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Diagenetic alteration in sandstones of the gas-, water-, and transition- zone of a gas reservoir, Molasse Zone, Austria

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Sandstones of the studied Miocene gas reservoir are resedimented deposits from the southern slope of the Austrian Alpine Molasse Basin. Reservoir rocks are heterogeneous medium- to coarse grained sandstones containing large clasts of shales and carbonates. The gas reservoir has been produced and is now used for underground gas storage. To better understand the mineralogy of the reservoir sandstones with respect to the different zones (gas-, water- and transition zone) and the effect of drilling fluids to the formation, multiple analyses were carried out.

Diagenetic alterations in the sandstones are feldspar overgrowths on detrital K-feldspar grains; authigenic quartz overgrowths; framboidal pyrite formation, later dissolution and octahedral pyrite formation; calcite- and dolomite cementation; authigenic clay mineral formation and an early formation of glauconite (mainly as rims).

The focus was to characterise the authigenic clay fraction (excluding shale clasts) in the different zones. Samples of the gas-bearing, the transition, the secondary watered and the initial water zone were analysed.

X-ray diffraction analyses of the clay fractions showed that there are clear zone-dependent differences. Increasing crystallinity of smectite, chlorite and illite from the gas-bearing to the initial water zone and an increase in the clay mineral content could be observed. Most important is the fact, that there are no expandable clay minerals in the gas-bearing zone. This changes in the transition zone where smectites are devel-

oping.

There is a considerable effect of the rising water level (due to gas production) on the authigenesis of clay minerals in the pore space. Within a few years of the start of water infiltration new clay minerals are forming. Existing ones start to recrystallise and expandable clays appear in the transition zone where primarily none were present.

The drilling mud had little interaction with the reservoir rocks. Expandable clay minerals showed different behavior from the outer rim (about 1cm) of the cores towards the center. Smectites adsorbed potassium and/or barium from the drilling mud which resulted in a decrease of the interlayer spacing. Barite originating from the drilling mud infiltrated the outermost 2 mm of the cores with a decrease from the margin to the center.