INTERNATIONAL EXPLORATIONISTS

HGS INTERNATIONAL GROUP DINNER MEETING—OCTOBER 19, 1992

Post Oak Doubletree Inn
Social hour, 5:30 p.m., Dinner, 6:30 p.m.
Technical Presentation, 7:30 p.m.

MATEU ESTEBAN* and S. QING SUN—
Biographical Sketches

Mateu Esteban received his M.S. and Ph.D. in the University of Barcelona (Spain) in 1969 and 1973, where he was Lecturer and Associated Research Scientist. He created a research group on carbonate stratigraphy, sedimentology and diagenesis and conducted extensive carbonate research programs in the Universities of Dijon (France), Liverpool (UK), Miami (Florida), Wisconsin (Madison) and Pisa (Italy), and since 1977 was involved in part-time consulting with different groups. After three years as Staff Research Scientist in Amoco Production in Tulsa (Oklahoma), in 1985 he joined Petroleum Information Corporation as Geological Research Director of the London subsidiary ERICO Petroleum Information Ltd. Esteban has directed and contributed to a large number of consulting projects, field studies and training programs; major topics have been Mesozoic and Tertiary carbonates of the Mediterranean regions; Miocene carbonates in Mediterranean, Middle East, Southeast Asia, and Central America; African lacustrine basins; worldwide paleokarsts and unconformities in carbonates, etc.

Esteban's special interests are unconformity analysis and predictive strategies in exploration and production in paleokarst reservoirs, together with the study of Miocene reefs and Alpine carbonate geology. He has been the Dean

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McGee AAPG Distinguished Lecturer (1991-92), the Foreign AAPG Distinguished Lecturer (1987-88) and Lecturer in the 1980-81 Continuing Education Program of AAPG.

S. Qing Sun received a B.S. degree in Petroleum Geology in 1985 and an M.S. degree in Organic Geochemistry in 1987 from Daqing Petroleum Institute (northeast China), after which he came to UK and obtained a Ph.D. degree in Sedimentology from Reading University in 1990.

Sun's first industrial experience was with GAPS Geological Consultants and in June 1990 he joined Petroleum Information Corporation at its London subsidiary ERICO Petroleum Information Ltd. He has been involved as co-author and senior author in several exclusive and multi-client projects on Miocene carbonates and sandstones of Southeast Asia, Gulf of Suez, Morocco and Iraq. Sun is now concentrating on a new project on dolomite reservoirs worldwide.

Sun's primary interest is carbonate diagenesis and its influence on reservoir quality, and he has published several papers in this aspect. He believes that trends and patterns in carbonate diagenesis and porosity distribution can be better understood and predicted with a proper assessment of large-scale controls, such as paleoclimate, paleoceanography and depositional facies.

**Speaker*

PALEOCLIMATIC CONTROLS ON DIAGENESIS AND RESERVOIR QUALITY: LESSONS FROM THE MIOCENE CARBONATES

Miocene carbonate reservoirs worldwide were deposited in a wide spectrum of climatic regimes. Diagenetic pathways and reservoir quality of these Miocene carbonates appear to have been primarily controlled by the prevailing climatic regime. Two end-members are here discussed: 1) humid-oceanic tropical to subtropical settings, and 2) arid, land-locked temperate to subtropical settings.

In humid-oceanic, tropical/subtropical settings (i.e., Miocene carbonates in Southeast Asia and early to middle Miocene carbonates in the Western Mediterranean), meteoric involvment is essential in the development of economic reservoirs. Porosity distribution and evolution are dependent on depositional trends and sequence boundaries. Transgressive carbonates are mostly tight because of their relatively fine-grained textures, intense compaction, and isolation from meteoric water influence. In contrast, porosity is best developed immediately beneath type-I sequence boundaries in highstand carbonate buildups where the effects of meteoric-water leaching and karstification are most intense. Laterally, types and values of porosity change rapidly from one facies to another. Moldic and vuggy porosity is best developed in reef core and peri-reef facies because of the abundance of metastable skeletal grains. Lagoonal and inter-reef sediments are commonly mud-supported with predominant intercrystalline and chalky microporosity. Off-reef/basinal facies are mostly tight because of the common mud-size matrix material and intense compaction. Calcite cementation is a common porosity obliterating process, occurring in both meteoric and burial environments. Dolomite occurs only locally and may have been related to different types of mixing of marine and meteoric waters, oceanic groundwater pumping or warm fluids derived from basinal compaction. In essence, porosity generation for these humid-oceanic, tropical-subtropical Miocene carbonates was largely associated with subaerial dissolution processes although hydrothermal corrosion and fracturing in the subsurface also produced significant quantities of porosity locally.

In comparison, in arid, evaporitic settings (i.e., early and middle Miocene carbonates in the Middle East and late Tortonian-Messinian carbonates in the Mediterranean), more limited recharge of fresh groundwaters minimized both leaching of metastable skeletal components and karst processes. Instead, sea-level fall and lowstand commonly resulted in evaporitic conditions. With the ensuing marine transgression, mixing of hypersaline basinal brine and normal sea water would cause extensive dolomitization and associated leaching of metastable skeletal components, particularly along the platform margins. As the marine transgression proceeded, processes of dolomitization and dissolution could also have occurred within the platform-interior carbonates. This would depend on the volume of basinal hypersaline brines and the degree to which they were diluted by normal sea-water. Consequently, a large volume of moldic, vuggy and intercrystalline porosity were created. Calcite cements are rare because the dissolved calcium carbonates were incorporated into dolomites. Under shallow burial conditions, the most common porosity-obliterating process is the widespread anhydrite cementation. In some cases, both the primary porosity and early-generated secondary porosity were almost entirely occluded by anhydrite cements. With continued burial, the porosity of these carbonates was restored to 15-30% through fracturing and late corrosion of anhydrite cements, micritized grains and matrix. The corrosive fluids responsible for such a large-scale late corrosion are believed to have been associated with source-rock maturation or basinal shale compaction. Porosity generation of these arid, subtropical- and temperate-type carbonates was essentially associated with early dolomitization, skeletal aragonite dissolution, and late corrosion of anhydrite cements and fine-grained sediments.

Diagenetic pathways in these two end members of climatic settings are clearly controlled by the balance of evaporation/rainfall and related paleooceanographic factors. The well-studied pathways in humid-oceanic, tropical/subtropical carbonates are predominatly controlled by early fresh water diagenesis and depositional facies. In arid, land-locked settings, less-publicized diagenetic processes related to basinal evaporitic conditions override the effects of the early fresh-water diagenesis.