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Real-time Geopressures While Drilling – Considerations and Case Histories

Abstract

The failure to accurately quantify geopressures (pore pressure and fracture gradients) at the wellsite for wells drilled in areas of high pore pressures can be costly, both in terms of well cost and human and environmental safety. This is an especially difficult problem for wells in deep water in areas of little known geology, where only surface seismic data is available for the prediction of geopressures. Often there is not sufficient resolution in the surface seismic data to accurately identify the depth of hazards such as shallow gas pockets and pressure zones.

This presentation describes the experience obtained in using a variety of types and kinds of real-time data collected at the wellsite, analyzed by several different models, all integrated together in a single computer system to quantify geopressures. Traditional real-time measurements such as gamma ray, resistivity and drilling parameters are discussed, as are some of the newer measurements such as sonic, pressure while drilling and seismic while drilling. The experience has shown that where individual porosity indicators, such as resistivity, are used alone, they can be misleading and problematic. Resistivity, for example, is affected by environmental factors such as temperature and salinity, and sometimes gives a false pressure indication in areas where those factors prevail. However, when resistivity data are used in combination with sonic data, and perhaps multiple models are used with each, the variety of results significantly enhances the ability to quantify results. When other geopressure indicators are added in, such as gas volumes, drilling data (drilling exponent), etc., the picture becomes even clearer. With the benefit of VSPs and/or seismic while drilling, it becomes possible to "look ahead of the bit" to further identify hazards. So while each measurement on its own can provide sometimes misleading and hard to interpret results, the integration of several of them together can give a much clearer picture.

Several case histories will be presented that illustrate application of this technology in areas that range from the Gulf of Mexico to the North Sea and the South China Sea. Case histories will include the use of available data to predict accurately the pressures ahead of the bit and the successful transferring of experience and calibrations from one area to another.

Biographical Sketch

JAMES W. BRIDGES is the founder and president of Knowledge Systems and Geopressure Systems. Mr. Bridges has been involved in the design, development and support of engineering software for more than 30 years, founding his first software company in 1969 and seeing it go public in the 1980s. He founded Knowledge Systems in 1985 to develop knowledge-based software applications for the oil and gas industry. Mr. Bridges designed the DrillWorks/PREDICT software system. Funding for development of the system was provided by an industry consortium of several major oil companies organized through the Drilling Engineering Association. DrillWorks/PREDICT was introduced as a commercial software product in 1991 and has since become the most widely used software system in the world today for geopressure analysis. In 1997, Geopressure Systems was formed as a division of Knowledge Systems to provide services at the wellsite to monitor geopressures while drilling using DrillWorks/PREDICT in such areas as Gulf of Mexico, Trinidad, West Coast of Africa, and the South China Sea. Currently he is managing another industry consortium project through the Drilling Engineering Association to develop an improved methodology for pre-drill geopressure prediction for wells in deepwater. He holds a BS and MS in civil engineering from Texas A&M University. □

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