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MORPHOLOGICAL AND MICROCHEMICAL CORRELATIONS OF LIVING AND FOSSIL BOTRYOCOCCUS

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ABSTRACT

The morphological variation of living colonies of green algae of the genus *Botryococcus*, as induced by pH, [hv], agitation and [NH₄⁺] regimes, allows for the mathematical designation of boundary conditions referable to these parameters in the environment:

$$n_c/N = 10^{0.43-S/0.12} = 10^{0.96-Y/0.28}$$

and

$$S = V_t - nv = kY - 0.57 = (\text{pH}/6.1)^{0.12},$$

where $n_c/N = \frac{f(\text{microcolonies})}{\text{colonies}}$, S = sheath volume, Y = degree of agitation,

V_t = volume of colony, v = cell volume and k = 2.0. Fossil algal morphologies may be used to predict ecological parameters prior to fossilization. Cannel and boghead coal types mathematically cluster as referable to low Y, low [hv] or high [NH₄⁺], and high Y, low [hv] or high [NH₄⁺] conditions in the growth phase of included thalli, respectively. Transmission electron micrographs correlated with enzyme catalysis relate the cytoplasmic location of microchemical fractions with the sheath having a chitin (40-44%) - hydrocarbon (56-60%) composition. Thirteen hydrocarbon constituents of 39 sapropelic coals are related to algal biosynthesis. The presence of the "I-peak" is shown to correlate with the relative age of the coal sample. A chemosynthetic scheme is proposed relating differential microchemical preservation to post-fossilization reactions during coal formation. Multivariant statistical analyses correlate morphology and chemistry of fossil thalli with coal type. Cannel coals are shown to differ from boghead coals in having a greater influx of lignin-degradation products from associated vascular flora (14-18% of the coal matrix is derivable from condensation reactions of vanillan, vanillic and protocatechuic acids). Algal cells accumulated under anaerobic and reducing conditions with transport conditions resulting in high Y and slower degradation. A reducing to oxidizing transition is suggested by chemosynthetic flow models causing polymerization of humic gels and phenolic plant derivatives.