

# Occurrence and chemical composition of the Karelian Shungite, northwest Russia

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Shungite is a general name of carbon-rich rocks in the Lower Proterozoic Karelian Super Group that is widely distributed in the area around the northwest part of Lake Onega in Karelian Republic of northwestern Russia. Those rocks are black, fine-grained rock and divided into five types on the basis of the carbon content, i.e., type I (carbon content 98 - 75 wt %), II (75 - 35 wt %), III (35 - 20 wt %), IV (20 - 10 wt %) and V (less than 10 wt %). The supergroup is divided into the Jatulian, Ludicovian, Kalevian, Vepsian groups in ascending order. Though types I-II shungite are limited in Ludicovian Group as a small body, types III-V shungite are widely yielded in the Ludicovian and Kalevian groups. We had an opportunity to examine the occurrence of shungite in the Shunga, Maksovo and Zazhogino areas.

In the Shunga area, the mode of occurrence of shungite types I-II is a dyke and sheet like bodies cutting type III shungite. The intrusion of type II shungite, which contains micro particle of carbon material on a microscopic scale, into the host rock of types III-IV shungite with brecciation is observed in the Zazhogino area. Near Maksovo area, type III shungite is formed as black material along peperitic margin of basaltic intrusive bodies in black carbonaceous sediments.

In whole rock geochemistry of shungite, loss of ignition and SiO<sub>2</sub> show a strong negative correlation, reflecting relative proportion of amorphous carbon, whereas loss of ignition and total iron, P<sub>2</sub>O<sub>5</sub>, alkali metals and alkali earth metals correlate positively. Especially, types I-II shungite have low-SiO<sub>2</sub>, Rb, Cr and Zr, and high-V, Ni contents, which is suggestive of similar compositional pattern to that of combustion ash of petroleum. Types III-V shungite are characterized by high-SiO<sub>2</sub> and have a trace element pattern similar to that of several Proterozoic siliceous mudstones.

The field relationship between type III shungite and basaltic rocks is suggestive that the carbonaceous material is primary produced by reaction between muddy sediments and basaltic intrusion. The intrusive relationship between carbon-rich and -poor shungites and characteristics of whole rock geochemistry permit an inference that the formation of carbon-rich shungite such as types I and II is a result of the migration of carbonaceous material as a fluid flow squeezed from nonspecified locale. However, the origin of primary carbon material in the sediment and the formation process of a large amount of types III-V shungite are still obscure.