# Graphite Mineralization In Ruangwa Area, Southeastern Tanzania

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## 1 Introduction

### 1-1 General

This report has been prepared for Almohandes Paints Co Ltd (Sudan) based on a short visit to a graphite deposit in Southeastern Tanzania. The deposit is in a concession lease owned by Sootexmineral Investment Limited. The concession comprises five prospecting licenses (PLs) covering a total area of 258.6 sq km. In this visit (10 to 12 . 12. 2021) only two PLs have been seen, namely PL 10809 and PL 108010 covering an area of 38 sq km and hosting the most important graphite target areas (Moye, 2019).

### 1-2 Location

The project area is about 210 km NW of Mtwara port in the southeast Tanzanian Indian Ocean coast (Fig.1). About 144 km of the distance is a paved bitumen road; the rest is a good passable gravel road via Ruangwa Township to the project area.


Figure 1: Location map of Prospecting Licences in Souteat Tanzania, from Moye (2019)

## 2- Geology of Project Area

The concession area is an integral part of the Late Proterozoic Mozambique Belt. It is underlain by a NE\SW trending belt of high grade paragneisses associated with quartzites and recrystallized marble. The paragneisses have been recrystallized in the upper facies of regional

metamorphism and intruded by a late to syntectonic granitoid complex. The granitoid is of about 600 MA age (C. D. Moye, Person. Commun.).

The gneisses are comprised of feldspars, quartz, graphite, kyanite, garnet, and minor iron and manganese oxides as accessory components. Later contact metamorphism due to emplacement of granitoid produced static garnet giving rise to hornfelsic texture (Plate 1). This assemblage suggests an arenaceous protolith with subordinate pelitic layers.

Plate 1: Hornfesic texture shown by static garnet due to contact metamorphism

At least three phases of deformation are discernable which produced major folds in the area clearly observed in the marble outcrops (Plate 2) and the graphitic paragenisses. The original primary sedimentary structures have been obliterated by metamorphic banding and later transposed by shearing.

Plate 2: Polyphase deformation in graphitic marble

## 3- Graphite Mineralization

### 3-1 Synopsis

Graphite is a polymorph of carbon ( C ). It is an important industrial mineral that has both metal and nonmetal properties. There are two types of graphite mineralization: syngenetic and epigenetic. Syngenetic type results from graphitization of organic matter in sediments during regional metamorphism. Graphite of this type is crystallized in large flakes. Epigenetic type of graphite occurs as lumps and veins produced by precipitation of C-O-H fluids during retrograde metamorphism (Bullock and Morgan, 2015). The unique physical and chemical properties of graphite make an important strategic mineral and a major industrial material for fuel cells, lithium-ion batteries, aircraft wings, nuclear industries, and green energy production (Rosing-Schow, et al., 2017).

The world production of natural graphite was about 1.17 million tone in 2014 (Olson, 2015), with China producing (67%) followed by India (15 %) and Brazil (7%). The demand for graphite is increasing especially crystalline flake type which can be processed into grapheme that can be used to make expensive electronic goods for the modern generation.

## 3-2 Graphite in Project Area

Graphite in the project area is hosted by kyanite bearing graphitic quartzite, graphitic quartzo-felspathic gneisses, and graphitic marbles ((Moye, 2019). The main mineralized structures form large extension up to 60 thick and 5km strike length. This indicates high potential and a considerable graphite resource.

In this work the graphite mineralized structures in Target 1 and part of Target 2 have been seen. In both of the localities the mineralization is hosted by the quartzo-feldspthic gneisses and quartie most probably resulting from the metamorphism of organic matter in the original arenacious protolith.

Graphite occurs as flakes of variable size ranging from less than 200 micron to more than 200 micron (Moye, 2019). The concentration of graphite ranges between 1.7% and 19%, associated with kyanite. Graphite is recrystallised and showing a silvery metallic luster indicative of maturity. The associated minerals are feldspars, quartz, kyanite, garnet, with minor iron and manganese oxides. It is really important to note that there is no biotite or other sheet silicates that may affect floatation processes.

It has been observed that both of the flake size and graphite concentration increase with decreasing kyanite. This can be explained as follows:

a) Kyanite is a high pressure (stress) mineral tends to grow and concentrate in high pressure zones like limbs of folds during regional metamorphism. Graphite, unlike kyanite is an unti-stress mineral that migrates during folding to folds hinges. This has been observed during field examination, especially in Target 2 area (Plate 3).

Plate 3: Concentration of graphite in hinge areas of folds

b) High graphite concentration and large graphite flakes have been observed near to contact between the graphitic gneisses and shoots of the late tectonic granitoid observed in Target 1 area, therefore can be attributed to contact metamorphism.

c) The variation of kyanite content from one locality to another might be due to the variation of argillaceous component in the original protolith.

### 3-3 Exploration Work

Exploration work executed by Sootexmineral Investment Limited includes:

1- Regional mapping of the whole of the large concession area,

2- Detailed geologic and structural

mapping has been made for targeted areas.

3- EM ground surveying has been conducted for target 1 and showed clear anomalies indicating continuations of the mineralized structures.

4- Extraction test has been made by an accredited centre in Germany.

Planned exploration work includes trenching and RC drilling based on detailed geological and structural mapping and EM results.

## 4- Invstment Opportiunity

The world demand for high quality graphite is increasing. Graphite mineralization in southeast Tanzania is of high quality (Moye et. al., 2021). The investment environment in Tanzania is conducive for mining progects. Exploration and mining licenses are renewable. The government is entitled to a royalty of 3%. Early production of industrial minerals such as graphite is allowed for national companies during exploration. A number of national and international companies have already obtained mining and exploration licenses there.

The project area hosts a real graphite deposit. The maturity, flake size, and grade of graphite meet the requirement for relevant industries. The dimensions of the outcropping ore bodies especially in target2 render it suitable for open pit mining techniques.

Processing of graphite is very simple involving flotation which is mainly physical technique that needs no chemical treatment. There are no sheet silicates such as micas or clay minerals that may affect floatation process.

The target areas are crossed by a river (Mbwemkuru River) which supplies the required amount of water needed for mining and processing.

The project area is only 6 km from the main road to Metwara port on the Indian Ocean, makes it easy to import equipment needed and to export products.

The project area is adjacent to a large scale graphite mine which will start soon. The area is very stable with a friendly rural community. Telecommunication nets are available and the National Grid is nearby.

## 5 Cnclusion and Recommendations

### 5-1 Conclusion

The Sootexmineral Investment Limited lease in southeast Tanzania has been visited to assess graphite resources and investment possibilities. The area hosts a high quality graphite deposit in high grade quartzo-feldspathic gneisses and quartzites. The graphite content ranges from 3% to 19%, and the graphite flake size is between less than 200 microns and more than 200 micron.

Processing test has shown very good recovery by floatation. The dimensions of the ore bodies allow open pit mining methods.

The investment environment and the infrastructure in the area encourage mining projects.

### 5-2 Recommendations

The project area is highly potential for graphite, but the present level of information may allow a small scale mining project, even though some trenches and RC holes need to be made to insure down dip length of the mineralized structures.

It is therefore fully recommended to join Sootexmineral Investment Limited in the project. Trenching and RC drilling must be made at least to have an inferred resource. Mining can start with the large structures in Target2.

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