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TO: Mr. Robert E. Browning, Director, HLWM

FROM: Paul T. Prestholt, Sr. On-Site Licensing Representative

DATE: December 10, 1987

SUBJECT: Newspaper Articles

Please find enclosed more information that appeared in our local newspaper that is of interest.

PTP:nan

cc: Mr. Greg Cook
Ms. Sue Gagner

8C/Las Vegas Review-Journal/Thursday, December 10, 1987

Research could help design better nuke dumps, quake-proof buildings

Associated Press

SAN FRANCISCO — Scientists made three-dimensional sculptures of microscopic cracks in rocks by injecting liquid metal into limestone, a new tool for designing leakproof nuclear waste dumps and quake-resistant building materials.

"This research could help in stopping and suppressing fractures in the walls of underground excavations like nuclear waste repositories, where these cracks allow the leaking of nuclear waste," mineral engineer Ziqiong "Z.Z." Zheng said Wednesday.

Learning how rocks crack under pressure can help engineers design better reinforcement to prevent such leakage, protect buildings from quake damage and avoid the collapse of oil well drill holes, mines and tunnels, Zheng, a graduate student at the University of California, Berkeley, said during the American Geophysical Union's fall meeting.

"The new technique is expected to aid assessment of nuclear waste repository safety and the earthquake resistance of building materials," a university news release said.

The study was funded by the U.S. Department of Energy, the agency responsible for building nuclear waste dumps. Co-authors were materials science and mineral engineering professor Neville Cook, of the university's Lawrence Berkeley Laboratory, and Fiona Doyle, an assistant professor.

The researchers formed microcracks in 1-inch-diameter, 3-inch-long cylinders of limestone by putting the rock under 10,000 pounds of pressure per square inch — "like putting a medium-sized truck on a space the size of a square inch," Zheng said.

The limestone cylinders were submerged in a molten alloy made of bismuth, lead, tin and cadmium, so that when the pressure was applied, the metal filled the cracks. Then Zheng and his colleagues used hydrochloric acid to etch away the outer four-hundredths of an inch of each rock cylinder's surface, leaving a metal sculpture of the microscopic cracks.

The sculpture then was sprayed with a superfine layer of gold, which reflects electrons shot out by a scanning electron microscope, just as topography on the seafloor reflects sound waves from sonar. In that manner, the electron microscope made detailed pictures of the sculptures of cracks.

The pictures, some magnified 320 times, revealed most cracks are nearly parallel to the direction of the pressure that formed the cracks.

They also showed cracks form where there are small, slightly inclined pre-existing cracks; in crystals or grains that are squeezed together in the rock; where a long, horizontal grain snaps under vertical pressure; and where the grains are internally weak.

"We're seeing how cracks are formed and what they look like in three dimensions," Zheng said.

By knowing the direction and location of cracks that form when concrete or other materials are stressed, buildings and excavations can be better designed and reinforced to prevent cracking or stop cracks from growing, said Zheng, 27, who left his home in Beijing, China, five years ago to study in California.