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Geometry-Lithology-Origin: Solving the mystery of the Late Miocene mounded features below Lake Balaton

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The Department of Geophysics and Space Sciences of Eötvös University has carried out single- and multichannel water seismic surveys at the Lake Balaton since 1993. The dense grid of 2D profiles offers a high resolution image of the Late Miocene sedimentary strata (Tihany, Somló and Szák Formations) up to a thickness of 200 meters below the lake. These strata can be divided into smaller sedimentary units by numerous parasequence boundaries (Sztanó&Magyar, 2007). In one of these parasequence interesting, high amplitude mounded features have been observed that follow a seismic horizon over large area. It means that these features indicate a Late Miocene regional event.

In terms of their shape these mounds are few tens of meters wide, several tens to a hundreds of meters long and few meters high. Their geometry and inner structure were mapped from 2D segments that were used for 3D reconstructions.

The shape and stratigraphic position of these features have inspired Sacchi and Horvath (1999) to interpret them as the subsurface equivalent of the fresh-water siliceous-limestone mounds exposed on the Tihany Peninsula. They held these mounds as an evidence of dryland conditions in the time period of the formation of a Late Miocene erosional surface (PAN-2) that they regarded as a 3rd order sequence boundary. In addition to this so called “travertine” concept another explanation was also formulated as the mounds are the product of sedimentary failures e.g. slumps or water escape.

To solve the problem an offshore drilling with a total depth of 19 meters was accomplished in October 2013 to sample one of these mounds and determine their origin. The well has not crossed any travertine body, instead alternating layers of clay-silt and very fine sand – without any convincing sign of fluid escape structures – were found in the core (typical lithology of the Tihany Formation).

3D structural analysis of the mounds revealed spherical organization composing bodies that are superposed on each other. The latter can be interpreted as series of small thrusts in a relatively thin mudstone layer. As coring has found silty material, without the presence of any fluid escape structures the most possible explanation for these features is sheet slumping mechanism that could be induced by seismicity.

Although “travertine” concept has been rejected, these mounds should indicate a regionally important geological event that could strengthen correlation of erosional surfaces such us PAN-2 from outcrop to water seismic images. Such an event could be possible the start of the 8 Ma volcanism in the area.

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References:

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