

Field Trip GEOEX 2013

16. March 2013 to 23. March 2013

This is a report from the Field Trip in USA with GEOEX 2013

Introduction

The group consists of 18 students from the 4th and 5th year from Technical Geology- engineering geology and resource geology from the department of geology and mineral resources at NTNU. The group travelled to the USA for their master excursion from 16-23 of March 2013. With us on the trip was Professor Anders Shomacker and professor Rune Larsen from NTNU.

The trip started in Las Vegas, Nevada, continued to Grand Canyon, Arizona. Then the group headed to California where the first stop was Los Angeles and then finished the field trip in San Diego.

The intention of the field trip was to give the students insight and inspiration in how to become a better employee, how to use our geological expertise in the best way and to give valuable input from the daily life in the USA to extend the understanding of other cultures. This was achieved by a combination of highly valued visits to very interesting geology sites. The academic program was put together by the professors with inputs from the students. To cover academic interests of the different study programs of the department of geology and mineral resources the sites of this trip were very varied and covered many aspects of both geology and engineering geology.



Figure1: The Group in Grand Canyon

The Group

Associate professor and group leaders were Anders Shcomacker and Rune Berg-Larsen.

Students

1. Camilla Gremmertsen
2. Ingrid Hagen
3. Ann Kristin Selmer
4. Maren Kristine Tandberg
5. Christine Langås
6. Silje Marie Nørsett
7. Charlotte Dammen Andersen
8. Tor Helge Hilmarsen
9. Jonas Eidesen
10. Edvard Falch
11. Arnstein Ommedal
12. Erik Martinelli
13. Eirik Hjelle
14. Magnus Sørensen
15. Christian Dyhr Refsli
16. Torben Wedervang
17. Hallvard Nordbrøden
18. Lars Nyhaug Jensen

About the USA

During this trip we are visiting three different states in the USA; Nevada, Arizona and California, which are located in southwest of the USA.

Nevada

Nevada is a state in the western part of the USA. Nevada is called the silver state due to the importance of silver to the state's history and economy. Nevada consists largely of desert and semiarid landscapes. The Mojave Desert is located south of the Great Basin, and Lake Tahoe and the Sierra Nevada are located north of the Great Basin. It was found silver here in 1859, and this was one of the reasons why Nevada State was founded in 1864. Tourism is the largest employer in Nevada with mining as a second. Nevada is the fourth largest producer of gold in the world.

The geology of Nevada has played an important role on its human history, economy and future. The Cordilleran tectonics have created the basin and range landscape with internal drainage of the Great basin, thereby Nevada is the driest state in the entire USA. Because of the special geology in Nevada it is the leading state in production of gold, silver, barite, lithium and mercury. These metals are related to igneous activity. The state also has productions of geothermal power and gypsum. The geology of Nevada is the foundation of its natural resources. The Colorado River runs through Nevada, and to exploit its resource in electrical power, the Hoover Dam has been built in Nevada.

It is a dry state with a complex geology, which is very interesting to geologists.

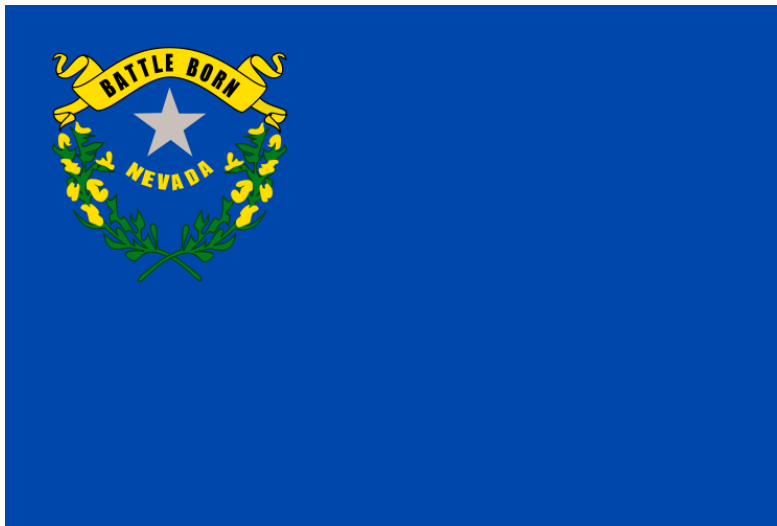


Figure 2: Nevada State symbol

Arizona

Arizona is also a part of the western states in the USA. Arizona became a state in 1912, the 48th in line. The state is divided in two with desert and very hot climate in the south, and mountains and forests in the north and of course the canyons.

The geology in Arizona is magnificent with the Grand Canyon as a showcase, where it is possible to see several geological layers. There is some mining activity in Arizona.



Figure 3: Arizona State symbol

California

The state of California is the westernmost state in the USA. California is a very popular state to live in and is the 3th largest state by area. California has both the lowest and highest point in the contiguous United States (Mt. Whitney and Death Valley respectively). Located nearby the Pacific Ring of Fire earthquakes are relatively common. In 1848 the California Gold rush started and led to dramatic changes, both demographic and social because of the immigration boom. In the 20th century Los Angeles became an entertainment capital and Silicon Valley just south of San Francisco grew because of the myriads of technology business emerging.

The geology in California is very complex due to the San Andreas Fault and plate tectonics. California is composed by 12 different geomorphic provinces. Because of the tectonic activity California is a land of the extremes. The climate in California varies, and while there statistically is a lot of sun in the south, there can be rain in the north and snow in the north-south bound mountain range Sierra Nevada. California's rocks, gems and minerals are mainly serpentine, gold and benitoite, all a product of plate tectonics.



Figure 4: California State symbol

The field trip program

Hoover Dam

Hoover Dam is an engineering wonder and a National Historic Civil Engineering Landmark. In 1928 the congress authorized the construction of Hoover Dam as an effort to stimulate the economy during the depression in the 1930s. The construction began in 1931 and continued through 1936. The Hoover Dam was the greatest dam of its day and is still a world renowned structure. The contractor Six Companies Inc completed the project two years ahead of the plan and under budget. The technical innovation developed during the construction of the dam transformed several American traditional engineering methods, and most likely several international engineering methods. The water storage and river control provided by the Hoover Dam and other project downstream enabled the residents of the southwest to use controlled water flow to farming, domestic water and hydroelectric power.

For engineering geology purposes the foundations of the dam and the tunnels controlling the water flow are of high interest. The rock mass quality in this part of the USA (Nevada and Arizona) is relatively poor compared to the rock mass quality in Norway. It is therefore interesting to experience the differences to get a broader perspective regarding rock mass quality.

The group was amazed by the dimension and the engineering work of the Hoover Dam. Because we have many hydropower plants in Norway with dams, we could compare the Hoover Dam with other Dams we have seen in Norway, and the group agreed that this was one of the most spectacular dam construction we had ever seen.



Figure 5: The Hoover Dam

Grand Canyon

On Monday the 18th of March we drove to Grand Canyon Village, Arizona. When we arrived we went to the visitor centre where we watched a movie about the formation of Grand Canyon. We scooped the view and it was magnificent. The group was very excited indeed and some could almost not wait for the next day when we were about to go down in to the canyon itself.



On Thursday the 19th of March the group started the hike down the amazing canyon. We passed several different geological layers. The group viewed Sandstone –Eolisk deposit in marine environment with silt and clay in descending order etc. We looked at structures and Professor Schomacker stopped at several geological locations on the way down to the plateau. After a well-earned lunch break two thirds down the canyon a big part of the group decided to go all the way down to the mighty Colorado River. What a scenic view we had at the bottom! The hike back to the top was long and steep but when we reached the top everyone agreed that this was an amazing geological hike, and it was very the long walk back up. After Grand Canyon we headed to Kingman, AZ, where we had a sleep over.



Figure 6: The Colorado River



Figure 7: The part of the group which went all the way down to the mighty Colorado River

The Rio Tinto Borax mine

On March 20th the excursion group visited the Rio Tinto US Borax mine west of Barstow in southern California. We watched a movie about the Rio Tinto US Borax mine and the Rio Tinto Group in general. Rio Tinto is a British–Australian company with mines all over the world. After the videos we had a guided tour down to the open pit mine with the chief of geology and two co-workers. The mine has a lot of deposits but only 1/16 of the rock they dig out are processed and used. The main type of minerals that they are looking for are Kernite, Ulexite, Colemanite and Borax. The orebody is approximately 1 mile wide, 2 miles long and up to 300 feet thick. The group was impressed of the sizes of the mine. The mine has some geotechnical issues with slope instability, and wall collapsing. The mine is located in the Mojave Desert with a warm and dry climate. The Rio Tinto mine has a strict health and environment policy, which is necessary such a big mine. After the visit at Rio Tinto the excursion headed to Los Angeles, California.



Figure 8: Students in the Rio Tinto US Borax mine

Los Angeles

After the group arrived in LA the group of students and the two teachers went out to dinner. We had a nice and social dinner in a lovely French restaurant. Most of the conversations were about the sites on the field trip so far.



Figure 9: Dinner in LA

La Brea Tar Pits

Los Angeles (LA) is located on top of several oil reservoirs. On the Wednesday morning 21th of March the group visited la Brea Tar Pits and museum in downtown LA. La Brea Tar Pits are a group of tar pits in the Hancock Park. Asphaltum/tar has seeped up from the ground for tens of thousands of years. Tar pits are composed of heavy oil fractions called asphaltum which seeped from the earth. In Hancock Park, crude oil seeps up along the 6th Street Fault from the Salt Lake Oil Field which underlies much of the Fairfax District in LA. The oil reaches the surface and forms pools at several locations in the park. It becomes asphalt as the lighter fractions of the petroleum biodegrade or evaporates. The museum is located beside the tar pits. In the museum we got a look at a geological movie, telling how the tar pits were formed and about all the animals stuck in the tar pits. The ancient animals trapped in the pits were very well preserved due to the low grade of decomposition in the asphalt rich tar pits. In the museum there are reconstructions of impressively well preserved bones and skulls. One of the museums task is to research the tar pits and dig out specimens of the animals that died there.



Figure 10: La Brea Tar pit

Ocean view gemstone mine

Like old times geologist we wanted to look for gemstones and on Thursday the 21th of March we went to the Ocean View gemstone mine. We washed parts of the output of the mine looking for gemstones. There are mainly pegmatites in the area with tourmaline, kunzites and morganites. We got instructions on how to wash the outputs from the mine the most efficient way in order to find gemstones. Some students were quite good and eager in their search for gemstones and found some magnificent stones to bring back home. Other students were more eager to get down in to the mine itself to look at the construction and support systems. The mine is operated on a hobby basis so it was not much rock support present nor health environment and safety guidelines (HMS). But there were some spectacular crystals of tourmaline and kunzite in the mine.



Figure 11: One of the students searching for gemstones



Figure 12: Students in the Gemstone mine with rather little rock support and without safety boots.

Salton Sea

On Friday the 22th of March we drove south of San Diego in to the dessert and stopped by the Salton Sea Field. The Salton Sea Field is located in Imperial County, California. The Salton Sea is a shallow, saline, endorheic Rift Lake located on top of the San Andreas Fault. From a geological point of view, the Colorado River worked to build up a delta in the south, and it reached the west shore of the Gulf of California and created a massive dam. If it was not for this dam, the entire area would have been flooded by the Pacific Ocean.



Figure 13: The Salton Sea



Figure 14: Map of The Salton Sea



Figure 15: The group was not allowed to go on the Salton Sea

Hydrothermal power plant

After our stop at Salton Sea we drove to CalEnergy, a hydrothermal power plant in the desert south of San Diego. The Imperial Valley geothermal facilities are located along the southeastern shore of the Salton Sea. There are around 220 employees at the power plant. The project consists of about 10 generating turbines that produce electricity solely from naturally occurring geothermal steam. The fluid flow through production wells to the surface and a series of vessels are being used to drive turbines to generate reliable and non-carbon emission electricity. The bedrock in the area is Sandstone, and it is possible to regulate the power supply on demand.

We had a geological lecture from the chief geologist and Director of Geothermal Resources, Alexander Schriener Jr. at the power plant. After the lecture we had a guided tour inside the control room where they monitored and operated the whole power plant. After this we got to take a closer look at the generators, turbines and the rest of the hydro power plant.



Figure 16: The Geothermal power plant

Beaches at San Diego

On Saturday the 23 of March we went to beach near San Diego. The cliffs at the beach consist of layered sandstone, silt and clay. In the lower layers we found several types of fossils. This environment is not affected to the San Andreas fault, and the reason why the layer are horizontal is because the deposit environment is the same today as in earlier times.



Summary

After several months of planning and meetings the GEOEX field trip to USA was present for us. It was a social and educational trip with interesting geological sites and visits to large international companies. All the students and teachers agreed that the trip was successful. After one intensive week with program from 7 am to 9 pm we all took a well-earned Easter holiday vacation. One went for a week of climbing, another visited his previous host brother, but most of the students vent on a classic road trip along Highway 1 in California, from San Diego to San Francisco and back.

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