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Diagenesis of Malmian Marlstones, Vienna Basin

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Burial diagenetic processes of pelitic sediments have been the subject of mineralogical investigations in Tertiary basins all over the world. Because of oil exploration, the investigations were focused on the Gulf Coast region in the United States. The diagenetic reaction from smectite to illite can be related to petroleum migration processes. The aim of this study is to characterize the diagenetic development of the Jurassic marls of the Mikulov Formation in the Vienna Basin.

The Vienna Basin is located in the NE part of Austria and extends into Slovakia and the Czech Republic. It is a Tertiary pull-apart basin along the junction of the Eastern Alps and the Western Carpathians. The evolution of the basin started during the early Miocene with subsidence along NE trending sinistral faults. It is underlain by alpine thrusted nappes and autochthonous Mesozoic sediments.

The clay mineralogy of 46 core samples from nine different wells was analyzed with X-ray diffraction and quantified. The wells penetrate the Mikulov Formation over a depth range of 1000 m to 8500 m which gives a unique opportunity to study the diagenetic changes of one formation from shallow to deep burial. Also, by following a single formation to depth, it is possible to minimize variations which might result from differences in provenance and depositional environment.

For separation of the < 2 μm fraction the carbonate was dissolved with a 0.1 M EDTA-solution before sedimentation. The clay fraction contains a prominent illite/smectite (I/S) mixed-layer mineral, illite, chlorite and kaolinite. The amounts of I/S and kaolinite decrease with depth, illite and chlorite increase with depth. A diagenetic overprint was revealed, involving a gradual transformation of smectite to illite through mixed-layer I/S intermediates. The illite content in I/S ranges from 25% for the shallowest sample to 90% for the deepest sample. The ordering of the mixed layer I/S changes with increasing depth from R0 (25% illite in I/S) to R1 (60-80 % illite) and R3 (90 % illite in I/S).