Petrography of Lepidolite-bearing Pegmatite at Ban Thung Chang, Si Mongkhon Subdistrict, Sai yok District, Kanchanaburi Province

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Abstract

This study investigates the lithology and petrography of lepidolite-bearing pegmatites from Ban Thung Chang, Sri Mongkhon Subdistrict, Sai Yok District, Kanchanaburi Province, based on 19 samples. The hand specimens are characterized by a distinct purple coloration due to the widespread distribution of lepidolite throughout the rock. Some samples exhibit contacts with granite, while others display mineral alignment within the rock fabric. The primary mineral constituents are quartz, plagioclase, and lepidolite. The rocks are predominantly coarse-grained, with locally fine-grained portions. Quartz ranges from 0.15–6.25 mm size, with an average content of 46.43%. Lepidolite ranges from 0.025–3.25 mm, averaging 41.74% and plagioclase ranges from 0.125–2.75 mm, averaging 11.83%. Accessory minerals include alkali feldspar and tourmaline, while sericite is observed as an alteration mineral. Distinguish texture and myrmekitic texture, characterized by worm-like quartz intergrowth within plagioclase, indicating the late stage of crystallization, Perthitic texture, characterized by lamellae within feldspar, indicating exsolution during temperature decrease. The alteration of feldspar to sericite indicates hydrothermal fluid infiltration along fractures, resulting in low-grade metamorphism. In addition, the preferred orientation of lepidolite indicates stress acting on the rock sample.

Introduction

As the world undergoes a global shift toward Green Energy, **Lithium (Li)** has emerged as an essential element for modern battery technology. Consequently, **Lepidolite [$K(Li, Al)_3 (Al, Si)_4O_{10}(F, OH)_2$]** has become a strategic resource for lithium extraction. **In Thailand, the Western Granite Province** is recognized as a significant rare-metal belt (Sn-W-Ta-Nb). Within the Sai Yok district of Kanchanaburi, the intrusion of highly fractionated granitic melts has resulted in the formation of **lepidolite-bearing pegmatites**, positioning this area as a key focus for future economic mineral assessment.

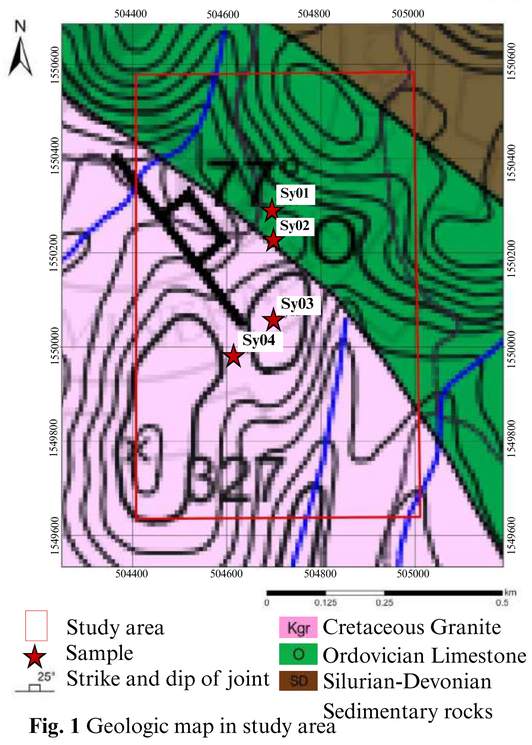


Fig. 1 Geologic map in study area

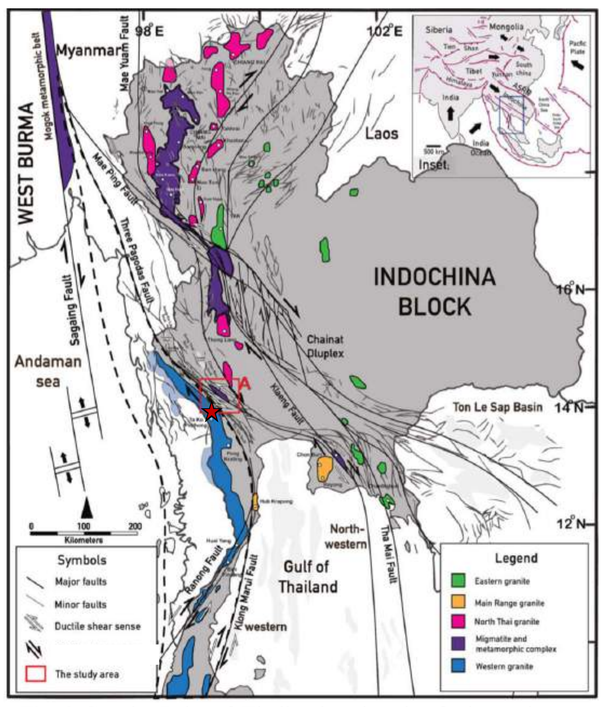


Fig. 2 Granite Belts of Thailand and major fault, study area labeled by star (modified after morley, 2012)

Objective

1. To characterize the petrography and textural variations of the pegmatites.
2. To determine the distribution and modal abundance of lepidolite.

Methodology

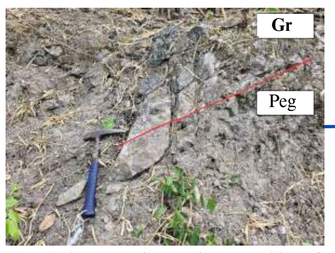


Fig. 3 Outcrop in study area (Granite (Gr) and Pegmatite (Peg))

Field investigation and rock sampling of pegmatite outcrops.



Fig. 4 Thin section

Rock sample preparation and thin section fabrication.



Fig. 5 Polarizing microscope

Petrographic analysis.

Result

Out of a total of 19 samples collected, four representative samples (SY01–SY04) are presented to illustrate the petrographic characteristics and textural variations of the pegmatites in the study area.

Sy01

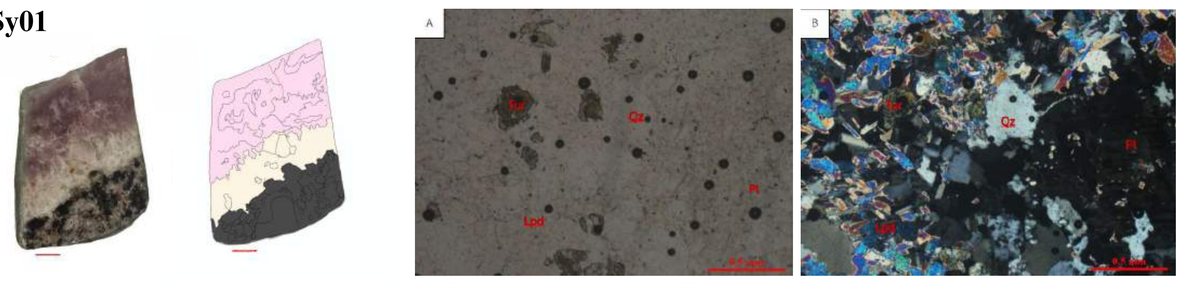


Fig. 6 Left, hand specimen and schematic sketch (Lepidolite zone (pink), Plagioclase zone (white) and Granite zone (black)), (scale 5 cm). Right, photomicrographs (PPL (A) and XPL (B)), (Quartz (Qz), Lepidolite (Lpd) Plagioclase (Pl), Tourmaline (Tur)).

Sy02

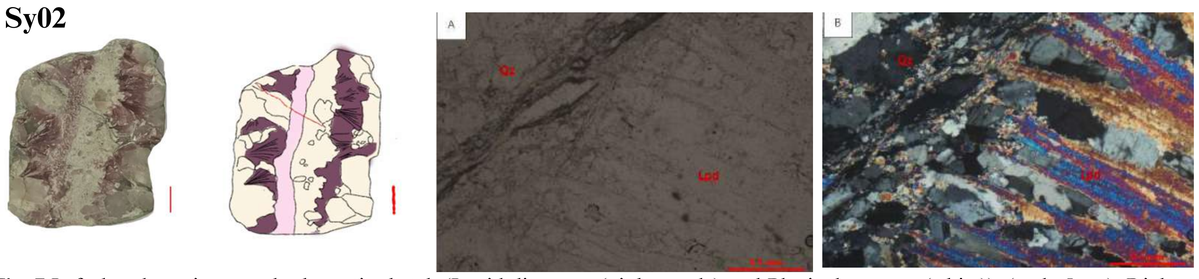


Fig. 7 Left, hand specimen and schematic sketch (Lepidolite zone (pink,purple) and Plagioclase zone (white)), (scale 5 cm). Right, photomicrographs (PPL (A) and XPL (B)), (Quartz (Qz), Lepidolite (Lpd) and Plagioclase (Pl)).

Sy03

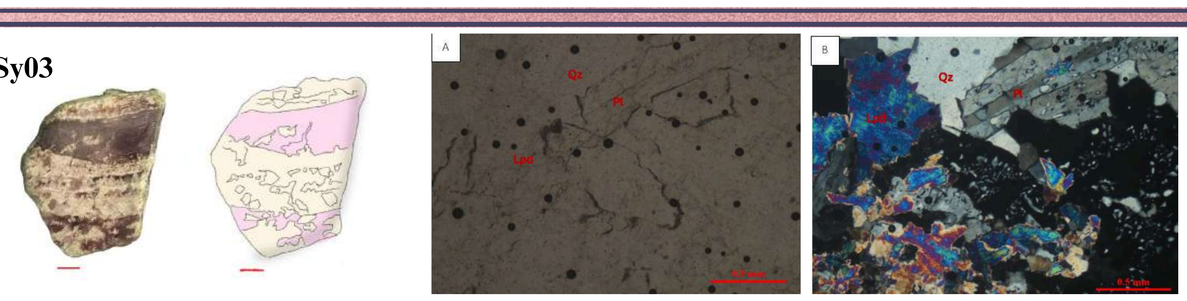


Fig. 8 Left, hand specimen and schematic sketch (Lepidolite zone (pink) and Plagioclase zone (white)), (scale 5 cm). Right, photomicrographs (PPL (A) and XPL (B)), (Quartz (Qz), Lepidolite (Lpd) and Plagioclase (Pl)).

Sy04

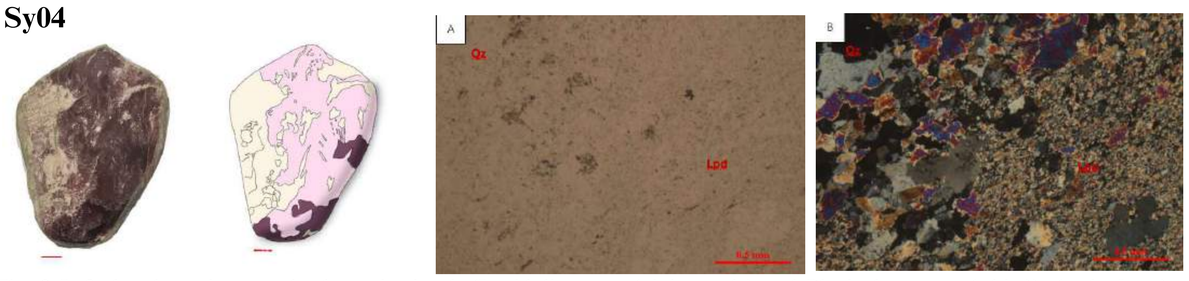


Fig. 9 Left, hand specimen and schematic sketch (Lepidolite zone (pink,purple) and Plagioclase zone (white)), (scale 5 cm). Right, photomicrographs (PPL (A) and XPL (B)), (Quartz (Qz), Lepidolite (Lpd) and Plagioclase (Pl)).

Table 1. Summary of petrographic characteristics, textures, and estimated lepidolite content from the studied samples.

Site	Characteristic & Texture	Lepidolite Content (400-point count)
SY01	Exhibits equigranular crystals, though quartz is unusually large and scattered. Shows widespread lepidolite distribution with high sericitization and perthitic textures. Quartz displays Grain Boundary Migration (GBM).	20% – 50%
SY02	Characterized by large crystals (megacrystic), with lepidolite distributed along the margins and within quartz. Localized sheared textures are present. Plagioclase shows myrmekitic texture and sericite alteration.	20% – 40%
SY03	Displays aligned/foliated textures. Lepidolite is distributed along the boundaries of large quartz crystals. A fine-grained matrix alternates with quartz and plagioclase phenocrysts. Includes myrmekitic textures.	20% – 40%
SY04	Shows distinct mineral alignment and foliated textures. Features a fine-grained matrix alternating with large quartz and plagioclase crystals. Quartz exhibits GBM.	40% – 60%

Based on the petrographic study of **19 samples**, the rocks are classified as **lepidolite-bearing pegmatites** based on their textural characteristics, further categorized as **quartz-rich granitoids** based on The QAP Ternary diagram (Streckeisen et al., 2002). The primary mineral assemblage consists of **quartz, lepidolite, plagioclase, and alkali feldspar, with tourmaline occurring as a minor** constituent in the associated granitic rocks. Key microscopic textures identified include **myrmekitic texture** (characterized by worm-like quartz intergrowth within plagioclase) and **perthitic texture** (characterized by exsolution lamellae within feldspar). Furthermore, **quartz grains exhibit Grain Boundary Migration (GBM)**, **lepidolite shows a distinct preferred mineral orientation (foliation)**, and **the alteration of plagioclase and alkali feldspar into sericite**

Conclusion

- The primary mineral assemblage consists of **Quartz, Lepidolite, Plagioclase and Alkali Feldspar with minor Tourmaline found in associated granitic rocks** and The texture include **myrmekitic texture, perthitic texture and alteration of plagioclase and alkali feldspar into sericite** indicating **a highly evolved, late-stage magmatic-hydrothermal crystallization** and **exsolution during temperature decrease.**
- It is inferred that the rocks in this area underwent crystallization at the margins, evidenced by the transition from tourmaline-bearing granite at **the contact zone to the pegmatite core**, where significant lepidolite accumulation is observed.
- The rocks in the study area exhibit a preferred **mineral orientation and foliated textures.** This fabric resulted from **shear stress** associated with the proximity to the **Three Pagodas Fault zone (Right-lateral strike-slip) during the Late Eocene India-Eurasia collision**, evidenced by **quartz grain boundary migration (GBM) and the lepidolite foliation.**

Discussion

- **Late-Stage Crystallization:** Lepidolite formation indicates the Pneumatolytic phase (<500°C) with high volatile activity Fersman. (1967) .
- **Classification:** Identified as LCT-family (Li-Cs-Ta), Complex-type, and Rare-element class pegmatites .
- **Geochemical Enrichment:** Enriched in incompatible elements (Li, Rb, Cs, Be, Sn, Ta > Nb) and volatiles (B, P, F).

Table 2. Pegmatite Classification

Class	Subclass	Type	Subtype	Family
Rare Element	Li	complex	spodumene, petalite, **lepidolite**, elbaite, amblygonite	**LCT**

modified from Černý el al. (2012)

Table 3. Petrogenetic Component of Pegmatite Classification

Family	Pegmatite subclass	Geochemical signature	Pegmatite bulk composition	Associated granite	Source lithologies
LCT	REL-Li, MI-Li	Li, Rb, Cs, Be, Sn, Ga, Ta > Nb, (B, P, F)	peraluminous to subaluminous	Orogenic to late-orogenic (to anorogenic); largely heterogeneous	Undepleted upper- to middle-crust supracrustal rocks and basement gneiss

modified from Černý el al. (2012)

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