Geological Evolution of Bago-Yoma Basin, Onshore Myanmar*

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Abstract

Onshore Myanmar is located on the eastern edge of the Himalayan convergence zone. There are eight Tertiary Basins in the onshore of Myanmar: Hukwang, Chindwin, Shwebo, Salin, Pyay Embayment, Irrawaddy Delta, Bago-Yoma, and Sittaung basins (Figure 1). They lie in a north-south trend between the Indo-Myanmar ranges to the west, and the Shan Plateau to the east (Figure 2). Surface and subsurface data suggests that these basins experienced northwest-southeast extension in the Miocene, followed by northeast-southwest transpression in the Pliocene during a change of maximum horizontal stress direction, resulting in a variety of structural styles, such as thrust faults, reverse faults, positive flower and folds that are compartmentalized by normal faults (Pivnik et al., 1998).

The Tertiary sediments deposited in these basins are a very thick (up to 15 km) sequence of Late Cretaceous and Cenozoic deposits (Figure 4). The large volume of sediments in these basins may be a result of sediment loading, reflecting an Early Cenozoic drainage system more closely linked to the eastern Himalaya. Cross-sections across the basins show that the deepest parts are situated in the west, and thinning to the east, with pronounced asymmetry (Figure 3). These cross sections also show the tectonic inversion of the Central Myanmar Basin as evidenced by eastward migration of the Miocene depocenters (Bertrand and Rangin, 2003). During much of the Cenozoic, the basins were broad and rapidly subsiding with little tectonic deformation until the Miocene in the central and southern parts (Figure 4).

The deposition of Eocene sediments probably took place during the pre-rifting stage and is characterized by terrestrial sequences, while Oligocene to Late Miocene sedimentation occurred during the syn-rift stage, characterized by shallow marine sequences (Figure 3). The Pliocene sedimentation deposited during post-rift stage is characterized by fluvial-deltaic sequences.

The Tertiary Bago-Yoma Basin is located to the southeast of the main petroleum producing fields of the Central Myanmar Basin (Figure 2). It is bounded by the Sagaing Fault to the east and Irrawaddy River to the west. The Bago-Yoma area is an area of hilly terrain rising over 400 m in elevation, and is bounded in the east by the linear structural segments of the Sagaing Fault (Figure 5). Bago-Yoma Basin can be sub-divided into five structural trends as shown in Figure 6, including the Wetchakkon-Meiktila Anticline in the northern part of the block, Thadodan trend to the west, Kalama Anticline to the southeast, Sinmadaung Anticline, and the Aunglan Anticline. This area is structurally complex owing to a strong interplay between the inversion of the older extensional faults and the superimposition of enechelon folds related to strike-slip faults. These folds are oriented in a north-northwest to south-southeast direction related to the Sagaing Fault and more compartmentalized by the normal cross faults. These normal cross faults could have been reactivated during the Pliocene with oblique slip or were recently formed as a result of associated folds (Figure 7).

There are two distinct belts of folds: the southern fold area and the northern fold area. Between these two belts lies the Pliocene basinal area that is weakly deformed by Pliocene deformation. The reconstruction work at the Thadodan structure reveals a long-lived horst block which was developed during the Miocene. The evidence of inversion of the normal faults can be found in almost all faults in the southern area, while evidence of the inversion can only be found in the major faults in the northern part (Figure 8).

This article utilizes newly acquired seismic data (2013) to confirm the prior established structural model for this area. Seismic characteristics such as onlap, angular unconformity and asymmetric anticline suggest that the area has undergone deformation that is consistent with the published model.

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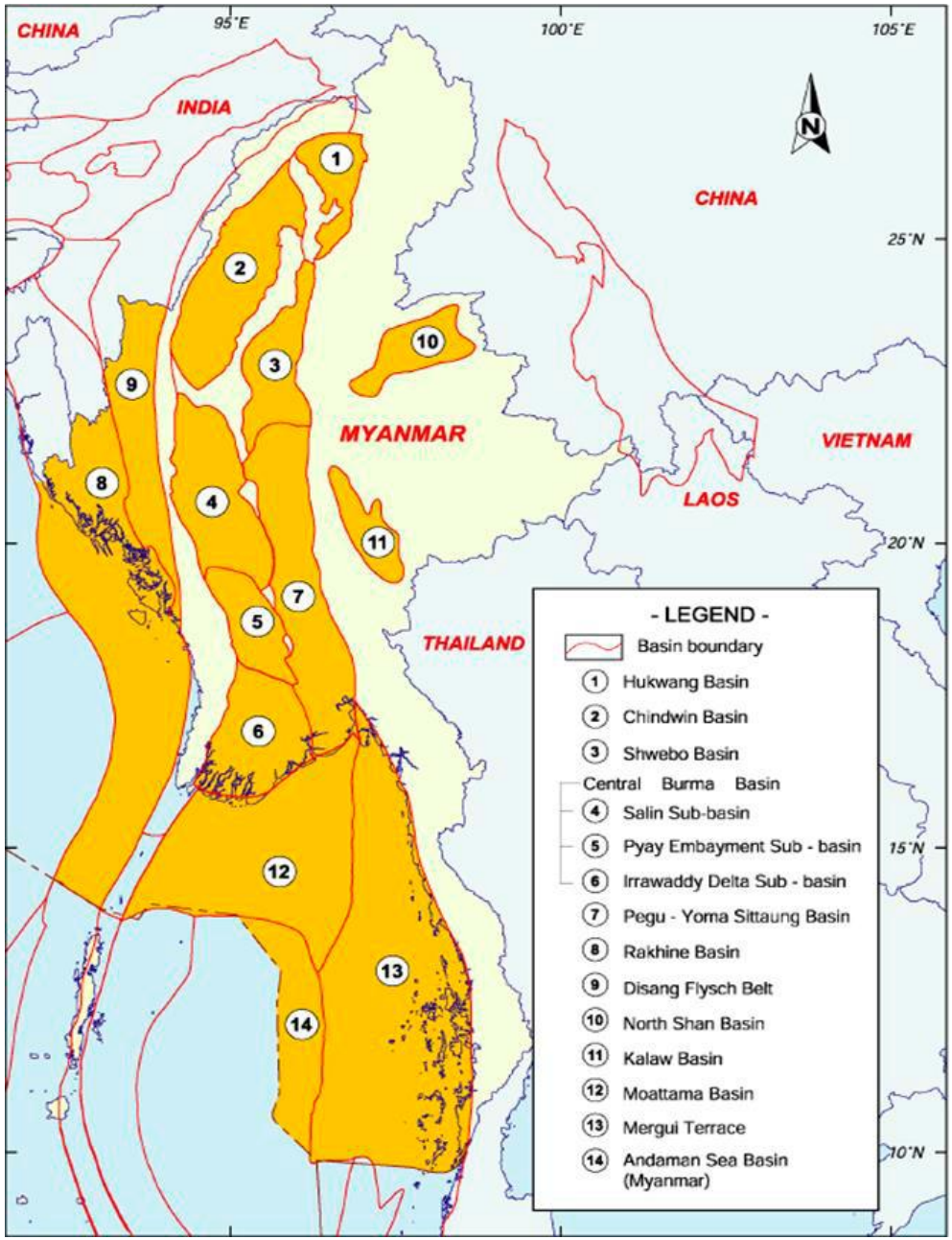

Figure 1. Location map showing basins in Myanmar.

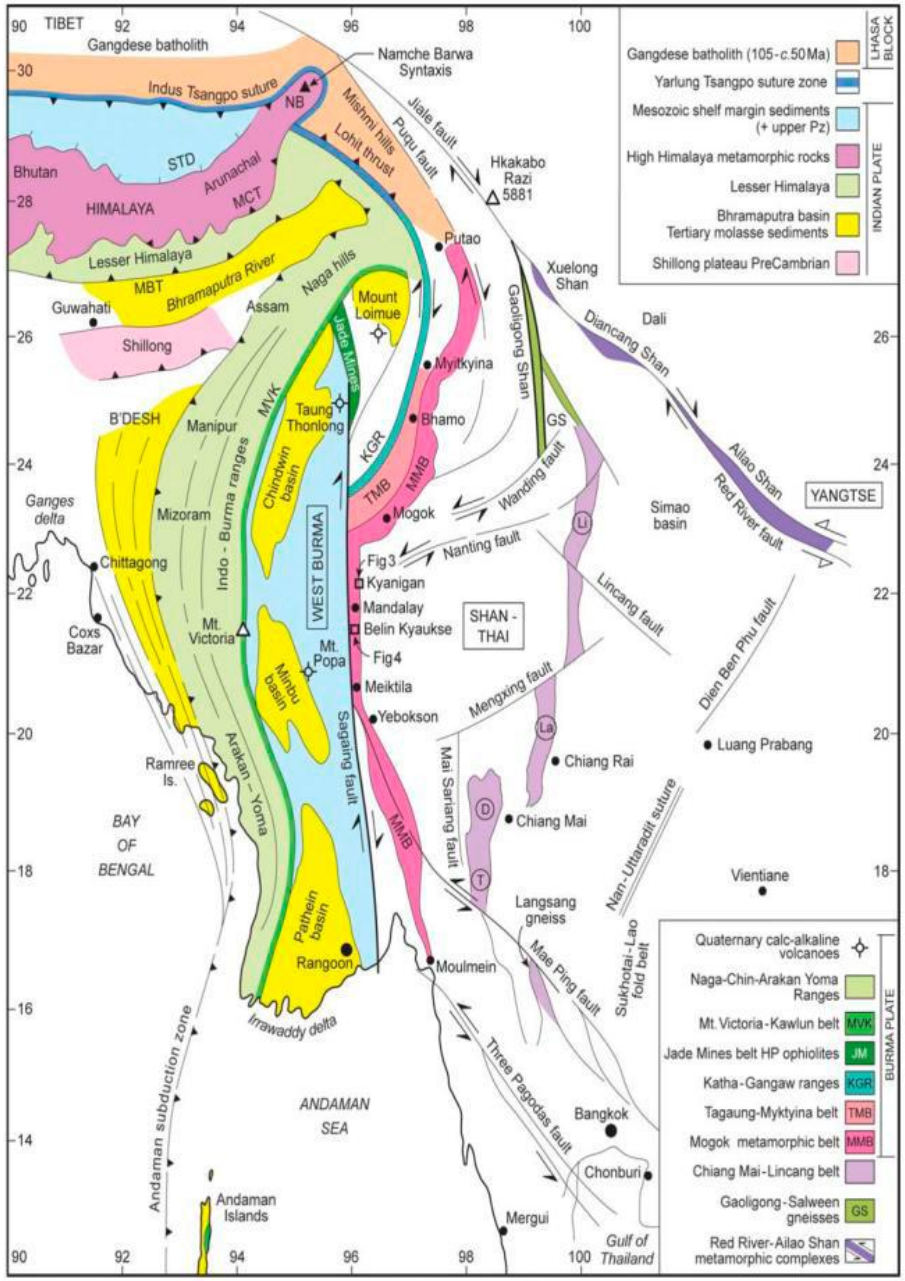

Figure 2. Tectonic setting of the central Myanmar (Searle et al., 2012).

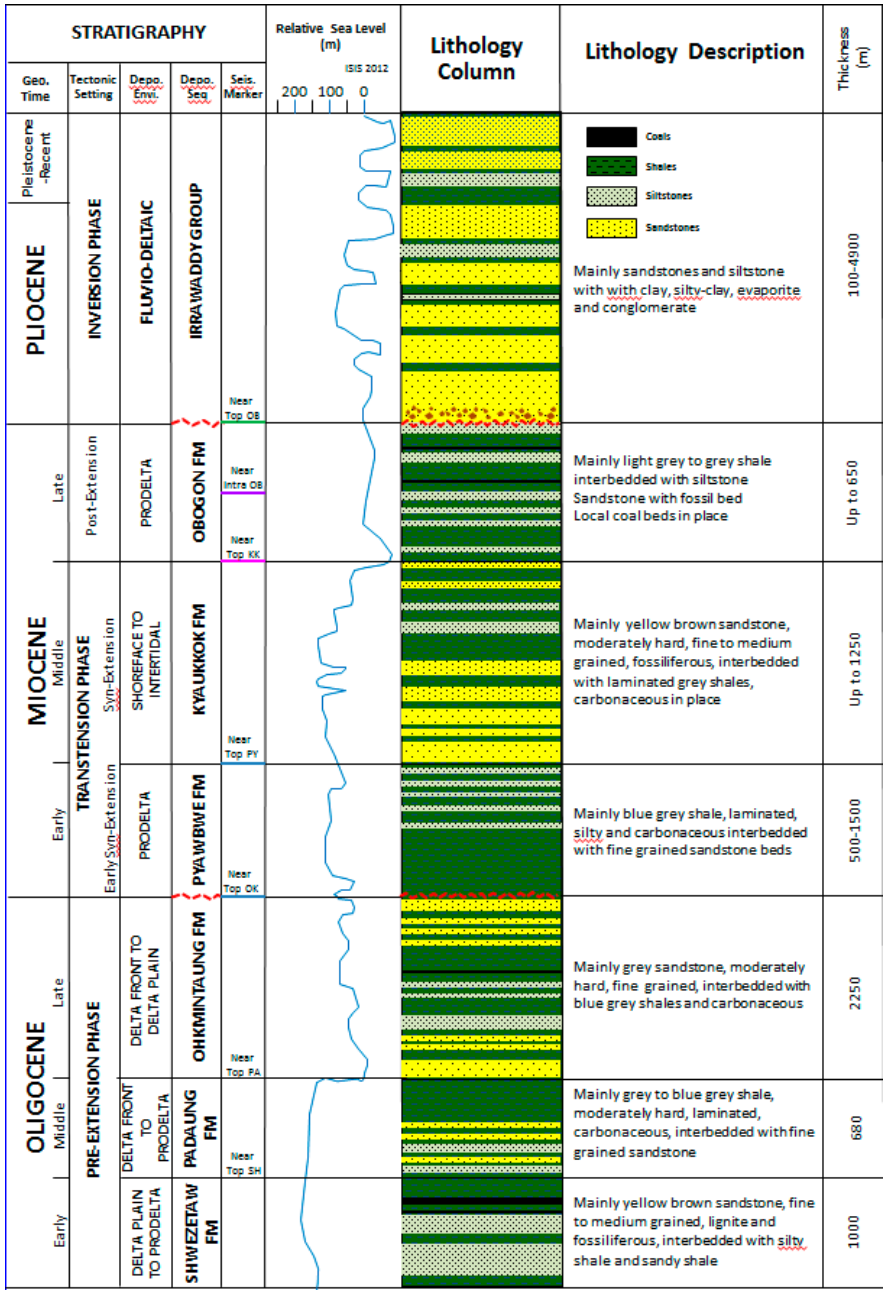

Figure 3. Generalized stratigraphic column of the Bago-Yoma Basin.

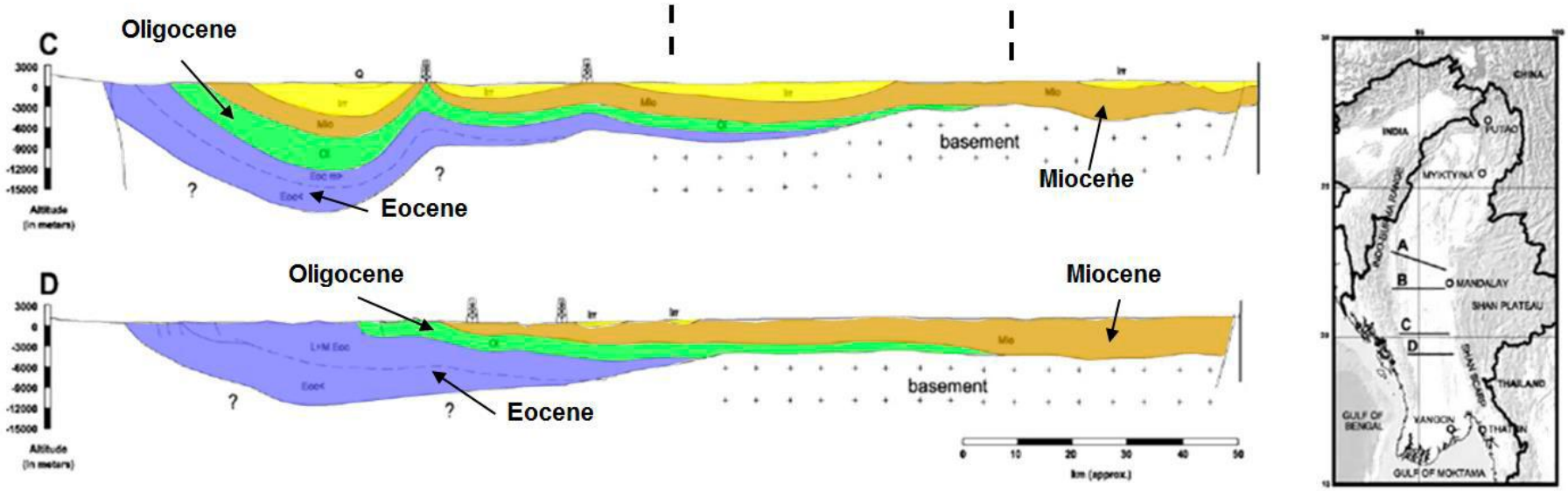

Figure 4. Schematic cross section of Bago-Yoma Basin (Modified from Bertrand and Rangin, 2003).

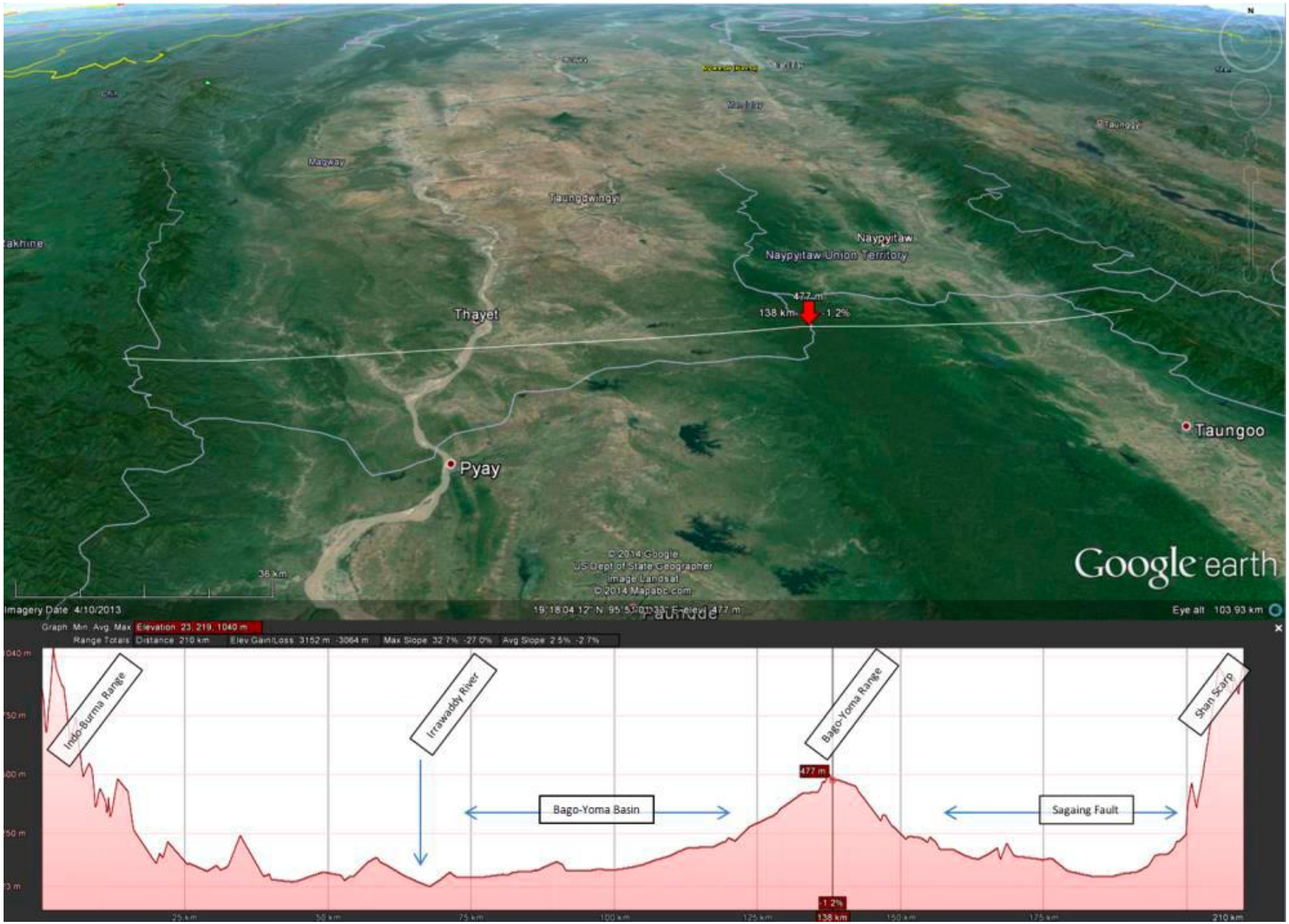

Figure 5. Elevation profile across the Bago-Yoma Basin, from Indo-Burma Range to Sagaing Fault (Image from Google Earth).

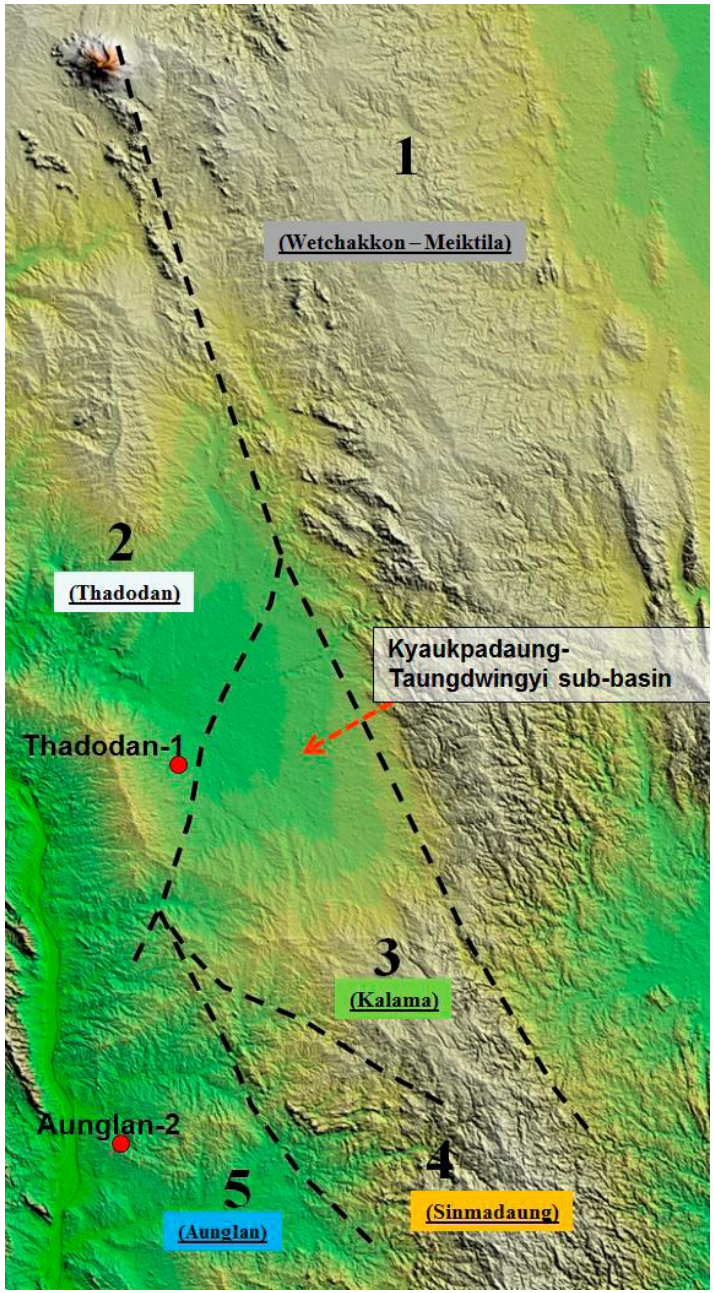

Figure 6. Colored relief map showing surface structural trends in Bago-Yoma Basin.

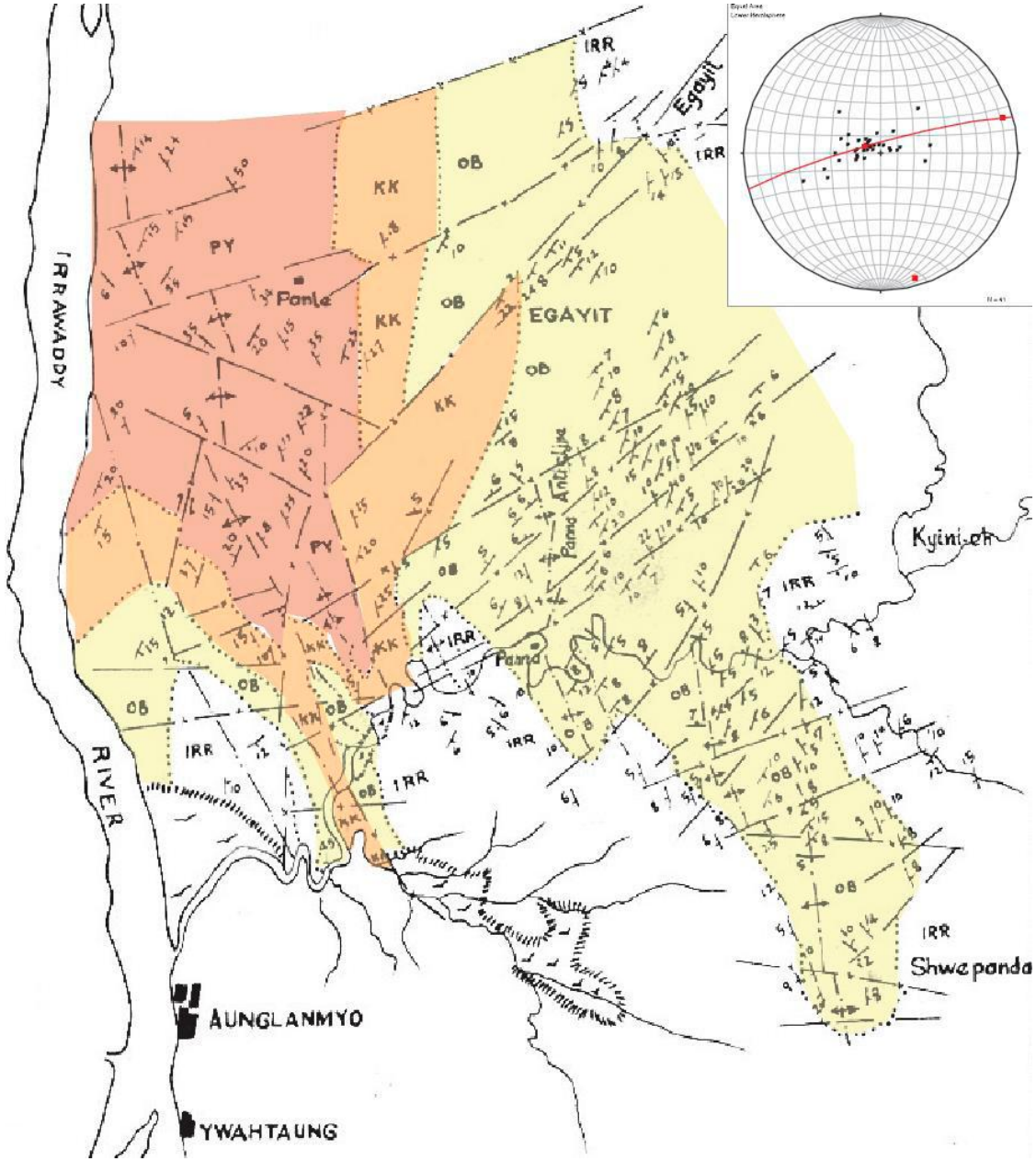

Figure 7. Example of enechelon folds in Bago-Yoma Basin, Aunglan area (modified from Myint Aye and Aung Nyat Kyaw, 1975). Stereonet of bedding of data taken from the map.

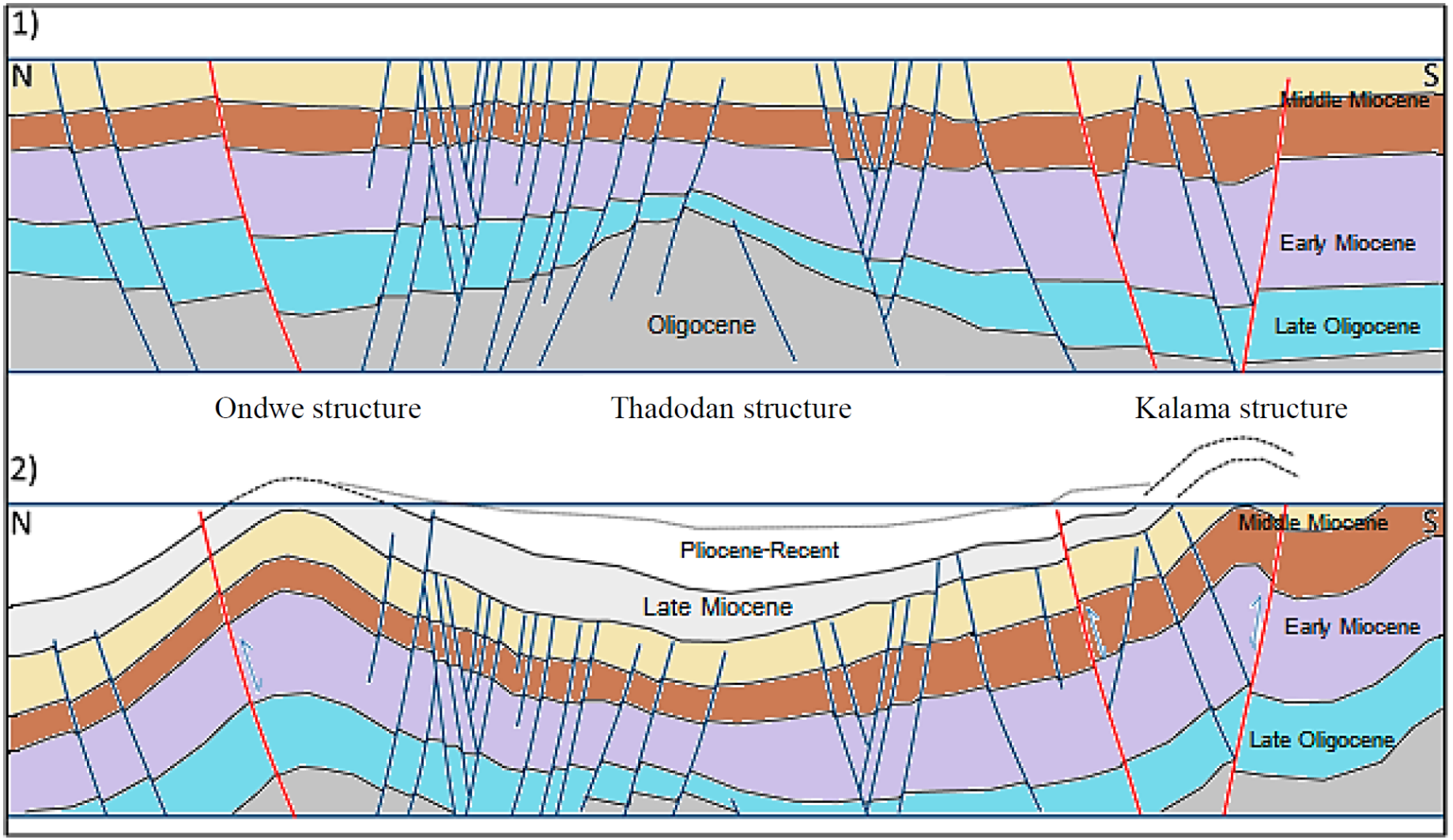

Figure 8. (1) Structural restoration along the seismic lines that pass through the Ondwe structure, Thadodan structure and Kalama structure, illustrating structural inversion in Bago-Yoma Basin. (2) Shows the expected Middle Miocene section as reconstructed from the recent seismic section.