SEDIMENTOLOGY OF EOCENE-MIOCENE CLASTIC STRATA IN THE SOUTHERN CHINDWIN BASIN, MYANMAR

PhD DISSERTATION

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ABSTRACT

The present study would offer the sedimentological history and tectonic environment of the clastic sedimentary rock units; the Pondaung Formation (late Middle Eocene), the Yaw Formation (Late Eocene) and the Letkat Formation (Early Miocene) exposed in the southern Chindwin Basin, situated in the southern part of Patolon syncline, Pale Towinship, Monywa District, mainly focused on petrofacies and provenance study, outcrop-based sedimentary facies analysis and sequence stratigraphic implications.

The stratigraphic sequences preserved in the southern part of Chindwin Basin provide detrital and geochemical information that document the unroofing history of a calc-alkaline magmatic arc originated along the convergence continental margin (i.e. Eurasia) and their detritus were deposited in the fore-arc basin during Middle Eocene.

Modal analysis on the sandstones provides a characteristic petrofacies spectrum from the feldspatholithic, volcaniclastic Pondaung sandstones (Q_{37}-F_{22}-L_{41}; Lm_{25}-Lv_{72}-Ls_3; Qm_{47}-P_{40}. K_{13}) at one extreme, and plutonic-metamorphic derivatives of the quartzo-feldspathic, quartzolithic Yaw sandstones (Q_{65}-F_{22}-L_{15}; Lm_{57}-Lv_{38}-Ls_5; Qm_{68}-P_8. K_{24}) and Letkat sandstones (Q_{50}-F_{25}-L_{25} ; Lm_{26}-Lv_{71}-Ls_3 ; Qm_{59}-P_{18}-K_{23}) at the other extreme. The volcano-plutonic and green-schist to amphibolite metamorphic derivatives are the characteristics of erosional unroofing of a magmatic arc and deeper level of erosion down to the plutonic root at an uplifted continental margin provenances. Triangular-plots of Dickinson also points out that the volcaniclastic Pondaung sandstones fall within the transitional to dissected magmatic arc provenances whereas quartzo-feldspathic and quartzo-lithic sandstones of the Yaw and Letkat Formations fit within the recycled orogenic provenance of the uplifted continental margin.

XRF-immobile trace element plots (Zr/TiO_2 - Nb/Y; Zr/Y – Zr; Rb - Y+Nb; and Nb - Y) for the volcaniclastic Pondaung sandstones dominated with plagioclase feldspar-phyric (i.e., plagioclase phenocrysts set in microlitic matrix) volcanic lithic fragments also suggest andesite and minor rhyodacite / dacite in composition of a calc-alkaline continental volcanic arc related to syn-collision tectonic setting. The radiometric dating on the zircon grains found in the volcaniclastic sandstones by using LA ICP-MS U-Pb zircon method give mostly early Middle Eocene (during 51.6 and 43.3 Ma

or average age around 47.2 Ma) indicating the geochronology of volcanic activities originated in a convergence continental margin setting.

These data combined with the mean paleo-current direction suggest that there was a definite magmatic arc sitting to the north-east (relative to present position) of the southern Chindwin Basin (i.e., analogous to the present plutonic belt along the western margin of Shan Plateau). Erosional unroofing of the inferred volcanic arc may have been occurred during the end of Middle Eocene (Bartonian) after deposition of the Pondaung Formation. It can be explained by abrupt change in petrofacies at the major sequence boundary between the Pondaung and the Yaw Formations.

The Pondaung Formation was deposited in an aggrading fluvial system. Markov Chain analysis on the Lower Member of the formation is interpreted to have deposited in a low sinuosity, high gradient, bed-load transported, braided river system. The Upper Member was deposited in a more sinuous, low gradient, mixed-load, meandering river system with thick variegated clays of floodplain paleosols. The entire fluvial sequence is divisible into three systems tracts; Lowstand systems Tract (LST), Transgressive Systems Tract (TST), and Highstand Systems Tract (HST) mainly based on systematic change in vertical stacking patterns of the architectural elements.

A regional-wide correlatable highly ferruginous lateritic horizon observed between the Pondaung Formation and the overlying Yaw Formation is proposed here as a sequence boundary (Emergence Surface coupled with marine Transgressive Surface or ES-TS) formed between the end of Bartonian and the early Priabonian. It is correlative to the major sequence boundary (37.10 Ma at Bart 2/Pr 1) defined in the sequence stratigraphic framework of the European Basins.

The Yaw Formation was deposited in a fluvial and tide dominated deltaic system. It was developed as transgressive to highstand systems tract (TST-HST) deposits as indicated by the retrogradational and progradational parasequence sets which are mainly composed of the shelf-prodelta and delta front facies associations.

The Letkat Formation was deposited in a fluvial river system characterized by the lowstand systems tract deposits (LST) incised into the underlying delta plain facies of the Yaw Formation during relative sea-level fall. It can also be regarded as an incised fluvial valley-filled sequence (IVF).

The boundary between the Yaw Formation and the overlying Letkat Formation is here defined as a Type I Sequence Boundary. It is characterized by abrupt facies changes between the overlying fluvial channel facies of the Letkat Formation and the underlying lower delta-plain facies of the Yaw Formation forming a phenomenon of basinward shift in facies.

The area around the north of Latitude 22°-high was possibly uplifted after the deposition of the Yaw Formation at end of Eocene and formed as an area of non deposition (Lacuna) during Oligocene time. It is evidenced by the facts that there is no Oligocene unit or absence of Tonhe Formation (Early Oligocene unit mainly exposed in the northern part of the Chindwin Basin) and the Letkat Formation (Early Miocene) is directly overlying the Yaw Formation in the study area, the southern part of Chindwin Basin.

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