tered, apparent dates ranging from Precambrian(?) to Paleozoic(?). R. E. Denison had earlier determined K-Ar and Rb-Sr mineral dates from the northern rocks to range from approximately 380 to 550 m.y.B.P., although these dates were considered spurious as plutonism in southern New Mexico has conventionally been assumed to be either Precambrian or Mesozoic-to-early Tertiary. Field relations for the northern block suggest some alkali granites-syenites are intrusive into the Bliss Formation (Cambrian-Ordovician) but younger than mid-to-late Paleozoic rocks, although the intrusive contacts have been questioned. New major and trace element chemical studies indicate a transition from alkali granite to syenite for the northern block and, more important, fresh material from drill cores has yielded Rb-Sr whole rock ages of 378 ± 19 m.y.B.P. (alkali granite suite) to 423 ± 24 m.y.B.P. (syenite suite) with a composite date of 405 ± 18 m.y.B.P. This age confirms Denison's work and argues for previously unrecognized Paleozoic plutonism in southern New Mexico, although it is not known at present whether this date represents a western extension of Ouachita-dates (i.e., parallel to the Texas lineament) or a separate, isolated event. Regardless, other apparent-Paleozoic dates from southern New Mexico must now be reexamined in light of the dates from the Floridas.

BROOKS, GREGG R., DOUGLAS M. PARKER, JOHN C. STEINMETZ, et al, Univ. South Florida, St. Petersburg, FL

Unusual Ponding of Sediments on Deep-Water Reef

The Florida Middle Ground is a deep-water coral reef on the outer continental shelf in the northeastern Gulf of Mexico. The reef consists of two parallel north-trending ridges, each about 50 km long and rising 11 m from the shelf to a depth of about 26 m. The ridges are separated by a broad, flat, sediment-filled valley about 8 km wide. The south end of the valley is partly occluded by irregular knolls. Station data (in transects) were collected over several seasons by Shipek grab, scuba team, and manned submersible. Detailed textural and constituent analyses of valley sediments reveal sand-sized carbonate material unlike the finer sands and silts found on the adjacent continental shelf. The percentage of terrigenous material in the valley is substantially less than that of the surrounding shelf.

Hurricanes, frequent storm fronts, the Gulf Loop Current, and semidiurnal tidal currents together comminute and erode ridge constituents. Those constituents transported between the ridges are mixed and trapped with shelf sediments. An accumulation of up to 5 m of sediment, over twice the thickness on the adjacent shelf, is ponded in the valley.

BRYANT, A. C., Dome Petroleum Corp., Calgary, Alta.

Entrada Oil Fields of Southern San Juan Basin, New Mexico

Twenty-two years elapsed between the discovery of the first Entrada (Jurassic) oil field at Media, Sandoval County (T19N, R3W) in 1953 and the discovery of Eagle Mesa, Sandoval County (T19N, R4W) in 1975. In the last two years, four additional but similar pools have been found at Ojo Encino, McKinley County (T20N, R5W), Papers Wash, McKinley County (T19N, R5W), Snake Eyes, San Juan County (T21N, R8W), and Leggs, San Juan County (T21N, R10W). These recent successes resulted from regional geologic studies, a reevaluation of the Media field, and the employment of high-resolution seismic techniques and processing. Oil is trapped in Entrada eolian sand dunes that have been preserved by the overlying lacustrine limestone and anhydrite of the Todilto Formation. Hydrodynamic influences have tilted the oil-water contacts in some of the fields. The oil, which is believed to have been generated within the Todilto limestones, is of medium gravity and high pour point. The geology, drilling, completion, and production of sample fields are discussed.

BUDAI, JOYCE M., and JAMES L. WILSON, Univ. Michigan, Ann Arbor, MI

Diagenesis of Lower Coralline Limestone (Chattian), Maltese Islands

The sequence of diagenetic fabrics in the lower Coralline Limestone (Chattian) on the Maltese Islands suggests that there was one phase of early marine cementation followed by at least two periods of phreatic cementation. Cements of marine origin include fine fibrous cement on algal and foraminiferal debris, and clouded syntaxial overgrowths on echinoid fragments. A younger generation of clear overgrowths on echinoid fragments displays luminescent zones that are restricted to the lower Coralline Limestone and lower member of the Globigerina Limestone and can be correlated throughout the Maltese Islands. These clear overgrowths are phreatic and formed both before and during sediment compaction. Subsequent phreatic cementation produced fine to medium-grained, non-luminescing scalenohedral calcite crystals that postdate compaction. The final stage of phreatic cementation consists of fine to medium-grained equant void-filling spar that is non-luminescent. Vertical and lateral distribution of phreatic cements and compacted textures is irregular and discontinuous. In general, well-cemented horizons also show overcompacted textures.

The relative timing of these diagenetic features indicates at least two episodes of emergence and meteoric cementation related to the development of freshwater lenses within the lower Coralline Limestone. Erosional and unconformable horizons in the overlying Miocene formations may record times of freshwater alteration corresponding to periods of eustatic lowering of sea level and emergence of the entire central Mediterranean platform.

BUFFLER, RICHARD T., and F. JEANNE SHAUB, Univ. Texas Marine Science Inst., Galveston, TX

Geologic History of Deep Southeastern Gulf of Mexico Basin—Seismic Stratigraphic Interpretation Ahead of Drill

A seismic stratigraphic analysis of multifold reflection data from the deep water part of the southeastern

Gulf of Mexico basin (located between the Campeche Escarpment and the Florida Escarpment and north of Cuba) provides the basis for an interpretation of the geologic history of the area.

A prominent unconformity of middle Cretaceous age (middle Cenomanian, 97 m.y.) separates the sedimentary section into two major depositional sequences. The pre-middle Cretaceous sequence consists of about 2 to 3 km of Middle Jurassic through middle Cretaceous sedimentary rocks unconformably overlying rifted, attenuated continental crust containing inferred Triassic-Lower Jurassic rift basins. This major sequence is further subdivided into several depositional sequences defined by unconformities tentatively age-dated by correlation with the global sea-level chart. Seismic facies analysis suggests that this major sequence represents a gradation upward from nonmarine to shallow marine and then to deeper marine rocks, the offbank equivalent of the Lower Cretaceous carbonate sections forming the adjacent Florida and Campeche Banks. Overlying the middle Cretaceous unconformity is a relatively thin sequence consisting mainly of pelagic and hemipelagic sediments mixed with carbonate debris eroded from adjacent banks (drilled in Deep Sea Drilling Project 97).

Two DSDP core holes will be drilled in this area in early 1981. Together, these two holes will sample a continuous section into the Jurassic, providing a valuable reference for extrapolating seismic data and unraveling the evolution of the southeastern gulf. In addition, these holes will test the principles of seismic stratigraphy as a tool for predicting depositional setting and age of sedimentary sequences ahead of the drill and will provide data for dating and understanding the origin of deep-sea unconformities.

BUNKER, BILLY J., and RAYMOND R. ANDERSON, Iowa Geol. Survey, Iowa City, IA

Assessment of Potential for Fluid Hydrocarbons in Iowa

Iowa has traditionally been regarded with only passing interest by the petroleum exploration industry operating in the Mid-Continent. This has been primarily due to the lack of structural and stratigraphic information in the area of greatest oil potential, the southwest quarter of the state. Thick deposits of glacial drift and a thick, poorly understood Pennsylvanian section have obscured the character of underlying Paleozoic rock units and restricted exploration incentive and subsurface control in the area. Working with recently acquired geophysical and well-control data, the Iowa Geological Survey has constructed a series of structural and stratigraphic maps that suggest that the oil potential of the Forest City basin in southwestern Iowa should be reevaluated.

Gravity and stratigraphic work along the northeast-trending Thurman-Redfield fault zone suggests vertical displacements of lower Paleozoic rocks of up to 1,000 ft (305 m). The abrupt termination of the large vertical component of the north-trending Humbolt fault against the Thurman-Redfield zone, and the recent recognition of left-lateral movement of the Humbolt fault in Nebraska and Kansas has led to speculation that transcurrent movement and associated structures could provide traps for oil migrating out of the basin. Stratigraphic mapping has also delineated a series of basins and uplifted areas throughout the Paleozoic column in Iowa, possibly associated with isostatic equilibration of the massive Keweenawan flood basalts of the Portage Lake Series, which forms the pronounced geophysical feature known as the Mid-Continent geophysical anomaly. Details of these basins are not clear at this time, but the potential for stratigraphic traps associated with such features in this area should not be ignored.

A series of maps and cross sections of the southwest quarter of Iowa has been prepared illustrating the results of recent and current studies.

BURCHFIEL, B. C., J. G. SCLATER, and L. ROYDEN, Massachusetts Inst. Technology, Cambridge, MA

Foreland Fold and Thrust Belt of Carpathians and Its Relation to Pannonian and Related Basins

The foreland fold and thrust belt of the Carpathians extends from Austria through the Carpathians to the south Carpathian bend in Romania where most structural units plunge beneath younger Pliocene-Pleistocene cover. Folds continue westward until all surface expression disappears before reaching Danube River. The belt is flanked by elements of the European, Russian, and Moesian cratonal areas which are overlain by foredeep deposits that are themselves involved within the external fold and thrust belt and overridden by it. Within the fold and thrust belt are older parts of the Carpathian orogene formed on continental crust with evolutionary differences between the western and eastern Carpathians.

The foreland fold and thrust belt consists of an inner flysch and an outer molasse cut into thrust sheets verging cratonward. Oldest flysch units are Middle Jurassic in the U.S.S.R., Upper Jurassic in Romania, and Upper Cretaceous in C.S.S.R. Oceanic crust may have underlain the flysch, and continental crust the molasse. Timing of thrusting is constrained locally, but suggests deformation in the western Carpathians developed during Oligocene to Miocene time progressively outward. Deformation in the eastern Carpathians began in the Albian or early Cenomanian internally and proceeded to late Miocene deformation externally.

The convex east loop of the Carpathian foreland fold and thrust belt resulted from subduction beneath inner Carpathian continental elements fragmented during collision within the European alpine system and driven or pulled eastward, molding the rocks of the fold and thrust belt against a recess in the craton. A Miocene volcanic arc lies internal to the fold and thrust belt, suggesting subduction of a few hundred kilometers of lithosphere.

Basins developed contemporaneous with thrusting within the Carpathian loop. Two types of basins occur: (1) peripheral (Vienna, Transcarpathian, and Transylvanian), showing fast initial subsidence followed by slower linear subsidence, and (2) central intra-Carpathian (Pannonian), showing only fast linear subsidence. Structural and thermal models indicate the peripheral basins formed by twofold stretching and some dike in-