

Zechstein in Lithuanian–Latvian Border Region

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The Southern Permian Basin in Central Europe extended from the area of the present-day North Sea towards the territory of Lithuania and Latvia. The Zechstein rocks from the eastern margin of the basin outcrop in three places: the Sudetes and the Holy Cross Mts. (Poland), and at the Lithuanian / Latvian border. Abundant fauna containing foraminifers, ostracods, molluscs, brachiopods, bryozoans, echinoderms, and vertebrates was documented from this area; some new taxa have been found in the present study. The palaeoecological analysis of the fauna assemblages was carried out in order to characterise the sedimentation environment.

Key words: Zechstein, Permian, palaeogeography

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The Southern Permian Basin in Central Europe extended from the area of the present-day North Sea towards the territory of Lithuania and Latvia. The Zechstein rocks from the eastern margin of the basin are exposed in three places: the Sudetes and the Holy Cross Mts. (Poland), and at the Lithuanian / Latvian border (Fig. 1). The distance between the Sudetes and the Lithuanian / Latvian border is ca. 800 km. In between, the Zechstein rocks are buried at the depths of several hundreds to a few thousand meters and are available only from boreholes. The north-eastern part of the Southern Permian Basin formed a bay on the Palaeozoic basement (Silurian–lowermost Carboniferous).

Only the Zechstein Limestone (Ca1) is exposed in the eastern end of the Zechstein Basin. Abundant fauna containing foraminifers, ostracods, molluscs, brachiopods, bryozoans, echinoderms, and vertebrates was documented from this area; some new taxa have been found in the present

study. The palaeoecological analysis of the fauna assemblages was carried out in order to characterise the sedimentation environment. The Zechstein Limestone in the marginal lagoon part of the basin contains abundant storm deposits. Further to the south, at the shelf edge, reefs occurred. Microscopic observations revealed that the Zechstein deposits underwent extensive early diagenesis due to frequent emersions of the area. It is demonstrated that the Zechstein deposits were covered in the past by a few hundred meters of younger deposits. A study of organic matter showed that the Zechstein rocks in western Lithuania are immature and outside the oil window.

The lithostratigraphy of the Zechstein Limestone (Fig. 2) in Lithuania and Latvia is more complete than in the central part of the Zechstein Basin (Poland). This was caused by shallow-water sedimentation which preserved even small changes in water depth and environmental energy. In contrast to Zechstein deposits from the Sudetes

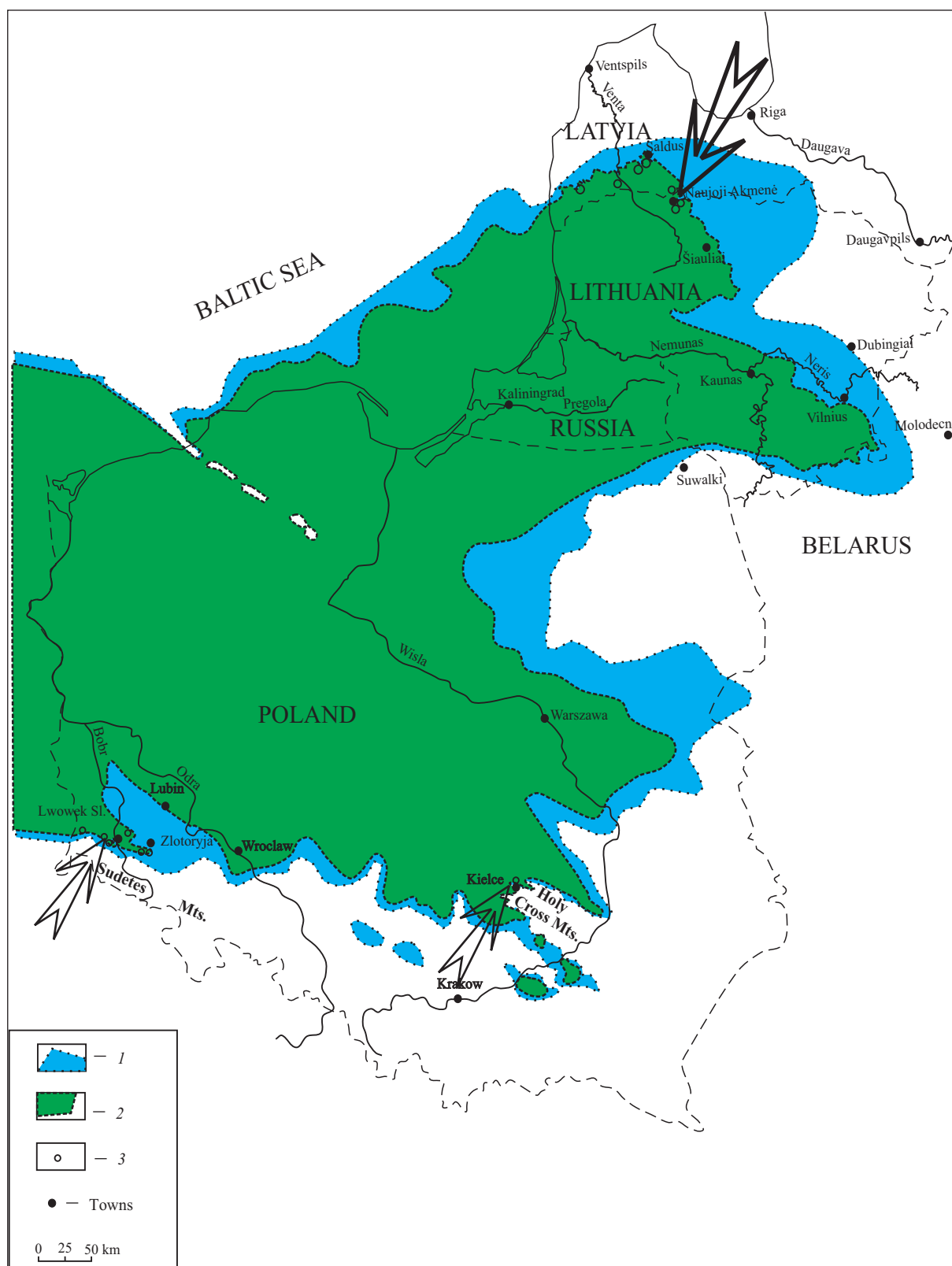


Fig. 1. Extent of the Zechstein Limestone in the eastern part of the European Basin (modified after Wagner, 1994). Extent: 1 – original; 2 – current distribution of Zechstein sediments in Poland, Lithuania and Latvia; 3 – Zechstein outcrops

1 pav. Cechšteino klinties paplitimas Europs baseino rytinėje dalyje (patikslintas Wagner, 1994): 1 – pirmi-
nis; 2 – dabartinis cechšteino nuosėdų paplitimas Lenkijos, Lietuvos ir Latvijos teritorijose; 3 – cechšteino
darinių atodangos

GLOBAL STRATI- GRAPHIC SCALE			REGIONAL STRATIGRA- PHIC UNITS (STAGES)	LOCAL STRATIGRAPHIC UNITS				STRATIGRAPHIC UNITS IN ADJACENT REGIONS
SYSTEM (Age Ma)	SERIES	STAGE		KALININGRAD REGION	SW and SE LITHUANIA	W LITHUANIA	SW LATVIA	
(252)		CHANG- SINGIAN?		(Paškevičius, 1997; Kadūnas, 2001)	(Kušs, Stinkule, 1997)		NORTH SUDETIC BASIN (SW POLAND)	RUSSIAN PLATFORM (Gradstein et al., 2012)
		—?	LEINE	Mamonovo (Šventapilis) Galindai Aistmarės			Perno-Triassic transition zone	Ohre Serie Aller Serie / PZ4
		—?	STASSFURT	Žalgiriai			Platy dolomite	Leine Serie / PZ3
				4 Mb. 3 Mb. 2 Mb. 1 Mb.				Stassfurt Serie / PZ2
				Prieglius			Septarian shales Upper Zechstein sandstones	U. Anhydrite Oldest Halite L. Anhydrite
					Upper Mb.	Alši	Middle Zechstein limestones and marls	Werra Serie / PZ1
				Naujoji Akmenė	Middle Mb.	Kūmas	Lead-bearing marls Copper-bearing marls Spotted marls	Zechstein Limestone CaI
					Lower Mb.	Sātiņi /Auce	Basal limestone	Kupferschiefer T1
				Sasnava			Basal conglomerate Rotliegend (Lower Permian)	Rotliegend (Lower Permian)
				Kalvarija				

Fig. 2. Lithostratigraphy of the Permian in Lithuania, Latvia, and SW Poland (after Paškevičius, 1997; Kuršs, Stinkule, 1997; Raczynski, 1997)

2 pav. Lietuvos, Latvijos ir PV Lenkijos permio litostratigrafija (pagal Paškevičius, 1997; Kuršs, Stinkule, 1997; Raczynski, 1997)

(Poland), carbonate rocks from Lithuania / Latvia do not contain much terrigenous material because of the generally flat depositional area and lack of uplifted massifs in the vicinity. The coastal zone in Lithuania / Latvia was much wider than in the Sudetes as a result of long-term erosion of the platform and the flattening of a large territory. The

Zechstein Limestone in Lithuania / Latvia is divided into three parts: conglomerates / sands and marls in the lower part, limestone in the centre, and dolomitic limestone in the upper part (Kadunas, 2001). The central and the upper parts may be observed in the Karpėnai (Fig. 3a–d) and Menčiai quarries (Fig. 4a, b).

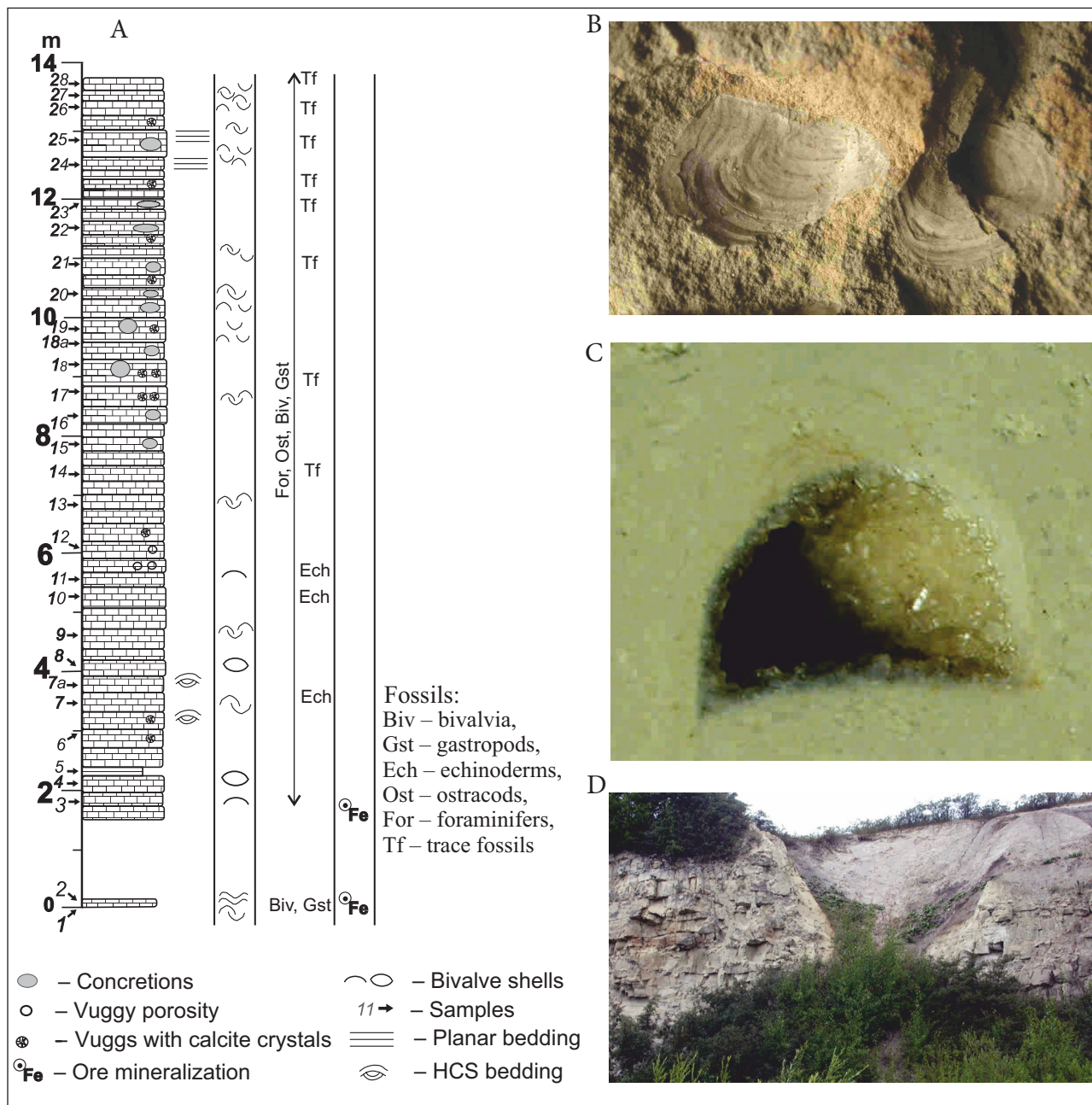


Fig. 3. Zechstein Limestone in the Karpėnai quarry. A – vertical section of north-eastern quarry wall; B – bivalve shells, fossil length 1 cm; C – arthropod (?) burrows with geopetal filling. Sample width 2 cm; D – karst funnel filled with Mesozoic and Cenozoic sediments

3 pav. Čechšteino klintis Karpėnų karjere: A – Šiaurės rytų karjero sienos vertikalus pjūvis; B – dvigeldžių kiautai, fosilijos ilgis 1 cm; C – artropodų rausimosi vietos, užpildytos geopetalijomis (pavyzdžio plotis 2 cm); D – karsto piltuvai, užpildyti mezozojaus ir kainozojaus nuosėdomis

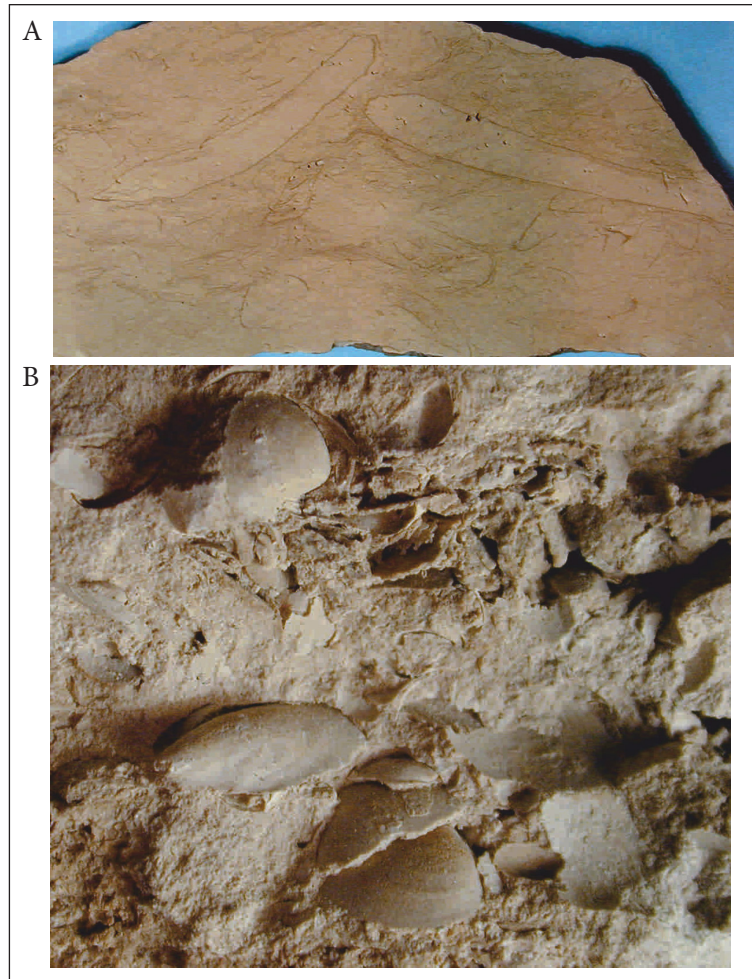


Fig. 4. Fossils from the Menčiai quarry, Lithuania.

A – abundant trace fossils in limestone, sample width 11 cm; B – coquina composed of mollusks, sample width 5 cm

4 pav. Fosilijos iš Menčių karjero (Lietuva).

A – fosilijų pėdsakai klintyje, pavyzdžio plotis 11 cm; B – iš moliuskų sudarytas kriauklainis, pavyzdžio plotis 5 cm

The layers rich in shells are interpreted as distal or – in the upper part of the section deposited closer to the basin border – proximal tempestites. They are similar to those from the Sudetes in Poland (Biernacka et al., 2005). Detrital storm deposits and marls deposited below a storm wave base are full of burrows left by organisms that lived between the storms (Figs. 3a, 4d).

Significant karst phenomena occur in the limestone of the Naujoji Akmenė Formation, especially in the vicinity of Naujoji Akmenė (Fig. 3d). The age of the sediments filling sinkholes is considered as Jurassic, but there is not sufficient evidence. The sediments in sinkholes also contain Cretaceous cherts and remnants of Cenozoic plants.

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LIETUVOS IR LATVIJOS PASIENIO CECHŠTEINAS

S a n t r a u k a

Pietinis permio baseinas Vidurio Europoje tęsiasi nuo dabartinės Šiaurės jūros link Lietuvos ir Latvijos. Cechšteino uolienos Lenkijoje atsidengia Sudetų ir Švento Kryžiaus kalnuose bei Lietuvos ir Latvijos pasienyje, o Lietuvoje – Karpėnų ir Menčių karjeruose (Lietuva). Nustatyta, kad cechšteino uolienos yra diagenetiškai pakitusios. Jose randama gausi foraminiferų, ostrakodų, brachiopodų ir kt. fauna. Taikant paleoekologinę analizę buvo bandoma nustatyti uolienų formavimosi paleoaplinką.

Raktažodžiai: cechšteinas, permis, paleogeografija