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High Resolution Aeromagnetic Evidence for Deep Seated Structural and Fault Control on Hydrocarbon Entrapment and New Oil and Gas Targets – East Texas and Northwest Louisiana

The relationships between structurally and stratigraphically entrapped oil and gas fields and underlying magnetic basement along the southern margin of the East Texas basin and southern and eastern flanks of the Sabine Uplift in Louisiana have been evaluated by integrating a high resolution aeromagnetic survey with a comprehensive Lower Cretaceous subsurface geologic dataset. Well control and field studies confirm that structures and faults are instrumental in controlling reservoir entrapment. The location of fields in this system, along with production from a variety of Woodbine, Austin Chalk, and deeper reservoirs, bears a direct relationship to deep, wrench fault-related structures imposed on the basement during the Ouachita – Marathon Orogeny and re-activated during various episodes of readjustment throughout the development of the Gulf of Mexico.

The aeromagnetic survey entails 25,000 line-miles of high resolution aeromagnetic data that was flown with a half-mile by one-mile flight-line grid. Flight altitude was 500 feet above ground. Surveying utilized GPS navigation, digital diurnal monitoring, high sensitivity Cesium vapor magnetometer and video ground recording. Careful de-culturing, profile analysis and grid filtering produced impressive images of residual structural highs, basement faults, intrasedimentary faults and regional wrench faults. Color SUNMAG/AUTOFAULT and gray shade images highlight the structure and fault trends at selected “pseudo depth slices”. Detailed 2-D Werner and 3-D Euler depth estimation provide a series of fault picks at different depths in the section.

The subsurface dataset incorporates over 40 sequence stratigraphic picks, net porosity evaluations from over 1000 wells and

core descriptions in eastern Texas and western Louisiana. Inter-relationships were examined among oil and gas production, aeromagnetic fault and structural patterns and isopach and porosity patterns within Lower Cretaceous stratigraphic intervals. These suggest that paleostructural trends exerted a strong influence on deposition, reservoir development and hydrocarbon entrapment. These relationships also suggest that this approach can be utilized to define exploration lead areas in other stratigraphic, structural and fracture plays both shallower and deeper where subsurface control is sparse or non-existent. This integrated approach is shown to be a good, non-invasive exploration tool for prospecting in advance of leasing and 3D seismic shooting. ■

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Biographical Sketches

BILL PEARSON is the founder and owner of Pearson Technologies, Inc. in Denver, Colorado. His company provides petroleum exploration gravity and magnetic consulting services and surveys to oil and gas companies and Mining companies. His focus has been on consulting, software development and industry schools. Bill earned a BS in geophysical engineering from the Colorado School of Mines in 1970 and a PhD in oceanography from the University of Washington in Seattle in 1975. Bill began his petroleum exploration career at Amoco as a seismic processor, programmer and interpreter before leaving to pursue a consulting career at EDCON and then with small consulting companies he founded and co-founded. Bill has been active in SEG work including eight years on the Scholarship Committee, **GSH** continued on page 23



one as its chairman. He has been involved in the Geophysical Integration Committee (SEG and AAPG). He has been co-chairman of the Denver Geophysical Society's and Rocky Mountain Association of Geologists' annual 3D Seismic Symposium for ten years and running. This symposium has attracted nearly 500 attendees to view state of the art 3D seismic techniques, results and case histories. Bill is currently helping with the 2004 SEG Convention on the technical program committee. Bill is a member of SEG, AAPG, Houston Geological Society, Denver Geophysical Society, Rocky Mountain Association of Geologists and is a registered Professional Geoscientist for the State of Texas.

DICK INDEN is a carbonate sedimentologist/stratigrapher who has more than twenty years in the petroleum industry, university teaching, and government agencies. In 1985, he founded LSSI, a geological consulting firm specializing in the detailed evaluation of carbonate reservoir systems, basin stratigraphic analysis, and

prospect generation. He has experience as a consulting geologist on projects throughout most of the United States, as well as Central America, South America, Europe, Africa, and Australia. Dick received his PhD in Geology from Louisiana State University with post-doctorate work at the University of South Carolina and he taught at the University of South Carolina and Kent State University. Dick has worked with the United States Geological Survey in their Basin Studies Group, with Superior Oil Company as Head of their Stratigraphic Analysis Group, and with MRO & Associates as an exploration geologist generating prospects in the Silurian Reef trend in the Illinois Basin. He has taught the industry short course, "Exploration for Carbonate Reservoirs," in Denver and to geologists from developing countries. He is a member of the American Association of Petroleum Geologists (AAPG), the Society of Economic Paleontologists and Mineralogists (SEPM), and the Rocky Mountain Association of Geologists (RMAG).