Wavelets - *The Eagle Ford Shale Trail*

By Li Chang, Nikolay Dyaur, and Robert R. Stewart

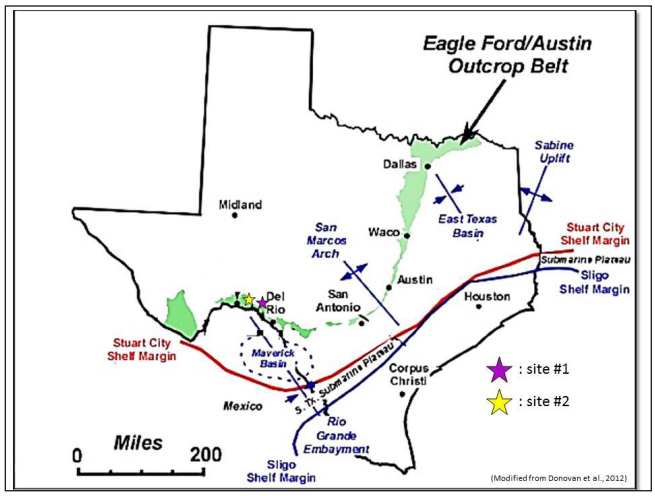

Figure 1: Map of Eagle Ford/Austin outcrop belt in Texas and our geophysical study sites.

The Eagle Ford shale has become a prolific hydrocarbon producer and subject of intense economic and geoscientific interest. Fortunately, this Upper Cretaceous marine shale outcrops in a swath across Texas (***Figure 1***) providing a unique opportunity for its study.

In January 2015 a group led by Dr. Nikolay Dyaur, Anoop William, and Li Chang from the Allied Geophysical Lab (AGL) at the University of Houston and three graduate students (Alexandre Sylvia, Elita Abreu, and Jiannan Wang) journeyed across south Texas to reconnoiter and undertake geophysical surveys over an outcrop area (***Figure 2***) near Del Rio. Two sites were chosen and hammer-seismic and GPR surveys were conducted, along with the collection of rock samples. Nearby sites were searched for suitable follow-on vibroseis surveys.

Figure 2: Photo of the Eagle Ford outcrop with AGL students and staff undertaking geophysical surveys and collecting rock samples.

Seismic surveys

The hammer-seismic lines were 214 m and 118 m long at sites 1 and 2. Both lines were oriented east-west with shot and receiver spacings at 2 m. A raw shot gather (***Figure 3***) shows the velocity of first breaks at ~550 m/s while the refraction's value is ~3,000 m/s. The crossover distance, at 20 m, gave a refractor depth of 8.3 m, which was close to the measured height of the outcrop package. Further processing is underway.

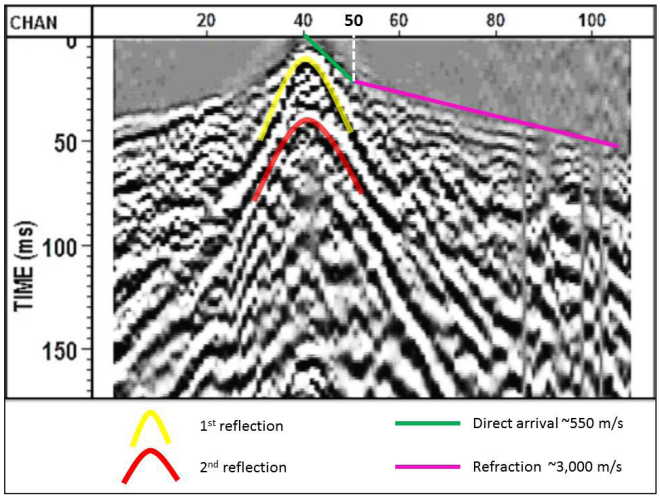

Figure 3: Seismic shot gathers from site 1 in field and from the lab.

Ground penetrating radar survey

We also undertook a number of traverses with a 250

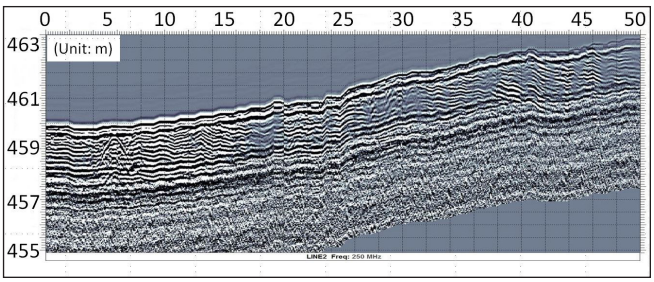

Figure 4: GPR survey at site 2 with depth penetration of about 3.5m.

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MHz ground penetrating radar system (GPR). A representative section from site 2 is shown in ***Figure 4***. After processing by colleague A. Aziz, which included dewow, gain, background noise subtraction, and topography correction, we were able to image depths of about 3.5 m and illuminate some interesting dipping beds.

Ultrasonic measurements

As mentioned before, we collected hand samples (e.g., ***Figure 5***) and measured their ultrasonic velocity upon return to the lab. Vp parallel to bedding is 3.94 km/s and normal to bedding is 3.11 km/s (with errors of ± 0.02 km/s). Vs parallel to bedding (in two directions) is Vs1 = 2.34 km/s with Vs2 = 2.03 km/s. Normal to bedding has lower values (Vs1 = 2.01 km/s, while Vs2 = 2.00 km/s, with errors of about 0.01 km/s).

The surveying was successfully completed in four days with a safe, but exhausting, return to Houston!

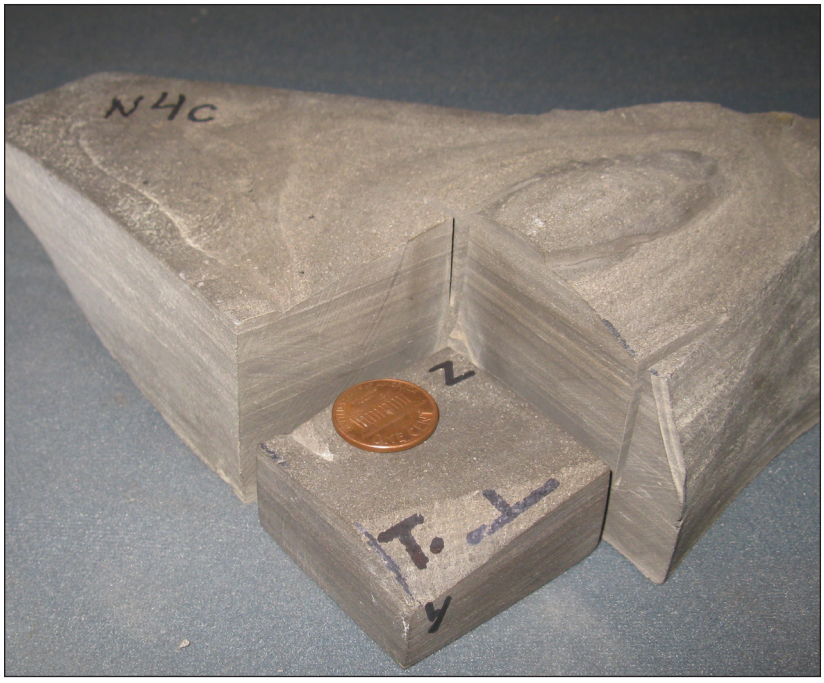

Figure 5: Eagle Ford shale sample and specimen prepared for ultrasonic measurements.