DISTRIBUTION OF GRAPHITE MINERALIZATIONS IN THE SOUTH- WESTERN PART OF SRI LANKA AND THE IDENTIFICATION OF SUITABLE LOCATIONS FOR MINING

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Abstract: Exploitation and utilization of extremely pure vein Graphite in Sri Lanka have been known since seventeenth century. Sri Lanka is rich with high-purity variety of lump graphite.. The graphite mineralization is more noticeable in the south western part which is underlain by granulitic facies of high-grade metamorphic rocks belong inthe Highland Complex (HC) of the island. Past mining sites were identified through the literature survey, collection of historical data and field investigations. Hundreds of abandoned mines and pits were identified throughout the region. Veins found in this region follow the direction of foliation pattern, fold axes and the fracture pattern. Foliation varies from 320^0 to 340^0 bearing and fold axes in major anticlines and synclines also follow the same directions. Major fracture patterns are in a direction which varies from 40^0 to 70^0. General dips of the veins are around 45^0. Vein thickness varies from 10cm to about 1m (lenses). Some of the major veins found in the area show over 90% carbon content. Three major areas have been identified as most suitable locations for further investigations to be followed by mining. They are Aluketiya-Meegahatenna, Delgoda-Kalutara and Watareka-Padukka.

Keywords: Vein Graphite, anticlinal structures, Foliation Pattern, Fold Axes, Fracture pattern

1. Introduction

Measuring the quality of a whole material is done by obtaining representative samples from the bulk material and by sample analysis. Practically, these analysed values deviate from the actual due to heterogeneity of the material involved. The fundamental reason for the difference between actual value and the analysed data is the accuracy of the sampling method used to obtain the representative sample. It is essential to consider the appropriateness of existing sampling methods which are used in the mineral processing industry.

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Generally, simple sampling methods have lesser accuracy than advanced methods. Although these advanced methods are of a higher accuracy, they are much complicated in operation with high equipment usage as well. Most of these sampling methods are biased to the operator's experience. Thus, the necessity of a sampling method with more representative sampling and with a. simple and faster procedure and less equipment usage has emerged.

1.1 Objectives

The main objective of developing a new sampling method is to ensure higher accuracy with less operator bias, minimum equipment usage. It is also intended to study the mineral properties affecting the accuracy of sampling methods and also to study the best sampling method for certain mineral mixtures.

2. Methodology

2.1 Preparing mineral samples for testing.

Two mineral samples were required to be prepared for the material mixture to be sampled. It was decided to choose Quartz and Ilmenite sand as mixing materials which can be easily distinguished from each other.

Then, the Quartz and Ilmanite samples were inspected visually in order to get get an idea about their grain sizes. Quartz was crushed using a Tema mill to reduce the grain sizes. Both sand samples were sieved separately using 250, 355 micron sieve set and, a few particle size ranges were collected.Then, Ilmenite and Quartz were mixed together using the regular mixing procedure.

2.2 Testing on existing sampling methods.

2.2.1 Cone and quartering method

Clean piece of paper was laid on the table and the material mixture was poured on to paper using a funnel as forming a uniform conical pile. Then the cone was spread radially from the centre to form a flattened disk of material. After that the disk was divided into equal quarters using plastic plate. One pair of opposite quarters was removed and the remaining pair was selected as the sample and same procedure was done once to the selected sample. After quartering the sample one pair of opposite quarters was removed again and remaining pair was selected as the final sample.

2.2.2 Grab sampling

The material mixture was placed on clean piece of paper and it was homogenized by spreading the material diagonally along the paper starting from each corner. Mixing

was carried out using a ruler. After mixing, the material samples were collected by grabbing from 15 randomly selected points and mixed to one sample.

2.3 Testing of New Sampling Method

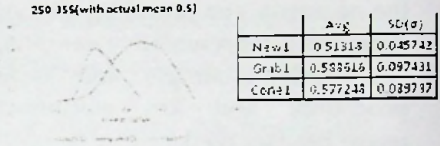
4"x2" rectangle was drawn on an A4 sheet using a marker pen and it was divided into 1"x1" squares. Four 1"x1" squares were cut off along the inner edges of marked lines using a paper cutter. Then, that sheet was placed on another A4 sheet. After that the material mixture was placed on the sheet and it was spread over the rectangle once from each sides of the rectangle using a ruler. Then, the A4 sheet which was on the top was gently lifted up with material mixture allowing material which was on the removed squares remaining on the under-lying sheet. The remaining material was selected as the final sample.

2.4 Grain counting for obtained samples

Final samples which were obtained from each sampling method were proceeded to grain counting. Small amount from sample was collected to a spatula and it was placed gently on a colour paper (orange/blue). Then the paper was placed on platform of the microscope. After focusing well, image was captured using a digital camera. Grain counting was done for samples with the aid of captured image.

3. Results

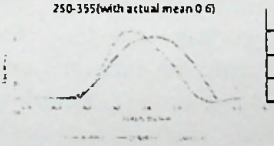
3.1 Results obtained from Mixture 1



	Avg	SD(σ)
New1	0.51316	0.045742
Grab1	0.538516	0.097431
Cone1	0.577248	0.089737

Figure 1: Normal distribution curves with standard deviation related to actual mean of sample (0.5) for particle size range 250-355μm

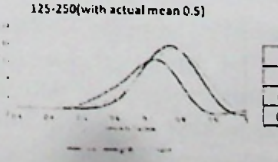
3.2 Results obtained from Mixture 2



	Avg	SD(σ)
New2	0.709549	0.126218
Grab2	0.727581	0.144523
Cone2	0.764319	0.175322

Figure 2: Normal distribution curves with standard deviation related to actual mean of sample (0.6) for particle size range 250-355μm

3.3 Results obtained from Mixture 3



	Avg	SD(σ)
New3	0.618385	0.134701
Grab3	0.6696	0.171629
Cone3	0.678361	0.18784

Figure 3: Normal distribution curves with standard deviation related to actual mean of sample (0.5) for particle size range 125-250μm

4. Discussion

It was observed that there is a problem of adequacy of sampling methods which are used in the mineral processing industry. Therefore, the need of a new method having more accurate,quick, simple and less equipment usage has immersed.

Generally, when a material mixture is placed on a plate, the mixture segregates to a certain amount. Mixing the material with rolling along each side of the rectangle was a means of minimizing that segregation error. In the new method, extraction and delimitation errors have been eliminated with the ability to collecting the under laying material as well. Here, samples are collected systematically. Therefore, the sample selection can be more accurate. The other advantage of the new method is that the material mixing and separation can be easily done. Thus, the new method is less biased on operator's experience. When we consider about final results, more accurate samples can be obtained by the new method with respect to other two methods. But the accuracies of other two methods have changed their positions with respect to each other. The variation could occur due to errors occurring at the stage of sample preparation, because sample preparation is done at the same time for all methods. And also when the proportion of one mineral is higher than the other and average particle size of minority mineral is little larger than the majority mineral, segregation of the mixture can be increased. However, in both stages the new sampling method has provided comparatively more representative samples than other two sampling methods.

5. Conclusions

Based on the results obtained, the new sampling method has presented lesser standard deviations than the other two sampling methods. Therefore, It can be concluded that new method is more appropriate than grab sampling and conning and quartering for a mineral sand mixture of Ilmenite (250-355μm) and Quartz (250-355μm) which has mixed in 1:1 or 3:2 (Ilmenite : Quartz) volume ratios and mineral sand mixture of Ilmenite (125-250μm) and Quartz (125-250μm) which has mixed in 1:1volume ratio.

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