Shale Pressure Reversals, Identification and Implications from Pore Pressure Models of the SMK Field, Onshore, Western Niger Delta

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Abstract

Pore pressure evaluations are crucial to assessing exploration risk factors with well control and development providing quality geo-scientific databases and enabling reserve development models for uptimal well production and management, concepts affected by the presence of lateral reservoir drainage.

The study carried out on an onshore Niger Delta field, dealt with the concept of overpressuring mechanism and estimation coupled with reservoir drainage identification using real time mud log data/MWD logs and postdrill wireline logs. Quantitative pressure analysis carried out on eight wells using Wireline/MWD logs revealed that compaction disequilibrium is the dominant geopressure mechanism in the field with trend deviations from normal compaction clearly discernible from the sonic logs around 9000ft(2727m). Shale pressures determined using standard Eaton and Equivalent depth methods revealed two pressure regimes, the normally pressured section(SMK 6,10 and 14) and the abnormally pressured section (SMK 1,8,11,12 and 13), results corroborated excellently by quantitative pressure analysis using the D-exponent from the four mud logs which serve as the calibrator for this study.

A geopressure implication from the Wireline/MWD shale profiles is the presence of lateral drainage observed from shoulder effects cutbacks due to reservoirs having lower pressures than adjacent shales, effects very distinct in the overpressured wells with ghost imprints in the normally pressured ones. Log analysis showed that reservoir conduit thickness and local tectonics are causes with the overpressured wells having uplifted reservoir flanks(less temperature and pressure hence slow pressure drainage) compared to the normally pressured ones(deep seated hence rapid pressure drainage and hydraulic fracturing prone) when correlated across the whole field. Attendant consequences of this phenomenon include enhanced seal capacity, hydrodynamic traps scenarios and better/enhanced reserve capacity for the field.