Wavelets - *Imaging Sand Bars Using 3D GPR: Cretaceous Ferron Sandstone, South-east, Utah*

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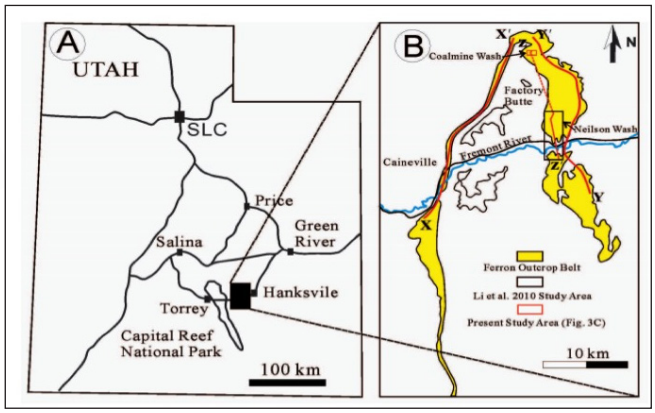

Figure 1: Study location of the outcrop and GPR acquisition.

Figure 2: Photo of acquiring GPR data using the 250 MHz Noggin SmartCart System at the Utah survey location.

Ground-penetrating radar (GPR) has been a very useful technique to image near-surface geology. Outcrops of the Cretaceous Ferron Sandstone at the top of the Notom Delta (a deltaic reservoir analogue) in southeast Utah provide an excellent site for 3D GPR imaging and analysis. Thus, a team of geoscientists from the University of Houston (UH) and Allied Geophysical Lab undertook GPR investigations at a Ferron sandstone outcrop north of Henry Mountain region. More specifically, GPR data were acquired to image architectural elements of friction-dominated distributary mouth bars within proximal delta front deposits in the Cretaceous Ferron Sandstone at the top of the Notom Delta (***Figure 1***). Sensor and Software's Noggin Plus SmartCart 250 MHz was used over a 25 m x 5 m grid (***Figure 2***) along with several 2D test lines. We employed an orthogonal acquisition geometry and spatial sampling of 0.5 m for the in-line (dip direction) and the cross-line (strike direction) directions.

The main objective of the study is to integrate GPR profiles with available plan view and outcrop data to reconstruct a 3D facies architecture model for the distributary mouth bars. Bedding diagrams from local cliff exposures show gently northeast dipping accretion of single large foresets that were interpreted as small scale unit bars, which are the building blocks of the large mouth bars.

The GPR radargrams help image and reveal their 3D shape. Detailed assessment of the GPR images also assists in making distinctions between various proximal mouth bar facies: upper friction-dominated dune-scale cross beds and bar-scale large foresets from lower inertia-dominated basal planar beds.

GPR data processing was undertaken using the Sensor & Software processing package EKKOView Deluxe. The main steps are: deconvolution, dewow, spherical and exponential compensation (SEC) gain, bandpass filtering, background removal, deconvolution, and 2D migration. ***Figure 3*** shows the data after deconvolution, dewow and gain. The depth of GPR penetration was about 3 m. We interpret the display to show upper dune-scale cross-beds on top of a unit bar consisting of steeply dipping bar scale single large foresets. The lower part of the mouth

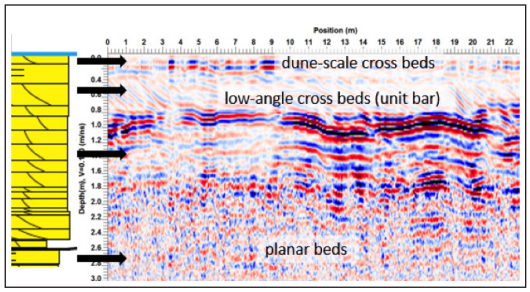

Figure 3: GPR image shows the architectural elements of a friction-dominated mouth bar. Deposition likely occurred sub-aqueously in water depths of no more than a few meters.

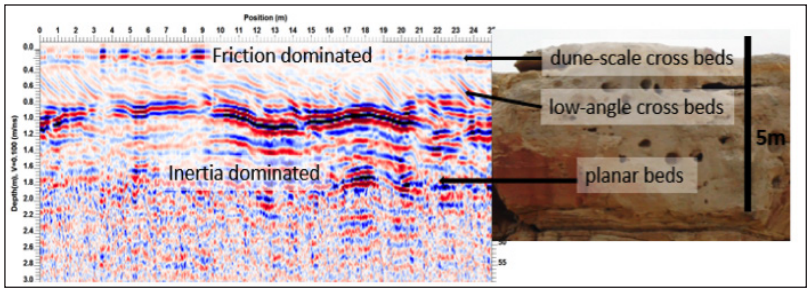

Figure 4: The proximal delta front facies composed of planar beds which pass upward into meter-scale low to high-angle cross beds, which, in turn, gradually decrease in thickness and width upward and finally change to dune-scale cross beds.

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bar shows coherent planar beds and is interpreted as coherent planar beds deposited in higher water depth.

Figure 4 further illustrates these architectural elements of a friction-dominated point bar in the study area.

The 3D GPR data over the 25 m x 5 m grid were acquired to augment the available sedimentological and stratigraphic information of a river-dominated mouth bar reservoir analogue in the Ferron Sandstone, Notom Delta, Utah. The 250 MHz GPR data have a vertical resolution of some 10 cm and depth of penetration of about 3 m. The GPR data assist in reconstructing the 3D geometry of the sand bars.

Acknowledgements

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Mystery Item

This is a geophysical item...

Do you know what it is?

This month's answer on page 35.