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ORIGINAL PAPER - EXPLORATION GEOPHYSICS

Design of safe well on the top of Atharamura anticline, Tripura, India, on the basis of predicted pore pressure from seismic velocity data

Jwngsar Brahma[1] · **Anirbid Sircar**[1]

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Abstract
Pore pressure prediction is an essential part of wildcat well planning. In India, Tripura sub-basin is characterised by huge anticlines, normal faults and abnormally pressured formations. These factors push the wildcat well planning in this area into wide margin of uncertainty. Pore pressures were predicted from seismic velocities by using modified Eaton's method over the synclinal and flank part of Atharamura to understand the pressure succession towards the anticline. These predicted pore pressures on the flank part lead to a reasonable match when plotted with offset well-measured pore pressures. To reduce the uncertainty, fracture pressures were established by various methods such as Hubbert and Willis method and Matthews and Kelly method from predicted pore pressures. But the fracture pressures were predicted with available horizontal stress correlations due to lack of Poisson's ratio curve for the study area. The mud pressure required to drill the well is calculated using median line principle, and hence drilling mud window is established by assuming virtual tight conditions. The plot of equivalent circulation density versus depth suggests that well can be drilled with two casing policy. But it is found that adding one more casing pipe will ensure the safety of well. Casing pipes were designed on the basis of collapse pressure, burst pressure and tensile load. Finally, a well plan which includes pore pressure, fracture pressure, drilling mud policy, casing policy and kick tolerance graph were proposed to give clear picture on well planning on the top of the anticline in pore pressure point of view.

Keywords Pore pressure · Fracture pressure · Atharamura · Tripura

Introduction

The systematic study of the fluid characteristics of subsurface formations is a critical importance in the well planning and formation evaluation. Pore pressure prediction plays a very important role in studying the hydrocarbon trap seals, mapping of hydrocarbon migration pathways, analysing trap configurations and basin geometry and providing calibrations for basin modelling. With the help of pore pressure prediction, an appropriate mud weight to be selected and drilling casing program to be optimised, safe and economic subsurface drilling can be designed. Nowadays, the prediction of pore pressure formed an integral part of prospect evaluation and well planning. The main objective of this study is to plan a safe well over Atharamura anticline to explore and exploit hydrocarbons. Planning an exploratory well from seismic velocities aims to produce: pore pressure prediction, establishing drilling mud window, target depth selection, optimal mud policy, kick tolerance guidelines and general guidelines for drillers. The main challenges in this area are there is no seismic velocity data available on the top of the Atharamura anticline. So, it is decided to take a model-based seismic velocity data which are developed by the operating company from offset seismic data. As the data are issued by the operating company, seismic velocity model-related details are not discussed here.

Hydrostatic pressure is defined as the pressure exerted by a column of water at any given point in that column, when the water at rest. It is the pressure due to the density and vertical height of the fluid column exerts force in all directions perpendicular to the contacting surfaces (Bourgoyne et al. 1991).

✉ Jwngsar Brahma
Jwngsar@gmail.com

Anirbid Sircar
Anirbid.sircar@spt.pdpu.ac.in

[1] Pandit Deendayal Petroleum University, Gandhinagar, India

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