Museum International

No 183 (Vol XLVI, n° 3, 1994)

Research laboratories

CONTENTS

No. 3, 1994

Front cover
Analysis of the colour separation of *The Astronomer* by Johannes Vermeer (1668, Louvre Museum) as shown in an image evoking the colours of the spectrum. Still photograph taken from the television broadcast *Palettes*, a co-production of France 3/Arte/Delta Image/Louvre Museum.
Photo: © Delta Image.

Back cover
Basalt. Photo taken with a petrographic microscope. Royal stoneware, Syria, middle second millennium B.C., Louvre Museum, Department of Oriental Antiquities.
Photo: © Laboratoire de Recherche des Musées de France.

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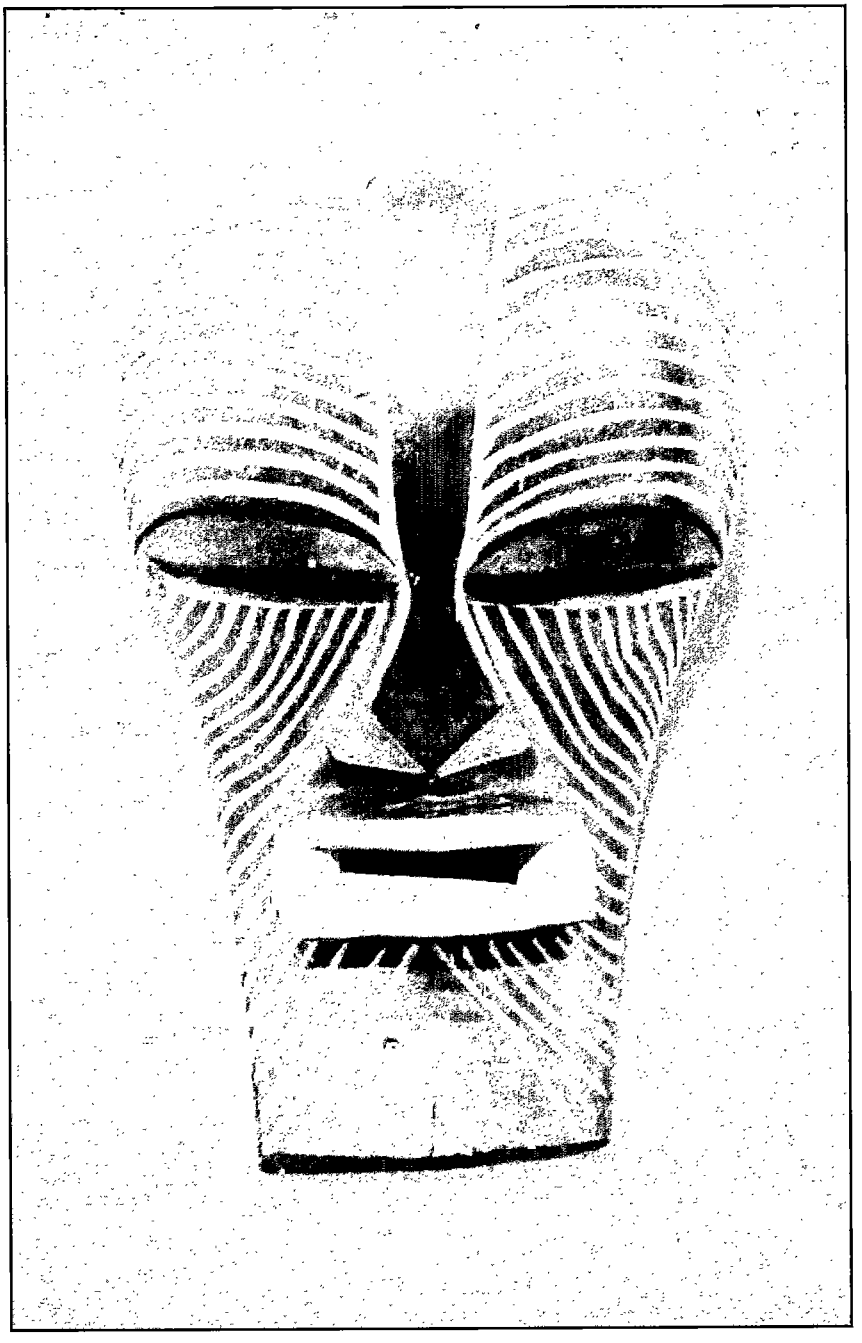
ISSN 1350-0775, *Museum International* (UNESCO, Paris), No. 183 (Vol. 46, No. 3, 1994)

Published by Blackwell Publishers, 108 Cowley Road, Oxford, OX4 1JF (UK) and 238 Main Street, Cambridge, MA 02142 (USA)



STOLEN

African carved wood mask entitled Dream, *decorated with white stripes on a black background and with a rectangular red mouth. Height: 30–35 cm; width: 20–25 cm; depth: 15–20 cm. The mask was stolen in October 1991 from a museum in Namur, Belgium. (Reference R.68.83.11023 Interpol Brussels)*

Photo by courtesy of the ICPO–Interpol General Secretariat

Editorial

Scientific research is increasingly called upon to unlock the secrets of museum objects and artefacts. Advances in physics, chemistry, geology and the natural sciences have brought research laboratories into a new and challenging partnership with museums throughout the world. Many of these laboratories are directly associated with major museums and are thus concerned primarily with the conservation and restoration of collections; others have developed sophisticated methods to identify the materials used by the artist or artisan and to reveal the techniques employed, the origin of the raw materials and even the circulation of the object from the time of its creation to the date of its acquisition by the museum. Such research has shed light on the development of cultures and communities by tracing the currents of civilization, exchanges among peoples, everyday practices and rituals, in short, the development of human behaviour since prehistoric times. By creatively exploiting this growing body of knowledge, museums are able to refine our perceptions and understanding of the past.

The articles in this issue's thematic dossier emphasize research rather than conservation in order to present a sampling of recent scientific inquiry which has spawned new thinking on a variety of old objects. They were selected under the vigilant eye of Mathilde Bellaigue, who served as co-ordinator and who is better known for her work at the Research Laboratory of the Museums of France and as vice-president of the ICOM International Committee on Museology. Our purpose is to demonstrate how museums can go beyond the simple presentation of the cultural and natural heritage so as to transmit in-depth knowledge of materials, techniques, and creative and historical processes. The dialogue between art and science so ardently advocated by the figures of the Enlightenment (and so appropriately evoked by Mathilde Bellaigue) has, perhaps, never before been so attainable or so fruitful.

M.L.

ISSN 1350-0775, *Museum International* (UNESCO, Paris), No. 183 (Vol. 46, No. 3, 1994)

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Towards a new interdisciplinarity

Mathilde Bellaigue

Until the end of the last century, our knowledge of the artistic and archaeological heritage of humanity was based on the visual perception of forms, on historical and stylistic data and on the interpretations of art historians. The work of art was understood only in terms of our knowledge of the period, the social and cultural circumstances in which the work was produced (commission, patronage, atelier, school, or by the artist alone), the relations between cultures, countries or artists, and any cross-influences. Until recently our only sources of knowledge of artists' work – in so far as we had access to them – were their writings: major treatises (Leonardo da Vinci, Cennini, Dürer), diaries (Delacroix), books (Kandinsky, Klee) and correspondence (Van Gogh); their apprenticeship or collaboration (Masolino/Masaccio); their affinities and working companionships (Van Gough/Gauguin); their discovery of new materials and processes; successive schools or movements; and their dealers' or collectors' documents and catalogues (Vollard, Guillaume, Barnes, Kahnweiler). All this amounted to a great deal of material it is true, yet when we look at the research methods available to us today, it seems insufficient.

As for archaeological objects, our knowledge was based on observation of the site, its environment, the stratigraphy of excavations, comparison of styles, the discovery and deciphering of written material, reports or journals on excavations and historical documents.

In both cases, knowledge and interpretation tended to be rather 'non-scientific', in the sense of what were called 'non-scientific disciplines' as opposed to 'scientific disciplines' (which we now call respectively the human sciences and the natural sciences).

For some fifty years now, new vistas have gradually been opened up by the increasingly efficient and widespread use of techniques of examination and analysis, research optimization methods in the natural sciences and closer links between researchers in the two above-mentioned fields, all too infrequent though they still are. This has led to what might be termed 'science in the service of art' through which conservation and restoration have been improved and a deeper and more detailed knowledge of the cultural heritage acquired, thanks to the science of materials. The history of art, and more generally history itself, have benefited from this development.

A substantial new body of knowledge has been formed with contributions from many laboratories, some of which are quoted here as examples. These may be attached to museums (for example, the Research Laboratory of the Museums of France (LRMF) in the heart of the 'Grand Louvre', which serves all French public collections, the laboratories in the British Museum, the National Gallery, the Smithsonian Institution, the Paul Getty Collection); or to universities (Research Laboratory for Archaeology and the History of Art, Oxford University). They may also work on an autonomous basis for their countries' museums (Tokyo National Research Institute of Cultural Properties), or study works of art or archaeological objects only from time to time (ANSTO in Australia).

In 1980, people were still talking about the '*mysterious* life of masterpieces' (exhibition at the Grand Palais, Paris: curator Madeleine Hours, then director of the LRMF). Fourteen years later, some 'mysteries' have been elucidated by science, but others have emerged, as we shall see in the following pages. These revelations fascinate the public when they learn about them. The media often take them up,

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sometimes in a sensational and anecdotal manner. It is for the museums, in pursuance of a proper cultural policy, to make judicious use of this additional knowledge by integrating it into their exhibitions.

Now in the late twentieth century, analytical techniques and the science of materials enable us to probe the very heart of matter and to analyse the creative gesture that embodied the artist's inspiration and choices, even if we must modestly admit that our knowledge will probably always fall short of the mystery of creation. It is therefore unimaginable that museums in the twenty-first century should fail to give these discoveries pride of place.

Museum International has often carried articles by curators, laboratory researchers and technicians on matters relating to conservation and restoration. They have discussed the physiochemistry of objects, the relations between curators and scientists, questions relating to climatology, hygrometry, light and various factors of deterioration, as well as problems encountered in the conservation of specific materials (metals, textiles, wood). Descriptions have been given of laboratories (South and South-East Asia) and restoration workshops (Guatemala). These are but a few examples.

Readers of this issue of *Museum International* should not be surprised on perusing its pages to see purely museological concerns taking second place to scientific illustrations and articles relating mainly to the natural sciences. The main contributors today are physicists and chemists.

This is the first time that a complete issue of *Museum International* has been devoted to the application of 'scientific research to the cultural heritage in the interest of new knowledge'. My position among the researchers of the Research Laboratory of the Museums of France and my first-hand knowledge of their work, which is not confined solely to the investigations necessary for restoration or acquisition, led me to propose to the editorial staff an issue on this theme, prepared in collaboration with researchers from different regions of the world. I am happy to say that they agreed immediately to collaborate with us and that the Editor responded positively to my proposal. It was unfortunately not possible to include contributions from more researchers, but it must be realized that this type of research is now being carried out nearly everywhere in the world and is being applied to heritages and cultures that vary widely in time and space.

It will be seen from these pages that the natural sciences provide us with valuable information which the human sciences alone cannot supply, in respect of a broad spectrum of works and objects, in very different materials, dating from prehistoric times to the present day.

In the field of prehistory, J. R. Bird relates the fabulous voyage across the Pacific of obsidian, a valuable volcanic material used by the inhabitants of the islands of Oceania for making weapons and tools. Geochemistry and elementary ion-beam analysis can be used to trace the origin of the material and its circulation. The approximate date at which obsidian artefacts were buried can be determined from calculating the gradual hydration of their surface. The observation of prehistoric flint under scanning electron microscopes reveals traces of matter remaining on the cutting edge of its worn parts (trace analysis), thereby enabling us to see how they were used (Maurice Bernard and the study by Marianne Christensen). These two archaeological examples take us somewhat into the field of ethnography with the study of

everyday objects that are valuable not so much because they are unusual or rare but because of the information they provide about the lives of people of whom we have no written record.

Gail Goriesky and Lambertus van Zelst show how the analysis of Mayan pottery by neutron activation can help us to establish where it was produced. This touches on problems of cultural exchanges, movement of craftsmen, borrowings of techniques and decorations from one country to another, which are brought out in the ceramic analyses of Islamic pottery by Robert B. Mason and M. S. Tite: comparative chronologies emerge from the stylistic analysis of forms and motifs, highlighting the temporary predominance of one culture over another; petrographic analysis (of the soil and kiln materials) and the analysis of glazes help us to discover when, where and how the potteries were made, to retrace their circulation between Iraq, Egypt, Iran and Syria, and the preeminence of Samarkand after the arrival of the famous 'China blues'. 'Molecular archaeology' also sheds light on the eating habits and pathology of our most distant ancestors (Goriesky and van Zelst).

Nevertheless, there remain uncharted areas, particularly in relation to isolated objects. Sadatoshi Miura used emissiography to decipher ancient inscriptions on rusty swords, but no explanation of the traces of vermilion that remained on them has yet been found. Such studies show clearly the need to take into account diachronic or synchronic series of objects in archaeological analyses.

In painting, the use of radiography, which began early this century, revealed compositions or details that were hidden beneath the finished painting: canvases already painted on had been used again or the artist had changed his mind, creating a 'pentimento'. Today this technique has become more refined and hence more effective, as demonstrated in Maurice Bernard's article on variations on the same theme in the work of Georges de la Tour.

However, artists are also craftsmen seeking the best materials, those most suited to their purpose; they keep track of changing techniques in the interests of their work, choosing either to remain faithful to traditional methods or to innovate. This is explained by Dusan Stulik who, thanks to a chronological database for pigments, demonstrates, for example, the change brought about by the use of industrial products, so that artists no longer needed to grind colours themselves, or the characteristic effect achieved by certain artists through their choice of binders.

Many museums do not derive as much benefit as they should from this wealth of information, from this marriage, which has yet to become completely successful, between science and the history of art, and this means that the public does not benefit from it either, or at least very little. It is not often that we see exhibitions that reflect the results of this research. (Surely certain alignments of shards could be made more attractive and would strike the imagination more if they were accompanied by scientific explanations.) There are, however, exceptions, as for example the Museum of Tautavel in France, or the temporary exhibitions like those at the London National Gallery (successively called *Art in the Making* and *The Making and Meaning*) or their equivalents at the Louvre, entitled '*expositions-dossiers*'. Another good example is the *Georges de la Tour ou les chefs-d'oeuvre révélés* exhibition (September–November 1993, Vic-sur-Seille, France), organized by the Research Laboratory of the Museums of France, the Museum of

Vic-sur-Seille and a researcher from the CNRS, to celebrate the quatercentenary of the artist.

It is surely only natural to wish to bring together wherever possible the discoveries of what we used to call 'non-scientists' and 'scientists', that is, researchers working sometimes on the same object but with a different angle of approach. Finally, in this day and age when the visual media hold sway, it is surely only natural to enhance our perception of the surfaces of objects with the images that are now easily provided by the most advanced techniques. Surely we have not lost forever the fellowship of the arts, sciences and techniques that was the hallmark of the European Age of Enlightenment.

It was this desire to decompartmentalize disciplines and the thrill of joint research rooted in different disciplines, in short, the wish to achieve the greatest possible interdisciplinarity in our museums – and a sense of wonder at what may result – that led us to prepare this issue of *Museum International*. ■

Tracing prehistoric materials

Roger Bird

Artefacts made from obsidian grace many a museum collection where they are frequently admired for their glass-like beauty. However, under careful scientific study, they have revealed a wealth of information about prehistoric cultures and about the movement of early peoples across vast oceanic tracts. This article describes how the Lucas Heights Research Laboratories in Australia have pioneered obsidian research in co-operation with the Australian Museum and other institutions. The laboratories, founded in the 1950s, are operated jointly by the Australian Nuclear Science and Technology Organization and the Commonwealth Scientific and Industrial Research Organization. Roger Bird began work at the Lucas Heights Laboratories in 1964 on neutron physics research and the development of ion beam analysis; he designed a facility for Accelerator Mass Spectrometry before retiring in 1992.

Volcanic activity takes many forms around the world. Explosions, towering clouds of pulverized rock, swift streams of bright-red molten rock, slowly advancing walls of blackened lava that destroy everything in their path, all provide vivid images of volcanic activity. Less dramatic but of vital importance are the longer-term results: compacted layers of ash and extended areas of volcanic rock and soil. Just occasionally, in regions of volcanic and earthquake disturbance of the earth's crust such as plate boundaries, rift valleys and ocean ridges are found very localized areas of volcanic glass – lava that cooled fast enough to avoid crystallization.

Basaltic lava has a relatively low silica content and flows freely, forming broad domes of rock. It occasionally cools with a glassy selvedge. Rhyolitic lava has a higher silica content and is thick and slow moving, forming classic cone-shaped mountains. If it cools within hours or days rather than months or years, it sometimes forms blocks or even cliffs of glass known as obsidian. Obsidian also may be found within ash deposits, among stream beds and beach boulders and other sediments eroded from primary sources.

Obsidian is an attractive material which ranges in colour from black through grey, green or yellow to red with many different patterns which occasionally have led to its being classified as a semi-precious stone. In prehistoric times, however, in cultures without access to metals, obsidian was an important resource for thousands of years for very different purposes, namely the making of tools and weapons.

The relative rarity and distinctive glassy nature of obsidian and its resistance to degradation during burial (even in tropical environments such as hot sea water) have ensured that evidence of prehistoric use is still to be found in archaeological sites throughout the world. It is readily recognizable in excavated sites, though other shiny black objects (such as burnt shell, black chert, industrial slag, etc.) may superficially appear to be black glass. The products, cores and residues are all valuable for studying ancient technologies, especially since obsidian lasts for long periods without significant deterioration.

From the point of view of the archaeologist, high-quality obsidian is an ideal material for study. The sources of raw materials used for the production of artefacts can be deduced from the chemical composition of each piece, and this provides information on the movement of people and materials that must have occurred in the past. Dates can also be determined from the thickness of the hydrated layer that forms at the surface of an artefact. However, archaeological studies of volcanic glass have necessarily been restricted to regions of significant volcanic activity. Three main regions have been dominant in such studies: the Mediterranean and Middle East, western parts of North and Central America, and Melanesia and the Pacific islands. Fewer investigations have been carried out in other regions such as Asia, Africa and South America.

Typical obsidian artefacts which were shaped by various flaking techniques.

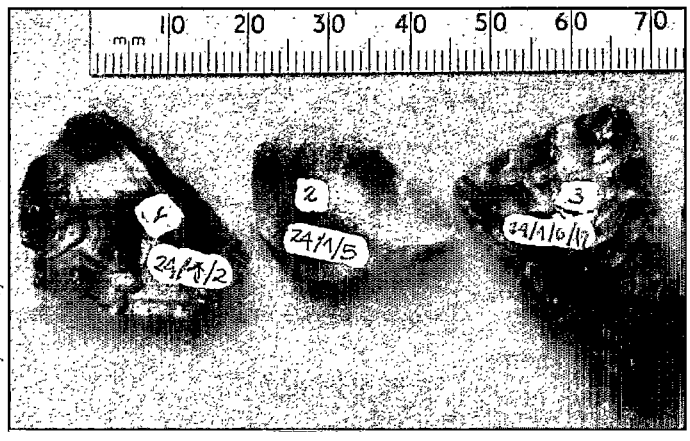

Photo by courtesy of the author

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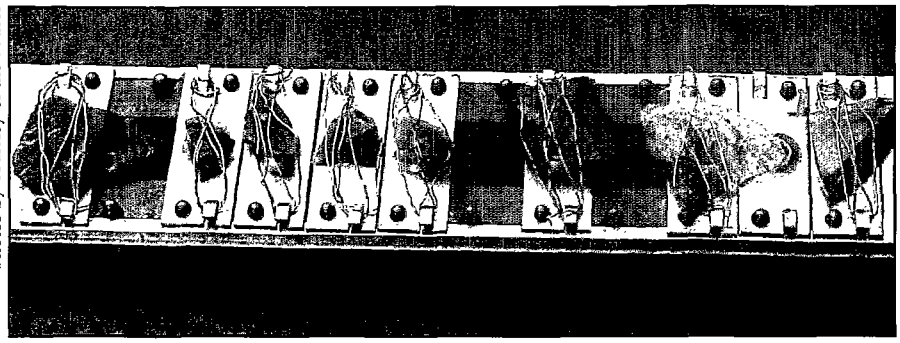

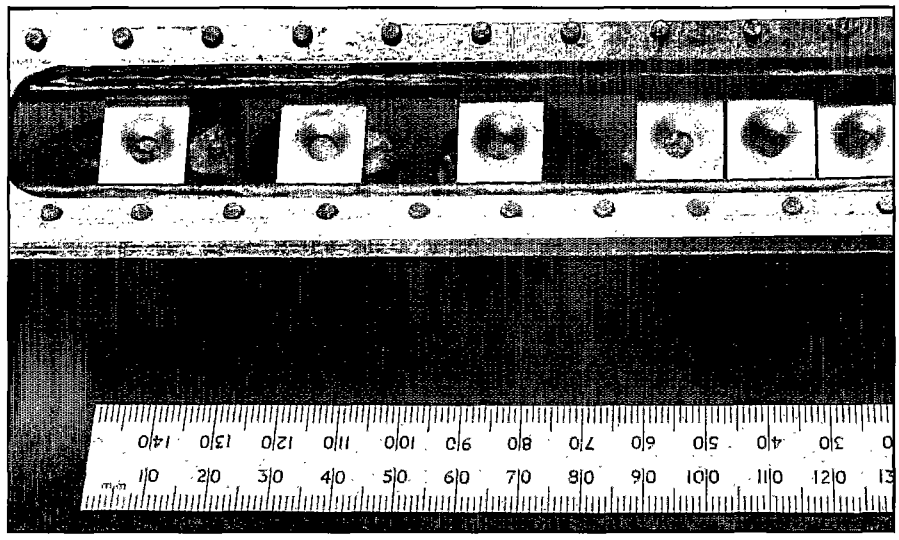

Samples with a variety of shapes are mounted on special holders (left) so that a smooth flat portion of each sample faces the proton beam (below). The set of samples is then washed in an ultrasonic bath to remove dirt and grease.

One result of archaeological studies in these regions is that large numbers of obsidian artefacts arrive back at the laboratory together with source samples from flows, beach debris, road cuttings and any other locations where it can be attributed to specific volcanic eruptions. It therefore becomes important to develop analytical techniques that can distinguish the different types of source material with minimum effort and cost.

A search for sources

Obsidian has the same composition as rhyolite (a fine-grained volcanic rock with 65 to 75 per cent silica plus minor oxides of sodium, magnesium, aluminium, potassium and calcium) in which the concentrations of minor elements vary from one source location to another and trace-element concentrations also vary, sometimes by large factors. Obsidian in one flow is found to be very uniform in composition suggesting that it is usually thoroughly brewed in a volcano before being poured out over the surrounding countryside. Successive flows from one vent are often identical in composition, whereas they usually vary from one volcano to another. Analysis of the composition of an artefact can therefore be used to determine possible sources from which the material was derived. Studies within specific geographic zones are most common but the possibility that there may be similarities between some deposits in different zones must always be kept in mind.

Much has been written about the logic and philosophy of obsidian characterization. Identical composition does not prove that an artefact came from a specific source. A slightly different problem also arises if a group of artefacts has a composition close to that of a known source but identifiably different in one or more elements. In this case, a number of conclusions are possible, making positive identification difficult. Clearly, the more extensive and more accurate the information available on source and artefact composition, as well as other evidence relating to possibilities of material transport between archaeological site and potential source locations, the more confidence can be placed on the suggested origin of artefact material.

Multi-element analysis gives the greatest information and the most reliable conclusions, especially when these involve fine distinctions between very similar material. Many different analytical techniques have been used for obsidian characterization, including neutron activation, X-ray fluorescence, electron microprobe, atomic

absorption, ion-beam analysis, etc. Ion-beam analysis is less well known than other methods but has proved to be a versatile technique for many archaeological, art and museum studies.

At the Lucas Heights ion-beam analysis facility, a small computer moves each sample in turn so that it is irradiated by the proton beam. During irradiation, the same computer collects data from the detectors and provides immediate information on the composition of each sample. A typical measuring time is five to ten minutes and the measurements are non-destructive so that they can be repeated at any time in order to check or improve the data. Sample mounting and cleaning is undoubtedly the most tedious aspect of the analysis and has been much alleviated by assistance from archaeologists. With several people handling the samples and another person looking after data processing, it is possible to analyse 100 to 120 samples a day with around-the-clock operation of the facility, provided that unattended overnight operation is not prematurely terminated by an accelerator spark, sample problems or interference by a neighbourhood possum investigating the equipment!

The Lucas Heights facility has been used for more than 10,000 measurements on samples from all known sources of volcanic glass from the Pacific region, as well as a number of samples from South America. The resulting data catalogue provides source composition for approximately 100 identified deposits of volcanic glass and information to support archaeological studies in many parts of the region.

A general feature of the use of volcanic glass in regions such as the Mediterranean, Middle East, central Africa, western United States and Mesoamerica, is that most obsidian artefacts are found at distances of 100 km or less from their source deposit. Such findings are explained by the time and effort needed to travel long distances, territorial and ownership limitations and the availability of other suitable stone resources.

In the Pacific region, on the other hand, transport of obsidian involved far greater distances. In Papua New Guinea, for example, obsidian from one local source (Fergusson Island) is found only in adjacent islands and along the southern Papuan coast as far as Port Moresby, a distance of some 500 km, which indicates a much greater mobility when travelling by boat offshore from the territory of other villages as well as a pattern of social interactions between groups. Curiously enough, no Fergusson obsidian has been found on the Australian mainland even though it is less than 200 km from the Papuan coast.

A major focus of prehistoric obsidian exploitation in the Pacific is the Bismarck Sea, an area of frequent volcanic activity, tropical islands and vegetation. A number of obsidian sources lie in the Admiralty Islands and New Britain, and material dating from at least 22,000 years ago to recent times has been found at many island sites within a range of several hundred kilometres. Analysis of artefacts shows that there were changes over time in the proportional use of different sources, permitting a study of physical and social factors which affected access to source locations:

> The widespread distribution of Lapita pottery [named from a characteristic style of dentate stamped decoration] and of obsidian may be an archaeological signature of the communications networks that linked small communities of pioneers with each other and back to their home bases.[1]

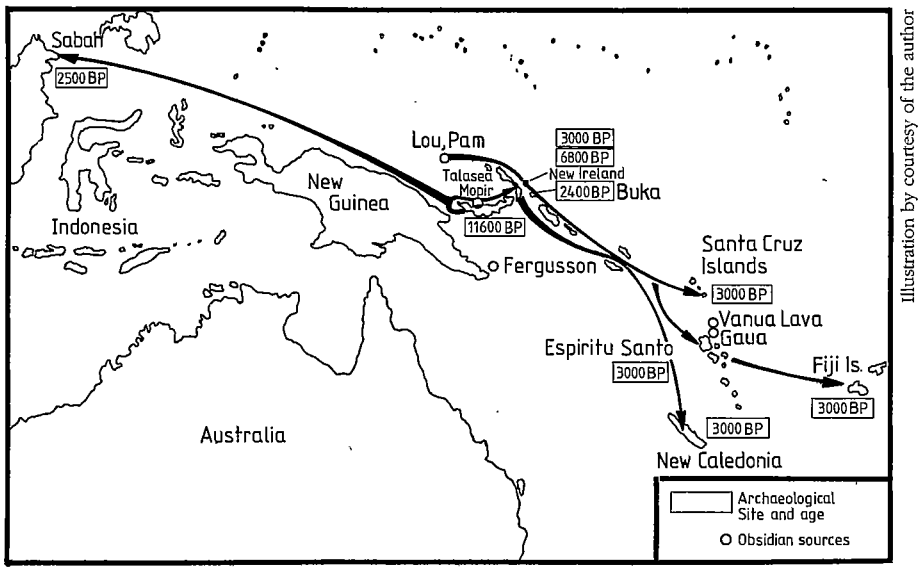

Illustration by courtesy of the author

The location and date of archaeological sites where obsidian has been found which is sourced to New Britain (Talasea and Mopir sources) or the Admiralty Islands (Lou and Pam sources).

These examples illustrate the variety of problems that can be investigated using elemental analysis to study stone tools.

The greatest journeys of all

The spread of human populations to the Pacific islands necessarily involved sea travel over long distances. The availability of a catalogue of the composition of all Pacific obsidian now provides a basis for testing hypotheses concerning the origin of such travellers. The most dramatic evidence to date concerning long-distance travel comes from Melanesia where coastal occupation sites have been dated to as far back as 33,000 years ago. Only South-East Asia and Australia are known to have been colonized earlier through significant sea voyages. Travelling among island archipelagoes would not have been especially difficult, the sea forming a bridge rather than a barrier. However, travellers would have needed to take enough food and other resources to use while becoming established at new locations; obsidian was one such resource.

Excavations of ancient sites in Melanesia show that voyagers travelled from the Bismarck Sea to the east and south-east, taking with them Admiralty and New Britain obsidian and pottery-making skills. Contact must have been maintained with obsidian sources over thousands of years of two-way travel. In fact, from 3,500 years ago onwards, people identified by Lapita pottery travelled as far as Fiji (some 3,500 km) with New Britain obsidian, manoeuvring open ocean crossings of 800 km or more. Lapita pottery has also been found in Samoa and Tonga, indicating that the conquest of the Pacific was initiated by people having contacts with the Lapita homelands in the Bismarck Sea area. It has been suggested that it is from Samoa and Tonga that Polynesians later spread throughout the Pacific area, surely the most impressive maritime achievement in prehistory.

A small number of artefacts of New Britain obsidian have also been found in Sabah, 3,500 km to the west, providing evidence of transport of material over a total distance of about 7,000 km, so that obsidian is said

to rank as the most widely distributed commodity of its period anywhere in the world. Of course, individual journeys would have been much shorter and more research is needed to provide an understanding of the movement of humans which presumably began in Asia and led to the colonization of even the most distant Pacific islands.

On Easter Island, some 3,000 km off the coast of Chile, four outcrops of obsidian have been identified as being rather similar in composition to the obsidian of New Zealand's Mayor Island, more than 7,000 km away. Known sources of obsidian on the South American mainland are different in composition. Did the first humans to arrive on Easter Island come from the west or the east? Did they come from the west, go on to South America and return? If they carried obsidian with them and if original artefacts can be located, such questions can now be answered.

In conclusion, it is clear that obsidian is of unique value in dating and tracing prehistoric materials through the combined efforts of archaeologists and analysts. Automated non-destructive analysis offers many advantages and can also be used for identification of valuable materials, confirmation of authenticity and other studies of museum collections. Inter-disciplinary activities of this kind provide the basis for converting collections of objects into exciting displays of natural and human history. ■

Note

1. Torrence et al., *Australian Natural History*, Vol. 23, 1990, pp. 457–63.

Scanning a silver sword

Sadatoshi Miura, Chie Sano and Chiaki Tanaka

A new technique, which the authors call 'emissiography', peers into the heart of an artefact to reveal long-hidden features and details that traditional X-rays cannot read. It is described by its creator, Sadatoshi Miura, Director of the Department of Conservation Science of the Tokyo National Research Institute of Cultural Properties, and two colleagues, Chie Sano, also of the Institute, and Chiaki Tanaka of the Bridgestone Museum of Art in Tokyo. Their study was funded by a grant from the Japanese Ministry of Education, Science and Culture.

In 1873, a stone coffin was excavated from a fifth-century tomb called Etafunayama Kofun, located in the Kumamoto prefecture in southern Japan. The coffin was found to contain a storehouse of ancient objects, including mirrors, ornaments, ceramics, horse trappings, armour, weapons and twelve swords among which was a silver inlaid sword measuring 91 x 4 cm and weighing 1,975 g. After cleaning, seventy-five silver inlaid letters were discovered on its back. The letters were regarded as an important reference in the study of Japanese history around the fifth century (Kofun period), but their significance remained a mystery.

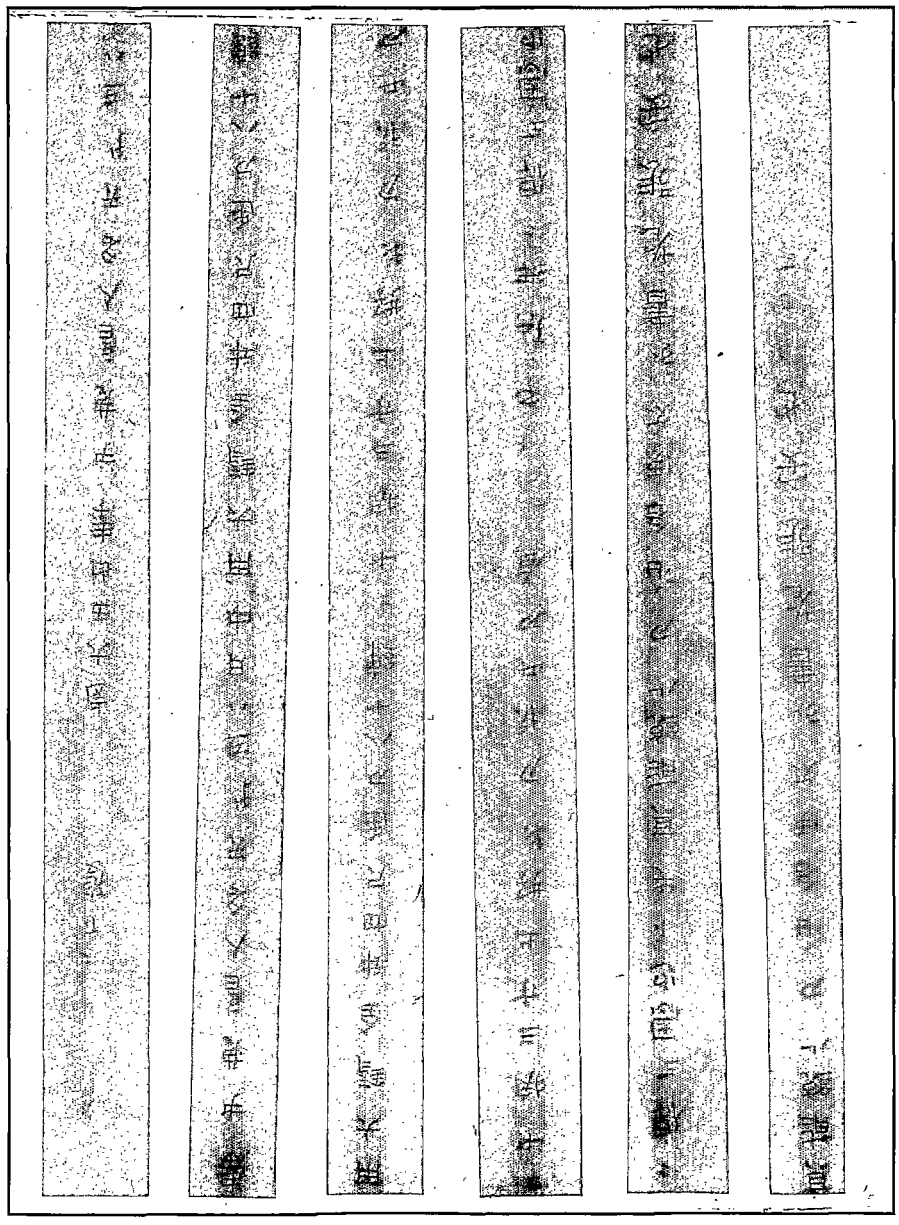

Photo by courtesy of the author

Emissiogram of inlaid letters on the back of the sword (number of inlaid letters are more than seventy-five, because the photographs overlap each other).

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In 1968, another sword was excavated, this time at Inariyama Kofun in the Saitama prefecture. There were 115 gold letters inlaid on the side of the sword, two of which indicated the date of the sword (A.D. 471), and seven revealing the name of the donor, Emperor Yuryaku.

This discovery brought the Etafunayama Kofun sword once more into the public eye. Although it had been conserved in fairly good condition at the Tokyo National Museum, the letters and patterns had become illegible due to corrosion during its 100 years of display. The authors were requested by the museum to identify the letters before the sword underwent cleaning and polishing.[1] The resources of the Tokyo National Research Institute of Cultural Properties were thus called into play.

The Institute, founded in 1952, consists of five departments: fine arts, performing arts, conservation science, restoration techniques, and archives and general affairs. A separate division is concerned with international co-operation for conservation. Within the department of conservation science are separate sections for chemistry, physics and biology. The chemistry section carries out studies of materials and their deterioration, including the study of production and provenance of bronze objects by means of lead-isotope analysis. The physics section studies the climate in museums and on sites and also develops non-destructive methods of examination. The biology section conducts research on preventing bio-deterioration by micro-organisms and insects.

The examination of the silver inlaid sword presented a number of thorny problems. For example, had the letters been inlaid on the side of the sword, they could have been clearly observed by traditional X-radiography. However, as they were placed on the back of the sword, the usual method proved inapplicable since the thickness of the iron ground along the X-ray path was much greater than the thickness of the inlaid silver; an X-radiograph showed no difference between inlaid and non-inlaid parts.

It was then decided to try photo-electron radiography, or emissiography, a method that had been developed in 1985 for research on large wall paintings in Japan and which had proved extremely useful in the study of Japanese art history.[2]

Emissiography is one of the methods of X-radiography. It consists of placing a film on the front surface of an object and may thus be used on wall paintings and inlaid metal works for which the use of usual X-radiography is difficult.[3] The method makes a photograph of secondary electrons (photo-electrons) emitted from pigments or metals when they are irradiated by hard X-rays. Heavy elements such as gold, lead, mercury and silver, emit more electrons than do light elements, producing black shadows on the resulting photograph (emissiogram) and creating a black-and-white pattern opposite to that of the X-radiograph.

There is an optimum X-ray energy for emissiography which is determined by the type of material being examined. For example, it had previously been demonstrated that gold, lead and mercury pigments could be distinguished from other light pigments by using an X-ray-tube voltage of approximately 230 kV with a tin X-ray filter. Since silver is a lighter element than gold, lead or mercury, the sword was examined with slightly lower energy X-rays (210 kV) and a 10-mm-thick copper filter. It was irradiated with an X-ray tube current of 4 mA at a distance of 150 cm for three minutes, using Fuji PB100 film.

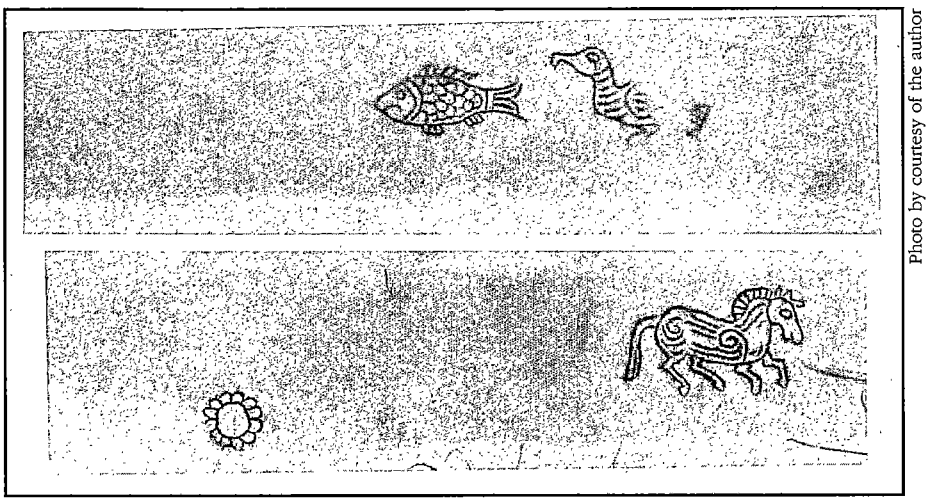


Photo by courtesy of the author

Emissiogram of inlaid patterns of both sides of the sword.

The results were impressive and provided far more information than a photograph taken after the sword had been polished: all seventy-five letters were clearly revealed, in spite of the corrosion. By enlarging the emissiograms, the calligraphy could be examined in fine detail. The silver inlaid patterns of a flower and a horse on one side of the sword and of a bird and a fish on the other, were shown clearly separated; had usual X-ray techniques been used, they would have appeared to overlap. Emissiography also uncovered a pattern of blots, which seemed to indicate that the silver may have diffused into the iron ground; as this same type of diffusion was noted at missing portions of the inlay, this enabled the observer to discriminate lacunae from simple scratches.

The sword had given rise to much historical speculation since its discovery because the letters and markings were indistinct. As a result of the analysis described above, historians were at last able to conclude that the first eleven letters indicated the name of the fifth-century Emperor Yuryaku, the same name carved on the sword found at Inariyama Kofun. In addition, it was observed that the last five letters, indicating the name of the author of the text found on the sword, were carved larger and sharper than the others; historians have interpreted this as a sign of the prestige that writing had acquired among the aristocracy of that period when characters had recently been introduced from China along with other cultural elements. Emissiography had clearly proved its usefulness in studying this excavated silver-inlaid sword and it will be applied to other inlaid archaeological objects. ■

Notes

1. Tokyo National Museum, *Report of the Silver Inlaid Sword Excavated at Etafunayama Kofun*, 1993. (In Japanese.)

2. S. Miura, 'Emissiography and Reflectography of Ornamented Columns', *Preprints of the Eighth Triennial Meeting of ICOM-CC, 1987*, pp. 897–900.

3. C. F. Bridgeman, S. Keck and H. F. Sherwood, 'The Radiography of Panel Paintings by Electron Emission', *Studies in Conservation*, Vol. 3, 1958, pp. 175–82.

Shedding light on life

Gail Goriesky and Lambertus van Zelst

The Museum Support Center of the Smithsonian Institution is a state-of-the-art research complex which applies the most advanced scientific methods to lay bare the history of works of art and archaeology and place them into a living context. Gail Goriesky is a conservation information technican at the Center's Conservation Analytical Laboratory; Lambertus van Zelst is Director of the laboratory.

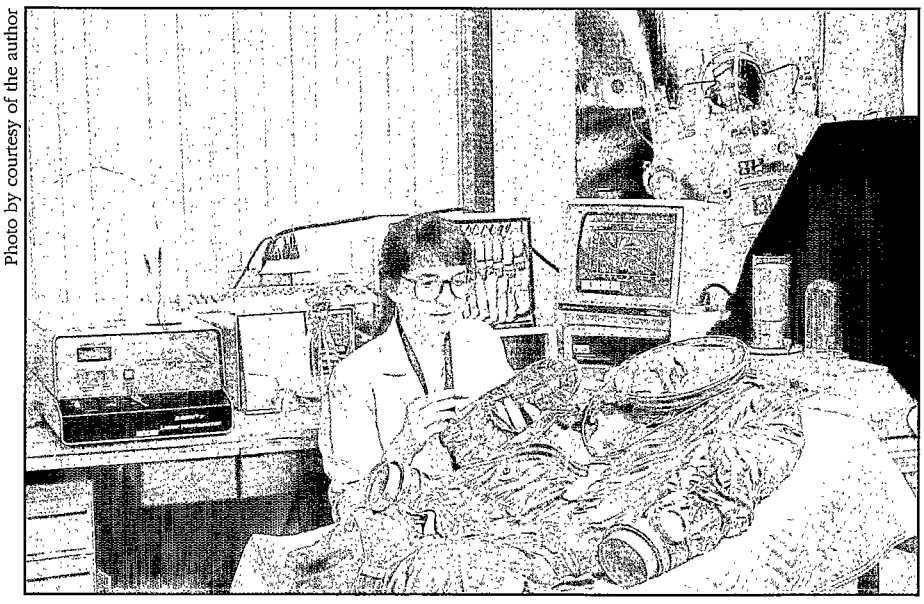
Some 12 km south of Washington, D.C., the Museum Support Center of the Smithsonian Institution houses the laboratories and offices of the thirty-eight staff members of the Conservation Analytical Laboratory (CAL). CAL is a research and training facility of the Smithsonian, which includes fifteen national museums, the national zoo, and seven research facilities. CAL is dedicated to research and training in the areas of conservation, technical studies and analyses of museum collections and related cultural materials.

Its Archaeometry Department is especially concerned with the application of chemical, physical and biological technologies and methodologies to address questions of an art-historical or archaeological nature. For that purpose, staff members utilize the extensive equipment and facilities at CAL and at other institutions, especially the National Institute of Standards (NIST) and the Carnegie Institution of Washington, D.C. This article highlights some examples of work done at CAL.

Radiography and paintings

It has long been recognized that beneath the surface of a painting lies hidden information which can be of great importance to enhancing our understanding of art history and connoisseurship. Techniques such as X-radiography and infra-red reflectography have become well-established research tools. CAL researchers have added another technique to this arsenal: neutron-activated autoradiography. Developed in the early 1970s at Brookhaven National Laboratory, the technique was further enhanced in a joint programme involving CAL and NIST. The painting is exposed to a beam of thermal neutrons from a nuclear reactor for a short time period. Most of these neutrons pass through the painting without any effect, but a few react with atoms in the various constituents of the painting to produce radioactive isotopes. After the activation with thermal neutrons is completed, radio-isotopes continue to emit radiation which produces an image of their specific distribution on photographic film placed near the surface of

Photo by courtesy of the author



Polymer research chemist Mary Baker carries out research on a Project Mercury space-flight suit in order to establish the proper storage and handling procedures.

ISSN 1350-0775, *Museum International* (UNESCO, Paris), No. 183 (Vol. 46, No. 3, 1994)

Published by Blackwell Publishers, 108 Cowley Road, Oxford, OX4 1JF (UK) and 238 Main Street, Cambridge, MA 02142 (USA)

the painting. Different elements will form different radio-isotopes, each with their own characteristics, among which is lifetime. Because of these differences in lifetimes, it is possible to generate a series of 'autoradiographs' by periodically changing the photographic film: the earlier exposures predominantly show the distribution of the shorter-lived radio-isotopes, the later ones are dominated by the longer-lived ones. Thus, a series of distribution images of different chemical elements results, which in turn represents the distributions of the painting's components, most importantly the pigments. After two to three months, the radiation from the painting is so reduced that no more information can be obtained and the painting can safely be returned to the gallery.

Autoradiographs look like X-radiographs, and present similar information on artist technique, compositional adjustments, pentimenti (changes made by the artist), etc. The X-radiographs reveal mainly the heavy elements, such as lead in white lead paint. Autoradiographs tell us where a number of other elements, or pigments, are located in the painting. Dr Ingrid Alexander, research art historian, made extensive use of the technique in a study of the work of the nineteenth-century American artist, Albert P. Ryder. While living a bohemian life in New York City, Ryder created his own imaginative vision of the world by translating thick passages of colour into vibrant biblical and literary scenes. He frequently reworked his paintings, sometimes over several years and is known to have made numerous changes while composing them.

In *Christ Appearing to Mary* in the collection of the National Museum of American Art, Smithsonian Institution, several changes in composition can be seen in the autoradiographs. The artist altered Christ's gesture of blessing and lowered his left hand. The right arm has also been changed to appear thinner and may be related to a story told by the artist's friend, Charles Fitzpatrick, who felt the figure of Christ was much too robust to pose as one who had just been in the grave for three days. The horizon line has been raised, blocking out some of the light that originally bathed the entire scene. A broad halo around Christ's head has also been eliminated in the final picture. The autoradiographic image reveals quick jots and dabs of paint in several areas and attests to Ryder's rapid style of execution.

Archaeological ceramics research

Clay, the primary raw material for ceramics, is formed through the weathering of rock. The major mineral components of clays tend to be quite similar regardless of origin; however, the chemical composition is very much a reflection of the source rock. Of special importance are elements that are measured in fractions of a percentage or 'traces'. The rock formations from which the clay is formed determine the trace-element composition of the rock, and hence greatly influence the chemical composition of the clay. Therefore, the trace-element composition of a clay is very similar in clays from the same geological source and the trace-element composition of ceramics will reflect those of the clay from which they were made. This fact allows researchers to characterize archaeological ceramics by their trace-element composition, grouping those made with clay from the same source and differentiating ceramics from different geographic origins. Such provenance studies can provide invaluable insights into trade and exchange patterns between populations of various sites.

Painting by Albert Pinkham Ryder of Christ Appearing to Mary, c. *1885, National Museum of American Art. Note that Christ's arm is pointed downward.*

At CAL, a major programme of trace-element analyses of ceramics and chipped or ground tools is operated in a joint effort with NIST. The analytical technique, neutron activation analysis, requires only minute samples, which are obtained by drilling into the edge of a shard or grinding from the underside of a vessel. Dr Ronald Bishop, senior research archaeologist, has made extensive use of the technique to study trade and exchange among the ancient Maya in order to gain a better understanding of their social, economic and political relationships. An illustrative example is his collaborative systematic study (with Duke University art historian Dr Dorie Reents-Budet and Guatemalan epigrapher Arq. Federico Ortega) of beautiful, intricately painted vessels that represent a culmination of Mayan artistry. Using a vast analytical database obtained by the analyses of thousands of excavated Mayan ceramic fragments, they determine the source of production for the elaborately painted pottery, including museum vessels. This permits an objective and geographic perspective for the determination of ceramic production and distribution and also for the interpretation of the information carried by a vessel's glyphic texts or scenes of historical or ritual significance.

Ceramic materials scientist Dr Pamela Vandiver is also concerned with archaeological and historical ceramics. Her research centres on the technology involved in their production, answering questions concerning: the techniques used in forming Early Middle Eastern ceramics; the technological

factors that account for the differences between Korean and Chinese celadons; and the technological innovations involved in the making of St Porchaire ware. Lately, Dr Vandiver has been studying very early ceramics from the Dolní Věstonice Upper Palaeolithic sites in the Czech Republic. The continuous production of utilitarian ceramics (pottery) dates back to the late Pleistocene Jomon culture some 12,500 years ago. However, clay modelling and production of non-utilitarian forms preceded this by at least 15,000 years. Archaeological reports regarding the artefacts from Dolní Věstonice had indicated that the figurines were made of crushed mammoth bone, ash, loess (a fine-grained yellowish-brown soil) and probably animal fat. An inventory of the shapes, sizes and numbers of fragmentary figurines was made and the variability in colour, texture and hardness was assessed. It was found that only fourteen of the fragmentary figurines from Dolní Věstonice were human representations, one male and thirteen female, and that 707 were animal representations of identifiable genus. Another 3,000 fragments formed parts of unidentifiable animals. Other classifications of artefacts were flattened and spherical pieces and pellet-like shapes smaller than a centimetre. Many of the artefacts had impressions of fingertips and tools, especially microliths. Joins between separate parts could be identified, such as legs added to bodies, or noses, ears and tails separately modelled and pressed into place.

A representative sub-sample of thirty fragments was studied by xeroradiography, X-ray diffraction, microprobe analysis, scanning-electron microscopy, and liquid and gas chromatography. The fragments were found to have been fired between 600 and 800°C, to have been made of local loess with no organic or bone additions and to have been hand-formed in a wet condition with individual parts made separately and added to one another. The ceramic figurines were found set off from the living site in a ceramic firing area suggesting that the ceramics were made for a special purpose. Based on the number of fractured figurine fragments, several explanations have been proposed. Undried or imperfectly dried figurines when placed in a hot fire may have blown up while some may have remained intact. The whole process could have served a socio-ritual purpose. Through collaborative studies with Dr Olga Soffer of the University of Illinois, this research is being used to explore the significance of this ceramic technology for understanding Upper Palaeolithic behaviour.

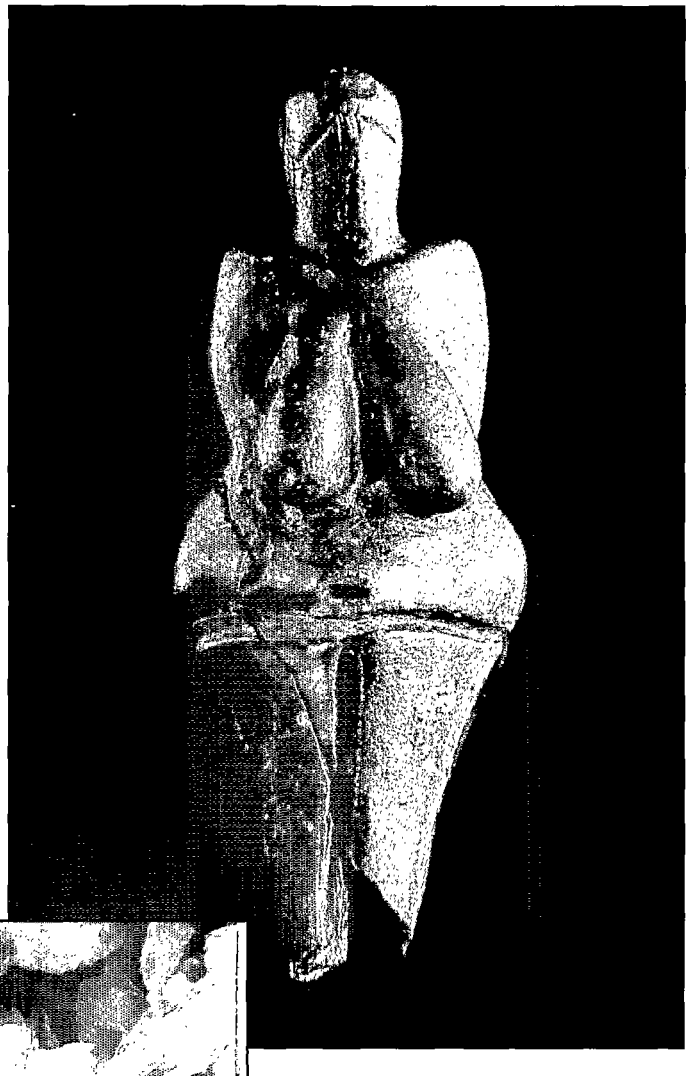


Photo by courtesy of Ira Block and the National Geographic Society

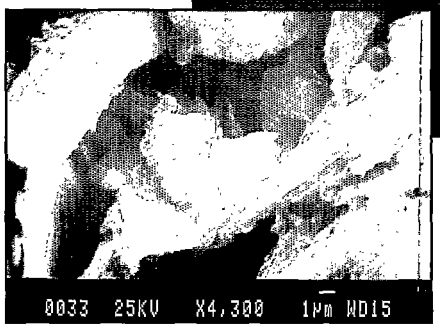


Photo by courtesy of P. Vandiver

Above: *Ceramic 'Venus' figurine, dated to the Upper Palaeolithic period, c. 26,000 years ago, excavated by Karel Absolom in 1924 at Dolní Věstonice I, south of Brno in Moravia, Czech Republic.*

Left: *Using scanning electron microscopy, we can see the internal structure of the Venus. Low-fired clay platelets are stuck together and joined with glass to form the ceramic.*

Bones, DNA, diet and disease

In addition to revealing the objects humans make, the archaeological record supplies evidence of past ways of life, relationships, migrations, diseases and ecosystem interactions in the molecules that survive in biological materials, including bones and teeth. Biogeochemist Dr Noreen Tuross applies the techniques of protein biochemistry, molecular biology and isotope geochemistry to investigate the preservation and information contained in vertebrate fossil remains. Recently, in collaboration with Marilyn Fogel of the Carnegie Institution of Washington, the duration of infant breast feeding was determined in two ancient Amerind populations by examining the stable isotopes of nitrogen in skeletons. The diet of one of the oldest human populations in the New World was also investigated by studying carbon and nitrogen isotope ratios, and it was found that estuarine-based foodstuffs were utilized by these Native Americans. These types of dietary studies have opened a separate window on the past that can be compared with the more conventional methods of reconstructing diets. Currently, palaeodietary studies at CAL are extending the temporal range of the investigations into the Palaeolithic by studying the bones and teeth from the Kents Cavern site in Devon, United Kingdom.

Other molecules preserved in bone also show promise of shedding light on life in the past. Immunoglobulins (antibodies) have been found in a variety of human bone samples, and the exposure to disease is currently being explored at CAL focusing on treponemal infections such as syphilis or yaws. Genetic material in the form of DNA is also present in much of the excavated bone from the Pleistocene, and the potential for establishing relationships between contemporary and ancient peoples at the DNA level is at the cutting edge of molecular archaeology.

The examples cited in this article are but a sampling of the large amount of work in progress at CAL. Other research projects involve studies of the provenance of archaeological and historic metals, ancient and historical metallurgy, trade and exchange patterns of obsidian, an improved understanding of the deterioration of collection materials, the formulation of improved storage and exhibit conditions, and the testing and development of conservation treatment technology. ■

The authors gratefully acknowledge the contributions made to this article by Dr Ingrid C. Alexander, Dr Ronald L. Bishop, Dr Noreen C. Tuross and Dr Pamela B. Vandiver, and the editorial assistance of Jacqueline S. Olin and Alan W. Postlewaite.

Seeing with new eyes

Dusan Stulik

True or false? Old or new? Artist X or Artist Y? These are but a few of the problems that art restorers and historians confront daily. To provide an answer to these questions, they now have at their disposal a broad range of scientific methods for analysing pigments and binding media. Dusan Stulik, acting scientific programme director of the Getty Conservation Institute in California, describes recent advances in this field.

Prior to the Industrial Revolution and the development of manufactured paints, a painter was not merely an artist but also a colorist. Mixing pigments with selected binding media (the material holding the pigment together and bonding the paint to a support), the painter made his own paint and thus acquired a profound understanding of his materials and their properties. Differences in paint formulae proliferated as artists experimented with a multiplicity of binding media, seeking the special combination that would give their paints the desired optical and handling properties.

With the introduction of collapsible paint tubes in 1841 and the development of the paint industry, artists became separated from the paint-manufacturing process and lost the motivation to learn the details of the paint-making trade. They gained considerable freedom in the creative process since collapsible paint tubes allowed them to leave the studio and develop new styles of painting. It may even be said that without these technological advances, there would have been no artistic movement such as Impressionism. But there were negative results as well: using incorrect materials, working with poorly tested paints and experimenting with paint formulae with scant knowledge of the consequences led to disastrous effects on the longevity of paintings.

Analysing paintings to determine the pigments and binding media used is important for two reasons: (a) to enable the restorer, before embarking upon the cleaning or restoration of a painting, to design a strategy which will not damage the artwork and (b) to provide the art historian with the detailed study of painting techniques that will allow him or her to confirm the provenance and authenticity of a work.

In the beginning . . . pigments

The first task is the identification of pigments. Pigment chronology reveals when different pigments were used and when new ones were introduced to the artist's palette. Some pigments have been used since the time of Palaeolithic cave paintings, while others were discovered or developed by alchemists or chemists. The authentification of paintings is sometimes based on the identification of pigments. For example, if titanium white (TiO_2), which was created as an artist pigment after 1920, is found in a supposedly medieval painting, it might indicate that the painting is either a twentieth-century copy or a forgery.

Information about pigment particle size and morphology is also important. To distinguish a natural from an artificial ultramarine is a relatively easy task despite the fact that both have the same chemical composition. The natural ultramarine is prepared from a semi-precious stone, lapis lazuli, and under the microscope displays large blue crystals; in contrast, the particles of synthetic ultramarine are very small.

Such analyses may be done non-destructively and without touching the painting by using X-ray fluorescence (XRF) and suitable instrumentation. While this method answers many questions, it has serious limitations when several pigments have been mixed together or have been adulterated with fillers and extenders, or, as is the case with many medieval paintings, a layer of paint is composed of several sub-layers having quite different pigment composition. In these cases, XRF results must be regarded as preliminary and in need of confirmation from other methods which usually require the actual removal of samples.

ISSN 1350-0775, *Museum International* (UNESCO, Paris), No. 183 (Vol. 46, No. 3, 1994)

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Using a special needle or a scalpel, the conservator removes a sample of picture varnish, paint layer, ground or a particle for a paint-layer cross-section. Wherever possible, these are taken either from the edge of the painting or from an area where sampling does not interrupt the integrity of the work (for example, from an already damaged spot or crack). Samples, including cross-sections, are generally of less than 1 mg and are almost invisible to the naked eye.

A standard procedure for identifying pigments from samples at the Getty Conservation Institute starts with polarized-light microscopy (PLM). In a series of simple tests, pigments can be identified based on their colour-particle size, particle morphology and other factors. A well-trained microscopist with a good collection of historical and modern standard pigment samples is able to identify most pigments used in paintings and can answer almost all questions concerning pigments. However, should PLM results be inconclusive, electron-microprobe analysis (EMPA) and X-ray diffraction (XRD) can be used to support and confirm the PLM results.

Binding media analysis

The next step in painting analysis is the identification of paint media and varnishes, a task that is more difficult than pigment identification but equally important, if not more so.

Until the revolutionary changes in the artist's palette that took place in the nineteenth and twentieth centuries, artists' techniques throughout the past differed more with respect to binding media than to pigments. (It should be noted that it is the medium that determines the technique of

On-site macrophotography and scanning electron microscope analysis revealed that a genuine painting was laid over a charcoal sketch.

Transversal cut into the colour blue showing crystals of natural ultramarine (lapis lazuli). Sample taken from a painting by Titian.

painting.) Binding media are not as diverse as pigments, but they are much more complex compounds of organic substances (e.g. egg used as a binder in tempera paintings contains proteins, fats, sugars, vitamins, sterols, dyes, water, etc.).

A number of artists used mixed binding-media techniques. Various parts of a work might also be painted using different binding media. Some painters working with linseed-oil based paints used much less yellowing poppyseed oil to prepare white and blue paints. Others used multiple layers of different binding media such as animal glue ground, oil emulsion paint layer, oil glazes and natural resin varnish. Works of art may also have been treated many times by other artists, restorers and conservators using additional materials or chemicals which could result in the alteration of the original composition of the paint layer. Organic materials are also well known to age with time and exposure to light, oxygen and pollutants. All these factors make analysis of binding media extremely challenging.

Such analysis begins with orientation tests which should provide information on the class of binding media used. Three methods are particularly useful in this respect: organic elemental analysis (OEA), fluorescence microscopy (FM) and Fourier transform infra-red spectrometry (FTIS).

OEA provides quantitative information on the amounts of carbon, hydrogen, nitrogen, sulphur and oxygen in organic material. It is not a new method but recent advances in instrument design and a drastic reduction of sample size has allowed this technique to be applied to art research.

The advantage of using FM is that it works with paint cross-sections which may be used for several tests, thus reducing analysis time. This method evolved from medical research and staining techniques used in clinical pathology, and enables researchers to see whether a given binding medium is present and which layers of the paint structure contain the same binding medium.

More sophisticated analysis of binding media from cross-sections can be achieved using FTIS microscopy which tests selected sample areas as small as 10 x 10 mm.

Once major components of the complex binding medium have been identified, the next task is to identify all minor components. Usually, several analytical methods have to be used to answer related questions and reconfirm findings.

For example, when drying oil has been used as a painting medium, it might be important to determine its plant source. This question is closely connected to the artist's technique. Some artists experimented heavily, always looking for new recipes and methods to achieve desired optical and structural effects. Others mastered their medium and did not risk the consequences of further experimentation. Although linseed oil was the most common drying oil, poppyseed and black walnut oils were also used; Claude Monet used poppyseed oil in many of his paintings while walnut oil was more popular in Flanders and Germany.

In addition to drying oil, other binding media were used such as egg, animal glue and casein. Egg yolk or whole egg was used for tempera painting and egg white was sometimes used as a temporary varnish on oil paintings and in the form of glair in illuminated manuscripts. Both casein and animal glue temperas were used in medieval times as an alternative to the more common egg tempera.

All these types of binding media contain various proteins and their overall chemical composition can be rather simple, as in animal glue, or very complex, as in casein and egg. High-performance liquid chromatography (HPLC) analysis can differentiate the various media and the entire analytical procedure can be performed using paint samples as small as a few micrograms. In the case of multiple-component binding media, the Getty Conservation Institute has developed a single-sample, one-technique, multistep procedure for the quantitative analysis of paint samples. This allows us to identify the exact type of binding medium used and thus determine whether its composition

Sample of paint from a polychrome sculpture.

corresponds to the binding media known to be favoured by the same artists in other paintings or during a specific time period.

Establishing dates

Art historians can frequently determine dates, provenance and authenticity by using a trained eye and detailed knowledge of an artist's works, supplemented by archival research. When the results are inconclusive, or when historians disagree among themselves, the types of pigment analysis described above may be called into play. If still further precision is required, radiocarbon dating using accelerator mass spectrometry (AMS) can be applied to tiny samples and can often indicate dates with a precision of plus or minus thirty years. If suspicion of forgery exists, this is the only method that can provide the necessary data for definitive art-historical interpretation.

One of the major goals of the Getty Conservation Institute Binding Media Project has been to develop an experimental strategy that would allow chemical separation of complex binding medium mixtures and permit isolation of critical datable material as needed for AMS experiments. The success of this separation strategy combined with AMS radiocarbon dating has opened a whole new chapter in the application of scientific methods to art research. ■

Science in the service of art

Maurice Bernard

By probing into the secrets of a work of art or revealing hidden traces in ancient archaeological artefacts, the scientist has joined the historian in uncovering new meanings for many familiar museum objects. In France, the Research Laboratory of the Museums of France brings together the most up-to-date equipment and techniques with experienced art historians to shed light on the country's public collections, which are among the most important in the world. Maurice Bernard was formerly director of teaching and research at the École Polytechnique, and has been Director of the laboratory since 1990.

In October 1991 beneath the Louvre Pyramid, the Research Laboratory of the Museums of France (LRMF) celebrated its sixty years of existence – a respectable age. Many scientific laboratories are younger and among the earliest ones to have been established several have disappeared or been swallowed up by new structures. Yet for an intellectual discipline, sixty years is not long, especially in comparison with mathematics, history or archaeology. So far, very little has been done in the field in which the Research Laboratory of the Museums of France is active, namely science in the service of art. As early as 1865 Louis Pasteur predicted that the marriage of science and art would be fruitful. On 6 March 1865 he told the students of the École des Beaux-Arts: 'There are times when I see clearly the possible and desirable alliance of science and art, when the chemist and the physicist may take their place beside you and shed light on your work.' It was not until after the First World War, however, when it became apparent that X-rays could reveal not only the inside of the human body but also the hidden details of a painting, that the history of art became linked with the science of materials. Between the two world wars and throughout the 1950s and 1960s the laboratory was one of the first to demonstrate what extraordinary tools of analysis and discovery could be provided for the history of art by the natural sciences.

The laboratory, which was born in the shadow of the Louvre, remained an integral part of it until 1968, when it became the Research Laboratory of the Museums of France, thus extending its services to all French public collections. This typically French centralization is also to be found to varying extents elsewhere in the world, but in many other countries each museum seeks to obtain its own scientific facilities, to be used almost exclusively for its own collections. The restoration of works of art in France is also largely centralized.

This kind of organization has advantages and drawbacks. The drawbacks include those inevitable concomitants of centralized structures, delays and red tape together with an inefficient communication system and inadequate decentralized services. On the other hand, there is one obvious advantage: namely, the possibility in a central laboratory of drawing on resources that would never be made available to a single museum, even the largest in the world. We shall refer below to two outstanding examples of this: ion-beam analysis through AGLAE,[1] and the high-definition digital scanning of radiographic images, through the NARCISSE project.[2]

The laboratory's various activities may be divided into three main tasks: the first is to carry out the analyses, measurements and research needed for the restoration or acquisition of a work of art or museum exhibit for the public collections. This demands precise, reliable and accessible analytical methods as well as close collaboration with curators and restorers.

The second task is to start developing today the scientific methods that will be useful for the history of art tomorrow. If this is to be successful, close relations have to be maintained with scientists, especially those specializing in the science of materials, so that any scientific or technological innovation that might be of use to museums does not escape our attention.

The laboratory's third task is to conduct multidisciplinary research with art historians, so that a historical approach can be combined with the most subtle analyses, through a judicious partnership.

ISSN 1350-0775, *Museum International* (UNESCO, Paris), No. 183 (Vol. 46, No. 3, 1994)

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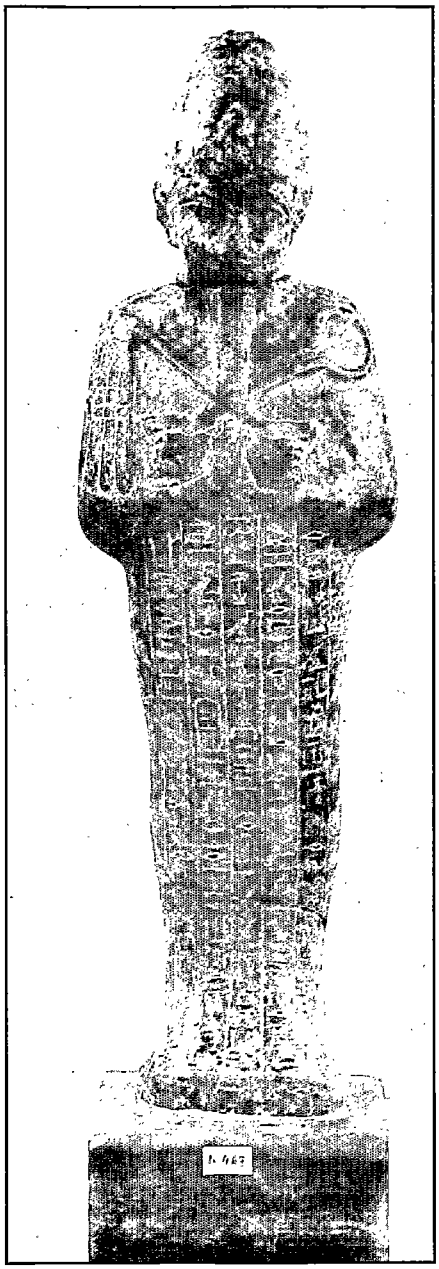
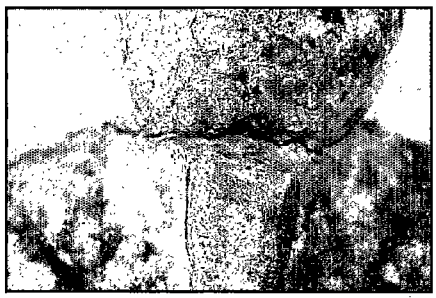


Left: *The Louvre ushabti recovers its head (Inv. N467).*

Below: *The break-line shows clearly how the two parts of the ushabti fit together.*



The laboratory's role is not confined solely to these tasks. It is also required to participate in certain training activities and to respond to the interest of a wide public.

These various activities are illustrated by the following examples.

A ushabti recovers its head

The Department of Egyptian Antiquities of the Louvre has in its collection a ushabti of Pharaoh Amenophis III (eighteenth dynasty, *c.* 1403–1365 B.C.). This statue is of porphyroid granite with pink potassium feldspar phenocrysts, a rock commonly used in Ancient Egyptian statuary. The statue was acquired by the Louvre Museum in the mid-nineteenth century, but had lost its head.

One of the curators (Jean-Louis Hellouin de Cenival) had noticed in a Paris antique shop a pink granite head possibly corresponding to the missing part of the ushabti. Before deciding whether or not to purchase the piece, it was important to ascertain that the head did in fact fit the Louvre statue.

The chemical and mineralogical characterization of the two parts was of limited interest: it was obvious from other museum statues that monolithic granite structures display great variability within the same granite block.

Several fairly obvious joining-points and facets made it possible to fit the head on the body in a stable, logical way. Along these facets, which were linked by apparently perfectly matching surfaces, the same crystal was detected, which made it even more probable that the two pieces were part of the same statue.

A systematic petrographic examination of the nature, form and orientation of the micro-crystals and the areas of severance inside the fissure lines themselves, on either side of the joins, made

it possible to draw further conclusions. The following observations were recorded:

A transverse line, emphasized by a series of pink feldspars and black biotites is to be found in the same place along both breaks.

Still following the pink feldspars, the break occurred along specific crystalline veins, creating a tetrahedric shape in relief (at the level of the statue's right shoulder). The corresponding shape in concave was to be found along the break-line of the head: the two parts fitted into each other perfectly. This occurred in at least three places.

A lamellar cluster of black biotites below the right ear was found in both parts, with the same crystalline characteristics.

It is quite clear from these observations that the head undeniably belongs to Ushabti No. 467 of the Department of Egyptian Antiquities of the Louvre Museum. And so it was that this statue recovered its head after what was probably a very long period without it.

This example, which fits in with the first of the laboratory's tasks, is interesting on more than one count. It proves; first, that it is more important than ever for curators to possess a good eye and a very detailed knowledge of their collections; second, that traditional examinations with the naked eye and the microscope still retain their full practical value when carried out by experienced mineralogists; and, third, that serendipity is the reward of patience.

A famous wedding

The restoration of Veronese's *The Wedding at Cana* was completed in 1992. This restoration project, the most important of its kind ever, was carried out *in situ* in the Louvre, between 1989 and 1992, beneath the gaze of the public. This large-scale venture involving many different disciplines enlisted the skills of a wide range of specialists for more than three years: from restorers to curators and specialists in Venetian art of the Renaissance, not to mention the technicians and researchers who produced the innumerable photographs, X-rays and paint analyses, and interpreted them in collaboration with their colleagues.

The complete radiography of *The Wedding at Cana,* the photographic coverage – visible, ultra-violet and infra-red – coupled with many physio-chemical analyses, enabled specialists not only to achieve the best possible restoration but also to add to the fund of knowledge on Veronese, his work and times.[3]

Radiography and chronology

As we have seen, the radiography of paintings is the first scientific technique to have provided art historians with objective data whereby to confirm or refute certain historical interpretations. The possibilities and limitations of radiography, combined with photographic information and paint analysis, may seem to be clearly defined.

Yet the recent work carried out in the LRMF by Elizabeth Martin et al.[4] on the paintings of Georges de La Tour seems to open up new prospects. From this study I shall mention the representative case of the same subject being painted at least twice by an artist. The work of Georges de La Tour provides several such examples, one of the paintings being the original version and the other a later version. We shall not consider the case in which the later version might not have been painted by the same artist, that is, where we are faced with a

copy. *Le Tricheur à l'as de trèfle* [The Cheat with the Ace of Clubs] (Fort Worth) and *Le Tricheur à l'as de carreau* [The Cheat with the Ace of Diamonds] (Louvre), the two *Saint Jérômes* (Stockholm and Grenoble), and the two *Saint Sebastians* (Paris and Berlin) are among the most famous *doubles* in George de La Tour's work.

A minute examination of the two versions of the same work leads us to focus our attention on the details that differ from one composition to another or from one radiograph to another.

The first situation that may arise is that the details in each painting are identical both in the composition and the radiograph. This case is of little interest and does not enable us to deduce which version is the earlier of the two. For example, we may move from one *Cheat* to the other, merely replacing clubs with diamonds or vice versa; each painting is identical both as regards the composition of the playing card and its radiograph. There is nothing that enables us to say that Georges de La Tour first painted *Le Tricheur à l'as de trèfle* and *Le Tricheur à l'as de carreau* later; this chronology can only be established by considerations of a different nature.

The most interesting situation is that in which a difference occurs in a specific detail between the composition and its radiograph. This difference shows that the artist had second thoughts and made an alteration during the work, thereby creating a pentimento: the painting expresses the final idea, which is seen in the radiograph along with the artist's original brushstrokes.

It has often been said that a pentimento is the mark of a first version, an original, whereas its absence denotes a replica or a copy. This is not always true: it cannot be regarded as clear proof, only as an indication. It is the presence of a pentimento combined with a comparison of the radiographs and the compositions that make it possible to establish a chronology of some of Georges de La Tour's *doubles*.

One case that occurs frequently in the exhaustive preliminary study for the Vic-sur-Seille exhibition is that in which the detail in question is identical in the two compositions but one of the radiographs shows the existence of a pentimento. The explanation that immediately springs to mind is that the painter, in a first version, hesitated before achieving the effect he wanted – hence the pentimento – whereas in the second version he produced the composition without hesitation. Can this be regarded as a certainty? If we take the opposite argument, we could say that the artist painted, for example, the torch in *Saint Sebastian Tended by Saint Irene* without hesitation, and in the second version he achieved the same composition after first painting something else!

In other cases the relevant detail seems identical in the two radiographs, but was overpainted later by the artist in one of the versions so that the final works show a difference. This means that a later date may be proposed for the version with the pentimento. Thus for the Stockholm *Saint Jérôme* the artist reproduced the composition of the Grenoble *Saint Jérôme* before modifying certain details, in particular the position of the saint's right foot.

The demonstrative value of these analyses is strengthened because, in both examples, the same observations may be made concerning several other details, all pointing in the same direction and giving greater coherence to the argument.

Georges de La Tour: Saint Sebastian Tended by Saint Irene. *Paris, Louvre Musem (Inv. R.F. 1979–53).*

Besides a meticulous study of works and their radiographs, such as the recent study presented at the Vic-sur-Seille symposium in the particular case of Georges de La Tour, the digitalization of scientific images (radiographs and photographs) will soon lead to entirely new research methods. The power to manipulate these images almost ad infinitum opens up new prospects for comparative analysis. If we go back to the example of Georges de La Tour, the production by the artist of a replica of an original work, sometimes long completed and probably already sold, remains shrouded in mystery, since we have no material evidence of any transfer system. Thanks to the NARCISSE project to which we refer above, the manipulation of digital images may soon shed

new light on this problem and may lead to investigation of many other questions.

The 'buttered bread' model

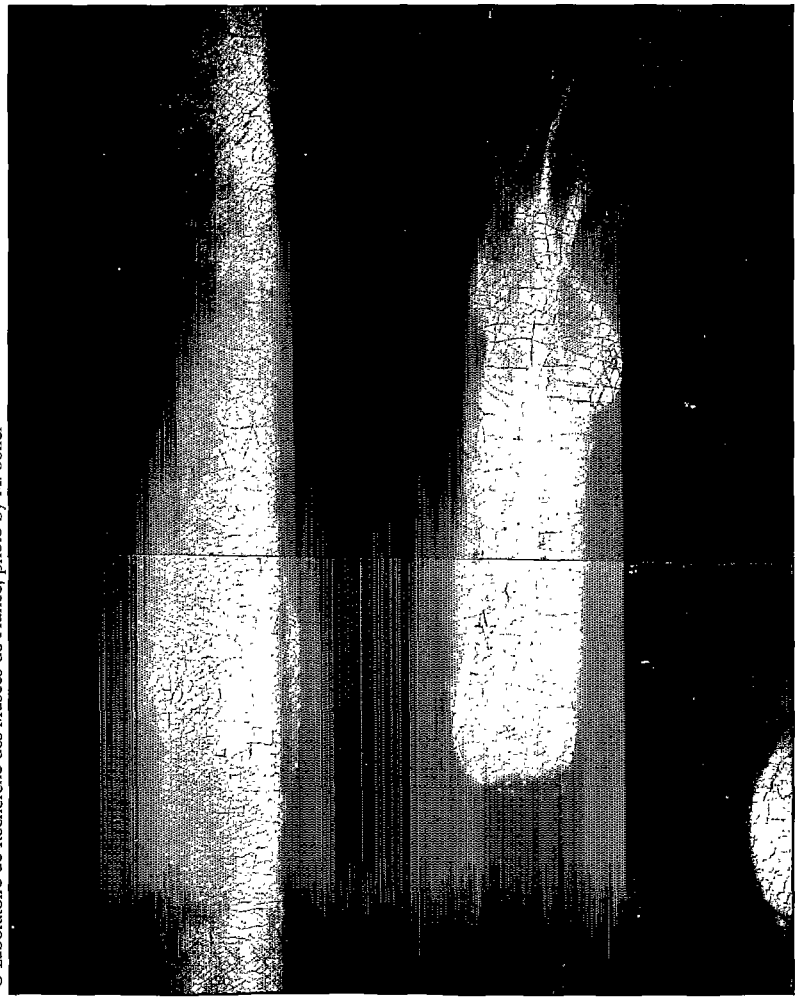
Archaeologists, particularly prehistorians, have for many years been developing trace analysis of archaeological objects, more precisely of flint implements. Naked-eye and microscope examination of these flint tools clearly shows facies with their function. Comparisons with modern implements made by researchers and used in model conditions have made it possible to establish a typology of these facies with some success.

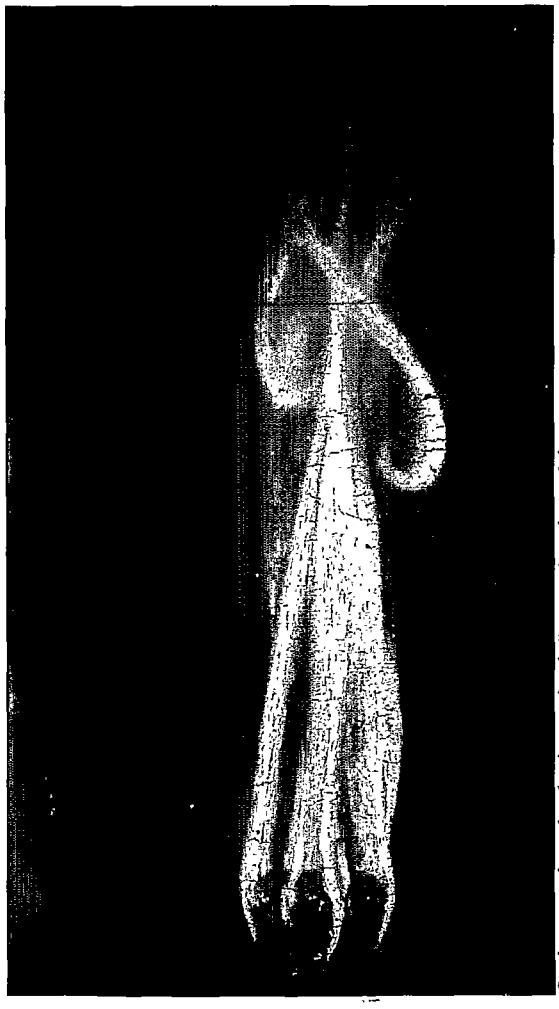
The idea of finding on the flint itself an irrefutable material trace of the substance worked on goes back some years: it was tested by various researchers and, for the last three years, has been the subject of a systematic study by the Research Laboratory of the Museums of France,[5] using the most powerful analytical methods at its disposal today. The flints, both experimental and from specific collections, are analysed either (a) by examination under the scanning electron microscope, with a system of energy-dispersive X-ray analysis, or (b) by analysis using the AGLAE micro-beams with 3 μV protons, which gives access to high sensitivities, even for light elements.

One of the aims of the study is to make a distinction between flint tools used on bone, antlers and ivory respectively.

Preliminary studies on experimental flints have made it possible to establish the validity of a model known as the 'buttered bread' model. As pressure was exerted on the sharp cutting edge of the tool, the material worked on accumulated in small quantities ▸

Georges de la Tour: St Sebastian Tended by Saint Irene. *Radiographic detail of the torch held by St Irene. On the left, the version of the painting in the Louvre, Paris. On the right, the version of the painting in the Staatliche Museum, Berlin. The artist's hesitations may be noted in the Louvre painting: he first painted the flame and later cropped its width; he then painted the base of the burning brand in dark tones over the already existing flame. On the Berlin version, the artist painted the base of the burning brand directly onto the prepared canvas, which leads to the conclusion that this is the later version of the painting.*





in the micro-structure of the flint. This material is in fact made up of microscopic grains of quartz (a few microns) surrounded by a less hard material, chalcedony. Even after a flint has spent thousands of years in an unstable environment, for example in the ground of a constantly damp cave, a very tiny fraction of the material worked on remains embedded in the uneven surface of the flint, in the same way that butter remains in the holes in bread, even though it is carefully scraped with a knife.

The studies have shown that the analytical methods available today enable us to distinguish clearly between the experimental flints used for working bone or antlers, on the one hand, and ivory, on the other. The study of early archaeological flints has begun and seems highly promising.

During the past decades, the natural sciences, and particularly the science of materials, have placed ever more powerful research tools at the disposal of historians.

This has led to the rapid development of our knowledge of works of art, so that they can be better identified, preserved, restored, understood and given their rightful place in the history of civilizations.

This trend will continue and is sure to be bolstered in the future by the emerging cognitive sciences and the digital revolution. ■

Notes

1. AGLAE: Accélérateur Grand Louvre d'Analyse Élémentaire.

2. NARCISSE: Network of Art Research Computer Image Systems in Europe.

3. The Wedding at Cana *by Veronese, His work and Its Restoration* (exhibition catalogue, 16 November 1992 to 29 March 1993), Musée du Louvre, 1993, Paris.

4. *Georges de La Tour ou les chefs-d'œuvre révélés* (catalogue, 1993 and proceedings of the Symposium, Vic-sur-Seille, 9–11 September 1993).

5. Marianne Christensen (unpublished thesis).

Islamic pottery: a tale of men and migrations

Robert B. Mason and M. S. Tite

The relationship between crafts and history tells us much about ancient patterns of technology transfer. The wealth of information that may be gleaned from a simple pottery shard is described by two experts from Oxford University: Robert B. Mason, on leave from the Royal Ontario Museum in Toronto, is undertaking research towards a Ph.D. at Oxford; Michael Tite was formerly keeper of the British Museum Research Laboratory and, since 1989, has been professor of archaeological science and head of the Research Laboratory for Archaeology and History of Art at Oxford. The laboratory was founded in 1955 and currently concentrates on the following fields of research: analysis of archaeological artefacts for the determination of provenance and for gaining an understanding of ancient technologies; luminescence dating of ancient pottery, burnt flint and sediment; radiocarbon dating of very small organic samples using accelerator mass spectrometry; and DNA analysis of ancient bone to obtain palaeogenic data.

Archaeological materials tend to be important to the people who study them, but Islamic glazed pottery has a wider importance due to a number of factors. Firstly, it was often made in large production centres associated with important dynasties, and the pottery was widely exported, being found from China to Europe and East Africa. Secondly, Islamic pottery often represented a highly varied and advanced ceramic technology, with many unique contributions which were copied or emulated in Europe and East Asia. Given the importance of these aspects of Islamic pottery, it is perhaps strange that serious gaps existed in the knowledge of not only how this pottery was made, but also where it was made. Hence, a programme of study and analysis of Islamic pottery was initiated at the Research Laboratory for Archaeology and the History of Art of Oxford University, United Kingdom, in co-operation with the Royal Ontario Museum, Toronto, Canada. This study approaches the problem of Islamic pottery using three main methodologies, directed at solving problems of when, where and how the pottery was made.

First, using standard archaeological techniques for studying pottery, including drawing vessel shapes and the detailed recording of design motifs, a chronology for the pottery is developed and then tested against available dating from excavations and inscriptural evidence. This has never been attempted for many of the fine glazed wares, which have generally only been subjected to the connoisseurship of art-historians. This new typology makes it possible to put our other research into a chronological relationship, without which it is impossible to talk about ideas such as 'development'.

Second, problems of provenance, or determining where the pottery was actually made, are being solved using petrographic analysis. This is a geological technique, in which a sample is fixed to a glass slide and ground to a thickness of 0.03 mm, making a 'thin-section'. This is then observed in a microscope with polarizing filters, which enables analysis of the texture and mineralogy of the ceramic sample. The petrographic characteristics of the pottery from a particular production centre, its petrofabric, is defined by the geological and geomorphological environment of that centre. Once this petrofabric is defined by analysis of material from kilns, then all other pottery with the same petrofabric may be attributed to production in the area of those kilns.

Third, the study investigated the technology of the ceramic bodies, and also that of the glazes, including both their principal fluxes of lead and/or alkalis and their pigments. The primary tool for the investigation of technology was the scanning electron microscope (SEM), which uses electrons in much the same way as ordinary microscopes use light, to which is attached an X-ray spectrometer for chemical analysis. A small piece of the ceramic to be studied, including glaze and body, is mounted in a resin block and polished with diamond pastes. This polished section is then observed in the SEM in back-scattered electron mode, in which the different components of the ceramic reflect electrons in relationship to the atomic number of their constituent elements. As such, a fragment of quartz will appear relatively dark, while a lead glaze will be very bright. Areas of the polished section may now be analysed with the X-ray spectrometer, in which the area to be analysed is bombarded with electrons, which emits X-rays with energy characteristic of the elements present. Hence it is possible to determine the chemical composition of a very small area of the material studied. This technique is by far the best

ISSN 1350-0775, *Museum International* (UNESCO, Paris), No. 183 (Vol. 46, No. 3, 1994)

Published by Blackwell Publishers, 108 Cowley Road, Oxford, OX4 1JF (UK) and 238 Main Street, Cambridge, MA 02142 (USA)

approach to glaze chemistry and pigments, as glaze inhomogeneity and weathering of the surface makes other techniques unsatisfactory. The study has covered most of the time-range of Islamic ceramic production, so to give the reader an idea of the findings that have been made we will present a short history of Islamic ceramics.

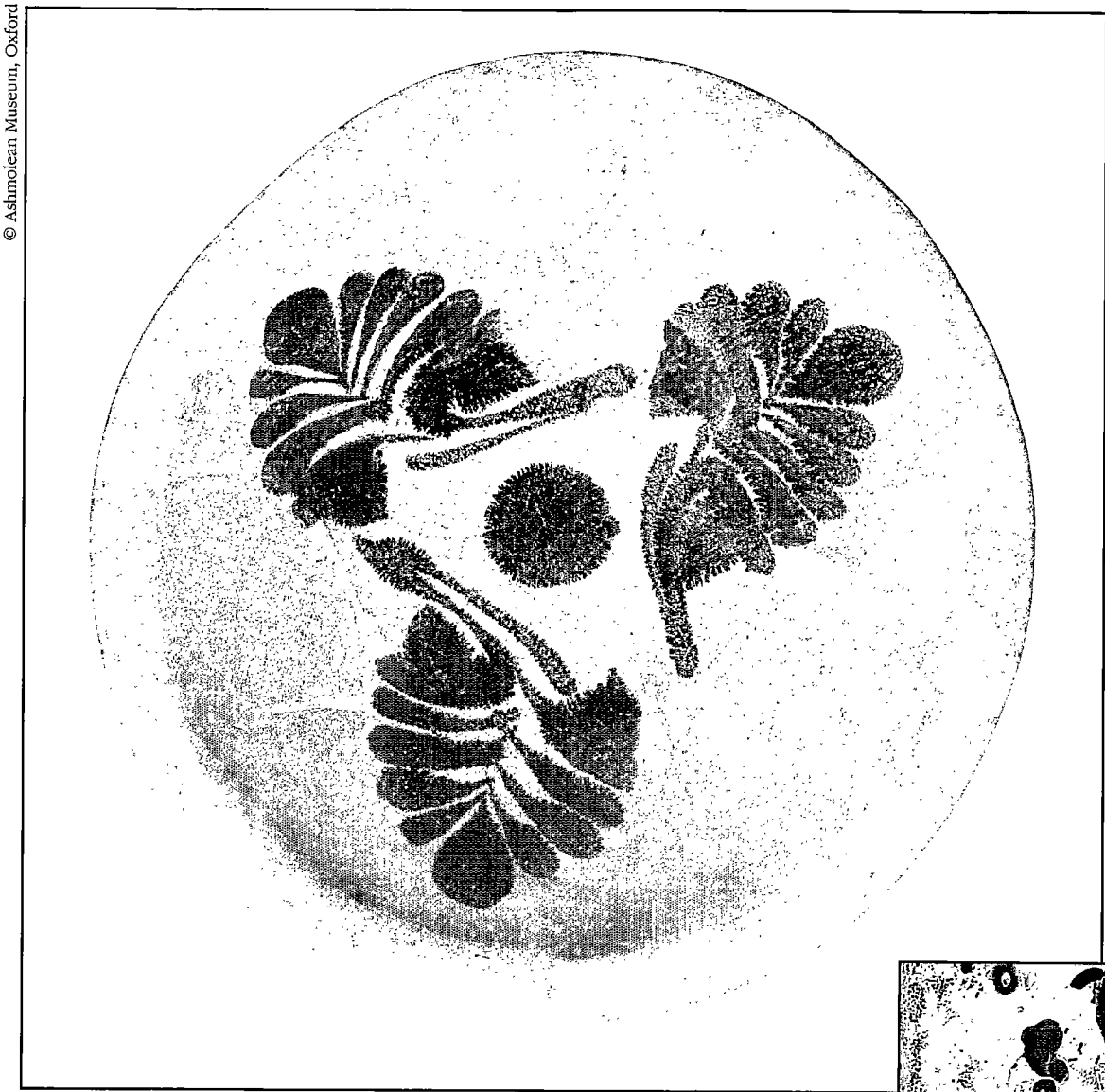
Abbasid pottery

The first uniquely Islamic glazed wares may be associated with the early Abbasid caliphate, during the eighth to tenth centuries (for simplicity, all dates are A.D.). Iraq at this time was the focus of the Islamic world not only politically but also with regard to culture, science, and trade. Iraqi pottery in this period was transported across the known world, from Western Europe to China and East Africa. These Iraqi wares were made in a number of centres, but by far the foremost was Old Basra, then 10 km west of its present site. Although documentary evidence included Basra as one of a number of production centres, it was petrographic analysis that illuminated the importance of this site. The wares made solely at Basra include the first glazed wares with cobalt-blue paint, dating from the eighth century and the metallic lustre-wares introduced in about 800. Both of these techniques of decoration were applied over the glaze, as it is at this time that we see the first introduction of tin-opacified glazes, a technique that would become as important in Europe as it was in the Islamic lands.

The early Islamic world had inherited two basic glaze technologies. In the Romano-Byzantine world lead glazes were used on moulded vessels imitating metal shapes. The second glaze technology was developed in ancient Mesopotamia, and relied on fluxing with the alkalis sodium and potassium, often derived from plant ash. Some of these pre-Islamic alkaline glazes contained bubbles, undissolved grains of quartz and feldspar, and also newly crystallized inclusions such as calcium silicates and magnesium–calcium silicates. In some cases, these silicates would crystallize along the interface between the glaze and body, forming a white layer like a thin false slip, which, by being effective at reflecting the light from the body, gives the glaze itself a clearer appearance. In other cases, the inclusion would be spread throughout the glaze effectively making it opaque. In the eighth century we see the appearance of crystals of tin oxide in glazes otherwise identical to pre-Islamic opaque alkaline glazes containing a little lead, and by about 800 the full tin-opacified glaze predominantly fluxed by lead was in production.

Among the various sites suggested as possible centres of production of the Abbasid type of lustre-ware was the site of Fustat, or Old Cairo, in Egypt. Petrographic analysis indicates that no early lustre-wares were made in Egypt, but production did begin in the late tenth century, associated with the foundation of the Fatimid caliphate. This period was a time of severe decline for Iraq, which was never again to see the wealth it had enjoyed in early Abbasid times. Egypt, on the other hand, was about to enter a golden age, unequalled anywhere else in contemporary Islam. It is perhaps not surprising, then, that amongst the flood of people attracted to the new wealth of Egypt were the potters of Basra, who brought to Fustat the secrets of tin-opacified glazes and lustre-paint. Another set of technologies brought from Iraq would lead in Egypt to the development of the next great Islamic ceramic development – stonepaste.

Stonepaste is also called by some others faience, quartz-frit, fritware, kashi, quartz-frit-clay paste, and so on. Stonepaste is the



Cobalt-blue painted bowl, Basra, second half of eighth century. The opaque white glaze is transitional from pre-Islamic practice to full tin-opacified.

Back-scattered electron photomicrograph of pottery similar to the Basra bowl, showing glaze. Note the various inclusions, including round bubbles, dark quartz grains, thin wollastonite crystals, and white tin-oxide particles.

term translated from the Persian, as it is still in use in Iran and is technically the most acceptable. From various historical, ethnographic and technical sources it may be described as about ten parts quartz, one part frit-glass, and one part clay. The clay keeps the material together and provides plasticity during forming, then during firing it joins with the frit-glass to cement the quartz particles together. In early Abbasid Iraq, quartz had been used as a white slip, while glass fragments had been added to increase vitrification of the otherwise ordinary clay body. These two techniques, perhaps linked with the ancient siliceous body (so-called Egyptian faience), led to the gradual development of true stonepaste by the mid-eleventh century in Egypt.

Lustre-wares would be produced in Egypt up to the end of the Fatimid period, that is, into the 1170s, but our study of the ceramic typology, supported by technological and provenance study, would indicate that potters left Egypt in about 1075. Reasons for this may have lain in the natural, political and military disasters that were plaguing Cairo at this time, but the potters would have also been attracted by the new Seljuk courts in Iran. It may have been at this time that lustre technology was also introduced to Syria and Spain. Once again in Iran we have evidence for a number of centres of pottery production, but petrographic analysis indicates only one centre could have been producing lustre-wares. Unfortunately we have no kiln evidence

Lustre-painted bowl, Kashan, c. 1100. The motifs, form and technology of this piece are related to Egyptian prototypes made in the mid-eleventh century.

from this site, but the petrographic data ties in well with the documentary and inscriptional evidence, which also supports lustre production for one site only – Kashan. Hence, although there is documentary and archaeological evidence for production of various types of pottery at other centres, lustre-wares appear to have only been made at Kashan. Kashan would be the foremost production centre until the mid-fourteenth century, when it apparently ceased production, even though there is documentary evidence of production in the twentieth century.

The only rivals to Kashan in the twelfth and thirteenth centuries were in Syria. The site of Raqqa was traditionally known as an important production centre, due to the extensive kiln debris from the site, but most specialists in the field question the supremacy of Raqqa and are finding evidence of other centres. Petrographic analysis has revealed that the lustre-wares of Syria in this period were produced at Raqqa, effectively restoring the reputation of this site. However, a second centre whose importance has been revealed by our analysis is Damascus. Here the pottery was decorated by application of a pigment under the transparent alkaline glaze. These pigments were commonly black (chromium or manganese) and blue (cobalt), with red (iron oxides) in some cases. At first underglaze-painted pottery would be secondary in importance to lustre, but in the fourteenth century they would be equal in quality.

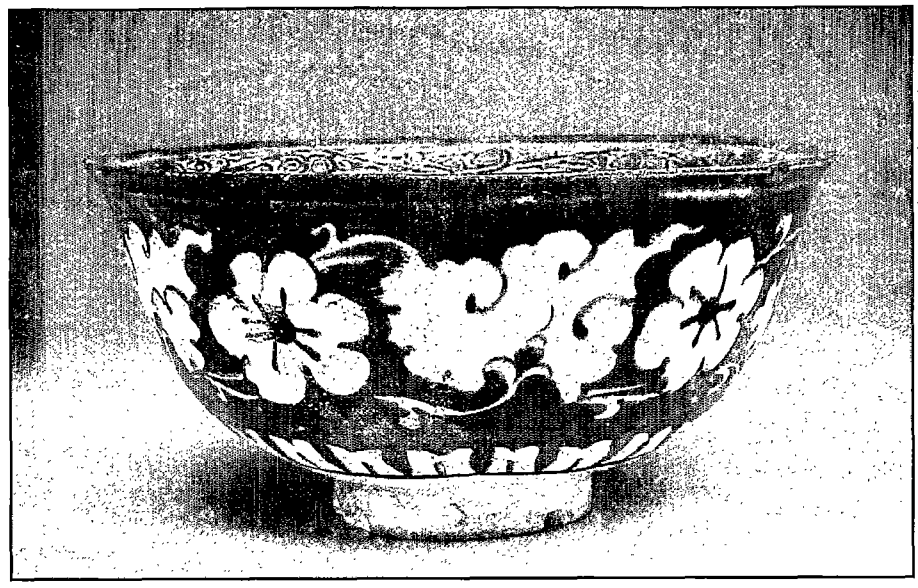
Unlike Raqqa, where production appears to have ceased after it was sacked by the Mongols, Damascus continued to rank foremost in the production of Islamic ceramics for many centuries afterwards.

Blue-and-white

In the fourteenth century, two invasions were to radically alter the appearance of Islamic pottery. The first came out of Yüan Dynasty China, and brought with it cobalt-blue underglaze-painted porcelain. The second came from Central Asia, with Timur the Lame and his Turco-Mongol hordes.

Yüan porcelain seems to have arrived via the sea route in the Islamic world and was best imitated in Damascus, then a very wealthy city on the trade route from the East to the Mediterranean, though it was ultimately governed from Egypt by the Mameluke sultanate. The potters of Cairo also imitated Yüan pottery, but their attempts could not equal the quality of the Damascus wares. In Iraq at this time, the geometric fashions of earlier underglaze-painted pottery continued.

This would all be changed by Timur. Iranian production centres active in the late fourteenth century all ceased produc-



Underglaze cobalt-blue painted bowl, Samarkand, c. 1420. Prior to this study this bowl might have been attributed to anywhere from Syria to northern Iran.

tion on the arrival of Timur. It seems as though he was only interested in augmenting the position of Samarkand, and leaving desolation elsewhere. In 1402 he took Damascus, and documentary evidence indicates that he took craftsmen from that city to Samarkand. It is perhaps not surprising then that the early-fifteenth-century pottery of Iran and Central Asia is dominated by Samarkand, which produced pottery with motifs derived from the Damascus imitations of Yüan prototypes. The importance of this production centre was effectively unknown before the Samarkand wares were defined by analysis of pottery excavated in the city. Those Samarkand pieces in museums or in auctions are often described as 'Syrian', or occasionally as 'Iranian'.

Later blue-and-white was dominated by Nishapur, which was producing the finest pottery in the Islamic world in the mid-fifteenth century, and also to a lesser extent Mashhad. Both of these centres were situated in Khorasan, the heartland of the Timurid empire in the late fifteenth century. Both centres appear to have received potters from Samarkand, and in turn potters went from Khorasan to Tabriz. Here pottery was produced for the Turkoman court in the 1460s, and for the Saffavids in the early sixteenth century. In turn these potters would again move on to Ottoman Turkey, to produce the so-called 'Iznik' wares. Preliminary petrographic analysis of this group, however, suggests that Iznik was not the only, and perhaps not the most important, centre producing this pottery.

The significance of being able to finally state for certain where Islamic pottery was produced is clear. It enables us to suggest a relationship between crafts and the great dynasties, whether we wish to think of it as government support of industry or patronage of the arts. In each case we can see technology and chronology combining with provenance to indicate the movement of potters, at first producing pottery in the tradition of their previous home, but soon to develop a style unique to each centre. Clearly potters were highly skilled artisans, using some of the foremost industrial technology of their period.

Apart from being able to produce information about the past, being able to identify the origins of a ceramic piece may be pertinent to the restoration of stolen cultural property, even despite the often wide distribution. This research can also be used for authentication, by determining whether the body of a particular vessel is consistent with the place of its supposed manufacture, or whether it was fabricated by modern or ancient forgers.

Although much of the finer Islamic glazed wares have been studied, there remain some areas where work yet needs to be done. It is clear that further studies will produce further radical results. ■

Note

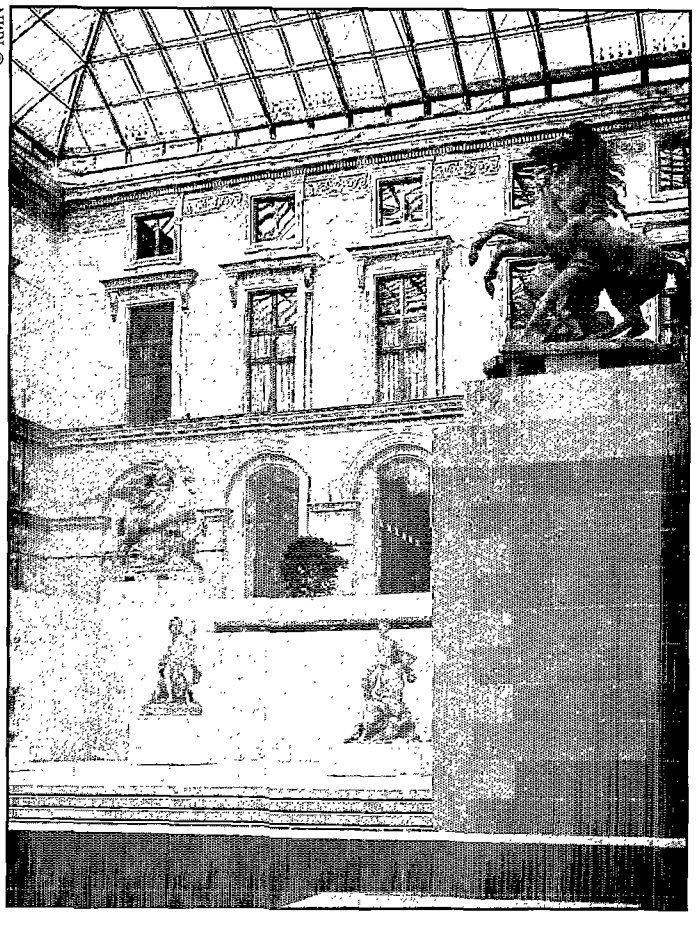
A bibliography provided by the authors is available on request from *Museum International* – Ed.

The Grand Louvre

A Museum International *report*

On 18 November 1993, 200 years to the day after the creation of the Louvre Museum in Paris, the opening of the Richelieu wing was inaugurated by the President of the French Republic, François Mitterrand. More than a mere addition of exhibition space, the new wing amply demonstrates how an art museum can become in itself a work of art. Museum International *was invited to tour the premises and is pleased to share its impressions with its readers.*

The Grand Louvre project, whose second phase was completed in November 1993, consists of nothing less than a complete revamping of the old Musée du Louvre. The scale of the project is overwhelming: since work began in 1984, exhibition space in the already large museum has been doubled, and the total museum area trebled. While the first phase included the creation of a new underground reception area, crowned by the architect I. M. Pei's now famous pyramid, the second phase has centred on the refurbishing of the Richelieu wing. This wing had never before formed part of the museum and for more than 100 years it housed the Ministry of Finance. With its transformation, the Louvre acquired more than 21,000 m² of additional space, the equivalent of Paris's Musée d'Orsay. Also included in the second phase of the Grand Louvre project is an underground car park and commercial areas adjacent to the reception areas.



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View of the Marly Court with one of Guillaume Coustou's horses in the foreground.

The Richelieu wing contains the collections of French and Assyrian sculpture, the Department of Decorative Arts, the Northern schools of painting and part of the collection of French paintings, as well as the Islamic art collection. All the original exterior, façades and roofs have been preserved; however, with the exception of the apartments of Napoleon III on the first floor, the interior of the wing, with its clutter of small offices, has been completely cleared out and rebuilt. Access to the upper floors has been facilitated by a daringly designed pair of escalators. The three courtyards of the wing have been covered by vaulted glass roofs and turned into sculpture courts, with spectacular spaces moulded so as to give the sculptures the palatial setting they deserve.

All display in a museum is a manifestation of a particular interpretation of history and artefacts. In deciding how to display a painting, one also determines how it is to be viewed, which aspects will be emphasized and which will be subdued. When done in one particular way for a long time, a type of display may come to be regarded as sacrosanct. Today, for example, many consider that paintings should only be displayed on white walls with plenty of space between them. Any deviation from the established canon will call into question the choices made and their inevitable subjectivity. If well done, it can also give familiar, well-known works of art a fresh new look. The exhibitions in the Richelieu wing do just that.

ISSN 1350-0775, *Museum International* (UNESCO, Paris), No. 183 (Vol. 46, No. 3, 1994)

Published by Blackwell Publishers, 108 Cowley Road, Oxford, OX4 1JF (UK) and 238 Main Street, Cambridge, MA 02142 (USA)

First and foremost, there are the colours. Dark greens, wine-dark reds, subdued shades of grey, plum and straw now act as the background for the art works. Pale shades were chosen for the French paintings, brighter ones for the Northern schools, each colour being selected not to decorate the space but to bring out what is regarded as essential in the art. French Renaissance sculpture, for example, is displayed in rooms of burnt sienna. Against this dark background, the white marble sculptures seem newly invigorated, as if endowed with a warmth they never had before. The Médicis cycle, a series of large paintings by Rubens celebrating the reign of Marie de Médicis, used to hang in the vibrant red Hall of State. They have been moved to a central space in the Richelieu wing and given a tailor-made interior. Gone are the gilt, the red, and the grand scale of the Hall of State: I. M. Pei has given the paintings quieter surroundings. In a gallery of proportions similar to those of the original site in the Luxembourg Palace, he has designed an interior of shallow niches in two shades of green, in which, in a positive classical manner, the architecture acts as a frame for the paintings. With their simple black frames and softly illuminated by daylight sifting through the vaulted ceiling, the paintings seem to have changed; they appear brighter, the design more delicate. Rather than being awed by the splendour of the gallery, the visitor is led to focus attention where it belongs – on the paintings themselves.

The second ingenious feat of the Richelieu wing is the lighting. I. M. Pei has opted for natural overhead lighting, though not in the form we are accustomed to seeing, evenly spread out on the floor, leaving the paintings on the wall in impenetrable shadow. A set of non-mechanical grilles is designed to throw light on to the gallery walls and is complemented by a cruciform ▶

The Grand Louvre in figures

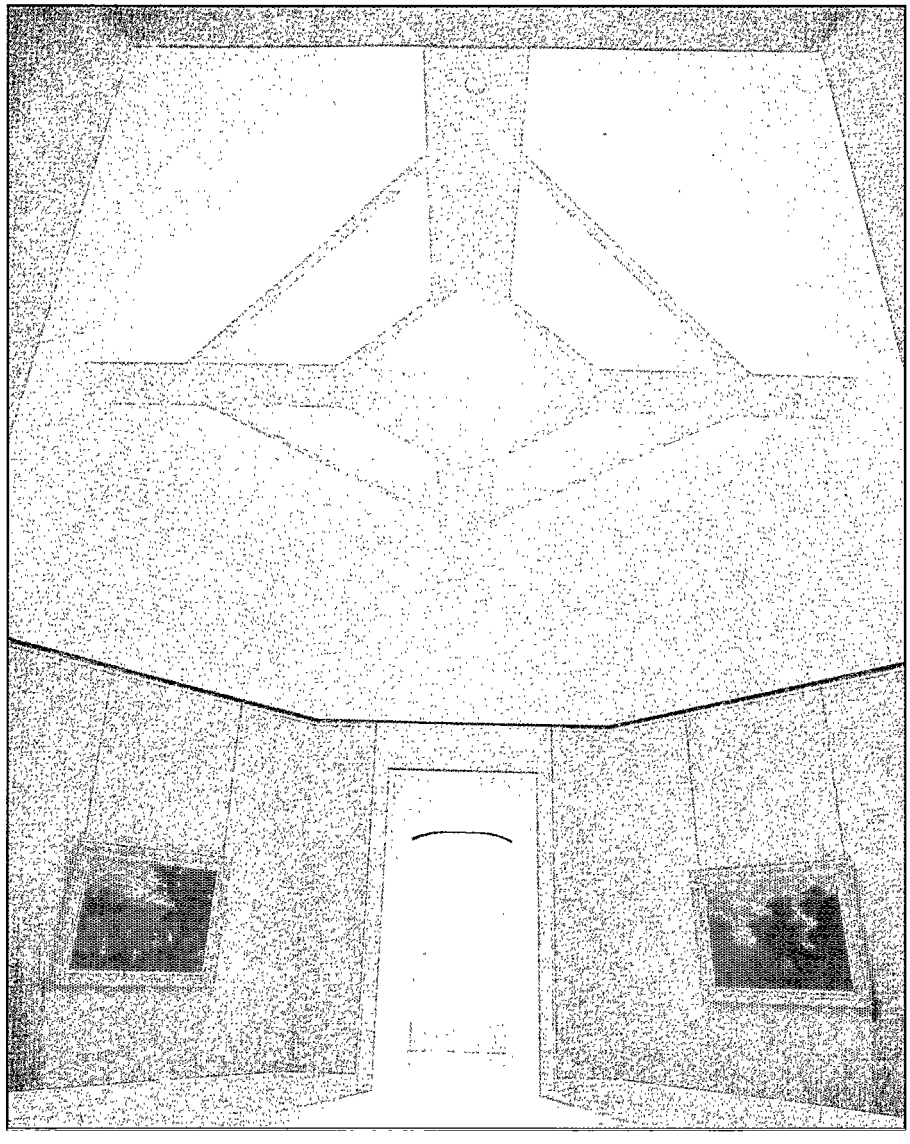
(Architects: Ieoh Ming Pei, Michel Macary, Jean-Michel Wilmotte)

Overall cost of project	6.3 billion French francs (approximately $1 billion)
New rooms in the Richelieu wing	165
Increase in exhibition space	100 per cent
Increase in number of objects on display	25 per cent
Area of façade cleaned	110,000 m^2
Area of roof cleaned and restored	70,000 m^2
Volume of debris resulting from the demolition of the interior of the Richelieu wing	55,000 m^3
Visitors on opening weekend	106,000
Employees	1,500
Professions employed	40
Buttons specially produced for staff uniforms	20,000
Weekly opening hours	62
Cafés/restaurants	7

design on the ceilings, which permits artificial light to supplement the daylight when needed. Decorative features in themselves, these devices give softness to the paintings and make their colours more distinct.

These two factors have in a way transformed the art itself, enabling the visitor to see well-known works of art as if for the first time. What more could one ask of a museum? It remains to be seen, however, whether other museums will follow in this direction. The advantage of white walls is that they are easy to achieve; choosing colours requires a great deal more aesthetic sensitivity.

The Richelieu wing also breaks new ground by opening the museum to its surrounding environment. One of I. M. Pei's many changes to the Louvre was the creation of a north–south axis linking the Rue de Rivoli



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The Poussin Room with a view of Les Saisons *[The Seasons].*

and the River Seine, which involved carving a passageway through the Richelieu wing. Here, the side apertures have been left open, allowing passers-by a ringside view of the two sculpture courts. What is more, the windows in the Richelieu wing have been preserved, on the one hand letting light through to the rooms and, on the other, reinforcing the link between the inside of the museum and the outside world, thus making it easier for visitors to orient themselves. This innovative approach was made possible by new technology that makes windows almost as safe as stone walls.

The Louvre transformation may be a demonstration of bold politics, innovative design and trend-setting museology, but above all it is a tribute to thoroughness. Everything seems to have been thought out with the same painstaking attention to detail, whether it be the dimensions of the steel girders of the courtyard roofs which have been calculated to prevent them from casting shadows on the sculptures beneath, the cleaning and electrical fitting of the Napoleon III chandeliers, the choice of the newest materials which nevertheless complement the old, the design of display cabinets, or the buttons matching the staff uniforms which harmonize with the walls. The project has now entered its final stage, which should be completed by 1997. When it is finished, Paris will boast a virtually self-contained city of culture within the city. The Louvre buildings will also house the renovated Museums of Fashion and Textiles and of Decorative Arts and a new Museum of Advertising. With all the façades cleaned and the adorning sculptures restored, the looming grey walls will have found their original pre-pollution pale pink colour; tourist buses will no longer litter the site but will be discreetly parked underground; and, surprising in a car-loving city such as Paris, the square to the north of the Louvre (the famous Palais Royal) will be turned into a pedestrian precinct. The two small gardens on either side of the Cour Carrée will be renovated, as will the gardens of the Tuileries and the Carrousel. With the old Orangerie having long ago been turned into a museum, a new one is to be built to shelter orange, lemon and bay trees in the winter. As in the eighteenth and nineteenth centuries, the Tuileries will once again be a real garden, giving off faint, exotic scents.

The architect I. M. Pei said at the opening of the Richelieu wing that the ten years he had been working on the Louvre project had been the most exciting period of his life. For art-loving Parisians and tourists, the excitement has only just begun. ■

Editor's note: Ika Kaminka, author of this article, was Assistant Professor of Art History at the University of Bergen (Norway). She served as Assistant Editor of *Museum International* from July 1993 to January 1994 when she left to pursue her doctoral studies in Japan.

A Nigerian treasure in Ibadan

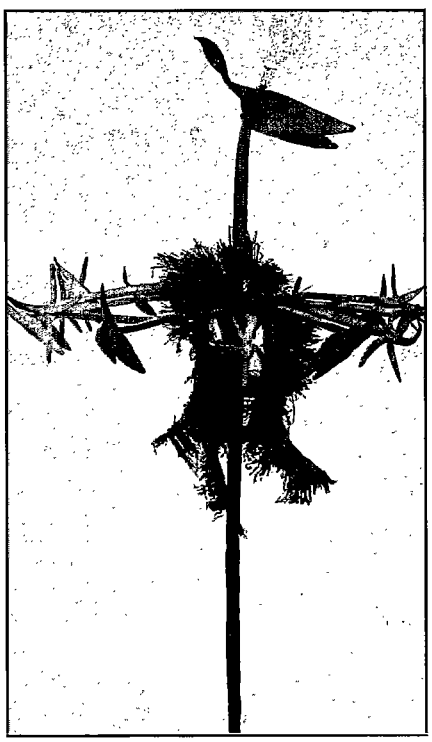
Cornelius O. Adepegba

The Museum of the Institute of African Studies of the University of Ibadan (Nigeria) boasts a unique collection of metal sculpture of both archaeological and ethnographic importance. Dr Cornelius O. Adepegba, Director of the Institute, describes the objects and provides a first-hand glimpse of how a young museum with modest means copes with the challenge of displaying its rich artistic heritage.

The Institute of African Studies of the University of Ibadan was originally planned to include a museum which was to be housed in a separate building. Hence the collection of artefacts – traditional sculptures and other cultural objects including contemporary Nigerian arts – began as soon as the Institute was established in 1962. However, financial constraints made it impossible to provide the necessary space until 1984, when the institute's large store room behind its open courtyard was converted into a gallery, a lecture room and a store. This allowed the collection to be exhibited to the public on a fairly regular basis.

A unique aspect of the collection is the richness of its metal sculptures which are not well known in the outside world. Nigeria abounds in metal sculptures of both archaeological and ethnographic significance, but so far scholars have mainly focused their attention on the collection's older sculptures of archaeological significance. The decorative metal sculptures from the archaeological site of Igbo Ukwu, the idealized naturalistic works from the ancient Yoruba city of Ife, the Benin court arts carried to Europe after the British subjugated the town in 1897, and the human and animal figures from the Nupe villages of Jebga and Tada have been of greater interest to art scholars than the presumably more recent objects of ethnographic significance collected from their various functional contexts.

Photo by courtesy of the author



Osanyan staff, Yoruba.

These types of objects were produced by the Yoruba, Edo, Ibo, Tiv and Jukun peoples, although production has waned somewhat in recent years. They are generally made of non-ferrous metal, mostly brass; sculptures in forged iron are found only among the Yoruba and the Edo. The staffs associated with the gods of herbal medicine, Osanyan of the Yoruba and Oshun of the Edo, are similar in forms and purpose and this is undoubtedly due to the geographical and cultural proximity as well as the possible historical links between the two peoples.

The Institute's collection is not, however, representative of Nigerian ethnographic metal sculpture as a whole, since nearly all the sculptures in the collection are from the Yoruba, with the exception of three Edo and two Ibo sculptures. (The Edo pieces are recent full-figure representations of the traditional ruler of Benin produced for tourism or other non-traditional purposes. One of them was commissioned and presented to the institute by the traditional ruler of Benin in 1984 when he was formally invited to open the museum.)

The preponderance of Yoruba artefacts in the collection is not surprising, considering that Ibadan lies in the heart of Yorubaland

ISSN 1350-0775, *Museum International* (UNESCO, Paris), No. 183 (Vol. 46, No. 3, 1994)

Published by Blackwell Publishers, 108 Cowley Road, Oxford, OX4 1JF (UK) and 238 Main Street, Cambridge, MA 02142 (USA)

and that the Yoruba have the greatest variety of such objects. Even in other Nigerian museums where efforts have been made to build up representative collections, such as in the National Museum in Lagos, objects from other producers of metal sculpture remain scanty and the majority of works are Yoruba-type objects.

The metal sculptures can be divided into four groups according to their forms and functions: symbolic stationary objects of sanctuary significance; prestige insignias of positions and membership of religious groups; figure compositions and figural containers of uncertain uses but reflecting their owners' social standing; and, lastly, jewellery.

Stationary sanctuary-type objects

Although many of the metal sculptures are kept within the household, most of them are intended to be carried or displayed outdoors as a manifestation of their owners' cult, religion, profession, social position or wealth. Only a few objects are therefore kept permanently in sanctuaries. There are iron figures of Osanyan, each with a stalk for planting into the ground and spoke-like arms projecting from the staff and terminating in arrow or bird forms. Sometimes only the centrepiece carries a bird, a fact that has intrigued some art scholars. The object is associated with the god of medicine, also known by the name Osanyan; however, it is not kept in the work-rooms of the medicine men, but rather in the shrines of deities related to the religious masquerade devoted to the ancestors.

Other stationary sculptures in sanctuaries include male and female figures normally kept in the shrines and cult houses, often those of the Ogboni, the Yoruba secret cult of the elder. There are invocation bells used in worship rituals as well as cutlasses with ornamental handles which are also kept in sanctuaries, seemingly as weapons for the gods to enable them to fight for the causes of their worshippers.

Insignias of religious groups and social position

The objects belonging to this group consist mainly of tall staffs, clubs and pokers carried by their owners during ceremonial outings, in addition to various bells that are tied to the body by certain Yoruba masquerades and chieftains, but above all by important religious chieftains of the Ibo.

Some of the Yoruba objects in this group are made of iron. The Orere and Yemo staffs accompany eminent and chiefly diviners and the priesthood of Yemo, a female deity who was supposed to be the wife of the Yoruba god of creation, Obatala. There is also the staff of the god of agriculture, Orisa Oko, which is not the usual round stalk but is distinguished by its thick blade-like form. It is generally carried by female devotees.

The other objects in this group are not forged but are cast in non-ferrous metals. Various tall staffs with applied figures, usually about 120 cm long, are without religious significance; they are, rather, indications of their owners' individual prestige. Most of them were made in one of the two brass-casting centres in Abeokuta town. There are also clubs, dance wands, pokers and bells in this group, including *ose*, the dance wand used by the priesthood of Sango, the Yoruba god of thunder and supposedly one of the early rulers of Oyo, the capital of the most powerful of the Yoruba states until its collapse before the Muslim jihadists in the nineteenth century.

Photo by courtesy of the author

Group composition, Yoruba. Its use uncertain but associated with Osun, a female deity.

The *ose* is mostly made from wood and the only known metal versions are those in the museum. Other clubs, such as the *oduro* and *ogbo*, are the symbols of certain Yoruba chieftains. Similar to the clubs are pokers cast with figurative handles and carried by chiefs of blacksmiths as symbols of their profession. One spectacular object has an intriguing shape, resembling a spoon and decorated on the back and handle with a raised circle. It is Ibo in origin and is used as a prestigious substitute for the *ofo*, the unadorned twig of a tree carried by lineage heads as a sign of their authority.

A number of bells in the collection were worn to announce the approach of their wearers. Such bells, when of quadrangular shape, are worn by the north-eastern masquerade, *epa*, of the Yoruba, whereas the popular Benin bells are worn as emblems by warriors. In Ijebu-Ode, a Yoruba town, some chiefs wear round bells as emblems of their hereditary chieftain positions. Round bells decorated all over with spiral motifs used to be worn by the chief of Nri, a theocratic leader of the Ibo. The museum has only one copy of each of these three bell types.

Figure compositions, containers and jewellery

There are both single and group compositions using the human figure. While most of them are full figure, two represent only busts. Both of these are depicted with a bird perching on the forehead, facing downwards. With the exception of two figures of colonial police officers, which are shown standing, the single full figures are portrayed either seated or squatting. In one composition a seated Janus figure is shown with the mouth pushed forward in the opposite direction to the head.

In the group compositions, the central figure is invariably seated, with his subordinates, musicians or attendants, standing around him. One such composition contains a lidded container in the form of a bird standing on the side. There are two other figure compositions with lidded containers; one is an equestrian figure carrying a spear and the other is of two birds standing under an open-work support for a container made in the form of a tortoise. Single-figure representations include animals, crocodiles and a miniature chameleon, lizard and bird. We do not know for certain what these containers were used for, but most are associated with Osun, a female deity whose worship is popular in the northern Yoruba region.

The jewellery in the collection includes bangles, bracelets and armlets. One pair of

Photo by courtesy by the author

Back view of a spoon used as a substitute for ofo*; Ibo or Western Ijo.*

bangles is made with no images. Such bangles are associated with Osun while the other bangles decorated with images or open work are personal ornaments. The bracelets or armlets are about 10 to 12 cm in height. Human figures and open work are combined as decorations on some of them while others are decorated only with relief images. The objects are usually associated with the Ogboni, the secret cult of the elders, which, in the Ijebu area where most of the objects were found, is known as Osugbo. However, in a more practical sense, the objects were prestigious displays of wealth. Cult members and the priesthood were certainly élite groups of some sort in pre-colonial Yorubaland.

The non-ferrous metal used for the majority of the sculptures in the museum is brass, which was very highly prized among some Nigerian peoples before European contact. In Benin, it was used exclusively by royalty and, because of its shining quality, was believed to be capable of repelling evil. Among the Yoruba, only children were as highly prized as brass and coral beads.

The exhibition space in the museum is very limited and able to accommodate only a few showcases and box stands. Exhibitions are thus either organized around themes or are rotated. The metal sculptures have been displayed only once, in 1986, and the exhibition, like others in the museum, was very modest, unaccompanied by any catalogue, and explained to the visitors with only typewritten information labels pasted alongside the exhibits. The display of the sculptures in the exhibition was based on their shapes and sizes. Most of the staffs, especially the tall ones, were simply fixed to flat wooden platforms placed on the ground or on box stands, depending on the height of both the sculptures and the stands, while other objects were either hung or placed on stands in showcases. However, the display arrangement coupled with the richness of the exhibits made the exhibition one of the most impressive ever held in the museum. ■

Connecting theory and practice in museology

Philippe Dubé

The mingling of disciplines so characteristic of museological studies may have been a liability in the past but today it may turn out to be the profession's greatest asset, according to Philippe Dubé, professor of museology at Laval University in Quebec, Canada. In his plea for a new perspective in interpreting training programmes, he underlines the necessity for museology to come to terms with its essentially multidisciplinary nature. His article is based on an address to the International Committee for the Training of Personnel (ICTOP) during the 1992 ICOM General Conference.

University courses in museology have mushroomed in the past few years, all of them designed to 'professionalize' a job that until recently used to be learned as one went along. There seems to be no obstacle to this very clear intention to improve the professional services offered in and by museums. Governments are generally in favour of universities' taking on responsibility for museum training, and the invitation to improve qualifications is usually well received in professional circles. So what is the problem? The courses are now available, and they are being taken up with enthusiasm. So all is for the best, in the best of all possible worlds.

But in fact there are two problems. The first is that the professionals who are so eager to improve their qualifications often do not know what exactly they want to improve, and the second is that the courses they are offered have been designed on an aridly theoretical basis. How can we reconcile the unreconcilable and create a kind of theoretical training that meets professionals' needs, bearing in mind that their needs are, after all, fairly specific? Not without reopening the age-old debate that sets the university as the trainer of the mind against the world of work as the ultimate arena of practical achievement. Mind and matter cross swords once again, each claiming to be the best and noblest sphere of human intelligence. But in many areas this artificial antagonism was reconciled long ago by marking out the boundaries of training and specifying the territory to be covered by each of the two spheres. The university pretentiously arrogated to itself the universal, fundamental, epistemological outer reaches of knowledge: the absolute, in other words. And the professionals, for their part, hung jealously on to what they regarded as the essential preparation for professional activity which must meet a number of standards or criteria inherent in the profession and, lastly, provide an acceptable level of service to the public.

On closer examination it can be seen that medicine, for example, as a discipline, is continually accumulating new knowledge on a subject that to start with is relatively simple – the subject of health. Alongside this accumulation of scientific knowledge, the medical profession collectively develops a more and more strictly regulated code of practice both to uphold recognized professional standards and to protect the public as users of the services provided. This two-track development occurs in a number of professions, dividing the expertise required into two watertight compartments while recognizing and respecting the goals pursued by both. On the one hand there is a discipline evolving in its own way and with its own priorities, and on the other an association of practitioners who have agreed on a number of shared tenets which set the highest possible standards for the exercise of their profession.

This type of development, which is not particularly new, has the great advantage of drawing a distinction between the acquisition, firstly, of a basis of knowledge which is ineluctably linked to human values and, secondly, of a more technical know-how corresponding to a quality of service that is unanimously accepted by both practitioners and users. This very clear distinction means that in our societies we can acquire a body of knowledge that will eventually enable us to practise a profession, but that the only recognized training is in two stages: first, university training, providing a basis that can vary considerably from one institution to another; secondly and consequently, vocational training which essentially establishes

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patterns of behaviour, so as to satisfy criteria recognized by and for the practitioners themselves.

The debate could be closed forthwith by ruling that universities should be responsible for providing theoretical education in the discipline while vocational training would from now on be the responsibility of professional associations such as ours (ICTOP). We should then, like any 'responsible' professional body, set our own formal examinations authorizing those who pass them to practise our profession. We should thus have a first stage consisting of a university education, which would do what it could to improve the minds of school-leavers, and a second stage of practical training concerned basically with ways of doing the job which would control the access of all candidates to the profession.

But you will immediately retort that all this is both irrelevant and absurd; that we cannot find so easy a way out of this dilemma – the full force of which seems to be concentrated on us alone, so deeply is it bound up with our situation – without undermining the profession's already not particularly firm foundations. And you would be right. We cannot slavishly follow the patterns established in other, recognized, professions. We may be able to do so one day, but for the moment there is no sign of any clear or formal structure emerging for museology. We are more likely to continue for some time to flounder in a morass which we endure out of habit and often out of apathy. But if we were to subscribe to such a depressing view of our profession's future development we should soon lose all sense of purpose and should sooner or later drift into insignificance. We must pull ourselves together and offer a more positive image, not only to ourselves but also to those who still regard us with suspicion.

A kaleidoscope of approaches

The first step would be to recognize that the exercise of our profession is not the direct result of a unilateral academic approach to a particular discipline. Legal studies, for example, follow a relatively linear progression towards the goal of training officials for work in the legal context. One step, one stage, one level of qualification follows another. A person may become a solicitor, a legal adviser, a lawyer, a barrister or a judge, but all these are variations on a single theme – the law. Study of the law is the common thread running through and linking all the branches and specializations within the legal profession.

But our profession – museology – stubbornly resists this orderly progression from one stage of training to another, in a preordained linear sequence. The academic disciplines on which our work is based are many and varied, and the outcome in terms of the occupation that a person actually takes up is by no means a foregone conclusion: the basic academic training is simply converted for use on the applied side of the subject studied. To make my meaning clear I could say, perhaps mistakenly, that an art historian will always be an art historian: the museum is simply his place of work. Whatever he may say to the contrary, he is simply applying his knowledge of art history. An anthropologist who crosses the threshold of a museum brings with her all the methods of the social science in which she qualified and remains an anthropologist in just the same way, except that during her working day she will perform a series of actions that come under the catch-all term of 'applied' science.

To take my argument one step further, we museum professionals, unlike the mem-

bers of more established and traditional professions, share no common academic background with most of our colleagues (the museum conservation specialist will have been trained in material culture, the education specialist in teaching methods, the museum director in administration, and so on). Our paths will not have crossed until we begin to work in the museum. We have acquired our qualifications in university faculties that, if not rivals, are often regarded as incompatible, and from one day to the next we have been brought together to form a profession. On the one hand, a linear progression becomes plural, such is the range of different paths that can be followed; on the other, a plurality of paths converge on a single focal point, the museum.

This could be the reason behind a number of mistakes or misapprehensions in programmes that try to align the theory of museum work with its practice: our profession is not the logical conclusion of a course of study in one single discipline but the result of a kaleidoscope of approaches clumsily labelled 'museology'. Unfortunately, it is not recognized under this name. The hat fits too many heads to confer any recognizable professional identity. The practice of museology for most of us is, in my view, fortuitous, even for those who spend their whole working lives in museums. Botanists working in botanical gardens, for example, are first and foremost natural scientists, and that will continue to be the case for however long they work in a museum context. Throughout their career their museum work will be purely contingent, their support and sustenance coming from botany, not museology.

I should like at this point to make something clear, not in order to run down a discipline to which as a teacher I am fully committed, still less to invalidate our quest for a professional identity, which is often the starting-point of internal discussion, but rather to shed more light on what our university courses are doing and what needs we are really trying to meet. I am not questioning the legitimacy of museology: it has a life of its own and could have a promising future. It would also be useful to know whether or not museology, as a discipline, can provide the theoretical basis sought both by aspiring museum workers and by those who are simply interested in the subject without having any career objective in view. In other words, how can this type of course stimulate both a purely intellectual interest and the desire to improve one's professional qualifications? There is no contradiction here that cannot be resolved, but there is perhaps more a need for a terminological adjustment that would bring into clearer focus the subject and object of this discussion.

What exactly is the problem? Is there too much emphasis on theory in syllabuses aimed mainly at professionals or too much practical detail for neophytes seeking intellectual gratification? Of course, the question of proportion is important: theory must go hand in hand with a practical dimension, because most of the courses are designed for professionals. But does one need a university degree to be able to determine the ideal degree of relative humidity? Certainly not! Where does education stop and training begin? We are, surely, talking about two separate things.

I do not wish to lure you into ramifications that will add nothing useful to the discussion, as I have just stated that I feel it is time I reached a conclusion. But I hope you will understand that the question, or rather questions, are not in fact so simple and need to be carefully weighed before I can

see my way to any conclusion. What common denominator can be found in Master's courses that purport to provide further professional training when the students' previous studies can be, and often are, extremely diverse? What basis of acquired knowledge can be assumed which will enable students to engage in analysis and debate at a level accessible to all? For me this is a serious question to which I can find no obvious answer. These are the dilemmas that must be faced if we are to find the right wavelength and make it possible, despite the heterogeneity of student intake, to achieve some kind of consistency, and to do so before too long.

Convergence and divergence

Perhaps, collectively, our profession is in the situation in which almost all the countries of the West find themselves at present, and especially the younger and more affluent among them, namely, that of having to come to terms with the prospect of sharing their national identity with individuals from a variety of backgrounds, whether they belong to the same ethnic group as, or are descended from, the people who founded their nation, or whether they are newcomers. That considerable challenge has been taken up successfully by some nations, despite their short history, while others are still struggling with it, clinging to the more linear model of 'one people, one nation'. Although I do not wish to spring a political debate on an assembly whose purpose is honestly to consider museology, the comparison does offer an interesting illustration of convergence and divergence. In one case, branches shooting off in all directions from a common base, and in the other the exact opposite: a centripetal movement from far-flung points of departure towards a single destination.

In short, we may be wrong to insist on comparing ourselves to traditional career models when our own situation offers a much more contemporary paradigm of present-day social realities with which we are all familiar. Perhaps – who knows? – museology is unwittingly setting down markers for the future by adopting a pluralistic approach in harmony with, if not dictated by, its own essential nature. At the risk of being tedious, I should like to single out from this perhaps rather confused account one key idea. That is that our training programmes are not perfect and that we shall soon have to strike the right balance of theoretical and practical content, focusing our attention more on the practical ingredients, many of which have yet to be defined. We may be pioneering, but one thing seems to me certain: we should not be worried by the apparent 'reversal' of the normal situation in our profession – its non-linear character – because this apparent weakness could become our strength if, instead of just putting up with it, we were to make it our driving force, since the kind of progression I have described is much more in keeping with the modern social context.

What in fact I am trying to say is that we should not rush to align our profession on other, recognized, models, because what today is regarded as a defect, an impoverishment, even inside our profession, so deeply are we in thrall to the dominant canons, could soon be transformed into an asset, which might in the end enable us to leave our mark on society, finally making us feel that we had a right to exist in this 'upside-down country', to use a favourite expression of my colleague Denys Delage. Our feeling of inferiority to the major professions would be a thing of the past, for although less firmly established we would be respected for having 'done our own thing'. Our adaptability would be

such that those trained by us and experienced in our ways would be called upon to take leading roles in the world – our world. (An eloquent example of this trend would be Alpha Konaré, who, after being the President of ICOM, in June 1992 became President of Mali.)

Although we must try to remain within the bounds of reason, I do feel that museology will begin to achieve something only when it has come to terms with its essentially multidisciplinary nature and sets itself goals that correspond to the plurality of museological practice. The quest for a miracle theory that will make us all brothers and sisters carrying the same intellectual baggage is part of an outdated mythology that is an obstacle to progress. Let us rather accept our differences and start establishing a definition of our plurality that will benefit the greatest possible number. Museology will then be on the way to being a science with a genuinely all-round approach, for its professional application will encourage receptiveness to the ideas of others and it will, in so doing, offer a 'contrary' way of looking at the world. Several of us are already working on this, and the only limits we shall recognize will be those that are self-imposed. ■

The Leventis Municipal Museum in Nicosia

Alexandre Blokh

'Saving the cultural heritage of the city, organizing it and making it accessible' are, according to Alexandre Blokh, the goals of the Leventis Municipal Museum of Nicosia, crowned in 1991 with the European Museum of the Year award. The author served for many years with the United Nations and UNESCO, and is currently Secretary-General of International PEN. Under the pseudonym of Jean Blot, he has contributed as art and literary critic to a number of journals, such as La nouvelle revue française, Preuves, *and* L'Arche, *and is the author of a dozen novels and essays on English, French and Russian literature.*

The longer, more complicated and tragic the history of a country, the more difficult it is for its people to discover, develop and affirm their cultural identity. Cyprus is one of the oldest countries of the Western hemisphere (perhaps even of the world) and its history, which stretches back over close to four millennia, is steeped in drama, conflict and tragedy, of which the current one, dating from 1974, is but the most recent, and let us hope the last, in a regrettably long series.

The Leventis Municipal Museum of Nicosia intends to respond to Cyprus's cultural need and to chart an itinerary, using a few potent images strong enough to stir and focus the imagination – an itinerary whose twists and turns will meld memory and conscience. Nicosia is the capital of the island, its intellectual and historical heart, and thus the most obvious key to its history – and the portrait the museum sets out to present is that of Nicosia. Established in a huge nineteenth-century residence (rare on the island), which belonged to Dr Dervis, one of the city's first mayors, the museum is located in an exquisitely restored quarter that has been reserved for pedestrians – or strollers. By its very structure and interior design the building is a present reminder of the past.

And yet, by a didactically fortunate paradox, the museum is opening its doors to the public at a time when Nicosia is divided by a green line whose symbolic barricades of sandbags and barbed wire must be crossed in order to explore the city's history. The museum's collection of photographs, newspapers, maps, posters and scale models transport us back to a city (barely recognizable today owing to its rapid development) that served as the setting for the confrontations that finally brought independence to the island.

The turning-point is more fully explained in the next room: the independence process began with the agreement drawn up between the Ottoman Empire and Great Britain on 9 June 1878, from which date the latter took over the administration of the island. Illustrations, caricatures and drawings from British periodicals of that period (*Punch* in particular) help to re-create vividly the moment when the Union Jack was raised over Nicosia, which was none the less allowed the right to elect its own mayor. Governors Garret and Kitchener took great care to draw up maps of the city and island, which, the British public was informed, represented 'the gateway to Egypt, Syria and Asia Minor'; they were also told that 'any voyage to the East must begin with Cyprus', as borne out by the experience of travellers such as Sargon, Cyrus, Ptolemy and Harun-al-Raschid. Cyprus, whose colourful bazaars abounded with fabrics, carpets, tapestries, leather and ironwork, whose nameless streets were choked with wooden or zinc awnings, and where ox-carts crossed paths with barouches drawn by elaborately decked-out horses, saw its political life take shape primarily through the constitution granted it in 1882 and the municipality's efforts to introduce the Greek language and otherwise prepare for the island's union with Greece.

In 1912 Nicosia's streets were given 250 names originating from Antiquity and Cypriot and Greek history. When the First World War broke out Cypriot volunteers enlisted, and their decorations are lovingly preserved in the museum; the Second World War saw the same phenomenon. Meanwhile, Nicosian cultural life was developing through the founding of a lyceum, a library and a teachers' college, which added to the city's awareness of its Hellenic heritage. A referendum conducted in 1950 showed that 95.7 per cent of Greek

ISSN 1350-0775, *Museum International* (UNESCO, Paris), No. 183 (Vol. 46, No. 3, 1994)

Published by Blackwell Publishers, 108 Cowley Road, Oxford, OX4 1JF (UK) and 238 Main Street, Cambridge, MA 02142 (USA)

Leventis Municipal Museum of Nicosia

Frankish period, 1192–1489.

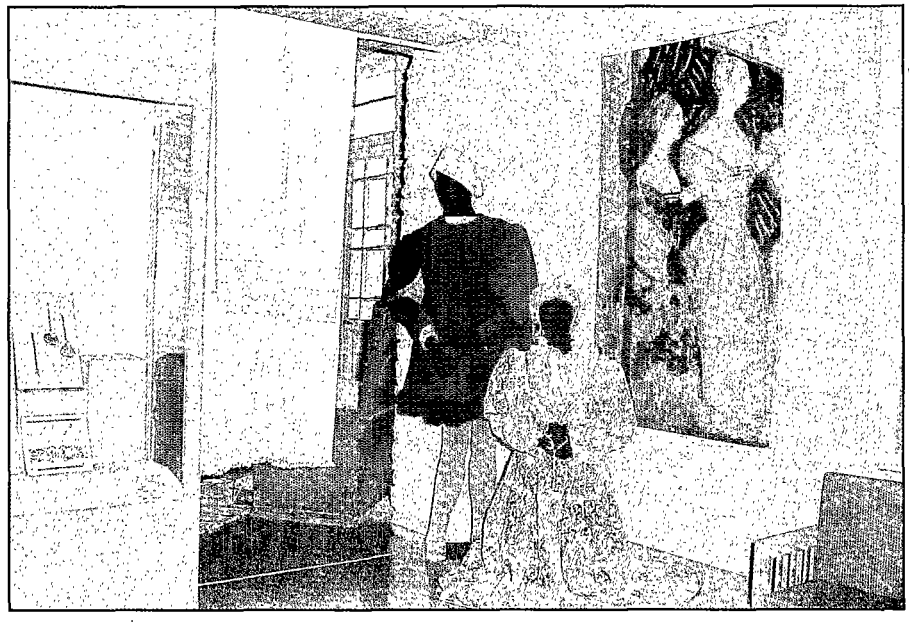
Cypriots were in favour of union with Greece. The EOKA national resistance movement, whose first proclamation is reverently preserved in the museum, took form and culminated in the Zurich Agreement of 1959, establishing the Republic of Cyprus.

Thus ended the long history begun with the period covered in the next room, which is devoted to the Ottoman Empire (1571–1878), and where originals and reproductions of pictures showing the siege of Nicosia by Mustafa Pasha are on display. The Turks massacred all resistants, installed a military regime, settled colonists, and forced the population to convert. Not long thereafter, through the Cypriot dragomans, who were interpreters but, most importantly, tax collectors, municipal life resumed and became increasingly autonomous. Here we can see a fresco depicting one such dignitary in a fur hat and sumptuous attire, his hand outstretched in a gesture of humility. The maintenance of national identity devolved, in fact, upon the Greek Orthodox Church and its archbishops, whose negotiating skills earned them a number of concessions, including the right to found their own schools. The sacerdotal clasps displayed here bear witness to the extreme degree of refinement attained by the clergy. The city flourished and expanded, attaining a population 16,000, and seventeenth- and eighteenth-century travellers admired it for its 'beautiful edifices, ancient churches, latticed windows, delicate balconies, and gardens blooming with orange and lemon trees'. The impressive star pattern of walls still stands. It was built by the Venetians on their arrival in the fifteenth century, following Catherine Carnaro, who had become Queen of Cyprus upon the death of her husband, the King. Neither Bellini's portrait of her, which hangs in the Museum of Budapest and is reproduced here, nor the illustration taken from a book published in the eighteenth century shows the queen to be a model of seduction. But through her the lion of Saint Mark entered Cyprus, and the Venetians quickly laid claim to all the kingdom's most prosperous enterprises. The first maps of the city and the island were drawn up at this time, a beautiful collection of originals and reproductions of which is kept here. The most ornate of these heralds the end of the Venetian reign and depicts the siege of the city by the Turkish army under its crescent banner. Objects such as silver-plated and solid-silver goblets as well as coins attest to the spread of wealth in Nicosia, and its visitors sang the praises of its monasteries, churches, climate and religious art, of which many examples are featured in the museum's collection.

And so we come to the Frankish period (1192–1489) of the Lusignans, perhaps the richest in legend and artistic expression, whose splendour was praised as early as 1211 in the writings of one distinguished visitor. For him Nicosia 'has many inhabitants, all of whom are extremely wealthy'. A drawing of the cathedral of St Sophia, modelled on Notre Dame in Paris, photographs of the western entrance, and the windows of the former palace of the Lusignans, bespeak the quality of the artistic treasures that adorned the capital during this period; a capital city 'whose air is healthy, whose water is pure, and which is replete with gardens and orchards'. Reproductions of thirteenth-century frescoes, gravestones and icons round out this picture. Cypriot history is rich in the stuff dreams are made of: it was here that Richard the Lion-Heart married Bérengère de Navarre before setting off on the Crusades, and here that the Knights Templars, to whom he sold the island, reduced its people to slavery. Its history stretches even further back, to embrace Byzantine icons, Roman coins, ancient Greek vases and remarkable figurines and pottery from the dawn of history.

A richly illustrated guidebook, from which I have borrowed liberally here, conducts the visitor through the museum's successive rooms and historical periods. The Leventis Foundation and the municipality can be said to have attained their self-designated goal of saving the cultural heritage of the city, organizing it and making it accessible, in order to provide the community with a sense of its unity and historical continuity. For schoolchildren, it will serve to illustrate and accompany courses they take at school, and they in turn will bring their parents to the museum, where there is a stream of lectures, seminars and exhibitions going on. The museum has appealed to the community for its support, and continues to add to its collections through individual donations. The community further participates by identifying postcards and photographs, and similar activities. It is easy to see why this museum and its curator, Mrs Hadjigavriel, were awarded the European Museum of the Year prize in 1991.

Perhaps on your way out you will discover, as I did, a hall filled with children sitting or sprawling on the floor drawing and painting with remarkable application. The history they are discovering is their own. Let us hope that by the time they become adults the unity their country knew in the past will have become a living reality, and that the 'White City' of Nicosia will belong in the fullest sense of the term to all its citizens. ■



Leventis Municipal Museum of Nicosia

Venetian period, 1489–1570.

Prevention rather than cure: preservation versus conservation

Graeme Gardiner

If conservation is to be seen as more than 'an interlude in a downward spiral of decay', another approach, which the author calls 'preventive conservation', must emerge. Graeme Gardiner trained as a paper conservator in London, where he now runs his own studio. He specializes in designing and implementing preservation programmes for private and public collections, and also works as a consultant for Atlantis European Ltd, the British supplier of archive preservation products. In 1989 he set up the European Art Conservation Trust which is currently involved with various conservation projects in eastern and central Europe.

Conservation, as opposed to restoration, is a relatively new phenomenon, having reached maturity only in the last thirty years. Whereas it used to be impossible to talk about conservation without reference to restoration, today many museums, libraries and archives have their own conservation workshops. Because conservation has a growing public image, institutions use their work in this field to illustrate a modern and ethical approach to the management and maintenance of collections.

One factor contributing to giving conservation a higher profile has been the increasing number of large international exhibitions which have created a greater demand for world-class exhibits. As most items are either conserved or at least surveyed before being exhibited, conservation workshops spend an increasing amount of time working towards the next exhibition, or tidying up from the last. Moreover, this has done much to educate the viewing public in what to expect. Twenty years ago, the visitor expected old paper to look white, as bleaching was regularly used. Now the opposite is more often true, as conservators, having become more aware of the dangers of certain chemical treatments, tend towards a less interventionist approach.

In recent decades, whether the approach has been interventionist or not, conservation programmes have concentrated on the more important collections of the larger institutions. This concentration on high-profile conservation has led to a backlog of work on less famous collections, and has thus created two tiers of collections management. To a certain extent this is of course inevitable; it is nearly impossible to give all holdings the same treatment and care. However, it is vital that all collections be stored correctly, so that even if they are not actively conserved, they are at least guaranteed against further deterioration.

Unfortunately there are no such assurances, and conservators will testify that most of the damage caused to collections has its roots in poor storage conditions: incorrect or fluctuating temperature and humidity, pollutants and dirt, excess light, insects and mildew, poor cataloguing and security. All these factors are catalysts for the decay of objects. However, because the decay happens almost imperceptibly, usually as the result of years of neglect, it is easy to ignore. Thus, whilst many institutions are active with regard to acquisition, and stage high-profile exhibitions demonstrating their commitment to conservation, they often turn a blind eye to the conditions in which their collections are being kept. Some items, damaged through poor storage, are merely conserved for exhibition before being put back into the very environment that caused the initial problem.

There are three main reasons for this:

First, the upgrading of storage conditions can be very expensive, requiring either extra funds or the diversion of existing ones. With most institutions fighting for budgets, allocating money to tackling a largely invisible problem is not an easy choice.

Secondly, storage problems are often so extensive that it is difficult to see how they can ever be dealt with satisfactorily. Given the diversity of most collections, these problems are not easily solved – not least because there are few people trained to do so.

Thirdly, better storage conditions generally require more space, not easily available to most museums and libraries which are often housed in old buildings in the centre of town where expansion possibilities are limited.

Adding to the previous problems is the fact that in many institutions the people who

ISSN 1350-0775, *Museum International* (UNESCO, Paris), No. 183 (Vol. 46, No. 3, 1994)

Published by Blackwell Publishers, 108 Cowley Road, Oxford, OX4 1JF (UK) and 238 Main Street, Cambridge, MA 02142 (USA)

are in the front line against collection decay do not have a position from which to argue their case. For example, the relative youth of conservation means that conservators often do not hold a formalized position within the institutional hierarchy that reflects their importance. Conservation workshops are often housed away from the main building. Separated from the collections they are to look after, the conservators can work only on what they are given, and have little or no say in the formulation of the conservation policies they serve.

Preventive conservation

However, things are improving, and in recent years some museums and libraries have become aware of the problems of storage and the urgent need to address them. Out of this the concept of preservation, or preventive conservation, has evolved, referring to a mixture of collection and storage management which involves little or no direct interference with the objects themselves. Preventive conservation can also be seen as an approach by which one may slow down or even stop the negative ageing effects of poor storage by improving the storage environment. This can be achieved by a combination of upgrading the quality of general storage conditions and housing material in protective containers. It also includes the provision of adequate cataloguing, access and security, so as to minimize the risks of both physical and chemical damage.

Because the life of the collections depends on so many factors, preservation programmes need a broad base, and will have to involve many members of staff. This is also important in a different respect: such programmes spread the responsibility for maintaining the collections beyond the curator and the conservator and may help to demystify many of the simple procedures for protecting collections.

As the future survival of collections is the main aim of any preservation programme, it shares the same goals as conservation. For this reason conservators will be at the centre of any preservation strategy. In a perfect world, a detailed preservation strategy would be established at the same time as a conservation department, allowing for all the collections to be stabilized before any large-scale improvement takes place. Thus, even given the financial restrictions under which most museums work, many more collections could be preserved for a given sum of money than conserved. This is not an argument against conservation, which will always be necessary for certain objects. Rather, it is a realization that a high standard of storage is universally required for all museum holdings, while not all holdings require conservation. Also, with the current non-interventionist policies of modern conservation, and a growing reluctance to work on an item unless it is absolutely necessary, there are increasing arguments for prevention rather than cure.

The emphasis on a mixed strategy of preservation followed by conservation is slowly gaining ground. Many institutions remain, however, reluctant to allow their conservation departments to concentrate on less interventionist, but more effective, preservation policies, and to extend responsibility for collection survival to a broader spectrum of museum staff. Nevertheless, there are some exceptions, of which the Dutch Delta plan forms a prominent example: through this government-supported preservation project, the Dutch are approaching the problem on a nationwide scale. Established in 1989, the Delta plan pledged government support in the

form of 50 per cent grants for maintaining and improving the standards of preservation and presentation in national museums. A survey carried out on all museums, libraries and archives in the country showed the extent of decay caused by poor storage and management. This has led to preservation projects being given higher priority, with financing for conservation being made available only after the problems of cataloguing and storage have been addressed.

Eastern and central Europe: a critical situation

Unfortunately, most governments are not as far-sighted as the Dutch, nor as willing to place the preservation of their heritage quite so high up on the national agenda. In many cases this is not because of the lack of political will, but rather to the lack of appropriate funding. This is particularly true of the new democracies in eastern and central Europe, where lack of resources is causing increasing damage to national collections.

There are very few grants available to help preservation policies in the region; most of the foreign assistance given to the cultural-heritage sector is in the form of computerization. Furthermore, much of the help comes in the form of corporate funding, inevitably given with an eye to future profits. The financial-profit motive hardly relates to most conservation work, with the possible exception of architectural restoration, which is about the only area of conservation receiving external funding at the moment. More-over, since the region is renowned for its fine conservation workshops with skilled and dedicated staff, many aid programmes do not consider that assistance is needed in spite of the fact that these workshops are critically short of materials and equipment.

The situation is not helped by the fact that so few of the collections are known outside the region. They often represent the little that is left from pre-communist culture, and are vital to the area if it is to rediscover its cultural traditions and heritage. Ironically, the development of new computer cataloguing systems throughout the region will encourage interest in, and access to, these little-known collections. But if there are no adequate conservation and preservation programmes in place, one may ask what the effects of this growing interest will be – if not to hasten the decay of the collections.

Even with an increase in support, their conservation strategies will not be able to deal with the backlog of work that now exists. The only way that such problems can be tackled is through large-scale preservation programmes that will do more than create an interlude in a downward spiral of decay. The extreme situation in these areas is a good illustration of how such programmes, if properly considered, could halt the decay of many important collections.

Conservation has made many strides during the last three decades, not least in its contribution to increasing public knowledge and awareness. But institutions should be cautious of becoming too infatuated with such achievements. Conservation is only one facet of collections management which, if taken as a whole, will influence the way people in the future will look at the past. Preservation strategies need to be established to ensure that our historical heritage will survive so that future generations will be able to construct a balanced picture of the past, and not simply a pastiche of those areas that are today regarded as exhibitable. ■

Setting museum standards: the United States experience

Kim Igoe

Assuring high quality and public accountability is the goal of the Accreditation Program of the American Association of Museums (AAM). Originally designed to measure museum performance against accepted professional standards, the Accreditation Program has evolved into an ongoing process of self-examination and reflection. Kim Igoe currently directs the Accreditation and Museum Standards Programs for the AAM and has had long experience with the Museum Assessment Programs and the Institute of Museum Services.

Museum standards were under discussion in 1906 when delegates from leading American museums met in New York to found the American Association of Museums (AAM). Today, the AAM represents the interests of over 10,000 members, including 2,500 museums and 8,000 individual museum professionals. The association leads the effort in the United States to establish and advance professional standards in museum programmes and operations.

Following years of discussion and debate within the museum field, an AAM committee was appointed in 1968 to design an accreditation programme to measure the performance of individual museums against generally accepted professional standards. The AAM's Accreditation Program, developed by museum practitioners, is grounded in self-study and peer review. Over the past twenty-two years, the programme has emphasized quality institutional performance and service to the public.

As a way to assist museums in achieving the goal of accreditation, a second national programme was developed to provide practical information and consultation to the field about current professional standards: the Museum Assessment Program (MAP). The first of three MAP programmes, MAP I, was established in 1981 to focus on overall operations and institutional planning. The second, MAP II, was introduced in 1985 and focuses on collections care and management. The newest assessment, MAP III, was instituted in 1991 to review the public dimension of the museum. The MAP programmes are funded by the Institute of Museum Services (IMS).

Self-study and peer review

Accreditation, as well as each of the three MAP components, requires a museum's staff and governing authority to complete a comprehensive self-study questionnaire and to participate in an on-site visit conducted by peer reviewers. Museums are examined in light of their own stated institutional purpose and the efficiency with which they carry out their mission. Museum operations are reviewed to determine the quality of financial, human and collection resource management, the ability of the staff to formulate and implement policies and procedures, the professional care and knowledgeable use of objects, and the meaningful interpretation of the collections.

The MAP review culminates in the museum's receipt of a summary report containing observations, suggestions and recommendations for improving its programmes and operations. A seven-member Accreditation Commission evaluates each participating museum's self-study questionnaire and the narrative report of the on-site peer reviewers. Following deliberation, the commission makes a final determination on whether the museum merits accredited status.

The self-study questionnaire for both MAP and accreditation serves several purposes. As a mechanism for self-examination, it can act as a catalyst for identifying and articulating institutional priorities and needs. It facilitates communication between staff and board, and it ensures that institutional performance is based on the most current professional standards of the field.

The self-study process, and the written documents, are subject to ongoing review. The MAP Advisory Committee and the Accreditation Commission are each responsible for ensuring that the documents are up to date and relevant in order that the programmes remain viable and responsive to the needs of the field.

ISSN 1350-0775, *Museum International* (UNESCO, Paris), No. 183 (Vol. 46, No. 3, 1994)

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The nomination of the peer reviewers for both accreditation and MAP is based on their museum experience, academic training and areas of expertise. The size and geographic location of the institutions for which they work are also considerations. These individuals have a breadth of knowledge and experience, and are able to apply this understanding of generally accepted standards to individual institutions. Their credentials must also include strong interpersonal and writing skills.

A peer reviewer must be able to make comparisons between theory and practice and, in the case of MAP, be able to offer constructive insights into the relationship between what is intended and what actually takes place. Peer reviewers offer individual museums a fresh perspective on old problems and can bring new insight to issues that may no longer be obvious to those most closely involved.

Peer reviewers must complete a biographical information form which includes a signed statement concerning the confidential nature of the process and an agreement to fulfil their responsibilities in a timely manner. Participation as an accreditation and/or MAP peer reviewer is considered an honour as it signifies that the individual is a recognized leader in the museum community.

Evolving standards

AAM accreditation signifies that an individual museum voluntarily engages in ongoing self-examination and uses the results of that rigorous self-study and peer review to actively improve its programmes and operations. A museum's accredited status is reviewed every five to ten years.

The three elements of the accreditation process – self-study, peer review and evaluation by the Accreditation Commission – ensure that only those museums that meet the highest professional standards, and have the capacity for continuous improvement, are awarded accreditation. There are currently 722 AAM-accredited museums. Based on information from the AAM's *Data Report: From the 1989 National Museum Survey*,[1] there are approximately 8,200 museums in the United States. Therefore, less than 10 per cent of the country's museum are currently accredited.

The greatest value and utility of museum accreditation is that it provides credible evidence that a museum is able to fulfil its purpose and attain the goals that it proclaims in its mission. Participation encourages and helps individual museums to evaluate operations on a regular basis and use the results of that self-evaluation, as well as the input of peer reviewers, to improve operations and performance.

Because of the broad institutional benefits that have resulted from participation in the programme, there has been a gradual shift in perspective about the purpose and role of accreditation. Although originally perceived as a one-time judgement of whether or not a museum met minimum fixed criteria at a specific point in time, the benefits of participating in a complex, multi-faceted process of self-examination are now recognized and valued.

Accreditation has become the field's primary mechanism for quality assurance and public accountability, and the major avenue for self-improvement. The process provides a thoughtful framework for assessing how well an individual museum is continuing to meet evolving professional standards and provides par-

ticipants with a comprehensive institutional history that registers growth and change.

As an additional support to peer reviewers and museum staff, the AAM's Technical Information Service (TIS) collects and disseminates practical and timely information about museum standards and practices as well as issues of concern to the field. TIS produces a variety of publications and source lists and can respond to specific requests for information by providing sample policies and issues to determine the informational interests and needs of the field and, as a result, can produce useful publications in a variety of formats that reflect and promote current practices and standards.

The structure and approach of the Accreditation and MAP programmes allow for considerable variation among museum types and sizes. Both of these processes provide a systematic framework for reviewing institutional practices and offer objective professional feedback.

More and more of the museums that now apply for accreditation have previously participated in one or more of the Museum Assessment Programs. Consequently, at the end of the two years customarily needed to complete the accreditation process – progressing from self-study to peer review to analysis by the Accreditation Commission – a museum has carried on an intensive internal dialogue about standards and should have an accurate idea of whether or not its performance meets the requirements and expectations of accreditation.

Professional standards will continue to evolve and the Accreditation, MAP and Technical Information programmes will keep the field informed. The AAM's newly adopted policy document, *Excellence and Equity: Education and the Public Dimension of Museums*,[2] identifies ten major principles for consideration and action by the museum field. With this policy in mind, the Accreditation Commission has begun the process of reviewing and revising the current accreditation self-study questionnaire and the checklist of required supporting documents requested from each museum. The commission anticipates that a revised self-study will provide a more thorough picture of each museum's activities and operations, and will more accurately reflect current professional standards. AAM's Technical Information Service is using the ten principles to identify and share information about exemplary educational programmes and activities that implement the recommendations in *Excellence and Equity*. And the newest Museum Assessment Program, MAP III, has already helped seventy-three museums to assess the public dimension of their activities, including the public's perception, experience and involvement with their institutions.

Through this kind of concerted effort, the AAM continues to meet its mission of promoting improved practices and increased professional standards of museums in the United States. ■

Notes

1. Ann Hofstra Grogg (ed.), *Data Report: From the 1989 National Museum Survey*, p.40, Washington, D.C., American Association of Museums, 1992.

2. Ellen Cochran Hirzy (ed.), *Excellence and Equity: Education and the Public Dimension of Museums*, Washington, D.C., American Association of Museums, 1992. (See also 'Professional News', *Museum International*, Vol. 45, No. 4, 1993 – Ed.)

Illicit traffic

New draft convention on stolen or illegally exported cultural objects approved by experts

Governmental experts from forty-three countries, meeting in Rome in October 1993, approved a new draft Convention on stolen or illegally exported cultural objects. Prepared at the request of UNESCO to complement the Organization's 1970 Convention on the Means of Prohibiting and Preventing the Illicit Import, Export and Transfer of Ownership of Cultural Property, the new instrument will be submitted for adoption to a diplomatic conference scheduled for late 1994.

Work on the text has been under way since 1985 under the auspices of the International Institute for the Unification of Private Law (UNIDROIT) in Rome. It is intended to regulate the private law aspects of trade in cultural objects and represents a compromise of diverse positions between legal systems based on very different principles. A critical issue which remains to be settled by the Diplomatic Conference is that of the length of time within which claims can be made and whether longer periods should be allowed for certain special categories of cultural object. According to Lyndel Prott, Chief of UNESCO's International Standards Section, the most significant innovation of the draft is that buyers of cultural property from other countries will no longer be presumed to be bona fide. They will have to prove that they have been especially diligent to ensure that the object was not stolen. 'In view of the rising tide of theft of cultural objects all over the world, purchasers will be required to take greater care,' she said.

The new Convention, if adopted, will not affect the legal status of items transferred before its entry into force. Claims for these objects, if not subject to the 1970 UNESCO Convention (now in force in seventy-eight countries), will still have to be resolved through bilateral negotiations or through UNESCO's Intergovernmental Committee for Promoting the Return of Cultural Property to its Country of Origin or its Restitution in case of Illicit Appropriation.

Books

Museums and Cultural Centres in the Pacific, edited by Soroi Marepo Eoe and Pamela Swadling. Papua New Guinea National Museum, 1991.

Museums in developing countries, particularly among the least developed, suffer from a chronic shortage of resources, both financial and human. Heritage preservation is still far from being as widely approved by society and supported by governments as it is in the industrialized world, where, according to Peter Davey, writing in *The Architectural Review* (No.1088, October 1987, p.27), the museum and the cultural centre 'have become powerful foci of civic architecture and awareness . . . they represent the kind of opportunities for civic display and formal experiment that the town hall offered the last century'. These roles have set the stage for museum developments elsewhere as well. All too often, particularly in the

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immediate post-colonial past, the result has been simply 'echoes and mimicry' on the part of urban élites. But increasingly, there are much more thoughtful responses, based on a search for different missions and uses. This search brings heritage management professionals, particularly museum curators, face to face with some basic issues. How can their institutions become truly meaningful in terms of local cultural values? Can they be set up within the means available and can they be made cheap and practical to maintain?

Questions such as these were addressed at a workshop held at the Papua New Guinea National Museum and Art Gallery in Port Moresby in June 1989. The workshop was funded by the national authorities, together with the Wenner-Gren Foundation for Anthropological Research, UNESCO, and the Australian Museum, Sydney. Eighteen specialists from overseas sat together with sixteen from Papua New Guinea. As they reviewed 'the successes and failures of existing museums and cultural centres in order to achieve . . . a stronger and better development of these institutions', the participants seemed to wish to emphasize what they could do for their own societies rather than what the latter could do for them. This commitment emerges clearly from the forty-five papers published here (twenty-seven from Melanesia, eight from Micronesia, eight from Polynesia – including Hawaii and New Zealand – and two from Australia). The book also contains a mine of factual information (with fifty-seven illustrations) for all those interested in the development of museums in this part of the world.

As Soroi Marepo Eoe's foreword states, 'the message is clear, those museums and cultural centres which best serve their communities are those with well-trained staff who are able to fully use the funds and facilities available and provide a service for their community'.

Book reviewed by Yudhisthir Raj Isar. Born in India and trained in economics and social anthropology in Delhi and Paris, he has been Director of UNESCO's International Fund for the Promotion of Culture since 1989. In 1986/87 he was executive director of the Aga Khan Program for Islamic Architecture at Harvard University and the Massachusetts Institute of Technology.

Professional news

ICAHM 1994

The next conference of the ICOMOS International Committee on Archaeological Heritage (ICAHM) will be held in Montreal, Canada, 11–15 October 1994, under the title, 'Archaeological Remains: In Situ Preservation'.

For further information:
Secrétariat Colloque ICAHM Montréal,
303 rue Notre-Dame Est, 5e étage,
Montreal, Quebec (Canada H2Y 3Y8)
Tel: (1.514) 872.7531
Fax: (1.514) 872.0024

AVICOM 94: Photography and Museums

The Museum Committee for Audio-visual Technology (AVICOM) of the International Council of Museums (ICOM) is holding its fourth international

symposium from 20 to 23 September 1994, at the recently opened House of History of the Federal Republic of Germany in Bonn. The main themes of the meeting are: photographs as a subject of collection and research; photography museums; photography in documentation and inventory (including audio-visual and data processing media); new photo-technology; photography and law; and photography and museum education.

For further information:
AVICOM (Dr Michael Faber),
c/o Rheinisches Freilichtmuseum Kommern,
Auf dem Kahlenbusch,
D-53894 Mechernich-Kommern (Germany)
Tel: (49) 2443.5051
Fax: (49) 2443.5572

European museum information project

EPISTEME, the European Project of Information on Scientific and Technical Exhibitions and Museum Effectiveness, aims to develop information, documentation and communication between museums. Focusing on transport and communication museums, it provides information on their structure and organization as well as on special exhibits and cultural events. It also collects catalogues, videotapes, publications and other forms of information that illustrate museum organization and activities; it plans to develop programmes aimed at broadening awareness of science and technology at a local level by bringing people into contact with the most important science and technology museums in Italy and elsewhere.

For further information:
Pasquale Petrucci,
Provincia di Bologna, Settore Beni Culturali,
Strada Maggiore 80,
40125 Bologna (Italy)

Museum Training Institute

Recognizing that training is a crucial part of the changes affecting the museum, gallery and heritage sector, the Museum Training Institute (MTI) was established in 1989 in the United Kingdom. In March 1993, MTI organized the first national conference devoted entirely to training, for directors of museums and similar institutions. A booklet has been published to support the conference and to carry the message to a wider audience: *Museum Training Today – For Tomorrow.* MTI has also conducted various training courses, ranging from a one-day course on 'Effective and Productive Meetings in Museums and Galleries' to a three-day course called 'First Encounter – Foundation Course for Attendants and Warders'.

For further information:
Museum Training Institute,
Kershaw House,
55 Well Street,
Bradford BD1 5PS (United Kingdom)
Tel: (44.274) 391056

New publications

Museum Security and Protection. A Handbook for Cultural Heritage Institutions. Edited by David Liston for ICOM and the International Committee on Museum Security. Published by ICOM in conjunction with Routledge, London and New York, 1993, 319 pp. (ISBN hardback 0-415-05457-5; ISBN paperback 0-415-07509-2.)

Security is a major problem faced by all cultural heritage institutions of whatever size, from museums, galleries and monuments to parks, gardens and archaeological sites. They need protection from theft and intrusion, from fire and other disasters and from damage and decay. The safety of visitors is also a major concern. This new handbook covers every aspect of museum security and is written and presented in a clear and simple form, making use of

checklists and question-and-answer sessions. It establishes new standards of museum security practice for use worldwide.

Directory of Museum Professionals in Africa/Répertoire des professionels de musées en Afrique. Published by ICOM and WAMP (West African Museums Programme), 1993, 220 pp. (ISBN 92-9012-016-9.) Distributed by ICOM, UNESCO, 1 rue Miollis, 75732 Paris Cedex 15 (France), or WAMP, 140 rue Mousse Diop, B.P. 357, Dakar (Senegal).

The first reference tool to provide information on the entire network of museum professionals on the African continent, this directory contains the names and addresses of more than 850 specialists as well as 300 museums and other institutions, classified according to type of activity.

Guide SEAT des 7000 musées et collections en France. Published by Cherche Midi Éditeur, 23 rue du Cherche-Midi, 75006 Paris (France), 1993, 528 pp. (ISBN 2-862-74-248-1.)

The fruit of many years' work by two museum specialists, this guide contains ample information on the 7,000 museums and collections in France, from the most famous to the most arcane. Foreign tourists will be pleased to find notes on the languages spoken in each museum, access conditions for handicapped visitors, as well as a selection of museums for children.

Écrire sur les murs (Writing on the Wall.) Published by the Office de Coopération et d'Information Muséographiques, 36 rue Chabot-Charny, 21000 Dijon (France), 1993. 58 pp. (ISBN 2-11-087697-2.)

It's an all too familiar feeling for many museum visitors. You really want to know which artist did it. You roam about the room in search of a label, and find that all the labels are inconspicuously placed together in a corner, printed in a microscopic typeface and grouped in such a way as to make it virtually impossible to make out which cryptic explanation refers to what untitled work. However, there is hope. The booklet *Écrire sur les murs,* originally published in English in 1989 by the National Maritime Museum in London, has now been translated into French, making available to a larger public its practical and pertinent information on how to approach the business of writing text for museum exhibitions. Dealing with everything from content, length and literary style to typefaces and hanging height, it should be most useful for exhibition designers struggling to get their message across.

Planning Science Museums for the New Europe. Proceedings of a Seminar held at the Národní Technické Muzeum, Prague, edited by James Bradburne and Ivo Janousek. Published by UNESCO/ Národní Technické Muzeum, 1993, 103 pp.

How should eastern European museums cope with their new situation? How can they promote development and modernization? What attitude should they take to Western museums, what can be learned and what had better be left untouched? These were among the questions addressed during an international conference in Prague in April 1992. The publication presents twelve papers grouped under the following themes: science and technology museums in a new Europe; the role of the object and the collection; understanding understanding: science and interactivity; and science, technology and culture: the role of the science museum.

Conservation – Restoration. The Options. Published by the Conservation Unit of the Museums and Galleries Commission, 16 Queen Anne's Gate, London SW1H 9AA (United Kingdom).

Owners of works of art and other objects of cultural value that need cleaning or repairing may be confused by the apparently different services on offer. Should they go to a conservator or a restorer, and what do these different professionals do? This eight-page leaflet provides answers to these and other questions.

WFFM chronicle

World Federation of Friends of Museums,
Sierra Mojada 466,
Lomas de Barrilaco,
México, D.F. 11010

José Pintado-Rivero, President of the Mexican Federation of Friends of Museums, was unanimously elected as ninth President of the WFFM. Meeting in October 1993 in Baltimore (United States), WFFM Council delegates from fourteen countries also elected four Vice-presidents, one from each of the continents where WFFM is represented. They are: Annick Bourlet (France), Lucrecia Garcia-Arias (Argentina), Mary Naquin-Sharp (United States), and Carol Serventy (Australia). Oscar Mairlot (Belgium) was elected Treasurer and Carla Bossi-Comelli in Mexico continues as General Secretary. The next General Congress of the World Federation will be held in 1996 in Mexico.

museum international

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Museum International (English edition) is published four times a year in December, March, June and September by Blackwell Publishers, 108 Cowley Road, Oxford, OX4 1JF (UK) and 238 Main Street, Cambridge, MA 02142 (USA).

New orders and sample copy requests should be addressed to the Journals Marketing Manager at the Publisher's address above. Renewals, claims and all other correspondence relating to subscriptions should be addressed to the Journals Subscriptions Department, Marston Book Services, P.O. Box 87, Oxford, OX2 0DT (UK). Cheques should be made payable to Basil Blackwell Ltd.

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Microform: The journal is available on microfilm (16 mm or 35 mm) or 105 mm microfiche from the Serials Acquisitions Department, University Microfilms Inc., 300 North Zeeb Road, Ann Arbor, MI 48106 (USA).

US mailing: Second-class postage paid at Rahway, New Jersey. Postmaster: send address corrections to *Museum International*, c/o Mercury Airfreight International Ltd Inc., 2323 E-F Randolph Avenue, Avenel, NJ 07001 (USA) (US mailing agent).

Advertising: For details contact Pamela Courtney, Albert House, Monnington on Wye, Hereford, HR4 7NL (UK). Tel: (09817) 344.

Printed and bound in Great Britain by Headley Brothers Ltd, Kent. Printed on acid-free paper.