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Review of *Hydrology and Geochemistry of Glacial Deposits in Northeastern Kansas* by Jane E. Denne, Rachel E. Miller, Lawrence R. Hathaway, Howard G. O'Connor, and William C. Johnson

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Hydrology and Geochemistry of Glacial Deposits in Northeastern Kansas. Jane E. Denne, Rachel E. Miller, Lawrence R. Hathaway, Howard G. O'Connor, and William C. Johnson. Lawrence: Kansas Geological Survey, 1998. Bulletin 229. 127 pp. Illustrations, plates, figures, notes, references, folded map. $25.00 paper.

Northeastern Kansas is characterized by dissected till plains. Glacial sediments overlie the older Paleozoic sedimentary rocks. Outcropping rocks of Paleozoic age include the Pennsylvanian and Permian rocks extensively studied in other reports. This report includes the twelve northeastern Kansas Counties (Atchison, Brown, Doniphan, Douglas, Jackson, Jefferson, Johnson, Leavenworth, Nemaha, Shawnee, Wabaunsee, and Wyandotte) that were glaciated during Pleistocene time. The study area was entirely glaciated during pre-Illinoian (classical Kansas and Nebraskan) time, except for its southern fringe. The deposits exposed in the area include glacial drift (till, outwash, lake deposits), loess, and alluvium. Pregacial drainage ways became buried valleys after glaciation, filled by deposits ranging from clayey sediments to sand and gravel.

The discussion of recent changes in the pre-Illinoian glacial stratigraphy recognizes that several tills indicate that more than the traditional two glacial advances occurred in Kansas and Nebraska. Age dating shows that the well-known Pearlette Ash marker bed for the top of the Kansan represents deposits of three distinct ages, making it useless as a marker bed. Other convincing evidence indicates that the classical terms "Nebraskan, Kansas" should be dropped from glacial stratigraphy.

Much of the bulletin (about 60%) is devoted to discussions of geology and ground water on a county level. Point data maps of each county show

depth to bedrock, total Pleistocene sand and gravel thickness, estimated well yield, depth to water in wells and test wells, and saturated thickness of Pleistocene deposits. For some counties additional data are presented when needed.

The section on Aquifer Properties carefully defines the terms "Transmissivity" (T) and "Storage Coefficient" (S), but on headings on Table 2 the term "Approximate storage capacity" is used for the "S" term. On Table 3 the term "Pump storage" is used for the "S" term, and on Table 4, concerned with bedrock aquifers, the term "Storage Capacity" is used for the "S" term. It is well established among hydrologists that only wells with one or more observation wells can be used to compute a storage coefficient "S"; but on Tables 2 and 3 some wells with no observation wells are analyzed for "S," and some wells with multiple observation wells are not. On Table 4 one well is listed for a 1,500 minute test with no "T" or "S" listed; one has to ask why this test was listed at all. The aquifer tests indicate that the highest transmissivities are in the Missouri River alluvium, followed by the Kansas River alluvium. In the buried valley systems the transmissivity varies with the amount of fine grained material fraction in the sand and gravel.

The material listed for water use data and its discussion are well presented, as is the section on the chemical quality of ground waters in northeastern Kansas, though its data are for 1981. These data indicate that the water is generally a hard calcium bicarbonate that may contain iron, manganese, sulfide, and sometimes chloride.

If residents of the twelve counties want a review of the hydrogeology and geochemistry of northeastern Kansas, this report will suffice. It contains dated material, however, and is not an improvement over previous county reports in the area since the data presented are point data and no interpretation is made by the authors. Minor editorial problems also mar the report, which is unusual for a Kansas Geological Survey publication. **Edwin D. Gutentag**, *US Geological Survey, Denver.*