

UTILIZATION OF ARID LANDS PROJECT

(General Statement)

By

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In June 1958 the University of Arizona initiated a three year interdisciplinary study on "The Utilization of Arid Lands," under a grant by the Rockefeller Foundation. This integrated attack involves a number of disciplines, such as archaeology, biology, climatology, geochronology, and geohydrology with the broad objectives to obtain information that will lead to new techniques and methodologies applicable to a long range use and occupancy of arid lands throughout the world. The reports following this statement are concerned with parts of the studies in geohydrology and geochronology.

As water supply problems are of utmost importance in arid lands, the phases of work included in the geohydrologic and geochronologic disciplines are closely coordinated. Much of the effort is concentrated in a particular geographic area in order to realize optimum results from a river basin in the Sonoran desert. The Gila-San Simon basin in southeastern Arizona was selected because water problems have been studied in conjunction with irrigation. In this basin, investigators are conducting intense research in geomorphology hydrology, sedimentation, stratigraphy, mineralogy, palynology, paleontology, and other related fields. From these studies it is hoped to obtain information on the mechanics of the evolution of the deposits which constitute the principal aquifers in certain arid regions. A knowledge of surface morphology, erosion and sedimentation processes, detailed stratigraphy, and well log analysis will aid the hydrologist in defining and understanding the natural operation of the hydrologic system. As so little is known about the quantitative geomorphology and quaternary history of the arid southwest, this pilot study will help provide information for the assessment and intelligent use of ground water assets.

The principal geochronologic study that is integrated with geohydrology in the Gila-San Simon Valley is paleontological research, including pollen analyses. The paleoecological history developed from this work will illuminate the environment of deposition of the valley sediments and provide an understanding of the relations between deposition, climate, and ecologic changes within arid regions. Studies of sediments and certain entrapped fossils, such as mammals, are quite useful for precise geologic dating. Other organic remains as pollen, mollusks, fish, diatoms, and reptiles are helpful in making ecological interpretations. The Cenozoic sediments in the project area appear to be rich in mammalian fossils and the current discoveries are disclosing many new forms. Commonly associated with these remains are pollen grains and spores, and the establishment of their sequence in the Cenozoic deposits may provide standards for use in other sediments which do not contain vertebrate or invertebrate fossils.

In order to develop and conserve water resources in arid lands intelligently, a knowledge of the storage capacity, rate of water movement, amounts of recharge and discharge, and the geometry of the reservoir must be known. A realistic understanding of these factors is dependent upon adequate information of continental sedimentation, aggradational and degradational responses to tectonic and climatic environments. Existing well logs and samples provide an opportunity to study the geologic fabric and basin framework and provide tools for determining techniques for translating geologic parameters into permeability parameters necessary for making quantitative appraisals.

A study of the origin of the drainage pattern of basin development has been completed and further studies on quantitative geomorphology, to glean an understanding of processes, should shed light on the mechanics of arid basin evaluation. Complete geologic mapping of formations, facies, terrace levels, and other geomorphic features will make possible documentation of the past geologic record.

An inventory of all water wells, all tests, and compilation of water table maps and chemical quality of the water has been made. The integration of these factors with the geologic factors will provide an understanding of the operation of the natural hydrologic system and the effect of disturbance created by man.

A number of workers have devoted considerable time and effort and have obtained large amounts of new information on the Gila-San Simon Valley. These workers include full-time professional personnel in the Ground Water Branch, U. S. Geological Survey, and the Geology and Geochronology departments, University of Arizona, and exceptionally well-qualified graduate students pursuing advanced degrees. The total aggregate of these short papers indicates that much has been accomplished; however, it will be only a small part compared to the results when the project is completed.