Environmental problems in New Mexico, as elsewhere, arise from modern society's intensive use of the earth. The hallmark of environmental geology should be effective communication with nongeologists. Available information on deep-seated and surficial geologic processes and products should be clearly presented. Above all, the impact of these processes and products on human affairs must be put in proper time-space perspective. The following examples of geology-related problems discussed in this paper reflect the varied geologic terranes and physiography of the state.

Large deposits of coal, uranium, and natural gas underlie tablelands and valleys of the Colorado Plateau province. Environmental concerns include impacts of underground mining, mine and mill waste disposal, and power-plant siting. Rugged terrane, relatively cool-moist climate, and mass-wasting processes characterize high mountain areas throughout the state. Mineral and forest exploitation has affected these areas for several centuries. Modern society increasingly uses alpine terranes for intensive recreational pursuits, and development of geothermal resources is planned in several areas. Extensive Quaternary solution-subsidence features associated with Permian carbonate and evaporite terranes in the Great Plains–Pecos Valley region are being investigated in connection with evaluation of bedded salt as a repository for radioactive wastes. In the Basin and Range province traditional environmental concerns relate to management of water resources in the Rio Grande Valley and adjacent intermontane basins. Metal mining and agriculture have had significant impacts. Recent geologic investigations have focused on young faults and site selection for hazardous-waste disposal.

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Geologic and Hydrologic Criteria for Disposal of Hazardous Wastes in New Mexico

Suggested geologic and hydrologic criteria for shallow burial of hazardous wastes in New Mexico include: (1) rock type and permeability; thick, clay-rich sedimentary and volcaniclastic rocks with low permeability should be considered as the best type of waste repository; where the water table is deep (exceeding 200 ft or 62 m) thick units containing some permeable strata may be considered; (2) absence of known aquifers below or adjacent to site and minimum depths to the water-table exceeding 100 to 200 ft (31 to 62 m); (3) surface stability in terms of water and wind erosion, with minimum land-surface ages in the 10,000 to 100,000-year range; the site should also be stable in terms of seismic and solution subsidence processes; (4) absence of known mineral and geothermal resources whose development could be affected by disposal operations.

No site should be located near a perennial stream or alluvial valley aquifer system or upwind from population centers or farming areas. Sites recommended for consideration in New Mexico have been at least 3 mi (4.8 km) from floors of perennial stream valleys. Climatic criteria should include limiting sites to areas where mean annual evaporation greatly exceeds precipitation. Permanent burial of hazardous wastes is recommended only for solid wastes that do not appear to be capable of recycling.

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Gallup Sandstone: Complex of Wave-Dominated Deltaic and Low-Sinuosity Braided Fluvial Deposits, Gallup Sag, New Mexico

The Upper Cretaceous Gallup Sandstone in northwestern New Mexico is interpreted as coastal-barrier or delta-front deposits. A study of 160 closely spaced sections along nearly continuous exposures in the Gallup Sag, New Mexico, suggests that these deposits are related to wave-dominated delta and low-sinuosity braided fluvial systems.

The Gallup Sandstone in this area is divided into three prograded depositional packages. The lowermost package consists of shoreface sheetlike sandstones, siltstones, and shales, which coarsen upward into coalesced distributary-mouth-bar and beach sandstones that are locally dissected by fluvially and tidally influenced channel sandstones. This package is overlain by constructional delta-plain deposits and coastal back-barrier deposits, the latter being associated with the destructional phase of the delta system. The constructional delta-plain deposits consist of meandering distributary channels interspersed with interdistributary crevasse-splay sandstones and backswamp coals, carbonaceous shales, siltstones, and shales. The destructional coastal back-barrier deposits consist of heavily bioturbated lagoonal or bay sequences of sandstones, siltstones, shales, and carbonaceous shales. Coal beds associated with this destructional facies are as much as 4 ft (1.2 m) thick and extend laterally as much as 4.2 mi (6.7 km). These coal beds are blanketlike in contrast to the constructional delta-plain coal beds, which are thin, discontinuous, and lenticular. This overall package is overlain by an alluvial depositional package consisting of numerous stacked, overlapped, lenticular, varicolored, pebbly sandstones. These sandstones, which are blanketlike in extent and contain a few poorly developed coals, probably represent low-sinuosity braided-stream deposits.

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Upper Cretaceous Stratigraphy in Hunter Wash Area, San Juan Basin, New Mexico

The Bisti Fruitland area contains about 1,870 million tons of subbituminous low-sulfur coal beneath less than 250 ft (76.2 m) of overburden and is the largest undeveloped reserve in the San Juan basin. To aid prudent development of these resources intensive field investigations of the depositional environments of the strata were undertaken east and southeast of the old Bisti Trading Post.

Seventeen measured sections were made in the vicinity of Hunter Wash. The stratigraphic sequence exposed consists of interbedded shales, siltstones, channel sandstones, and coals. Coals are more prominent in the lower part of the sequence. Correlations were facilitated by the presence of a prominent, medium-grained, reddish-brown sandstone. The usefulness of coals for correlation in the study area has not been demonstrated.

The included sequence contains the Fruitland-Kirtland contact with most of the strata in the Fruitland Formation. This contact is approximately 200 ft (61 m) lower in elevation than the Pictured Cliffs Sandstone–Fruitland Formation contact about 5 mi (8 km) southeast. There are possible correlations of the rocks in this area with those of the "fossil forest" near the Split Lip Flats on the southeast.