

ripples (ripple drift). *Minor flow units* (less than 3 feet thick), consisting of many different combinations of massive, laminated, small current-rippled, and silty or shaly intervals, are found in channels, over-bank deposits, and as a peripheral aureole of fringe deposits.

Flow-unit thickness, velocity, and distance of travel were controlled by the volume of sediment initially released as cataclysmic avalanches and mud flows in submarine canyons.

KILKENNY, JOHN E., Union Oil Company of California, Los Angeles, Calif.

ASPHALT JUNGLE TODAY

The small but prolific Los Angeles basin in the state of California has experienced a resurgence of exploration activity during the past decade. Most of the on-shore activity has been concentrated in a part of the basin popularly called the "Asphalt Jungle" which includes approximately 100 square miles in the urban area of the city of Los Angeles west of the Civic Center.

From 1890 to 1912, when this area was largely open country, there was active wildcatting and several important oil fields were found. Westward expansion of the city's residential section prevented further exploration for many years. Triggered by the deep-zone discovery in the Beverly Hills field in 1954, town-lot lease blocks were assembled, and Los Angeles city drilling restrictions were modified to permit daylight corehole drilling and high-angle directional development drilling from sound-proofed derricks. The result has been the development of 30,000 BOPD new production, with estimated oil reserves of 170 million barrels and 300 billion cubic feet of gas reserves from eight new oil fields. At present Las Cienegas is the largest field with a production of 15,000 BOPD, although a more recent discovery on the west may equal or surpass it.

The surface of the "Asphalt Jungle" consists of flat-lying late Pleistocene and Recent alluvial deposits which conceal sharp, asymmetrically folded, faulted, generally west-east-trending anticlines in the Pliocene, late Miocene, and older rocks. The main producing zones are in the upper Miocene alternating sandstone and shale section with a maximum net pay thickness in excess of 800 feet. Producing depths range from 2,000 to 10,000 feet, and gravity of the oil from 20° to 40°.

KNIGHT, R. L., Mobil Oil Corp., Santa Fe Springs, Calif.

GAS SHOWS LEADING INDICATOR OF PRODUCTION

(Abstract not submitted.)

KNUTSON, C. F., Continental Oil Co., Ponca City, Okla.

EFFECT OF NUCLEAR ENERGY ON PETROLEUM EXPLORATION

An evaluation of the characteristics of contained nuclear explosions shows attributes that may be useful in petroleum production as well as in the recovery of wealth from deposits that may be leached *in situ*, and from "thermal" areas.

The broken rock and associated fracture zone produced in the underground "pay" zone by a nuclear explosion conceivably can (1) make commercial petroleum reservoirs out of traps that are too tight to yield commercial hydrocarbon rates with currently

known completion techniques, (2) allow *in situ* reporting of oil shales, and (3) aid in commercial exploitation of tar-sand deposits.

Although nuclear explosions have not been used to date in petroleum reservoirs, the data developed from several contained shots in other media can be extrapolated to yield a picture of potential nuclear stimulation "targets." In general, these are seen to be moderately deep, thick, brittle formations located in areas of low population density.

The results of a series of generalized economic analyses are presented graphically. Thus the effects of such parameters as (1) formation thickness, (2) depth of burial, (3) volume of hydrocarbon in place, and (4) device cost on the rate of return may be determined.

KULM, L. D., and **C. HANS NELSON**, Department of Oceanography, Oregon State University, Corvallis, Ore.

COMPARISON OF DEEP-SEA CHANNEL AND INTERCHANNEL DEPOSITS OFF OREGON

Deep-sea channel and interchannel deposits from the southern part of the Cascadia abyssal plain have been studied through textural and coarse fraction analyses, fauna, radiocarbon dating, and stratigraphic sequence. Piston cores were taken along a line from the base of the continental slope off central Oregon to the western edge of the abyssal plain.

Faunal and color changes between the upper and lower sections of several cores take place abruptly in the cores. The horizon separating the upper and lower sections is a significant one (a change from glacial to post-glacial conditions). The ratio of planktonic foraminifers to radiolarians is less than one above the horizon and greater than one below. The radiocarbon age of the deposits just below the horizon is 15,200 B.P.

Both channel and interchannel sediments show a marked increase in the number and thickness of sand layers deposited during glacial time, whereas post-glacial deposits show a decrease in sand. Only post-glacial deposits have been observed in Cascadia and Astoria channels and in the interchannel area east of the latter. The coarsest layers in these channels consist of coarse silt and very fine sand, respectively. Two unnamed channels on the western side of the plain display a largely glacial section consisting chiefly of very fine sand and coarse silt. Interchannel deposits on the western edge of the plain are significantly finer-grained than those on the east.

The highest sedimentation rates in the area apparently occurred during glacial time. Radiocarbon dates indicate a rate of accumulation during glacial time of about 170 centimeters per 1,000 years for an interchannel area on the western edge of the plain. Post-glacial rates of deposition are highest on the eastern side of the plain, particularly in the area adjacent to the continental slope, and in Astoria and Cascadia channels.

LAMB, JAMES L., Esso Production Research Company, Houston, Tex.

PALEONTOLOGIC CONFIRMATION OF POST-OLIGOCENE MOVEMENT ALONG SAN ANDREAS FAULT

The major fault zone of California is the San Andreas. Right-lateral displacements along this fault as great as 225 miles since late Eocene time and 175 miles since Oligocene-Miocene time have been proposed. Although post-middle Miocene displacements