Oil Generation In Uranium-Enriched, And Hydrothermally, Dolomitized Coals, Macedonia, Greece

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ABSTRACT

Low rank coals (brown coals and lignites and sub-bituminous) are widespread in many sedimentary basins around the world, and are almost exclusively used for combustion and electricity generation. Generally these low rank coal deposits, such as the widespread deposits within Greece, are geologically young, near the surface because of limited geothermal burial, and the vast majority are Tertiary in age. Currently coal in general is being 're-visited' as an economic source for both liquid and gas hydrocarbons. In this study we have used organic petrology, Rock Eval and geochemistry to determine whether enhanced hydrocarbon generation has occurred within highly uranium-enriched, Upper Eocene-Oligocene coal lenses, thin coal beds, and carbonaceous shales from a volcanic-hydrothermal setting of Rhodope massif area, Drama basin eastern Macedonia, Paranesti, Greece. Uranium in the Paranesti coals ranges from ~ 15 to > 50000 ppm, which is a very high concentration of this metal relative to world averages of U in coal. Thus, hydrothermal alteration and radiogenic gamma ray radiation of organic matter in the coals could both potentially result in thermal maturity anomalies and possibly enhanced petroleum generation.

Fixed carbon contents, dry ash free, for the Paranesti coal lenses and thin coal beds (hereafter coals) range from 37 to 61 %. The majority of the coaly intervals in the study area have average vitrinite $\%Ro_R$ values ranging from 0.40 to 0.50 - sub-bituminous rank, which is well above regional thermal maturation levels. Anomalous vitrinite $\%Ro_R$ values of up to 1.7 occur in hydrothermally altered coals where macerals are notably fractured and infilled by coarse-grained, late stage, likely high temperature, dolomite. Bitumen and crude oil inclusions in the hydrothermal dolomites are clear evidence of petroleum generation and migration. High calcium coals show petrographic evidence of post-depositional hydrothermal alteration and show a negative correlation between %Ro and U whereas low calcium coals which do not how any evidence of hydrothermal alteration show positive correlation with %Ro, suggesting that both hydrothermal and radioactive alteration controlled degree of thermal alteration. Hydrogen Indices and the concentration of volatile hydrocarbons in the coals decrease as a function of both uranium concentration and degree of thermal alteration by hydrothermal fluids.