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Understanding the Pressure Regimes Along the West Africa Margin and Their Implications for Prospectivty

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Abstract

One of the key exploration risks along the margin is to understand the pressure regime. This understanding is both vital for well design but also for de-risking of traps for hydraulic breach for instance. Clearly, pressure prediction has proved problematic during the various phases of drilling in West Africa, as evidenced by the number of kicks taken, for instance, in the Niger Delta and Cameroon. This observation suggests that the pore pressure regime is not understood fully even in areas where existing well penetrations are present.

Part of the complexity of pressure prediction (and geomechanics) along the margin is due to the highly variable lithology. In Morocco, for instance, Jurassic carbonates are proving exploration targets. These are frequently associated with taking drilling losses. In Gabon, throughout the offshore, drilling is below the Ezanga salt. In some areas the pre-salt Gamba reservoirs are normally pressured, in others, highly overpressured - this is due to the presence of rubble zones and/or reservoir connectivity/isolation. In Mauritania, Cretaceous reservoirs in clastics have highly variable pressure; the shale pressures are frequently much higher than their associated reservoir pressures. In the Niger Delta, the challenge is that due to the very deep drilling, the shales are very hot and secondary overpressure mechanisms are more likely, creating HP/HT conditions.

Thus, in order to produce models for pore pressure and so be able to de-risk our prospects for seal failure, the above all need to be acknowledged/understood and quantified. This article presents a series of solutions based on building a coupled geological-pressure model. This or these, simple models are the result of combining typical "geological" information such as basin stress, lithology, and temperature gradient and sedimentation rates, with knowledge of pressure generation mechanisms. Once done, accurate pore pressure can then be input into seal capacity relationships to establish likely risk of failure and migration of hydrocarbons out of a trap, as well as map dynamic aquifers, commonly found, where fluid distributions are affected by hydrodynamic spill points.