PACIFIC SECTION PAPERS AND ABSTRACTS

1. "Introductory Remarks of Symposium on Occurrence and Production of Oil from Fractured Rocks in California," ROLLIN ECKIS, Richfield Oil Corporation, Los Angeles.

2. "Summary of Production from Fractured Rock Reservoirs in California," W. S. EGGLESTON, Union Oil Company, Los Angeles.

The main source of oil production in California is in sand reservoirs. In recent years, however, production from fractured rock reservoirs has gained prominence. Fractured rock reservoirs can in general be divided into two groups: fractured cherts and shales in sedimentary beds and fractured metamorphosed basement rocks. Approximately 55,000 barrels of oil per day are being produced at present from fractured rock reservoirs. It is estimated that 15,000 barrels per day are being produced from fractured basement rocks and 40,000 barrels per day from fractured cherts and shales.

3. "Occurrence and Origin of Chert in the Monterey Formation," M. N. BRAMLETTE, University of California at Los Angeles.

Chert is less common than the other siliceous rocks in the Monterey but is locally prominent, especially in lower parts of the formation. Evidence is presented indicating that most of the siliceous rocks were formed through an alteration of originally diatomaceous rocks, the chert forming from beds and areas of relatively pure diatomaceous deposits. Most of this alteration by solution and recementation was after burial of the deposits.

Surface rocks commonly show recementation of the fractured cherts. More open fractures might persist, however, if accumulation of oil were nearly coincident with some of the structural deformation and fracturing.

4. "Fractured Reservoirs of the Santa Maria District," L. J. REGAN, JR., General Petroleum Corporation, Santa Maria, and A. W. HUGHES, Union Oil Company, Santa Maria.

Cumulative production of the Santa Maria district to January 1, 1947, was 250,637,000 barrels of which an estimated 77% originated in fractured rocks and 23% in oil sands. 74.5% of the oil was produced from fractured rocks in the Monterey formation and 2% from fractured "Knoxville" sandstone. Monterey fractured rocks in order of importance include (1) Mohnian cherts, (2) Luisian calcareous shale, and (3) Mohnian platy siliceous and porcellaneous shale. The distribution, age, and character of fractured zones are illustrated by stratigraphic sections. The distribution of maximum chert development suggests chert originated as a sedimentary facies. General characteristics of potentially productive fractured rocks of the district are analyzed and their permeabilities and porosities as indicated by production data are discussed.

5. "Oil Production from Fractured Rocks on West Side San Joaquin Valley," S. M. REYNOLDS, consulting geologist, Taft.

There are three known areas on the west side of the San Joaquin Valley where oil is produced exclusively from fractured rocks. These are in the South Belridge, Elk Hills, and Sunset oil fields. In each accumulation the structure is anticlinal; the fractured rocks are shale of upper Miocene age. The physical characteristics of the fractured rocks are not well known generally. The upper Miocene contains considerable brittle siliceous shales on the west side of the San Joaquin Valley which are known to have favorable reservoir characteristics in some places where tested. The distribution of these members is discussed.

6. "The Nature of the Basement Complex Oil Reservoir, Edison Oil Field, California," J. C. MAY and R. L. HEWITT, Tide Water Associated Oil Company, Bakersfield.

The completion of the H. H. Magee and Independent Exploration Company's "Brockman" well No. 3, Sec. 13, T. 30 S., R. 29 E., MDB & M, in the Edison field, Kern County, initiated commercial production from basement complex rocks in the San Joaquin Valley. At the present time about 1,500 acres of these rocks are oil productive in this field. The geologic structure of the field at basement complex depth is a faulted, dome-like fold with extensive south and west flanks, but with the north and east flanks shortened by faulting. The basement complex rocks are divisible into two groups: metamorphic rocks derived from sediments and igneous intrusives, and a younger igneous rock (Sierra Nevada) which was the chief cause of metamorphism in the older rocks. The metamorphic rocks in order of their probable age are (1) McCowan schist, (2) Hershey schist, (3) Dougherty schist, and (4) felsites. The McCowan schists are satiny, lead-gray, laminar rocks of sedimentary origin which occupy the eastern part of the field. The Hershey schists of doubtful sedimentary origin, are pistachio green, poorly laminated rocks. The Dougherty schists are variously metamorphosed fine-grained igneous rocks of probable malachite or diorite-aplite composition which comprise the west half of the basement producing area. The felsites are fresh, fine-grained igneous rocks, mineralogically akin to the Dougherty schists, which occur as segregations throughout the field. The quartz diorite of the Sierra Nevada batholith bounds the east edge of the oil field. Metamorphism is regional, characteristic of the epizone, and its effects increase as the quartz diorite is approached. The oil originated in the westerly extending Tertiary sedimentary basin and migrated into the pore and fracture spaces of the structurally higher schist. Its accumulation apparently is unaffected by the type of schist, but is governed by the degree of metamorphism, fracturing, and the control of several large faults.

7. "Examples of Electrical Logs in Fractured Rocks," R. D. FORD, Schlumberger Well Surveying Corporation, Long Beach, and MILTON E. LOY, Bakersfield.

A discussion of electrical logs in fractured rocks is of interest in this symposium because, to the geologist and engineer, not only does a fractured rock reservoir require a different interpretive technique, so also does the electric log. Inasmuch as the electrical characteristics of basement rocks, fractured shales, and cherts may all be similar, all are referred to as fractured rocks.

Slides are shown illustrating the following areas:

Santa Maria cherts	Elk Hills chert and shales
Edison schist	Newport Beach—fractured shales
Maricopa shales	Wilmington schist

These illustrations show that there is apparently very little correlation between resistivity and production. This apparent lack of correlation may be attributed to the fact that the physical characteristics controlling resistivity are not necessarily the same as those which control production.

8. "Summary Remarks Concluding the Symposium on the Occurrence and Production of Oil from Fractured Rocks in California," ROLLIN ECKIS.

9. "Summary of Geology and Exploration in Sacramento Valley," W. E. MCKITRICK, Shell Oil Company, Sacramento.

Summarizes the stratigraphy and structure of the gas fields in the Sacramento Valley, with a summary of statistics on distribution and results of exploration. Slides show location of fields, selected type logs to illustrate stratigraphy and seven regional geologic sections.

10. "Summary of Geology and Exploration in Salinas Valley," J. E. KILKENNY, Chanslor-Canfield Midway Oil Company, Los Angeles.

Intermittent unsuccessful exploration for oil has been carried on in the Salinas Valley for 50 years. A favorable sedimentary section of both source and reservoir beds has prompted a periodic renewal of wildcat drilling, the most recent of which was undertaken in 1946 and is still in progress. The general stratigraphy and structure of the basin are reviewed and some exploration statistics presented. Recent wells drilled have shown that the Vaqueros sand is less extensive than originally thought. In addition, new light has been thrown on the King City fault, revealing two periods and types of movement and indicating that B. L. Clark's fault-block theory of the origin of present-day structural features may be valid in this particular area.

11. "Oil and Gas Prospects of Washington and Oregon," HAMPTON SMITH, consulting geologist, Los Angeles.

After many years of nearly complete quiescence, scientific prospecting for oil and gas in Washington and Oregon entered a period of accelerated activity during the war, which activity will probably continue for several years.

The area of interest included several non-contiguous districts in a region 400 miles long and 100 miles wide, covering most of western Washington and Oregon. Operators have carried out extensive projects of surface mapping and seismograph work in one or more of these districts and more than 15 wildcat wells were drilled or are drilling. No commercial production has been developed but some encouraging showings of oil and gas have been reported and much of new geological information has been obtained.

A brief outline of the geology of western Washington and Oregon is presented and an attempt is made to evaluate the prospects of this territory in light of the data obtained in the current exploration cycle.

12. "Relative Cost of Finding Oil in California," GRAHAM B. MOODY, Standard Oil Company, San Francisco.

Statistics indicate that the cost of finding oil in California is not by any means a fixed quantity but fluctuates between wide limits. The variables that affect finding costs are discussed.

13. "Prospecting for Petroleum," E. DEGOLYER, A.A.P.G. distinguished lecturer, Dallas, Texas.

A critical examination of the theories of oil occurrences from the time of announcement of the anticlinal theory to the present. The outlook for prospecting in the United States is discussed and the effectiveness of current exploration procedures considered on a quantitative basis.