

INVESTIGATING CRYSTAL CHARACTERISTICS OF VEIN GRAPHITE FOR INDUSTRIAL APPLICATIONS, VALUE ADDITION AND LOW-CARBON DEVELOPMENT

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Sri Lanka's vein graphite, renowned for its exceptional purity (95 – 99.99% carbon), represents a globally significant yet underutilised mineral resource. A critical research gap exists in understanding how different graphite morphological varieties found in Sri Lanka correlate with specific industrial uses. This lack of clarity limits efficient resource utilisation and product development for high-value markets, including emerging eco-friendly technologies. The primary objective of this study was to evaluate how different crystal structures and quantities of vein graphite influence specific industrial applications to enhance value addition and contribute to low-carbon development, while investigating the feasibility of integrating renewable energy into production, which will effectively reduce the carbon footprint of graphite operations. Initial site investigations were conducted, and samples were collected from major graphite mines in Sri Lanka, including Bogala, Kahatagaha, and Ragedara, and some minor mines in Boralugoda and Agalawatta. Sample characteristics, morphologies of graphite crystals in different graphite sites, host rock, and mineralogy analyses were done for the samples collected. The main host rock types were identified as biotite gneisses, garnet-biotite gneisses, charnockitic-gneiss, marble, and charnockitic-sillimanite-gneiss, with main impurities being quartz, pyrite, mica, feldspar, and garnet. Preliminary results indicate that the carbon percentage of the four graphite types varies by mine, suggesting it may be influenced by the original fluid characteristics that form the veins. Therefore, characteristics of the four types of vein graphite and their formation mechanisms will be studied further with isotopic and geochemical analyses. It is also aimed to identify optimal graphite types and quantities for specific applications, promoting low-carbon development and suggesting sustainable mining and processing techniques that reduce carbon emissions, waste generation, while focusing on renewable energy integration. The findings will provide policy recommendations to modernise the graphite industry, aligning it with global sustainability trends and enhancing its economic and strategic value.

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