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Salt deformation mechanism and gas accumulation in the Transylvanian Basin, Romania

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The Transylvanian Basin is the main producer of hydrocarbon gases in Romania. The first gas field (Sarmasel) has been discovered in 1909, untill now more than 129 gas structures being identified and exploited. The aim of this paper is to investigate the causes that created zones with different intensity of the diapirism in relation with the methane generation and accumulation. The Badenian salt movement had different intensities in the Transylvanian Basin. In the central part there are salt pillows, salt layers and piercement of salt. In this zone the salt is not outcropping and its flow produced only the doming of the overlying deposits. In the eastern and western parts of the basin salt flow determined an intensively deformation of the overlying rocks and the formation of the salt diapirs and salt wall growth. In these areas the salt even outcrops within a few sectors. The following mechanisms could be implied in the Badenian salt flow: salt buoyancy, differential sediment loading, flexural buckling of the overburden and drag by overburden. To evaluate which mechanism dominates in the Badenian salt flow in the Transylvanian Basin a simple model has been used considering an elastic plate overlying a viscous fluid. In this model the viscous fluid is the layer of Badenian salt and the elastic plate is represented by the overburden composed of Upper Miocene and Pliocene deposits. The vertical pressure gradient was calculated considering a constant density of overburden (2500 kg/m3) in correlation with the different sedimentary rates of the Upper Badenian (450 m/Ma), Sarmatian (150 m/Ma) and Pliocene (80 m/Ma). The initial salt thickness was variable, less than 300 m south of Mureş River and more than 500 m in the other zones of the basin. The amplitude and the wavelength of folding as well as the others parameters, like the thickness of the overburden and of the salt encountered in the apex of the structures as well as in the adjacent synclines have been measured on the seismic profiles in correlation with the well logs. The results of this study suggest that in the Transylvanian Basin acted all four mechanisms of salt flow. The initiation of salt movement was not only the result of buoyancy. It was initiated by drag of the overburden in the eastern and western parts of the basin where the sedimentary environment of the Sarmatian deposits is of deltaic type. These deposits slipped centerward of the basin and dragged the Badenian salt. The dome shape of the gas fields was created both by the compressive stress regime and salt diapirism. The generation onset of the methane took place during Pliocene after the dome formation. The gases encountered suitable structural conditions for accumulation in the central part of the basin where the largest gas fields are.