

Physiography of New Mexico

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PHYSIOGRAPHY OF NEW MEXICO

BY CHARLES R. KEYES

Socorro, N. Mex.

NEW Mexican physiography is remarkable because of its peculiar types and its wealth of detail. Lying within the semi-arid belt, geologic processes have operated in a manner entirely unknown in eastern United States. Nowhere else in the country do so many distinct geologic provinces meet.

GENERAL CONSIDERATIONS

The area of New Mexico embraces 122,580 square miles. In extent it is about equal to the combined areas of the six New England states, New York and New Jersey. The extreme points are about 560 miles apart; or a distance equal to that between New York and Cincinnati, or between Chicago and Washington.

New Mexico belongs to a part of the United States that is historically of great interest. Its northeastern part was included in the Louisiana Purchase from France in 1803. The eastern half was annexed to the United States in 1845 as a portion of Texas. Most of the western half was ceded by Mexico in 1848. A small part of the extreme southwest was included in the Gadsden Purchase in 1853.

New Mexico rests on the backbone of the American continent. From the north extends southward into its boundaries the lofty Rocky range. In the west are the extensive and rugged Mogollon mountains. Through the central portion are numerous high block-ridges rising 3,000 to 5,000 feet above the surrounding country. Over the entire area are scattered volcanic piles, some of which are the most remarkable eruptive phenomena on the continent. Yet, among all these varied features the most dominant feature of surface relief in New Mexico is the plain.

GEOGRAPHIC PROVINCES

Main Characters. The newer geographic descriptions of regions do not take into account the colloquial districts which ordinarily are arbitrary sub-divisions, often with only vaguely defined boundaries. On the other hand, attempt is made to differentiate natural units having for their foundation distinctive physical features. Thus understood, a geographic province has certain characteristics of general surface relief, geologic formation, geotectonic arrangement, drainage features, climatic conditions, soil character, plant growth, economic resources, and harmonious environment for human habitation, that have unity and close relationships among them-

selves, and that contrast strikingly with similar natural features possessed by neighboring provinces.

New Mexico presents four such natural provinces, all of which have more or less sharply defined boundaries according to the criteria already set forth. These great geographic provinces may be named as follows: (1) the Great Plains Province, occupying the eastern part of the region, east of the Pecos river; (2) the Rocky Mountain Province, reaching southward from Colorado in a long narrow tongue to the Glorietta pass; (3) the Mexican Tableland Province, in the south-central part; and (4) the High Plateau Region including all of the northwest.

These provinces are outlined in the accompanying cut.

Great Plains Province. The vast level plains which stretch out eastwardly from the Rocky Mountain front to the Missouri river, extend southward into Texas nearly to the Rio Grande. Of this broad plains region only a comparatively small portion is represented within the limits of New Mexico. The Llano Estacado and the plains to the north, across the Canadian river, constitute the westernmost extension of the Great Plains. This province comprises all of eastern New Mexico east of the Pecos river.

Genetically the intermontane plains of the Mexican Plateau properly belong to the same topographic feature, but for reasons hereafter stated, these are best considered in connection with the description of that district. While the two provinces were once continuous they have of late become separated by the gouging out of the great Pecos and Canadian valleys.

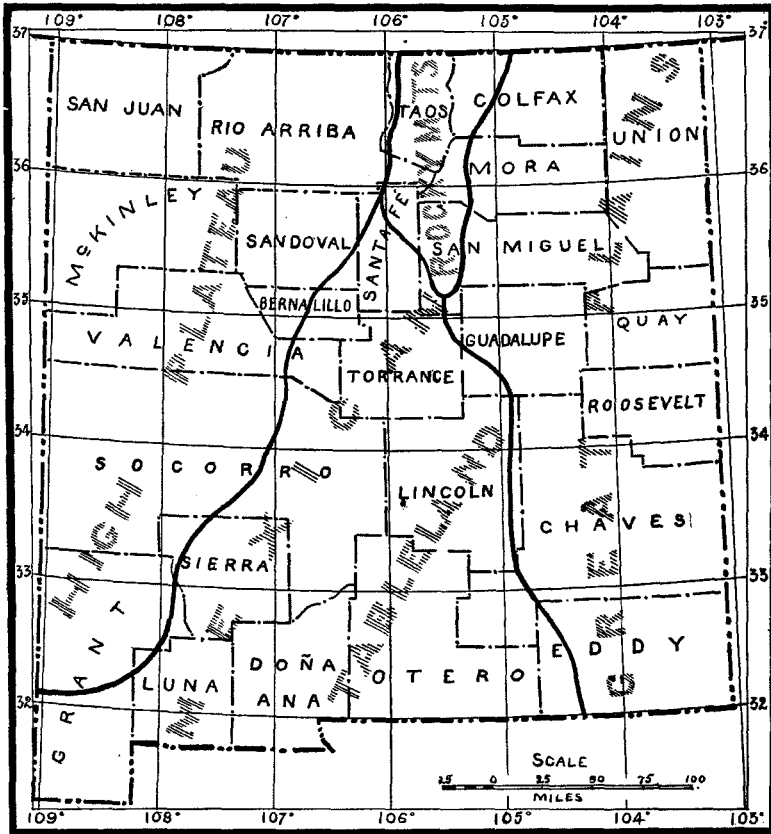
That part of the Great Plains which lies in New Mexico is a high, flat tableland which is inclined slightly to the southeast. It is apparently level and even as far as the eye can reach. Without trees and sparsely covered by gray grasses it presents the appearance of a vast desert, yet supplies pasturage for countless cattle and sheep. At the eastern margin of this province the elevation above the sea is about 5,000 feet, and the seaward inclination is between 8 to 10 feet to the mile.

With the exception of the valleys of the Canadian river and the Rio Pecos, the Great Plains province in New Mexico is unfurrowed by drainage-ways of any consequence. Where these two rivers traverse the province, deep valleys are hollowed out. Prominent escarpments form the sides of these valleys, and the plains surface comes to the very brink of the trough or canyon.

Rocky Mountain Province. The Rocky mountains end in northern New Mexico. Lofty ranges continue southward over the southern Colorado line. Southward the final expression is a pitching anticline which takes the last range beneath the level of the Mexican plateau. As in

Colorado, the Front range is bordered by foot-hills of the "hogback" type, formed by the upturned edges of hard sandstone layers along a profound faultline. The shape of this province in New Mexico is that of a broad wedge with the sharp end at the Glorietta pass.

The peaks of this province rise to an elevation of 13,000 feet. In the



heart of these mountains the Rio Pecos takes its rise. Before it leaves the province the stream cuts a deep valley, the western side of which is the magnificent Glorietta escarpment.

Mexican Table Land Province. This province embraces a large part of central and southern New Mexico. In the southwest it extends over the continental divide. The distinguishing features of the region are the vast, even tableland and the block-mountain ranges which rise 3,000 to 5,000 feet above the plains at the base and from 8,000 to 12,000 feet above tide-

level. These tilted piles of strata resemble, on a huge scale, ice-blocks in a river during the breaking-up in the spring.

To such intermontane plains the Spaniards early gave the name "Bolson," meaning purse. Most of the bolsons have no water-courses traversing them. The intermittent brooks and freshet torrents which come down from the mountains soon lose themselves in the porous soils and unconsolidated surface deposits.

Only a single through-flowing river traverses the region. This is the Rio Grande, which has completely destroyed the line of bolsons through which it flows. It now occupies a channel 1,000 to 2,000 feet below the original level of bolsons on either side. The broad valley has a diversified topography which is peculiarly its own.

High Plateau Province. The northwestern and western parts of New Mexico belong to the High Plateau region, which also embraces northern Arizona, southeastern Utah, and southwestern Colorado. In the main, the surface is a vast elevated plain, over which are scattered many volcanic hills and mountains. The continental divide passes through the central part of the New Mexican portion of the province. In its small features the whole country is fully as rugged as any mountain district, but of a very different type. In general, the entire region is a series of gigantic steps formed by the hard layers of slightly tilted strata. This rough surface is channeled by numerous canyons.

PLAINS OF NEW MEXICO

The foundation of the most characteristic feature of the New Mexican region is believed to be a general plain of degradation worn out on the beveled edges of the rock layers, and inclined slightly to the seaward. The period of the last great erosion was probably Mid-Tertiary or Miocene or possibly as early as Eocene.

As they exist at present there are four principal classes of plains: Plateau plains, bolson or intermontane plains, river plains, and alluvial plains. Plains of the plateau type are easily recognizable as distinct levels. Above the surrounding country they rise by abrupt escarpments. A number of these levels are of wide extent. In the northeast the Mesa de Maya stands 3,000 feet above the Ocate mesa and the latter 500 feet above the Las Vegas plateau. The last is 2,000 to 3,000 feet above the present river beds.

The bolsons are large even-surfaced plains, the foundation of which is a planation surface on beveled strata, and which are floored with loose gravels, sands, and clays. These plains are uncut by water-ways. The drainage from the high, often mountainous periphery, is centrifugal. Evaporation is so great that lakes are rarely found in the centers.

River plains border the great through-flowing rivers which have furrowed out wide flat-bottomed valleys with high canyon walls. Below the level of these canyons the present streams have carved out much deeper channels with broad alluvial plains on either side. The fourth type of plains is the alluvial plain already mentioned.

MOUNTAIN SYSTEMS

If the plain is the dominant feature of the New Mexican region, the mountain is the most conspicuous relief feature. Of all, it is the one feature which usually attracts the greatest attention. Genetically no less than seven distinct types are represented: (1) The mountains of compression find only a single example—the Rocky mountains. (2) Mountains of erosion are best exemplified by the Raton range, in northeast New Mexico. (3) The magnificent Ortiz, Tueritos, San Ysidro, and Cerrillos groups are laccolitic in nature. (4) Block mountains, so characteristic of the Great Basin region, have the Sandia range for a type. (5) The Socorro mountain is an old Tertiary type of volcanic activity. (6) Isleta mountain is a low basaltic cone, a type which has many representatives in the region. (7) The Capulin mountain is a huge cinder cone rivaling that of Vesuvius and of very recent formation; it has a height of 3,000 feet above the surrounding plains.

These mountain ranges rise above the general plain, which itself is 4,000 to 7,000 feet above sea-level.

RIVERS OF NEW MEXICO

Main Features. The drainage of the semi-arid region is wholly unlike anything that is found in more humid regions. That of New Mexico is one of the most remarkable known. Most of the precipitation sinks into the porous soil, and never reaches the large streamways.

The principal waterways are of three kinds. Their waters may be continuous, as in the case of most rivers, or they may be interrupted, or they may be intermittent.

On the whole the drainage is in a nascent stage. In a physiographic sense even the through-flowing streams are consequent rivers. In the bolson plains there are no permanent and distinct drainage-ways and the torrential waters flow down the slopes at the foot of the mountains in broad sheets.

Continuous Streams. Of the first class of drainage-ways are the Rio Grande, the Canadian, Pecos, and San Juan rivers. These are through-flowing rivers rising in the southern Rocky mountains. While these streams receive practically no additions from the tributaries in the country which they traverse, they have an interesting geological history. The huge

valleys which they occupy appear to be, at first sight, out of all proportion to their size, as they are usually seen. Their high gradients, however, enable them to carry enormous quantities of water when the snows are melting in the mountains. Their effective erosive power is further shown in the turbid character of their waters and the vast amounts of silt which they carry at all times. The valleys of these streams are among the most interesting known. They lie many hundreds of feet below the general level of the plains around.

Interrupted Streams. Many of the drainage-ways are in some places flowing streams and in other places they have dry channels for a considerable portion of the year, the waters flowing in the sands and gravels beneath. The Rio Galisteo, the Rio Puerco, and a large number of other drainage-ways are of this order.

Intermittent Streams. This class embraces a very large proportion of the minor water-ways. They carry considerable amounts of water during heavy local rain-falls but soon cease flowing when the precipitation ceases. They thus are sporadic torrential channels. Throughout the region they are termed "arroyos" or dry creeks. Their gradients are high and in times of flowage carry along enormous amounts of gravels, sands and clays.

Many arroyos leading down from the mountains flow for a considerable portion of the year but upon entering the plains with their porous soils soon sink from view and become "lost rivers."

LAKES

Climatic conditions are not favorable to the existence of large bodies of quiet waters. While the centrally depressed bolson plains would be, under ordinary circumstances, lake basins, the present relationships of precipitation and great evaporation are such that when bodies of water are found in them they are comparatively small in size.

The lakes of the region are of two distinct types: mountain lakes and plain lakes. The latter are usually more or less temporary in character. There is also a class of lakes which occurs in connection with the bolsons that appears to have escaped the notice of writers on the region. For want of a better title they have been called Ephemeral lakes. They originate under abnormal though frequently recurring conditions.

SPRINGS

The springs of New Mexico are numerous. Little need be said concerning them in the present connection as they are to receive special treatment shortly. Besides ordinary springs for domestic purposes there are many hot springs and mineral springs which are invaluable for medicinal purposes. Some of these already have a wide reputation for their curative qualities.