the cooling of the ignimbrite and local faulting. Structure is related to the valley bounding fault. Numerous unconformities and ignimbrite flows date the structural movement. Exact source of the oil is unknown, however both Tertiary-Cretaceous Sheep Pass Formation and Mississippian Chainman Shale are possible sources.

Oil has been generated in commercial quantities in Nevada. Unconventional traps, reservoirs, and source rocks should be regarded as normal. Exploration for conventional traps and accumulations of hydrocarbons in Nevada may be part of the reason for past failures.

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X-Ray Mineralogy of Upper Freeport Coal

Relative concentrations of the major mineral phases have been determined on 75 bench-channel samples of the Upper Freeport coal collected near Homer City, Pennsylvania. Spearman rank correlation coefficients (non-parametric) were determined on a data matrix which consisted of the X-ray diffraction data, the major oxide concentrations, heat content, total sulfur, and maceral concentrations. At the 95% confidence level, illite and kaolinite are correlated with Si, Al, Mg, and K as well as with vitrinite, vitrodetrinite, inertrodetrinite, fusinite, semifusinite, and macrinite. Quartz is correlated with Si, Al, Mg, and K and is strongly correlated with all of the inertinites except micrinite. Clay and quartz are not correlated with exinites; however, pyrite is correlated with micrinite and all the exinites as well as with C, S, Ca, Fe, and Na. Calcite is correlated with heat content, S, Ca, and Fe but not with any macerals. However, elemental Ca, as CaO, is correlated with spornite and micrinite. Statistical correlations imply genetic relations but not necessarily observed mineral-maceral-element associations.

The X-ray mineralogy data are consistent with our working hypothesis on the origin of the mineral matter in coal, which in part states that inherent plant mineral matter was the primary source of the quartz and clay components of the Upper Freeport coal ash. Pyrite and calcite are thought to be indirectly related to bacterial degradation because of their statistically distinct associations.

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Source-Rock Quality and Thermal Maturity, Palo Duro Basin, Texas

Measurements of source-rock quality in the Palo Duro and Dalhart basins suggest that fair to very good hydrocarbon source materials are present. Total organic carbon (TOC) was measured in samples taken from a range of depths and stratigraphic intervals, with sampling concentrated in Pennsylvanian and Wolfcampian shales from basin and prodelta facies. TOC content for all samples ranges between 0.008 and 6.866 wt %. Highest TOC content is in Upper Permian (Guadalupian) San Andres dolomite in the southern part of the basin. Pennsylvanian and Wolfcampian basinal shales are fair to very good source rocks on the basis of TOC values of up to 2.4%.

Optical properties of organic material in source rocks, especially kerogen and vitrinite reflectance, indicate maximum paleotemperatures. Pennsylvanian and Wolfcampian kerogen is yellow-orange to orange, which indicates slight thermal alteration. Temperatures were probably high enough to begin generation of hydrocarbons from lipid-rich organic material, which is most abundant in the deep-basin shale facies. Palo Duro basin samples have a broad range of vitrinite reflectance values (Ro), but populations with the lowest reflectance probably indicate the true paleotemperatures reached. Vitrinite with higher reflectance may have been reworked from older sediments. The average reflectance in representative Pennsylvanian vitrinite is 0.52%; in Wolfcampian samples the average reflectance is 0.48%. These values are consistent with the kerogen color and suggest that source rocks in the Palo Duro basin may have begun to generate hydrocarbons.

Potential hydrocarbon reservoirs are present in shelf-margin dolomite, fan-delta, and high-constructive delta sandstone. Juxtaposed reservoir facies and source beds delineate possible hydrocarbon fairways.

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Bivalve Trace Fossils in British Silesian

In the English Pennines, *Pelecypodichnus* Seilacher, a bivalve burrow, is common in silty to sandy sediments of Carboniferous age from near the top of the Kinderscoutian Stage of the Namurian deltaic succession to the lower part of the Westphalian A. At the base of this sequence burrows are short, typically inclined to the bedding, and were primarily resting places of the marine bivalve *Enevillia variabilis* Eagar MS (formerly cf. *Sanguinolites* Hind *non* M'Coy). In the lower part of the succeeding Marsdenian Stage the burrows become longer to form escape structures. These tend to be more nearly vertical to the bedding, straighter, and more numerous, their longer horizontal axes being broadly aligned to prevalent currents. *Carbonicola,* a nonmarine genus, first appears in the middle of the Marsdenian, evidently having evolved from *Enevillia.* Escape shafts associated with *Carbonicola* are indistinguishable from earlier ones and reach their maximum length near the top of the Namurian, where there was probably selection for elongate shells with low obesity. The latter, being more successful "risers" under heavy sedimentation on the prodelta, ultimately reached low-energy environments as the delta advanced southward. Thus the delta invaded the paleoenvironments of the bivalves, which moved upward or perished. Recent evidence has shown that rising of *Enevillia* was preceded by downward burrowing to a nearly vertical position, anterior end downward, and that this position was in turn sometimes preceded by a ploughing movement connected to escape shafts as seen in trails of cf. *Chevronichnus* Hakes (cf. movement of the living *Margaritifera*). In Westphalian B Stage *Pelecypodichnus* is sometimes associated with the nonmarine bivalve *Anthracosia.*