RELATION OF EOCENE DEPOSITIONAL ENVIRONMENTS TO SULFUR CONTENT AND QUALITY OF SURFACE WATERS AT LIGNITE STRIP MINES NEAR FAIRFIELD, TEXAS

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Interpretation of facies exposed in highwalls in one of the two Big Brown lignite strip mines ("B Area") can be related to pyritic sulfur content. Acid mine waters due to oxidation of pyrite in spoil were not observed at Big Brown, although high sulfate concentrations were observed in "A Area" mine waters.

The Big Brown lignite deposit formed as a thick peat deposited in fresh-water swamps and marshes in an interlevee floodbasin between meanderbelts, low on the alluvial plain of the Mt. Pleasant Fluvial System in the Eocene Wilcox Group. Following deposition of the thick peat, two coarsening-upward facies sequences, fed by extended crevasse distributaries, initiated by overbank flooding and crevassing on trunk streams to the northeast and south, were deposited: (1) Swamp crevasse splay and distributary channel-fill, well-drained swamp, and poorly drained swamp facies form the lower sequence. (2) Lacustrine, lacustrine delta fill and distributary channel fill, and capping poorly drained swamp facies form the upper sequence.

Following burial of overburden sediments, low ferrous iron and sulfate concentrations in fresh ground waters may have been the principal factors limiting the formation of pyrite. Pyrite is concentrated in the lowest 2 centimeters of crevasse splay silty mud at the commercial lignite-sediment contact (0.68 - 3.92 percent pyritic sulfur by weight). Hydrogen sulfide was carried in ground waters from peats where organic compounds for sulfate-reducing bacterial metabolism were available, into adjacent sediments where reactive iron was present. The capping poorly drained swamp muddy lignite of the upper facies sequence contained abundant in-situ reactive iron, which resulted in high pyritic sulfur content (0.56 percent). Other facies in the two mine areas contain from 0.05 to 0.35 percent pyritic sulfur by weight. Pyrite content of overburden in the A Area is more than twice that of the B Area.

Oxidation of pyrite accounts for abnormally high sulfate concentrations (775 - 1795 mg/1) observed in A Area mine waters. These waters were obtained in springs that issue from perched ground water in reclaimed and unreclaimed spoil. Ground waters issuing from the spoil during winter, 1974-75, may be nearly saturated with gypsum, suggesting that the waters may redissolve soluble sulfate compounds formed in part during hot, low rainfall summer

months, by evaporation of ground waters within the spoil. Downstream, high sulfate surface waters are rapidly diluted. Small volumes of highly mineralized ground water in the spoil may recharge the Wilcox aquifer, but would probably significantly affect water quality only in shallow Wilcox water wells in the immediate vicinity of strip mines.