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Petrography, geochemistry, and depositional setting of the San Pedro and Santo Tomas coal zones: Anomalous algae-rich coals in the middle part of the Claiborne Group (Eocene) of Webb County, Texas

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Abstract

Two coal zones, the San Pedro and the overlying Santo Tomas, are present for nearly 35 km in outcrop, surface and underground mines, and shallow drill holes along the strike of the middle part of the Claiborne Group (Eocene) in Webb County, Texas. A sandstone-dominated interval of 25 to 35 m separates the two coal zones, which range up to 3 m in thickness. Each coal zone contains carbonaceous shales, thin (<0.75 m) impure coal beds, and thin (<0.85 m) but commercially significant nonbanded coal beds. The nonbanded coals are different from other Tertiary coals of the Gulf of Mexico Coastal Plain: unlike

lignites that are typical of the older Wilcox Group (Paleocene-Eocene) and younger Jackson Group (Eocene), nonbanded coals of the Claiborne Group have high vitrinite-reflectance values (0.53 R_{max}) and high calorific yields (average 6670 kcal/kg or 12,000 Btu, dry basis). The coals are weakly agglomerating (free-swelling index is 1.5â€“2.0) and have an apparent rank of high-volatile bituminous.

The coal-bearing portion of the middle Claiborne Group in the Rio Grande area represents a fining-upward transition from sandstone-dominated, marine-influenced, lower delta plain depositional environments to more inland, mudstone-rich, predominantly freshwater deltaic settings. Discontinuities within the San Pedro coal zone are attributed mainly to the influence of contemporaneous deposition of distributary mouth-bar sand bodies. The less variable nature of the Santo Tomas coal zone reflects its origin in the upper part of an interlobe basin that received only minor clastic influx.

Petrographic attributes of the nonbanded coals indicate that they formed subaqueously in fresh to possibly brackish waters. A highly degraded groundmass composed of eugelinite is the main petrographic component (approximately 71%, mineral-matter-free basis). An enriched liptinite fraction (approximately 23%) probably accounts for unusually high calorific values. There is negligible inertinite. Petrographic study of polished blocks indicates that approximately 10 percent of the nonbanded coal from both coal zones is composed of green algae fructifications, which also occur in clastic rocks of the coal-bearing interval. Such algal material cannot be identified or quantified by conventional coal petrographic techniques that utilize particle pellets or by palynological analyses that include acid preparation.

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