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Preliminary report on the study of the rock units exposed along the Mongla - Kengtung - Tarchileik road section, Eastern Shan State

Khin Khin Lin

Abstract

The study area lies in and Kengtung andTarchileik Townships, in the easternmost part of the Shan State. This study mainly deals with the lithostratigraphy and petrography of the rock units exposed along the Kengtung-Tarchileik-Mongla car road. The lithostratigraphic units exposed in the study area are clastic sedimentary rocks, granitoid rocks and metamorphic rocks.

The distinctive sedimentary rock units are Loi Mwe red sandstones. They are pinkish to reddish, medium-grained ferruginous sandstone and quartz arenite. These red sandstones are unconformably overlained by the yellowish brown sandstone. According to the tectonostratigraphic study of the northwestern Thailand and southwestern China, the study area falls in the Chainging Belt. These sandstone beds can be regarded as the Jurassic-Cretaceous age and can be correlated with the Kalaw Red Bed.

Large bodies of granitic rocks exposed in the study area might belong to the so- called Eastern Granitoid Belt of Myanmar. These igneous rocks are intruded into the sedimentary sequences. The granites are usually coarse-grained and mineralogically very similar throughout the entire region. They are two-mica granites containing abundant orthoclase (± microcline), plagioclase, biotite, muscovite and minor hornblende. Accessory minerals are rarely present. The age of these granites as determined by U/Pb dating method of Laser ICP-MS yields 216 ± 6 and 224 ± 4 m.y.

Low-grade meta-sedimentary rocks such as chlorite schist, phyllite, slate and metagreywacke are sporadically exposed and are found to be intruded by granites.

Introduction

The present study area lies in Kengtung and Tarchileik Townships in the easternmost part of the Shan State close to the borders with China, Thailand and Laos (Fig. 1). Despite the fact that the area is accessible by air from Mandalay to Kengtung and Tarchileik, and the car road connecting Mongla, Kengtung and Tarchileik can be used throughout the year, the

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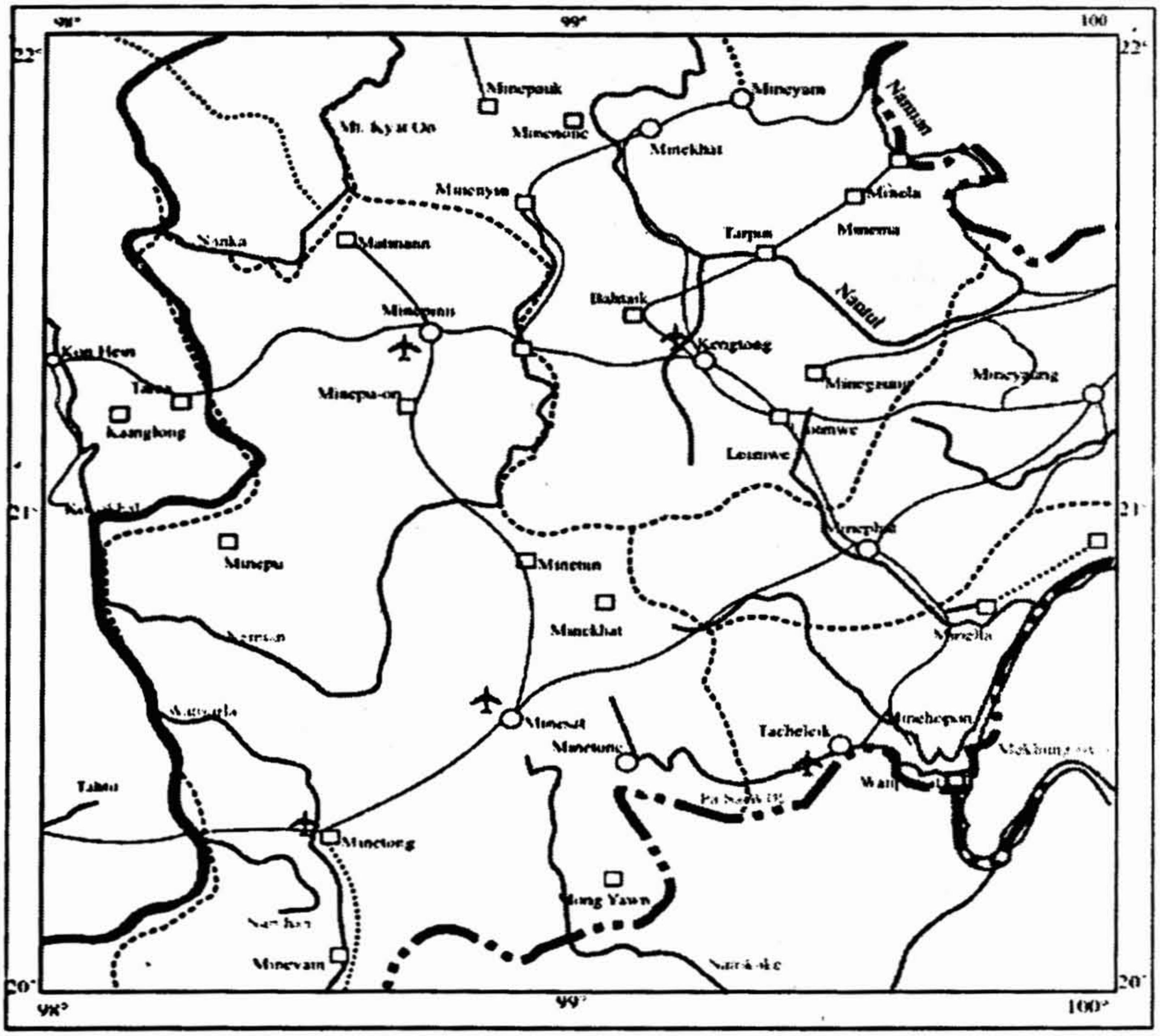
geology of this part of the Shan State has been little known due to circumstances.

Fifty per cent of the area is occupied by rugged mountainous area while the rest by rolling hills and alluvial plains. The mountain ranges are deeply dissected resulting in many peaks, some of which exceed 5000 feet in height. All of the ridges and valleys are running generally in N-S direction and the rocks are dipping to the east and west. Wunkwe Taung (3933 ft), Loi Mwe Taung (5552 ft) and Loi Honwe Taung (5450 ft) are situated in the northwestern part and Nan Kham Taung (2800 ft) in the middle part of the study area. The southeastern part of the Tarchileik is generally a low rolling terrain. A thick terra rossa soil cover supports crop cultivation. The common drainage pattern is mainly dendritic, and the areas with igneous rocks often show radial drainage pattern.

This study mainly deals with the lithostratigraphy and petrography of the rock units exposed along the Mongla-Kengtung-Tachileik car road which is about 104 miles long. Geological traverses were made in April 2005 and collected geologic data and representative rock samples. Thin sections of the samples collected were then studied under the microscope in the laboratory. Some samples were sent to Freiberg University, Germany for radio chronological analysis using the Laser ICP-MS Method.

Regional Geotectonic Setting

This region is geotectonically situated in the eastern part of the Eastern Highland (Shan-Tenasserim Block). Western boundary of this section of continental crust is marked by the N-S striking Shan Boundary Fault, which accompanies the Shan Escarpment in the West and is presumed to continue to the south in the Gulf of Martaban. Also it form part of the land mass of the Indo-Chinese Peninsula (Yunan, Thailand and Malaysia), which extends to the south in Sundaland (Hutchison, 1973).



Legend

City ○

Town/ Village □

Airport

River

Road

District border

International border

Scale

1 inch= 42 miles

Fig. 1. Location Map of the study area

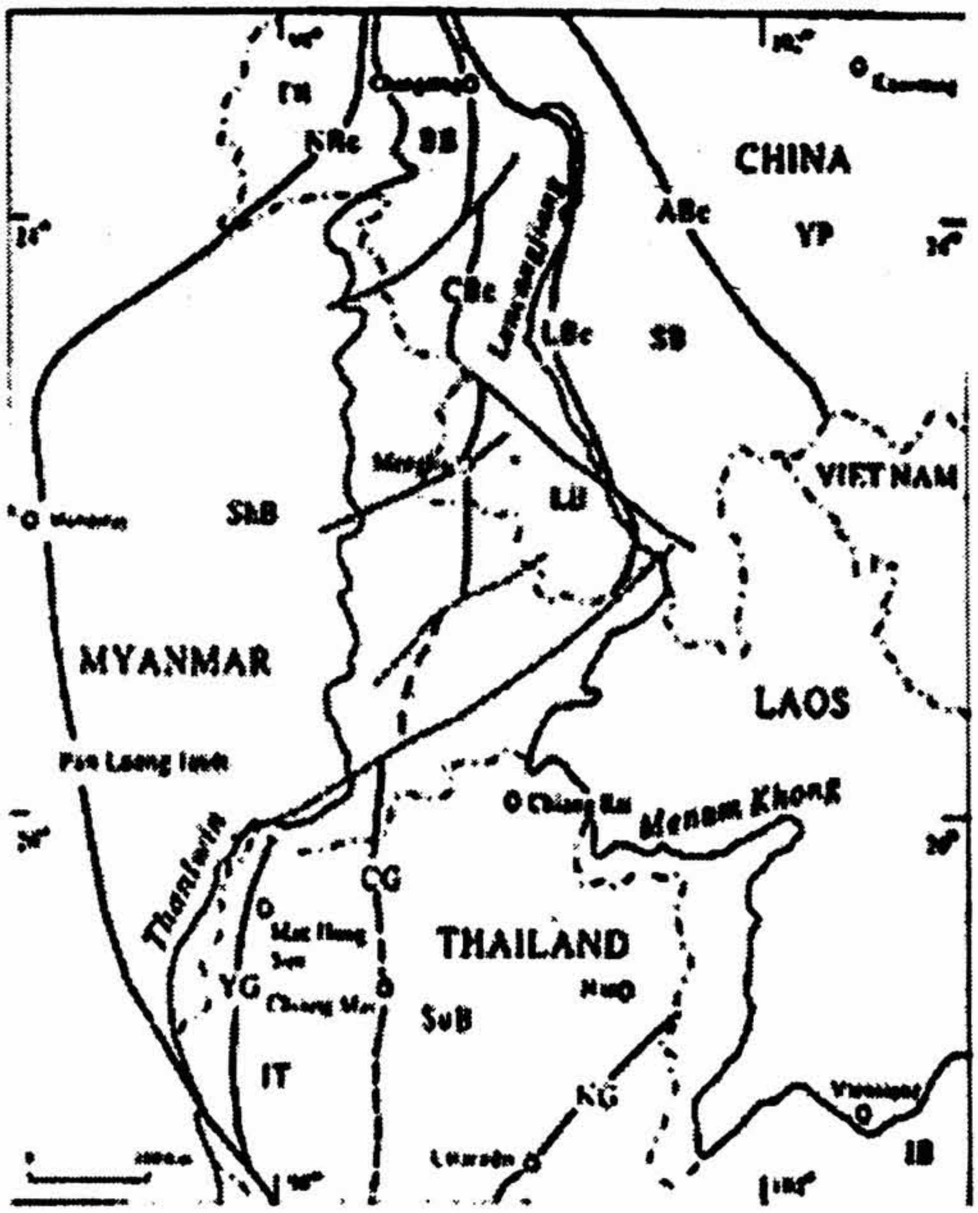


Fig. 2. Map showing tectono- geographic units in southwest China and North Thailand. CBe: Changning-Menglian Belt; CG: Ching Mai Geosuture; SuB: Sukhothai Block; ShB : Shan Block; Qinglai Feng et al. (2005)

The easternmost part of this study area is approximately bordered by the Mekong River and the middle course of which is largely controlled by the regional position of granitic intrusions and metamorphic rocks mostly situated on the right bank of the river and regionally trending NE to NS striking bands. They are regionally presumably interrupted by intercalations of marine rocks which are due to the episodic inundations (Wolfrat, 1985).

According to Bunopas (1994), the Shan-Thai Block is situated to the west of the Ailaoshan and Nan-Uttaradit sutures and to the east of the Lujiang and Pan Laung Fault. Together with southwestern Yunan it also covers eastern Myanmar (including the present study area), most of the western and peninsular Thailand and western peninsular Malaysia (Fig.2) (Quinglai Feng, 2005).

Lithostratigraphic Units

The lithostratigraphic units exposed in the study area are clastic sedimentary rocks, granitoid rocks and metamorphic rocks. Large bodies of granitic rocks, probably belong to the so-called Eastern Granitoid Belt (Khin Zaw, 1987) are frequently found along the road. Igneous rocks with sedimentary rock intercalations of folded Paleozoic and mostly continental rocks of Mesozoic age continue from the Menglian in China to the (Minela - Kengtung - Tachileik) road section of Myanmar (Jin Xiaochi et al 2001) just as in the Chinese part (Yunnan) and the eastern boundary of the Shan Massif. The sedimentary successions of this study are defined as the Loi Mwe red bed unit, Tertiary sandstones unit and gravels. Sample locations of the rock units are shown in Fig. 3.

Loi Mwe red beds

They are found along the Kengtung-Tachileik car road, near Wun Kwe -Loi Mwe Taung and Nan Kham Taung in Tar Lae area.

The rock succession comprises numerous interbeds of conglomerate-sandstone and mudstone, both of which are distinctly in red color. The sandstones are medium- to thick-bedded, pinkish or reddish color, coarse-grained. The lower part of this sequence is mostly friable pebbly sandstone, quartz, quartzite and chert pebble conglomerate band. In the upper part, sandstones are more abundant and in some places, they are intercalated with shale and clay. Clay units are reddish brown to grey and some are intercalated with coal measures. A conglomerate-sandstone unit forms an upward fining sequence, a few to several feet thick, or a composite of such sequences.

A typical succession of each sequence, in ascending order, shows (1) an erosive base, (2) pebble conglomerate or pebbly sandstone to fine sandstone with large- scale tabular and trough cross beddings, (3) a fine to very fine sandstone with small-scale cross bedding or laminations, and (4) very fine sandstone to mudstone with parallel and /or ripple laminations in many places (Fig. 4 & 5).

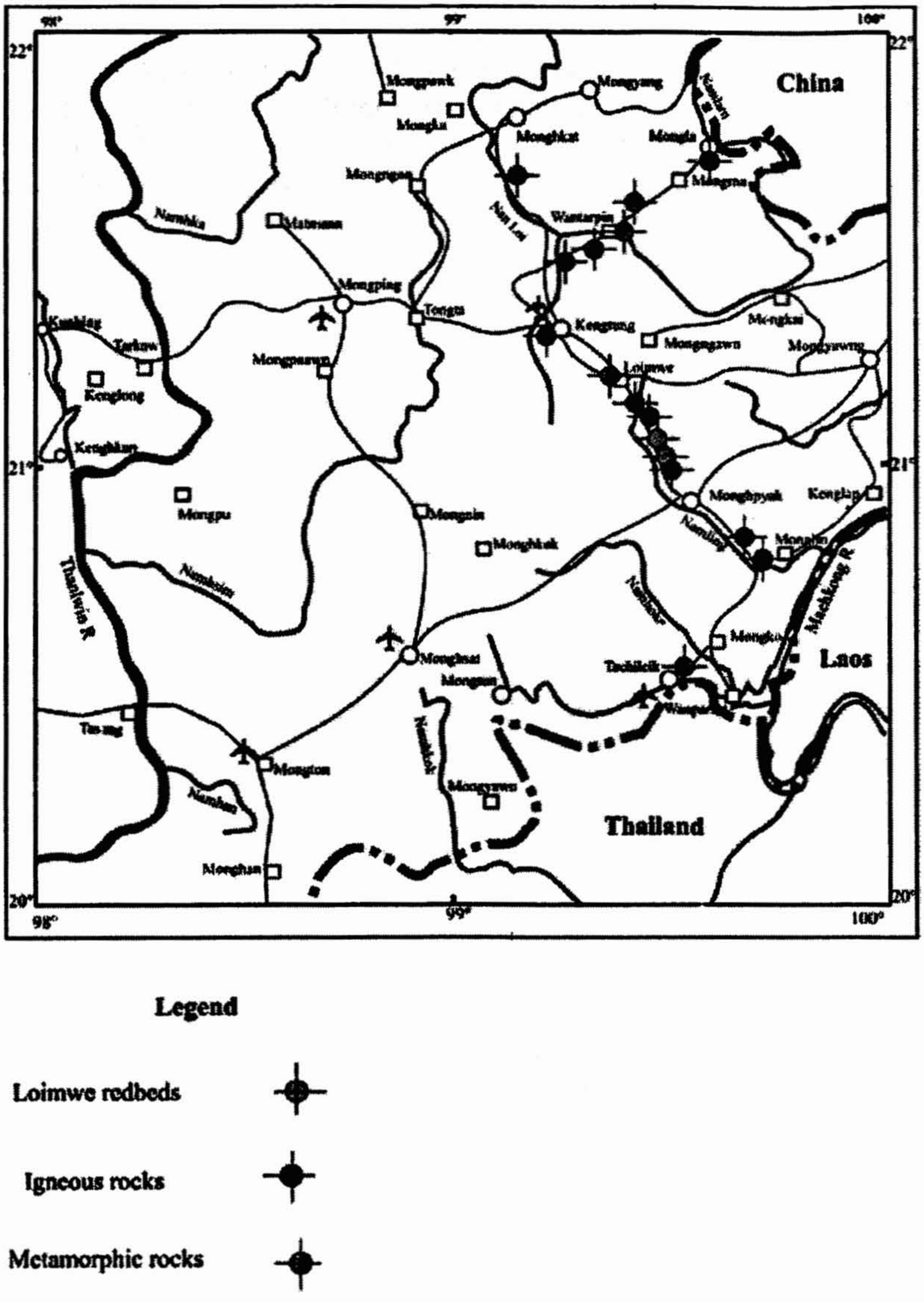


Fig. 3. Sample locations of the rock units exposed along Kentung-Minela-Tarchileik car road.

Petrographically, these sandstones are ferruginous and consist of 70-75% quartz grains, 1-2% feldspar, 2% mica, up to about 4% of matrix, 6-8% detrital rock fragments, iron minerals and 10-15% cement. Sand grains are usually coated with hematite or iron pigment. Cements can be observed on grain boundaries. Hence the red color of sandstone appears to be under the control of degree of iron pigment coating on sand grains (Fig. 6 A & B)

Quartz grains are subrounded to subangular, medium to coarse-grained and mostly are polycrystalline. Irregular forms of fluid inclusions are found in the quartz grains (Fig. 7 A & B). They usually show sharp extinction but wavy extinction is not uncommon. Grain boundaries are sharp and distinct Feldspar grains are detrital and clear but most grains are completely clouded with alteration products

The study area lies in the eastern part of the Changning-Menglian Belt and can be correlated in stratigraphy with those of southwestern Yunan and northern Thailand (Quinglai Feng, 2005). Based on the lithologic similarity, Loi-Mwe red beds can also be correlated with the Kalaw Red Bed unit, whose age is assigned to be Jurassic-Cretaceous

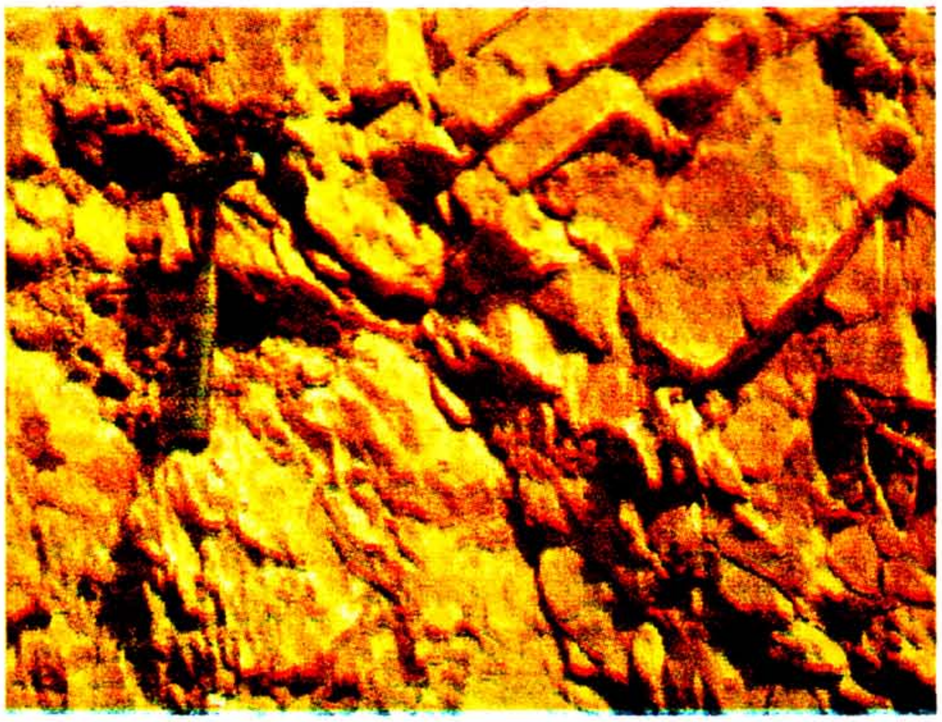


Fig. 4. Pebble conglomerate or pebbly sandstone to fine sandstone in Loi-Mwe red bed.

Fig 5 Outcrop showing sequence of the Loi-Mwe sandstone red bed

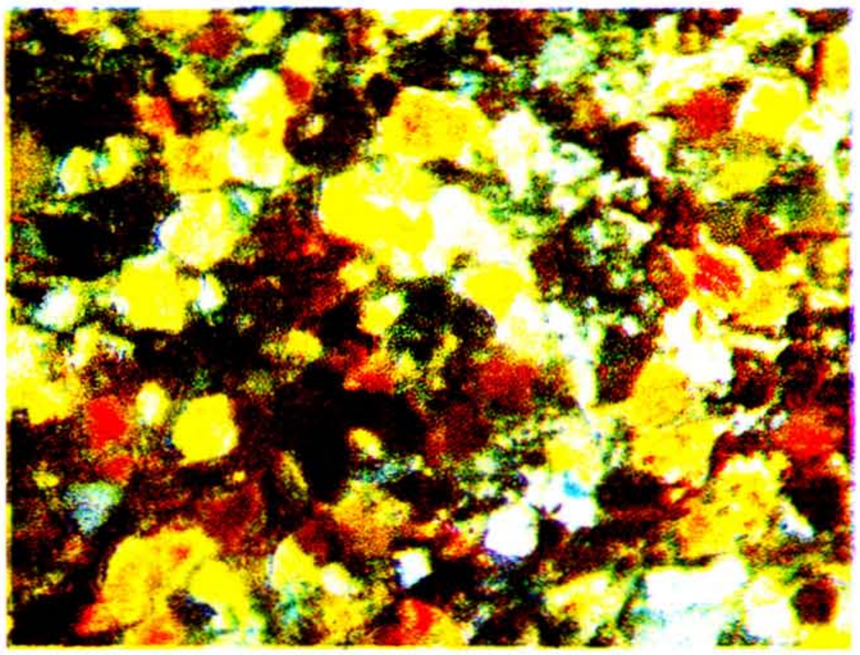


Fig. 6 A (XN)

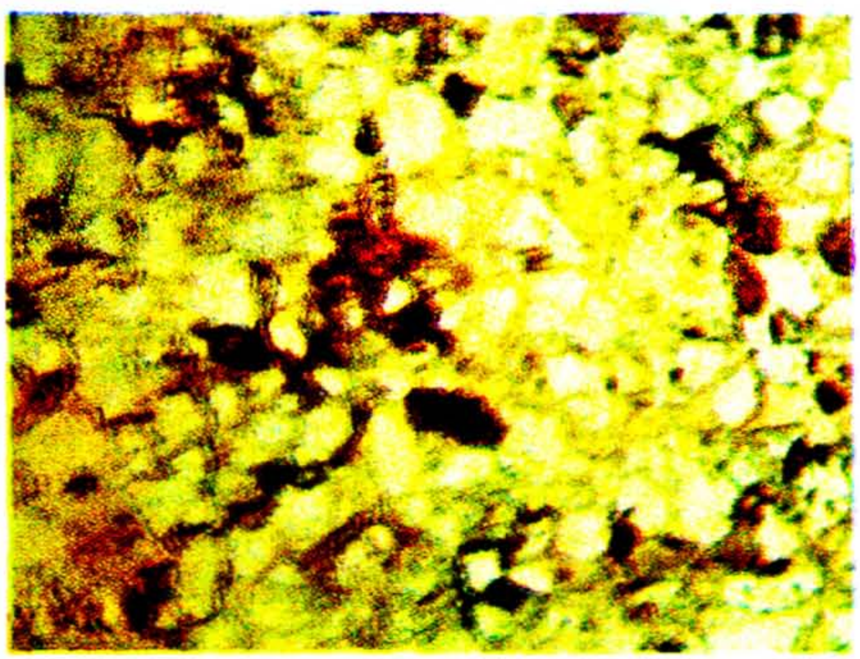


Fig 6 B (PPL)

Fig 6 A & B Photomicrographs showing subrounded to subangular quartz grains cemented by hematite and igneous rock fragments

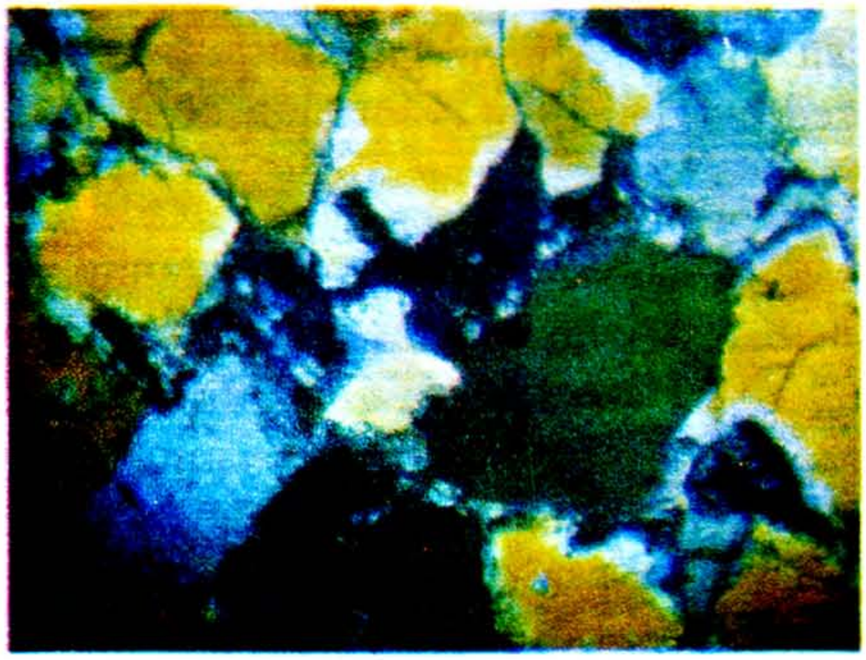


Fig. 7 A (XN)

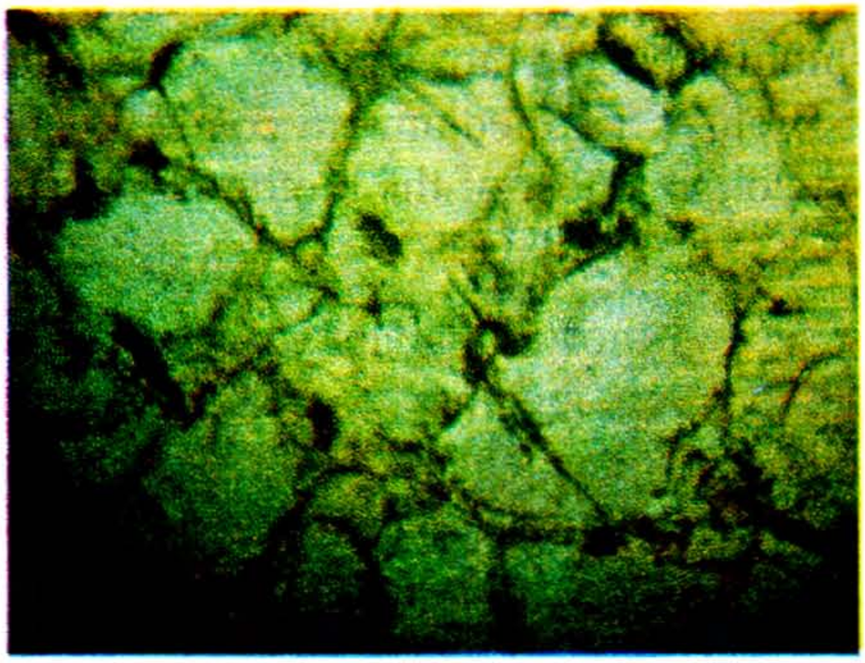


Fig. 7 B (PPL)

Fig. 7 A & B. Photomicrographs showing quartz grains with numerous Inclusions

Tertiary Sandstone Unit

Around Kengtung, Hokho and Nan Lat, the Tertiary sandstone units are widely distributed. They are yellowish brown, buff- and grey-colored, fine-grained, thick-bedded to massive sandstone interbedded with shales and clays. Sometimes coal measures are found. They are unconformably underlain by Loi Mwe red bed. The upper part of this unit is typified by gravel beds.

Igneous Rocks

Large bodies of granitic rocks and diorites are exposed along the car road. The granite is usually coarse- to medium- grained, whitish to brownish and greenish when fresh and grayish to pinkish when weathered. Some are characterized by very light color and few scattered biotite grains (Fig.8 & 9).

Most of the igneous rocks are biotite granite. They are coarse-grained, equigranular rocks showing hypidiomorphic granular texture. Mineralogically, the granites are very similar throughout the entire region, comprising quartz (25% - 30%), orthoclase± microcline (35% - 40%), plagioclase (10% - 15%), biotite and muscovite (10% - 15%) and accessory minerals. Hornblende is rarely present. Quartz is coarse-grained, subhedral to anhedral and characterized by clear surface and wavy extension. Orthoclase with Carlsbad twin is coarse-grained and dirty in general. Sometimes it shows numerous mineral inclusion and alterations (Fig.10). Plagioclase is commonly altered to sericite, and patchy alteration is distinctive (Fig. 11). Biotites are medium- to coarse-grained, characterized by its brownish to red colour. Most of the biotite flakes are bent. (Fig.12 & 13).

Diorite is the second most abundant igneous roc in the study area. Lithologically it is a dark-grey, medium- to coarse-grained rock composed mainly of feldspar and hornblende. Quartz, biotite and magnetite are present in minor amounts. Quartz is subhedral to anhedral and hypidiomorphic granular textured. Among feldspars, plagioclase is the most abundant, consisting up to 50%., Plagioclase is tabular or prismatic, anhedral to subhedral and coarse-grained. The plagioclase sometimes shows a combination of Carlsbad (simple twin) and Albite (multiple twin). Orthoclase is rare. Hornblende shows long prismatic form, bright colour under cross Nicols and brown colour under PPL.

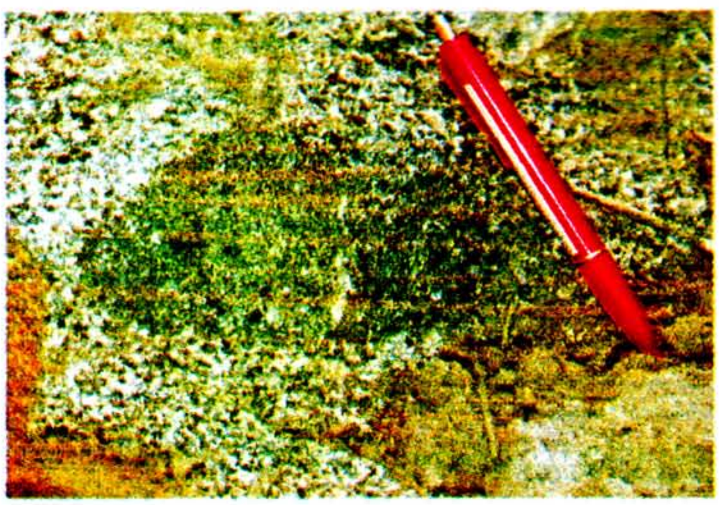


Fig. 8

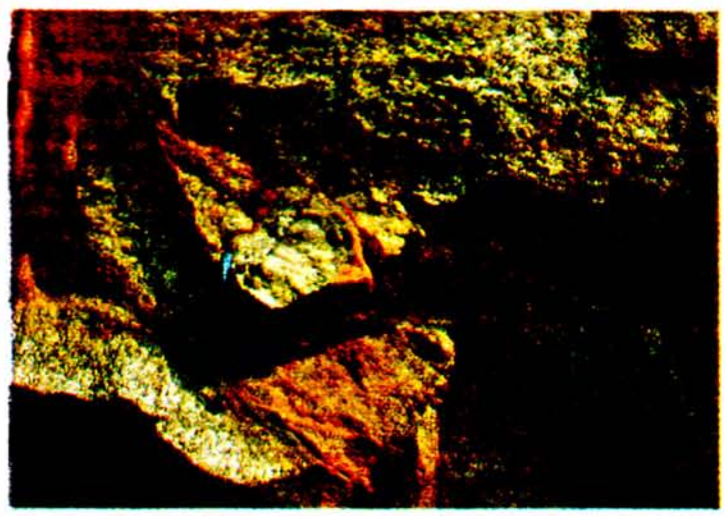


Fig. 9

Fig. 8 & 9. Photographs of coarse-grained biotite granite (Zircon age- 224^{+}_{-} 4 Ma).

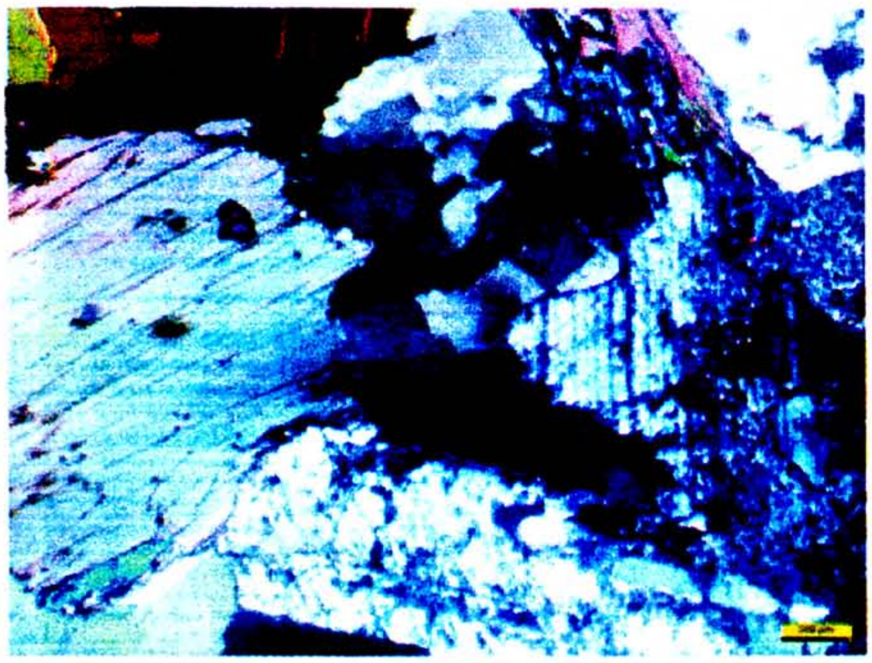


Fig. 10. Subhedral orthoclase with mineral inclusions in coarse-grained biotite granite.

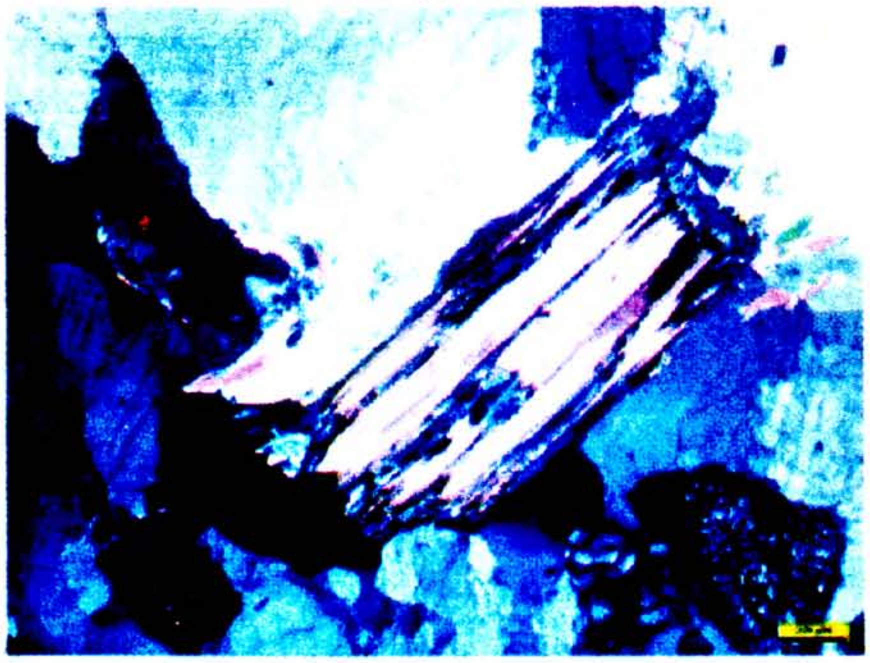


Fig.11. Chloritization of biotite and sericitization of feldspar in biotite granite.

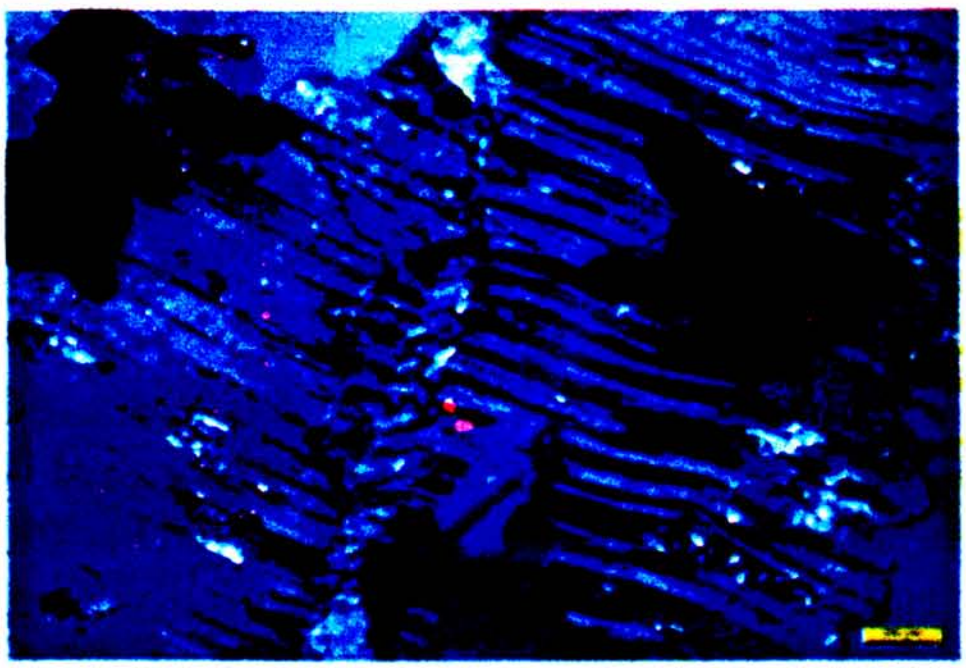


Fig. 12. Bending of feldspar with mineral inclusions (XN).

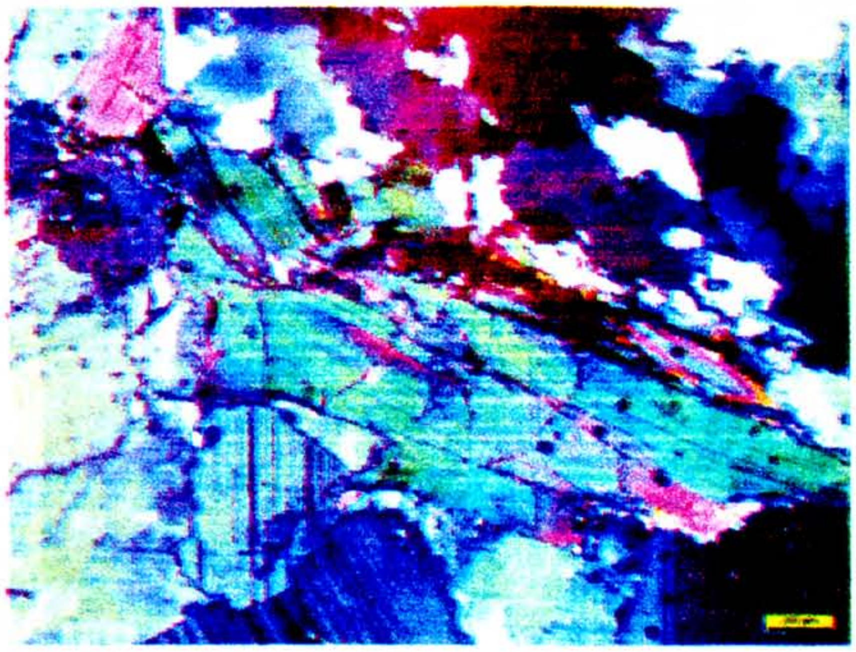


Fig. 13. Quartz, orthoclase, plagioclase (showing polysynthetic twining) and altered biotite (XN).

The granite occurrences in the Tenasserim region extends into the Thailand and traced to the north, the determination of age dating (Rb/Sr and K/Ar) revealed an Upper Triassic (210-205 m.y.). The granite of Mae Sariang (N-S running intrusion between 18? and 19? N at the western border of Thailand) are Upper Triassic-Lower Triassic age (210-205 m.y.) and to South of it, in a small isolated intrusion, an Upper Cretaceous age (70-80 m.y.). These can be correlated with the granites East of Fang in North Thailand to which a Lower Triassic age is assigned (Von Braun et al., 1976).

The granite belt in the east of Chiang Mai is Lower Triassic age (232±31 my, 235± 5 m.y., 236±14 m.y.). The granites of Kengtung are probably the northern continuation of the Triassic granites of Thailand (Von Braun et al., 1976). Very recently, this was also approved by U/Pb ages of Laser ICPMS, (216±6 and 224±4 my) of Kengtung area (Myo Min, written communication, 2006). These run from north Thailand to the south into Tenasserim area, Kengtong area, and northwestern part of China. It is likely that the chains of acid granite intrusion phase occurred at that time.

Granite from Mongla-Kengtung-Tachileik has a close petrological and chronological affinities with the Chiang Rai Batholith of Thailand. Chiang Rai Batholith is a part of the Eastern Marginal Granite Belt of Thailand which lies near to the junction of the North Thai Province with the Eastern Province, and forms a mountain chain partially flanked by Tertiary sedimentary basins to the east and west (Cobbing et al., 1992). This batholith is emplaced into a volcanosedimentary sequence that ranges from Silurian to Middle Triassic in age (Braun and Hahn, 1976) and unconformably overlain by Mesozoic continental deposits of probable Jurassic age (Cobbing et al, 1992).

Metamorphic rocks

The metamorphic rocks are generally trending NW-SE, and low-grade meta-sedimentary rocks such as chlorite schist, actinolite schist (Fig.14), phyllite, quartzitic graphite schist and metagreywacke. They are mostly found, near Wanyan village, Wan Tapin (Kaymarwara Bridge), Mongla, near Mong Hpyak and Tarkyauk village. Quartzitic graphite schists are well exposed near Tachileik air port. These rocks are unconformably overlain by the Loi Mwe red sandstones. Igneous rocks are intruded into the metamorphic rocks.

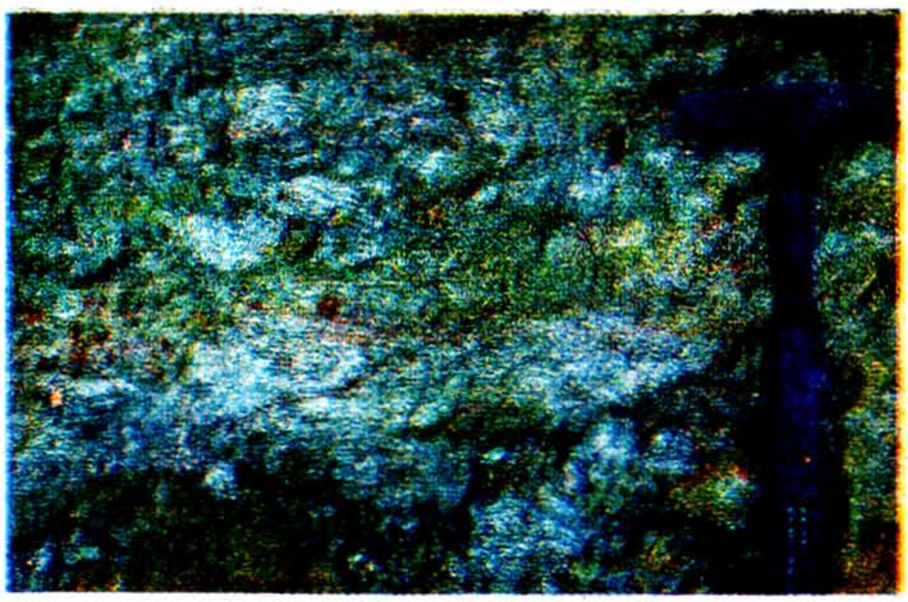


Fig. 14. Photograph showing close up view of actinolite schist.

Conclusion

This is merely a preliminary investigation carried out on a short field trip to give information about the presence of red beds which are very similar in lithology with the Kalaw red beds (Jurassic – Cretaceous) of southern Shan State and the overlying Tertiary sandstone units. Age assignments for Loi Mwe red bed and overlying sandstones are tentative, and need to be checked by further field investigation. However, the U/Pb dating of the granites in the study area can reveal that the granites in the easternmost part of Shan Massif are definitely the northern extension of the Western Granitoid Belt of Thailand which were intruded mainly in Triassic time.

Acknowledgement

I wish to express my sincere gratitude to Dr Khin Maung Myint, Head of the Geology Department, Mandalay. University, for his encouragement to carry out this research. Special thanks go to U Myo Min for his kind help throughout the field works and for making possible to gain the radiometric dating results from Freiberg University, Germany.

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