during deeper burial. Calculations of the total amounts of CO_2 released by kerogen in sedimentary basins suggest that secondary porosity is favored by high contents of humic kerogen, but that the CO_2 produced and/or pore-water flow in many types of basins are too small to create significant amounts of secondary porosity. Reactions with clay minerals may, however, provide additional sources of acid.

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Three-Dimensional Seismic Interpretation of a Piercement Salt Dome

Eugene Island Block 77 field is a shallow (1,100 ft, 335 m) piercement salt dome with a low relief overhang which is productive from upper Miocene sands at depths between 13,300 and 15,800 ft (4,054 and 4,816 m, or between 3.260 and 3.690 sec). These hydrocarbon accumulations are trapped in steeply dipping beds (10 to 40° by dipmeter) between the salt mass and the rim syncline. Small radial faults (50 ft, 15.2 m, of throw) also affect reservoir limits, as is evidenced by varied gas/water contacts and reservoir production performance.

This combination of factors (piercement dome, salt overhang, deep objective, steeply dipping beds, tight rim syncline, small faults) makes Block 77 field difficult to map accurately with 2-D seismic. Unmigrated lines do not show the dip between the salt mass and rim syncline; migrated lines contain migration artifacts, making a salt interface interpretation ambiguous and recognition of small faults impossible. To overcome the problems inherent to the 2-D seismic method, a dense grid of data (trace spacing of 110 ft, 33.5 m, in both X and Y directions) was collected over this field and migrated in three dimensions. This placed events in their proper spatial relationship, thus enhancing both fault delineation and salt face interpretation. In previous interpretations (based on 2-D data), only one fault was mapped—a large down-to-the-north fault extending eastward from the northeast quadrant of the dome. The 3-D data show a more complicated combination of fault systems including other large parallel faults, some with compensating faults; buried down-to-the-south faults; and an extensive system of small radial faults.

Salt-face maps based on 2-D data were very inaccurate. Due to sideswipe problems, only lines shot radially across the dome were interpretable. This created large areas of no control. Using a 3-D grid eliminated the sideswipe problem and increased the amount of control on which to base the interpretation. The salt face, as seen on the seismic was tied to existing well control to make an accurate salt-face interpretation.

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Fan-Delta and Lacustrine Margin Sedimentation, Chinle Formation (Upper Triassic), Canyonlands National Park, Utah

Cyclic fluvial, fan-delta, and lacustrine margin depositional systems dominate the lower part of the Chinle Formation, Canyonlands area, southeastern Utah. Detailed facies analysis of the Moss Back Member and related strata document two alternating fluvial-lacustrine sequences. (1) During high fluvial output, coarse-grained meander belts built fan-deltas into shallow lakes. (2) During low fluvial output, braided streams waned before reaching the lakes, and algal and evaporatic mud flats formed on broad lacustrine perimeters.

The high fluvial output phase comprises three depositional systems. (1) The coarse-grained meander belt system consists of point-bar and channel deposits. Abundant carbonate grains were cannibalized from upland caliche soils and lowland oncolite-bearing carbonate mud flats. (2) The fan-delta system contains sandstone and mudstone delta foresets that coarsen upward into delta-distributary deposits. (3) Blue-green, bentonitic, limy mudstone was deposited in the shallow lacustrine system.

The low fluvial output phase comprises three depositional systems. (1) Braided stream deposits contain trough and planar cross-stratified calcarenite, calcirudite, and quartzarenite. (2) Micritic limestone, algal mats, and oncolites formed on swampy lake margins. (3) Shallow, warm, clear-water, lacustrine deposits are represented by continuous micritic limestone beds and bioturbated limy mudstone and sandstone.

Three external controls produced the cycles. Tectonics associated with the adjacent salt anticline region affected source terrane (intrabasinal carbonate output) and fluvial discharge. Regional humid-arid cycles affected fluvial discharge and lake levels. Volcanic eruptions to the southwest produced periodic influx of volcanic debris that caused increased turbidity and sedimentation rates and decreased carbonate production.

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Sedimentology and Provenance of Miocene Intraclastic Chalks, Blake-Bahama Basin

Leg 76 of the Deep Sea Drilling Project cored 165 m of a 500-m thick Miocene intraclastic chalk formation in the Blake-Bahama Basin. The carbonate material was derived mainly from the Blake Plateau and slopes of Little Bahama Bank with less amounts coming from the shallow platform of Little Bahama Bank. The sediment was transported 150 to 200 mi (240 to 320 km) into the Blake-Bahama Basin via Great Abaco Canyon and Eleuthera Ridge (a Miocene submarine canyon).

Deposition close to the sources was primarily by mass flow or debris flow mechanisms (medium to coarse grains of both shallow- and deeper-water origin float chaotically in a matrix of carbonate mud), whereas turbidite deposition (finely laminated to massive silt and clay-size carbonate) dominates throughout most of the basin. Turbidite sedimentary structures also dominate over debris flow structures in the various facies of this formation.

Upon entering the basin, these chalk turbidites descended below the carbonate compensation depth and eroded and incorporated clasts of partly consolidated siliceous mudstone (the background hemipelagic sedimentation). These clasts of mudstone, as well as clasts of limestone and previously cemented chalk, produce the distinctive appearance so characteristic of this formation.

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U.S. Geological Survey Activities in Oil Shale

Since the early 20th century, the U.S. Geological Survey has been concerned with oil shale; the extent of Survey activity has fluctuated widely during these decades as functions of changing national energy needs and economic outlook for competitive production. Recent international events, namely the rapid price escalation of crude oil imposed by OPEC and the ever-lingering concern over further import constraints, have again made oil shale a potentially attractive energy source. Although organic-rich shales occur in several formations in the United States, the rich deposits of the Green River Formation in Colorado, Utah,