Natural Attenuation of Explosives at the Louisiana Army Ammunition Plant, Minden, Louisiana

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A three-year study of natural attenuation of explosives at Louisiana Army Ammunition Plant (LAAP) is currently being conducted. This research effort is a demonstration project designed to assess the feasibility of, and to develop the guidance for, selection and implementation of natural attenuation of explosives as a possible remediation alternative for groundwater and soils.

LAAP is a government owned facility located 22 miles east of Shreveport, Louisiana. The 14,974 acre plant manufactured high explosives (TNT and RDX) and load and pack ammunition items between 1942 and 1995. As part of the manufacturing activities, 16 unlined ponds were dug in fine grained silty-sands to contain the wastewater contaminated with TNT and RDX. These ponds covered an area of approximately 25 acres and received explosive-laden water sporadically between 1942 and 1981. LAAP was selected for the natural attenuation project because the source of contamination has been removed, ten years of annual ground water quality data exists, and 71 monitoring wells are installed on the site. Of the 71 existing wells, 30 were selected for a two year sampling program. These 30 wells were sampled and analyzed for explosives monthly from February through August 1996 and will be monitored quarterly through 1998.

Preliminary examination of plume maps revealed that RDX has migrated farther than TNT is spite of the greater aqueous solubility of TNT. This observation supports the case that natural attenuation of TNT is occurring at LAAP.

Interpreting Sequence Stratigraphic Architecture From Biostratigraphic Signatures: Case Studies From the Northern Gulf of Mexico

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Digital capture of microfossil data from well and outcrop samples permits rapid computer analysis and plotting biostratigraphic range charts, cross plots, and 'curves'. Integrating these biostratigraphic plots with log and seismic data indicates the microfossil record reliably characterizes the key stratal surfaces (flooding surfaces and sequence boundaries) which underpin the interpretation of sequence stratigraphic architecture.

Using in-house software (The Integrated Paleontologic System=IPS), I generated and interpreted biostratigraphic plots integrated with log data for >200 wells in the northern Gulf of Mexico. The well sections range in age from Oligocene to Pleistocene and represent deposition in fluvio-deltaic through lower-bathyal paleoenvironments. Field- to exploration-scale case studies illustrate the value of using biostratigraphic signatures to help solve geologic problems via an integrated, sequence-stratigraphic approach.

IPS-generated paleobathymetry curves covering various chronostratigraphic intervals from many Gulf locations provide the raw material for defining local to regional, relative sea-level events. Also, the vertical succession of paleobathymetry changes associated with higher-order sequences can produce unique stratigraphic signatures useful for detailed correlation.

Future research should: (1) document biostratigraphic signatures across well-constrained cycles in sea level from different dip positions and accommodation settings; (2) apply numerical techniques to integrate biostratigraphic data with log and seismic attributes and achieve computer-generated geologic interpretations.

Borehole Electrical Images And Dipmeter Patterns of Fluvial-Deltaic Reservoirs: Outcrop Examples From Arkansas

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Stratigraphic interpretation and modeling of sedimentary successions and characterization of reservoir intervals have benefited from development of borehole electrical imaging technology. The ability to resolve individual bedding features and faults has made this technology a valuable subsurface tool. While a complete analysis combines integration of images and core data, core is often not available. This paper bridges the gap by presenting the results of an outcrop-logging program and provides *new* information on recognizing sedimentary and dip features in the most common fluvial-deltaic reservoir sand bodies.

Gamma ray, induction, and FMI data collected during this study are compared to 3-D exposures of Pennsylvanian meanderbelt, distributary mouth bar, and delta-front deposits exposed at several quarry localities in the Arkansas Valley.

The value of these data is that they: (1) provide a practical correlation of images to the physical bedding in three dimensions: (2) point out the complexity of natural conditions as opposed to the simplified conditions shown by published depositional models: and (3) establish the merit of hand-picked dip patterns in defining reservoir stacking pattern and geometry.

The significance of this work to the oil industry is that the relationships established between outcrops and log data provide guidelines for improved stratigraphic interpretations of borehole images. This facilitates the prediction of reservoir geometry and lateral and vertical variations.

Interaction Between Salt Diapir Growth and Sedimentation: An Example from Côte Blanche Island Field, Louisiana

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This paper presents a detailed study of the evolution of a salt diapir from the Late Oligocene to Present based on 3-D seismic, well logs and biostratigraphic information.

There is a notable lack of faulting associated with the diapir. The only faults are a large counter-regional normal fault dissecting the diapir and a small number of synthetic and antithetic faults. This observation is in striking contrast with older interpretations of this field since its discovery in 1948. Those proposed a large number of radial faults extending outward from the diapir; in concert with the thinking of the time that all diapirs have to actively breach their overburden on their way to the surface, causing intense faulting. This study presents evidence that a diapir *can* reach the surface and enter a mature state without causing extensive faulting. This study suggests that the faults observed in the field are coeval with diapirism, but are related to deeper, lateral withdrawal of salt that is feeding the growing diapir. The faults are not caused by emplacement, but are related to diapir growth.

The reinterpretation of the field changes the reservoir interpretation. Missing section observed in wells high on structure does not represent normal faults, but rather unconformities caused by differential salt uplift. Individual reservoirs are not constrained laterally by faulting. Rather, complexities in their behavior are due to depositional facies variations. Most of the reservoirs are constrained updip by either salt or uplift-induced onlap. The new interpretation of the field has led to an extensive workover and development drilling program that has revitalized this mature field.

Novel Processing and Facies and Tectonic Results From North Louisiana Seismic Data

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The Structural and Formational Interpretation (SFI) technique developed in Moscow, Russia, principally for seismic reflections data, has been developed to provide an integrated analysis of time sections and provide results from proprietary procedures such as Spectral and Temporal ANalysis (STAN). There is a need for models, geologic and geophysical, in any interpretation (equally applicable to sequence stratigraphy). The SFI technique uses all stratal information available in a hierarchical frame, from individual sediment grains to members, formations, and series (as in reverse order, 1st, 2nd, 3rd, 4th, 5th orders in sequence stratigraphy). Formational complexes are determined, including spectral and temporal characteristics, with attention toward unconformity interpretation. Determination of hierarchical rank may be accomplished by using frequency ranges; 10-15 Hz, 20-25 Hz, and 50-55 Hz, for example. When formations are studied within the seismic data, they are designated as seismoformations (SF) with given geometries and dimensions. Often SFs (members and subformations) can be identified as certain seismic facies and, as such, related to a definite sedimentation environment, SFI becomes a mechanism for finer study by applying narrow band filters to locate specific facies (geometries, sizes, and spectral) and formations.

SFI techniques have been applied to a dip section in Winn County, northern Louisiana. Traditional tectonic interpretations have been of normal, down-to-the-basin/south-dipping faults. Trend analysis at various frequencies indicate numerous counter-regional faults with thrust components at depths of one and three seconds.

Seismic data with finer resolution indicates mound configurations near the basal Hosston, channel-like/concave-upward features in the Hosston, lens-shaped bodies (possibly slump blocks) in the Midway, and prograding wedges with possible carbonate buildups in the Mouringsport, providing additional seismic facies data not obtained from classical sequence stratigraphy.

SFI, with its dependence on digital data processing, frequency-based analysis, and seismic unit determination, in an excellent compliment to the visually-based, geometry-oriented sequence stratigraphy.