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Evidence of Grain Cushing during mechanical Compaction of Reservoir Sandstones-A Comparison with Experimental Results

Porosity in sandstones is a function of mechanical and chemical compaction. The extent of mechanical compaction in reservoir sandstones has been studied using standard petrographic and cathodoluminiscence microscopy. Most reservoir sandstones compact mechanically down to 2-2.5 km burial depth (70-1008C). At greater depth precipitation of quartz cement strengthens the grain framework enough to prevent further mechanical compaction. In reservoir sandstones from the North Sea grain fracturing is common in medium to coarse-grained sandstones but it is rarely observed in the fine-grained sandstones. Petrographic textures in reservoir sandstones are similar to those produced during one-dimensional compression experiments at high stress (15-50MPa). The degree of grain fracturing is a function of effective stress and increases with increasing grain size. Some deeply buried (5 km) sandstones at Haltenbanken show evidence of more extensive grain crushing. This is because grain coatings have delayed quartz cementation. The deeply buried reservoir sandstones (6 km) from Azerbaijan area with rapid subsidence and low geothermal gradient have very little quartz cement and show evidence of intense grain fracturing. Fracturing in these deeply buried sandstones must have occurred when the sandstones suffered an overburden of more than 40-50 MPa effective stress i.e., 4-5 km burial depths. It is therefore important to consider grain crushing due to mechanical compaction during modelling of compaction in deeper parts of sedimentary basins. It determines the porosities (IGV) and grain surface properties at the onset of quartz cementation.