New Mexico Science and Engineering Fair 2002
New Mexico Bureau of Geology and Mineral Resources
Excellence in Geoscience Award

New Mexico Geology congratulates the nearly 500 students who presented their original research at the 50th annual New Mexico Science and Engineering Fair held April 12–13, 2002, at New Mexico Tech. Employees of the New Mexico Bureau of Geology and Mineral Resources sponsored their 3rd annual *Excellence in Geoscience* award. Geoscience exhibits covered a range of topics from several analyzing water for quality, hardness, and contamination to studies of flow rates of the Rio Grande and soil permeability to theories on dinosaur extinction, earthquake prediction, and magnetite distribution in the Sandia Mountains.

Photo: © Matt Bernhardt

Can We Stop Beach Erosion?
Experimentation in Erosion Prevention,
by *Erin Schellinger,* Rio Rancho High School, Rio Rancho
Winner, Senior Division

Beach erosion is a monumental problem that threatens shorelines worldwide. Many beaches dangerously recede every year, damaging not only human infrastructure and buildings, but the natural environment. The problem of the experiment is to explore the methods of preventing the damage of beach erosion. My hypothesis is that any of the five used prevention methods (soil renourishment, rounded/angular structures, simulated sand bags, and artificial seaweed) will help reduce the effects of erosion. The basic methodology of the experiment is as follows: beach sand duplication, shoreline simulation, and quantitatively finding which prevention method is most efficient. The control of the experiment is the trial in which no prevention method is used in the beach simulation. The variables are the prevention methods, and the constants include the tub in which the simulation occurs, the same amount of water and waves, and the same amount of sand. Most of the data does support my hypothesis, for (except the renourishment) prevention methods decreased the amount of erosion. The mass of the collected sand when no prevention method was used is 207.25 g. The others are as follows: renourishment (379.08 g), rounded structures (168.85 g), angular structures (60.92 g), sand bags (108.42 g), and seaweed (101.76 g). There may have been a cause of error in the creation of the waves, for this was done manually.

In conclusion, beach erosion may be prevented, possibly by using one of the above methods, but renourishment, which is what many shoreline states use, is not efficient. This project may be expanded in the future by using other prevention methods, or possibly other sand grain sizes.

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The Effects of Acid Rain on Common Building Materials: Phase II,
by *Katharine G. Dahm*, Rio Rancho High School, Rio Rancho
Runner up, Senior Division

In uncontaminated environments, the deterioration of buildings, monuments, and statues by weathering is a slow process. Measurable changes occur over centuries. Acid rain, however, is a serious problem worldwide. Because marble, limestone, slate, quartzite, and granite are widely used building materials in stone construction, understanding how they deteriorate when exposed to acid rain is important. In addition, it would be valuable to find substances to protect these materials. Last year, limestone was shown to be most susceptible and granite least susceptible to weathering.

Building companies have developed sealants to protect outdoor surfaces. These sealants are inorganic polymers. They are applied in liquid form using organic solvents. The two experimental sealants used in this study are silicon based. Both are penetrating sealants that form a polymer that strengthens the rock. There are two important questions when testing sealants. Do the sealants prevent deterioration as measured by weight loss when exposed to acid? Do the sealants prevent or retard surface deterioration or corrosion when seen by electron microscopy?

Quartzite was least affected by acid. Acid effects increased in the order of quartzite, slate, granite, marble, and limestone. The two sealants showed differential protection depending on rock type. They protected slate and marble from acidity, while they failed to protect limestone, quartzite, and granite. There was no significant difference between the two sealants. All rock types except quartzite would benefit from a good protective sealant. There was no significant difference in weight loss between the acid and the DI water treatments for quartzite.

From nearly 50 geoscience exhibitors, the judges selected a winner and runner up in the senior and junior divisions. However, all Science Fair participants, their teachers, and parents should be congratulated for literally hundreds of intelligent and creative projects. *New Mexico Geology* is pleased to introduce four of these talented students and their projects to our readers.

Erin Schellinger is a sophomore at Rio Rancho High School. Her science teacher is Jennifer Miyashiro. Erin won third place honors in the Engineering category.

Katharine Dahm, a Placitas resident, is a junior and a student of Janet Penevolpe at Rio Rancho High School. Katharine was awarded honorable mention in the Environmental Science category. She also won certificates of merit from the Association for Women Geoscientists and National Association of Corrosion Engineers and the David K. Shortess Award.

Terrin Hoffmann is in 7th grade at Sierra Middle School, Las Cruces; her science teacher is Gabriela Alaniz. Terrin won third place in the Earth & Space Science category. Terrin also received certificates of recognition from the New Mexico Groundwater Association and Discovery Junior Scientist Challenge and an award from the American Society of Civil Engineers.

Katelyn Turnbow, a Corrales resident, is in Mark Williams' 8th grade science class at Taylor Middle School, Albuquerque. Katelyn won first place in the Earth & Space Science category. Katelyn also received a scholarship from the New Mexico Geological Society and a certificate of recognition from the Discovery Junior Scientist Challenge.

Photo: © Matt Bernhardt

Oil in the Soil and Other Contaminants in the Vadose Zone How Can We Protect New Mexico's Groundwater?, by *Terrin A. Hoffmann*, Sierra Middle School, Las Cruces
Winner, Junior Division

Photo: © Matt Bernhardt

A Sea of Change,
by *Katelyn A. Turnbow*,
Taylor Middle School, Albuquerque
Runner up, Junior Division

Knowing how precious water is in New Mexico, I wondered: "What pollutes our ground water, and how can we protect it?" I picked five common pollutants in New Mexico that were safe to experiment with: ammonia, chlorine, cow urine, motor-oil, and pesticide.

In Phase I, I filled pipes with poorly graded sand (typical vadose zone in New Mexico). Next I poured 500 ml each of the five contaminants into their own pipes and waited for each to seep into a cylinder (the ground water). I recorded when each contaminant first flowed into its cylinder and took additional readings until each contaminant stopped flowing.

In Phase II, I put a zeolite barrier at the bottom of each pipe under the sand. I wanted to see if the zeolite would keep significant amounts of the contaminants I tested out of the ground water and also slow the time it took pollutants to reach the water table.

I found all the pollutants I tested reached the ground water fairly quickly. Cow urine reached the ground water the quickest. I discovered that zeolite did somewhat reduce the amount of pollutant that seeped into the ground water. My best discovery though, was that zeolite dramatically decreased the time it took for contaminants to reach the water table.

In conclusion, New Mexicans should work to prevent pollutants from entering the soil as they will likely contaminate the ground water below. If pollutants have already been spilled, then scientists should consider using zeolite barriers to slow down and reduce the volume of their flow into our ground water.

This project represents a systematic examination of Pennsylvanian period fossil assemblages contained in the Jemez Springs Shale Member of the Madera Formation. Sutherland and Harlow (1967) defined this highly fossiliferous, marine member as a shale interbedded with thin limestones. At the collecting locality in the Jemez Mountains, it was approximately 10 m thick with non-marine sandstones and conglomerates below and above.

On previous visits, this researcher noted differences in the fossil assemblages from the lowest to the highest portions of the shale outcrop. Therefore, the question is: what changes occurred in the fossil assemblages during the relatively short geologic time represented by the Jemez Springs Shale Member?

The hypothesis is that there were minor changes in the shallow marine assemblages found in the Jemez Springs Shale Member. To address the hypothesis, one-liter samples were systematically collected from lowest to highest point within the member. The outcrop was mapped, and notes were taken. During the laboratory work, the samples were screened and washed, and the fossils sorted, counted, and if possible, identified to genus or species.

This study showed the hypothesis was partially correct. The samples showed only minor differences in the fossil taxa throughout the outcrop. The overall frequencies of animals, however, changed drastically. This variation probably is the result of changing environmental conditions on the sea floor.