R. F. FLEGE, L. J. PARKINSON, Standard Oil Company of California; J. E. BEITZEL, California Institute of Technology; R. J. SONTAG, University of Utah: Magnetic Characteristics of California Basement Rock Types

Twenty-seven areas of basement outcrop in California were systematically examined in an attempt to correlate rock type and magnetic susceptibility with observed magnetic response. The investigation was performed by traversing selected areas of basement outcrop with a portable total intensity magnetometer, mapping lithologic contacts along the traverses, and sampling the different rock types for later petrographic identification and susceptibility determination in an inductance bridge.

In general, results from 275 samples support the established relationships between magnetic susceptibility and rock composition; i.e., acidic igneous rocks and metasediments are less susceptible than basic igneous rocks. However, magnetic susceptibility is primarily a function of magnetite and ilmenite content, and susceptibilities of individual samples within a given rock type were found to vary widely and in direct relation to the percentages of these minerals.

Good over-all correlation is shown between magnetic response and rock magnetic susceptibility, but theoretical susceptibility contrasts calculated from the magnetometer profile gradients are usually very much higher than the laboratory measured susceptibilities. This discrepancy is most probably due either to weathering effects on the surface rocks or to an insufficient number of samples. Serpentinite yielded the highest mean susceptibilities both by laboratory measurement and analysis of gradients measured in the field.

GERALD A. FOWLER, University of Southern California: Submarine Geology of Lasuen Bank

Lasuen Bank is a prominent feature of the Continental Borderland located between Dana Point and the south end of Catalina Island. It is elliptical in plan, elongate NW-SE, and asymmetrical in profile. Rocks ranging in age from Middle Miocene to Late Pliocene are exposed over most of the Bank's surface. The most distinctive lithology present is contained in a group of sedimentary rocks very similar to the Altamira, Valmonte, Malaga, and Capistrana Formations cropping out on the nearby mainland. Abundant volcanic rocks are interpreted as interbeds within these sediments. There is no evidence to support the presence of "Franciscan" Basement. Rock fragments of this type are referred to the San Onofre Formation. Representatives of the Topanga, Repetto, and Pico Formations are also present. Exposures become progressively younger toward the east. Lasuen Bank is a result of block faulting originating in the Late Pliocene or Early Pleistocene and continuing to the present. A system of fractures trending N 30° W is visible on profiles. Several terraces and associated features occurring down to 360 meters indicate the Bank was very near or above sea-level at least once during the Pleistocene.

R. J. GRAEBNER and D. F. BRENNAN, Geophysical Service, Incorporated: Analysis Techniques and Signal Enhancement Methods Applied to Bellshill Lake Stratigraphic Trap Program

A test program was conducted in the Bellshill Lake field, Alberta, Canada, to investigate the application of seismic techniques to finding the stratigraphic trap formed by the irregular sand bar type build-up within the Basal Quartz section controlling production in the field.

The seismic interpretative criteria were postulated from synthetic seismograms.

Controlled field tests were conducted to find the factors which influenced record quality, to examine the effect of each factor on the signal-to-noise ratio, and to evaluate the field techniques developed from the test results. Critical field techniques were the selection of charge sizes and hole depths yielding both suitable shot wave forms and a means for attacking the ghost reflection problem, the attenuation of shot generated boundary waves through wave length filtering with arrays of multiple seismometers, and the preservation of true amplitude information in the recording procedure. Special data processing techniques included the application of a velocity filter, the "pie-slice" process, to improve the signal-to-noise ratio without signal distortion and the stacking of vertically distributed charges with a process designed to eliminate the ghost over a broad frequency range without signal distortion.

The emphasis in the experimental survey was in the methods of investigation and the particular balance in techniques which must be struck to solve an exploration problem rather than in a demonstration of techniques as such.

OTTO HACKEL and ROBERT D. HOFFMAN, consulting geologists: Subsurface Geology of the Northern San Joaquin Valley

For several years, the Northern San Joaquin Valley has been one of the most active wildcat areas in California. This activity has resulted in the discovery of the McMullin Ranch and Lathrop gas fields and the extension of the Vernalis gas field.

The present extensive exploration continues to be encouraged by several factors among which are a thick marine sedimentary section of variable stratigraphic conditions and relatively low land and drilling costs.

The clastic stratigraphic section consists of continental Plio-Miocene overlying marine Eocene. The Eocene in turn overlies a thick section of marine upper Cretaceous. On the west margin of the basin, the upper Cretaceous rests on lower Cretaceous. Eastward the upper Cretaceous rests on granitic basement. Due to uplift of the "Stockton Arch," the Eocene and some of the upper Cretaceous were eroded from the northernmost portion of the area before deposition of the Continental Plio-Miocene.

Structurally the area has a northwest-southeast grain. From west to east the major features include: (1) the relatively steep outcropping west flank of the basin, (2) the Tracy-Vernalis anticline and fault trend, (3) the central basin syncline, and (4) the long platform-like east flank. The basin plunges south from the cross-trending Stockton Arch fault.

HIDEYO HAGA, University of Southern California: Distribution of Foraminifera in the Gulf of Thailand Sediments

The area investigated is mainly a shallow shelf environment including the Gulf of Thailand and part of the South China Sea. Large amounts of precipitation and runoff cause marked seasonal variations in the temperatures and salinities of the sea water in the area. The Gulf sediments are dominated by olive brown muds, and the shelf sediments are dominated by yellow-brown sands.

The foraminiferal number, species number, and the percentage of planktonic Foraminifera increase with depth and distance off shore and toward mid-gulf.

Species of *Globigerina* constitute the eurythermal planktonic fauna and are relatively common in the

inner shelf. Below 54 m. a diverse planktonic fauna, including the many warm water species, appears in the sediments.

Hyaline Foraminifera compose fifty per cent or more of the benthic population in all but the two stations which are located near large rivers.

The beach fauna is dominated by *Ammonia beccarii sobrina* and various species of *Elphidium*. The inner shelf fauna has an abundance of various *Ammonia* species, *Hanzawaia nipponica*, and *Rotorbinella versiformis*. The outer shelf fauna consists largely of *Bolivina robusta*, *Cibicides haidingeri pacificus*, and *Epistominella pulchra*. The dominant upper bathyal species are *Cassidulina subglobosa*, *Cibicides pseudoungerianus*, and *Gümbelitria vivans*.

Size measurements of a few species indicated a tendency toward dwarfism in the fauna of the closed basin in the Gulf.

JOHN C. HAZZARD and WILLIAM R. MORAN, Union Oil Company of California: Structural Patterns Reflected in Soil Mantle Overlying Tertiary Rocks, Dasht-i-kavir Desert Basin, North-Central Iran

The Dasht-i-Kavir or Great Salt Desert of north central Iran occupies a northeast-trending elongate area of about 9,000 square miles. Its geographic center is about 225 miles southeast of Teheran. The average surface elevation of the essentially flat desert plain is close to 2,000 feet above sea-level; maximum relief within the plain is probably about 50 feet.

Structurally, the desert basin area is a graben separated from the adjoining highlands by major active faults. Metamorphic rocks of pre-Mesozoic age and Jurassic and Cretaceous sediments crop out in the bordering mountains and are presumed to underlie the graben at depth. The post-Mesozoic sequence includes a thick Eocene sedimentary and volcanic section with possibly some evaporites. Oligo-Miocene evaporites and marine limestone and Miocene red beds and evaporites overlie the Eocene. The post-Cretaceous section probably totals as much as several thousand meters in thickness. Approximately 35 salt plugs occur within a restricted area on the north side of the graben. The major part of these salt masses is tentatively considered to originate in the Oligo-Miocene evaporitic section.

Available maps show the Kavir as a salt waste apparently without topographic pattern. This is essentially true for most of the area occupied by salt pans; however, when viewed from the air the remaining area shows a striking pattern of light and dark brown bands which closely resemble form lines on a structural contour map.

On-the-ground examinations confirm this relation. In areas not covered by recent salt pans the surface is mantled by puffy, saline, "self-rising" soil which ranges from a few inches to a few feet in thickness. The underlying bedded rocks which are known to have dips as great as 50° or more do not crop out. The visible color banding is entirely a surface soil pattern which reflects the structure at the base of the soil mantle. Surface color differences do not appear to conform to color difference in underlying unweathered rocks. It is suggested that the color contrast is at least in part a function of the moisture content or "wettability" of the surface soils. This is in turn dependent on the physical-chemical properties of the particular rock layer from which the soil is derived and on the water-table level and rate of evaporation.

RONALD G. HECK and ANTHONY E. L. MORRIS, Pauley Petroleum, Inc.: Distribution of Starkey Sand, Sacramento Valley, California

The Starkey sand unit is named from the Amerada "Starkey Fee" No. 1, completed in 1944 as the discovery well for Millar Field in Sacramento Valley, California.

The sands represent a transgressive-regressive, shallow sea depositional environment and occupy an area in the subsurface approximately 85 miles long and 40 miles at the greatest width.

The northerly extension of the Starkey sand is progressively truncated by Eocene Capay shale. Capay is also found truncating the Starkey on the northwest, while the southwest portion shales into what was a deeper depositional area. Along the eastern edge the Starkey laps onto basement and does not crop out.

The Starkey sand is the youngest Upper Cretaceous unit in the Sacramento Valley and the top thereby represents the Paleocene-Cretaceous and Eocene-Cretaceous contact over a large area. Fauna are scarce and poorly preserved, but those found are included in Goudkoff's C^1, D-1 and D-2 Zones.

JOHN C. HOLDEN, San Diego State College: Upper Cretaceous Ostracode Faunule from Carlsbad, California

A limited exposure of Upper Cretaceous marine siltstones and claystones near the coastal town of Carlsbad, southern California, contains a remarkably well preserved microfauna.

Twenty-six species of ostracodes including twenty-three new species and one new trachyleberid genus occur in the upper part of the section. This faunule possesses distinct Cenozoic affinities expressed by the presence of the genera *Trachyleberis*, *Actinocythereis*, and *Idiocythere*, all of which previously have been reported from rocks no older than Lower Tertiary. Generic affinities with European faunas are also noted by new species of *Idiocythere*, previously reported from the Eocene of Germany only, and *Isocythereis*, previously from the Cretaceous of Germany only. Three species occur which also occur in Upper Cretaceous rocks of the U. S. Gulf Coast. These are *Brachycythere darensis* Swain, 1952, *Krithe cushmani* Alexander, 1929, and *Cytheropteron coryelli* Schmidt, 1948.

JAMES C. INGLE, JR., University of Southern California: Miocene-Pliocene Paleoecology of San Fernando Basin, California

Sedimentary rocks exposed along the periphery of the San Fernando Valley indicate the area was a separate marine basin during Miocene and Pliocene time. Although the surrounding geology is well known, the basin is virtually unrecognized as a major Tertiary basin of Southern California.

Structure, stratigraphy, and sedimentology indicate the basin's history is similar to that of other Continental Borderland basins. Localized subsidence in the Late Middle Miocene formed the basin as a discrete unit. Basin filling took place during Pliocene and Pleistocene time. Benthonic Foraminifera indicate that the San Fernando basin was separate from the adjacent and deeper Ventura basin but remained an integral part of the east-west Ventura embayment.

Over 900 meters of Late Miocene and Pliocene sediments are well exposed on the south side of the basin. Shales and diatomites typify the Miocene sequence whereas silts and sands are characteristic of the Pliocene. Laminated diatomite was probably deposited in a subsill oxygen-deficient environment analogous to the existing Santa Barbara basin. Coarse, arkosic continental sands interfinger with Pliocene marine sediments at the eastern end of the basin.

Benthonic Foraminifera and Radiolaria show that