relief are ancestral to tidal channels cut into the underlying Pleistocene sandstone beds.

CHANUT, CLAUDE, CHARLES HUBAULT, and PHILIPPE RICHE, Société Pétrolière Française en Algérie, Algiers, Algeria

OIL AND GAS ACCUMULATIONS IN TIN FOUYE TABANKORT AREA (ALGERIA)

During the past decade several large oil and gas fields have been discovered in the Tin Fouye Tabankort area, which is in the eastern Algerian Sahara Desert approximately 1,000 km southeast of Algiers. The oil and gas accumulations are related to a large Paleozoic north-south trending arch on the southern edge of the Ghadames basin. The hydrocarbons are found in 2 major stratigraphic zones: (1) an uppermost Ordovician sandstone which contains 2 major accumulations, (a) a gas accumulation in the highest part of the arch on the south (*ca.* 40 billion cu m reserves), and (b) a major oil accumulation extending northward from the gas to the plunging nose of the arch (*ca.* 150 million cu m reserves); (2) Upper Silurian to Lower Devonian zones in which 4 oil fields have been discovered on northward-plunging noses; the 2 northernmost do not have structural closure on the south (*ca.* 145 million cu m reserves).

Three petroleum concessions have been granted in the Tin Fouye Tabankort area. SOPEFAL is the operator of the ASCOOP concession. The oil fields in the northern part of the arch have oil-water contacts tilted north to northwest with slopes ranging from 5 to 15 m/km. The Ordovician reservoir is enhanced both in size and petrophysical characteristics as a result of the development of a fluvioglacial facies related to the last Ordovician ice period.

CHENOWETH, PHILIP A., Consultant, Tulsa, OK 74119

UNCONFORMITY TRAPS

Unconformities occur in three different parts of the depositional environment—on the shelf, the basin-margin coastal plain, and within the basin. Those on the shelf, typified by the Pennsylvanian-Permian of the Mid-Continent, are regional disconformities occurring above and below coal cyclothems. Sand-filled channels are commonly present above these surfaces, and they can form long, narrow, oil and gas traps.

Regional low-angle unconformities characterize the coastal plain as exemplified by the Cretaceous of southern Arkansas and east Texas. They are angular unconformities only from the regional viewpoint, for the structural difference between stratigraphic units is generally less than ½°. Porous belts are commonly truncated and overlapped by impermeable layers, producing large-scale stratigraphic traps concealed in a confusing array of overlapping and offlapping sequences.

Erosion occurred at places deep in the depositional basin on relatively local anticlines. Such folds may be part of a mid-basin arch or may simply be local tectonic features. Salt or shale domes and igneous intrusions produce similar effects. Porous formations are sharply truncated by unconformities; locally the difference in dip between units above and below may be as much as 90°. Traps formed under these conditions are narrow and commonly short, but the oil or gas column may be high.

Of the various kinds of traps associated with unconformities, those which form in the area of gentle and repeated tilting and warping on the basin margin are the largest and most copious. Search for them involves problems in stratigraphy and geometry, but ultimately may prove to be vastly rewarding.

CHUBER, STEWART, Consulting Geologist, Houston, TX 77002

PERMIAN AND EOCENE CLASTIC STRATIGRAPHIC TRAPS IN TEXAS AND LOUISIANA

Stratigraphic traps account for oil production from clastic reservoirs in 4 studied fields of Texas and Louisiana. Three of the traps occur in Eocene beds of the Upper Gulf Coast area; the fourth is in Cisco rocks and formed on the eastern shelf of the Permian basin. Subsurface data were used to delineate typical barrier bars in the 2 Texas fields. In Louisiana the sandstone stratigraphic traps have a delta-distributary channel pattern.

The electric log character of these sandstone reservoirs may be diagnostic of their sedimentary environments.

CLIFTON, B. B., and E. H. FRANKLIN*, Esso Standard Oil (Australia) Ltd., Sydney, Australia

HALIBUT FIELD, GIPPSLAND BASIN, SOUTHEASTERN AUSTRALIA

Australia's first offshore production, in the Gippsland basin of southeastern Australia, was discovered in 1965. Further exploratory drilling in the area has led to the discovery of additional oil and gas fields.

The Halibut oil field, currently being developed, is considered as a field case history of this Australian offshore operation. The field was discovered, by drilling only 1 exploratory well, in August 1967. It is 40 mi offshore in 238 ft of water and encompasses an area of 11 sq mi. At this early stage, the confidence factor on the seismic interpretation was sufficient to construct a 24-conductor drilling platform.

Oil, associated with a common oil-water contact, is found at the top of the Latrobe complex of Paleocene rocks between depths of 7,400 and 7,856 ft subsea. Stratigraphically the reservoir is composed of braided stream sandstones with some point bar and stream mouth bar sandstones that have been subdivided and mapped as 8 units separated by impermeable breaks. These strata, dipping monoclinally westward, are truncated by a post-Eocene angular unconformity. Closure in excess of 500 ft is provided at the unconformable surface by the combination of erosion and post-Oligocene tilting.

The field is being developed by drilling deviated wells, some in excess of 45° and 6,000 ft from the centrally located platform. With an available maximum of only 24 conductors, optimum drainage points must be selected with care. The number of wells to be drilled to any specific sandstone unit is based on its respective percentage of total reserves. The optimum drainage position is then determined from structure and isopach maps where individual sandstone units are in their highest nontruncated structural position.

COLINVAUX, PAUL A., and DANIEL GOODMAN, Acad. Faculty of Zoology, Ohio State Univ., Columbus, OH 43210

RECENT SILICA GEL FROM SALINE LAKE IN GALAPAGOS ISLANDS

A 4-m drill core of undisturbed sedimentary rock from the crater lake on Isla Genovesa (Tower) has well-defined banding, revealing a complex depositional

* Senior author

history spanning at least 5,000 years. Amidst the bands are intervals of translucent green gel, with white granular inclusions in places. One section of gel occupies an interval of nearly 10 cm, and the uppermost is within 20 cm of the rock/water interface. Three hypotheses describing the structure of the gel seemed plausible: that it was a proteinaceous gel, a polysaccharide gel, or a silica gel. Infrared spectroscopy of a sample which had separated during storage revealed no absorption at 6 μ, precluding the presence of peptide bonds. There was little in the spectra to suggest that saccharides were present, but strong absorption between 9 and 10 μ suggested abundant silicon. X-ray diffraction of samples soaked in distilled water gave strong indications of halite, which would mask the presence of silicon. D.C. arc emission spectroscopy showed the sample to be rich in silicon, sodium, calcium, and magnesium, and to contain trace amounts of other elements normally present in seawater. We conclude that the sample is a silica gel, hydrated with seawater and containing microcrystals of sodium and magnesium salts.

The gels formed on the bottom of a lake which is now 30 m deep and with a salinity of 52 ‰, or half again as salty as seawater. The lake is highly productive so that reducing conditions with free sulfides prevail at the bottom. This fertile condition is apparently maintained by a large input of guano from the immense colonies of seabirds which inhabit the island. Study of diatoms and other fossils incorporated in the gels, and of the pigments preserved in them, is enabling us to reconstruct the environment in which a silica gel forms under the waters of this crater lake. These conclusions may prove useful when seeking to explain the origin of cherts.

CUMMING, A. D., Atlantic Oil Producing Co., London, England, and CHARLES L. WYNDHAM, Phillips Petroleum Co., London, England

GEOLOGY AND DEVELOPMENT OF HEWETT GAS FIELD, UNITED KINGDOM NORTH SEA AREA

The Hewett gas field is 15 mi off the Norfolk coast, and has an estimated 3.5 Tcf of recoverable gas contained in 2 Triassic Bunter sandstones. The field was discovered late in 1966 and placed on production in July 1969. By that time 22 wells had been drilled, permanent offshore and onshore facilities installed, unitization negotiations concluded, and market secured. The contract with the purchaser calls for a gradual increase in daily production to an average rate of 600 MMcf by 1974. The 2 reservoirs are largely coextensive, and the field, roughly elliptical in outline, has a length of 18 mi and a maximum width of 3 mi. Average depth to the middle Bunter Sandstone is 3,000 ft and to the lower Bunter Sandstone is 4,150 ft. Maximum observed gross pay thicknesses are 323 ft (middle) and 202 ft (lower). Both reservoirs have excellent porosity and permeability. The Hewett structure is apparent on seismic profiles and at both Bunter levels a fault-bounded, NW-SE-trending anticline is present. The gas in the lower Bunter differs from that in the middle Bunter in that it is free of hydrogen sulfide, but whether this implies different sources has not been demonstrated conclusively. The lower Bunter Sandstone has a limited distribution in the North Sea area. Since the discovery of Hewett several North Sea wells have found gas in the middle Bunter, but follow-up wells have been unsuccessful. The Hewett field may remain unique.

CURRAN, JOHN F., Consultant, and KEMPTOM B. HALL, Consultant, Santa Barbara, CA 93104, and ROBERT F. HERRON, Marine Resource Consultants, Inc., Santa Monica, CA 90401

GEOLOGY, OIL FIELDS, AND FUTURE PETROLEUM POTENTIAL OF SANTA BARBARA CHANNEL REGION, CALIFORNIA

The Santa Barbara Channel region is the westerly part of the Transverse Ranges geomorphic province of California. It includes the submerged seaward extension of the Ventura basin and the continental slope to a distance of 70 mi offshore. A nearly complete post-Jurassic sedimentary section is present. The total section ranges in thickness from 19,200 to 67,600 ft. Potential reservoir rocks range in thickness from 4,600 to 25,400 ft. The section is 30% arenaceous.

Geologic structures are generally west trending. Anticlinal trends with steeply dipping flanks (up to 75°) are prominent. Numerous nearly vertical lateral faults and high-angle reverse faults are also prominent. Vertical displacements in excess of 10,000 ft and lateral displacements of more than 3 mi are recognized.

Twenty-three oil or gas fields are present in the region. Of these 5 have been discovered on Federal lands in the past 2 years, but only 1 was being developed in August 1970. Cumulative production from all fields is more than 1 billion bbl of oil and nearly 300 Bcf of gas.

Statistical approaches to the determination of original oil in place in the region have yielded varying results in the magnitude of 25–35 billion bbl. However, comparisons with other sedimentary basins of the California Coast Ranges indicate that an estimate of 10–15 billion bbl of oil in place is more likely to be in the right order of magnitude.

CURRY, WILLIAM H., Consultant, Casper, WY 82602

THE PETROLEUM GEOLOGIST—TOMORROW

The successful petroleum geologist of tomorrow will have to be a well-trained individual with a degree (preferably higher) in geology in its broadest sense. The future degree might better be "rounder" than "higher," with mineral law, mineral economics, reservoir engineering, and geophysics as integral parts. The petroleum geologist will have to be a man who follows the precepts of AAPG, namely, be a professional person with scientific interests. Bearing in mind that not all geologists well based in scientific theory are successful oil finders, he must achieve judgment, balance, and decision, in addition to knowledge. These he must do in his technical field by not only properly weighing geologic data, but he also must be able to relate his professional work to industry in particular, and society in general. To the questions of what are an explorationist's responsibilities to the public, to the environment, and to the nation, he must have positive answers. If tomorrow's petroleum geologist is to be inspired to do these things for self proficiency he must have: (1) political acceptance of his credibility, and a willingness on the part of others to establish honest dialogue on issues affecting his profession; (2) governmental recognition of the essential role his profession plays in energy resource exploration and development by making workable leasing and development policies on all energy mineral fields—oil, gas, oil shale, uranium, and coal—so there will be a multiplicity of continuing opportunities