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Press Release 2006

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CL 50

CL 80 SP

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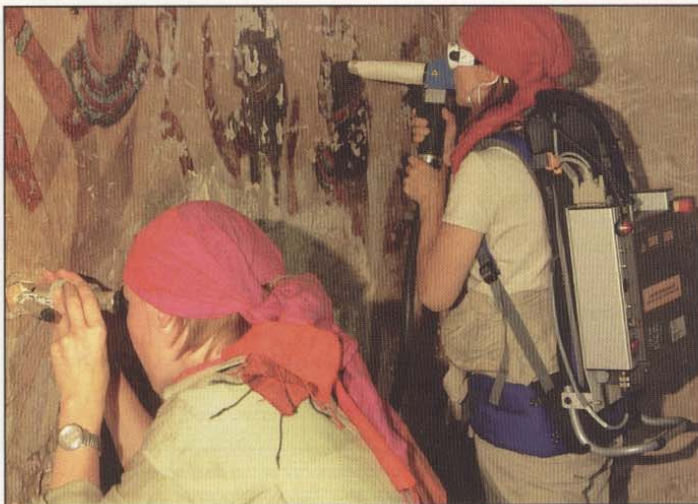
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Portable Fiber Laser Cleans Ancient Tomb



A portable ytterbium fiber laser is enabling conservators to clean an ancient Egyptian tomb. Here, Christina Verbeek uses the laser while Birte Graue inspects cleaned areas with a microscope. ©Thomas Haupt.



The art of using the laser system is to adjust the power density, repetition rate and velocity of the beam across the surface so that dirt is removed without damaging the underlying paint and the subsurface. ©Thomas Haupt.

The conservation of an Egyptian tomb is a delicate, painstaking process. Dirt must be removed without damaging the fragile surfaces of the walls. In some cases, the grime is attached so firmly to the surface that even conventional hand-cleaning using chemical or mechanical methods is unsuitable. Application of water or solvents can lead to further penetration of the soot particles into the surface, and the deteriorated surface may be too fragile for mechanical cleaning.

This is where laser technology comes in. A group of German conservators is using an ytterbium fiber laser to conserve the 3300-year-old tomb of Neferhotep, a senior Egyptian scribe who served in the temple of the god Amun.

"This is the first time a laser has been used for this application," said conservator Christina Verbeek of Neferhotep eV in Cologne. Verbeek and her colleagues Susanne Brinkmann and Birte Graue are using a portable laser system from Clean Lasersysteme GmbH of Herzogenrath, Germany.

"It is particularly useful on the white background, where soot and dirt are firmly attached to the surface," Verbeek noted. "Laser-cleaning these areas is particularly successful because it is a contactless process, and the lime and gypsum surfaces have a resistance to laser light because of their higher reflectivity of the laser light compared with the soot."

"Cleaning art monuments with laser light is a challenge in many ways," said Michael Panzner, a physicist at the Fraunhofer Institut für Werkstoff- und Strahltechnik in Dresden, Germany, who is supporting the effort. "Because they are unique, they must on no account be damaged. In addition to this, every subsurface — be it plaster, mortar or stone — has specific physical properties and reacts to the



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laser light differently."

The art is to adjust the power density, the repetition rate and the velocity of the laser beam across the surface so that the dirt is removed while the paint and the subsurface are conserved.

The laser unit used by the conservators is worn as a backpack and has a maximum power of 20 W, a pulse duration of approximately 100 ns and a repetition rate that is adjustable from 20 to 60 kHz. Compared with other laser systems used for cleaning, the ytterbium fiber one has several advantages: It is low-cost, compact, battery-operated and lightweight, and it features a handset that is fiber-coupled to the laser head, enabling the beam to be easily moved and focused.

The conservators started by treat-

ing test areas on the wall of the burial chamber with laser parameters that applied only a very low power density and number of laser pulses per area to the surface. After each trial run, the result was examined through a microscope. Then they gradually modified the parameters until the ideal settings for damage-free cleaning had been found.

Although cleaning with a laser is still time-consuming, the researchers found it much faster than traditional methods in some circumstances. The ability to ablate very thin layers was also an advantage. However, compared with traditional chemical or mechanical methods, it is more expensive, and it was found to discolor some pigments in advance trials on test pieces in the laboratory.

The team is continuing its evaluation of the laser system for this application and is excited about using the technology in the conservation of such an ancient tomb.

"If you know what the laser can do and what its strengths and weaknesses are, it is an excellent supplement to the usual mechanical and chemical conservation methods," Verbeek said. □

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