characterizes eastern Abaco lagoon where it overlies the wackestone facies, accounting for 50% of the normal marine section. The N.M. wackestone typically grades downward into a dark gray restricted marine (brackish to hypersaline) skeletal wackestone, $\lesssim$70 cm thick, and then to a dark brown non-marine soil zone, $\leq$16 cm thick, above bedrock. Radiocarbon dates indicate flooding of Abaco lagoon at least by 7,446 YBP at – 10 m, followed by the transition from restricted to normal marine conditions as early as 4,716 YBP. Sedimentation rates increase from 16 cm/1,000 years for the restricted marine wackestone, to 58-104 cm/1,000 years and 216 cm/1,000 years for the N.M. wackestone and packstone facies, respectively. The windward lagoon setting illustrates the caution required in prediction of facies continuity perpendicular to carbonate bank margins. Recognition of an ancient windward lagoon sequence may have important implications regarding sea level history and paleogeographic reconstruction.

LOHMANN, G. P., Woods Hole Oceanog. Inst., Woods Hole, MA

Heterobathyal Benthic Foraminifera: Bathymetric Migrations as Oceans Change

Reconstructions of the past distribution of Quaternary deep-water benthic foraminifera from both the Atlantic Ocean and Mediterranean Sea show that the bathymetric range of most common species has changed substantially through time.

An Atlantic Ocean abyssal biofacies characterized by "*Epistominella*" *umbonifera* periodically migrated hundreds of meters as ice-age climates influenced deep-water production in polar latitudes. At the same time, bathyal biofacies, especially ones characterized by *Uvigerina* and *Globocassidulina,* extended their bathymetric ranges as much as 2 km deeper.

In response to the Quaternary stagnations and recirculation associated with sapropel deposition in the eastern Mediterranean, most benthic foraminifera changed their bathymetric distributions. Deep-water biofacies (*Globobulimina, Articulina)* shallowed as deep basins became anoxic; shallower biofacies (miliolids) extended their ranges as recirculation oxygenated the deep water.

LOMANDO, ANTHONY J., JR., Marathon Oil Co., Midland, TX, B. CHARLOTTE SCHREIBER, Queens College of City Univ. New York, Flushing, NY, and ROY D. NURMI, Schlumberger-Doll Research Center, Ridgefield, CT

Sedimentation and Diagenesis of Upper Smackover Grainstone, Jay Field Area, West Florida

The examination of core and logs from a well 3 mi (5 km) southwest of the Jay field has given considerable insight into the upper Smackover facies distribution, diagenesis, and the application of recent models for the sedimentation and diagenesis of this Jurassic reservoir. A 63-ft (19 m) thick unit of oolitic and oolite-oncolite grainstones is recognized in the upper Smackover. High-angle inclined bedding, visible on both core and dipmeter, with a consistent 15 to 20° northeast dip, demonstrates the presence of oolite bars. These bars formed a barrier which affected subsequent deposition and diagenesis in the Jay field area. A complicated diagenetic history of marine and vadose cementation, and pervasive and selective dolomitization have left a unique imprint on the porosity and permeability of these rocks.

Dipmeter results and petrographic analysis of the grainstones indicate that cementation and diagenesis have not been uniform. Within the large-scale cross-strata, permeable beds are interstratified with tightly cemented or compacted, impermeable beds. Horizontal flow should be greatest along the strike of the inclined units, because the flow would remain within the permeable planes of the inclined strata. Thus, dipmeter correlation permits an interpretation of the direction of bedding permeability anisotropy produced by the inclination of the pore system.

The characteristics of sedimentation and facies distribution in the Jay field area have previously been compared with a modern analog from Joulters Cay in the Bahamas. The Trucial Coast of the Persian Gulf in the Abu Dhabi region may be a better model. The style of deposition and distribution of carbonate and evaporite sediments, and diagenetic characteristics in the grainstone barriers and lagoons closely fit the sedimentation and diagenetic pattern in the Jay Field area.

LONG, DAVID T., and ROBERT GUDRAMOVICS, Michigan State Univ., East Lansing, MI

Chemical Evolution of Brines from Modern Coastal Marine Sabkha

Certain minerals in ancient clastic and carbonate rocks such as selenite and iron sulfides are commonly taken as indicators of a sabkha environment. The wind-tidal flat area of Laguna Madre, Texas (a silicoclastic sabkha), is a modern locus for the deposition of these minerals and thus affords an excellent opportunity to determine the controls on their deposition. The purpose of this research is to study the chemical evolution of the subsurface brines associated with the mineral deposition.

A system of 20 well sites has been established along the 22-km width of the tidal flats to investigate the chemistry and the hydrology of the sabkha system. The chemistry and peizometric potential of the waters were determined at each site from two wells (depths of 1.9 and 3.8 m) and from a shallow trench dug to intersect the water table. The chemical data from two sampling periods (August 1979 to March 1980) were reduced by computer. Using Br^- as a conservative ion, the results of this study are as follows: (1) the concentrated waters (2 to 9 times the salinity of seawater) are typically NaCl solutions which are high in Mg^{2+}, K^+, and SO_4^{2-} and low in Ca^{2+} and HCO_3^-; (2) the major source of water is from Laguna Madre with minor contributions from continental ground waters; (3) the mixing zone of the two waters is on the continental side of the chloride plateau; (4) the sabkha hydrology is dominated by wind-generated flood recharge with localized evidence of evaporitic pumping and reflux; (5) the chemistry of the brines primarily reflects the degree of evaporation of the Laguna Madre waters and the extent of flooding; (6) the brines are all undersaturated with respect to halite and supersaturated with respect to dolomite, but vary in saturation state with respect to gypsum and calcite.

Previous work in this area, and the two sampling periods of this study indicate minor changes in brine geochemistry as a function of season. In general, the chemical nature of the brines from the Laguna Madre sabkha is similar to brines of other active coastal sabkhas; variations can be attributed to differences in climate, geomorphology, and hydrology.

LOOPE, DAVID B., Univ. Wyoming, Laramie, WY

Products and Processes of Ancient Arid Coastline: Lower Cutler Group (Permian), Southeastern Utah