

unique approach to regulating injection wells used for waterflooding, enhanced recovery or brine disposal. The Environmental Protection Agency (EPA) was placed in the position of delegating enforcement responsibility to states based on the effectiveness of their in-place programs rather than on their adoption of federally prescribed requirements. This approach has led to the development of a state/EPA partnership, which, in most cases, has resulted in the strengthening of state programs and avoiding major disruption of states and industry. The program has now been in place for more than five years in the major states, and both the EPA and the states have begun assessing some of the basic requirements to determine the strength and weaknesses of the program.

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"Bouse-Type" Deltaic System: Alluvial-Deltaic Interactions in High-Relief Basin

Deltaic facies of the Miocene-Pliocene Bouse Formation (southeastern California-western Arizona) differ significantly from previously published deltaic facies models. Whereas in conventional deltaic models, the nature of the delta is dictated by processes operating in the receiving basin. In the "Bouse-type" system receiving basin physiography is the principal first-order control on the character of the sediment package. A "Bouse-type" system is produced when a major river progrades into a steep irregular basin where emergent topographic highs form islands. Thus, (1) the delta plain is characterized by a complex system of distributary channels that are deflected around topographic highs, (2) locally derived alluvial/fan-delta deposits flank emergent highs and interfinger basinward with fine-grained deltaic material, (3) depositional basinward dip of marginal coarse-clastic strata produces a buttressing relationship with flat deltaic beds, and (4) radial downslope and shore-perpendicular transport directions in basin margin units show complex relationships with the dominant downchannel paleocurrent direction of deltaic strata.

In general, studies of modern deltaic systems, even in steep topographically irregular settings, focus on strata of deltaic (fluvial-derived) origin, and fail to consider adjacent/interfingering alluvial units. Study of the Bouse Formation demonstrates that in some contexts, flanking alluvial strata form an integral part of the overall character of the "deltaic" sediment package. Evaluation of both modern and ancient systems in the light of the evolving "Bouse-type" model is expected to allow improved recognition and more precise understanding of a category of deltaic deposits that may remain misidentified or poorly understood under existing facies models.

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Anomalous Velocities in Salton Sea Area

As part of the Salton Sea Scientific Drilling Project in California, several vertical seismic profiles (VSP) were run in State Well 2-14. Data were recorded downhole using a three-component receiver with vertical and horizontal surface sources offset 300 ft and 2,300 ft.

The compressional and shear-wave velocities determined from these VSPs show a near linear increase from the surface to a depth of 4,000 ft. The V_p/V_s ratio over this interval ranges from 10 at the surface to 1.5 at 4,000 ft. In terms of Poisson's ratio, the change is remarkably linear, decreasing with depth.

The Imperial Valley is one of the most seismically active areas in California. The liquidlike characteristics of the near surface manifest themselves during earthquakes by surface liquefaction and sand boils.

The rapid change in V_p/V_s with depth results in very different ray paths for the compressional waves and shear waves, which is apparent on the offset VSPs.

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Fixed Ammonium Determination: Quantitative Method Using Fusion Decomposition

A method was developed for determination of fixed ammonium (NH_4^+) content using a small volume of sample. After removing the exchangeable (surface) NH_4^+ from the clay-rich sediment samples by distillation, fusion decomposition was used to isolate the fixed (lattice)

NH_4^+ from the samples.

Fusion decomposition takes place in a closed system, breaking down the silicate minerals at a temperature of approximately 500 °C. Sodium hydroxide (NaOH) is used as a flux. Ammonium liberated from the sample during fusion decomposition is trapped in a dilute solution of hydrochloric acid (HCl). The NH_4^+ content of the trap solution was quantitatively determined using a Dionex 2000i ion chromatograph with an electrical conductivity detector and a CSI sulfonated polyvinyl benzene resin column.

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Difficult Equity Net Pay Determination by Computer

The East Wilmington oil field is currently undergoing an equity determination. The net pay must be determined for 92 tracts as accurately as possible. This will be done on the computer by following a detailed procedure.

This procedure involves the construction of a computer model that bounds an enclosed volume. The largest uniquely mappable segment must be defined and mapped. The segments are added together at a later stage for the final volume determination. Our smallest definable segment is bounded by two nonvertical faults, two structural surfaces, an oil-water contact and a boundary truncation.

Grids of the structural surfaces and nonvertical fault surfaces are constructed. Vertical barriers or faults are then defined.

The fault grids and barriers are combined with the structural grids. This is accomplished through a series of operations that result in a single grid based on each structural horizon. All unwanted grid data above or below the intercepts are dropped. Next, all values of the grid below the oil-water contact are set to the value of the contact. This results in a bounding grid that represents all but one side of the segment to be mapped. Two stratigraphically adjacent boundary grids are then subtracted.

The resulting grid represents the enclosed volume between the two grids. This grid is the net pay isochore unless there are enclosed shales. The shales can be taken out by multiplying this grid times a percent-shale grid.

All of the individual pieces are constructed for a given interval. The pieces are then added together horizontally to form a complete grid over the area of study. Some overlaps result along nonvertical fault boundaries. These are vertically added as part of the horizontal assembly. This grid can now be contoured and have volumetrics determined.

This procedure is no more than a series of geometric manipulations, but the results are easily applicable to other petroleum problems.

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Perspectives on Conglomerates in Basin Analysis

(No abstract.)

COLBURN, I. P., and E. BLOCK, California State University, Los Angeles, CA

Comparative Analysis of Cretaceous Trabuco Formation Conglomerates of Santa Ana and Santa Monica Mountains, California

(No abstract.)

COLBURN, I. P., and G. NOVAK, California State University, Los Angeles, CA

Provenance and Correlation of Paleocene Conglomerates of Santa Monica Mountains, California

(No abstract.)

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Observing Transport and Fate of Petroleum Hydrocarbons in Soils and in Ground Water Using Flow Visualization Techniques