where within the reservoir bed. The flocculation or dissociation of these colloids appears to be greatly affected by the Donnan-equilibrium-controlled anion-exclusion and cation-absorption properties of high-electrical-charge-density materials such as shales.

When the migration is terminated by either dissociation or flocculation, the resulting finely dispersed unstable organic particles or oil droplets will start to aggregate. Consequently, buoyancy will cause them to rise (or fall) through the water phase to the top (or bottom) few inches of the porous reservoir. If the oil or oil-forming material accumulates in the top few inches of the reservoir bed in sufficient concentration to subsequently produce extensive oil-phase continuity, then additional migration by the continuous-phase flow mechanism can occur.

The third mechanism, molecular solubility in water, may be a significant factor in selectively transporting certain hydrocarbon fractions and thereby modifying the oil characteristics.

If only the first mechanism were operative, source beds should be detectable by their high residual hydrocarbon content. If the second mechanism were commonly operative, such source beds could not be identified simply by measuring the residual oil saturation; and if source beds of this type are throughout most marine sedimentary sections, the limited occurrence of major oil production must be related to conditions required for continuous entrapment and preservation of oil since the time of origin.

The entrapment of oil is primarily controlled by the first mechanism—continuous-phase flow. Therefore, a critical evaluation of this mechanism under both hydrodynamic and hydrostatic conditions throughout the geologic history of an area is recommended for finding both broad oil provinces and specific oil fields.

Prospecting for Stratigraphic Traps

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Stratigraphic traps are directly related to their respective environments of deposition. An understanding of the depositional environment is essential to successful prospecting for oil or gas from this type of reservoir. Isopach studies of shale units directly above or, both above and below a lenticular reservoir sandstone, are of considerable value in reconstructing depositional environments. Such shale intervals, either directly above a reservoir sandstone, or embracing it, are genetic units and variations in thickness are completely independent of present-day structural configuration. Isopach maps of such genetic units serve as realistic indicators of where certain lenticular sands were deposited. Depositional trends of beach sands, offshore bars, and strike valley sands are readily determined from such studies. Structural maps, constructed on a reliable time marker within the genetic interval, serve as a means of localizing oil or gas accumulation within any of these reservoir types. In all such studies electrical log data are essential, since arbitrarily selected genetic units are seldom named formational units. The thinner the genetic interval, the greater the necessity for accurate "picks" from electrical log data.

Deltaic reservoirs are poorly understood and only rarely recognized by the geologist. This type of reservoir is, nevertheless, abundantly preserved in the sedimentary section. Regional isopach studies of deposition environment are an essential prerequisite for the construction of meaningful exploration maps of this type of reservoir. An understanding of the trends of distributary fingers and the influence of differential compaction in producing drape structures, likewise, is important.

Educating Future Earth Scientists

R. R. Shrock, Massachusetts Institute of Technology, Cambridge

With knowledge expanding at a quickening pace, there is obvious necessity for broad and substantial preparation in mathematics and the physical sciences as a basis on which to build the derivative earth sciences. Three of these earth sciences—geology, geophysics,