Weeks

Main corridor of the new Egyptian tomb and statue of the god Osiris.

that a captured thief had tried in 1150 B.C. to rob the tomb of Ramses II and an adjacent burial, which they assumed was the site covered over by Carter.

They established the location of the tomb's entrance in 1988 and have conducted annual fieldwork since then. Last February, Weeks and his coworkers finished clearing debris from the entry area and two chambers just beyond it. Beyond the back door of the second chamber lay dozens of rooms along three corridors arrayed in a T shape.

Stairs and sloping passages at the end of two corridors apparently lead to rooms on a lower level, probably the actual burial chambers, Weeks says.

The team has identified the names of four sons of Ramses II, including his first-born son, on walls or artifacts in the tomb. Objects found so far include pottery, inscribed stone vessels, pieces of wooden furniture, statue and stone-coffin fragments, offerings of cooked meats, and pieces of mummified human bodies.

Rooms on the mausoleum's upper level may have served as chapels where priests performed rituals for the dead, Weeks says. More than a dozen walls in these chambers display painted scenes of Ramses II presenting various of his sons to Egyptian gods and goddesses, accompanied by written descriptions of the scene and religious texts.

Burials probably occurred on the lower, still unexplored level, Weeks asserts. Ancient grave robbers probably dragged bodies out of the tomb, he says, and left behind the mummified pieces found on the upper level.

Investigators assume that as many as 50 of Ramses II's sons were buried in the tomb; separate graves for two of his sons have already been found.

The date of the mausoleum's construction remains unknown, although Weeks suspects it occurred late in Ramses II's reign. Curiously, artistic styles in the tomb resemble those from his early years of power, Weeks says.

Researchers have noted that Ramses II mentioned his more than 100 children in numerous pieces of art and inscriptions. Other pharaohs left records mainly of their first-born sons and built much smaller tombs than the one authorized by Ramses II.

"Ramses II was a unique Egyptian king in that he had so many sons and daughters and was so devoted to them," says Abdel Halim Nour ed-Din, head of Egypt's Supreme Council for Antiquities in Cairo. "But the size of this new tomb still surprises me."

Work at the site will resume in July. Further excavations may take 6 years or more, Weeks says. "This tomb is so weird, all bets are off on what or who we'll end up finding," he remarks. *— B. Bower*

Taking chlorine out of tough pollutants

The crisp white paper that readers and writers enjoy bears more than a monetary price. The unseen cost comes in the form of pollution, since many of the chemicals generated in paper manufacturing resist natural degradation and instead tend to linger, unwanted, in the environment.

In the process of bleaching wood pulp to press out pearly reams, paper mills may create up to 250 different types of chlorinated contaminants (SN: 5/12/90, p.303). The most tenacious include a class of halogenated aromatic compounds called trichlorophenols (TCPs). At the heart of a TCP molecule lies a tightly bound ring of atoms that includes three chlorines.

The structure of TCPs allows them to stand up to nature's degradative forces, presenting soil-borne microorganisms with an indigestible meal. Their resistance to decomposition causes trouble for the paper industry, which must safely dispose of the long-lasting waste.

Offering a potential solution to this problem, chemists Alexander Sorokin and Bernard Meunier at the National Scientific Research Center (CNRS) in Toulouse Cedex, France, and Jean-Louis Séris of GRL-Biotechnology in Artix describe a new type of catalytic system for breaking up TCPs.

Using hydrogen peroxide, a relatively safe and environmentally benign agent, coupled with a readily available iron-based catalyst, the new system oxidizes TCP molecules by breaking open the chlorinated rings at their cores. The chemical compounds resulting from the reaction can then undergo natural degradation, the team reports in the May 26 SCIENCE.

"Many of these pollutants can be converted into less dangerous organic products and can be eventually degraded by different microorganisms," the researchers point out. "Systems that can remove halogen substitutents from [TCPs] may produce compounds that can be more easily biodegraded.

"In this case," they add, "the use of chemical catalysts to convert recalcitrant pollutants to more degradable molecules by microorganisms would be beneficial."

The iron-based catalyst crucial to the new dechlorination technique bears the unwieldy name 2,9,16,23-tetrasulfophthalocyanine. Its power lies in its ability to "cleave" the aromatic chlorine-containing rings of the otherwise impenetrable TCPs, Meunier says.

Upon mixing the difficult-to-destroy trichlorophenols with hydrogen peroxide, then adding the iron-containing catalyst, the chemists found that the chlorine atoms freed by TCP breakup linked with other molecules to form four relatively benign products.

Moreover, they found that it took only a little catalyst to trigger the desired reactions. And the process goes speedily: In several tests of the catalytic system, the chemists converted all of the toxic compounds into tolerable ones in less than 5 minutes, they report.

This system offers several potential advantages to industry, Meunier says. Both hydrogen peroxide and the catalyst are relatively "clean," easy to make, and inexpensive.

"The chemical industry has been worrying about the accumulation of these compounds that don't break down," he says. "But if you make them biodegradable, then microorganisms will take care of them."

"This catalytic process is quite general," Meunier adds. "You could use it to treat many chemicals. We use trichlorophenol mainly to show that the method works."

The new technique could prove useful for processing contaminants at toxic waste sites, the researchers say. "Now we have to try other molecules and demonstrate that the system works on a large scale."

"We've had a good start," observes Meunier, who adds that he and his colleagues are exploring potential applications with industry. *— R. Lipkin*