THE GEOLOGY OF WATER AND ITS IMPORTANCE TO OUR INDUSTRIAL CIVILIZATION

GEORGE B. MAXEY

Water is the most necessary mineral commodity used by man. Its availability in adequate quantity and quality undoubtedly has been one of the chief factors in the placement, growth, and maintenance of most of the works of man. Continued economic expansion of western civilization and its extension into heretofore undeveloped areas present a stimulating challenge to hydrogeologists throughout the world—a challenge that is only partly met by present methods and developments.

The general principles of the geology of water which were developed during the late nineteenth and early twentieth century are still valid but, in many instances, are still ignored, misunderstood, and misused not only by laymen but by engineers and geologists. Meinzer, on the basis of his and many other investigators' work, clearly and accurately described the types of water and their origin; the movement and occurrence of ground water; the close relationship between soil water, surface water, and ground water; and the development and other economic aspects of ground water. His work was based on a conservative but sound knowledge and deep understanding of geological phenomena and principles. Meinzer was also chiefly responsible for initiation and support of those quantitative studies of a primarily mathematical and engineering nature which are the chief basis for present-day evaluation of ground water supplies.

Concurrently, many other workers were collecting and interpreting facts and formulating ideas bearing on the areas of surface water and soil moisture. This work was done primarily by engineers, physicists, and pedologists and was not always based on sound geologic thinking—indeed, it was often conducted in ignorance of geologic fact and principle.

Recent progress by later workers in clarifying, refining, amplifying and applying these principles has been impressive and has resulted in broader, more accurate understanding of them. However, many problems still remain to be solved and the responsibility of the geologist in water resources studies has increased rather than lessened. Actually, the advances in quantitative studies following the introduction of methods based on the Theis non-equilibrium formula, the theory of image wells, relaxation and other numerical analysis methods, flow nets, and various analogs have tremendously increased the need and have justified expenditure for highly detailed and definitive geologic information. Undoubtedly this need will increase rather than slacken in the next few decades for the economic expansion of our national life demands far more efficient conservation and development of water resources than has heretofore been practiced.

The petroleum industry uses large quantities of water for industrial and domestic purposes. Thus, it faces supply and distribution problems similar to those of other industries. Unique hydrologic problems are encountered in the practice of secondary recovery of oil which is most commonly accomplished by water-flooding. The most efficient and successful water-flooding project requires an adequate supply of water of a quality that is compatible with the formations into which it is to be injected. These formations are not very permeable as compared with the water-supply aquifers which are frequently re-

charged artificially, therefore problems of compatability of the water, complete saturation of the formations, and other factors involving permeability are more critical than in ordinary recharge projects. It is believed that greater use of geohydrologic methods may help in the solution of difficulties faced in secondary recovery projects.