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Diagenesis and reservoir quality evolution of palaeocene deepwater, marine sandstones, the shetland-faroes basin, the british continental shelf

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Mineralogic, petrographic, and geochemical analyses of siliciclastic, turbiditic sediments recovered from nine wells in the West of Shetland Basin are used to decipher and discuss the diagenetic alterations and related subsequent reservoir quality evolution. The Middle-Upper Palaeocene sandstones (subarkoses to arkoses) from the Shetland-Faroes Basin, British continental shelf are submarine turbiditic deposits that are cemented predominantly by carbonates, quartz and clay minerals. Carbonate cements (Intergranular and grain replacive calcite, siderite, ferroan dolomite and ankerite) are of eogenetic and mesogenetic origins. The eogenetic alterations has been mediated by marine, meteoric and mixed marine/meteoric porewaters and resulted mainly in the precipitation of calcite (δ^{18}OPDB = -10.9 per mille and -3.8 per mille), trace amounts of non-ferroan dolomite, siderite o(δ^{18}OPDB = -14.4 to -0.6 per mille), smectite and kaolinite. Minor eogenetic siderite has precipitated between expanded and kaolinitized micas, primarily biotite. The mesogenetic alterations are interpreted to have been mediated by evolved marine porewaters and resulted in the precipitation of calcite (δ^{18}OPDB = -12.9 to -7.8 per mille) and Fe-dolomite/ankerite (δ^{18}OPDB =

-12.1 to -6.3 per mille) at temperatures of 50-140˚C and 60-140˚C,respectively.

Quartz overgrowths, outgrowth post- and pre-date the mesogenetic carbonate cements. Discrete quartz cement, which is closely associated with illite and chlorite, is the final diagenetic phase. The clay minerals include intergranular and grain replacive eogenetic kaolinite, smectite and mesogenetic illite and chlorite. Kaolinite has been subjected to mesogenetic replacement by dickite. The K-feldspar and plagioclase grains have been albitized. Dissolution of calcite cement and of framework grain (feldspar, volcanic fragments and mud intraclasts) has resulted in a considerable enhancement of reservoir quality.