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PREFACE: UNCONVENTIONAL HYDROCARBON ACCUMULATIONS IN THE EAST EUROPEAN CRATON IN POLAND

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This collection of eight papers is a follow-up to the series of articles that appeared in Issue 2 of ASGP Volume 89 (see also Golonka and Bębenek, 2017). These contributions provide a good sample of the scope of a major research project (BG1/GAZGEOLMOD/13), devoted to unravelling the unconventional hydrocarbon potential of the Lower Palaeozoic shales of the East European Craton (EEC) in Poland and funded by the Polish National Research and Development Centre (NCBiR). The principal aim of this research was optimization of the exploration process, using innovative data analysis based on state-of-the-art geological and geophysical techniques, as well as definition of the technological limitations, imposed by the geological conditions encountered in license areas of the Polish Oil and Gas Company and Orlen Upstream.

Our research focused on three Ediacaran-Early Palaeozoic depocentres, known as the Baltic, Podlasie and Lublin basins (Fig. 1), with emphasis on the structure, biostratigraphy, lithostratigraphic development, stratigraphic mapping and tectono-thermal history of the Ordovician–Silurian (Fig. 2) black shales. On the basis of a series of geological maps and cross-sections, an exhaustive review of the structural setting and geological evolution of these basins is provided in an introductory paper (Poprawa, this volume). The basin development was placed within a series of palaeogeographic reconstructions, showing the locations of the EEC during the Palaeozoic (Golonka *et al*., this volume). The palaeogeographic reconstructions provide a large-scale framework for understanding the temporal evolution of the EEC in terms of plate kinematics, yielding additional insight into the distribution of petroleum system components.

A significant effort was made towards cartographic representation of selected stratigraphic surfaces, thickness data, fault zones, total organic carbon contents and tectono-thermal domains across the entire EEC segment subcropping in Poland. An innovative methodology for database creation and mapping is summarized in a separate contribution (Papiernik and Michna, this volume). The input data for the cartographic work were 104 published maps (Żelichowski and Kozłowski, 1983; Kotański, 1997; Modliński, 2010) and a wealth of new structural and stratigraphic data, derived from the PolandSPAN seismic cross-sections through the Baltic and Lublin basins (Kasperska *et al.,* 2019; Kufrasa *et al.,* 2019) and acquired during realization of the BLUEGAS project modules.

Biostratigraphic work concentrated on the graptolite stratigraphy of the Ordovician and Silurian mudrocks. The results permitted updating of the existing, local stratigraphic divisions into the O–S standard stages, while age determinations of the newly acquired well cores resulted in improved dating of some lithostratigraphic units (Podhalańska, this volume). New palaeoenvironmental interpretations were presented for the Cambrian siliciclastic shelf of the Podlasie Basin (Wendorff, this volume), following similar research in the Lublin Basin (Stadnik *et al*., 2019).

A restoration technique was used to verify the correctness of the structural and palaeothickness maps and to reproduce the initial geometry and thickness of three basin-fill stages in the Cambrian–Devonian succession (Barmuta *et al*., this volume). An application of illite-smectite palaeothermometry showed that the maximum heating and gas generation occurred in the Early Carboniferous, at the turn of the Early and Late Carboniferous and during the Early Permian (Kowalska *et al*., this volume). Therefore, it is suggested that the Mesozoic inversion across the EEC may have resulted in the significant escape of gas.

In the closing contribution (Papiernik *et al*., this volume), a range of potential gas-bearing reservoirs is pinpointed on

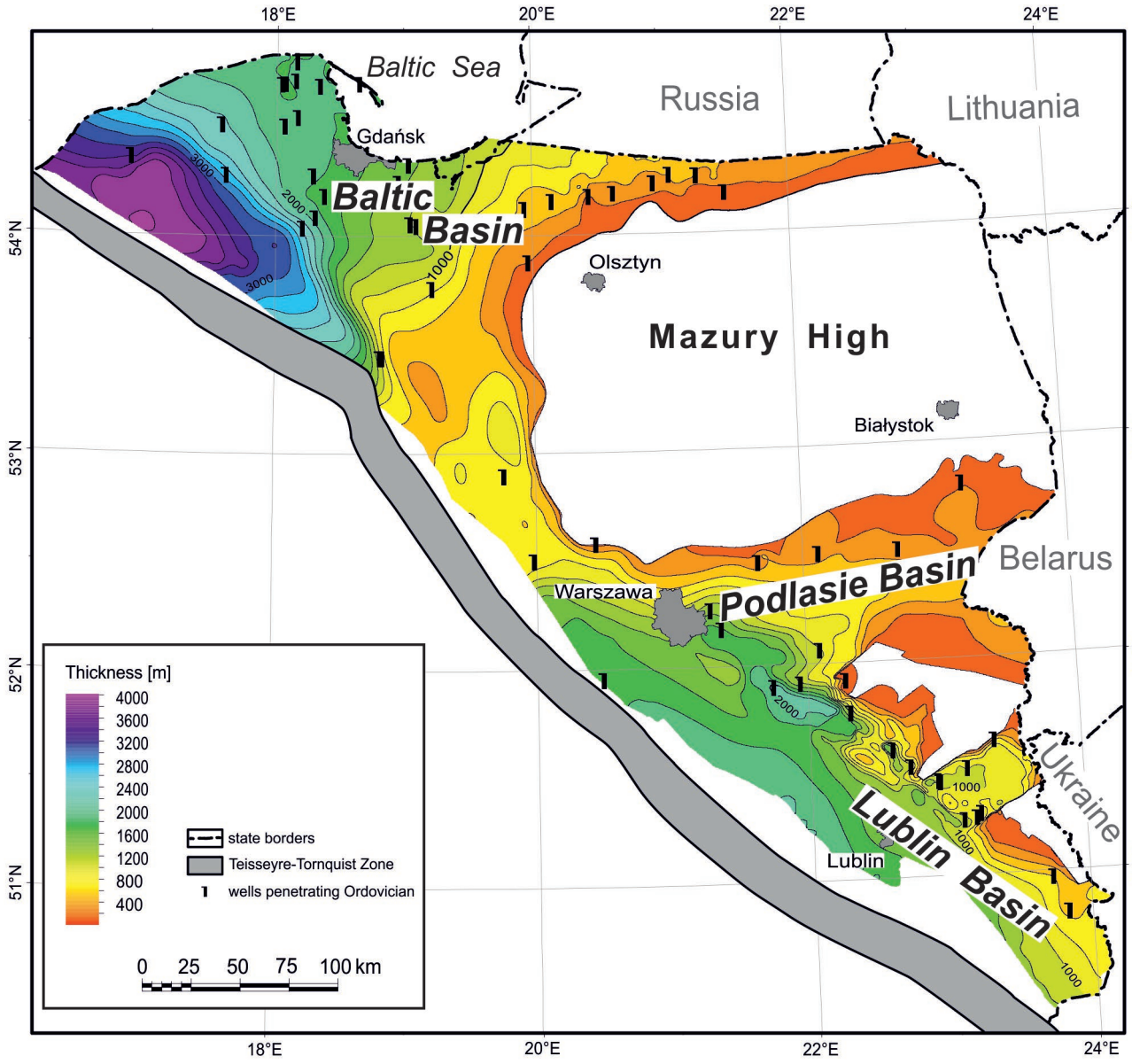

Fig. 1. Location of the Baltic, Podlasie and Lublin basins against a background of the thickness map of Silurian deposits (after Porębski and Podhalańska, 2019).

the basis of the spatial interpretation of thermal maturity and total organic carbon content, calibrated against the most important findings of the project (Botor *et al.,* 2019a, b; Cichostępski *et al*., 2019; Kasperska *et al*., 2019; Kufrasa *et al.*, 2019; Porębski and Podhalańska, 2019). It is concluded that the regional, W-increasing thermal maturity pattern is made up of a series of tectono-thermal domains, each with its own maturity pattern. Good-quality, unconventional reservoirs can be expected in the Sasino Formation (Caradoc) and Jantar Formation (early Llandovery) in domains located in the central and western Baltic Basin. Despite a considerable hydrocarbon loss, due to the multiphase basin inversion, the Ordovician and Silurian mudrocks can be expected to contain huge quantities of dispersed gas. Successful exploitation of it would demand the adoption of advanced fracking methods.

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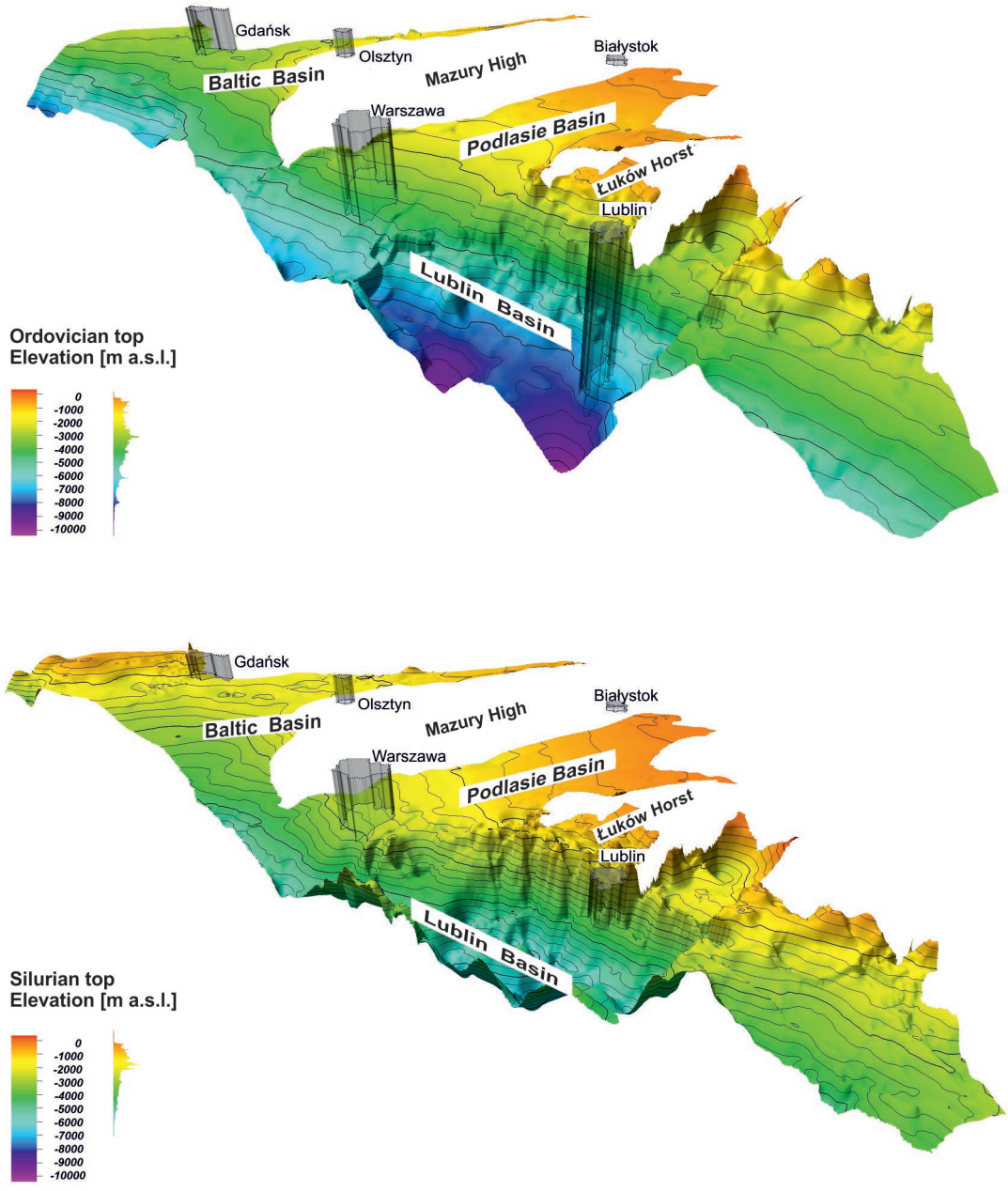

Fig. 2. Thickness of the Ordovician and Silurian deposits.

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