kilns are often placed within houses. Nevertheless, we should not discount the hypothesis that Site 829 was a ceramic production center, a rural industrial site, especially when we consider the convenience and close proximity of water and clay beds. Also, in terms of surface artifact count and scatter area, it numbers in the top thirty of nearly a thousand sites surveyed within the chora. While this idea does not agree with the surface finds suggesting domestic habitation—loom weights and cooking ware sherds, among other things—it is possible that the site changed owners or function over the course of its lifetime. To summarize, whether Site 829’s kiln was designed for domestic use or commercial production, or both, remains unknown—and unknowable—at present.

As exceptional and important as Site 829 appears to be in the archaeology of Classical and Hellenistic farmhouses, only a proper ground-truthing (i.e. excavation for verification) can confirm our tentative interpretations of the gradiometer data. In a wider sense, the contrast between Sites 327 and 829 is striking. When first documented during the 1982 field survey season, Site 327 was characterized by an “extremely heavy” surface artifact scatter over an area of ca. 40 m x 30 m and the abundant presence of foundation stones, all signs akin to our discoveries at Site 829. When it was revisited in 2001, Site 327 was characterized by only a “heavy” surface artifact scatter covering an area of ca. 70 m x 50 m—more than twice the original area—and no foundation stones were visible in the immediate vicinity. Clearly they had been collected and removed by the owner, and the site had been spread and diluted by 20 years of plowing. The 2003 gradiometer survey shows that the site has been completely erased at an architectural level. Such may be the fate of Site 829, and others in similar states, unless the decision is made to excavate and document it to preserve a record of its potentially extraordinary features.
With the passing of time the Centro di Agroarcheologia at Pantanello is becoming increasingly important. It is considered a fundamental point of reference for bioarchaeological studies in southern Italy, and it is the object of ever more frequent visits by scholars, university students, institutes, school groups, and other persons interested in archaeology. The Centro’s popularity is due largely to the proximity of several major archaeological attractions in the area: the ICA excavations of the Greek sanctuary at Pantanello, the National Archaeological Museum at Metaponto, and the excavations in the ancient urban center of Metaponto sponsored by the Superintendency of Antiquities for Basilicata.

Numerous activities took place at the Centro in the summer of 2003. In June Prof. Rebecca Miller Ammerman of Colgate University continued her research on Metapontine terracotta votive figurines and plaques, with the help of two student assistants. Profs. Maciej and Renata Henneberg of the Adelaide University Medical School furthered their research on the skeletal remains from the Pantanello Necropolis with two Australian assistants, R. Hepworth and J. Cecchin.

In the first three weeks of August the Centro hosted the ICA magnetometry team (see contribution by D. Davis), followed by the ICA field survey team (see contribution by A. Prieto) from late August through early October. Throughout the summer the Centro served as the logistical base for a number of other scholars and experts contributing to the survey publication: E. Cracolici, R. Fletcher, S. Gabrieli, E. Lapadula, C. Raho, M. Robinson, and E. Vittoria. All of the Centro’s guests enjoyed its wide range of bibliographic and technological resources, including ICA publications, standard and hard-to-find publications on south Italian archaeology, computers, fax, telephone, photocopier, etc. A digital projector was purchased for instructional demonstrations of software and field techniques and professional presentations. The Centro also acquired a digital camera for the use of collaborators and researchers.

In September many of the Centro’s collaborators participated in a seminar at Matera promoted by the Region of Basilicata under the auspices of the Superintendency of Antiquities; the theme was “Daily Life in Magna Grecia: Metapontine Farmers at Pantanello, Agriculture, Diet, and Health.” Papers were delivered by Prof. Joseph Carter, S. Gabrieli, Prof. Henneberg and Dr. Henneberg, and Drs. Lorenzo Costantini and Loredana Biasini Costantini, researchers in the Department of Bioarchaeology and Electron

Figure 1. The library and conference room at Pantanello.
Microscopy at the Museum of Oriental Art in Rome. The seminar was well-received and garnered much attention from the Italian press. The proceedings have been published on the Region’s web site (www.basilicatanet.it).

In the fall of 2003 several collaborators of the Centro launched a project of photographically documenting the changes in natural and agricultural vegetation in Basilicata through the progression of the seasons, in order to create a visual archive for future studies. Many of the images capture the beauty of the region’s varied landscapes, which have made it a source of inspiration for artists and scholars.

This year the Centro was further enriched and equipped through the purchase of additional office furnishings and technological equipment, as well as a second telephone line. In the library-conference room a large table was constructed with space for twenty persons, ideal for individual research and professional meetings. In the house, the principal room of the ground floor was converted into an administrative office which can function also as a reception area for small working meetings when the library is occupied by researchers. An adjacent room was converted into a work-area for the cleaning, sorting, and cataloguing of artifacts recovered during the field survey. The house was made more comfortable for guests and researchers through the purchase of new appliances and kitchen equipment. This year also saw the installation of climate control equipment in the office spaces, library-conference room, and house to keep both equipment and occupants cool in summer and warm in winter.

Figure 2. ICA’s Metaponto home, with office space on the ground level and living area above.
CONSERVATION

2003 Fieldwork

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Anca Dan (small finds, Site 151), Sorbonne
Jada Hansen (pottery, Site 151), U. of Minnesota
Lyudmila Kirichenko, Kyiv. U.
Evelina Kravchenko (prehistoric pottery), Inst. of Archaeology, Kyiv
Dott. Eugenia La Rosa (lithics), U. of Rome
Valerio C. Valeri (stamped amphorae), Classics, UT Austin
Rowanne Wayland (terracotta), Rutgers U.
Evgeniy Zherebtsov (grave monuments), Sevastopol
Denis Zhuravlev, (red-slip ceramics), State Historic Museum, Moscow
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Dr. Richard Posamentir, DAI, Istanbul

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Olga Andreeva (Medieval pottery), NPTC
Dr. Joseph Carter (Greek pottery), ICA
Dr. Andrei Opait (Roman pottery), Toronto
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Metaponto
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Dott. Vincenzo Cracolici (black-gloss pottery)
Cesare D'Annibale, Parks Canada (prehistoric materials, Greek coarse ware)
Richard Fletcher, Sydney (database)
Smadar Gabrieli, Sydney (cooking ware)
Jada Hansen, U. of Minnesota (data entry)
Dott. Erminia Lapadula, U. of Lecce (Roman and Medieval ceramics)
Dott. Cesare Raho, U. of Lecce (photography and illustration)
Marsha Robbins, U. of Southampton (transport amphorae)
Dott. Eloisa Vittoria, U. of Lecce (black-gloss, grey ware, coarse ware)

Remote Sensing Survey
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Dan Davis, co-director, ICA
Karen Christensen, Institute of Archaeology, U. College London
Bjørn Loven, Royal Holloway, U. of London

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Caterina Pelazza, U. of Lecce
Amber Seely, UT Austin


Lebedinski, V. “Underwater Archaeological Investigations of Chersonesos and Its Chora: Results and Perspectives.” 118–119.


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**Invited Papers at Meetings by ICA Staff and Collaborators**


87
Carter, J.C. The Contributions of the Sciences to the Study of the Greek Chora.
Vita quotidiana in Magna Grecia: gli agricoltori del Metapontino a Pantanello. Agricoltura, Alimentazione, Salute. Matera, Italy. 20-21 September, 2003
Costantini, L. e L. Costantini Biasini. L’Agricoltura della Basilicata antica alla luce delle evidenze archeobotaniche di Pantanello–Metaponto
Carter, J.C. Avanzi della tavola, allevamento e cacciagione a Metaponto antica
Gabrieli, S. Sapori Antichi: la cucina nell antica Metaponto
Henneberg, R. and M. Henneberg. Nutrizione e salute degli antichi Metapontini
De Siena, A. Organizzazione del territorio, bonifiche e presenze indigene a Metaponto

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