Geochemical Characteristics and Zircon U-Pb Geochronology of the Late Triassic Granite in the Pilok Tin-Tungsten Deposit, Kanchanaburi, Thailand

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The Pilok Sn-W deposit, situated in the Southeast Asian tin belt, is a significant Sn-W deposit in Thailand. The main Sn-W mineralization occurs as veins, greisen, and veinlets. This study aims to investigate whole-rock chemical compositions, U-Pb ages, and trace element characteristics of zircon within granites in the deposit to determine the petrogenesis and tectonic setting of the granitic magmatism.

The granites are divided into biotite-muscovite granite and tourmaline-biotite-muscovite granite. The biotite-muscovite granite is composed of quartz, plagioclase, K-feldspar, and muscovite, with accessory zircon, biotite, apatite, and opaque minerals. Whole-rock geochemistry indicates that the granites are peraluminous (ASI = 1.2 - 1.5) and calc-alkaline in composition, classifying them as S-type granites.

Zircons are classified into four types based on morphology and cathodoluminescence (CL) textures. Type I zircon shows oscillatory zoning while Type II zircon shows weak oscillatory zoning. Both types show REE patterns characterized by gradually increasing concentrations from La to Lu with positive Ce and negative Eu anomalies, typical for magmatic zircon. In contrast, Type III zircons show dark CL, whereas Type IV zircons display a porous texture, irregular zoning, and elevated total REE contents. Type III and Type IV exhibit less negative Eu anomalies and subdued Ce anomalies compared to Type I and Type II. These patterns are typical for hydrothermal and metamict zircon.

U-Pb dating of magmatic zircons yielded 211.7 Ma and 211.1 Ma for the biotite-muscovite granite and the tourmaline-biotite-muscovite granite, respectively, indicating Late Triassic magmatism. These ages are consistent with a post-collisional tectonic setting following the Sibumasu–Indochina collision. A combination of zircon geochronology, internal textures, and whole-rock chemistry suggests that the granites in the Pilok Sn-W deposit were likely formed from crustal sources under reducing conditions, with subsequent fluid interaction that favored Sn-W mineralization.