Lite Geology

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ISSUE 38

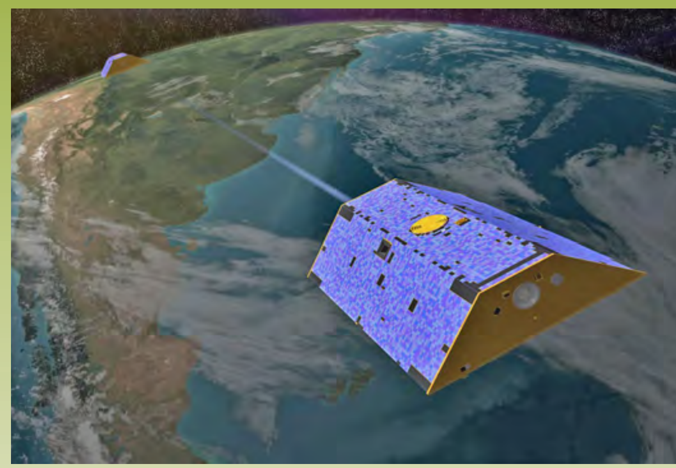
Earth Briefs: Gravity and GRACE

Shari Kelley

IN 2002, NASA CAME UP WITH a clever way to use a pair of satellites separated by 220 km that travel around the Earth's poles to measure regional-scale changes in Earth's gravity on a monthly basis. The gravity data collected during this investigation, which is called GRACE (Gravity Recovery and Climate Experiment), allow scientists to monitor global changes in continental groundwater storage, the volume of the oceans, and the size of glaciers.

So, how does this work? You might remember from your study of physics that gravity is an unseen force that pulls two masses toward each other. Dense rocks like basalt have a larger gravitational attraction than a less-dense rock like granite. Similarly, sandstone that is saturated with water will have a greater gravitational attraction than dry sandstone. Spatial and temporal variations in density will result in small changes in the gravitational field of the Earth.

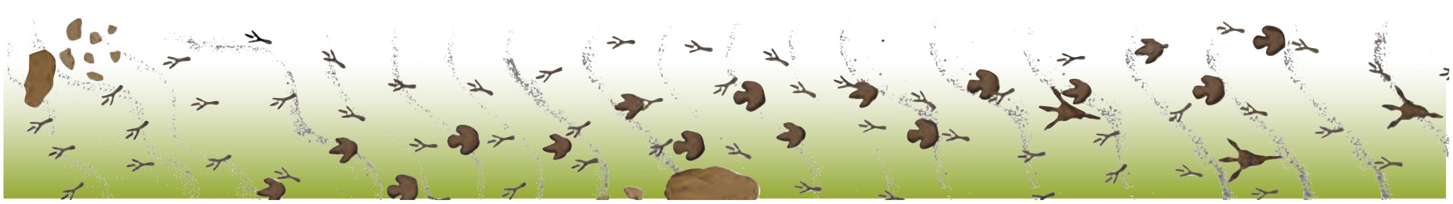
The measurement of gravity using a satellite pair in space requires very precise measurements of the relative speed of each satellite and the distance between the satellites. The velocity of the front satellite and the distance between the pair will increase if denser material within the Earth is in front of the pair. The higher gravitational attraction of the denser material will pull the front satellite toward the denser mass. Once the denser material is in between the satellites, the distance between the pair will decrease. The opposite reaction will occur as the pair approaches low density material.



Artist's conceptual image of Gravity Recovery and Climate Experiment (GRACE), which uses twin satellites to measure Earth's gravity field. *Image provided by NASA/JPL-Caltech.*

Researchers have been using GRACE data during the last decade to evaluate the health of groundwater aquifers by observing trends in gravitational changes through time and tying those changes to water level measurements and water storage calculations collected by more traditional means. Typically, depth-to-water-table is monitored by lowering a tape down a well and by installing data loggers. These

In This Issue...



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types of measurements are time consuming and are restricted to areas that have water wells. Remotely-sensed changes in groundwater storage using GRACE data allow scientists to make these types of assessments in sparsely populated areas or in areas where groundwater levels are not routinely monitored or reported. One down side of GRACE studies is the spatial resolution is low; an aquifer system must cover more than 115,000 square kilometers in order to extract meaningful interpretations.

An example of a study using GRACE data to investigate large aquifer systems was just published in the July, 2015 issue of *Water Resources Research*. Here, scientists examined gravity changes associated with water use in 37 of the world's largest aquifers between January of 2003 and December of 2013. Water use outpaced water replenishment in 21 of the studied basins and eight basins are described as overstressed. The most stressed basins are in the Middle East, in northern Africa, and along the India-Pakistan border. The stress is attributed to large populations and intense agricultural activity; arid climate is a contributing factor in certain cases.

Most of the aquifers in New Mexico, with the exception of the Ogallala aquifer that underlies the High Plains of the eastern part of the state, are smaller than the resolution of GRACE. In this case, we must resort to ground-based measurements. Hydrologist Alex Rinehart at the NMBGMR has recently purchased a high-precision gravimeter and GPS surveying equipment and he is planning to conduct repeat gravity surveys of basins near Socorro in order to keep tabs on possible changes in groundwater storage through time in this area. Watch for reports of Alex's work in future issues of Lite Geology!

For more information about GRACE, go to:

http://www.nasa.gov/mission_pages/Grace/index.html#.Vcuz29VeWGA

http://podaac.jpl.nasa.gov/grace/

LITE Geology Evolves!

An Introduction to our New Look

Maureen Wilks

LITE GEOLOGY IS SHIFTING GEARS. We're returning to our original roots with shorter, lighter articles that are still packed with great geological information but are easier to digest, download, and remember. This issue will focus on what geologists do, from making geologic maps, predicting the next volcanic eruption in New Mexico, to figuring out how early travelers survived the trek across the Jornada del Muerto Basin. We hope you enjoy the new Lite Geology!

The Volcano Dating Game

Matt Zimmerer

View of the 28,000 yr-old Zuni Salt Lake, a maar volcano with small cinder cones in the crater. This is only one example of the diverse volcanic landscape we have here in NM. *Photo courtesy of Matt Zimmerer.*

THERE HAVE BEEN THOUSANDS of volcanic eruptions in the southwestern United States during the past several hundred thousand years. Many geologists believe that volcanism in the region has not stopped and there will be more eruptions sometime in the future. My job involves studying New Mexico's most recent volcanic history so that we can determine when and where to expect future eruptions.

I measure the ages of the volcanic rocks to understand how frequently volcanoes erupt. One component of my job is collecting the volcanic rocks to analyze; this involves traveling to some amazing locations. For example, many of the national monuments in our state showcase young volcanoes, such as Capulin, Rio del Norte, and El Malpais. Getting to the more remote volcanoes often requires long drives on four-wheel drive roads. I collect samples by hiking up and down the volcanoes looking for pristine rocks. I break off a couple kilograms of rock with a small sledge hammer, put them in my backpack, and take them back to the laboratory for analysis.

Fortunately, New Mexico is home to one of the best research laboratories in the country for determining the ages of volcanic rocks, aptly titled the New Mexico Geochronology Research Laboratory. This laboratory uses the principle of radioactive decay to measure the age of a rock, the decay of Potassium-40 to Argon-40 specifically. Luckily, Potassium is the 8th most abundant element in the Earth's crust and is commonly found within volcanic rocks. When a volcano erupts, Argon-40 starts to accumulate in the rock, and as we say "the Argon clock starts." By knowing the rate at which Potassium-40 decays (is converted to) Argon-40, and then measuring the amount of Argon-40 in the rock presently, we can very precisely determine when this rock was erupted, in other words its age. The laboratory uses state-of-the-art instruments, such as multiple types of lasers and noble gas mass spectrometers, to extract then measure the Argon in a rock.

The new ages for young volcanoes that I have determined are very important for assessing volcanic hazards. For example, the new data show that vent locations are slowly migrating eastward and that the next volcano is more likely to erupt on the east side of each volcanic field. The ages also indicate that the rate of eruptions in some New Mexico volcanic fields has increased during the last 100,000 yrs. Maybe the next eruption in the southwest will be here in New Mexico!

View of the New Mexico Geochronology Research Laboratory. *Photo courtesy of Matt Zimmerer.*

Scrambling My Way Through the Earth's Past

Dan Koning

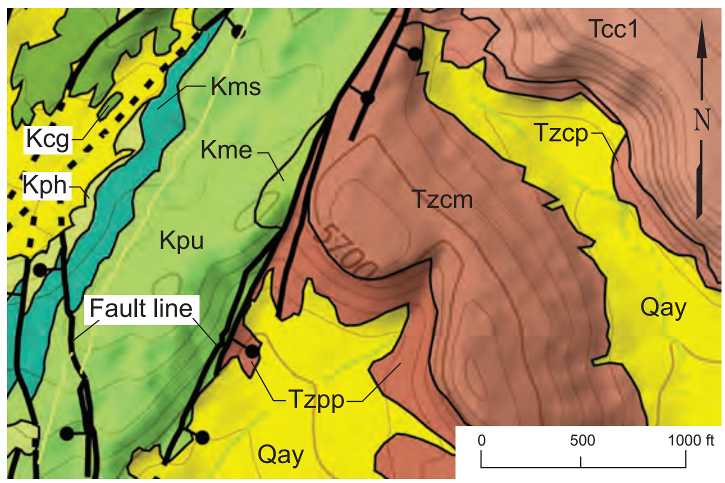
I'M A FIELD GEOLOGIST with the New Mexico Bureau of Geology, and I admit it's a dream job. Basically, it entails hiking around the beautiful mountains, plains, and deserts of New Mexico. While hiking, I describe geologic features, note their locations, and measure some of their attributes, such as orientation of bedding or sand grain size. Hiking on a trail is not the norm; usually what I'm doing is scrambling up and down steep hillsides, climbing ledges, or bushwhacking. True, there is a substantial office component, where I compile my field data and write papers. But I always find the outside (field) component engaging, especially on a nice day if I'm working in a beautiful or geologically interesting area. In times like these—when I'm out there recreating landscapes, tectonic forces, or climates involving time spans of millions of years—I gain a lot of appreciation for the world we live in.

A picture of me sitting on a bed of ash blown into the Albuquerque basin from the last major eruption in Yellowstone (640,000 years ago). *Photo courtesy of Dan Koning.*

One of my primary tasks is making geologic maps. All of us have used maps showing roads, cities, or boundaries between states or countries. Geologic maps depict boundaries between distinctive rock layers and locations of earth features like lava flows, sand dunes, and earthquake fault lines. A good geologic map can be very useful in identifying resources. For example, certain geologic formations hold more groundwater than others, or may contain oil, coal, gravel, or mineral deposits.

Another aspect of my job, often a spin-off from the geologic mapping, is characterizing the spatial extent and physical properties of groundwater aquifers. This entails knowing what lies beneath the Earth's surface. To do that, I draw cross sections or assist in making 3-D geologic models of the subsurface; these efforts entail using geologic maps coupled with data from existing wells or geophysical methods. The latter commonly includes measurements of the Earth's gravitational field, which show lower acceleration values where porous, non-compacted aquifer material is thicker. Not only does aquifer characterization help us find the best places to drill water wells, but characterizing the subsurface is useful for mining and oil exploration companies as well.

What I find particularly stimulating in my job is discovering and recreating scenes of the Earth's past. Practically, this tends to be an important thing to do in most field-based geologic investigations, and often these reconstructions are communicated to the public in reports. But in a personal sense, it's gratifying to walk up to rock outcrops and basically read them like one would read a book. Sometimes I feel like a shaman or prophet. But instead of foretelling the future, I get to experience from an outcrop visions of a pre-human Earth.



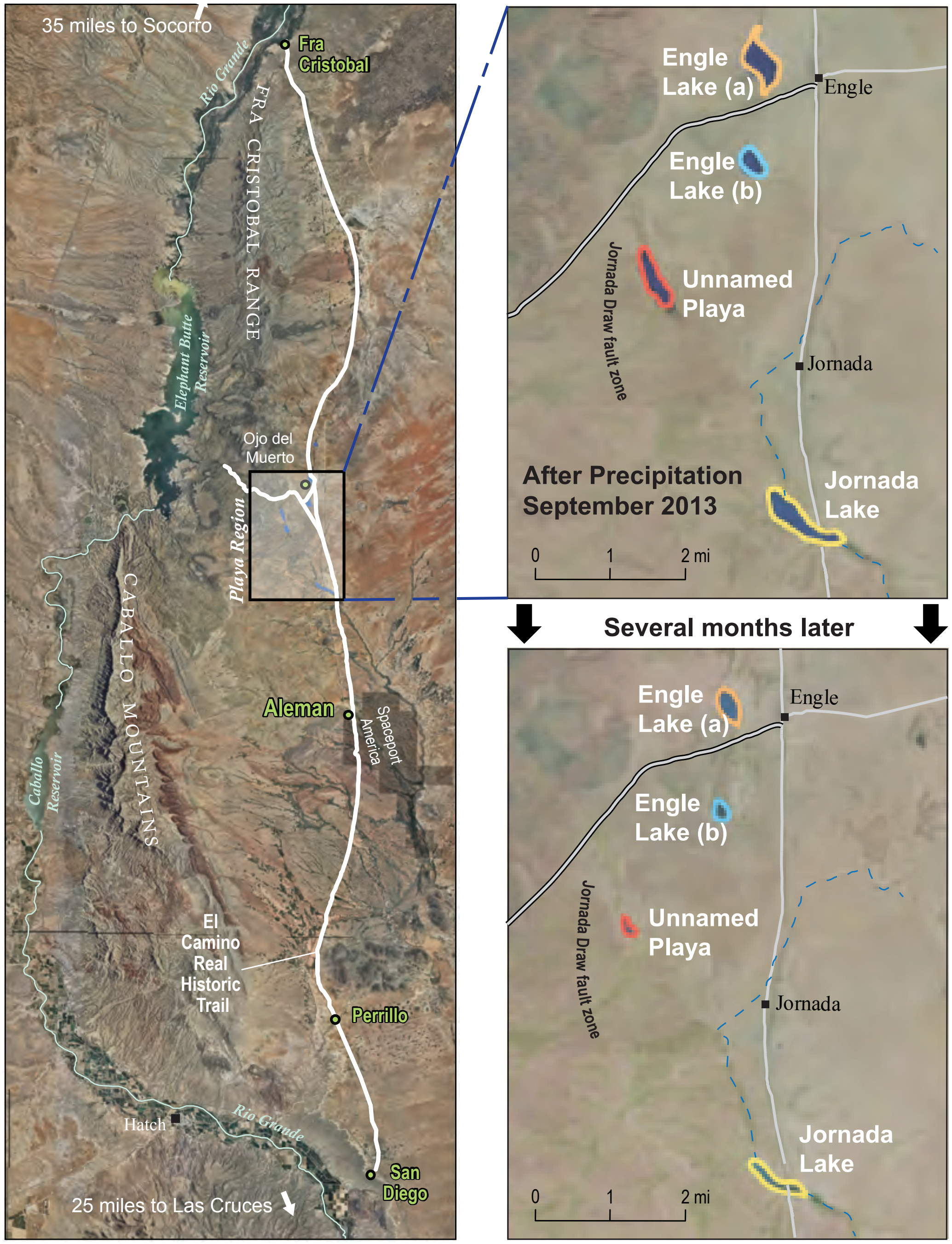
Portion of a geologic map located about 20 miles northwest of downtown Albuquerque. The brownish lines represent elevation contours, like one would see on a topographic map. The color-shaded areas, separated by thin black lines, depict locations of different ages and kinds of rocks. The labels on the various colors are abbreviations for specific rock unit names. The greenish shades are sandstones and shales deposited near an ocean shoreline 82–87 million years ago, when dinosaurs were tromping around the Albuquerque area. The brown shades represent sandstones laid down by rivers and wind about 15–20 million years ago; these are much more permeable than the green-shaded units and make a better aquifer. The thick black lines are fault locations, where rock layers have been offset along major cracks in the Earth's crust. The ball and bar symbols alongside the faults denote which side moved down. Recurring movement along the central fault has dropped down the brown-shaded units against the green-shaded units. On which side of the fault do you think one should drill a water well?

Surviving the Desert

Ethan Mamer

THE JORNADA DEL MUERTO, or Journey of the Dead Man, is the sinister name given to a 100-mile stretch of desert that was used to travel between Las Cruces in the south and Fra Cristobal, a campsite, just north of the modern day Elephant Butte Reservoir. It is part of the larger El Camino Real, the trade route between Mexico City and San Juan Pueblo, which has returned to its former name, Ohkay Owingeh, just north of Santa Fe. For the majority of its extent in New Mexico the trail follows the Rio Grande north, taking advantage of its ample supply of water. However, due to difficult terrain along the river channel north of Las Cruces, the trail veers off into the desert. This led us to ask, how did these travelers survive this inauspicious trek?

In May of 2013 the New Mexico Bureau of Geology did an initial survey of water sources in the area to find what water may have been available to travelers. With the exception of a large spring, we found what one might expect: desert, and a lot of it. However, when we went back in October to sample the spring and some wells we came across the unexpected: water, entire playa lakes filled with it. As is frequently the case with science, this observation raised more questions than it answered: how often do these lakes fill up? How long do they last? Could travelers have relied upon these ephemeral lakes as a source of water while traveling the Jornada? On first glance, these seemed like difficult questions to answer. After all, our data set was pretty small (it was dry in May and wet in October). In the end we had to get a little creative, utilizing a dataset not typically used in hydrogeology, and certainly not for its intended purpose.



Long map (above left) shows the extent of the Jornada Del Muerto. The two maps on the right are time-lapsed, Landsat satellite images of the playa region. Above right—Immediately following the 2013 rain event, and Below right—several months later when the lake areas were visibly reduced. *Source: New Mexico Bureau of Geology Open-File Report 573, Hydrogeology of central Jornada del Muerto: Implications for travel along El Camino Real de Tierra Adentro, Sierra and Doña Ana Counties, New Mexico. Access this report online at:* **http://geoinfo.nmt.edu/publications/openfile/home.cfml**

To find out when the playas had flooded in the past we used historic satellite imagery obtained from Landsat. Landsat is an earth observing program operated by NASA and the USGS, and has been imaging the earth's surface over the past 40 years. The satellite is outfitted with numerous

Above is one of the flooded playa lakes along the Jornada del Muerto, which filled as result of the September, 2013 storms. Playa lakes, when filled, have the capacity to provision large groups of travelers, as well as their herds. However, the playas did not always contain water and did not fill every year. Even if there was a good monsoon there was no guarantee that the playas would have water, since playas only flood as result of major storm events. We found that between September and October travelers would have a ~35% chance of finding water in the playas. During the months of August, November and December the probability of water being present drops to 20%. In other words, on average, travelers would have found water in the playas every third to fifth year.

sensors that collect images, and spectral band data useful for monitoring everything from the health of crops, to the extent of the ice shelves. The satellite collects a narrow band of images as it orbits the earth, repeating its path every 16 days. By combing through 40 years of satellite photos, taking note when the playas filled, and measuring their area every 16 days as they dried, we obtained a unique and useful dataset. With this record, combined with a precipitation record, we were able to determine what rain conditions resulted in playa flooding events. Next, by filtering 100 years of precipitation data for storms that met the flood conditions, we determined how often the playas filled, how long they stayed wet, and what months travelers were most likely to find water.

Interestingly, we found that the likelihood of finding water in the playas wasn't too bad if you knew when to look. The chance of finding water in the playas during September and October is as high as 35%, while there is only a 2% chance of finding water in them during May. In all likelihood, travelers hoping to cross the Jornada del Muerto would have wanted to ask other travelers if there was water in the playas before they attempted the journey.

JOIN US FOR
THE MINERAL MUSEUM'S

GRAND OPENING

At our NEW Location
in the Headen Building (New Mexico Bureau of Geology)
on Bullock Blvd. on the northeast side of the
New Mexico Tech campus

Friday, November 13th
5 pm–7 pm in the Atrium

El Morro National Monument

Stacy Timmons

Inscriptions are visible along the north point of the Zuni Sandstone cliff at El Morro National Monument. *Photos courtesy of Shari Kelley.*

EL MORRO NATIONAL MONUMENT, featuring an impressive and iconic sandstone cliff, is located approximately 56 miles southeast of Gallup and 42 miles southwest of Grants. The geologic highlight of this national monument is the 200-foot wall of sandstone with over 2,000 carved signatures and petroglyphs, some more than 500 years old. The sandstone cliff is composed of the Jurassic age Zuni Sandstone, which was deposited in a wind-blown dune field environment about 160 million years ago. During this time, a very large dune field covered this region of the southwest including northwest New Mexico, northeastern Arizona, southeastern Utah, and southwestern Colorado. Approximately 65 million years of time is missing in the rock record (an unconformity) between the top of the Zuni Sandstone and the cap of this cliff, the Dakota Sandstone (Late Cretaceous, ~95 million years old). Much later in geologic history, a mere 115,000 years ago, volcanic eruptions to the east, at the Zuni-Bandera volcanic field, formed basaltic lava flows in some of the low-lying valleys in the area. These lava flows are found in the campground area of the national monument.

Travelers in the more geologically recent years (last 500+ years) have sought this location for its water source, a spring fed pool of water at the base of this cliff. Travelers now-a-days can access El Morro National Monument for a nominal entrance fee, and enjoy hiking, camping and picnicking in this geologically and historically intriguing area. For more information, please visit: **http://www.nps.gov/elmo**

Through the Hand Lens: Profile of a New Mexico Earth Science Teacher

Susie Welch

ANNA SUGGS TEACHES 6TH GRADE integrated science at Zia Middle School in Las Cruces, New Mexico. In 2012 she was a Presidential Award recipient for Elementary Science. Anna loves to inspire her students with community and science based projects, such as the campaign to remove all Styrofoam products from her school, along with recycling, collection drives for the food pantry, Pink Week, and others. Anna's after school programs have included: 1) Growing Up Thinking Scientifically, 2) Science, Engineering and Aerospace Academy, 3) BEST Robotics, and 4) Zia Rocket Club. She is an active member of the New Mexico Science Teachers Association (NMSTA) Board, and serves as a presenter and conference planner at NMSTA conferences.

While traveling to Washington D.C. for the Presidential Award ceremony, I was delayed because of canceled flights during a massive snowstorm. My daughter and I drove 8 hours in the snow to get to D.C. and she dropped me off at the White House gate. I had no time to change clothes, and when I was shaking the President's hand I apologized for my attire. He replied, "That is okay, I would rather be wearing what you are wearing. They make me wear suits!" *Photo courtesy of Anna Suggs.*

Educational Background:

- Bachelors of Science, Agricultural Animal Science, New Mexico State University (NMSU)
- Alternative licensure, College of the Southwest
- Masters of Arts, Curriculum and Instruction- New Mexico State University

Professional Development:

Presenter at: Making Sense of Science, New Mexico STEM Symposium, NSTA regional conference, SC^2 (NMSU) Summer Science Conference and Spring Symposium

Grants Awarded: Remote Sensing Earth Science Teacher Project at Goddard Space Flight Center and White Sands National Monument

Why is it important for students to learn about Earth science?

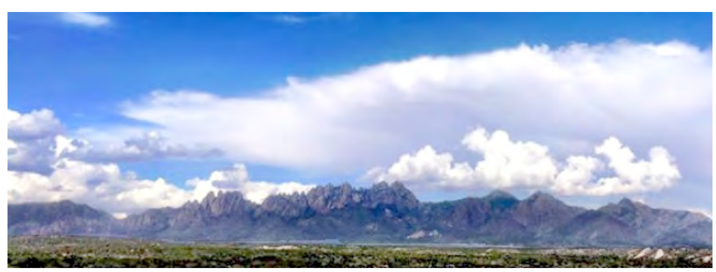
Earth science is the foundation for students to understand our world today. They must gain knowledge of how the Earth is made, its resources, and its interactions that impact our human race. They can then use this knowledge to make informed choices about how they interact with our Earth.

ADVICE OR SUGGESTIONS FOR OTHER EARTH SCIENCE TEACHERS: We are lucky in New Mexico to have so many wonderful natural resources. We as teachers need to expose our students to those resources. Take them outside, give them rocks and minerals to use, let them do research on New Mexico's geologic history. Kids love it when they find out about all the volcanoes that have erupted right where we live.

WHEN DID YOU FALL IN LOVE WITH GEOLOGY? Growing up in New Mexico, I think I was always curious about land formations. I did not actually fall in love with geology until I began teaching it. Then, I became enamored with all the rocks, minerals, land formations, etc. Now I cannot drive anywhere without trying to figure out when and how a formation was made.

What are your hobbies that relate to Earth science teaching?

I am an amateur astronomer and own two telescopes. I also love rock and fossil collecting,



View looking east to the Organ Mountains, Las Cruces, NM. *Photo courtesy of Jamie Gill.*

FAVORITE GEOLOGIC FEATURE IN NM: The Organ Mountains (above) is a landmark that I admire while driving to and from school. I teach my students about the structure of the Organ Mountains and what they mean to the Mesilla Valley. They also provide a beautiful place to hike.

Classroom Activity
The Great New Mexico ShakeOut!

A STATE-WIDE EARTHQUAKE DRILL

http://shakeout.org/newmexico/

At 10:15 a.m. on October 15, 2015, tens of thousands of people will "Drop, Cover, and Hold On" in The Great New Mexico ShakeOut, the state's largest earthquake drill ever! All K-12 schools and districts are encouraged to participate in the drill (or plan a more extensive exercise).

Major earthquakes may happen anywhere you live, work, or travel. The ShakeOut is our chance to practice how to protect ourselves, and for everyone to become prepared. The goal is to prevent a major earthquake from becoming a catastrophe for you, your organization, and your community. Why is a "Drop, Cover, and Hold On" drill important? To respond quickly you must practice often. You may only have seconds to protect yourself in an earthquake before strong shaking knocks you down, or something falls on you.

Here are a few suggestions for what K-12 schools and districts can do to participate in the ShakeOut. Learn more at ShakeOut.org/newmexico/howtoparticipate.

PLAN YOUR DRILL:

- Register at ShakeOut.org/newmexico/register to be counted as participating, get email updates, and more.
- Download a Drill Broadcast recording from ShakeOut.org/newmexico/drill/broadcast.
- Have a "Drop, Cover, and Hold On" drill at 10:15 a.m. on October 15. You can also practice other aspects of your emergency plan.
- Discuss what you learned and make improvements.

GET PREPARED FOR EARTHQUAKES:

- Check your emergency supplies and equipment; make sure they are accessible and functional.
- Download and review school preparedness materials from ShakeOut.org/newmexico/howtoparticipate
- Encourage staff and students to prepare at home.
- Distribute ShakeOut take-home materials.

SHARE THE SHAKEOUT:

- Encourage students and staff to ask their friends, families and neighbors to register.
- Ask colleagues at other schools to participate.
- Find posters, flyers, and other materials for promoting the ShakeOut at ShakeOut.org/newmexico/resources.
- Share photos and stories of your drill at ShakeOut.org/newmexico/share.

Short Items of Interest for Everyone

Earth Science Movie Review: San Andreas (2015)

Andy Jochems

Rated PG-13

Director: Brad Peyton

Cast: Dwayne Johnson, Paul Giamatti, Alexandra Daddario

THOUGH THE WORLDS OF HOLLYWOOD AND GEOLOGY seldom collide, the results can be spectacular when they do. They can also be spectacularly wrong from a scientific standpoint. Movies like Dante's Peak and Volcano were renowned for their shaky foundations in science, while more recent Earth science/disaster flicks like 2012 feature eye-popping effects but largely continue the tradition of scientific hyperbole in film.

San Andreas firmly establishes itself in the "action first, science second" genre, but it differs from its predecessors in some key facets, discussed below. The film stars Dwayne "The Rock" Johnson (sorry geologists, he's actually a human) as Ray Gaines, an ex-military helicopter pilot now running rescue missions with the Los Angeles Fire Department. In the opening scene, Gaines deftly flies his team into an apparently bottomless chasm to rescue a woman trapped in her car after an earthquake hits the LA metro area. These dark gorges seemingly reach to the bottom of the crust and are a recurring feature in the movie, elevating the suspense of Gaines' many rescue endeavors. But they simply aren't realistic because ruptures along strike-slip faults such as the San Andreas cause plates to move past but not apart from one another. The film does get at least one aspect of the San Andreas right—namely it's right-lateral sense of slip. Yet even this is reversed in some scenes!

Gaines' counterpart in the hero role is Dr. Lawrence Hayes (Paul Giamatti), a seismologist at Cal Tech. Hayes is introduced to us in a lecture scene, describing to students some of the largest earthquakes ever recorded, including real events in Alaska and Chile. It's always refreshing to see a scientist play the hero in film, but Giamatti's character becomes regrettably mired in inaccuracies. Among these embellishments is his warning that California will be struck by tremors of magnitude 9 or more. Fortunately for Californians, earthquakes of this size are not possible due to the length and depth of the San Andreas fault. Hayes also states that tremors will be felt on the east coast and, more egregiously, that earthquakes can be predicted. Despite many advances in seismology, there is no technology that allows scientists to predict the timing of quakes. However, the triggering effect of earthquakes shown several times in the movie is possible.

While Hayes attempts to warn the public, Gaines travels to San Francisco where he must rescue his daughter (Alexandra Daddario) who has been abandoned by her mother's cowardly boyfriend while on a business trip. Gaines' rescue efforts come to symbolize the salvation of his family; he also saves his soon-to-be ex-wife from a skyscraper rooftop in LA while inexplicably flying a helicopter alone. But the reunion doesn't happen before disaster strikes once more, this time in the form of a tsunami cresting at the Golden Gate Bridge. Though the initial receding waters of the tsunami are accurately depicted, the gigantic cresting wave and post-tsunami flood of San Francisco (apparently never receding to sea level) are again purely theatrics. In fact, the San Andreas is unlikely to produce a significant tsunami because it occurs mostly inland and ruptures with horizontal (strike-slip) motion.

Despite the typical Hollywood treatment of earthquake science, San Andreas does deliver some important messages regarding disaster safety. "Drop, cover, and hold on" is repeated frequently, and the administration of first aid and formulation of back-up plans demonstrated by Johnson and Daddario's characters are critical, life-saving strategies. The phrase "inaccurate to a fault" applies to this movie on multiple levels, but Johnson and Giamatti play their roles well and the portrayal of the seismologist and rescue specialist as co-heroes is sure to please both geoscientists and thrill-seekers alike.

For more information on earthquakes, visit these websites:

Earthquake Country Alliance: http://www.earthquakecountry.org/

US Geological Survey: http://earthquake.usgs.gov/earthquakes/

Rating: 2.5/5 "picks"

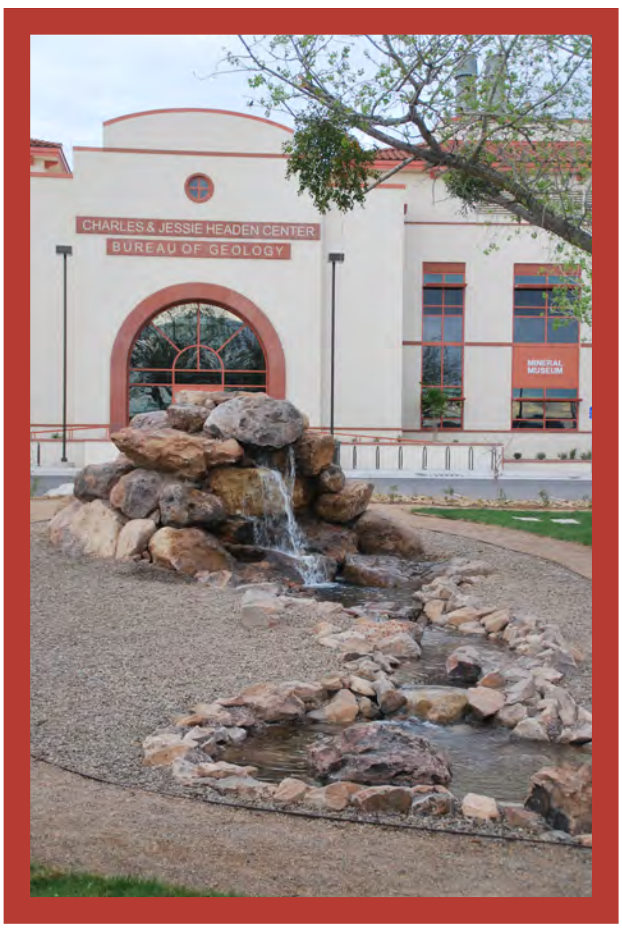
ROCKIN' AROUND NEW MEXICO 2015

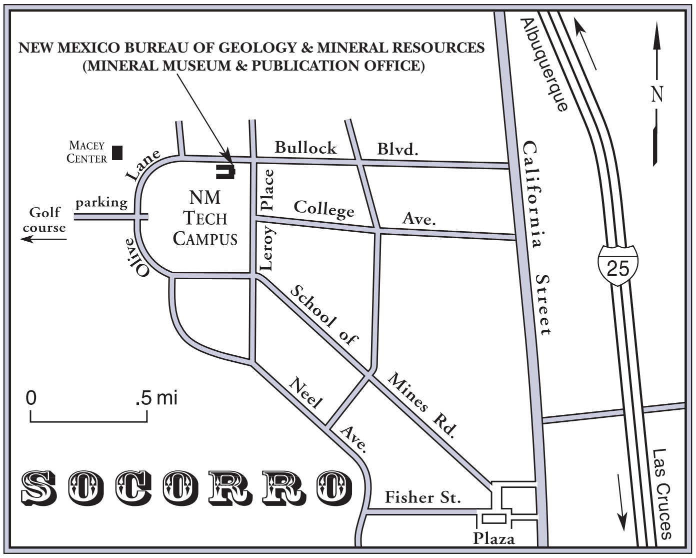
NEW MEXICO BUREAU OF GEOLOGY conducted a 3-day teacher workshop that was attended by 26 teachers on July 8-10 in Socorro, New Mexico. Topics covered were 1) hydrogeology of the Magdalena area, 2) seismic potential of subsurface faults, and 3) seismic hazards in New Mexico, along with discussions on safety and survival for schools.

Several field trip stops included discussions about precipitation, surface runoff, and infiltration as it impacts aquifer recharge. Teachers also learned that the extensive faulting and fracturing in Magdalena and the surrounding area complicates groundwater flow and plays a role in rapid well depletion in high demand situations, which was the case during the 2013 Magdalena water shortage. The main producing well lies along the subsurface Madgalena fault that runs through the middle of town. While the water levels in the municipal wells have recovered from the low levels in 2013, that recovery was attributed mostly to conservation by residents rather than precipitation events leading to aquifer recharge.

Teachers also visited a watershed study site on the New Mexico Tech campus where surface water runoff, infiltration, and erosion rates are being measured. Near this site, teachers saw an exposed fault that runs northwest-southeast and, as seen on aerial images, appears to extend underneath several vacant areas of the New Mexico Tech campus along with the golf course and some faculty housing.

All participants received instruction on the characteristics of earthquake waves and the potential for damage as various waves travel through the Earth. After an update on the recovery operations following the 2011 Christ Church, New Zealand earthquake, teachers practiced the Drop, Cover and Hold On! earthquake safety drill. This workshop was sponsored by New Mexico Department of Homeland Security and Emergency Management, New Mexico Bureau of Geology, New Mexico Mining Association, and New Mexico Tech.





The Mineral Museum is on the campus of New Mexico Tech in Socorro, New Mexico

9 a.m. to 5 p.m., Monday through Friday

10 a.m. to 3 p.m., Saturday and Sunday

Closed on New Mexico Tech holidays

The new Bureau of Geology building is located at the corner of Leroy Place and Bullock Blvd. on the campus of New Mexico Tech in Socorro (see photo on page 12). Visitor parking on the east side of the building provides convenient access to the Mineral Museum and Publications Sales office.

MINERAL MUSEUM

The bureau's mineralogical collection contains more than 16,000 specimens of minerals from New Mexico, the United States, and around the world, along with mining artifacts and fossils. About 5,000 minerals are on display at a time.

For teachers, students, and other groups, we offer free tours of the museum. We like to show off our home state minerals, as well as give students an idea of how minerals end up in products we use every day. Museum staff can also identify rocks or minerals for visitors. Please call ahead to ensure someone will be available. For more information on the museum, please visit our website at: geoinfo.nmt.edu/museum/

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To Schedule a Museum Tour, Contact:

Susie Welch: Education Outreach

575-835-5112; swelch@nmbg.nmt.edu

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