Impact of Atomic Energy
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Current Economic Outlook in Petroleum Industry
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Geological Research Developments
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Research activities yielding information applicable to petroleum geology are at an all-time high. They are being conducted at an accelerated pace in many parts of the world and in all the major fields of geology, as well as in a number of related sciences including chemistry, physics, biology, and oceanography. Routine research, which utilizes accepted techniques and applies established concepts, forms the hard core of these activities and focuses attention on broadscope problems. The solution of such problems requires fundamental or basic research directed toward formulation of working principles and the improvement of established techniques or development of new methods.

Support given fundamental research concerned with processes and facies in modern depositional environments and with geochemical methods of isotope dating indicates that these activities are having great impact on petroleum geologists. Of widespread interest also are micropaleontological investigations designed to improve age dating and stratigraphic correlations; studies of pelagic foraminifers, protista, and acid-insoluble microfossils, including hystrichosphaerids, spores, and pollen are currently being pursued. The origin, migration, and accumulation of oil, and the definition of source rocks are topics which have been receiving industry's support for many years. Increasing emphasis is being placed on hydrodynamics of oil accumulation and on factors controlling various geologic structures. Techniques for portraying geologic data on maps, for interpreting airphotos, and for analyzing sediments and determining sedimentary rock properties are being developed or improved, including research in petrophysics, petrofabrics, remnant magnetism, clay mineralogy, and diagenesis. All research is being built on a background of information that has been accumulating for many years. Although progress can be reported in all areas, no sudden break-through is anticipated.

The A.A.P.G. plays a significant role as a catalyst in the over-all research effort. Through research committees, industry's needs are surveyed, projects are outlined, and pertinent research in progress is evaluated and recommended for support. Bulletins of the Association, journals of affiliated organizations, and publications of regional and local societies make results of research widely available. Petroleum geologists thus play a prominent part in developing knowledge which is a principal goal of all geologic research.

Origin of Oil
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The origin of oil has fascinated geologists and chemists alike for a great many years. The relative complexity of crude oil as a substance and its fluid and migratory nature all add to the difficulty of obtaining indisputable answers as to how it was formed.

The history of scientific inquiry on the origin of oil began with a period of limited observation and unlimited speculation extending into the 1920s. Between 1926 and 1952 the API sponsored Projects 6 and 43, which added greatly to the fundamental knowledge about natural organic compounds and provided some clues as to how petroleum might have formed.

During the past decade great progress has been made, largely due to advances in chemical and instrumental methods of analysis. As a result, we now know certain important facts: (1) hydrocarbons, the main constituent of petroleum, are widespread in recent sediments but in amounts generally less than 2 per cent of the total organic content; (2) the Carbon-14 method has proved that the hydrocarbons and other organic fractions in recent sediments are recent in origin; (3) the ratio of hydrocarbons to other organic compounds is slightly different between recent and ancient sediments but in both it is vastly different from that in crude oil; (4) qualitatively, recent sediments and crude oils contain the same types of hydrocarbons, with minor exceptions; (5) the assemblages of various types of hydrocarbons in both sediments and crude oil are remarkably simple, considering the vast number of compounds theoretically possible; (6) the solubility of hydrocarbons is much higher in colloidal electrolyte solutions that in ordinary solutions, and recent data suggest that the relative solubilities in such dilute electrolytes may be related to the amounts of these compounds present in crude oils.

These and other discoveries point to the formation of crude oil by a mechanism involving the physical concentration of hydrocarbons already disseminated through the recent sediments or hydrocarbons formed from closely related compounds in the first few hundred feet of burial. The presence of natural solubilizers in water being squeezed from a compacting mass of sediments may selectively concentrate in colloidal form the various components which together form petroleum. The efficiency of the process is so very poor that only a small percentage of the available hydrocarbons are finally concentrated in a trap as crude oil.

Chemical studies of the organic compounds present in living organisms and in recent sediments containing their dead remains have proved to be very fruitful and should be continued, using the most advanced techniques available.

Oil Migration

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Physical analysis of oil migration through a water-saturated, hydrophilic, porous sediment suggests the following mechanisms of migration: (1) continuous-phase flow, (2) colloidal dispersion in water, and (3) molecular solubility in water.

The first mechanism, continuous-phase flow, is a major factor in controlling the movement of oil through porous reservoir rocks, the migration of oil into traps, or leakage of oil out of traps. Relatively high saturation of hydrocarbons (15–25 per cent of pore volume) must exist to create the continuity of the oil phase necessary for migration by this mechanism. The relatively low residual hydrocarbon saturations observed in many shales considered as probable source beds suggest that migration by this mechanism has not occurred therein.

The second mechanism, colloidal dispersion in water, appears to be a major factor in controlling the primary migration of oil out of many typical source beds. These migrating colloids may vary from the partially reduced organic complexes found colloidally dispersed in sea water and sea-bottom muds to oil solubilized by naturally occurring soap micelles or other solubilizing agents. If this mechanism has occurred in a shale, the organic content of the shale source bed may be low, and the residual hydrocarbon content in per cent of pore volume may be almost nil.

Two primary requirements for the operation of this second migration mechanism are the following.

1. The source-bed mineral surfaces must be hydrophilic. Experimental evidence indicates that the predominantly sodium-based mineral surfaces found in a normal marine sediment are generally hydrophilic and, therefore, could be source beds; whereas the predominantly calcium-magnesium-based mineral surfaces of many non-marine sediments may commonly be oleophilic and, consequently, probably are non-source beds.

2. The organic colloid, soap micelle, or other solubilizing agent must be stable and mobile within the source bed and must become unstable, immobile, or dissociated some-