Polish/American Heritage Conservation Cooperation

Susan I. Sherwood

In 1989, the National Park Service co-sponsored three bi-lateral workshops with Poland: Park Management Practices (at the Bialowieza Forest National Park, Spring 1989), Air Pollution and Historic Monuments (Cracow, June 1989) and Cultural Landscapes (Warsaw and other sites in Poland, September 1989). These opportunities for technical exchanges and professional discussions have grown into flourishing bi-lateral cooperation with continuing programs on a wide-range of CRM issues. For example, a second landscape workshop in June 1993 was held on "Defining Values of Natural/Cultural Landscapes and the Role of Society in Their Preservation." Polish and American professionals met in a variety of venues, including the Warsaw Royal Castle, Sweitokrzyski NP, a monastery in Czestochowa, the Palace of Culture in Zagan, and the Rokosowo Palace.

This article focuses on conservation research projects which originated with the 1989 pollution symposium.

Fig. 1. Wawel Castle in the Historic Center of Cracow; 16th century.

These micro-environment projects, designed to provide the technical basis for detailed conservation strategies based on the control of pollution and microclimate, have drawn on a number of non-NPS funding sources. For example, the American Express Foundation donated equipment to the Cracow Institute of Fine Arts to monitor temperature and condensation on the stained glass in St. Mary's Church. As weather changes, the system alerts the Catholic nuns who are the church's caretakers to turn on heaters near the windows to prevent condensation from forming. The warm air shields the stained glass from pollutant deposition and slows the decay associated with moisture cycling. Other environmental monitoring projects—with primary support from the Maria Sklodowka-Curie Joint Fund II (a bi-lateral science and technology research fund managed by the State Department under the auspices of the U S-Polish Joint Commission) and supplementary contributions from the World Heritage Fund—have been undertaken at the Wieliczka Salt Mine World Heritage Site near Cracow and in selected museums in the Central Cracow World Heritage Site. The technical approach for pollution monitoring in these projects was originally developed with support from the Getty Conservation Institute in the late 1980s, under the direction of Dr. Frank Preusser.

Fig. 2. Crucifixion in St. Anthony's Chapel, Wieliczka Salt Mines, near Cracow; 17th century. Photo by R.P. Hosker, NOAA (February 1992).

Cracow is a city of approximately one million people, located in the valley of the Vistula River in southern Poland. An important example of Renaissance urbanism, Cracow was the royal capital of Poland from the 14th to 16th centuries. The 16th century Wawel Castle dominates the center of the old city (figure 1). Many of the buildings were renovated during the century of Austrian rule before World War I, lending a Viennese ambience to the old city. Cracow's affluence during the Middle Ages and Renaissance derived from trading salt, when it was one of a limited number of sources in Europe for this foodstuff preservative. The city's wealth is seen in remarkably rich collections of Renaissance art. The old city was generally spared from destruction during World Wars I and II, except for the Jewish Cemetery and outdoor monuments, which were systematically removed by the Germans to dampen Polish nationalism.

Since World War II, air pollution has become a serious problem in southern Poland. Grime and acids transported from the heavily industrialized areas of Czechoslovakia, Germany, and Silesia (Poland) account for about half of the pollution in Cracow. Within Cracow proper, about 200,000 residences and 1,600 industries burn high sulfur coal, nearly doubling pollutant levels in the winter. The Lenin Steel Works at Nowa Huta in the eastern suburbs was one of the largest polluters in the world until the late 1980s, when steel production was somewhat curtailed.

The World Heritage Committee designated the old city of central Cracow a World Heritage Site in 1978. Since 1989, special efforts have been made to protect the historic buildings in the old city. An especially low sulfur dioxide

*(**Sherwood** —continued on page 24)*

(***Sherwood***—*continued from page 23)*

(SO_2) standard was set at 11 $\mu g / m^3$ in order to reduce pollution damage. This is a very ambitious goal, compared with the American standard of 50 $\mu g / m^3$ for SO_2, and the current levels in Cracow of about 200 $\mu g / m^3$. Actual attainment of this goal are decades away. In the interim, questions abound about the most effective program for remedying existing damage and for protecting and conserving historic buildings and collections.

The Wieliczka Salt Mine, in the Cracow suburbs, is also a World Heritage Site. Salt mines in this area have operated continuously since the Neolithic period, and the Wieliczka Salt Mine was of major importance to the Polish economy from the Middle Ages until the early 20th century. It is a massive underground complex (figure 3), with nine levels of chambers hewn into the rock salt, covering roughly 5.5 km x 1.5 km x 325 m deep. There are about 2,000 chambers and 200 - 300 km corridors, from which 7.5 million cubic meters of salt have been removed during 700 years of excavation. Vertical shafts and horizontal passages serve to move both air and people through the mine, with peak visitation of 3,000 per day in the summer.

Carvings in the rock salt walls are found throughout the mine. The earliest sculptures in the 17th-century Chapel of St. Anthony (figures 2 and 4) are severely deteriorated through erosion and efflorescence, and there are large cracks in free standing figures and columns. Rock salt is attacked when the relative humidity (RH) exceeds 75%. A liquid film develops on the salt and begins to dissolve the solid surface. Protection of the salt sculptures may require different conservation strategies depending on the moisture source. If the primary cause of the problem is indeed condensation, then a relatively simple conservation solution is to dehumidify the air, adding filters to remove pollutants if they prove to be an agent of decay.

Between February 1992 and Spring 1993, the temperature, humidity, air flow, and pollution conditions in the mine were monitored to identify the moisture sources and balance, and to evaluate the potential for atmospheric chemicals to accelerate sculpture deterioration.

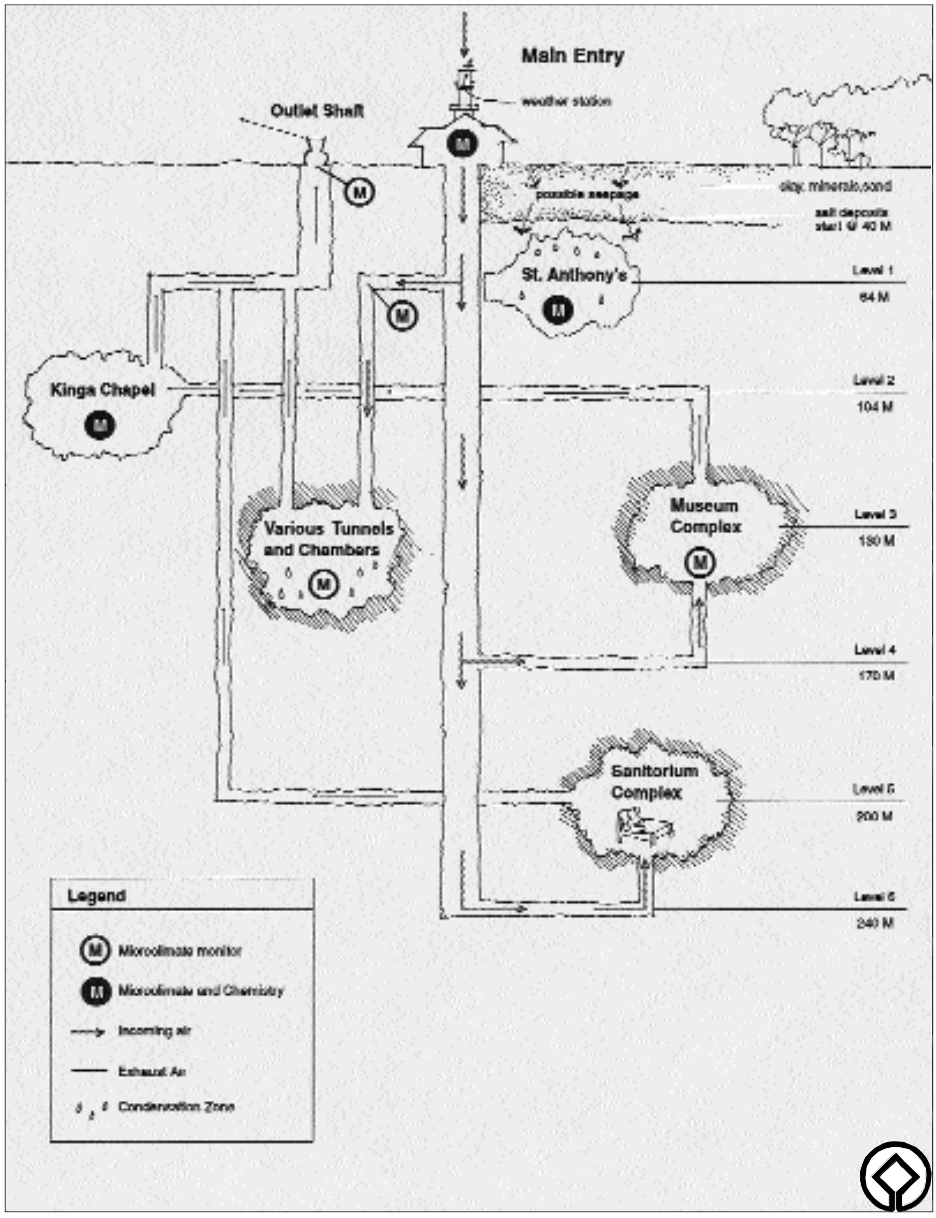

Fig. 3. The Wieliczka Salt Mine's 2,000 grottoes stretch 180 miles on nine levels (only six are shown; the lowest three have been filled for site stabilization). Wieliczka was placed on the World Heritage List in 1978. Delineated by John Le (1993).

The research team included experts from the US National Oceanic and Atmospheric Administration (NOAA), the US National Park Service, the California Institute of Technology (Caltech), the US Bureau of Mines, the Polish Academy of Sciences (PAN), and the Wieliczka Salt Mine management. Drs. R. P. Hosker, Jr. (NOAA) and R. Kozlowski (PAN) lead the research effort, with assistance from H. A. Crosby, NPS Denver Service Center, J. D. Womack and M. E. Hall (NOAA), G. R. Cass and L. G. Salmon (Caltech), and A. Hejda (PAN).

In the winter, air inside the mine is quite dry. In contrast, the relative humidity (RH) increases at all monitoring locations in the spring and summer during visiting hours. Most of the chambers are safe from a conservation point of view because neither diurnal nor seasonal oscillations exceed the critical RH of 75%. However, St. Anthony's Chapel, where the most dramatic salt damage is found, exceeds 70% most of the spring and reaches 75% most summer days. In St. Anthony's Chapel throughout the summer, the RH is nearly constant at 75%. Water drops appear on salt walls; standing water accumulates in small depressions in chapel floor. When there are no large school tours visiting the mine, smaller moisture increases are observed; no daytime increase was found on Easter Sunday when the mine was closed and the ventilation system shut down.

SO_2 is scavenged from the outdoor air very efficiently by the rock salt walls; by the time the air reaches St. Anthony's

Fig. 4. Sculptures of the blessed Queen Kinga (the legendary "foundress" of the mine) and knights and miners, Wieliczka Salt Mine. Photo by R.P. Hosker, NOAA (February 1992).

Chapel about 50 m below the surface, pollutant levels are negligible. Although sulfate particles are accumulating on sculptural and wall surfaces, there is no evidence of a lower deliquescence point that would require a target RH much lower than 73%.

The team designed a microclimate control system for the Wieliczka Salt Mine based on cooling and dehumidifying air entering the mine during the summer, using a commercially available air-conditioning system mounted adjacent to or within the mine entrance building. Once this system is operational, the path of the air flow through St. Anthony's Chapel can be modified to improve the ventilation at the site of greatest sculptural damage as necessary. A summary of the technical effort is being prepared in Polish and English for distribution to visitors to the Wieliczka Salt Mine.

Cracow's collection of Renaissance tapestries, textiles, paintings, and libraries may be at risk from atmospheric chemicals penetrating church and museum interiors. Dustfall in Cracow is about 150,000 tons / year. Newly stuccoed buildings appear dingy in 3-6 months. Particles also soil interior artifacts, and depending on the chemistry, airborne grime can damage museum objects.

The second joint Polish-US project under the auspices of the Marie Curie Fund is investigating the infiltration of pollution into Cracow's historic buildings and museums, using the same techniques as the pollutant component of the Salt Mine study. The principal participants are A. O'Bright (NPS), Professor G. Cass and L. Salmon (Caltech), Dr. K. Brückman (PAN), and T. Chruscicki, Director of the National Museum in Cracow. The measurements of pollutant chemistry and concentrations inside the Wawel Castle and museums will assist in selecting appropriate protection for sensitive objects. Protection methods might include: (re)design of ventilation systems (including window opening / closing options), increased cleaning schedules, display cases for sensitive materials, controlled storage conditions for especially sensitive materials, etc..

In July 1993, monitors for SO_2, NOx, ozone, and particle chemistry were installed at Wawel Castle and the Matejko Museum in the Central Cracow World Heritage Site, to be operated for one year. In addition, short term and one-month pollution samples were taken at the Cloth Hall, the new National Museum, and the Jagiellonian University Museum, which houses Copernicus' astronomical devices and handpainted globes.

These efforts are coordinated with a pollution monitoring network established as part of a $25 million initiative by our President in 1989 to protect the cultural heritage of Cracow through environmental improvement. Real progress is being made in pollution control by retrofitting power plants with American emission reduction technology, improving the city's district heating system, and switching from high sulfur coal to natural gas in residences inside the World Heritage Site. As environmental conditions in southern Poland improve, long-term preservation of historic buildings and monuments in Cracow enters the realm of the possible.

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*(**Graham**—continued from page 22)*

advice of the National Park Service. With the help of the Historic American Buildings Survey (HABS) and the strong support of Dr. Robert J. Kapsch, Chief of HABS / HAER, the team is accumulating records of buildings recorded by HABS. Using computer scan equipment, this information will be sorted and placed on a database suitable for transmittal to the Pontifical Commission in Rome. With the help of HABS, the University will establish its own criteria for recording properties. In addition, the team has begun to use the resources of the Archdioceses of Washington and Baltimore for information on historic properties. It is expected that many future recording projects will be sponsored by the US National Conference of Catholic Bishops for the express purpose of adding to the inventory of cultural property.

Carol D. Shull, Chief of Registration, National Register of Historic Places, has made the National Park Service's National Register Information System (NRIS) and archives on registered and eligible structures available to researchers from the School of Architecture at Catholic University. The Service is also participating in the preservation curriculum of the School of Architecture by providing lecturers, professionals for design reviews, material for research, and opportunities for interns.

From these studies the School of Architecture hopes to expand its historic preservation program to include: publications on design guidelines for the maintenance and preservation of historic Roman Catholic properties; projects on the design of new construction compatible with historic structures; development of standards for restorations / rehabilitations; publication of guidelines for fund raising, the disposal of "redundant" property, etc. This comprehensive program could provide the model for other religious denominations in protecting their historic resources.

Roy Graham, AIA, who for a decade was the Resident Architect of Colonial Williamsburg, is now a Professor of Architecture at The Catholic University of America. He has supervised over 25 HABS documentary recording projects.