

Recognition of Paleo-Tethys Suture Zone in eastern Myanmar

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Abstract: The site of final closure of Paleo-Tethys Ocean during the Triassic-Jurassic was marked by the collisional event between the Shan Massif and Indochina plate, in eastern Myanmar. Previous site of consumption of Paleo-Tethys is now occupied by a complex zone of suturing and deformation along Than Lwin River and in the east of it, formed by drastic tectonic evolution. It is geographically located approximately between longitudes 98E and 100E, and it extends northwards to Yunnan and southwards into West Thailand. The sigmoidal wrench structures of suture zone is situated in the east of step-like structures of Shan Massif, and the western boundary of the suture zone must be immediately on the west side of Than Lwin River and the eastern boundary is near the east border of Myanmar. The area is largely covered by younger rocks of Paleozoic and Mesozoic age. The Upper Paleozoic units of Carboniferous to Permian comprise limestone and dolomite of the Plateau Limestone overlying unconformably the Lower Paleozoic rocks. Metasedimentary rocks of the Carboniferous and their metamorphic equivalents and the flysch-like Triassic-Jurassic units are found as folded and thrust beds in the area. Large complex of granitic rocks of Late Triassic are also found. Metavolcanics, gabbro and a large number of chromite occur along with these units. A preliminary delineation of a suture zone as the site of closure of Paleo-Tethys Ocean in Myanmar territory is made for the first time and this zone is believed to be a tectonic linkage between Changning-Menglian belt of West China and Inthanon Zone of West Thailand.

Key words: Paleo-Tethys; suture zone; sigmoidal structure; wrench fault; delineation; linkage; tectonic movement; collision

1 Introduction

A broad belt, located in the eastern Myanmar between longitudes 98E and 100E, along the Than Lwin River and to the east of it, was first described by Ba Than Haq in 1981 (B.T. Haq, 1981). In the figure (drawn in 1974), he did not give any particular name to this belt, only mentioned as Region of Caledonian folding, resulted from a tectonic movement at the end of Silurian up to Carboniferous. He had also shown this area as Antimony Province, where the antimony mineralization took place particularly in Carboniferous clastics and carbonates. There was no scientific or research work relating to this area since then. After studying available literatures of local and foreign institutions, and unpublished geological information including personal communication, a broad belt along the Than Lwin River has been marked as a suture zone and it corresponds to Inthanon Zone in the south of West Thailand. Inthanon Zone includes imbricated serpentinites, oceanic basalts, radiolarian, chert and massive limestones from Devonian to Triassic ages, which was interpreted as ocean floor material and ocean seamounts with carbonate caps (Sashida, 1993). A broad and long belt which B. T. Haq mentioned in

1981 is believed to be the northern continuation of Inthanon Zone.

2 Geology

Geological mapping for mineral exploration and hydropower projects was carried out by the faculty members of University of Yangon and there were two geological maps came out. The area along the Than Lwin River and further east of it was largely covered with Upper Paleozoic and Mesozoic units overlying unconformably the Lower Paleozoic units and the basement rocks of Pre-Cambrian. The older rock units exposed as inliers along the river course. Sandstones, mudstones and shales of the Shweminbon Formation (Triassic-Jurassic), thick limestones and dolomites with karst topography, sandstones, pebbly mudstones, calcareous shale, slaty shale associated with turbidites of Carboniferous age and their metamorphic equivalents are found as overturned and thrust beds in the east of the Than Lwin river. A large number of chromite, gabbros and volcanics occur near Myanmar-Thai border (pers. com., Nyunt Htay, 2008). On the other side of the border, sandstone and shale of the Carboniferous age of Mae Tha Formation are isoclinally folded, thrust and underlain by green schist facies

of slate and phyllite with mafic metavolcanics and minor cherts of Permo-Carboniferous age (Rhodes et al., 2005).

Large complex of granitic rocks at the east of the Than Lwin River that can be correlated with the granites east of Fang (N. Thailand) was assigned to early Triassic (Bender, 1983). These granites belong to the granites of Northern Thailand and migmatites complex of S-type of Cobbing et al. (1992). Collision between the Yangtze Block and the northern continental collage along the Red River Suture may have been coincident or followed by the collision of SE Asia along major suture marked by ophiolitic and island-arc terranes of the Mekaung fold belt and other fold belts (Schermer, Jones and Howell, 1984).

According to the facts mentioned above, granitic intrusives of S-type must have welded the two terranes: Shan Massif terrane and Indochina terrane in late Triassic-Jurassic. The granitic rocks are found from Myanmar territory through west Thailand to Malay peninsula. Mesozoic representatives of *Daonella* and *Halobia* are found in the Shweminbon Formation on the eastern side of the Than Lwin River (Nyunt Htay, 2008).

3 Structure

From the studies of satellite image of topographic map of Myanmar (Fig. 1), tectonic lineaments are drawn and shown in Fig. 2. Shan Boundary fault trending NNW-SSE direction demarcates the Shan Massif in the west and merges with the Sagaing Fault near Mandalay.

There is a series of longitudinal faults running parallel in N-S direction, in the east of SBF. The Pan Laung-Nwalebo Fault, Kyaukkyan Fault, Ingyi-In-

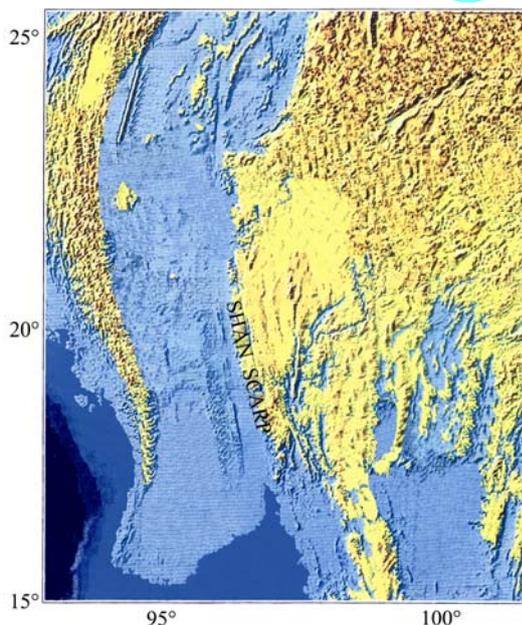


Fig. 1 Topographic Map of Myanmar (G.I.A.C. Project, 1996-1999)

gaung Fault and Pawn Chaung Fault are traced as major faults. They were believed to be formed as thrust faults by accretion process and later reactivated as wrench faults by younger movement mainly in the Cenozoic. These longitudinal faults dissected the Shan Massif and shaped into step-like Plateau structures. Toward further east of it, there is no such a succession of parallel faults but only sigmoidal wrench structures are found (Fig. 2). The sigmoidal wrench structures in the map are parallel to the structural grain in the older fold belt. The sigmoidal bends may be result of offset and drag along the Red River fault during extrusion of Indochina plate. Their shape may be inherited from the original grain of Indosinian fold belt which marked the closure of Paleo-Tethys Ocean in late Triassic-Jurassic. The peripheral area immediately on the west side of the Than Lwin River must be considered as the west boundary of suture zone for Myanmar territory. Extension of the Mae Yuam fault which demarcates the Inthanon Zone in west Thailand has been found as a fault trace in the west of the Than Lwin River. Mae Yuam fault forms distinctly in the map in Thailand, but to the north, the fault extends as trace of lineament and far to the north it becomes less distinct, appearing to merge in the north with the west boundary of Changning-Menglian Belt. In the east of the river, wrench faults in N-S direction and sigmoidal wrench structures are found in the map, particularly evident along the Than Lwin River. These structures were interpreted by the previous authors as the trace of Indosinian fold belt of Late Triassic age. The Than Lwin fold belt

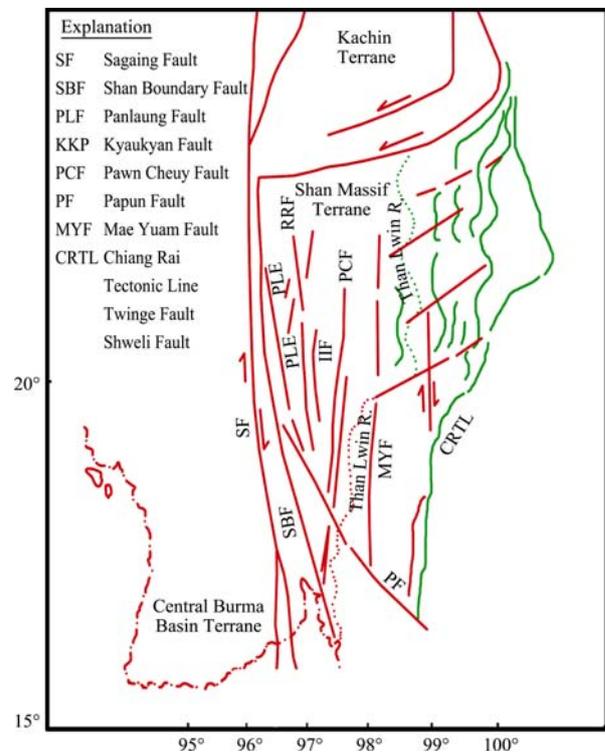


Fig. 2 Map of Tectonic Lineaments in the east of Sagaing Fault. Drawn from Topographic Map of Myanmar.

must be the site of final closure of Paleo-Tethys and it was later affected by drastic tectonic evolution, shaping the fold belt into sigmoidal wrench structures. Eastern boundary of the suture zone can be traced in the map from Thailand through Myanmar up to Yunnan, China. The sigmoidal wrench structures in the map are parallel to the structural grain in the older fold belt. The brittle normal faults trending ENE-WSW and NE-SW, the sigmoidal wrench structures and wrench faults trending N-S are formed by NW-SE or NNW-SSE oriented extensional deformation and E-W or ENE-WSW oriented regional compression during extrusion of Indochina plate along Red River fault from 35-15 Ma (Rangin, G.I.A.C. Project, 1996-1999). Focal mechanism of shallow earthquakes in the area testifies the fact that the suture zone has been affected by compression.

All of these structures follow the simple shear extension pattern. The combined effects of juvenile faults and headward erosion create favorable condition for the formation of waterfalls. Kyaing Taung waterfall on the Nan Teng River in Southern Shan State, Pwe-gauk waterfall near Maymyo, a large waterfall on the Gelaung River near Wetwin in Northern Shan State and many small waterfalls are supposed to be of such origin (Gorshkov, 1959).

4 Discussion

This paper is a preliminary attempt by the author to delineate the suture zone for the Myanmar territory which marked the site of closure of Paleo-Tethys Ocean during late Triassic-Jurassic. Satellite images are used in defining the suture zone, combined with geological information obtained from field work and from literatures published and unpublished. In many

cases, however, more lines of evidence such as detailed field work, substantial field confirmation, data of geometry, kinematics, tectonic geomorphology and related structures are necessary to determine that these lineaments are faults and to delineate the boundary of Paleo-Tethys suture zone, herein named the Than Lwin fold belt. In order to do so, the work requires detailed knowledge of kinematics of strike-slip faults and folds within the suture zone.

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