

Geosciences & Engineering



SwRI uses physical analog models to reproduce the developmental sequence and overall geometry of geologic structures. This tabletop model uses sand to simulate extensional faulting in rock strata. Other models use clay or putty to simulate real-world structures and test tectonic hypotheses.

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Southwest Research Institute provides a significant, single resource for earth sciences and engineering services to government agencies, multinational corporations and service companies. The Nuclear Regulatory Commission, which established the Center for Nuclear Waste Regulatory Analyses at SwRI in 1987, remains our largest client. For almost two decades, we have focused our expertise on helping NRC evaluate the safety of disposing high-level nuclear waste at a potential [geologic repository](#) at Yucca Mountain, Nevada.

While various issues delay the Department of Energy license application for the potential repository, SwRI continues to enhance and apply its capabilities to assess the application upon submission. For instance, we augmented the [Total-system Performance Assessment code](#) to address design changes and new repository information,

providing enhanced risk insights. SwRI also improved the user interface and functionality of the [Pre-Closure Safety Analysis Tool](#), which models and analyzes nuclear waste handling operations to evaluate the potential risk of various structures, systems and components. This knowledge enhances pre-licensing interactions with the DOE on pre-closure safety.

In related work, we conducted environmental reviews for four major facilities and trained employees at federal and state



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agencies using a CNWRA®-developed course on [environmental assessment](#).

To address nuclear power plant safety, SwRI is evaluating the chemical effects of interactions between spray water and exposed materials within a nuclear power reactor containment building. In addition, we are developing a [thermodynamic model](#) that simulates chemical interactions and possible damage to components in the unlikely event of a loss of coolant.

In the international arena, the CNWRA is supporting Japan and Sweden as these nations search for geologic repository sites. Our work includes developing a [software-based performance assessment model](#) to look at generic high-level waste repository sites in Japan, as well as reviewing a proposed high-level waste repository

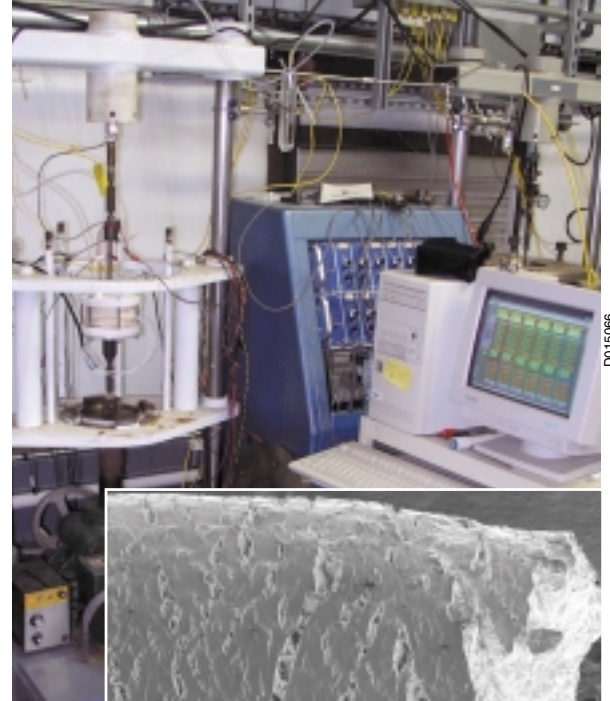
SwRI's radiochemistry laboratory includes facilities for investigating geochemical sorption processes, testing environmental samples, and evaluating remedial technologies related to technologically enhanced, naturally occurring radioactive material ([tenorm.swri.org](#)).

geophysical & geological investigations • groundwater resource evaluation •

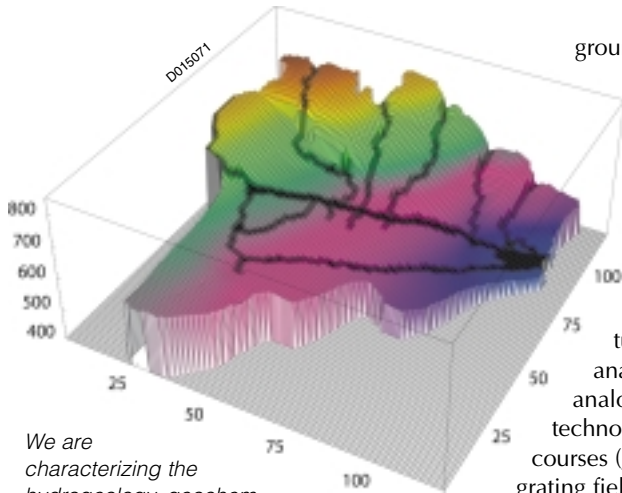
energy exploration • chemical & radiological contaminant transport • planetary sciences •

laboratory, field & numerical analyses of geosciences processes •

CNWRRA® researchers use a wide spectrum of test equipment and control systems to evaluate the stress corrosion cracking susceptibility of waste package materials in potential repository environments. Our slow strain rate test results (inset) established the possibility of Alloy 22 stress corrosion cracking within a narrow range of environmental conditions and electrochemical potentials (corrosion.swri.org).



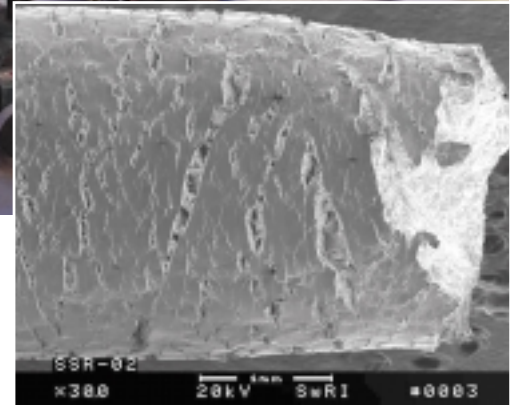
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We are characterizing the hydrogeology, geochemistry and structural geology of important portions of the Edwards Aquifer in Texas to enable governing authorities to more effectively manage critical water resources.

groundwater issues peculiar to aquifers in limestone formations.

To improve exploration and production of oil and gas, we support the [petroleum industry](http://petroleumindustry.org) with structural geological analyses, laboratory analog investigations, 3-D imaging technologies and field training courses (geoscience.swri.org). By integrating field-specific investigations, outcrop analog studies and physical analog models, SwRI has significantly advanced the understanding of how faults and fractures affect carbonate reservoirs.



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safety assessment and developing sophisticated fracture-flow modeling capabilities for Sweden.

Until recently, our broad technology base was dedicated almost exclusively to the NRC high-level waste program. We can now use this expertise to help solve [real-world problems](http://real-world-problems.org) for industry and other government agencies as well.

Concerns about groundwater supplies and quality are increasing worldwide. Our staff is assisting the [water supply and treatment](http://water-supply-and-treatment.org) industries, researching karst limestone aquifers in Texas and Florida (karst.swri.org). We are also leading a consortium of organizations from North America and the Caribbean in an investigation of

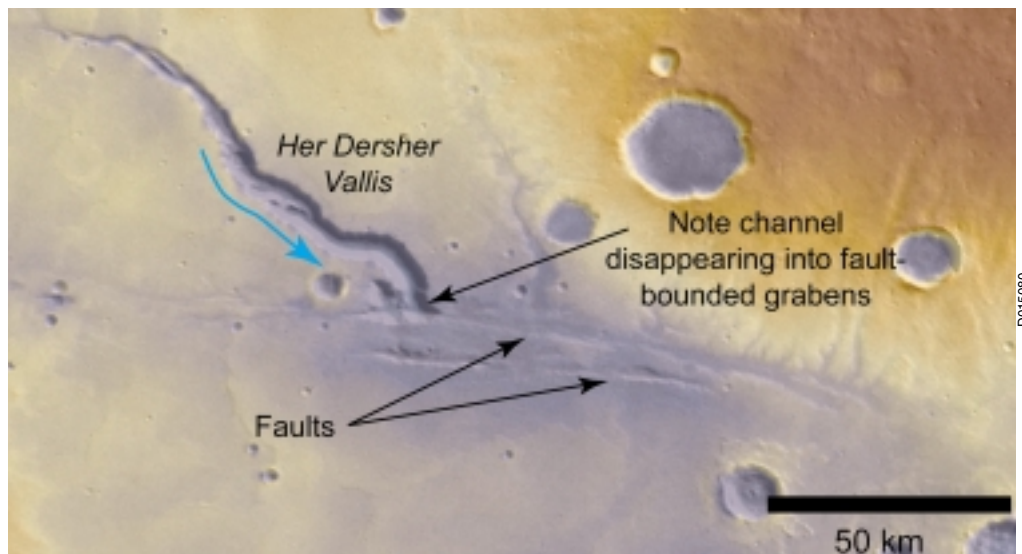
We recently expanded support to the [aggregates](http://aggregates.org) industry to include properties in Alabama, Arkansas, Oklahoma and Texas. This work combines our expertise in geophysics, geographical information systems and global positioning systems to help the industry locate and characterize potential sand and gravel resources.

Many of our earth science capabilities transfer to studying [terrestrial planets and satellites](http://terrestrial-planets-and-satellites.org). We recently concluded an internal research initiative on Mars. The

expertise we developed and demonstrated through that initiative resulted in four NASA research grants to study the structural geology of Ganymede and Mars and terrestrial analogs for Mars. Our research extends to resource exploration, hydrology and geophysical characterization of Mars. ❖

Visit geosciences-engineering.swri.org for more information or contact Vice President Dr. Wesley C. Patrick at (210) 522-5158 or wpatrick@swri.org.

SwRI researchers, combining altimetry data and photographs, produce images that suggest faults on Mars may have controlled the recharge and flow of groundwater at Her Dersher Vallis and other channels. SwRI scientists are studying how these faults influenced the direction of groundwater flow and whether they may be sites for ground ice storage today.



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