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Introduction

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This is one of many related papers that were included in the 1951 NMGS Fall Field Conference Guidebook.

Annual NMGS Fall Field Conference Guidebooks

Every fall since 1950, the New Mexico Geological Society (NMGS) has held an annual [Fall Field Conference](#) that explores some region of New Mexico (or surrounding states). Always well attended, these conferences provide a guidebook to participants. Besides detailed road logs, the guidebooks contain many well written, edited, and peer-reviewed geoscience papers. These books have set the national standard for geologic guidebooks and are an essential geologic reference for anyone working in or around New Mexico.

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INTRODUCTION

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The San Juan Basin, which is roughly circular, includes much of northwestern New Mexico, a narrow strip of northeastern Arizona, and a zone 25 miles wide in southwestern Colorado, or a total area of almost 20,000 square miles. The greater part of the basin is drained by the San Juan River, but much of the south and west sides is drained by tributaries of the Little Colorado River. The extreme southwestern corner is within the watershed of the Rio Grande.

Except for badland surfaces in areas of Tertiary sediments, the inner portion of the basin is characterized by shallow, open valleys separated by broad mesas or by low cuestas. In regions of Cretaceous and older rocks the surface is more varied in appearance. Prominent hogbacks follow the margins of the basin and are sharp ridges where dips are steep as along the north side. Maximum altitudes along the south and west sides of the basin rarely exceed 9,500 feet and a maximum relief of 5,000 feet is noted at Mount Taylor.

The climate is semi-arid to arid although some of the uplift areas receive considerable snowfall. Nearly all the precipitation is in the form of scattered, intense thundershowers in the summer months; such storms may produce rainfall measureable in inches, but only over an area of a few square miles or less.

Density of population is much greater on the well-watered north side of the basin; Gallup and Grants are the only towns of any consequence on the south and west sides. U. S. Highways 66, 84, 160, 550, and 666 outline much of the basin rim, but roads in the central part are poor. New Mexico Highway 44 crosses the basin diagonally connecting Albuquerque and Durango, the principal supply centers, through Cuba and Aztec. The main line of the Atchison, Topeka and Santa Fe Railroad crosses the southern part of the basin, and a narrow-gauge line of the Denver and Rio Grande Western serves Chama, Durango, Aztec and Farmington. Air service by Frontier Airlines reaches Gallup, Farmington, Durango, and Cortez and connects with north-south and east-west transcontinental airlines at Albuquerque.

The economy of the San Juan Basin is remarkably varied. The tourist trade, particularly along the southern boundary probably accounts for the largest dollar income, closely followed by natural gas and petroleum production, mineral and coal mining, grazing and farming. Coal mining centered mainly at Gallup and Durango has been declining because of loss of its markets to petroleum and natural gas products. Natural gas is the most important product of the basin although a small but steadily increasing production of high gravity crude oil from several different horizons contributes about one-quarter of the combined value of production. Some of the gas is rich in helium and a plant at Shiprock operated by the U. S. Bureau of Mines is kept in a standby condition to expand helium production when the occasion warrants. New discoveries of uranium near Grants and Laguna show promise of increasing our supplies of this vital metal. Grants boasts one of the largest pumice mining and milling operations in the United States, and exploration of nearby perlite deposits is in progress. Gold, silver, copper, lead and zinc are produced in the San Juan Mountains along the north rim of the basin and some fluorite mining is continuing in the Zuni Mountains on the south side.

Grazing and minor amounts of farming furnish the principal occupation for the Indians who make up the largest part of the population outside the towns around the margin of the basin. Elsewhere in this guidebook, the groundwater conditions and the possibilities for additional grazing and farming are estimated. Lack of sufficient precipitation in recent years has made water problems critical in the livelihood of the several thousand Indians who occupy the Navajo, Hopi, Zuni, and Pueblo Reservations in the basin. Over one-third of the land in the basin is in Indian Reservations or controlled by allotments.

Sedimentary rocks in the basin proper are almost exclusively of Mesozoic age or younger, although older Paleozoic and pre-Cambrian outcrops occur in the uplift areas or along the steeply upturned edges of the basin. The geologic record is more complete along the north and east sides of the basin than along the south and west sides. The central part of the basin is covered with early Tertiary sedimentary rocks, which are surrounded by a more or less circular outcrop of Cretaceous beds in a bewildering variety of facies changes and marine and non-marine intertonguing. In general, Jurassic and Triassic rocks mark the outer limits of the depressed part of the basin and on the south and west sides the adjacent

uplifts are capped with thick Permian sediments. Locally, extensive areas of pre-Cambrian rocks are exposed in the higher more deeply eroded parts of the uplift areas. Small intrusive plugs, dikes and associated flows mostly of basaltic composition and Tertiary and Quaternary age are scattered indiscriminately along marginal parts of the basin. Along the south and west sides of the basin the rocks show only slight erosional disconformities throughout large parts of the section; karst topography on upper Permian limestone, extensive truncation at the base of the upper Cretaceous and an angular unconformity at the base of lower Tertiary rocks are the only evidences of non-deposition and orogeny. Elsewhere the rocks are essentially parallel throughout the section.

The first field conference of the New Mexico Geological Society visited outcrops along the north and east sides of the San Juan Basin and examined rocks which have been exploited most heavily during the current search for petroleum. Since it was impossible to cover all of the region last year, the second field conference is completing the study of the nearly circular basin by examining the rocks on the south and west sides. Access to the west side of the basin is limited and the exposures are such that it is difficult to route the trip to see all of the section in as many places as is desirable. As a result, the first day is spent mostly in Tertiary or younger rocks with only limited views of the older parts of the section until afternoon when Cretaceous and Permian rocks are along the route. The last stop of the day allows study of the pre-Cambrian and overlying Pennsylvanian rocks in the eastern end of the Zuni Mountains. Most of the second day is devoted to Cretaceous rocks where excellent exposures of widespread marine and non-marine

intertonguing will be examined in detail. The last day permits examination of Permian rocks as well as one of the most spectacular Jurassic sections exposed in the western United States.

A great deal of the trip will be on private land or on Indian Reservation; pictures of scenery, geology, or of the caravan are permissible but please do not photograph the Indians or their homes without permission. As you will be passing through some of the most colorful and photogenic country in the southwest, you are welcome to drop out of the caravan for photography at any time and may regain your position at the next stop.

The guidebook consists of five short papers on the rocks exposed along the route of the field conference and several papers of a regional nature which discuss the tectonic history, mineral resources, land status, groundwater resources, and the history of gas and oil development and production in the San Juan Basin. Some of these papers are reprinted from the 1950 guidebook; some are revised and completely rewritten contributions from similar papers in the 1950 guidebook; and most are new discussions written by persons most familiar with the south and west sides of the basin. The emphasis in this guidebook has been placed on the road log and its accompanying illustrations and all of the material is deliberately slanted toward the south and west sides of the basin. For the broader regional features of the San Juan Basin, the reader is referred to the 1950 guidebook.