HGS LUNCHEON MEETING— JANUARY 31, 1990

DAVID T. LAWRENCE—Biographical Sketch

Dave Lawrence received his BA in Geology from Lawrence University in 1977 and his Ph.D. in geology from Yale University in 1984. From 1977 to 1979, he taught geology at Yavapai College in Prescott, Arizona. He has worked for Plateau Resources, Grand Junction, Colorado in uranium exploration and for the U.S. Geological Survey Coal Branch, Denver, Colorado. Dave joined Shell Development Company in 1984 where his current position is Sr. Research Geologist. His research interests include basin analysis, geologic modeling, field studies and seismic stratigraphy. He has presented many papers to professional societies including AAPG, SEG, SEPM, IGC, and GSA.

APPLICATION OF STRATIGRAPHIC FORWARD MODELS IN EXPLORATION SETTINGS

A two-dimensional stratigraphic simulation program has been successfully applied to clastic, carbonate, and mixed clastic/carbonate depositional regimes. The program may be used to predict reservoir distribution, to constrain interpretations of well and seismic data, to rapidly test exploration scenarios in frontier basins, to calculate thermal and maturity histories, and to evaluate the fundamental controls on observed basin stratigraphy. Applications to seismic and well-log data sets from Main Pass (U.S. Gulf Coast), Offshore Sarawak (Malaysia) and Baltimore Canyon (U.S. East Coast) demonstrate that the program can be used to simulate stratigraphy on a basin wide scale as well as on the scale of individual prospects.

The Main Pass section, offshore Louisiana, Mississippi and Alabama is an offlapping sequence of Neogene clastics. The model simulates 17 million years of geologic history at a 200,000 year resolution and predicts the depth and location of nearshore marine sands, intervals of sediment bypass into deep water, paleobathymetry, shelf margin positions, major and minor sequence boundaries, and gross basin geometry. A movie will be shown illustrating the geologic history of Main Pass from the Miocene to the present.

Central Luconia, offshore Sarawak, Malaysia is an important gas province with 7 giant gas fields and 20 smaller fields. Much of the production is from middle to late Miocene carbonate buildups. Three of these buildups were simulated using a sea level history optimized to reproduce the carbonate growth anatomy. The model predicts subaerial exposure phases associated with zones of enhanced porosity in two updip buildups with gas production. Seismic reflection geometries indicative of transgressive, aggradational, progradational and retrogradational phases are reproduced.

Jurassic to Pleistocene stratigraphic sequence geometries, mixed clastic / carbonate facies distribution and thermal/maturity history were simulated along a 300 km regional dip line of the Baltimore Canyon Trough. Modeled features of interest include a progradational Middle Jurassic carbonate margin punctuated by clastic deposition during sea level lowstands and a late Jurassic / early Cretaceous aggradational carbonate margin culminating in the development and subsequent drowning of isolated carbonate buildups. This section is of particular interest because Shell Offshore Incorporated drilled three exploration wells in record setting water depths (maximum 2119 meters) to test the Upper Jurassic - Lower Cretaceous carbonate shelf margin. The model predicts that, initially, carbonate buildups formed coeval with interbedded clastics and carbonates in an intrashelf basin. During a subsequent sea level lowstand, the margin was subaerially exposed with consequent leaching of carbonates and porosity enhancement of the buildups. As sea level rose again, the shoreline retreated landward and a shale seal was deposited. Model predictions are supported by detailed petrographic and seismostratigraphic analysis.