Tectonic control on sedimentation pattern in the late Miocene of the western Pannonian basin, Hungary

LÁSZLÓ FODOR[1], ORSOLYA SZTANÓ[2], IMRE MAGYAR[3], BALÁZS TÖRŐ[4], ANDRÁS UHRIN[5], ATTILA VÁRKONYI[6], GÁBOR CSILLAG[7], SZILVIA KÖVÉR[1] and ZOLTÁN LANTOS[7]

1 – Geological, Geophysical and Space Science Research Group of the Hungarian Academy of Sciences at Eötvös Loránd University, Budapest 1117 Pázmány P. sétány 1/C, Hungary

2 – Department of General and Applied Geology, Eötvös Loránd University, Budapest 1117, Pázmány P. sétány 1/C, Hungary

3 – MOL Ltd., Budapest

4 – CASP West Building 181A Huntingdon Road Cambridge, CB3 0DH United Kingdom

5 – Eriksfjord, Stavanger, Norway

6 – O & G Development Ltd., 1024 Budapest, Lövőház u. 39, Hungary

7 – Geological and Geophysical Institute of Hungary, Budapest, Stefánia 14, Hungary

The Pannonian Basin system is due to late Early to Mid-Miocene lithospheric extension of the formerly thickened Alpine-Carpathian crust. The major crustal faulting occurred between 19 and 11.5 Ma which resulted in a dense network of normal and strike-slip faults of varying orientation. The faults bounded more or less isolated sub-basins, generally half grabens where a relatively modest sedimentary sequence (the so-called syn-rift sequence) deposited while the intermittent basin highs were marked by a reduced sedimentation.

At the beginning of the Late Miocene (Pannonian) ca. 11.5 Ma ago, the sedimentation patter has been changed and the former basin highs were progressively inundated by the brakish Lake Pannon. The initial transgressive phase of ca. 11.5–9.5 Ma was gradually changed and clastic input from fluvial network progressively filled the lake. In our research, we investigated the sedimentation pattern, facies relationship of the late Miocene sediments and the tectonic style, geometry and kinematics of Late Miocene structures and their influence on sedimentation by the help of surface structural, sedimentological and palaeontological observations, and by 2D and 3D seismic reflection data sets. Our research extended into the Transdanubian Range (TR), the largest high in the Miocene, and sub-basins west, south and east of it.

The initial transgressive phase inherited a dissected basin topography from the previous syn-rift deformations. The inherited structures and active deformation resulted in a variable facies pattern, which could be simplified as in the following: deep lacustrine marl-claymarl sequence (“basinal marls”) accumulated in the deep sub-basins. This lithofacies changed to a slightly different marl along the margins of the basement highs, which was still deposited below wave base (ca. 50-80m), which we refer to as “basin-margin marls” (Szák Fm.). This lithofacies is characteristic along the western margin of the TR, during 9.5–9 Ma. The clastic input reached the basin from the NW and resulted in deltas of ca. 20–50 m thick dominantly sandy sedimentary packages (Újfalu Fm.). These shelf deltas changed to slopes of several hundred meter high in the deep sub-basins (Algyő Fm.),

while slopes were missing from above highs. Deltas were prograding across all highs but with reduced sequences. The final stage of basin fill was a fluvial sedimentation (Zagyva Fm.).

Systematic mapping of clinoforms of the slope sediments clearly indicate the influence of basement highs which deflected slope progradation into a direction sub-parallel to highs. These basement highs were partly inherited from the syn-rift deformation. However, seismic sections clearly demonstrate active syn-sedimentary faulting during the transgressive phase, and partly during slope progradation, ca. between 11.5 and 8 Ma.

Surface measurements suggest an E–W to ESE–WNW extensional stress field in agreement with seismic fault mapping. Fault-controlled abrasional gravels and fault breccias formed the margins along the TR which probably changed rapidly to "basin-margin marls" toward basin centres. Map-scale normal or oblique-slip faults characterize most sub-basins around the TR. On the other hand, the ca. E-W trending Kilimán High represented contractional features already at the early basin marl deposition, ca. 11.5-8.8 Ma. The last stage of deformation affected the deltaic sequences near the Rechnitz windows (Kovács et al., 2015) and in the north-westernmost Gerecse (Bartha et al., 2014) around 9–8.6 Ma.

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