PETROGRAPHY OF MIOCENE SANDSTONES IN THE PYAWBWE AREA, MINBU TOWNSHIP

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Abstract

Miocene clastic sedimentary rocks exposed in the Pyawbwe area of Minbu Township occupying the western trough of Central Cenozoic Belt. This mollassic sequence consists of Pyawbwe Formation (Aquitanian) and Kyaukkok Formation (Burdigalian) of Upper Pegu Group (Miocene). The present research mainly focuses on petrography of Miocene sandstones. The sandstones of the study area mainly composed of quartz, feldspar, rock fragments, glauconites, chlorite, mica, bioclasts grains, accessory minerals and cements. Petrographically, the majority of sandstone of the study area are arkose, lithic arkose and feldspathic lithicarenite. The sediments of the study area are derived from dissected arc and transitional arc to undissected arc provenances. The early diagenetic features such as grains compaction, distortation of mica, broken shell fragments, grains compaction of cacitization and glauconization well marked. Late diagenetic features are formation of concretion and nodules, corrosion of grain and iron oxide pigmentation.

Keywords: Central Cenozoic Belt, Mollassic, Miocene

Introduction

The study area is situated in the west of Minbu Township, Magway Region. It lies between latitudes 19° 51′ 00" N to 20° 04′ 00" N and longitudes 94° 37′30" E to 94° 47′ 00" E in topographic map index 84 L/12, 85 I/ 9 and 85/I13 of Myanmar Survey Department (Figure 1). The area is 21.12 km long along the north to south and 16.72 km wide along the east to west. The total areal coverage is 353 square kilometers. The sandstones of the present area are mollassic clastic sediments. The Miocene sandstones constitute about 68 to 83% of detrital grains and 17 to 32% of cements in Pyawbwe sandstones and 78 to 87% of detrital grains and 13 to 22% of cement in Kyaukkok sandstones. These sandstones are composed of quartz, feldspar, mica, heavy minerals and rock fragments. The maximum detrital grains are 1.35 mm in diameter and 0.25 mm in the minimum diameter. The grain to grain boundaries are tangential, long and suture contact. Modal composition of the detrital grains in shown in table(1). The detrital grains of the Lower Miocene sandstones are mostly sub-angular to sub-rounded, medium to coarse-grained arkose, lithic

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arkose and feldspathic lithiarenite. (After Folk, 1974) see Fig. (2).I would like to aim that the study of the source rock types are suggested by sandstone composition and the provenance terrain from sandstone modal data.

Methods

Fifty sandstone samples were collected from the stream outcrops of the Pyawbwe and Kyaukkok Formations mainly exposed in western part of Minbu Basin. Standard petrographic thin sections for twenty medium-grained sandstones were cut and examined out of which ten of thin sections were selected and analyzed using a modified Gazzi-Dickinson method of point counting (Gazzi, 1996; Dickinson, 1970, 1985; Ingersoll et al., 1984). A total of 300 – 400 framework grains were identified per thin section for QFL mode and lithic population at spacing of 0.5 mm. The medium-grained sandstones were selected for the provenance study in point counting data because sand grains control on their composition.

Petrographic counting parameters are presented in table 1. Point count raw data are shown in appendix and the data recalculated and resulting modes and lithic percentages appear in Table 2. Four types of triangular plots were constructed from these data. The QFL plots of McBride (1963) and Dickinson (1985) are used for classification and provenance study. Moreover, the triangular plots of Dickinson (1979, 1985); Qm-P-K, Qm-F-Lt, and Lm-Lv-Ls plots are applied as the useful indicators for distinguishing provenances.

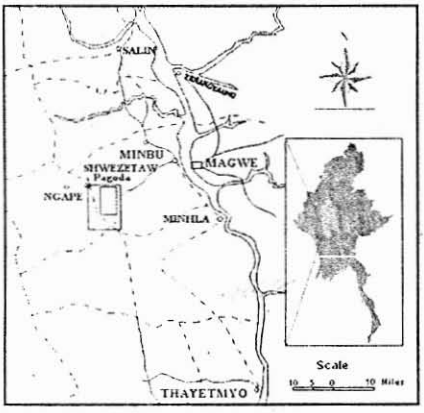

Figure (1) Geographic position of the study area

The detrital framework grains

Quartz

Detrital grains of quartz average about 30 to 39% of detrital fraction. Different types of quartz occur in Kyaukkok sandstones and Pyawbwe sandstones. Generally, monocrystalline quartz grains are more common than polycrystalline quartz grains. Monocrystalline quartz grains consist about 17 to 24 % of Kyaukkok sandstones and less than 10% of Pyawbwe sandstones.

Polycrystalline quartz derived from igneous and metamorphic fragments which are average about 1 to 10% respectively. The grains are mostly elongated or flattered and have a parallel crystallographic orientation. The metamorphic quartz is more elongated than igneous origion The inclusions in the monocrystalline quartz grains are muscovite, rutile and tourmaline and they show undulatory extinction with extinction angle between 5 ft and 25 ft. The monocrystalline quartz average 0.1 mm to 0.9 mm in size whereas polycrystalline quartz grains range from 0.3 mm upto 0.8 mm in diameter.

Feldspar

The detrital grains of feldspar are averaging about 25 to 50 percent of the detrital framework. Both alkali feldspar and plagioclase occur in Lower Miocene sandstones. Generally orthoclase including microcline is more than plagioclase but microcline is a very few amount of Pyawbwe sandstones. Kyaukkok sandstone is absent of microcline.

Most of the feldspars show sub-angular to sub-rounded, sub-equant to elongated shape and a few plagioclase grains exhibit undulatory extinction. Orthoclase feldspars are absent in twinning. Polysynthetic twin lamellas are distinct in plagioclase.

Rock fragments

The most abundant type of igneous rock fragments is volcanic grains which consist of andesitic fragments with parallel to sub-parallel feldspar laths in the altered fine-grained groundmass.

The second most abundant type of rock fragments is foliated metamorphic grains consisting of chlorite schist, quartz muscovite schist, chlorite phyllite and slate. Most of the sizes are ranging from 0.5 to 1.2 mm in diameter with subrounded and range in 0.15 to 0.58 mm and coated by iron oxide cement.

Mica

Biotite is more common than muscovite and they comprise about 0.55 to 3.1 % of detrital fraction. They are fresh to slightly weathered and subangular to subrounded in shape. The biotite is considerably altered sericite and mostly altered to chlorite, glauconite and iron oxide. Biotite flakes are bifurcated by introduction of calcite cement due to effect of compaction, mica flakes are bent. Some mica flakes are generally oriented parallel to sub-paralle and frequently occurred distorted crenulated nature.

Accessory minerals

The dominant accessory minerals are biotite, chlorite, muscovite, hornblende, augite, pyrite, tourmaline, zircon, serpentine and hematite as well as phosphate and glauconite are also present.

Glauconite and pyrite occur in Pyawbwe sandstones.

Chlorite, glauconite and iron oxide are probably altered from biotite and clay minerals (see Galliher, 1936).

The sandstones of Pyawbwe Formation are mostly composed of less than one to two percent and Kyaukkok sandstones consist of one to three percent.

Cement

In Miocene sandstones, calcite and iron oxide (hematite) cements are more abundant than others. They comprise about 17-32% of Pyawbwe sandstones and 13-21% of Kyaukkok sandstones. The calcite cement composes about 35 to 70 % in all cement types of the sandstones. Occasionally the cement occurs as poikilolitic texture and filled the pore spaces and some voids remain and the calcite crystals have subequant in shape and finely crystalline to medium crystalline (0.02 to 0.9 mm) in size.

Iron oxide cement is also occurred in the fossiliferous lithic arenite of Pyawbwe sandstones and Kyaukkok sandstones as well as inclusion in the calcite cement also present.

Silica cement is formed as quartz overgrowth on detrital grains and they compose about 10 to 15% in all cement types of the Lower Miocene sandstones. Quartz overgrowth formed as the first generation of cement and latter followed by calcite cement which marginally replacement the quartz overgrowths.

Bioclast

Most of the molluscan debris are usually leached and their molds are filled with calcite cement. Echinoids fragment is coating with iron oxide which mainly consist about 5% in the biogenic fragments. Foraminifera fragments especially echinoid spines are filled with sparry calcite cement. Larger foraminifera such as *Lepidocyclina* sp. are mainly composed with original calcitic materials and the microfossils of *Globigerinoides* sp. are also present Pyawbwe sandstones and Kyaukkok sandstones.

Table(1) Detrital percentages of the Lower Miocene sandstones exposed in the Pyawbwe area.

Sample No.	Quartz	Feldspar	Rock Fragment	Formation
T-mk_1	31.86	28.21	39.91	Kyaukkok Formation
T-mk_2	30.92	52.09	16.45	Kyaukkok Formation
T-mk_3	32.68	29.38	37.92	Kyaukkok Formation
T-mk_4	38.20	40.32	21.46	Kyaukkok Formation
Average	36.73	37.50	28.79	Kyaukkok Formation
T-mp_1	39.67	50.62	9.72	Pyawbwe Formation
T-mp_2	39.67	50.62	9.72	Pyawbwe Formation
T-mp_3	37.53	35.33	27.13	Pyawbwe Formation
T-mp_4	34.44	43.88	21.66	Pyawbwe Formation
Average	36.73	45.10	18.16	Pyawbwe Formation

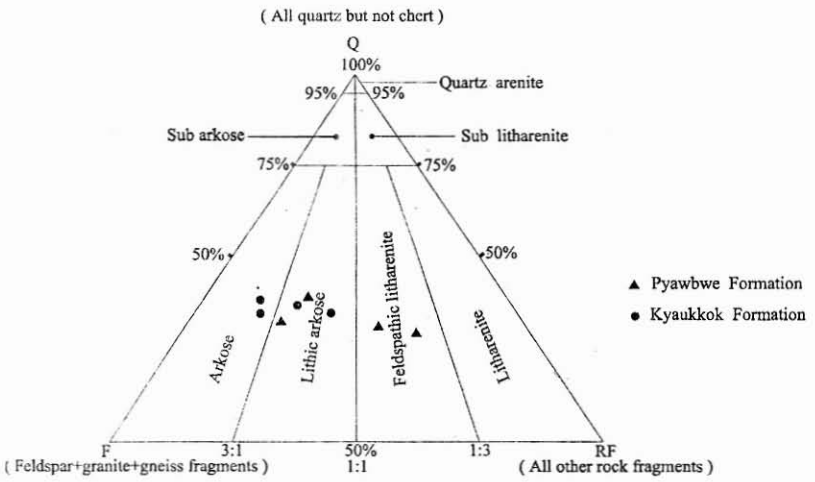

Figure (2) To show the composition of Miocene sandstones exposed in the Pyawbwe area. (After Folk . 1974)

The indicated provenance of the sandstones

The detrital composition of sandstones influenced the tectonic setting of its provenance region. Dickinson (1985) distinguished four major provenance terranes: stable craton, basement uplift, magmatic arc and recycled orogen. Provenance and basin are governed by plate tectonics, which controls the distribution of the different types of sandstones (Dickinson & Suczek, 1979). The studies of sandstones within western Minbu basin can be used to unravel the geological history of the provenance terrain. Point count data of the sandstones are recalculated and plotted on QFL, Q_mPK, $QmFL_t$ and L_m L_v L_s triangular plots of Dickinson (1979, 1985) clearly demonstrated that the Pyawbwe sandstones and Kyaukkok sandstones fall within the suites of transitional to dissected and undissected magmatic arc provenances (Figure 3 to 6, and Table 2).