Estimating the magnetite content of the Southern part of Eppawala Phosphate Deposit and its parent rock

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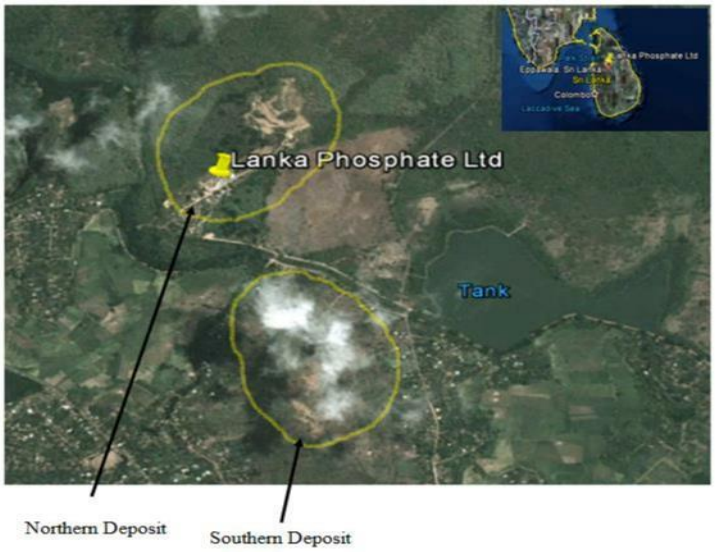
Introduction

Phosphorus is one of most important plant nutrients because its function cannot be performed by any other nutrient. Phosphate fertilizer is mainly produced from the natural phosphate rocks worldwide. Phosphate deposit at Eppawala is one of the most economically valuable mineral deposits in Sri Lanka. It contains up to 42% of P_2O_5 while the citric acid solubility of various components varies from 4% to 6%. Due to strong weathering of apatite-bearing parent carbonatite rock, an economically valuable secondary phosphate deposit has formed (Subasinghe, 2013). Former studies revealed that iron leaching from weathering parent rock played an important role in fixing phosphate and formation of secondary deposit through in-situ diagenesis (Subasinghe, 2012). Source of iron is assumed to be magnetite and other iron bearing minerals. To reap grater benefits from the deposit it is necessary to produce value added products such as triple super phosphates. Due to considerable amount of iron impurities from magnetite and other iron baring minerals, the production of super phosphate may pose some difficulties at industrial level. The objective of this study is to develop a methodology to estimate the magnetite, the main iron-bearing mineral, in the phosphate ore.

Methodology



Depending on the extent and exposure of the deposit two specific areas (Southern part and Northern part) were identified for the sample collection. Due to relative scarcity of magnetite in the northern deposit, seventy samples were collected randomly from only southern deposit. Then suitable twelve samples were selected for thin section making and ten samples were selected for XRF analysis. Then representative sample from each sample was selected and they were ground to pass 600 µm sieve. Then the fraction between 250 µm to 600 µm was taken and washed and dried. Then 25 g of representative sample again was taken for magnetic separation. At the first magnetite setting (0.125 A) was set and magnetites in the representative samples were separated by free fall mode. Then all other magnetic minerals in the representative sample was separated from the sample (1.2 A) by free fall mode. Samples powdered by disc mill were used to XRF analysis. Powder method was followed to analyze samples in XRF. Hand held XRF at GSMB was used to analyze samples. Thin section preparation of selected samples was done and they were analyzed by petrographic microscope at GSMB.

Result and Discussion

The average percentage of magnetite in primary rock is 0.1% and in the secondary phosphate deposit is 0.21%. The average percentage of magnetic minerals in the secondary deposit is 20.21 % and parent rock is 2.78%. Magnetic susceptibility data, XRF data and results from thin section analysis are not comparable with results gained from magnetic separation method. That means magnetite is not the only source of iron or magnetite is not having theoretical composition. During weathering processes, Fe^{3+} has greater tendency to accumulate in regolith. Because of its mass transfer coefficient is -1 that means element is completely lost from the parent rock (Hewawasam, 2013).

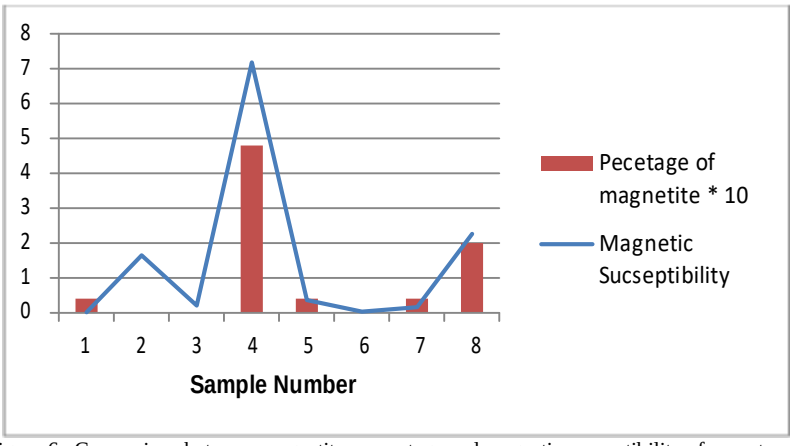


Figure 6 : Comparison between magnetite percentage and magnetic susceptibility of parent rock

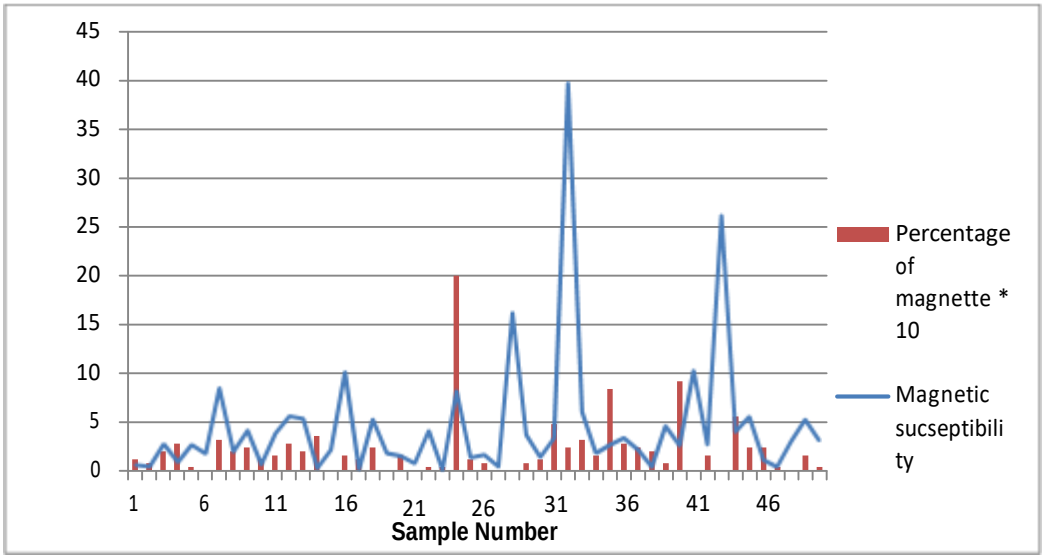


Figure 7 : Comparison between magnetite percentage and magnetic susceptibility of parent rock

Conclusions

According to data gathered from several methods described above it is clear that the magnetite percentage of the parent carbonatite rock and secondary phosphate rock of the southern part of the phosphate deposit at Eppawala is considerably very low. But percentage of all magnetic mineral is raised up to considerable amount. So it is clear that there are several magnetic as well as iron bearing minerals in both secondary deposit and parent rock. Rapid weathering of magnetite and other iron bearing minerals may be the reason for the percentage difference of magnetite and magnetic minerals in both parent rock and secondary deposit.

Acknowledgement

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References

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