Two earlier river channels of the Colorado River are known. One flowed into Matagorda Bay in the vicinity of Tres Palacios Creek. The other flowed, together with the Brazos River, into a large bay that occupied eastern Matagorda and western Brazoria Counties, Texas. Extensive deposition by these two rivers filled this bay and their combined delta advanced into the Gulf in the vicinity of Freeport. Any barrier beaches that were in front of the bay were buried by these sediments.

30. WILLIAM F. TANNER, Florida State University, Tallahassee, Florida

HISTORY OF APALACHICOLA RIVER DELTA AREA, FLORIDA

The Apalachicola River and its tributaries have delivered significant quantities of sediment into the northeastern corner of the Gulf of Mexico since early Tertiary time. The location of a major drainage outlet in the Alabama-Florida-Georgia tri-state area must be a matter of structural control, inasmuch as well-developed Cretaceous cuestas across southern Alabama and Georgia divert important drainages either toward the east (Atlantic Ocean) or the west (Alabama River system, draining into Mobile Bay). The early Tertiary predecessor of the Apalachicola River may have been located about 75 km. east of the present river.

The modern gorge of the Apalachicola has been occupied since perhaps middle Miocene time, when a previous estuary (in an important graben or half-graben) was completely filled with sediment. The Mio-Pliocene river built three or four cuspate deltas, at elevations of about 80, 50, 35, and perhaps 25 m. Three of these still exhibit relic offshore-flat, barrier-island, and drained lagoon topography.

Clear evidence is present in the area for Pleistocene sea-levels at 9, 6, 0, and −2 m. During the Pleistocene, the Apalachicola dammed the mouth of the Chipola River with sediment, forming Dead Lake, and almost completely filled a large estuary near the village of Apalachicola, leaving Lake Wimico and East Bay as remnants. Many of the features of the modern cuspate delta (including offshore shoals) have been formed, and reworked, as sea-level moved up and down during the Pleistocene. One of these features, an as yet inadequately explored and filled channel perhaps 35–40 m. deep, is under the present course of the river.

The low wave-energy level in the northeastern corner of the Gulf of Mexico—much like that along geosynclinal coasts of the past—is responsible for preservation of many delta characteristics which probably would have been eliminated if breaker heights had been typical of an open ocean.

Subtle structural deformation, still continuing in the delta area, partly controls the overall delta outline as well as many of the details. The prime structural trend in the area is N. 50° E.; there is less evidence for linears striking approximately N. 70° W.

ABSTRACTS OF PACIFIC SECTION PAPERS

April 9 and 10, 1964, Los Angeles, California

THOMAS A. BALDWIN, Humble Oil and Refining Company, Los Angeles, California

ISLAND OF FREEDOM

A dilemma faces geologists in the scientific societies. How can we cope with our need for improved professional status without tending to destroy scientific freedom through increased regulation? Members of the Association of Engineering Geologists have vigorously sponsored a state licensing law to regulate their field. Geologists in the other specialties feel that this legislation would divide the profession and hinder free scientific opportunity. Several Societies have condemned the proposed bill. The Pacific Section A.A.P.G. has led these groups toward more forceful action. The facilities of our Society have been used to organize an inter-society committee for the purpose of writing a registration law acceptable to all geologists. After the new committee was operative the Pacific Section stepped out of the picture and invited the American Institute of Professional Geologists to sponsor the activity.

These Pacific Section actions were necessary under the stringent circumstances, but the result of the action will be a regrettable increase in regulation. Disassociation from this activity was accomplished at the earliest possible moment. Long-continued or often-repeated professional activity would invite surveillance and regulation of our scientific society by governmental and corporate bodies. Many leaders of the Pacific Section feel that professional activities may occasionally be necessary but are always regrettable.

We should strive to keep the American Association of Petroleum Geologists an island of scientific freedom in the sea of professional regulation.

ORVILLE L. BANDY AND KELVIN S. RODOLFO, University of Southern California, Los Angeles, California

DISTRIBUTION OF FORAMINIFERA AND SEDIMENTS, PERU-CHILE TRENCH AREA.[1]

Nineteen trawl samples and 13 trigger cores were collected between depths of 179 and 6,250 m. in the Peru-Chile trench area off the western coast of South America. Sediments are mainly olive-green silt, clay, and colloidal material; however, four cores contain significant amounts of either sand-size Foraminifera or shale fragments, and one of these cores is mainly white volcanic ash. Values for organic carbon and nitrogen are much higher in the bathyal than in the abyssal zone. Sediment grain sizes do not exhibit definitive trends with either water depth or distance from shore.

Calcium carbonate content decreases sharply below 3,500 m., reflecting reduced quantities of calcareous Foraminifera in the trench. Deeper than 1,500 m., radiolarians are commonly more than twice as abundant as Foraminifera. Foraminifera larger than 0.5 mm. were concentrated in the trawl samples and below 1,000 m. are dominantly arenaceous. Among smaller Foraminifera, calcareous forms predominate down to 2,000 m.; at greater depths calcareous- arenaceous ratios fluctuate greatly. Planktonic foraminiferal tests are most abundant in the bathyal zone.

Bathymetric foraminiferal zonation is based upon upper limits of occurrence for both the larger live

[1] This work was supported by N.S.F. Grant No. G-19497, a part of the U. S. Antarctic Research Program of the National Science Foundation.

Foraminifera from the trawls and the smaller Foraminifera from the cores. Maximum size of the larger Foraminifera usually is between 1–10 mm. The zonation is:

TRAWLS

Meters	
179	*Valvulineria inflata* Group
878	*Cibicides wuellerstorfi* and *Reophax scorpiurus* Groups
1,171	*Cyclammina canellata* Group
1,863	*Alveolophragmium subglobosum* and *Reophax nodulosus* Groups
2,489	*Hormosina ovicula* Group
3,149	*Planispirinoides bucculenta* Group
3,404	*Recurvoides turbinatus-Bathysiphon* Group

CORES

Meters	
796	*Epistominella pacifica smithi* Group
1,171	*Bulimina rostrata* Group
1,932	*Eponides tumidulus* Group
2,498	*Nonion pompilioides* Group
3,257	*Stilostomella antillea* Group

Estimates of the total volumes of material caught by each trawl range from 2 to about 43 kg., dry weight.

FREDERICK A. F. BERRY, University of California, Berkeley, California

Origin of Nitrogen-Methane Gas and Anomalously High Fluid Pressures, Sacramento Valley, California

Nitrogen gas is commonly found in natural gas accumulations within Cretaceous and younger rocks in selected areas of the Sacramento Valley. Considerations of a variety of data and concepts suggest that the nitrogen originates independently from and earlier than the methane with which the nitrogen is now commingled and that it does not originate within the sediments in which the natural gas accumulations are found today. The proposed answer is that the Sacramento Valley nitrogen originates from low-grade metamorphism of sedimentary rocks containing organic matter. By elimination, the enigmatic Franciscan rocks of the Coast Range province appear to be the most probable source of this nitrogen. Abnormally high fluid pressures also exist within the Cretaceous sediments of the Sacramento Valley and may play a critical role in the origin of the methane within this dry-gas province. The existing fluid-potential distribution strongly suggests that the abnormally high-fluid potentials are the result of tectonic compaction—stemming from continuous uplift of the Coast Ranges at least from late Tertiary into Recent time.

The general fluid-potential distribution within the Sacramento Valley is such that vertically upward flow is commonly present. Water flowing upward through shales serving as methane sources would contain in solution different quantities of methane per unit volume of water depending upon the fluid pressures. The high solubilities of simple paraffin hydrocarbons in water as opposed to those of more complicated hydrocarbons and the exponential variation of these solubilities with pressure provide a mechanism for selectively transporting in aqueous solution essentially only simple paraffins—particularly methane—from a shale source at high pressure and discharging them as free gas at lower pressures in a reservoir rock. The operation of such a mechanism would be dependent upon significant vertical fluid-potential differences and would be independent of the age and degree of compaction of the shale. The methane for the Sacramento Valley dry-gas province thus may have evolved and accumulated fairly recently—subsequent to the presumed initiation of the regional high fluid potentials in late Tertiary time.

DONALD M. BLUE, Western Geophysical Company of America, Los Angeles, California

Reflection Techniques Suggest Nature of Deep-Ocean Sediments

Conventional reflection profiling reveals a deep-ocean sedimentary column up to 3,500 m. thick. Sedimentary layers are grouped into an upper acoustically transparent zone, 20–510 m. thick, and a lower acoustically responsive zone up to 3,000 m. thick. The former, exhibiting a minimum of internal structure, has an average $V_i = 1.70$ km./sec. determined from X^2, T^2 analyses, an average thickness of 200–250 m., and is interpreted as unconsolidated, water-saturated red clay or pelagic ooze. The responsive zone is strongly layered, has an average $V_i = 3.0$ km./sec., and is interpreted to be semi-consolidated to consolidated mixed red clay and ooze, turbidites, or volcanic products. Low-velocity sediments blanket ocean-bottom topography and exhibit relief (up to 100 m.) largely at the water-sediment interface suggesting bottom scour and transport. Higher-velocity, stratified sediments lie on an irregular basement with pronounced discordance; thickness is dependent on basement topography and suggests differing depositional processes and rates of diagenesis. The uniform, plane surface interface between the two sedimentary units and extraordinary smoothness of layers within the stratified zone may be explained by the leveling effect of turbidity currents in rapidly filling sediment basins.

EARL E. BRABB, U. S. Geological Survey, Menlo Park, California

Stratigraphy and Oil Possibilities of Mesozoic Rocks in Kandik Basin, East-Central Alaska

Mesozoic sedimentary rocks in the Kandik basin are subdivided provisionally into four units. The oldest, unit A, rests unconformably on the Tahkandit Limestone of Permian age. It consists mainly of carbonaceous argillite but includes some limestone, oil shale, and quartz arenite. This unit is about 5,000 ft. thick and ranges in age from Middle Triassic (Ladinian) at its base to Early Cretaceous (Valanginian) at its top. Conformably overlying unit A is unit B, a massive quartz arenite with minor interbeds of argillite and chert-pebble conglomerate. Unit B is less than 100 ft. thick south of the Yukon River but northward it thickens to about 1,000 ft. or more in the headwaters of the Black River. Pelecypods of Valanginian age have been found in the quartz arenite at several widely spaced localities. Unit B grades conformably upward into unit C, a rhythmically bedded quartz arenite and argillite, at least 5,000 ft. thick, that forms a substantial part of the Kandik Formation (Lower Cretaceous) at its type locality. Pelecypods of Valanginian age occur in the lower part of unit C. Unit D consists of chert-pebble conglomerate, sandstone, siltstone, and argillite, all of the graywacke type. It rests conformably on unit C in the vicinity of the Yukon