

Dynamic Integrated Data Analysis Of A Mature Hydrocarbon Basin -- A Case Study From The Bighorn Basin

Jenica Andersen¹, Brianna Berg¹, Cody Bomberger¹, and Michael H. Hofmann¹

¹AIM GeoAnalytics, Missoula, MT

ABSTRACT

When assessing mature hydrocarbon basins, objective evaluation of big data sets and large geographic areas can pose challenges. Namely, knowledge bias for an area can occlude a higher potential for production in another area. This study presents results from an assessment of existing and undiscovered oil resources in the Bighorn Basin, using an original method to dynamically evaluate large data sets. The assessment is based on a range of geologic elements and historic production data for individual stratigraphic intervals and for the basin as a whole -- all available from public resources. The Bighorn Basin contains 134 oil fields, seven of which fall within the state of Wyoming's top ten producing fields. Since its initial discovery in 1905, the Bighorn Basin has produced more than 2.67 billion barrels of oil, and in 2011 Bighorn Basin production accounted for 22 percent of Wyoming's oil production that year. The maturity of this basin, the complexity of the petroleum systems, and the vast amount of publicly available data make this basin an ideal case study for dynamic integrated data analysis (DIDA). This dynamic evaluation tool allows for on-the-fly parameter adjustment and a virtual comparison of probability for success. Parameter significance can be based on many factors, including data density and quality -- which are key considerations in mature basins where data comes from a range of sources and vintages. For example, in the Bighorn Basin, basin-wide porosity data is limited. Although porosity has the potential to significantly influence reservoir quality, the sparsity of the data set demands a more careful handling of this parameter in a basin-wide evaluation process. Being able to dynamically adjust the importance of different geologic parameters in a spatial framework allows one to evaluate and visualize the effect these parameters have, and improves probability mapping. Results from Bighorn Basin data evaluation show that the dynamic integration of large data sets is a successful screening tool for seeking areas of high potential, with the ability to visualize and select relative parameter importance. The findings and methods presented in this study provide a fast and objective evaluation of mature and data-rich hydrocarbon basins across North America and around the world, and can be implemented by individuals or companies during an early phase of basin evaluation.