Reservoir Characterization of the North Canton Gas Field "Clinton" Interval Using Well Log, Production, Hydraulic-Fracture, and Seismic Data

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The North Canton Gas Field in Ohio is now a gas storage field in the "Clinton" interval. The field was developed and produced during the 1930s and 1940s with more recent drilling carried out to develop it as a gas storage field. The goal of this investigation is to use the available data from this field to characterize the "Clinton" interval in northeastern Ohio for possible enhanced recovery operations. We utilized a data base comprising various density, sonic, gamma ray and neutron logs, initial production, initial formation pressures, and hydraulic-fracture data from more than 200 wells over sixteen square miles. We have over 50 miles of 60-fold vibroseis and dynamite seismic reflection data over the field. The seismic data comprises raw shot gathers, observer's reports, survey information and processed migrated stacks. We processed high resolution LIDAR data for lineament and fracture analysis. The well logs show the usual two lower coarsening-upward units that roughly correspond to the White and Red driller's "Clinton" and the upper, fining-upward Stray "Clinton". Lineament analysis of the LIDAR data shows a dominant NW to SW fracture trend in the area of interest. Initial productions from the wells show a NW to SW trend seemingly corresponding to major lineaments identified in the LIDAR data. Data from hydraulic fracture treatment of 71 wells enable mapping of breakdown pressures, which range from 1300 to 4700 psi and instantaneous shut-in pressures ranging from 825 to 2387 psi. The breakdown pressures during this treatment of wells appear to define a NW-SE trend suggesting control by natural fractures. Variogram surface analysis of initial productions also shows this trend. Preliminary estimates of net sand range from 6 to 77 feet increasing to the SE within the study area. Estimated natural reserves may show a NW-SE trend in this area but this trend is not as clear as that for initial production. Locally a prominent surface lineament correlates to a region of disruption of seismic reflection continuity; however, other prominent surface lineaments do not. Consequently, some surface lineaments may be associated with patterns of fracture to the depth of the "Clinton" interval. The "Clinton" interval is thin on the seismic sections at the scale of the wavelet, but we are investigating a subtle pattern of wavelet splitting within that interval as an indicator of net sand thickness.