Coal in the Pontian Mura Formation of the Mura-Zala Basin (NE Slovenia and NW Croatia)

The largest coal reserves in Slovenia occur within the Neogene Mura-Zala Basin in the SW part of the Pannonian Basin System. The Mura-Zala Basin consists of antiforms and sinforms bounded by normal and reverse faults (see Fig 1. in Markič, Oil and Gas in the M-Z B). It is filled in its deepest parts by more than 4 km of clastic sediments from lower Miocene upwards to Pontian (Šram et al. 2015).

Anomalies

Coal beds were found as numerous outcrops along the flanks of the Ormož-Selnica (O-S) antiform (Fig.1 – left).

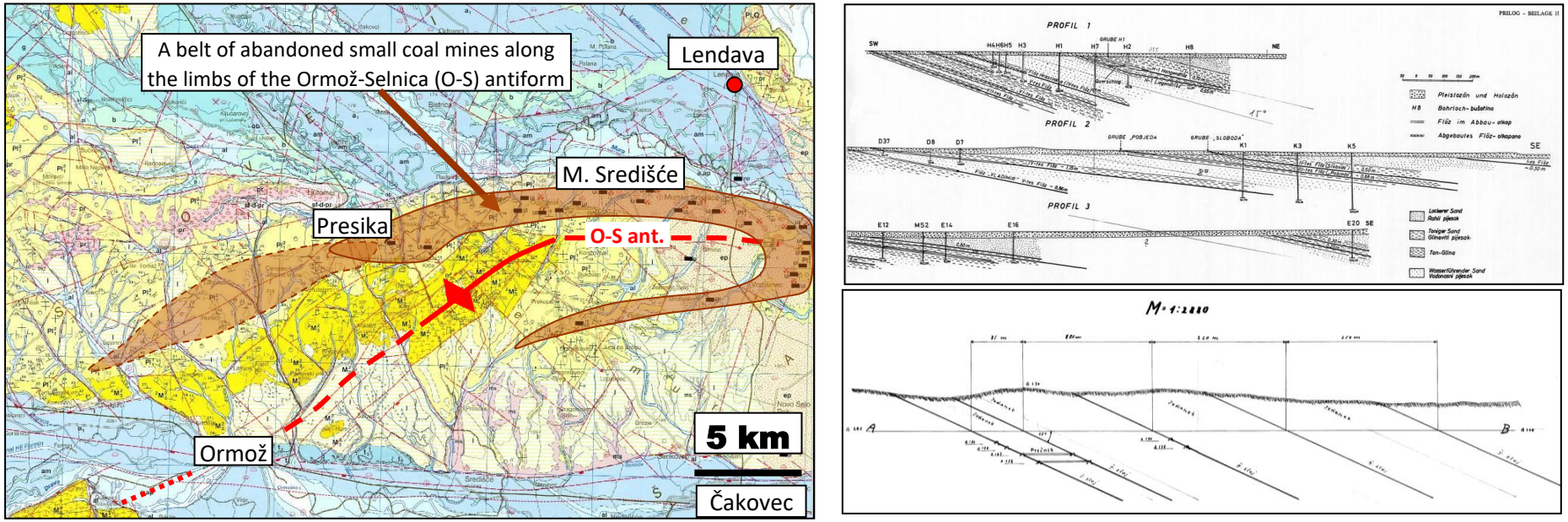

Fig. 1. Left: Abandoned collieries (black rectangles) along the flanks of the Ormož-Selnica (O-S) antiform. Geological background and localities of collieries (black rectangles) are from the Basic Geological Map of Slovenia and Croatia in Scale 1:100.000 – Sheet Čakovec (Mioč & Marković, 1998). Right: Two old

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sketches of gently dipping coal measures of the Mursko Središće colliery (above) (after Takšić, 1967) and of the Presika colliery (below) (from Markič et al., 2011 after Karničnik, 1965).

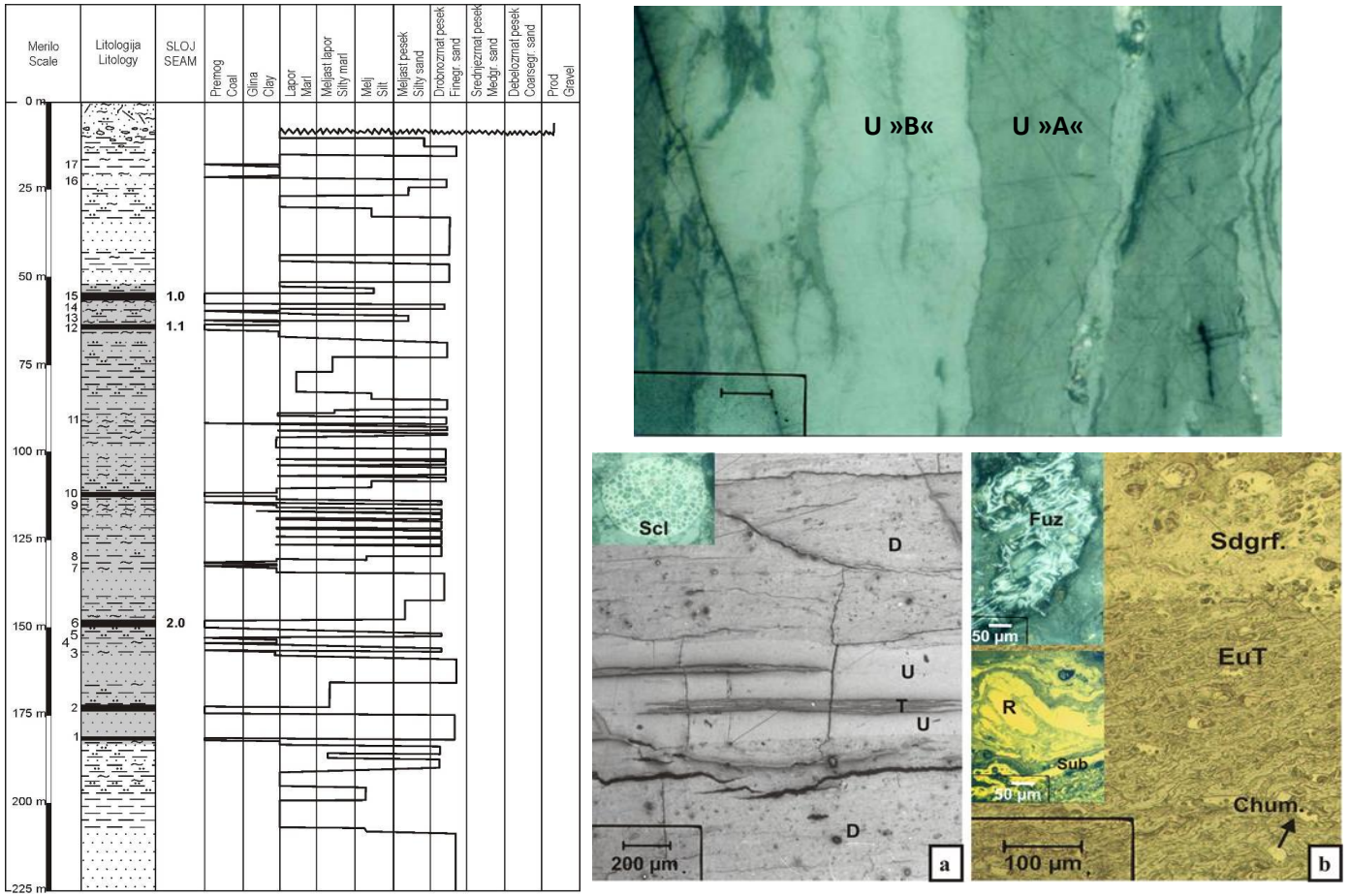

Fig. 2.

Left: Lithologic column of Pontian coal-bearing strata within the Mura formation in the Lendava – Mursko Središće area – generalized from numerous boreholes (from Markič et al., 2011; after Markič and Grad, 1991).

Right: Typical microscopic view of brown coal components – U: ulminite; U"A": low reflecting ulminite due to relatively higher hydrogen content; U"B" highly reflecting ulminite due to relatively high oxygen content; EuT: eutextinite; D: detrinite; Chum: corpohuminite; Scl: scleronite; Fuz: fuzinite: Sdgrf: semidegradofuzinite R: resinite; Sub: suberinite.

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The coal-bearing Mura Formation is of the Pontian age. It is more than 1000 m thick and consists of marls, silts, and sands, and of numerous (10–30) beds of brown coal. The coal-bearing depositional system is clearly deltaic - paralic. Original peatlands developed in freshwater environments while bulk sedimentation in-between was influenced of brackish waters. Well ascertained coal beds are only those in a restricted area (ca. 60 km^2) between Lendava (Slovenia) and Mursko Središće (Croatia) (Fig.1), where the coal beds dip almost from the surface downwards to depths of about 400 m. The whole coal-bearing bed-set is about 130 m thick but contains only three coal seams which are generally 1.0–2.2 m thick (Fig.2 - left) At the *"as received basis"* (25–30 % moisture content, 15–20 % ash yield), the calorific value of coal reaches ca. 14.5 MJ/kg. Average sulphur content is 1.6 % (Markič et al., 2011).

Coal beds in the broader area of NE Slovenia (ca 1000 km^2) are not well explored. They are known from deep oil, gas, and geothermal wells. The existing data are from master-logs and geophysical logs, by which coal thicknesses are most probably exaggerated. Therefore, in analogy with the Lendava – Mursko Sedišće coal-bearing area, considering that the coal seams thicker than 1 m are in total 5 m thick, than the total coal resources (at the 1.3 t/m^3 density) in the entire NE Slovenia amount to around 6500 Mt. In terms of energy, at calorific value of coal of 14.5 MJ/kg, it represents nearly 10^{14} MJ of energy stored.

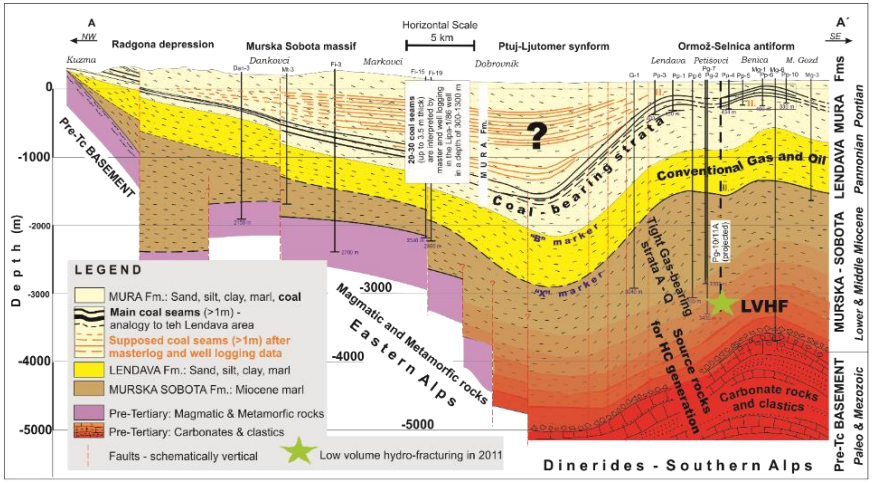

Fig. 3. Cross-section via NE Slovenia (the same as Fig. 3 in Oil and Gas in the Mura-Zala Basin) – question mark shows Mura Fm with coal beds drilled by deep wells but not ascertained by true coal thickness. Author: Miloš Markič

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