Wavelets

Salt of the Earth: In Situ Exploration at the Hockley Salt Dome

By Azie Aziz and Robert Stewart (UofH)

While we often make pictures of the subsurface and drill wells into it, we rarely go inside the Earth. But, there is an underground marvel close to Houston and it is possible to enter.

Figure 1. The research team from the Allied Geophysical Lab of University of Houston (E. Kocel photo).

A group of researchers (**Figure 1**), from the Allied Geophysical Lab of the Department of Earth and Atmospheric Sciences, University of Houston, visited the United Salt Corporation Mine located at the Hockley Salt Dome some 20 miles northwest of Houston, Texas. The top of the salt dome is about 1010 feet beneath the surface and approximately two by three miles across. Salt production by United began in 1932 and continues today.

Our reconnaissance started with a briefing by the safety manager, Mr. Daniel Frost, who outfitted us with personal mine safety gear - hard hats (and attached lights), goggles, and respirators (in case of fire). Our cameras and cell phones were allowed, but were kept in zip lock bags due to the corrosive salt dust. Each of us was given a numbered metal tag (for identification purposes) to carry. We were reminded to surrender the metal tag upon returning from the mine (a cheery thought, reminding us of Spartan soldier procedures).

We were next accompanied to the mine shaft area before entering the elevator cage. The air was thick with salt dust, but we could see a huge (ancient, but reliable) motor pulling the elevator cable. We stepped into the cage with our equipment and some excitement. After a fascinating descent, we arrived at the heart of the salt mine - 1500 feet deep.

The technical objectives of our visit were to:

- continue studying the Hockley area with its faults and salt domes
- further understand salt properties and tectonics
- undertake geophysical measurements of salt
- plan further surface and downhole seismic studies in the Hockley region (for salt and oil exploration).

Our first subsurface stop was the crushing mill. While some of us watched the boulder-sized salt crystals being transported by the conveyor belt before they plunged into the crusher, others began geophysical measurements. One group undertook gravity measurements, and the other acquired ground-penetrating radar (GPR) data. We had first taken gravity readings at the mine surface and now made them in situ. The gravity measurements increased with depth as expected: the measured increase was 44.7 mGal from the surface to 1500 feet deep.

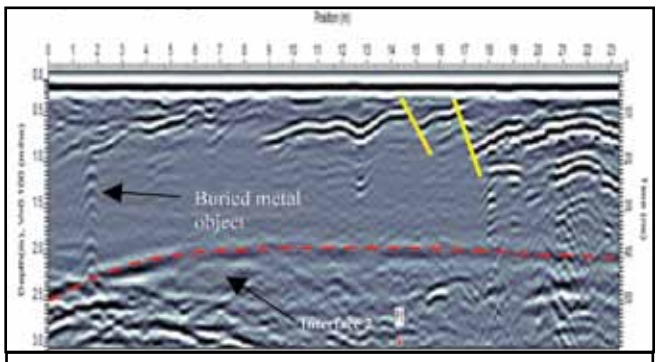

Figure 2. A 250 MHz radar survey data acquired in the mine at 1500 feet depth. Dipping salt layers are inferred from the section.

Previous work from the 1950's gave a similar value of 45.4 mGal. This implies an average density to the surface of 2.50 g/cc (being a sequence of salt, anhydrite, gypsum, and calcite).

Figure 2 shows a 250 MHZ GPR profile acquired over the floor of the crushing area. There is evidence of dipping layers, down to about 3 feet (1 m), which is also seen in some of the walls. Possible faulting, of interest to

Wavelets continued on page 31.

Wavelets continued from page 30.

Figure 3: Drilling holes on the salt wall to insert the explosives used in the mining process (E. Kocel photo).

Figure 4. Salt core ultrasonic measurement (N. Dyaur photo)

the miners, might be interpreted. A more crystalline salt area may rest beneath the layers. Other structures begin to become apparent at 6-7 feet (2-2.5 m) depths.

We then moved to an active mining room, where holes were being drilled to be loaded with explosives (**Figure 3**). The explosives would be detonated after personnel leave for the day.

United Salt generously made hand samples as well as lengths of core available to us. We have begun testing of these core samples in our labs (**Figure 4**). Preliminary ultrasonic measurements on the core indicate P-wave velocities of 4480 m/s and S-wave velocities of 2550 m/s, giving a Vp/Vs of 1.76.

Interestingly, there is also a broad-band seismometer (Seismic Station: HKT) in the mine which reports to the Global Seismic Network.

After three remarkable hours underground, we returned to the surface of the mine and handed back the safety equipment. Most importantly, all the metal tags were returned.

Acknowledgement

We would like to enthusiastically thank Mr. Cliff Mower, Mr. Daniel Frost, and United Salt Corporation for the opportunity to visit and work with the Hockley Salt Dome mine.

GSH Outreach - *Education*

By Lisa Buckner

The GSH Geoscience Center Education subcommittee had a very productive kick-off meeting. We decided that we will only conduct teacher workshops at the facility since the shelves full of museum items were too tempting for children to climb. Therefore, the facility was an unsafe environment, as currently configured, for student classroom instruction. There is a great need for professional development Earth Science courses for teachers in the Houston area; so we should have no trouble filling classes. Each teacher reaches over 100 students per year; so we can make a big impact.

We will offer certified teacher workshops tied to the TEKS curriculum requirements. To discourage no-shows, we will charge a nominal fee and provide lunch. They will make hands-on activities that they can take back to their classrooms for project based learning of Earth Science concepts. We will also provide them with information about geoscience careers, including geology and geophysics for oil and gas exploration.

It will take a few months to finish out the classroom facility remodeling, design the curriculum, and then obtain certification by the State Board of Education. Hopefully, we should be able to hold our first workshop next spring.

Are you interested in volunteering? Do you know of a school that has a career day seeking speakers or a career fair at which GSH might be able to host an exhibit booth? Or have you been invited to give a classroom presentation at your child's school? If so, please contact **Lisa Buckner at lbuckner@hess.com or 713-496-4256**, and we can work together to bring awareness to the students and their educators of the many high paying and fun careers in the geosciences.