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## STUDY OF GEOLOGICAL CONDITION OF MELUKOTE REGION FOR FINDING THE SUITABILITY OF MINERALS AND ROCKS FOR CONSTRUCTION AND FINDING ECONOMICAL MINERALS

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### Abstract

A study was carried out to understand the geological condition in and around MELUKOTE region. THE MELUKOTE located in Mandya district, Karnataka. During the geological survey we have found different minerals and rocks such as Gneiss, foliated and non-foliated rocks, foliated schist, sedimentary rock (Breccia), metamorphic rocks, mica sheets, mica schist, pink granite gneiss rock, Biotite, muscovite, sillimanite. The samples collected were analyzed for various physical properties that is form, colour, streak, lustre, cleavage, fracture, hardness, specific gravity, chemical composition. Among all these minerals quartzite and mica minerals are abundant and can be extracted economically. The rocks undergone physical, chemical, biological, weathering. Chemical weathering processes are among the most fundamental natural processes operating at and near the surfaces of earth [1]. These rocks are not suitable for construction. By the study of pediments near the new tank project, shows that Kaveri river is dried.

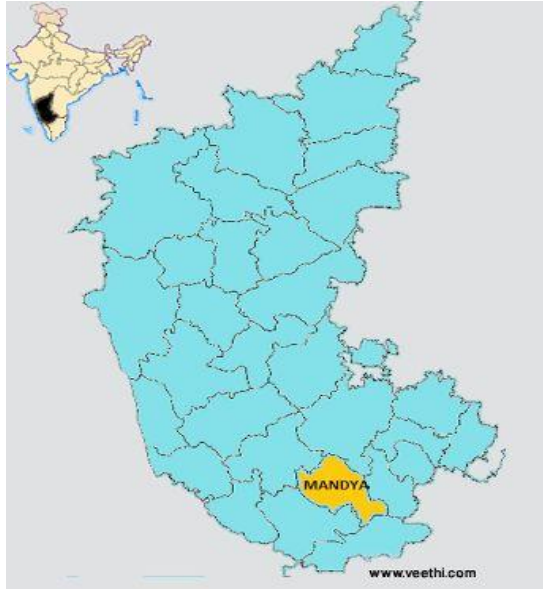
**Keywords:** Geological Condition of Melukote; Weathering Condition; Physical Properties of Rocks and Minerals.

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### 1. Introduction

During the geological investigation on 11 February 2017 near the New Tank Project Site in Melukote, Pandavapura Taluk, Mandya District, Karnataka state as shown in the Figure below

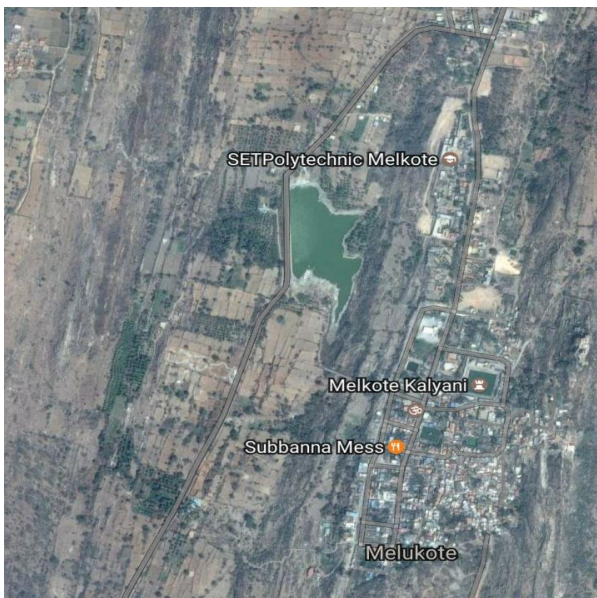
found Foliated & Non foliated rock, Foliated schist, Sedimentary rock (Breccia), Metamorphic rock, Mica sheets, Mica schist, Pink granite gneiss rock, Biotite & Muscovite (Mica minerals), Sillimanite together with metapelitic rock.



## 2. Materials and Methods

### 2.1. Study Area

The geological area 12°39'N 76°40'E / 12.65°N 76.67°E Melukote is located in Pandavapura Taluk, Mandya district, Karnataka state, India. It is mainly made up of gneiss, amphibolite and close pet granite, and some places granite rock intruded into gneisses. Among the different rock types gneiss are predominant.



## 2.2. Materials

Minerals and rock samples were collected in and around the Melukote Region to find out the specific mineral and rock present in that area. The samples were collected for the study of physical properties of minerals i.e. state, cleavage, hardness, specific gravity and chemical composition in geological laboratory.

## 2.3. Methods

Rocks and minerals samples were analyzed for physical and chemical parameters like Lustre. The Lustre of a mineral is its appearance in a reflected light. The cleavage of mineral is its tendency to split along certain parallel planes producing more or less smooth surface. The hardness of a mineral is the resistance it offers to abrasion, which is determined by observing the comparative ease or difficulty in scratching it with another mineral of known hardness (Mohr's scale of hardness). A mineral shows various shapes, which depend upon the internal structure, specific gravity and weight of the specimen of the minerals [2]. Analyzed minerals and rocks are confirmed as Biotite, quartzite, muscovite schist, fuchsite phyllosilicate.

## 3. Results and Discussions

The rocks and minerals has undergone physical, chemical and biological weathering, the samples found has the physical properties were shown in the Figure 1.



Figure 1: Physical structure of rock

### MICA

The mica group of sheet silicate (phyllosilicate) minerals includes several closely related materials having nearly perfect basal cleavage. Mica is the general group name for several complex hydrous aluminum silicate minerals [3]. All are monoclinic, with a tendency towards pseudo hexagonal crystals, and are similar in chemical composition. The nearly perfect cleavage, which is the most prominent characteristic of mica, is explained by the hexagonal sheet like arrangement of its atoms.

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Properties	Muscovite Mica (White Mica)
Form	Foliated
Colour	White colour
Streak	Colourless
Diaphaneity	Transparent
Lustre	Pearly
Cleavage	Present
Fracture	Even
Hardness	Medium
Specific Gravity	Medium
Chemical composition-	Silicate of Al and K
Occurrence.	Occurs in igneous and metamorphic rocks
Uses	Used as an insulating material in Electrical Apparatus Mica powders are used in mica bricks, steel plants, lubricants, filter in paints, rubber, plastic materials, wall papers, etc

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### CLASSIFICATION

Chemically, micas can be given the general formula,  $X_2Y_4 - 6Z_8O_{20} (OH, F)_4$ . In which, X is K ( i.e., Potassium ), Na ( i.e., Sodium ), or Ca ( i.e., Calcium ) or less commonly Ba ( i.e., Barium ), Rb ( i.e., Rubidium ) or Cs ( i.e., Caesium ) Y is AL ( i.e., Aluminium ), Mg ( i.e., Magnesium ) or Fe ( i.e., Iron ) Z is chiefly Si ( i.e., Silicon ) or Al ( i.e., Aluminium ), but also may include  $Fe^{3+}$  or Ti .

Structurally, Micas can be classed as Di-octahedral (Y=4) and tri-octahedral (Y=6). If the X ion is K or Na, that is common mica, whereas the mica is classed as a Brittle Mica. Here in the Melukote region during the Geological investigation found Di-octahedral Mica i.e., Muscovite and Tri-octahedral Mica i.e., Biotite. Di-octahedral muscovite is most commonly used mica [4].

**SEDIMENTARY ROCK**

In Melukote region the sedimentary rock i.e., BRECCIA is found near the New Tank Project site.

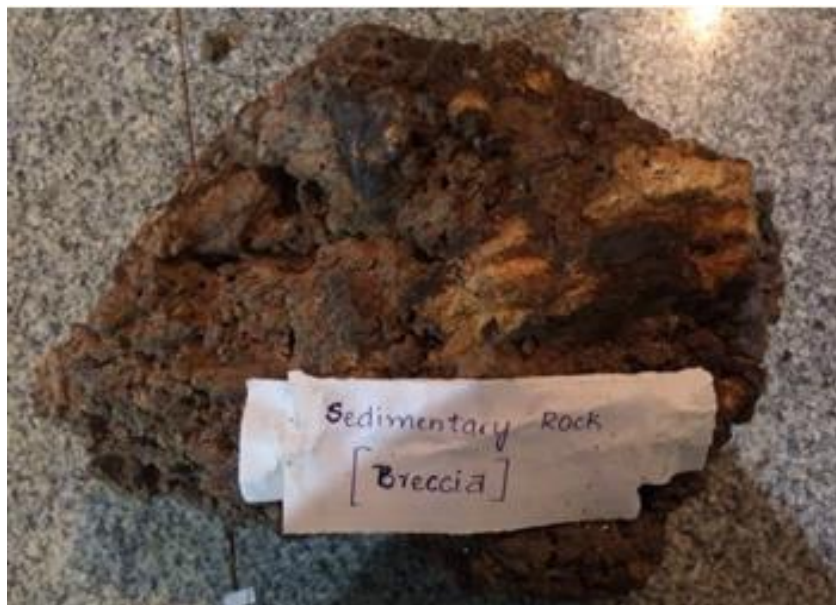
Sedimentary rocks are formed by the deposition and subsequent cementation of that material at the earth’s surface and within bodies of water. Sedimentation is the collective processes that cause mineral and/or organic particles (detritus) to settle in a place. To trace their lines of descent and to reconstruct the environment which give rise to the sedimentary rocks are difficult tasks [5].

**BRECCIA**

Breccia is rock comprised of angular fragments of pre-existing rocks, known as clasts, within a finer grained matrix. Rocks with rounded clasts are known as conglomerates. Breccia is characteristic of the deposition of clasts with minimal transport or in-situ fragmentation.

Breccia can be described as monomict if they contain clasts of only one rock type, oligmict if their clasts are several rock types or polymict if their clasts comprise of many rock types. They can be either clast-supported or matrix supported. Clasts can also be described as intraformational or extraformational depending on whether they are derived from the same geological unit as the breccia.

<b>Properties</b>	Breccia
Color	Light color
Grain size	Rudaceous
Minerals present	Angular pebbles
Cementing material	Siliceous (much quantity quartz)
Mode of origin	Mechanical
Engineering uses	Used as ornamental stone



**METAMORPHIC ROCK**

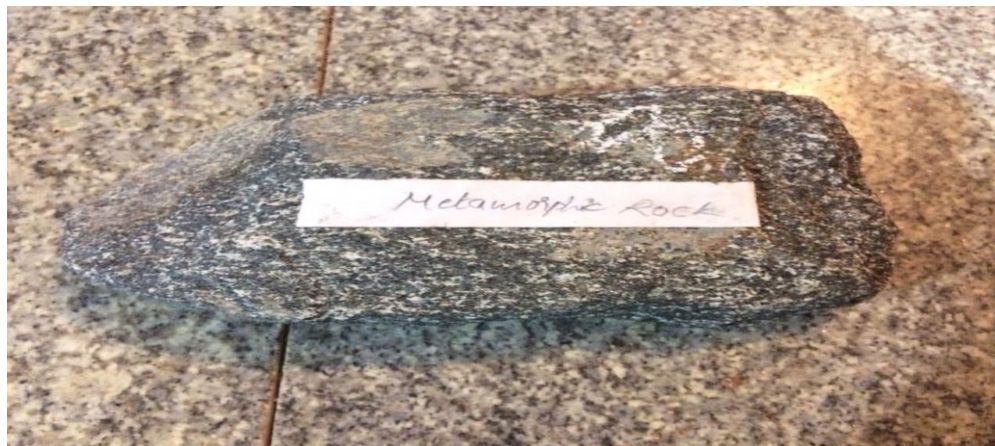
Metamorphic rocks arise from the transformation of existing rock types, in a process called “Metamorphism“, which means change in the form. The original rock is subjected to heat and pressures (temperatures greater than 150°to 200° and bars 1500 bars ), causing profound physical and/or chemical change. The protolith may be a sedimentary rock, an igneous rocks or another older metamorphic rocks. The most important typical metamorphism transforms sedimentary rocks by addition of heat during mountain building or by a large volume of magma in crust [6].

**METAMORPHIC MINERALS**

Metamorphic minerals are those that form only at the high temperatures and pressures associated with the process of metamorphism. These minerals known as index minerals include sillimanite, kyanite, staurolite, andalusite and some garnet.

Other minerals such as olivines, pyroxenes, amphiboles, micas, feldspars and quartz may be found in metamorphic rocks, but are not necessarily the result of the process of metamorphism.

Properties	Schist	Gneiss	Quartzite
Color	Dark	Alternate layers of dark and light	Light
Structure	Schistose	Gneissose	Granulose
Minerals present	Flaky minerals such as muscovite, Biotite hornblende, chlorite, talc etc. Depending upon the type of flaky mineral present the schist's are described.	Quartz, feldspar, Biotite, hornblende.	Quartz small amount of mica, tourmaline, graphite and iron minerals
Engineering uses	Schist being weak rock, are not used for important works	Used as a road metal and Concrete aggregates	Extensively used as a road metal and concrete aggregates



## SILLIMANITE

While investigating in and around the New Tank Project site in Melukote region we found sillimanite together with metapelitic schist. Sillimanite is an alumina-silicate mineral with the chemical formula  $Al_2SiO_5$ . Sillimanite is named after the American chemist Benjamin Silliman (1779-1864). It was first described in 1824 for an occurrence in Chester, Middlesex county, Connecticut, US. Sillimanite minerals are group of naturally occurring anhydrous aluminum silicates [7].

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<b>COLOUR</b>	Colourless or White to grey, brown, yellow, yellow-green, grey-green, blue-green, blue, colourless in thin section.
<b>CRYSTAL HABIT</b>	Prismatic crystals, Fibrous, Acicular.
<b>LUSTRE</b>	Vitreous to Sub adamantine, silky.
<b>DIAPHANEITY</b>	Transparent to translucent.
<b>PLEOCHROSIM</b>	Colourless to pale brown to yellow.
<b>FRACTURE</b>	Splintery
<b>STREAK</b>	White
<b>TENACITY</b>	Tough

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## OCCURRENCE

Sillimanite is one of three alumina-silicate, polymorphs the other two being andalusite and kyanite. A common variety of sillimanite is known as Fibrolite. So named because of the mineral appears like a bunch of fibres twisted together when viewed in thin section or even by the naked eye. It is an index mineral including high temperature but variable pressure.

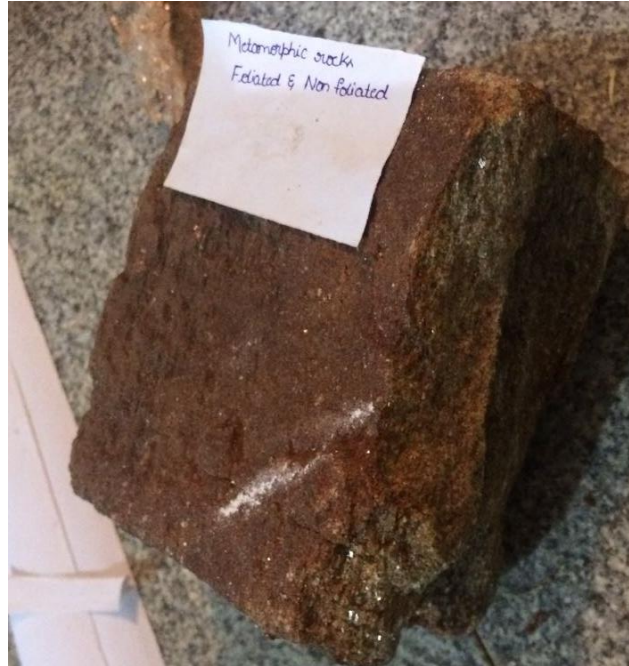
## USES

Sillimanite minerals are mainly utilized in the production of mullite or high alumina refractory's 95% of the worlds consumption of these minerals is used for the purpose in manufacture of the metals, glass, ceramics and cement.

## **FOLIATED METAMORPHIC ROCKS**

When mineral crystals arrange themselves in bands or layers it is called Foliation. Foliated metamorphic rocks tend to break along their mineral crystal bands.

When existing rocks like granite are placed under great pressure foliated metamorphic rocks are formed like gneiss. Under this great heat and pressure the minerals in the rock smelt and recrystallize into minerals that form bands.



## **NON FOLIATED ROCKS**

A Metamorphic rock that does not have its minerals arranged in bands is called Non Foliated. Non Foliated metamorphic rocks do not break in layers. Marble is formed from limestone and shows large calcite crystals. Quartzite is formed from sandstone and shows large quartz crystals.

### **QUARTZITE**

Quartzite is a hard, non-foliated metamorphic rock which was originally pure quartz sandstone. Sandstone is converted into quartzite through heating and pressure usually related to tectonic compression within orogenic belts. Pure quartzite is usually white to grey, though quartzites often occur in various shades of pink and red due to varying amounts of iron oxides ( $Fe_2O_3$ ). The Calcareous rocks of Daruli, Sawar and Quartzite of Rajmahal area also included in Shilwara supergroup [8].

### **Applications**

Because of its hardness and angular shape, crushed quartzite is often used as railway ballast. Quartzite is a decorative stone and may be used to cover walls, as roofing tiles, as flooring and stair steps. It is also used as counter tops in kitchen. Crushed quartzite is sometimes used in road construction.

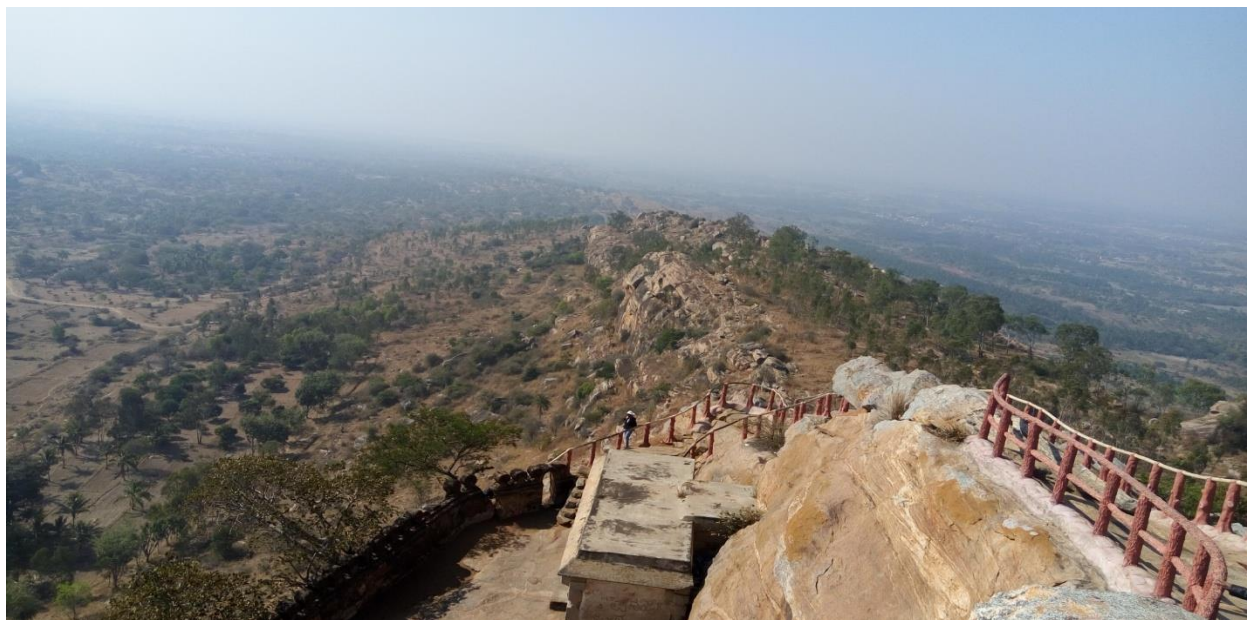




#### 4. Conclusions

During geological investigation joints, fractured rock, faults planes were present. These area should be treated before starting up any civil engineering projects such as construction of Dams, bridges, building. Small hilly regions were present may be formed due to plate tectonic movement during continental collision. The present study indicates that the rocks had undergone weathered condition and these rocks are not suitable for construction of basement structures dams or bridges, high rise buildings but it can be used for road ballast and also as an admixture in concrete. Mica was abundantly present in MELUKOTE this can be used for electrical apparatus. Mica powder is used in mica bricks, steel plants, lubricants, filter in rubber plants, plastic materials, wall paper, etc. Granite was semi metamorphosed to gneiss. Quartzite can be extracted economically. Granite gneiss can be used for building facings.





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