

MIDDLE TRIASSIC EVOLUTION OF THE NORTHERN PERI-TETHYS AREA AS INFLUENCED BY EARLY OPENING OF THE TETHYS OCEAN

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Abstract: During Middle Triassic times, the Germanic or northern Peri-Tethys Basin pertained to the western Tethys Ocean. The basin was closed from the north and open toward the Tethys by tectonically controlled depressions (gates). The gates were opened in different times. The marine incursions broke first (as early as in late Scythian time) through the eastern gates and from the Polish Basin advanced gradually to the west.

Semiclosed disposition of the basin resulted in its distinctive environmental diversification. Open marine environments developed along the southeastern margins which should be regarded as an integrate part of the Tethys Ocean rather than the epicontinental sea. Northward and westward from the Silesian and Carpathian domains the environments became more restricted. This resulted in significant facies diachrony between the western and eastern parts of the basin. As indicated by the faunal diversity, facies variability and geochemical properties of the sediments, during almost entire Anisian time the open marine sedimentation dominated in the eastern part while the western part displayed restricted circulation, typical for the semi-closed, evaporitic basin. The circulation reversed in Ladinian time when the westward shift of the tethyan spreading center gave rise to opening of the western gate. Meanwhile, the eastern and northern parts of the basin were uplifted and underwent emersion by the end of the Ladinian.

Evolution of the southern parts of the Germanic Basin (Silesia, Holy Cross Mts., SW Germany) has been directly influenced by the Tethys rifts. The crustal motion was transmitted from the Tethys rift onto its northern periphery by reactivated Hercynian master faults.

The Northern Germany and the North Sea basins were controlled by the North Atlantic–Arctic rift system. The central part of the basin was dominated by thermal subsidence.

Despite of the intense synsedimentary tectonism affecting the basin, the distinguished 3rd order depositional sequences resulted from eustatic controls. The concordance between the tethyan and peritethyan sequence stratigraphy argues for the overregional, eustatic nature of the sequences.

Faunal migration from the Tethys into its northern periphery followed generally the rift-controlled opening of the seaways within the Tethys. The first tethyan faunas which appeared in the south-eastern part of the Polish Basin as early as in Induan time came from the eastern branch of the Tethys Ocean (Paleo-Tethys). The next migration waves proceeded by western branches of the spreading ocean (Neo-Tethys) and entered the Germanic Basin through the Silesian-Moravian Gate (in Anisian time) and through the Western Gate from Ladinian time onward.

Abstrakt: W czasie środkowego triasu basen germański należał do północnego obrzeżenia Oceanu Tetydy nazywanego północną Perytetydą. Taka pozycja paleogeograficzna wskazuje że basen germański należy traktować raczej jako integralną część zachodniej Tetydy niż jako typowy basen epikontynentalny. Bezpośrednie połączenie między obszarem germańskim a Tetydą utrzymywane było przez system tektonicznie generowanych obniż (bram) rozwiniętych w obrębie spenepienizowanego lądu windelicko-bohemskiego stanowiącego strukturalną barierę między otwartym oceanem i jego strefą peryferyjną.

Przez większą część środkowego triasu basen germański wykazywał cechy basenu półzamkniętego o ograniczonej i jednokierunkowej cyrkulacji. Taki układ hydrologiczny powodował ewaporacyjny wzrost zasolenia wód basenu w miarę oddalania się od strefy dopływu wód oceanicznych. Znajduje to potwierdzenie w wyraźnym ubożeniu zespołów fauny zasiedlającej zbiornik jak i w zapisie izotopów stabilnych węgla i tlenu.

Otwieranie bram miało charakter diachroniczny i postępowało ze wschodu na zachód. Najwcześniej, bo już w środkowej części wczesnego triasu otwarta była tzw. Brama Wschodniokarpacka. W anizyku głównym połączeniem była Brama Morawsko-Śląska a w lądynie Brama Zachodnia. Diachronizm w otwieraniu bram był pochodną migracji głównej strefy spreadingu tetydzkiego, która przemieszczała się ze wschodu na zachód.

Wyróżnione dla basenu germańskiego sekwencje depozycyjne trzeciego rzędu wykazują dobrą korelację z sekwencjami z basenów alpejskich co pozwala stwierdzić, że cykle transgresywno-regresywne w basenie germań-

skim kontrolowane były głównie przez wahania eustatyczne.

Subtropicalna pozycja paleogeograficzna północnej Perytetydy warunkowała jej gorący i póluchy klimat. Okresowe zwilgotnienia w późnym lądynie i w karniku były pochodną przebudowy tektonicznej i intensywnej działalności wulkanicznej w obrębie Tetydy.

Key words: Late Scythian–Carnian, Tethys, Peri-Tethys, basin analysis, sequence stratigraphy, paleogeography, paleoenvironments.

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INTRODUCTION

Middle Triassic time was decisive for the Pangea supercontinent that started then to break up and a new ocean called Neo-Tethys formed within the opened, rift-controlled seaways system (Fig. 1). The presented paper is aimed on reconstruction of the middle to late Triassic evolution of the north-eastern margin of the western Tethys Ocean, called

Germanic or northern Peri-Tethys Basin. Therefore, though the study focuses essentially on the Polish and German parts of the basin, many aspects of their geological history have to be referred to the adjacent regions, including the alpine domains.

The sedimentary succession formed during late Scy-

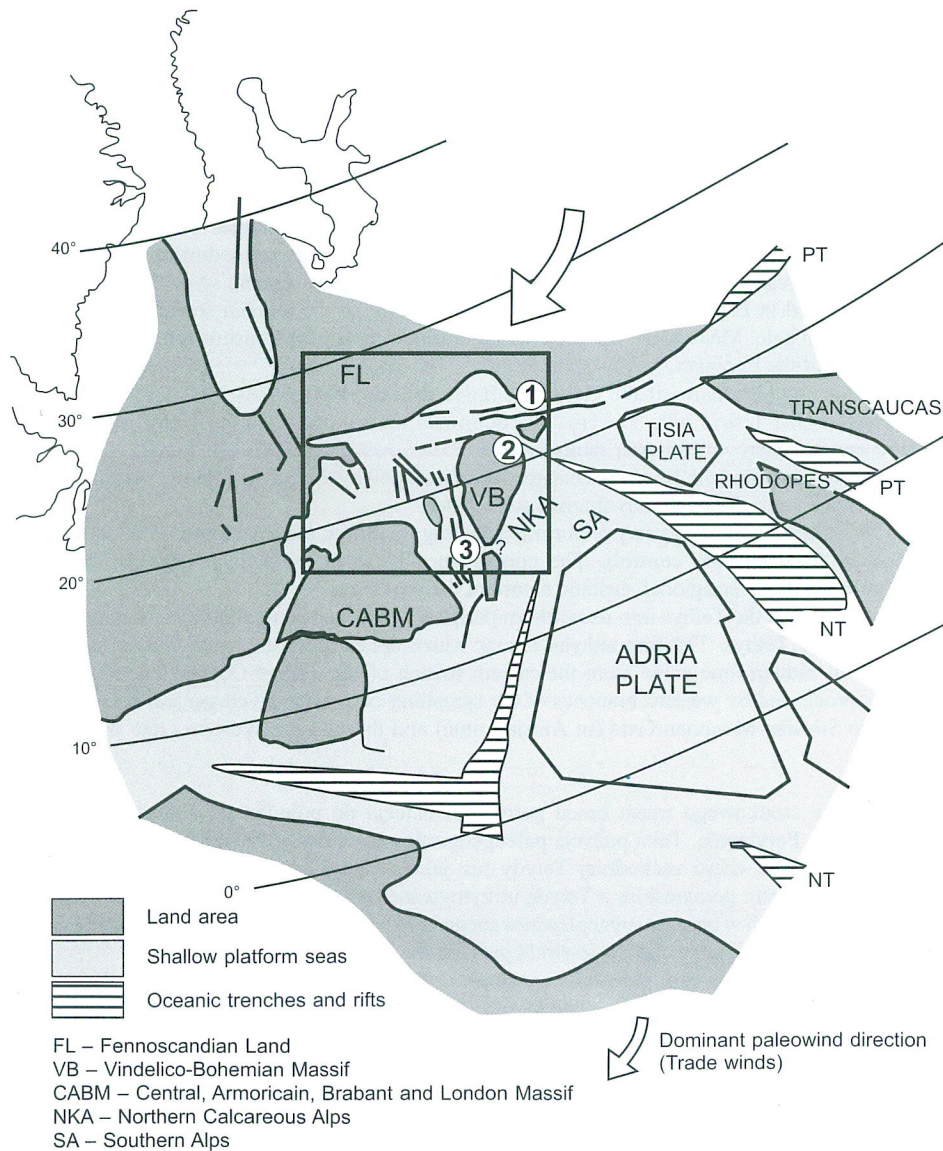


Fig. 1. Paleogeographical position of the northern Peri-Tethys Basin in Middle Triassic times. Modified from Szulc (1999). 1 – East Carpathian Gate, 2 – Silesian-Moravian Gate, 3 – Western Gate. Paleolatitudes inferred according to the Middle Triassic poles isolated by Theveniaut *et al.*, (1992)

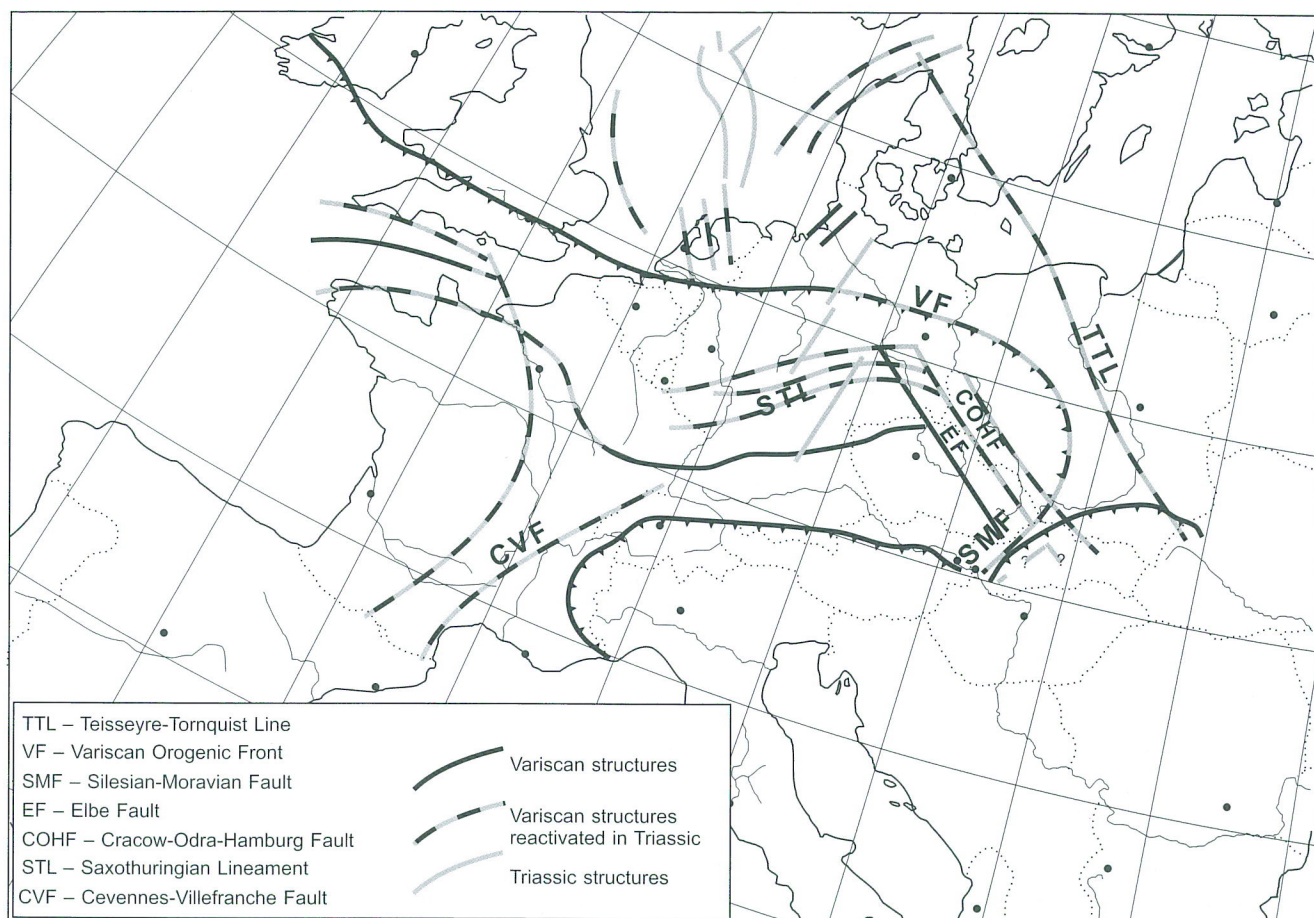


Fig. 2. Principal tectonic lineaments in Europe controlling the northern Peri-Tethys in Triassic times (after Szulc, 1999, partly modified)

thian–early Carnian time comprises lithological units distinguished as the Röt (Roetian), Muschelkalk and the lower-middle Keuper formations. In terms of sequence stratigraphy, all these units represent the principal Triassic transgressive-regressive cycle, which commenced with the Röt coastal playa deposits and terminated actually with the Schilfsandstein lowstand deposits of Carnian age.

General setting

The Triassic Germanic Basin was a tethyan periphery basin, closed to NE and E by the Fennosarmatian Land and to the west by Hercynian blocks of the Central, Armorican, Brabant and London Massifs (Fig. 1). To the south, the basin was separated from the Tethys by the Vindelico-Bohemian Massif. Tethys Ocean communicated with its northern periphery by system of seaways: the East Carpathian, Silesian-Moravian (or Silesian) and Western (“Burgundy”) Gates. The gates disposition and generally the basin topography were controlled by inherited Hercynian structures (Fig. 2; Szulc, 1993). Such a situation of the Germanic area, strongly affected sedimentary processes in the basin and finally resulted in a modification of eustatic fluctuations by regional or local tectonic controls. Diachronous sedimentary successions resulted from earlier transgression and earlier ultimate regression in the eastern (Polish) basin is the most outstanding feature of the Peri-Tethys evolution dur-

ing Middle Triassic times. The eastern gate was opened already in late Induan time while the western communication developed only during the Pelsonian. The diachroneity is explained as resultant from westward relocation of the connection tracts following the shift of the Tethys spreading center (Szulc, 1997a).

Posthercynian structural framework and the early Triassic of the Germanic Basin

During the earliest Triassic (lower Buntsandstein) the basin configuration followed basically the Zechstein disposition with a subsidence center situated upon the Teisseyre-Tornquist Zone. The only new Triassic structure was the Cracow–Tarnów Depression (Szyperko-Teller, 1997) separated from the northern and northwestern basin by an elevated range, encompassing Sudetes Mts. Małopolska and Lublin Massifs (Fig. 3). The both parts varied in basin evolution, particularly in Induan time (lower Buntsandstein–lower middle Buntsandstein). The deposits of the lower Buntsandstein are fine-grained clastics with a high proportion of oolitic beds typical for the entire German (Geluk & Röhlings, 1997) and northern Polish early Triassic succession. As evidenced by sedimentological studies (Pieńkowski, 1989) and paleontological data (Fuglewicz, 1980) the northern and western basins were strongly influenced by marine ingressions coming from the NW (i.e. from the Bo-