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Petrographic analysis at Lojing, Gua Musang Kelantan

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Abstract. A petrographic analysis was conducted to identify the mineral contents containing in the rock samples collected at study area located in Lojing, Gua Musang. The geology of the study area consists of metasedimentary rocks. There are six hand specimens collected and analysed using petrographic microscope. The limestone and carbonate rock is found at the study area. It has been subjected to some stress to such an extent that some of the grain boundaries have been modified by pervasive pressure solution of stylolites. Pressure solution is the process whereby this limestone has undergone selective dissolution to the extent that the grain boundaries were modified into thin dark n sutured seams. The rocks contain also microcrystalline to cryptocrystalline silica clasts which occur dispersed throughout the matrix. The petrographic analysis results show that the minerals contain in the six rock samples are micrite, bioclast, microspars, deformed quartz, K-feldspar, lithic and clayey carbonate lithic. The major minerals contained in the rocks are micrite and bioclast.

1. Introduction

Petrography is a branch of petrology that focuses on detailed descriptions of rocks including the mineral content and the textural relationships. It is also defined as the systematic description of geological materials, their composition and organization, in hand specimens and thin sections [1]. Geological materials such as various types of igneous, sedimentary and metamorphic rocks are diverse in both composition and structure. These properties have been distinguished and repeatedly exploited by people in the past based on their own culturally specific interpretations of the natural world. The detail analysis of minerals by optical mineralogy in thin section and the micro-texture and structure are critical to understanding the origin and history of the rock. Hand specimen descriptions and detailed and accurate core logging in exploration are vital, but a wealth of extra information on alteration and paragenetic sequences can be obtained by the old practice of slicing a 30 micron section of rock and analysing it under a petrographic microscope [1].

Petrography includes key analytical techniques used in modern science for identifying and characterizing rocks and sediments based on their mineralogical compositions and structures. Petrography is a technique commonly used in geology to describe and classify rocks [2]. This study aims to identify the mineral contents containing in the rocks at study area through the polarized microscope.

2. Geological setting

The study area located at 101˚46’1.5” E - 101˚48’31.8” E longitude and 4˚47’27” N - 4˚49’57” N latitude (Figure 1). The study areas are covered by palm plantation and rubber tree plantation that can be access by route of Gua Musang- Cameron Highlands. Gua Musang area lies in the middle of the Central Belt of the Peninsula Malaysia. Regional faults cross the area in general directions of the north – south. Some distribution rock units followed the direction of these regional faults. The Permian strata of the Central Belt are very well developed in southern Kelantan and northern Pahang. Most of them belong to the Permo-Triassic Gua Musang Formation which consists of mainly of three facies, which are limestone, volcanic and argillaceous facies.

In the western part of the Central Belt are Upper Palaeozoic rocks of the Gua Musang and Aring Formations in south Kelantan and Taku Schist in east Kelantan [3]. Gua Musang area comprises of Gua Musang Formation and Gunung Rabong Formation. Gua Musang Formation as mapped by [4] stretches to north Kelantan and southwards to north Pahang and is overlain unconformably by Gunung Rabong Formation. The age of this formation is Middle Permian to Late Triassic. The upper part of Gua Musang formation interfingers with Semantan Formation, Telong Formation, and Gunung Rabong formation. Four lithology had been identified which is calcareous facies, argillaceous facies, arenaceous facies and the volcanic facies. The depositional environment of this formation is a shallow marine shelf deposit with an active volcanic activity [5]. The thin bedded, laminated and fissile shaleis usually grey in colour but it is black when carbonaceous. It is occasionally associated with dark-grey to black bedded chert [6].

Gunung Rabong Formation is an argillaceous succession of age Middle Triassic to Upper Triassic which exposed between Gua Musang and upper reaches of Sungai Relai-Sungai Aring. The Gunong Rabong Formation is formed by argillaceous succession of crystal tuff, shale, quartzite, and minor conglomerate [4]. At the southern area, the lithology is alternation of shale and quartzite and minor conglomerate, meanwhile, black shale and crystal tuff is dominant at the northern area.

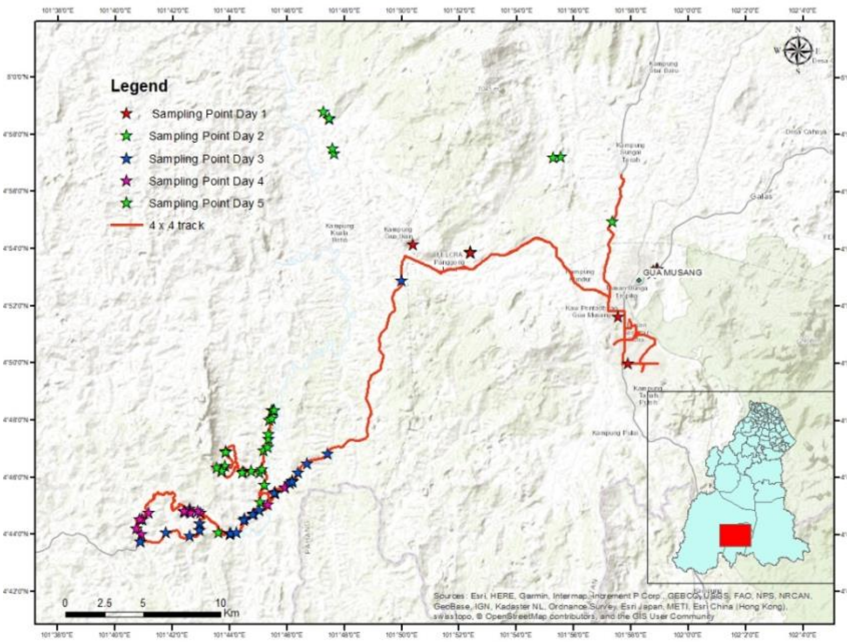

Figure 1. Location map of study area located at Lojing, Gua Musang.

Based on [7] lava flows are very subordinate. Flow banded spherulitic rhyolite trachyte, trachyandesite, and andesite lavas are associated with shale and water-deposited tuff and probably were extruded on the sea floor. To the west of Gua Musang town, in Kuala Betis area, rocks similar to and identified as the Gua Musang Formation, overlie a conglomerate-sandstone sequence conformably [8, 9]. The calcareous rocks become the most extensive facies of the Gua Musang Formation, with widespread development in Middle Permian and Triassic times [4]. Limestone in Gua Musang are estimated constitutes about 80% of the total rocks exposed in the Gua Musang – Merapoh area, but decreased rapidly towards the north and south [10].

3. Methodology

The method of this study is divided into two part. The first part was fieldwork or geological mapping (lithology, geomorphology and structural mapping) and the results had been interpreted using the ArcGIS software. Rock samples were collected during the fieldwork for further analysis in the laboratory. The location of each samples and details for geological data such as color, grain size and texture had been taken, by marking the position using Global Positioning System (GPS). The lithostratigraphy analysis data had been done by sedimentary logging method to correlate the rock strata hence to interpret the depositional environment. The second part was the laboratory works, where the rock samples had been processed following the standard thin section preparation method and observed under the polarized microscope for details interpretation. The detail interpretation of the rocks will be discussed in this paper with the name of each rock samples.

4. Results and Discussion

4.1. Sample 1

Figure 2 shows the petrographic texture of rock sample and labelled as biomicrite The characteristics of this specimen is a very fine grained limestone composed of calcite with minor dolomite, trace amounts of cryptocrystalline quartz and finely interspersed brown-reddish iron. The rock considered as having micritic matrix supported textures and contains bioclastic fragments. Microcrystalline to cyptocrystalline silica clasts occur dispersed throughout the matrix. Elsewhere, microsparitic calcite is also present. The limestone also showed an alteration of neomorphism in which some of the micrite cement was transformed into coarser size. This neomorphic spar has an irregular boundary and no sign of compaction or stress found in this rock.

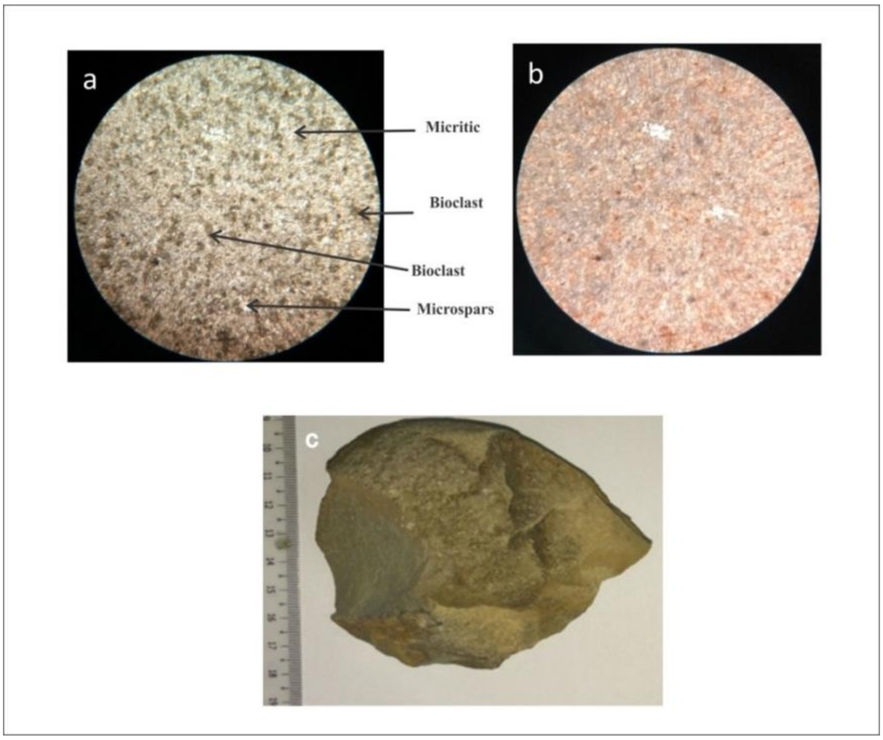

Figure 2. Petrography textures; a) Crossed polarized, b) Plane polarized view of the sample with field of view equal to 3.5mm, c) Hand specimen of limestone.

4.2. Sample 2

This inequigranular coarser grained granofels composed of quartz and opaque minerals. This granofels is composed mainly of quartz formed under high pressure metamorphism of a quart-rich protolith. The texture is significantly showed polygonal with triple junction. The boundary of the quartz crystral is mainly straight and exhibit undulatory extinction. Figure 3 shows the crossed polarized and planar polarized view of the sample with field of view equal to 3.5mm and hand specimen of granofels.

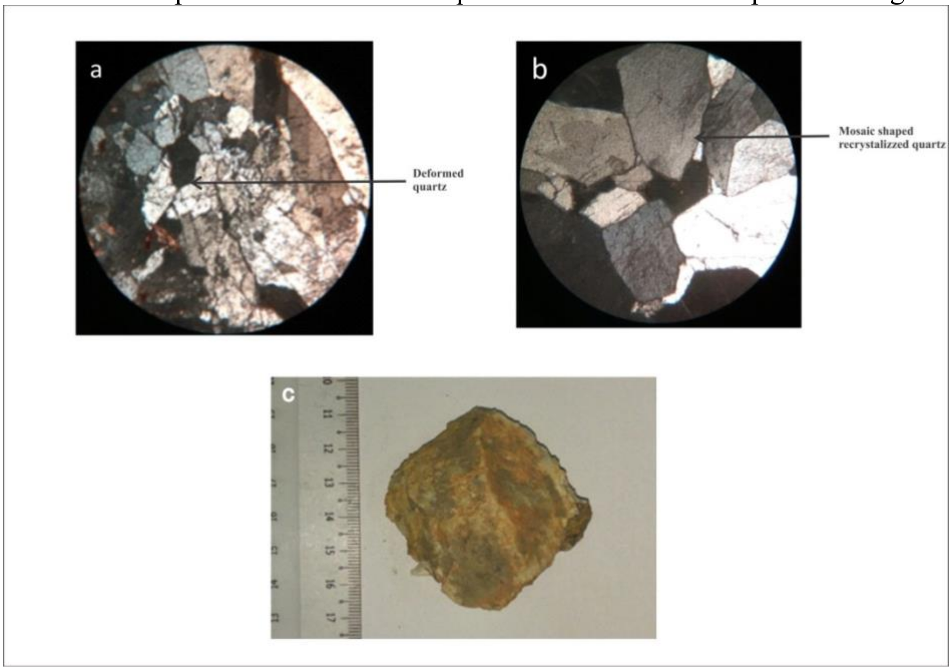

Figure 3. Petrography textures; a) Crossed polarized, b) Plane polarized view of the sample with field of view equal to 3.5mm, c) Hand specimen of granofels.

4.3. Sample 3

Figure 4 shows the mylonite hand specimen and its petrographic textures. This rock composed of quartz, k-feldspar, chlorite and sericite. The rocks present a mylonitic texture, in which a preferred orientation is also found. An intense deformations texture were showed by the presence of quartz's subgraining that surround the k-feldspar grains. The boundaries of the grains are serrated and slightly interlobate. Felsdspar shows fracturing and patchy extinction. The intergranular spaces are filled with micro-cryptocrystalline quartz. Most of the cracks are lined by brown-reddish iron oxide.

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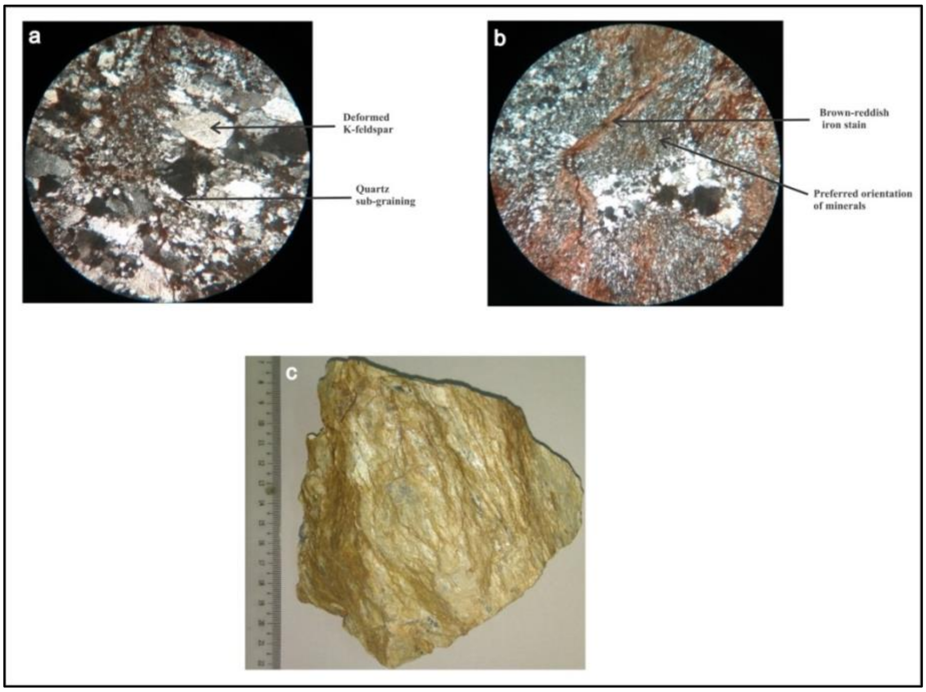

Figure 4. Petrography textures; a) Crossed polarized, b) Plane polarized view of the sample with field of view equal to 3.5mm, c) Hand specimen of mylonite.

4.4. Sample 4

Figure 5 shows the hand specimen of carbonate rock and its petrographic textures. It is a dense carbonate rock, grey on fresh surfaces with irregularly distributed pink patches about 1-2 mm in diameter, and weathers brown. The physical aspect of the rock is consistent with a clastic origin. This rock composed of micro crystalline limestone, greyish in color and the composition is dominated by micrite cements, calcite minerals size 0.05 to 0.35mm, lithics and opaque minerals (0.05 to 1.00 mm). Matrix supported and most of cavity porosity (inter and intraparticle) filled by micrite (70%). The micrite appeared as colorless, relief varies and measuring less than 0.02nm. Calcite grains occupied about 10% of the total volume, appeared as colorless grain, moderate relief, 0.02 to 0.2 mm grain size, double refraction extreme and equally present in the incision. Opaque minerals (5%) appeared as black grains, isotropic, high relief, 0.05 to 0.08 mm grain size and its related to Fe oxide minerals. Lithics (10%) found as gray to brownish grains, in the form of carbonate fragments and anhedron in shaped. Skeletal particles or bioclast presence not more than 5%, colorless and structurally not well preserved. The bioclasts are partly filled with sparry calcite and crystocrystalline silica. This limestone shows that the matrix is fine pseudospar. It is cloudy and contrasts with the coarsed infilling. Pore space in this limestone partially infilling by micritic sediments and ferroan ccalcite cement and its primary posity can be classified as intragranular porosity. The petrography textures of this rock illustrates that this limestone considered as not highly compacted and has not subjected to pressure solution mechanism.

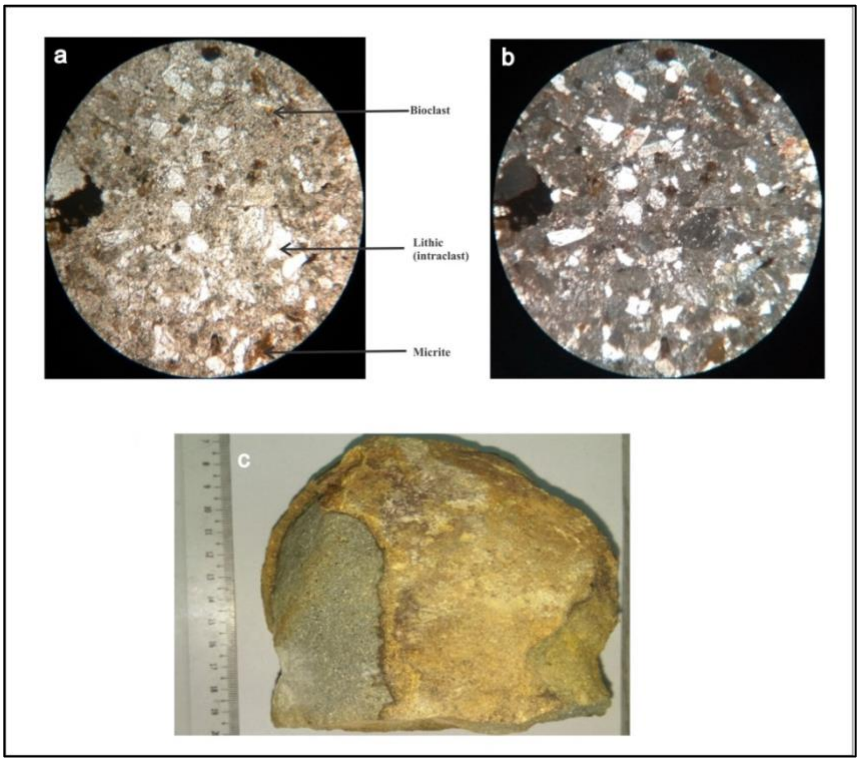

Figure 5. Petrography textures; a) Crossed polarized, b) Plane polarized view of the sample with field of view equal to 3.5mm, c) Hand specimen of carbonate rock.

4.5. Sample 5

In this grey limestone , most of the carbonate minerals are in sub to anhedral form and considered as non-skeletal or non allochems in nature (Figure 6). This rock is matrix-supported, in which its composed a mixture of carbonate mud of micrite and sparry calcite cement. Calcite crystals of sparite have seen as subhedral in shape, colourless in plane polarized light and have low relief. This limestone has been subjected to some stress to such an extent that some of the grain boundaries have been modified by pervasive pressure solution of stylolites. Pressure solution is the process whereby this limestone has undergone selective dissolution to the extent that the grain boundaries were modified into thin dark n sutured seams. The rocks contains also microcrystalline to cryptocrystalline silica clasts which occur dispersed throughout the matrix. In particular the micritic material of this limestone is only slightly transformed into coarser calcite of microspar size. The matrix still appeared as cloudy and showed its micritic relicts.

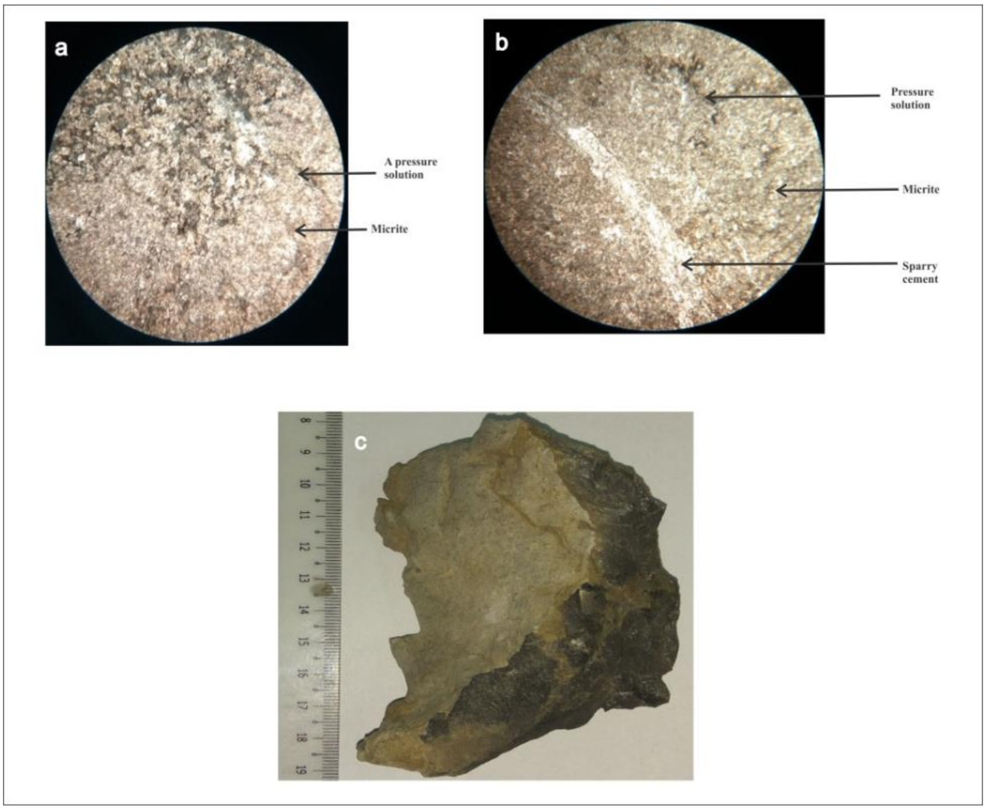

Figure 6. Petrography textures; a) Crossed polarized, b) Plane polarized view of the sample with field of view equal to 3.5mm, c) Hand specimen of limestone**.**

4.6. Sample 6

These grayish rocks have a massive appearance and composed with fine grained minerals that are exhibiting subhedral form (Figure 7). The rock considered as fine to medium grained limestone and its can be classified as grain-supported. The rock is composed of micritic calcite, abundant detrital lithics and also clayey carbonate grains. The micrite is colorless, relief varies, measuring less than 0.02mm and it showed very high color interference. The detrital lithics composed of grayish, brown in the form of carbonate rock fragments, 0.3-0.5mm grain size and irregular in grain shape. Most of large lithics shows an internal reworked structure and the micritic cement were binding the grains together. There is also some ferroan calcite cement found in the matrix. The limestone shows uncompacted fabrics and has not undergone pressure solution.

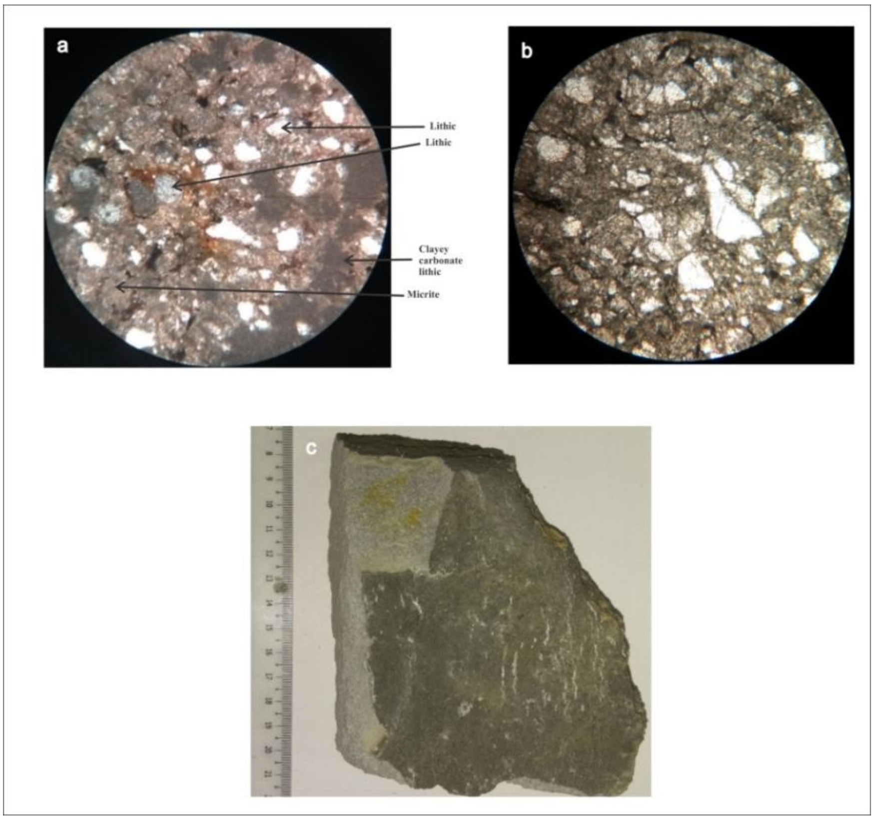

Figure 7. Petrography textures; a) Crossed polarized, b) Plane polarized view of the sample with field of view equal to 3.5mm, c) Hand specimen of limestone.

5. Conclusion

Data acquisition begins with a hand rock sample from the outcrop. The six hand specimen rock samples has been analyzed and interpreted by using a petrographic microscope. There are many types of mineral identified in each rock samples collected such as micrite, bioclast, microspars, deformed quartz, K-feldspar, lithic and clayey carbonate lithic. Some of the lithology considered as fine to medium grained limestone and its can be classified as grain-supported.

Acknowledgments

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