MODERN SEDIMENTATION AND THE SEARCH FOR PETROLEUM

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Abstract Prepared by the Author

The growing importance of stratigraphic traps focusses attention on methods of exploration applicable to such traps. Present methods, typified in isopach and regional stratigraphic studies, indicate the more promising counties or townships for exploration, but the problem is to reduce the scale to the specific section. The methods of quantitative sedimentation afford one means of narrowing the attack by furnishing more complete pictures of sedimentary processes and products.

The growth of quantitative ideas in sedimentation is illustrated by particle shape and roundness. It was shown that the development followed the sequence of setting up quantitative definitions and then applying them to natural deposits. By the accumulation of field data, supplemented by laboratory experiments, it was shown that shape (sphericity) is more fundamental in the dynamic processes of transportation and abrasion than is roundness, although roundness is more rapidly changed during abrasion. The settling velocity of a particle controls its transportation, and settling velocity itself is a function of size, shape, and density, so that sorting may occur on the basis of any of these three properties. Roundness and surface texture are of little significance in particle transportation, but angular particles respond quickly to abrasion, and surface texture responds to abrasion and solution. Particle orientation (imbrication or fabric) is a function of other particle properties and of conditions of transportation and deposition. Heavy mineral studies, finally, shed light on source areas and post-depositional phenomena.

Quantitative sedimentation has yielded important data on specific problems of sedimentary particles and their behavior, but a fuller understanding of sediment variations can be had when the quantitative approach is explicitly applied to environments of sedimentation. Progressive changes occur in particle properties due to abrasion and selection, and areal variations also occur in mass properties; for example, porosity, permeability, thickness, faunal content, organic carbon content, and other features. By relating these areal changes to physical and chemical conditions in the environment, as well as to energy transformations, a more dynamic picture of sediment behavior can be obtained than is now available.

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