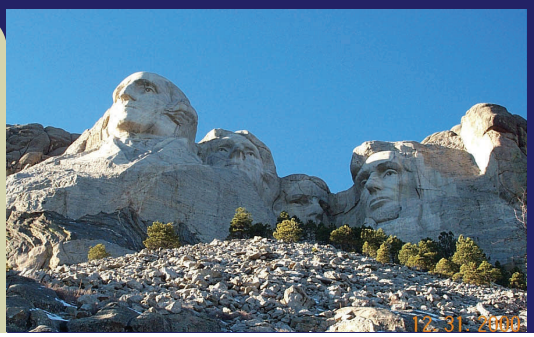
Association of Environmental and Engineering Geologists

The Rocky Mountain Section Newsletter

MARCH 2009



STUDENT NIGHT!!!

MEETING DATE

FRIDAY MARCH 27th, 2009

TIME

5:30 p.m. Social Hour
6:30 p.m. Dinner
7:30 p.m. Presentation

LOCATION

Berthoud Hall, Colorado School of Mines
1516 Illinois St.
Golden, Co 80401
Room 241
See Map Below

COST

$25 Members
$27 Non-members
Students free

RESERVATIONS

meetings@aegrms.org
or
WWW.AEGRMS.ORG

BY NOON, TUESDAY MARCH 24TH

STUDENT NIGHT!!!

Installing the Homestake HLS for Ground Motion Studies

Evan Keffeler and Katrina Knodel; South Dakota School of Mines

Two hydrostatic water level systems (HLS) have been installed in the former Homestake gold mine in Lead, South Dakota to monitor seismic-induced ground motion. Each HLS Array consists of six Fermilab-designed Tevatron sensors spaced 200 feet. Three of the sensors were installed in an east-west drift and three sensors in a north-south drift. Sensors were constructed from PVC pipe that were sealed on the ends with a Balluff proximity sensor screwed into the top. The bottom water-filled portion and the upper air-filled portion of each sensor bowl have been connected with tubing that creates a large water level. The sensors have a 5 m resolution and installation around a corner has allowed tilt direction as well vertical magnitude to be derived from the data. Air temperature, relative humidity and barometric pressure sensors were included in each of the HLS arrays. Data were recorded through A/D cards and fed out of the mine real time utilizing a fiber optic backbone. These instruments are used to monitor the mine for evidence of local and regional seismic events in addition to tidal cycles and long term trends associated with dewatering and excavation of new lab space. It is anticipated that the Homestake HLS will provide supplementary data to be used with pressure transducer data for evaluation of the three primary hydrological regimes in the mine--shafts and drifts, sand-filled stopes and fractures.

Characterization of the Carmel Knoll and Devils Punch Bowl Landslides of Coastal Oregon

Sarah Rickard and Jerry D. Higgins Colorado School of Mines
William Schulz United States Geological Survey

The Carmel Knoll and Devils Punch Bowl landslides, located on the central coast of Oregon, are being characterized to determine the driving mechanisms, age and the initial cause(s) and trigger(s) of failure for the slides. These results can be useful for future mitigation studies on the many similar landslides affecting highways and development along the coast. To identify mechanisms responsible for landslide formation and reactivation, several methods have been utilized. Drilling has been completed and geologic logs and borehole samples obtained contribute to the characterization of the shear zone location and material properties. Piezometers and water content sensors were installed in the borings and extensometers, rain gauges and atmospheric pressure sensors were also installed on the slides. The instruments are continuously monitored for movement, precipitation amounts and infiltration. **Continued on Page 3**

Words from the Chair

Thanks again to Alan Howard and Dr. Patrick Smith for their presentation last month on a new tunnel project in California. It's been awhile since we've had a tunnel talk, so that was very nice.

Well, it's time again for the annual Student Night which will be held Friday, March 27, 2009. The abstracts are starting to come in and it should be an informative and fun evening discussing the various research projects. A new Brunton compass will be awarded to the student with the top research project. Thanks to Golder Associates for donating another Brunton!

I'm sure everyone is aware that we rely heavily on donations from our generous members to assist students with discounted meeting dues throughout the year. I would like to urge every member to ask their employer to make a donation for this event. Donations start at just $25. Thanks to everyone who has already made a donation!

Please don't forget to RSVP by Tuesday March 24 at noon! See you there!

Sean Harvey, PG
Chair, AEG-RMS

2008-2009 Upcoming Meeting Presentations

April 9, 2009	Robin Dornfest	Sugar Beet Spoils, Geotechnical Implications
May 14, 2009	Susan Steele-Weir	Trip report from Antarctica—**Family Night**

If you are interested in Presenting at an AEG meeting contact Sean Harvey at chair@aegrms.org

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Characterization of the Carmel Knoll and Devils Punch Bowl Landslides of Coastal Oregon—continued from page 1

Engineering geologic mapping ensued to evaluate the boundaries of the slides. Laboratory residual shear strengths of the shear zone materials were measured for each slide at 14 degrees. During the winter of 2008/2009, the coast received 5.13 meters of rain during four major storm events which resulted in movement of the slide. These storms raised the pressure heads in the Carmel Knoll slide an average of 1.6 meters at the time of movement and had a minimum intensity of 1 mm/hr. Using the data from these storms and the characteristics of the slide materials, slope-stability analyses will be conducted in order to back calculate the shear strengths and unit weights of the slide materials. Finally the pre-failure topography will be re-constructed and failure analyses will be conducted to determine likely conditions and driving mechanisms during initial failure.

Method review: Hydrogeological site characterization in preparation for Uranium In-Situ Recovery mining

Sophie Hancock, Murray Hitzman, Andre Revil, and John McCray Colorado School of Mines

Sub-water table uranium roll front deposits developed by In-Situ Recovery (ISR) methods will continue to be important for future global uranium supply. Competent hydrogeological characterization of prospective ISR uranium mines is essential to mitigate the biggest risk: off-site groundwater pollution. To support production of these uranium deposits, a variety of non-traditional tools may be applied to improve estimation of hydrogeologic parameters beyond typical site investigation techniques. Groundwater flow generates an electrical current which can be measured at the surface. Electrical geophysical methods including self-potential, spectral induced polarization and direct-current resistivity are potential site characterization tools. Hydrogeologic parameters which can be measured geophysically include water table position and character, groundwater flow patterns, degree of aquifer saturation, hydraulic head, and transmissivity. Inverse modeling can estimate aquifer transmissivity distribution in heterogeneous aquifers, critical to evaluate ISR production potential. Mapping water saturation as a proxy for pore geometry to calculate *in-situ* water volume variability is useful to indicate both aquifer heterogeneity, and ISR production/restoration volumes. Applied groundwater geophysics also aids site specific interpretation of field pump test and drawdown data. To varying extents these geophysical techniques are currently being applied to other mineral exploration and water resource problems. Geostatistical methods can be used to produce more representative hydrogeologic parameters. Advantages of applying the geoelectric groundwater exploration methods include improved aquifer understanding for regulation and site development, reduction of the number of pump tests and wells, and resolution of site hydrostratigraphy. Data from such studies enable improvements to site specific ISR subsystems e.g. wellfield design, mine unit recovery and production.

Geological Engineering Design of The Proposed Transcanada Keystone Pipeline

Daniel Mergenthal, Michelle Jones, Kendra Kungu, Adam Hoffman, Brandon Lampe, Korry Burkhead, Alexandra Prisjatchew, and Peter Guck South Dakota School of Mines and Technology

A geological engineering design project was completed for TransCanada's planned Keystone pipeline in eastern South Dakota and a proposed pipeline route in western South Dakota. The primary objective of the project was to determine the most feasible pipeline routes through the western and eastern parts of South Dakota based on geology, hydrology, topography, economics, and identification of sensitive areas in order to minimize risks associated with pipeline leaks. The planned pipeline in eastern South Dakota traverses glacial sediments of low-permeability tills and highly permeable outwash. Shallow glacial aquifers, proximity to populated areas, and the James and Missouri River crossings indicated that Marshall, Clark, Hutchinson, and Yankton counties had the most sensitive areas to leaks from the pipeline. Adjustments in the planned route, thicker pipe walls, and enhanced leak detection systems were recommended. Rugged topography, bentonite-rich shale, sensitive river crossings, and locally utilized shallow aquifers were concerns for route selection and site characterization of the proposed pipeline route in western South Dakota. Geotechnical aspects included assessments of slope angle, toe loading, drainage, and erosion controls. Thicker pipe walls, enhanced leak detection systems, and reinforced pipe-joint seals were recommended for stream crossings and areas where contamination of aquifers was possible. The success of the TransCanada Keystone Pipeline project depends on thorough evaluation of geological, geotechnical, and hydrological conditions, in addition to careful pipeline design in unusually sensitive areas.

Degree of Clogging as a Predictor of Useable Lifespan of Horizontal Wick Drains

Kevin T. Mininger Colorado School of Mines

The use of horizontal wick drains is a relatively recent method developed to reduce excess ground water in slopes and thereby increase their stability. Through previous research the installation procedure has been developed, effectiveness at improving slope stability has been demonstrated, drain layout has been optimized and a detailed study of the shape and behavior of the water table in a drained slope completed. Yet the rate at which these drains become clogged, directly affecting their usable lifespan, has not yet been established. This project has been designed to measure the degree of clogging, the resulting change in flow rate, and the expected lifetime of the drains.

As the filter material of a wick drain clogs, either with transported soil particles or precipitated material, the flow rate through the drain decreases by a corresponding amount. For samples collected from the field the percentage of the filter that has clogged is measured both by weighing the samples and microscopic examination of the filter fabric. To correlate the degree of clogging with reduction in flow rate, an adaptation of the constant head test was developed to measure the flow rate of water through the same drain samples as well as clean fresh drain samples. If a strong relationship can be shown between the degree of clogging and reduction in flow rate then the much simpler and faster weight measurements and/or microscopic examinations can be used to determine reduction in flow rates. By examining wick drains that have been in use for varying lengths of time the reduction of flow rate over time can be measured leading to a predicted lifespan.

Yield Rates for Debris Flows in Burned Areas in the Western United States

Derrick Schimming Colorado School of Mines

The volume of material is a valuable in determining the hazards associated with debris flows. However, the amount of material initiating the flow can often be small and the majority of the volume of material in the debris flow is entrained along the path of the flow. This is apparent for burned areas, where much of the entrained volume is from in the channel. As the flow moves down the channel, it will either increase in volume or decrease in volume in the form of levees. This change in volume can be measured using the yield rate. A method developed by Thurber Consultants and Hunger et al. is the yield rate, the volume eroded per unit of channel length. This value is often expressed as a single value for the entire channel. However, the yield rate, as stated before, is not constant for the entire flow down its path. The yield rate of the channel will increase or decrease due to multiple factors geological, topographical, weather, and related to the burned area. Knowing how and why the yield rate changes will allow for possible mitigation and hazard warnings for specific areas. Using incremental volume measurements obtained from 46 debris flows in burned areas from Colorado, Utah, and California, yield rates were found along the channel. These rates range from 0.08 to 28.32 m^3/m, compared to the entire channel rates of 0.3 to 22.3 m^3/m. Many of the rates significantly increase at a critical point down the channel. This critical point is not observed in all the channels but can be identified with a significant change in the geology, topography, amount of material increase, weather changes, velocity of the flow, or a combination of these factors. These factors that cause a change of the yield rate for burned areas are being examined and classified for further study and application.

Student Night 2009 Sponsors—Thanks to All!!!

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Church Onsite Wastewater Consultants Susan Steele Weir Vista GeoScience LLC	Silver
Apex Consulting Services Becky Roland Colorado Geological Survey Ed Friend Julia Frazier Steve Compton	Bronze

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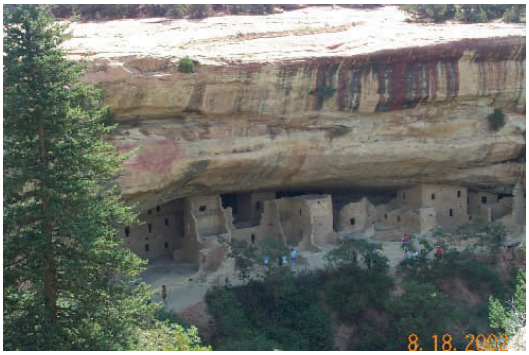

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30th ANNUAL SHORT COURSE

Grouting Fundamentals and Current Practice

June 22-26, 2009 • Colorado School of Mines

This course covers injection grouting as a method to improve soil settlement and strength characteristics, and to decrease permeability of soil and rock masses. Major topics covered include properties of cementitious and chemical grouts, procedures for cement and chemical grouting, field monitoring and verification, grouting rock under dams, grouting of rock anchors and micropiles, deep mixing, jet grouting, diaphragm walls, compaction grouting, slab jacking, structural grouting, and grouting for underground structures. Included in the curriculum is a field demonstration of compaction and permeation grouting, flow of ultrafine cement, grout mixing, use of cellular concrete in annular grouting, overburden drilling, grouting of rock anchors, and use of packers.

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