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A Methodology to Identify and Prioritize Exploration Focus Areas in GOM Using 3-Dimensional Volumes of Pressure, Temperature, and Other Subsurface Data

Reginald H. Beardsley and James E. Fore, ForeSight Energy

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Abstract

Explorers often use regional studies in the GOM to focus limited resources into preferred areas for lease sale preparations. Modern corporate and public scientific databases contain vast amounts of geological, geophysical, and engineering information to utilize in the regional studies. However, these databases often have a considerable amount of bad data. Traditional manual methods for validating the large data sets in mature areas are labor intensive and expensive. A cost effective multi-step statistical methodology for creating 3D property estimates at basin scale has been developed that exploits multivariate and spatial statistics to edit data and prepare 3D volumes to integrate with seismic 3D.

The methodology is demonstrated using public domain GOM temperature and pressure data from the MMS, NOAA, and the literature. Examples of regional temperature and pressure maps extracted from the resultant 3D volumes are shown. Selected isotherm and isopressure surfaces are then combined with well penetration data to identify untested areas for greater scrutiny.

The created 3D volumes of pressure and temperature estimates (or other properties as available) can be loaded on exploration workstations to allow the estimates to be superimposed directly on the seismic. In particular, the integration of the pressure data with the seismic further assists regional and detail understanding, pressure cell delineation, and prospect evaluation, risking, and prioritization. The 3D pressure volumes can also provide direct engineering support for regional pressure prediction to identify key wells for pressure analogs for well planning.

The described methodology can be applied to any large data set for which 3D sampling coordinates are available. With the addition of well test, wire-line, geochemical and paleontological data, additional criteria can be applied to further high-grade areas with the best exploration potential. Because only limited human interaction is required, the method scales well to the large data sets available in mature basins. The methodology greatly facilitates the integration of subsurface data with seismic with the potential to reduce exploration and drilling costs, to improve prospect evaluation and risking, and to optimize placement and planning of exploration wells.

Introduction

Companies often use regional studies in the GOM to focus limited resources into preferred areas for lease sale preparations and to assist in prospect evaluation, risking, and ranking. With more than 47,000 wells drilled in the GOM, corporate and public databases contain vast amounts of GOM subsurface information to utilize in the regional studies. However, these databases often have a considerable amount of bad data. Traditional manual methods for validating the large data sets in mature areas are labor intensive, expensive, time consuming, and often result in the regional study being completed late in the lease sale preparation process.

A cost effective multi-step statistical methodology for creating 3D property estimates at basin scale has been developed that exploits multivariate and spatial statistics to edit large volumes of subsurface data and to prepare 3D volumes of the subsurface data which integrate easily with seismic 3D data on the explorer's workstations. These 3D volumes can be