The results of sedimentological and gamma-ray logging of Upper Miocene lacustrine turbidites of the Transylvanian Basin

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The Miocene sediments of the Transylvanian Basin are important reservoirs of natural gas production. Recent studies have focused on the sedimentology and the palaeoenvironmental reconstruction of Upper Miocene sediments, but an in-depth study is lacking from the south-western part of the basin. Thus, our aim was to examine the less studied lacustrine turbidite outcrops in detail and set up an environmental reconstruction. In addition, we measured gamma-ray logs to investigate the relationship between facies and gamma-ray response. Studies at the scale of geophysical logs and outcrops together provide a curious perspective on reservoir characterization.

Detailed facies analysis was carried out in six outcrops. In four of them, the natural gamma radiation of the sediments was measured in a vertical log with a handheld 1024-channel gamma-ray spectrometer. A corresponding sedimentological log was drawn in the same vertical section. To find the appropriate measuring time and resolution, first several test measurements were done in the field: 60 sec/point and 10 to 3 points/metre gave the optimal result.

We have found the products of different sediment gravity flows: high density gravelly and sandy as well as low density turbidity currents and sandy debris flows alternated with settling of mud. Architectural elements of deep-water fans: complex channel fills, channel-levee systems and lobes were identified. The development of the systems in outcrop scale was also investigated. The measured gamma-ray logs do characterize the architectural elements. The observed complex channel fills, the channel fill part of channel-levee systems and lobes are all good reservoir analogues even though their geometry, volume, internal heterogeneity and connectivity differ.