PSA Preliminary Study on the Late Cenozoic Structural Characteristics of Arakan Fold Belt, Bay of Bengal*

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Abstract

The Arakan fold belt (Bay of Bengal), located at the west piedmont of the Indo-Burman Ranges, comprises a series of NNW-SSE-trending anticlines and its structural characteristics is very poorly studied. Integration of well data and 2-D seismic reflection profiles are used to study the late Cenozoic structural characteristics of the Arakan fold belt, focusing on the development characteristics of décollement, geometry and kinematics of anticlines. The Arakan fold belt is characterised by multiple décollements consisting of (1) basal décollement, which is situated at about 6.5 s (two-way travel time); (2) intermediate décollements, which are situated at the bottom of the Quaternary or the underlying upper Miocene at about 2.5 s. These décollement horizons generate two sets of detachment folds under regional compression. The basal décollements controlled the development of the Arakan fold belt, while the intermediate décollement affected the deformation locally, the deformation propagated from east to west with the leading edge formed in the Quaternary. Based on structural analysis results, we propose two end-member kinematic models for folding in Arakan fold belt. Model 1 without intermediate décollement level, detachment fold formed above basal décollement; Model 2 with intermediate décollement level, two sets of detachment folds developed above basal and intermediate décollements, respectively. The anticlinal wavelength in Model 2 is much shorter than that of Model 1, therefore, the anticlinal wavelength can be used to judge whether intermediate décollement level developed or not in deformed strata pile. The geometry and kinematics of anticlines are primarily controlled by underlying décollement level (s), the formation of overlapping anticlines or anticline bifurcation in the Arakan fold belt would imply the underlying décollement level(s) changed along strike. Fluid overpressure could be an important deformation-controlling factor in formation of Arakan fold belt.

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Theme 9 - 17B

Arakan fold belt (Bay of Bengal) is located at the west piedmont of Indo-Burma Ranges, comprising a series of NNW-SSE-trending anticlines (Fig. 1), its structural characteristics, especially offshore area, is very poorly studied due to lack of geophysical data. In this paper, we combined well data and 2D seismic reflection profiles to study the late Cenozoic structural characteristics of Arakan fold belt, focusing on the characteristics of detachment levels and geometry and kinematics of anticlines. Arakan fold belt is characterized by consisting of multiple detachment levels: (1) basal detachment level, which situated at about 6.5 s (Two-way traveltime) (Figs. 2-4 and 5a); (2) intermediate detachment levels, which situated at the bottom of Quaternary or underlying upper Miocene at about 2.5 s (Figs. 5b and 6). Those detachment levels generated two sets of detachment folds under regional compression. The basal detachment level controlled the development of Arakan fold belt, while the intermediate detachment level affected the deformation locally. The deformation time recorded by growth strata showed that the deformation of Arakan fold belt propagated from east to west with the leading edge formed in Quaternary (Figs. 3 and 4). Based on structural analysis results we proposed two end-member kinematic models for folding in Arakan fold belt (Figs. 7 and 8): Model 1 without intermediate detachment level, detachment fold formed above basal detachment level (Fig. 7a); Model 2 with intermediate detachment level, two sets of detachment folds developed above basal and intermediate detachment levels, respectively (Fig. 7b). The wavelength of anticline in Model 2 is much shorter than that of Model 1, therefore, the wavelength of anticline can be used to judge whether intermediate detachment level developed or not in deformed strata pile. The geometry and kinematics of anticline is primarily controlled by underlying detachment level(s), the formation of overlapping anticlines or anticline bifurcation in Arakan fold belt (Das et al., 2010) would imply the change of underlying detachment level(s) along strike (Figs. 5 and 7) Fluid overpressure could be an important deformation controlling factor in formation of Arakan fold belt.

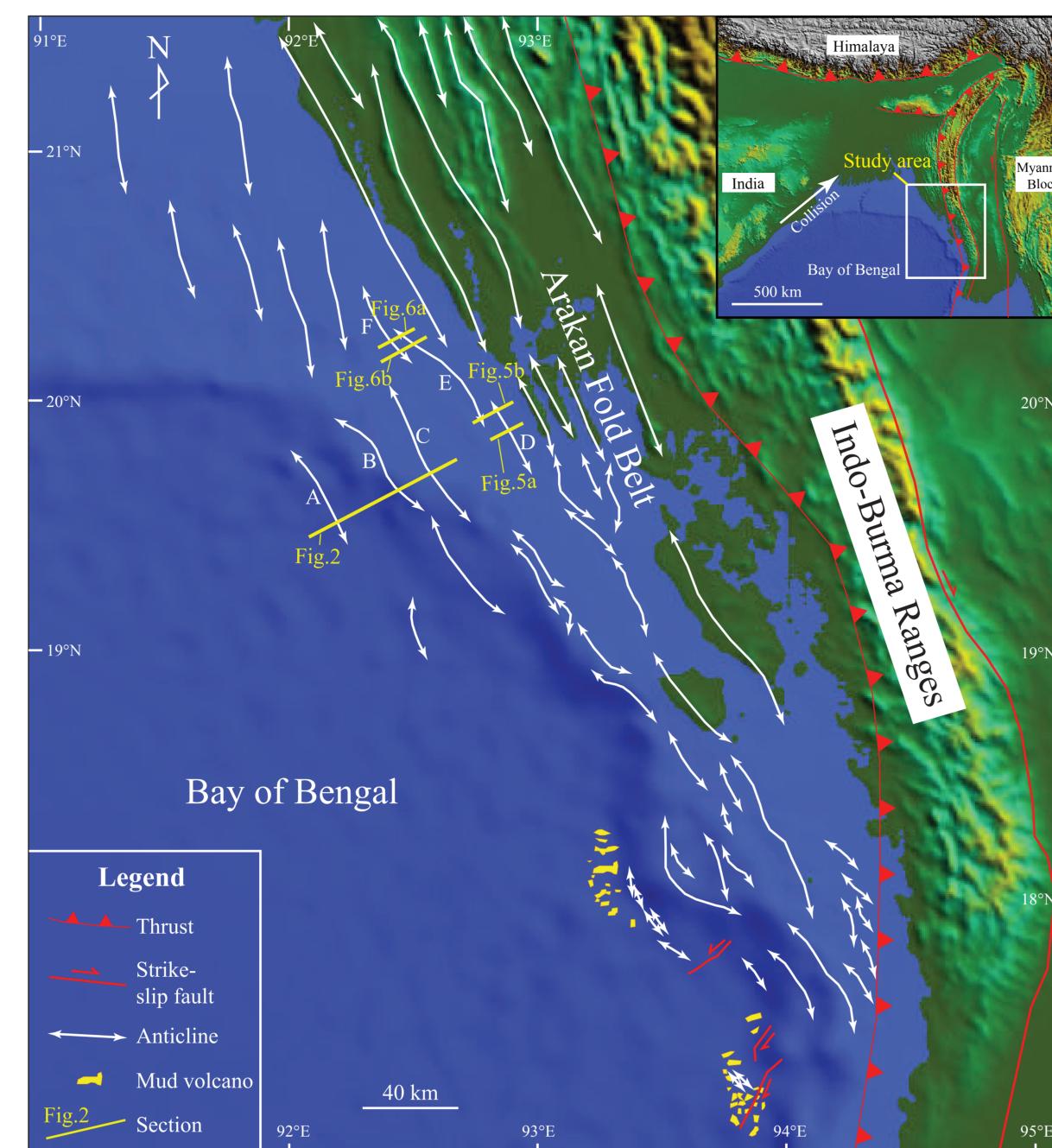
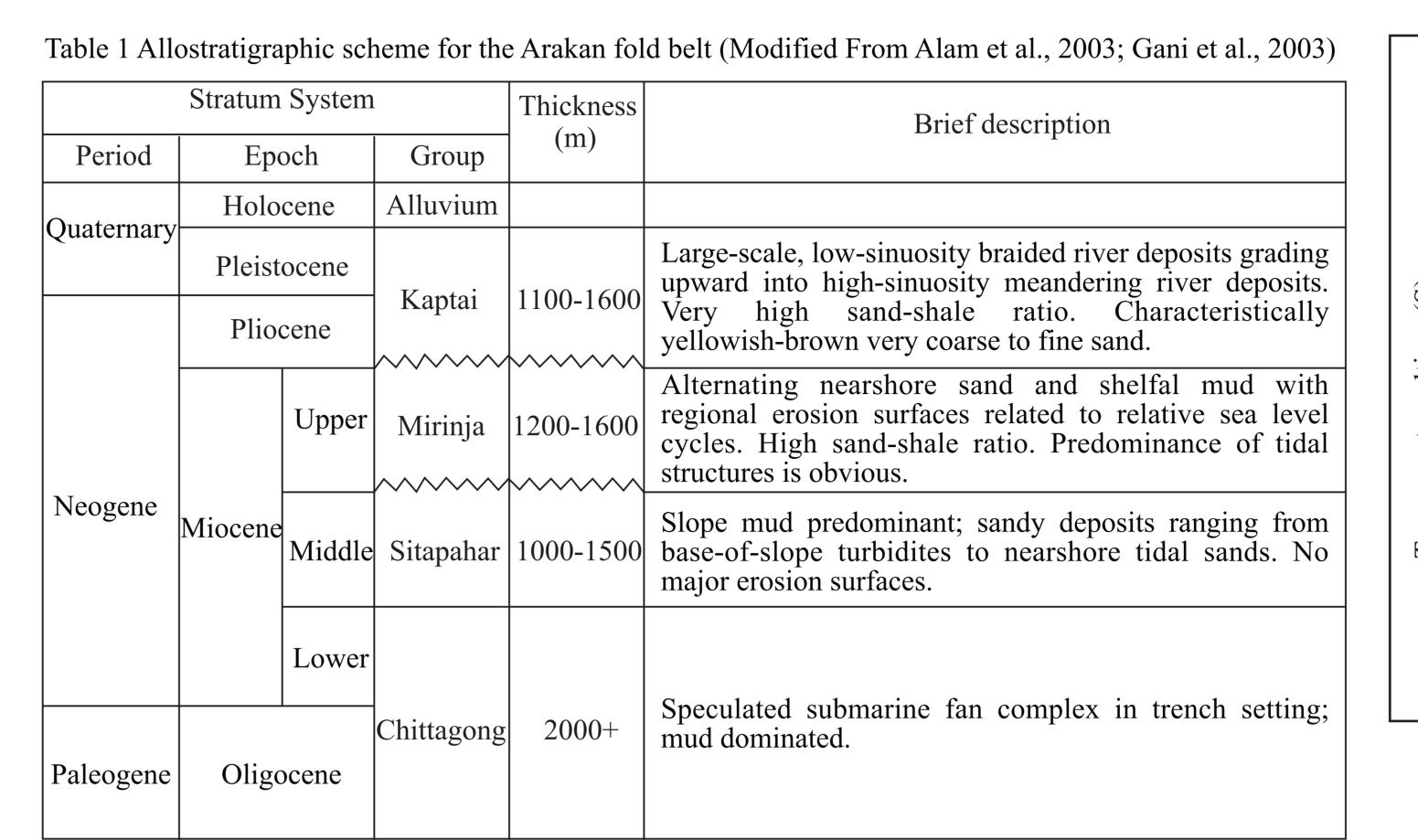


Fig. 1 Topographic map (using ETOPO1 data, http://www.ngdc.noaa.gov/mgg/global/etopo2 .html) of the Arakan fold belt and adjacent area showing traces of anticlines (after Sikder et al., 2003 and new 2D seismic data) and sections used in this study. Refer to inset for location of the Arakan fold belt, which formed in late Cenozoic due to oblique collision between India plate and Myanmar block (Dasgupta et al., 1995; Lohmann,1995)



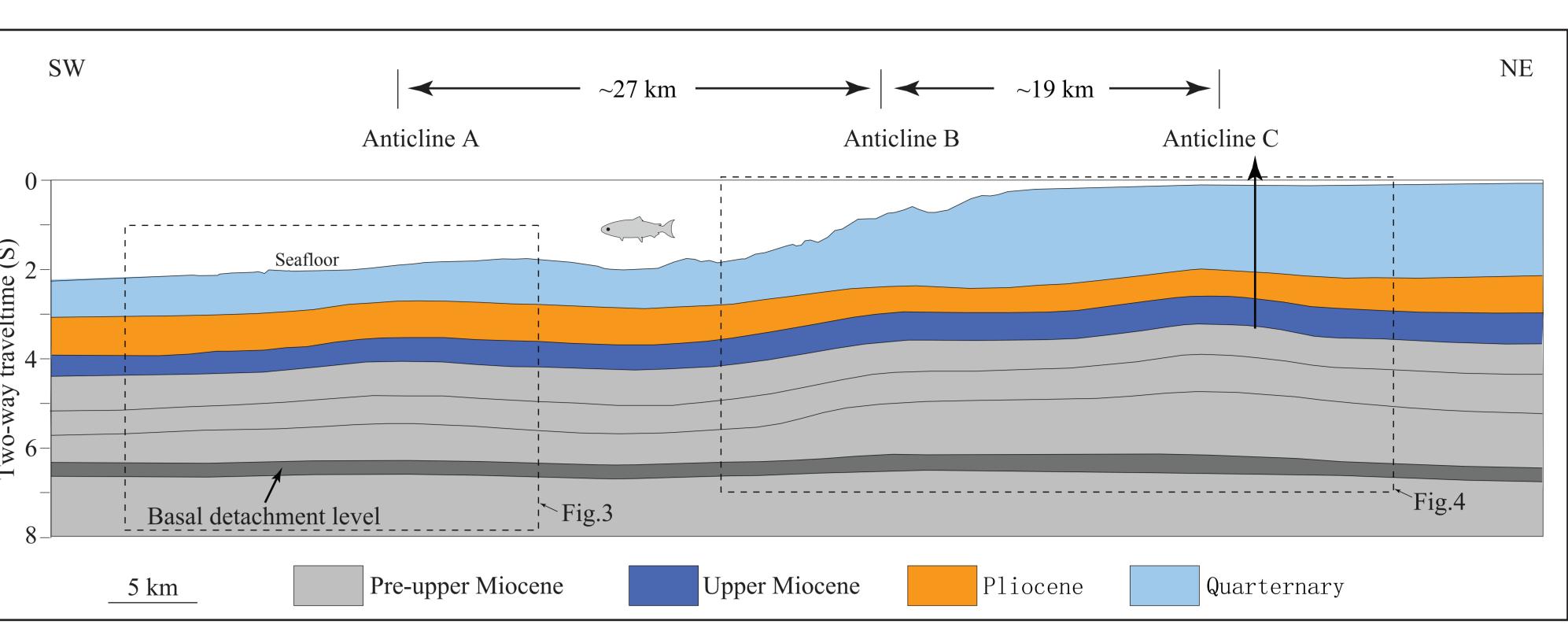


Fig. 2 Geological cross section across anticlines A, B and C, Arakan fold belt (see Fig. 1 for location). The structural style of anticlines is detachment fold above basal detahcment level. The distance amongst adjacent anticlines is 19-27 km, which is longer than that of anticlines formed above intermediate detachment level (Figs. 5b and 6)

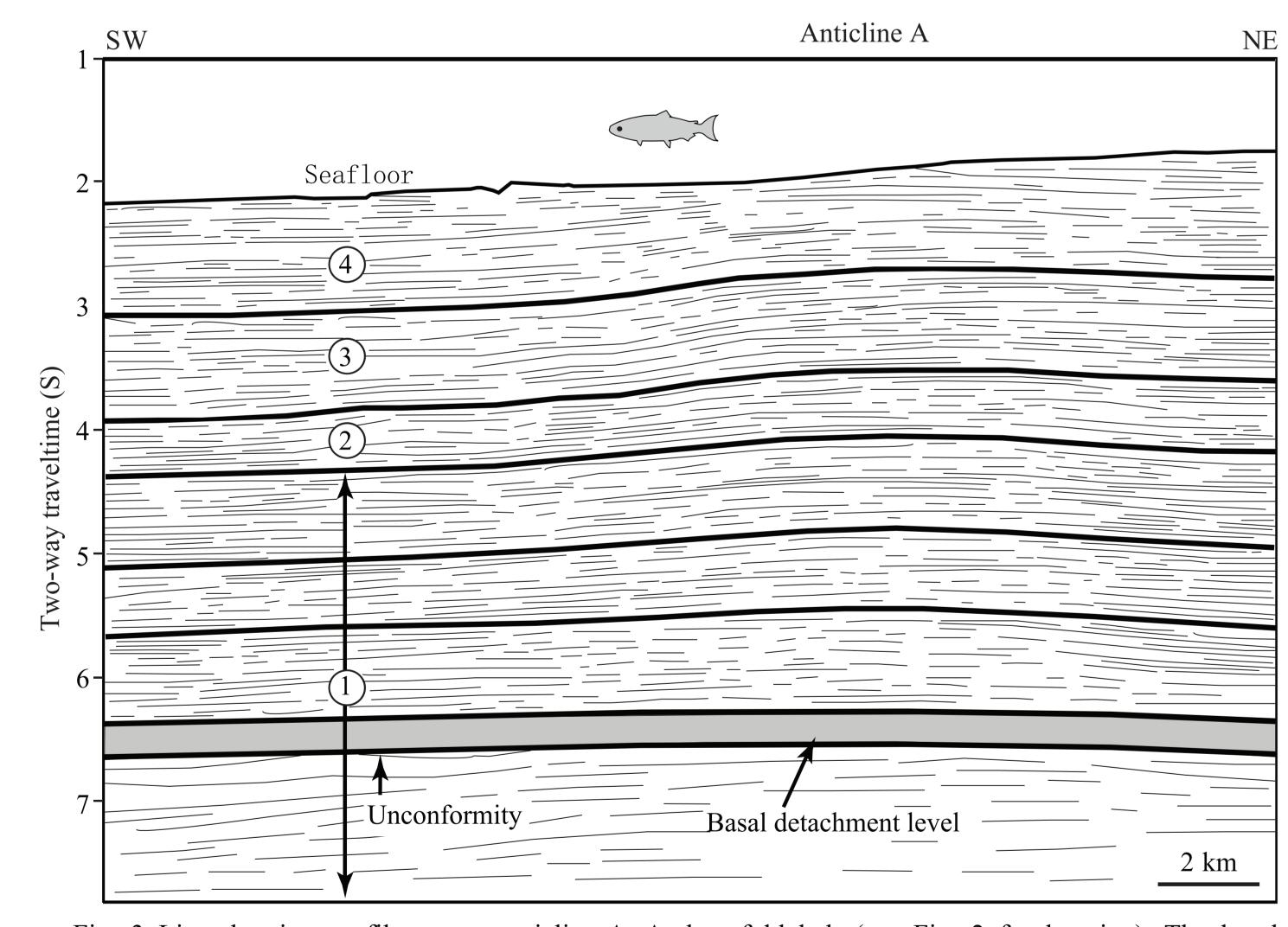


Fig. 3 Line drawing profile across anticline A, Arakan fold belt (see Fig. 2 for location). The basal detachment level situated at about 6.5 s (Two-way traveltime). Anticline A is located at the the deformation leading edge of Arakan fold belt, no obvious growth strata were formed on limbs of this anticline indicate that it would form in Quaternary. 1—Pre-Upper Miocene; 2—Upper Miocene; 3—Pliocene; 4—Quaternary

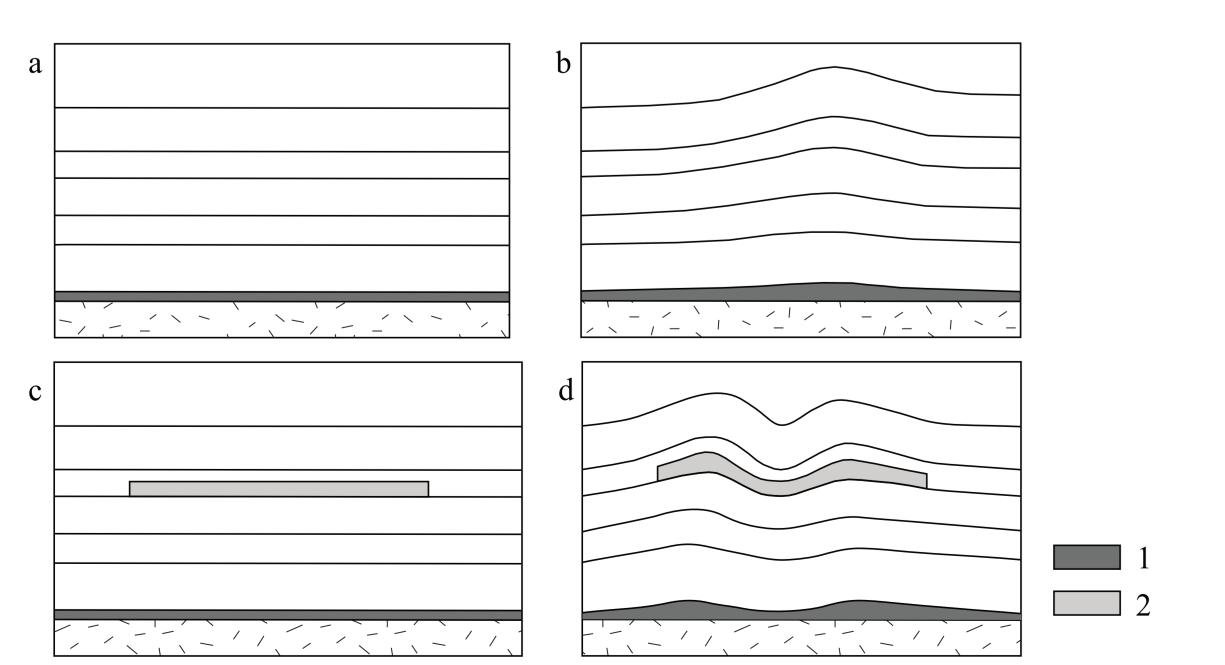


Fig. 7 Two end-member kinematic models for folding in Arakan fold belt. (a-b) Model 1 without intermediate detachment level, a- state before deformation; b- development of detachment fold above basal detachment level. (c-d) Model 2 with intermediate detachment level, c- state before deformation; d-development of detachment folds above basal and intermediate detachment levels. Note that the wavelength of anticline decreased obviously in Model 2. 1—Basal detachment level; 2—Intermediate detachment level

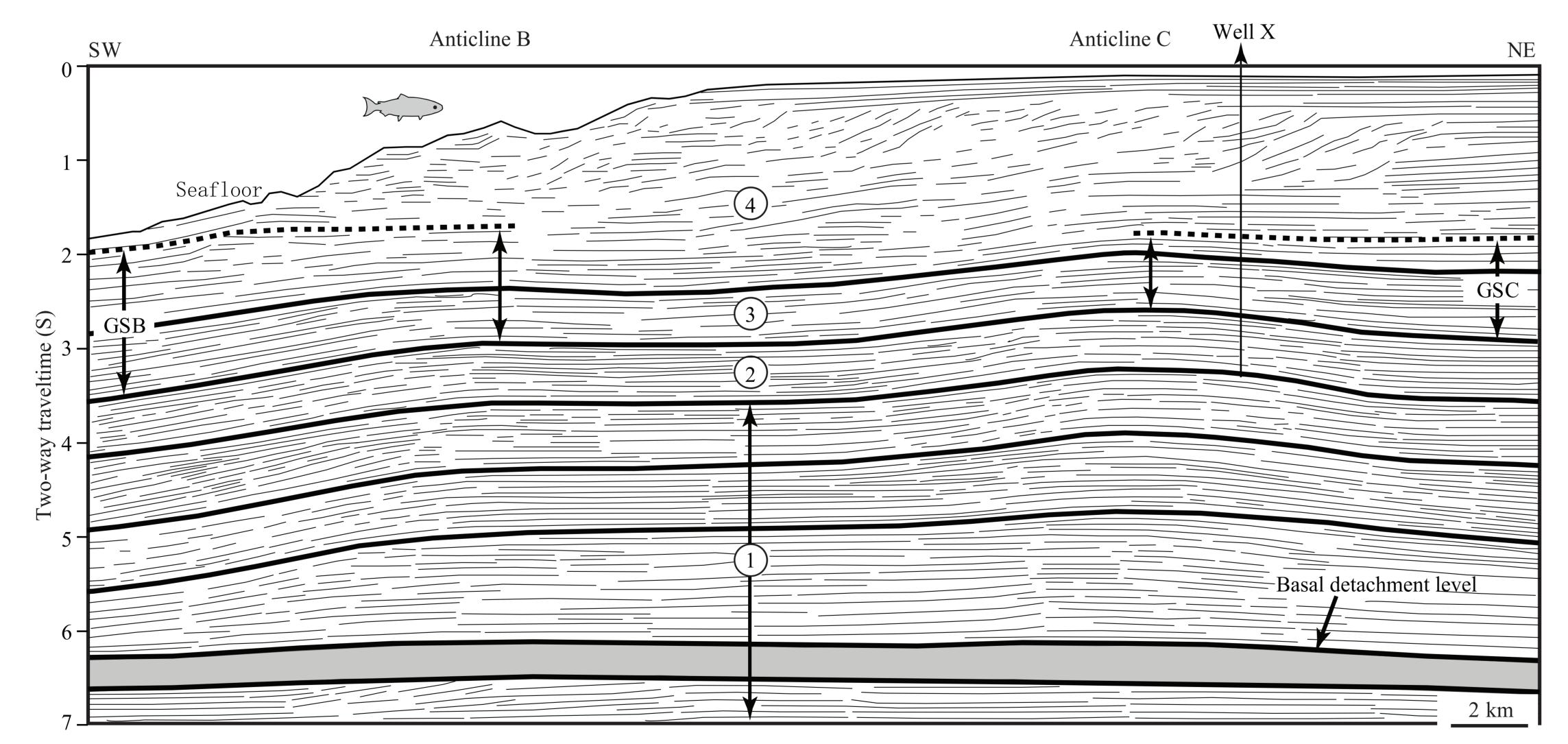


Fig. 4 Line drawing profile across anticlines B and C, Arakan fold belt (see Fig. 2 for location). Both of anticlines B and C were formed above basal detachment level in the Pliocene, which is earlier than anticline A (Fig. 3). Therefore, the deformation in the Arakan fold belt propageted from east to west. GSB: Fanning of limb dips in growth strata at west limb of anticline B; GSC: Fanning of limb dips in growth strata at east limb of anticline C. 1—Pre-Upper Miocene; 2—Upper Miocene; 3—Pliocene; 4—Quaternary

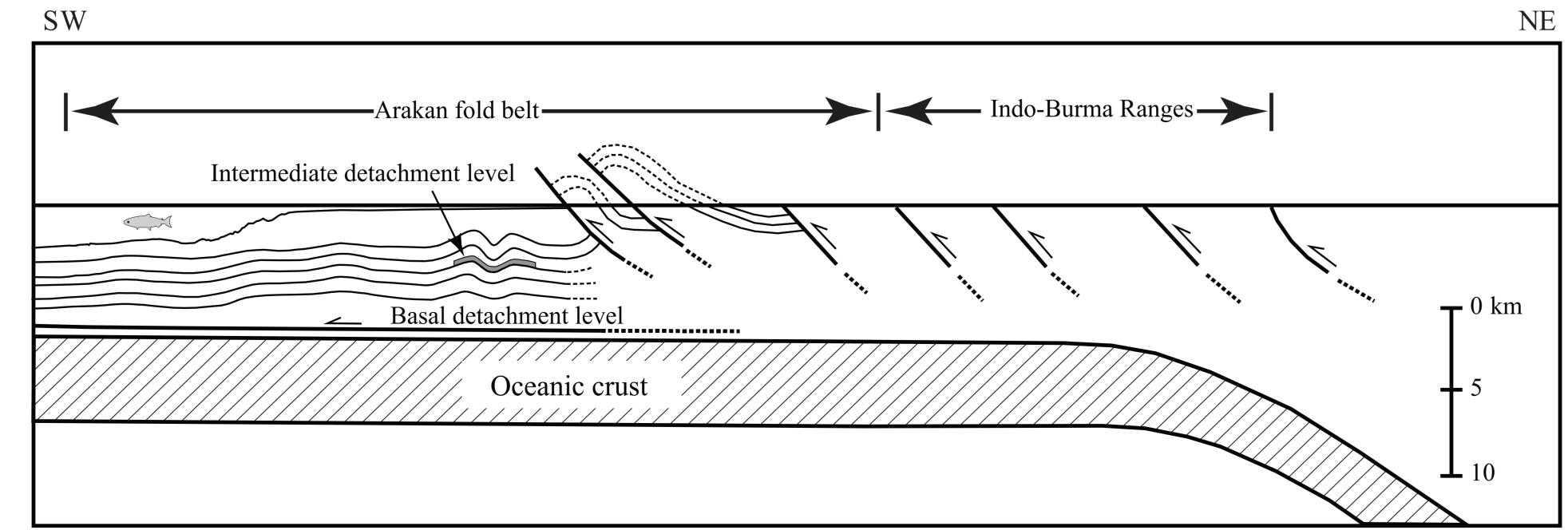
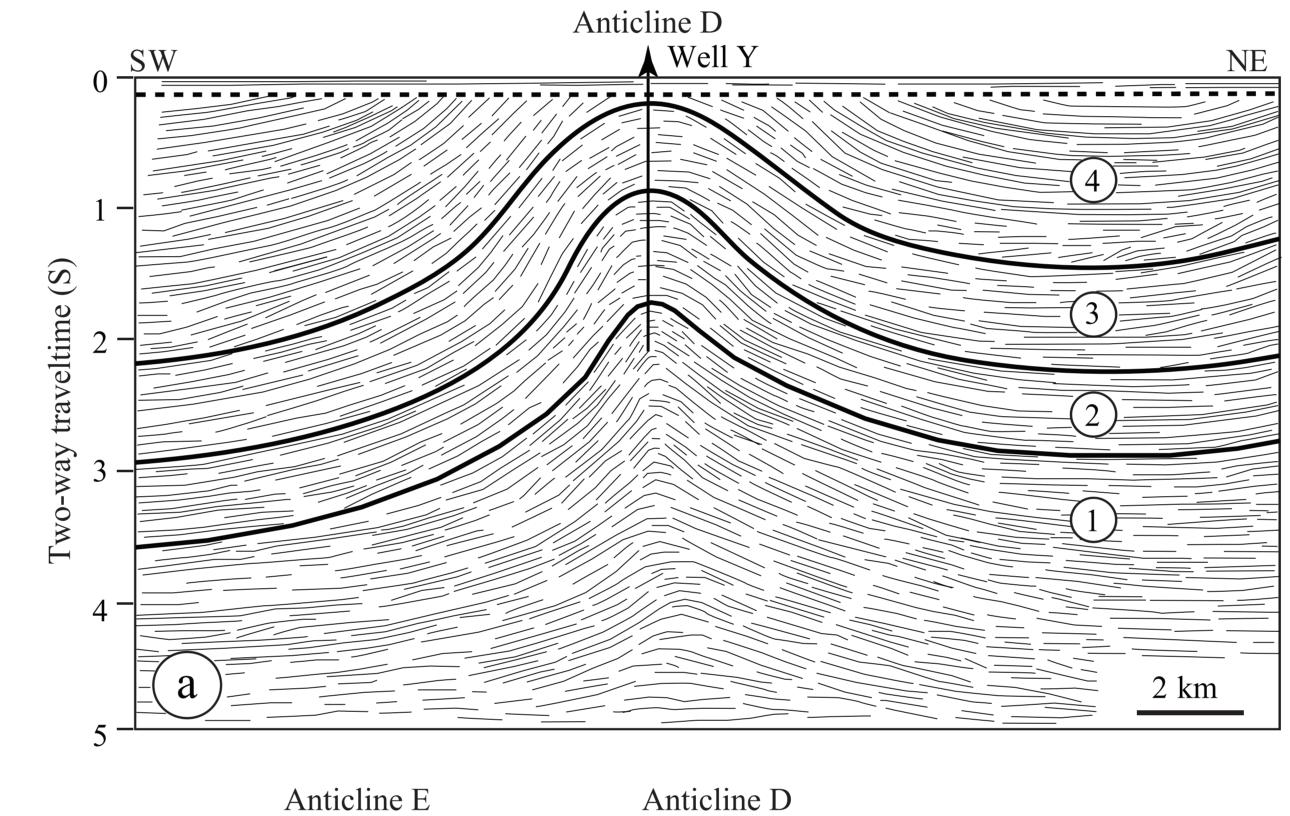


Fig. 8 Schematic cross-sectional profile across the Arakan fold belt and Indo-Burman ranges showing main structural features of Arakan fold belt (Modified from Sikder et al., 2003)



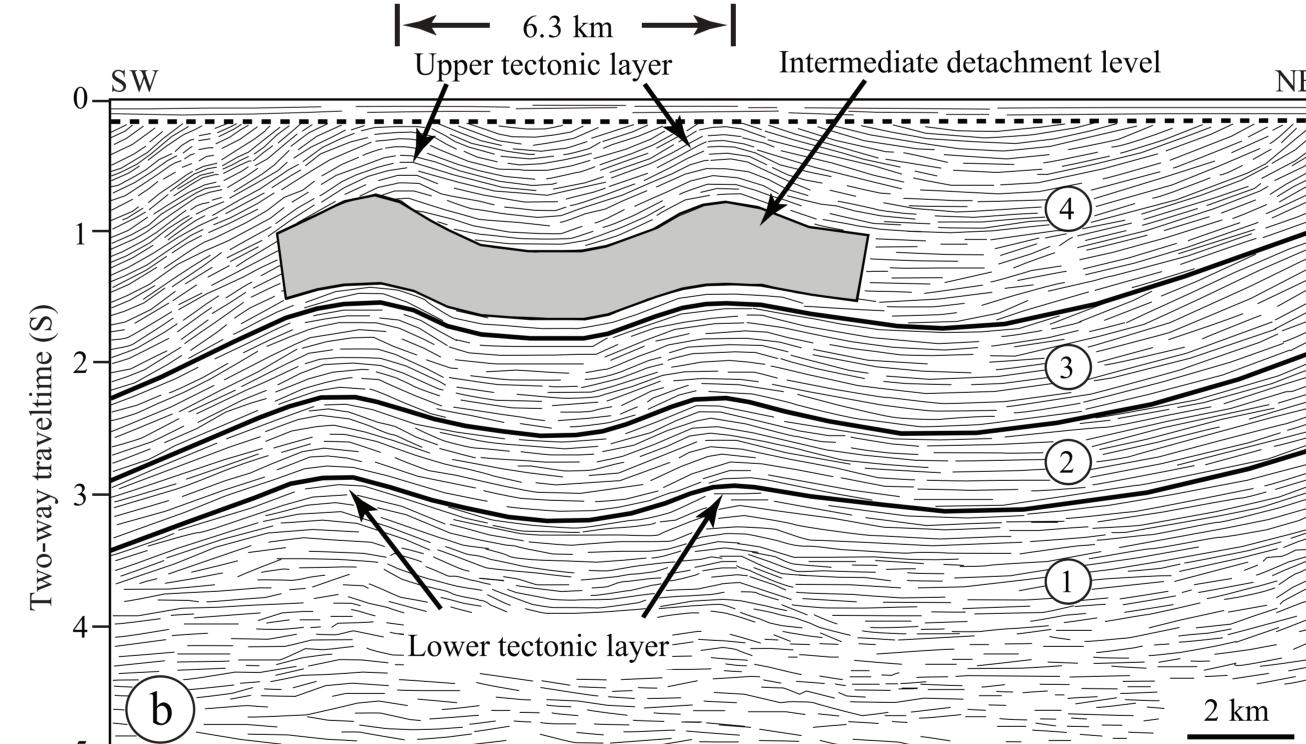
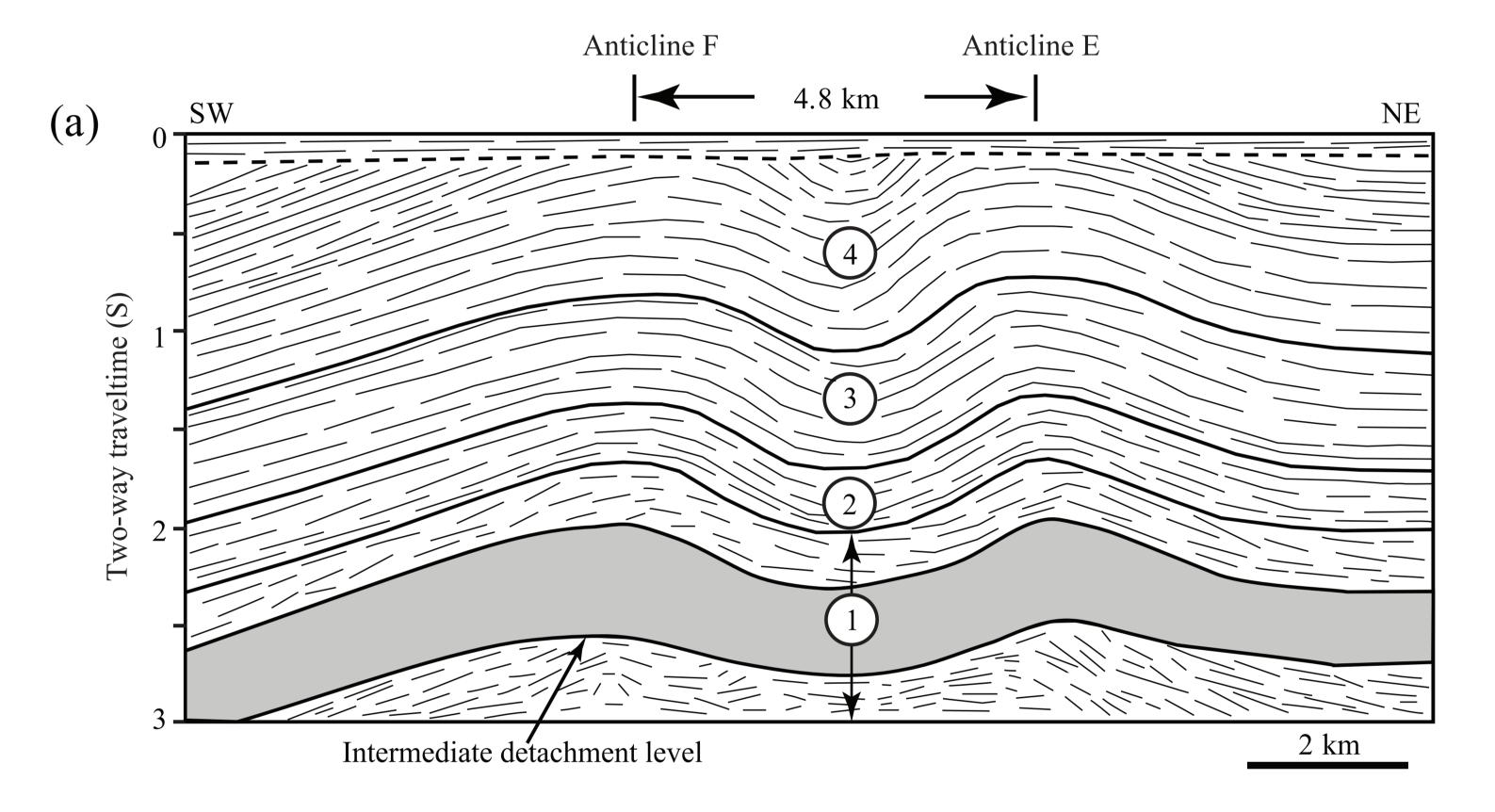


Fig. 5 Line drawing profiles across anticline D (a) and transfer zone between anticlines D and E (b), Arakan fold belt (see Fig. 1 for location). The geometry of anticline D varies along strike is mainly controlled by detachment level. 1—Pre-upper Miocene; 2—Upper Miocene; 3—Pliocene; 4—Quaternary



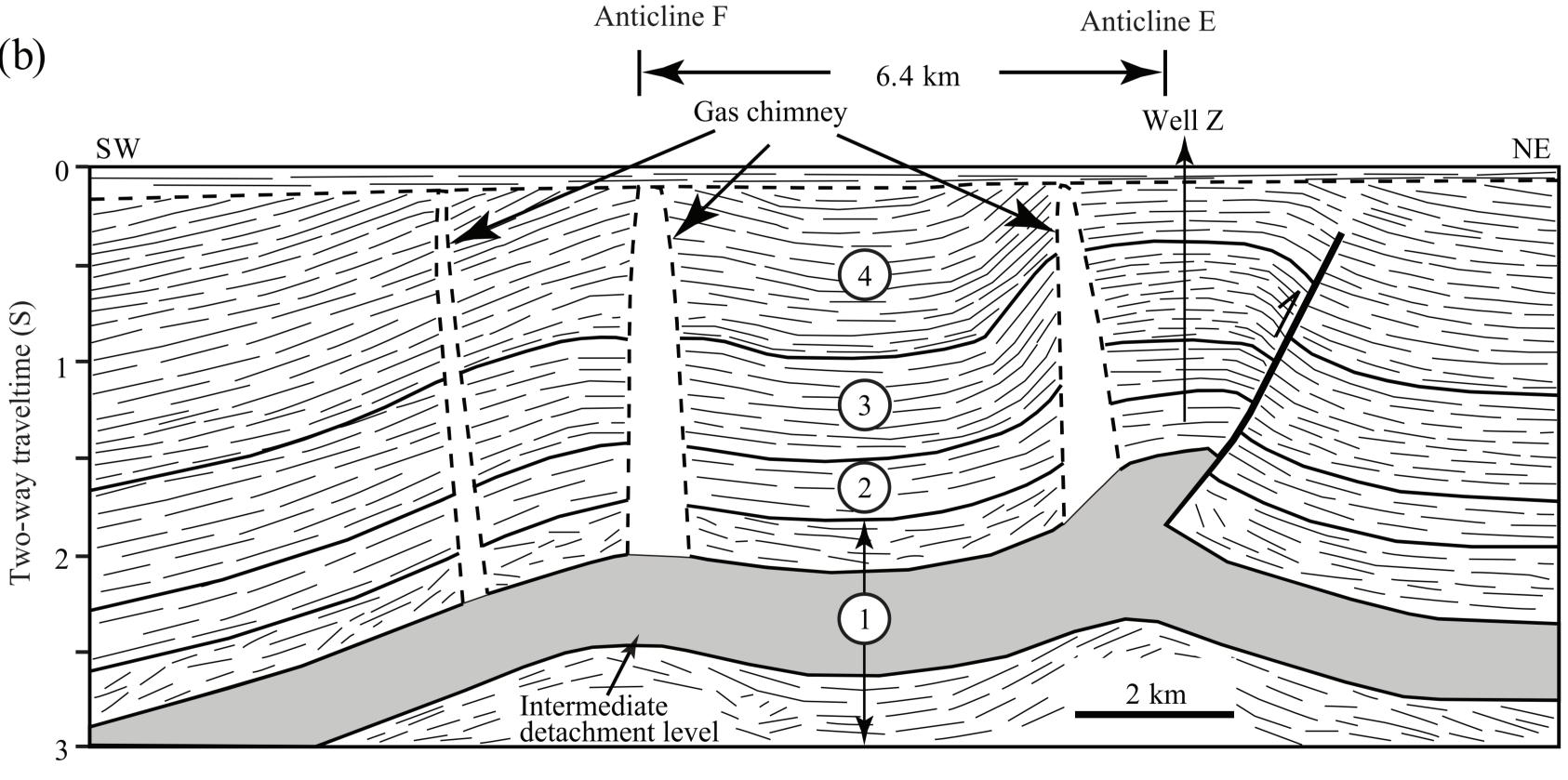


Fig. 6 Line drawing profiles across transfer zone between anticlines E and F, Arakan fold belt (see Fig. 1 for location). The intermediate detachment level situated at about 2.5 s, both of anticlines E and F are detachment folds, gas chimneys were developed at the crest and limbs of anticlines, and the vergence of anticline E changed along strike. 1—Pre-upper Miocene; 2—Upper Miocene; 3—Pliocene; 4—Quaternary

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