

THE 2000 Ma GIANT CARBON DEPOSIT AND GENERATION OF PETROLEUM: GEOLOGY, LITHOLOGY AND GEOCHEMISTRY OF KARELIAN SHUNGITES.

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The 2.0 Ga-old, 600 m-thick Zaonezhskaya Formation, NW Russia, contains high concentrations of Corg (up to 98%), averaging around 25%. The formation contains an estimated $25 \cdot 10^{10}$ tonnes of Corg accumulated within an area of 9000 km². The formation was deposited in brackish, sulphur-poor water in a non-euxinic, lagoonal environment. Corg is represented by shungite. The organic material suffered complex catagenetic and metamorphic alteration reflected in highly variable $\delta^{13}\text{C}_{\text{Corg}}$ (-45‰ to -17‰), bimodal distribution of $\delta^{13}\text{C}_{\text{Corg}}$ (with maxima at -28 and -39‰), and low H/C ratios (0.005 to 0.2). Abundant diagenetic carbonates ($\delta^{13}\text{C}_{\text{carb}}$ = -5 to -26‰) and the presence of pyrite ($\delta^{34}\text{S}$ -22 to +31‰), reflects substantial loss of Corg via bacterial reduction of sulphate during diagenesis. Evidence for fermentative diagenesis has not been detected. The shungite rocks are characterised by a further substantial loss (50%) of biologically produced Corg in the course of thermal maturation and by a depletion in $\delta^{12}\text{C}$ (10‰). Conservative estimates give $\delta^{13}\text{C}_{\text{Corg}}$ of -34‰ as the best value of the initial biomass. Autochthonous shungite occurs as disseminated organic material (0.1 to 50% Corg) which, when mixed with migrated bitumen, appears as coal-like seams and lenses of semilustrous and semimat layer-shungite rocks (oil shales, 50 to 75% Corg). Lustrous vein-and layer-shungite containing more than 80% Corg are considered to be allochthonous, migrated bitumen (originally petroleum). The generated oil has migrated both vertically and laterally with the highest concentration in cupola structures. $\delta^{13}\text{C}_{\text{Corg}}$ data cluster by locality rather than by shungite type.