cline against a large, normal fault, known as the Russell fault. This fault trends approximately N. 30° W., and dips steeply to the southwest. The Dibblee sand lies at depths ranging generally from 2,800 to 3,200 feet. The Colgrove zone lies approximately 1,000 feet below the top of the Dibblee.

The South Cuyama field, discovered in May of this year, lies in the foothills at the south margin of the valley, about 4 miles southeast of the Russell Ranch field in Santa Barbara County. Its productive limits have not yet been determined, but present development and productive outposts extend over an area 3 miles long and more than 1½ miles wide. This oil field occurs on an elongated faulted dome, its long axis trending northwest and southeast. Production is from the Dibblee zone, encountered at depths ranging from 4,000 to 4,400 feet. Exploration has not yet been carried below this zone. Unlike the Russell Ranch field, South Cuyama has a gas cap area at the crest of the dome.

The Dibblee sand is a friable, well sorted arkose, ranging from fine- to coarse-grained. It is characterized by high porosity, high permeability, and high productive indices. Potentials in both fields range upward to several thousand barrels per day. The Colgrove sand is similar in character to the Dibblee and well potentials are comparable, though generally somewhat smaller due to the lesser thickness of sand. Both fields are being developed on a ten-acre spacing pattern, with duplicate wells where the Colgrove zone is productive.

10:45 Nomination of Officers.

10:55 (4) GEOLOGY AND PROBLEMS OF EXPLORING FOR OIL IN NORTHERN ALASKA
Col. O. F. Kotick, USA, Naval Petroleum Reserve No. 4, Fairbanks, Alaska (read by Frank Morgan, Richfield Oil Corporation, Los Angeles).

The Arctic is a land of natural excesses and severities. Special problems are presented by the excessively cold temperatures, protracted periods of darkness, winds, fogs, permafrost, and magnetic storms.

The Lisburne limestone (Mississippian) forms prominent scarps and slopes along the north front of the Brooks Mountain Range, which is the northwestern extension of the Rocky Mountains. In the foothill belt north of the mountains, Permian, Triassic, Jurassic, and Cretaceous rocks are represented.

Cretaceous rocks make up the bulk of the drillable sediments of the Arctic basin. These rocks attain a maximum thickness of about 22,000 feet, principally dark shales with some fine, tight sandstones and silts.

Northward thrust faults provide the major structural features along the front of the Brooks Range; this orogeny has resulted in the lower Mesozoic rocks immediately in front of the Range being broken up into a highly complex zone of isoclinal and overturned folds and thrust faults. Farther north the outcropping Cretaceous rocks are gently folded into long east-west trending structures, slightly steeper on the north limbs.

All types of known accepted tools have been or are being used in this exploration project including magnetometer, gravity meter, seismograph, core drill, surface and subsurface geology, aerial photography, and photo-geology, and test wells with all accepted devices for well survey. Eight test wells have been drilled to date, and twelve more are planned through 1952.

The natives, organization and planning for exploration, and the extraneous activities supported by Navy funds are described briefly.

THURSDAY AFTERNOON, 2:00–4:00

Presiding: WILLIAM F. BARBAT, Standard Oil Company of California, San Francisco
LOYDE H. METZNER, Signal Oil and Gas Company, Los Angeles

2:00 (1) OFFSHORE SEISMIC PROBLEMS AFFECTING GEOLOGIC EVALUATION
Curtis H. Johnson, General Petroleum Corporation, Los Angeles, and Robert B. Galeski, Honolulu Oil Corporation, Los Angeles.

During 1948 and 1949 joint seismic operations were conducted offshore the coast of California by a group averaging 14 oil companies employing two crews for a total of 13 crew-months. This joint effort was required by the California Division of Fish and Game to minimize damage to fish. During this work a notable variety of problems were encountered.

It is concluded that geophysical methods other than seismic are not of sufficient resolving powers in the California offshore areas to detail structure.

Problems peculiar to marine work are: secondary energy bursts, circumvented by either firing charges shallow or jetting them into the bottom; multiple reflections from the ocean floor, which result in apparent reflections below basement for shallow water, unusable records in water around 500 feet deep and complete repetitions of section for very deep water; occurrence of high angle "erratics," interpreted in terms of faulting, buried stream channels, and bottom irregularities; constant velocity in deep water, handled by projecting shots and detectors to the ocean floor; surveying over vast expanses of water, accomplished by the use of shoran; and timing the programming of specific lines to best overcome bad weather, ocean traffic hazards, and damage to fish.

Tactics designed to facilitate geological interpretation involve density of lines and shot points along lines and the use of L-spreads to obtain strike and dip. Factors in the interpretation of seismic results are diagnostic unconformities known in adjacent areas, submarine coring, regional submarine topography, and data from supplementary geophysical methods.

2:25 (2) FLOOR OF LOS ANGELES BASIN[1]

J. E. Schoellhamer and A. O. Woodford, United States Geological Survey, Claremont.

The Miocene deposits of the Los Angeles Basin are between the San Gabriel Mountains and the sea, and extend from the Santa Monica Mountains to the Santa Ana Mountains. The sub-Miocene floor is largely composed of crystalline rocks of three types. Southwest of the Newport-Inglewood fault zone and in that zone the crystalline basement is made up of "Catalina schist,"[2] largely quartz and chlorite, and characterized especially by widespread glaucophane and lawsonite. The other two basement types, cropping out along the north and east margins of the Basin and penetrated in wells near these margins, are slate (and quartzose sandstone), possibly of Triassic age, and quartz diorite (and other quartz plutonites) intrusive into the slates.

In and near the Santa Ana Mountains Cretaceous and early Tertiary sedimentary rocks are intercalated between the slate-plutonite complex and the Miocene volcanic and sedimentary rocks.

The "Catalina schist" contains small masses of zoisite-bearing metagabbros but completely lack normal quartz plutonites. No gradation between the "Catalina schist" and the Triassic(?) slates has been found. The cordierite and other schists at the plutonite-slate contacts in the Santa Monica Mountains are very different from the "Catalina schist." The "Catalina schist" may be much older than the slates.

The surface of the "Catalina schist" west of the Inglewood-Signal Hill line shows great relief, from 1,100 feet above sea-level to 14,500 feet below. Elongate basement ridges trend northwest beneath the Torrance-Wilmington and El Segundo-Lawndale oil fields, somewhat less certainly beneath the Palos Verdes Hills, and considerably less certainly southeastward from the Playa del Rey oil field.

At the northeast edge of the Basin, from Pomona to Puente, the basement surface slopes southwestward about 800 feet to the mile.

The central part of the Los Angeles Basin northeast of the Newport-Inglewood fault zone has a floor that is probably far beneath the depths of 10,000–12,000 feet below sea level reached by the deepest wells. Aeromagnetic strip surveys from Playa del Rey to Pasadena and from the Palos Verdes Hills to the San Jose Hills locally give promise of contributing data on the basement surface but at present are generally inconclusive. The types of basement rock beneath the central deep are unknown, though a discontinuity within the basement has been suggested by seismic evidence.

2:45 (3) LEGAL ASPECT OF TIDELAND CONTROVERSY

William W. Clary, of law firm of O'Melveny and Myers, Los Angeles.

This talk covers the following points: (1) the three classes or types of water area involved, namely, inland waters, marginal sea, and continental shelf, and the present uncertainty about the definition and demcaration of each area; (2) the respective legal rights of States and Federal Government, so far as now determined, in each of the three water areas; also, international aspects of this problem and varying rights of foreign nations under international law in each of these water areas; (3) the present status of the Supreme Court litigation in the California, Texas, and Louisiana cases; (4) the present status of the legislation pending in Congress.

3:15 (4) THEORY OF TRANSGRESSIVE AND REGRESSIVE REEF (BIOHERM) DEVELOPMENT AND ORIGIN OF OIL WITHIN THEM

Theo. A. Link, consultant, Toronto, Ontario and Calgary, Alberta.

Part I

The established geological principle "transgression" and "regression" of epi-continental seas, the resultant sediments, together with their fauna and flora, is applied to coral-reef or bioherm-forming organisms. Bioherms which develop during a transgression are differentiated from those of a retreating sea by the associated sediments. A "transgressive" bioherm is surrounded and overlain by marine clastics deposited during submergence, while the "regressive" type of bioherm is associated with evaporites and/or other types of sediments deposited during withdrawal of the sea.

Part II

It is suggested that hydrocarbons found within coral-reef or bioherm reservoirs are in most instances indigenous, because of the obvious concentration and accumulation of organisms within

[1] Published by permission of the director of the United States Geological Survey.

[2] Name not adopted by the United States Geological Survey.