Formation and Mogollon Rim gravels of Arizona comprise an Eocene–early Oligocene sequence of claystone, mudstone, sandstone, and conglomerate which crops out in discontinuous exposures along an east-west-trending belt from Socorro, New Mexico, to Show Low, Arizona. The maximum exposed thickness is about 1,200 ft (365 m).

The outcrop belt transects the southern part of the east-west-trending Baca-Eagar basin. The basin is bounded on the north by the Defiance and Zuni uplifts, on the south by the Mogollon highland of Arizona and New Mexico, and on the east by the Sierra-Sandia uplift. These uplifts were the primary sources of sediments for the basin. Measurement of maximum clast size, gravel lithology counts, thin-section data, and paleocurrents were used to determine source areas and sediment dispersal patterns. Southward tilting and erosional stripping of the northern part of the basin resulted from uplift of the Colorado Plateau in Miocene-Pliocene time.

A depositional model is presented which consists of a braided alluvial plain–meander-belt–lacustrine facies tract. The meander-belt facies includes both fine- and coarse-grained point-bar deposits. The lacustrine facies contains both the classical Gilbert-type delta and the fine-grained marine-type delta. High concentrations of calcium carbonate in the lacustrine sediments indicate a closed-lake system.

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Variations in Cretaceous Coal-Bearing Strata, Gallup Coal Field, New Mexico

Cretaceous coals of the western Gallup field, New Mexico, occur with detrital wedges that interfinger to the northwest with brackish-marine sediments of the San Juan basin. This study documents detailed stratigraphic relations and the relation of coal occurrence to depositional environments of the Gallup, Crevasse Canyon, and Menefee formations. One hundred and fifteen sections form the basis for three-dimensional reconstructions of a 30-sq km area northwest of Gallup.

The regressive Gallup Sandstone represents reworking of river-mouth sands into coastal barriers where coals accumulated in back-barrier subfacies. This formation grades upward into the Dilco Coal Member of the Crevasse Canyon Formation characterized by varve-like fine-grained sediments, thin sandstones, and coals, which pass upward into thick, northwesterly transported fluvial sandstones. These merge laterally and upward into northerly oriented, thick paleochannel sandstones of the Bartlett Barren Member of the Crevasse Canyon Formation. The coal-bearing Gibson Coal Member of the Crevasse Canyon Formation, which cannot be differentiated from the Cleary Coal Member of the overlying Menefee Formation, contains finer grained sediments and coals deposited in a broad interfluvial depression bounded on the west by Bartlett alluvial channel facies. Coal accumulation in this depression was terminated by southeasterly oriented, crevasse-like deposits associated with thick fluvial sandstones (Menefee Formation).

Stratigraphic variations of coal beds are directly related to their proximity to contemporaneous channel facies. Uniformly thick coals trend subparallel to channel facies; near the channel facies, coals become erratic and pass into rooted, carbonaceous overbank detritus. Coals are offset locally by faults caused by differential compaction beneath overlying channel sandstones.

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Geologic Controls on Mineral-Matter Content of Coal in Central Appalachian Basin

Mineral-matter content of coal in the central Appalachian basin was primarily controlled by chemical conditions in a peat-forming paleoenvironment. Coal that is low in mineral matter was derived from peat that accumulated under highly acidic conditions (pH$<$4.5), whereas coal having high mineral-matter content was derived from peat that accumulated under pH conditions ranging from 4.5 to 7.5. Highly acid conditions during the peat-forming stage of coal formation favored leaching of mineral matter and inhibited bacterial degradation. Increasing pH resulting from buffering by dissolved calcium carbonate species could have (1) reduced the degree of leaching of mineral matter and (2) concentrated mineral matter, including sulfur compounds, because of increased bacterial degradation of peat and concomitant sulfate reduction.

Coal that has a low mineral-matter content (1) is associated with noncalcareous sedimentary sequences; (2) has a high kaolinite to illite ratio; and (3) has a relatively low calcium carbonate content. The converse is true for coal having high mineral-matter content. Mineral matter other than calcium, iron, and sulfur in Appalachian basin coal is dominated by inherent ash derived from plants. Calcium, iron, and sulfur contents are thought to have been fixed primarily by chemical reactions indirectly resulting from bacterial degradation during the early stages of coal formation.

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Geologic Controls on Sulfur Content in Coal

One of the principal factors controlling sulfur content of coal is the pH of the ancestral peat-forming environment. Coals derived from peats that are believed to have formed under highly acidic conditions (pH $<$4.5) are low in sulfur ($<$1%), whereas sulfur content in coals derived from peats that formed under elevated pH conditions (pH 4.5 to 7.5) tends to increase where pH was higher.

Maximum bacterial activity occurs where conditions are neutral, or nearly so; such conditions favor sulfate reduction and peat degradation. This pH model is consistent with Schopf's suggestion "that the sulfur content of a coal may give an indirect indication of the extent of anaerobic decay." Also, the common occurrence of pyrite in fusain bands may be related to pH conditions (neutral to slightly alkaline) in the pre-fusain layer caused by hydrolysis of alkali and alkaline earth metal ions, which were concentrated by burning.

Regional and stratigraphic differences in sulfur con-