EVIDENCE TECHNOLOGY MAGAZINE

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Finding Latent Prints

SOME OF THE TOPICS IN THIS ISSUE

- Prints from the skin of cadavers
- Comparison and analysis of pedal evidence
- Photo management at mass gravesites in Iraq
- Interview with a fire/arson investigator

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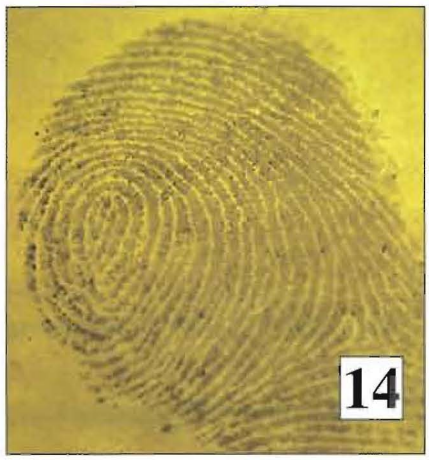
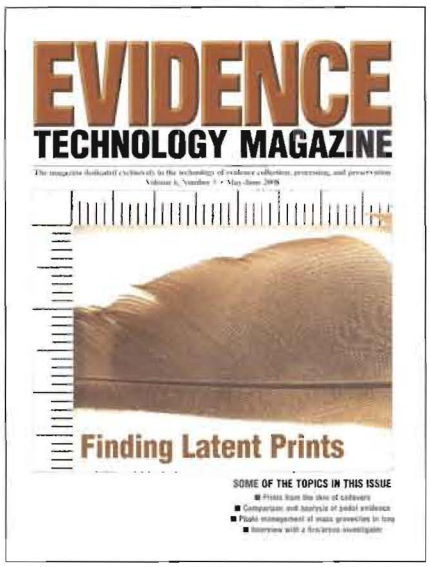




FEATURE ARTICLES

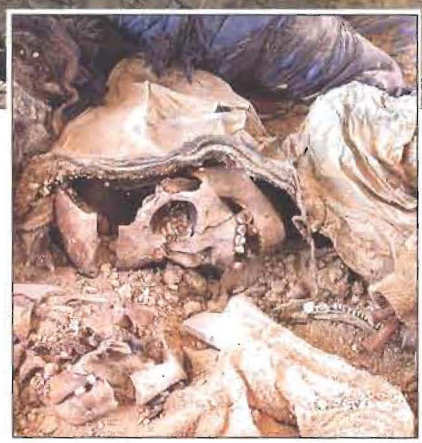
OTHER INFORMATIVE ITEMS

ON THE COVER:
When you are trying to find latent-fingerprint evidence at a crime scene, you might tend to overlook objects that would seem to be almost impossible to process. Could it be possible, for example, to find and develop a fingerprint on a bird's feather?

90,000 IMAGES

Digital-image management during the recovery of evidence from mass gravesites in Iraq

Written by Kristi Mayo



SKELETONIZED REMAINS that were carefully unearthed from the desert sands of Iraq tell their own story: the bones of an adult, still dressed in a woman's apparel, lie supine. The skull is perforated by a bullet hole. Tucked in the space between the ribs and the left humerus is a much smaller skeleton, bones in the skull un-fused, and the fully clothed body partially swaddled in a blanket.

All around this pair lie other human remains, piled one on top of the other. Some are blindfolded, others have their hands bound. They have been excavated from one of the documented mass graves in the Iraqi desert, the result of Saddam Hussein's attempt to wipe out the Kurdish people during the 1980s and 1990s.

Collecting evidence of genocide

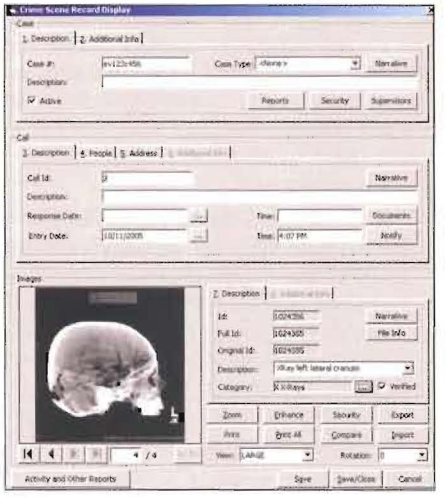
In the fall of 2004, the Mass Graves Investigation Team (MGIT)—a group of archaeologists, anthropologists, and other forensic experts—came together under the leadership of Dr. Michael K. Trimble of the U.S. Army Corps of Engineers. Their mission was to recover evidence of genocide—evidence that would subsequently be used by the U.S. Department of Justice's Regime Crimes Liaison Office (RCLO) in the trials against Hussein and other members of the former Iraqi regime.

Before beginning this historic project, the team leaders realized the importance of the evidence that they would be recovering and handling. All of the human remains, cultural objects, and other associated evidence—plus the actual exhumation, processing, and chain of custody of that evidence—would need to be thoroughly documented with photographs. There were multiple questions confronting the team leaders: How would they capture those images? How should they protect the integrity of those images? How could they organize them in such a way that they could be presented in trial?

Digital photography appeared to be the obvious solution to the team's immediate needs, but concerns still existed about the ability to defend the integrity of the digital images in court. So Trimble made a phone call to an expert who had spent his career defending the technology of digital imaging, David Knoerlein.

The mission of a lifetime

During the time he spent working as the forensic analyst in the digital-imaging lab at Broward County (Florida) Sheriff's Office, Knoerlein had the opportunity to defend digital-image enhancement in important cases such as *State of Florida v. Victor Reyes* (see *ETM*, July-August 2003, Vol. 1, No. 2).



As the team unearthed human remains from mass graves in Iraq, each body was assigned its own case number. Back at the laboratory, anthropologists and other experts worked side-by-side with photographers to capture precise images of the remains, showing trauma and other significant features. All of the images—including digital x-rays—were then loaded into a secure database, where notes, codes, and keywords could be assigned to aid in sifting through more than 90,000 different photos.

His reputation as an expert in the field led Trimble to call Knoerlein in 2004 and ask him to serve as the imaging systems manager for the Mass Graves Investigation Team.

When he received that phone call, Knoerlein was initially hesitant to take leave from his job at the sheriff's office to photograph mass graves in a war zone. But then his wife encouraged him by describing it as the chance of a lifetime. "Not everyone gets the chance of a lifetime," she told him, "and those who do, don't always take it."

"That was the phrase that got me going," said Knoerlein. "Through most of my career, I had been one of the people fighting for the acceptance of digital imaging in law enforcement in the United States, and here I would have a chance to do the same thing in a world court. This was the big show. I figured if I could create an all-digital system that could withstand the challenges in a world court, then we could bring it back home and we shouldn't have any problem with the court system in the United States accepting it."

Tough conditions

Before leaving home, Knoerlein had a lot of work to do, including making equipment lists and establishing the digital-imaging guidelines and procedures that the team would follow. He said establishing standard operating procedures (SOPs) was probably the most important part of his preparation.

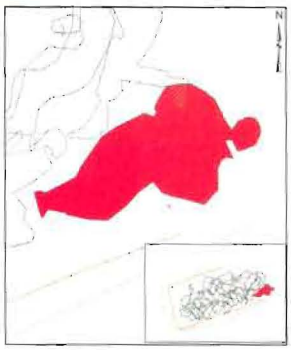
"I explained to the people in charge that the only way this would work was if I created a system that I could monitor—and then everyone involved would need to be trained on how to use that system," said Knoerlein. "We would write up the SOPs, and each individual involved in digital imaging would need to follow those SOPs specifically. If they didn't, then it could discredit the entire operation."

Upon arriving in Iraq for the first of seven trips he would make over a period of three years, Knoerlein quickly realized that no amount of preparation guarantees smooth operation in a war zone. Equipment trickled into the base camp, one small shipment at a time—if it made it there at all. Some of the equipment was stolen or blown up in a landmine incident.

The first mission was the most difficult, said Knoerlein, due to the lack of resources and situations that forced some improvisation and revisions to

The variety of cultural objects that were uncovered along with hundreds of human remains in a single grave-site paint a picture of the sudden and inhumane method with which the victims were gathered from their villages, herded into pits in the desert, and then executed on the spot. Many of the victims uncovered by the team were women and children.

A perpendicular image was taken of each body in situ *using a camera mounted on a long pole. A heads-up display connected by a long cable to the camera allowed the photographer to precisely position the camera overhead. Meanwhile, the forensic-mapping team plotted the coordinates of each body, producing a map to show its position in the mass grave.*



the SOPs. But it served as an important learning experience that paved the way for the following missions to run much smoother. The subsequent missions were also easier because the team moved to a permanent location on a military base in Baghdad—an eight-tent laboratory facility that they named the Forensic Analysis Facility (FAF).

Complicated database of images

By the time the team was on its second mission, the digital-imaging workflow had been well established. A careful understanding—and precise execution—of the SOPs by every member of the team was key, because the digital-imaging lab became a sort of hub for the entire operation.

"Almost every expert—whether it was an anthropologist or a cultural-objects analyst or a document archivist—dealt with digital imaging in the course of their work," said Knoerlein. "All of those images had to be put into the database."

That database began as a commercially available version of software—

Mannequins—both adult- and child-sized—were dressed in clothing that was recovered from the bodies in the mass graves. Images of these displays made a dramatic impression when presented in court.

Thousands of pages of image-driven reports were generated for each set of remains recovered. Organizing the images in the database made the compilation of these reports much easier.

created by DataWorks Plus—that was intended for law-enforcement applications. The program was tailored over time by Knoerlein, working with the DataWorks Plus technicians, to meet the specific needs of the operation. This was a secure database that preserved the images in their original, unaltered format. It also helped organize the images by allowing the digital-imaging team to catalog the images, add notes, and assign multiple codes to each—codes that made it much easier to search for specific types of images in the ever-growing database.

"In the database, first you would have the mass-grave number that was assigned to that particular location and province. Then, each set of remains was assigned an individual case number," Knoerlein explained.

Anything associated with that set of remains—such as clothing, jewelry, documents, or other cultural objects—was filed under that case number. Then, the team established a list of codes that could be assigned to note the significant elements that were shown in each photograph. For example, an image showing detail of trauma to a bone would list a trauma number, such as *Trauma 1* or *Trauma 4*, depending on the severity of the injury. There was a different code for each part of the anatomy, as well. Multiple codes could be assigned to a single image.

Adding this search function was critical when image-driven reports, consisting of thousands of pages, were compiled for presentation in court.

"As the archaeologists were writing their reports, they would get on the radio and call me and ask for *Evidence Number XYZ, Image Number 000*, and I was able to pull up the image, put it on a CD or a thumb drive, run it over to them, and they could insert it right into the report."

Digital-imaging workflow

Adding the images to the database was one of the final steps in the process. Some of the most important SOPs established for this project dictated how

the images were taken, what kinds of images were captured, and how they were handled before they were even uploaded to the database.

Images that were captured at the dig site and, later, in the laboratory, were categorized into one of two groups: *reference images* and *detail images*.

Reference images were shot in a lower-quality, compressed format, such as a JPEG. They included overall shots taken at the dig site; perpendicular shots of individual remains *in situ* (in place) at the gravesite; full-skeletal layout photographs taken in the laboratory; and images of each item of clothing and cultural objects after they were cleaned at the laboratory.

Detail images were shot as uncompressed TIFFs. These images, taken with a scale in place next to the object, showed important details of evidence, such as trauma to a bone or imperfections caused by projectiles in clothing. The high resolution of these detail images was intended to allow for further analysis by experts if necessary.

As these images were captured in the field or in the laboratory, the photographer was required to keep a written photo log. This included notes about the subject of each image. It was critical that the photographer account for every image, and that no images be deleted from the camera's memory card.

"There was absolutely no deleting allowed, anywhere," said Knoerlein. "No one deleted a bad shot, or even a picture of their foot. That stayed in and was actually recorded in the log as: *Picture of foot. Accident.*"

At the end of each day, the photographer working in the field uploaded the images from the camera's memory card to a laptop, and then burned a CD of the original, unaltered images. This CD would be packaged with the day's photo log. When the photographer returned from the field to the project's image-management database, he would load the images into the database along with his field notes.

At the FAF, team members responsible for capturing images throughout the day's work would deliver to the imaging-systems manager a job folder containing the memory card, the photo log, and other associated materials such as CDs. With the help of an assistant, this data was loaded into the database.

As images were acquired into the database, the original, unaltered, full-resolution image was automatically off-loaded by the DataWorks Plus software onto a separate hard drive, while two new copies of each image were generated in the database: (1) a low-resolution thumbnail and (2) a higher-resolution JPEG. The hard drives where the unaltered originals were stored were then cloned several times to serve as redundant backups.

"We ended up with about a dozen 250-gigabyte hard drives, and we would make two or three copies of each hard drive," said Knoerlein. As the project got into full swing, digital images were being delivered at the end of the day from a multitude of sources:

"For one set of remains at one site, you would have images taken at the

site of that set of remains; the skeletal-layout shot taken by the anthropologist; the detailed images of the skull or bones; the clothing; digital x-rays; and digital scans of film x-rays for anything bigger than a skull," listed Knoerlein.

"In the meantime, the mapping team would be working in their tent, using their data to put together map images. The map image showing the location of that one set of remains in the gravesite would need to be added to the digital database, as well.

"At the same time, if they recovered documents, those needed to be photographed before and after they were cleaned. Then I would perform a high-resolution scan and perform enhancements—so the full-resolution scan and the enhanced image would be included in the database.

"We also had all the images coming in from the intake tent and the archive tent, where photographs were taken to document chain of custody any time a packaged piece of evidence was sealed or unsealed."

SOPs spelled success

Providing guidance to all of the people involved in the creation of digital images for this project was the biggest challenge for Knoerlein. "The most important thing I did was create procedures and policies and SOPs that were strictly adhered to," said Knoerlein. "I set up the procedures based on talking with everybody involved in the project. And then we refined them as the team got better at it."

In the end, photographs of evidence collected during the operation were presented in trial, both in a PowerPoint presentation and as reports consisting of thousands of pages. And no one questioned the validity of those images.

"It is not a new idea to tell people in the U.S. that if they're going to use digital, they need to have procedures in place," Knoerlein said. "This project just proved that. When our images went to court, we did not get challenged."

The 90,000 images in the team's database helped complete the story of the genocide in northern Iraq:

At one site, more than 100 people were herded into a pit and fired upon. A total of 123 bodies were recovered and processed by the team at that site. There were more remains, but only a certain percentage of the total number in that gravesite were exhumed. Of the 123 victims, none were males, 25 were adult females, and 98 were children. Many showed trauma to the hands or arms, signs that they tried to protect their faces from the bullets. Forensic-mapping images show where the victims stood, where their assailants stood, and where the cartridge cases fell.

The cultural-objects analysts dressed the mannequins in the victims' clothing and photographed them. Today, these images can bring the victims' tattered shirts and dresses to life.

In court, Trimble showed one image of a mannequin dressed in a pregnant victim's clothes. "Trimble said there were tears in the eyes of the judges when he presented that particular image," said Knoerlein. "The images were very dramatic."

Faces of the victims recovered from the scene of a genocide

Faded identification cards recovered from mass graves in northern Iraq show the faces of three of the thousands of people who were killed and buried there. The careful work and documentation that was carried out by the Mass Graves Investigation Team helped in the subsequent conviction of five members of the former dictatorial regime, including Ali Hassan Al-Majid ("Chemical Ali"). Sadam Hussein's name was dropped from the defendent list after his execution in December 2006. The real end to this story, said David Knoerlein, was the thoughtful repatriation of the victims' remains. "With respect and dignity, we prepared them for transportation back to their homes and loved ones for proper burial." *(You can read more about this project beginning on Page 30 of this issue.)*

Do you have a crime-scene photo you would like to share?

If you have an interesting or unusual crime-scene photo, send it to us by e-mail for review. If we use it, we will send you a complete set of back issues. Send the image and a description of the crime-scene photo to... ***KMayo@EvidenceMagazine.com***