Northwestern Resources Co.'s Jewett Project is located approximately 100 mi (160 km) south of Dallas. It is within the Wilcox Group and is bounded on the west by the Navasota River and the east by Interstate Highway 45.

The geology is generally typical of the upper Calvert Bluff Formation, with the exception of the project's west end. This area is abruptly separated from the rest of the project by a series of normal faults with displacements of up to 200 ft (66 m). The area is characterized by steeply dipping beds (15 to 20°), discontinuous lignite seams, anomalous lignite thicknesses (up to 35 ft, 11 m), stacked seams, and low-quality lignite. Core information reveals areas where pebble to cobble-sized angular lignite fragments are contained in a silty to sandy matrix.

On a more local scale, lignite elevations, and parting and lignite thicknesses have been observed to range as much as 15 to 20 ft (4.5 to 6 m) between pilot hole and core hole. Core sampling has revealed bedding planes oriented at 40° or horizontal in overburden material at one site and horizontal bedding in a 28-ft (8.5-m) lignite seam at another site.

Various exploration and evaluation methods have been used in an attempt to decipher this geologically complex area. Electric logs, geologic mapping, and cross sections show some of the anomalous features.

The paper presents the area in a regional framework with consideration given to the Elkhorn graben system to the northeast and the Marquez dome to the immediate south. Evaluation of the depositional environment and subsequent geologic history has assisted in determining the potential for mining in this area.

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Storm-Dominated Shoreface Deposits, Sego Sandstone (Campanian), Northwestern Colorado

Characteristics of progradational shoreface units have been described from several sandstones in the Cretaceous Western Interior seaway. Little work has been done to document the characteristics of shoreface deposits in a transgressive setting. Outcrop studies of the Sego Sandstone (Campanian), in Rio Blanco County, Colorado, indicate that an initial episode of progradation was followed by a stagnation of the system in which minor transgressions occurred. Transgression of the foundering coast is evidenced by landward movement and storm breaching of a thinned shoreface unit and by the aggradation of a thick associated tidal flat and lagoonal complex.

Three lithofacies are recognized in the shoreface deposits from 80 measured sections; each is composed of very fine-grained, laminated sandstone. (1) Stacked sequenced, 1 to 1.5 m (3.3 to 5 ft) thick, of interbedded sandstone and rippled sandy mudstone. The sandstone beds have 0.5 to 1 m (1.6 to 3.3. ft) thick, imbricated wedge-planar laminations that thin rapidly to the northwest into broad low-angle trough and antiform bedding before pinching out into the mudstone as rippled and burrowed beds. (2) Sandstone with low-angle trough cross-stratification and imbricated wedge-planar sets, but no associated mudstone. This facies ranges up to 5 m (16 ft) thick, but is most commonly 2 to 3 m (6 to 10 ft) thick. (3) Sandstone in superposed accretionary sets ranging from 0.5 to 3 m (1.6 to 10 ft) thick and 8 to 30 m (26 to 100 ft) wide.

Facies 1, which always forms the base of a sequence, is a stacked series of washover fans that thinned rapidly beyond the confined shoreface breach and spread landward into adjacent lagoonal lows. Facies 2 is a stabilized shoreface and is interrupted along strike by facies 3, the longshore-derived fill of storm channels. The stacking and lateral occurrence of filled channels indicates that active zones of weakness existed, and that net landward movement of the shoreface occurred as result of storm washovers.

A thick (80 m, 260 ft) sequence of tidal and paludal sediments is found above the shoreface. Facies include: (1) ripple-stratified, bioturbated humates, and very fine-grained sandstone, interbedded with thin (1 to 30 cm, 0.4 to 12 in.) continuous coals. (2) Thin-bedded fine-grained sandstone and mudstone with flaser bedding and starved current ripples. (3) Very fine-grained, laminated sandstone with low-angle through cross-stratification and accretionary sets; nearly identical to facies 2 and 3 of the shoreface but thinner (1 m, 3.3 ft). (4) Small to large scale, stacked accretionary sets of fine-grained sandstone ranging to 10 m (33 ft) thick (individual sets 0.1 to 3 m, 4 in. to 10 ft thick), containing rippled foresets and abundant *Ophiomorpha*. Mud clast conglomerates are found in some of the smaller channel forms.

Study of 30 measured sections indicates that lagoonal deposits (facies 1) become sandier upward and are overlain by sand tidal flats and mixed tidal flats (facies 2). A system of meandering tidal creeks eroded into the contemporaneous tidal flat and lagoon facies. These creeks coalesced to form a central tidal inlet (facies 4). A subsequent transgression reworked shoreface sandstones (facies 3). Influx of sediment by longshore currents reinitiated progradation of the system. Meander-belt and floodplain facies were deposited over the tidal flat–lagoon complex during this regressive phase.

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Role of Geophysical Logging in Coal Exploration and Discrimination

Geophysical logging has become an important phase of coal exploration. Electric logs that were run in wells drilled for oil and gas can be used to make preliminary studies of structure, coal thickness, depth, and sedimentological anomalies that affect coal continuity. They can be used to locate the best areas for local exploration coring.

Radioactivity logging has become standard procedure in most areas in exploration drilling and coring programs. Thickness (and therefore tops and bottoms of seams) can be determined with great precision on density and neutron logs. Interpretation of radioactivity logs allows the predictions of local geological, structural, stratigraphic, and sedimentological anomalies that will influence mining programs. Ash content calculations which compares favorably with core analyses can be made with the use of density logs. With the use of sonic logs in conjunction with density logs, calculations can be made which will give an indication to the strength of roof and floor rocks.

This paper presents case studies of the successful use of geophysical logs in regional and local phases of exploration and the discrimination of coal seams in several geographic locations.

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Subsidence and Heat Flow Across a Sedimentary Basin–Uplift Boundary: A Thermal-Mechanical Model

The northern coast of the Gulf of Mexico contains major depositional basins in east Texas, north Louisiana, and central Mississippi. They are separated by the Sabine and Monroe uplifts. Basin subsidence can be interpreted as resulting from extension by rifting related to opening of the Gulf of Mexico during Late Triassic to Early Jurassic times. Subsidence of the North Louisiana salt basin, determined from well data, is consistent with crustal extension by a factor of 1.5 to 2. Seismic surveys across the East Texas and Central Mississippi salt basins also indicate thinned crust. Thus, a probable explanation for the intervening Sabine and Monroe uplifts is that they represent areas of unstretched or only slightly stretched lithosphere. This juxtaposition of thermally perturbed lithosphere with unperturbed or only slightly perturbed material is similar to interactions between oceanic crust of different ages across a fracture zone. A thermal-mechanical model describing lateral conduction of heat and mechanical coupling of the lithosphere across this boundary is presented. Effects of finite extension rate, increasing mechanical thickness with age as the lithosphere cools, and thermal blanketing by overlying sediment are included. Subsidence history, heat flow, and sedimentary stratigraphy predicted from this model are compared with observational data.

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Geochemical Study of Depletion of Elements During Retorting of Oil Shales from Lewis County, Kentucky

The prospect of oil shales as an alternative means of hydrocarbon production has sparked concerns as to the chemical composition of the original shale as well as that of the spent shale, oil, water, and gas fractions produced due to retorting. This study is concerned with a chemical concentration comparison between raw and spent shales from Lewis County, Kentucky. Eighteen elements (Si, Ti, Al, Fe, Mg, Ca, Na, K, P, Ba, Co, Cr, Cu, Mo, Ni, Pb, V, and Zn) were investigated in two shale lithologies: the Sunbury and Cleveland Shales. Three slightly different modified Fischer Assay procedures were compared for their effects on the resulting spent shale chemistry. Two procedures employed sweep gases (nitrogen and steam), while the third used no gas sweep. The heating rates during the procedure were also varied.

It was found that the employment of a sweep gas throughout the retorting procedure induces a measurable degree of depletion over a no gas sweep procedure. The gas flow enhances the effectiveness of pyrolysis, and aids in the formation of aerosols in which elements are carried out of the retort to be condensed in the oil and water fractions.

It was also found that differences in original shale mineralogy (e.g., elemental substitutions in major minerals and trace mineral compositions) was responsible for differential elemental depletions seen in the two lithologies.

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Paleoslope Models of Miocene-Pliocene and Campanian-Lower Maestrichtian Foraminifera of Maryland and New Jersey

Paleobathymetric or paleoslope models of the distribution of benthic foraminifera have been constructed for strandline to slope environments of deposition for the Campanian-lower Maestrichtian and the Miocene-Pliocene of the coastal plain of Maryland and New Jersey. Samples from outcrops and downdip wells in formations deposited during four cycles of sea level change in the Miocene-Pliocene and four in the Campanian-lower Maestrichtian are the data base from which the models are constructed. Foraminiferal distributions analyzed downdip in a paleoslope direction and vertically in stratigraphic section utilizing Walther's Law provide a rigid measure of the juxtaposition of biofacies and allow integration of biofacies from each sea level cycle into a single paleoslope profile. Distance downdip in the structurally uncomplicated passive margin of the coastal plain, used as a measure of increasing paleodepth, is a constraint on the estimation of bathymetry of each biofacies. The result is a paleoslope model that relates paleodepth to the abundance distribution of benthic species along the profile. This allows a more critical evaluation of the role played by benthic species in the shelf-upper slope environments during Miocene-Pliocene and Campanian-Maestrichtian times.

Miocene-Pliocene species that have maximum development in 0 to 25 m (82 ft) depth include *Elphidium gunteri, Buliminella elegantissima*, and *Nonionella auris*. Species characteristically developed in 30 to 50 m (100 to 165 ft) are *Cibicides lobatulus, Fursenkoina fusiformis*, and *Bolivina multicostata. Hanzawaia concentrica, Florilus atlantica, Textularia agglutinans*, and *Bolivina paula* are among several species with maximum abundance in 50 to 100 m (165 to 300 ft). In 100 to 200 m (330 to 660 ft) are peak occurrences of *Hanzawaia berthelotti, Spihogenerina spinosa, Cassidulinoides bradyi, Bolivina fragilis*, and *Stilostomella bradyi*. Species with distributions greater than 200 m (660 ft) include *Gyroidina regularis, Sigmoilina tenuis, Bulimina spicata, Oridorsalis tener*, and *Pullenia salisburyi*.

Campanian-lower Maestrichtian species with peak abundances in 10 to 50 m (33 to 165 ft) include *Lenticulina pseudosecans, Citharina suturalis, Pullenia americana*, and *Clavulina clavata*. Species abundant in 50 to 100 m (165 to 330 ft) are *Gaudryina stephenson, Clavulina trilatera, Gavelinella pinguis*, and nodosarids. Maximum occurrences of *Praebulimina carseyae, Coryphostoma plaitum, Loxostomum eleyi, Globorotalites micheliniana*, and *Gavelinella spissocostata* are identified with 100 to 200 m (330 to 660 ft). *Heterostomella americana, Osangularia cordierana, Stensioina exculpta gracilis, Pullenia cretacea*, and *Gavelinella ammonoides* are indicative of depths greater than 200 m (660 ft).

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Chemical Composition of 116 Gulf Coast Lignite Samples

Proximate and ultimate analyses, heat content, and forms of sulfur have been determined for 116 Gulf Coast lignite samples. In addition, the chemical composition of 10 oxides and 29 trace elements has been determined. The lignite samples are from strata assigned to the Wilcox Group and were collected from localities in Texas, Arkansas, Mississippi, and Alabama; the Claiborne Group in Arkansas and Tennessee; the Jackson Group in Arkansas; and the Midway Group in Alabama.

The ranges of the geometric means for elements Ga, Hg, Mo, Sc, U, V, and Y show small variation between sample localities; Co, Cr, La, Mn, Se, Zn, and Zr show larger variations. The average ash content for the lignite samples is 20.3%.

The arithmetic means of proximate and ultimate analyses show that moisture, oxygen, and sulfur contents are higher on the eastern side of the Mississippi embayment, and that volatile matter, fixed carbon, and BTUs are higher on the western side.

The trace-element content of the lignite samples in the vicinity of the igneous intrusives of Magnet Cove, Arkansas, show a systematic decrease in concentrations of 13 elements, both areally and stratigraphically away from the intrusives. This strongly suggests a source relationship of the elements to the Magnet Cove area.