

Evaluation of the Effectiveness of Using Gravity and Magnetic Data to Define 3-D Seismic Survey Areas for Fault Related Hydrothermal Dolomite Reservoir Identification

Alan W. Hinks¹, Robert L. Schulz², and Eric R. Johnson³

¹Westshore Consulting, Muskegon, Michigan, 49444, ahinks@westshoreconsulting.com

²Westshore Consulting, Muskegon, Michigan, 49444, bschulz@westshoreconsulting.com

³Westshore Consulting, Muskegon, Michigan, 49444, ejohnson@westshoreconsulting.com

Basement faults are reactivated through geologic time and often influence the position of faulting in overlying strata. Basement faults reactivated in a strike-slip sense cause strike-slip and wrench faults in overlying strata. Strike-slip and wrench faults are excellent conduits for hydrothermal fluids, and the formation of dolomite, especially at dilatational bends, at the end of faults, and at fault intersections. It appears that fault related hydrothermal dolomite reservoirs (FRHDRs) can be found in many ancient carbonate margins and platforms, suggesting the extent of these reservoirs is broad.

3-D seismic is an effective method to locate FRHDRs. Magnetic data is often used to map basement faults and gravity data is often used to map basement, and shallower faults. Some geoscientists have suggested it makes sense to define the general location of basement and shallower faults with relatively inexpensive gravity and magnetic data in order to minimize the acquisition of expensive 3-D seismic data. While this approach appears to make sense, little evidence has been presented documenting the success of the method. This study utilizes gravity/magnetic modeling and public domain gravity and magnetic data subjected to various processing and enhancement techniques to determine whether discernible gravity and magnetic anomalies are associated with known FRHDRs.

The results of the study show that in a significant number of cases where data quality is adequate, gravity and/or magnetic data can be used to locate the general position of FRHDRs. The data requirements and methodology needed to assure best results is also discussed.