

A Geologic History of the Bosque del Apache NWR

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The Bosque del Apache National Wildlife Refuge (BDA) is ten miles south of San Antonio, NM, covering nearly 50,000 acres of land east and west of the Rio Grande; only about 5,000 acres contain the swampy, grassy, cottonwood terrain preferred by the sandhill cranes and snow geese who winter on the Refuge. Deer, coyotes, rabbits, squirrels of various types, owls, turkeys, eagles, and a wide variety of neo-tropical migrant birds also use the Bosque for their own purposes. The preferred area extends for only a mile or two east and west of the river channel in the present flood plain. Before irrigation controls and check dams were established, the river meandered from one side of the flood plain to the other as flows increased or decreased with the variation in rainfall and snowfall on the headwaters of the river. Such a pattern has existed for at least the last fifty-one hundred thousand years.

One geologic principle, which must be understood, is the immensity of geologic time. No matter what type of crustal movement, stability, or instability is imagined, there is plenty of time for it to occur. Sixty-five years ago all geologic textbooks placed the age of the earth at approximately 2,750,000,000 (two billion, seven hundred fifty million) years. The present estimates range from 4,700,000,000 to 4,800,000,000 years. Thus in a little over half a century the age of the earth has nearly doubled. As more information is collected it is likely that the age will change again during the next half century, perhaps older, perhaps younger; human history represents less than 0.001% of the total so geologic time requires a completely different way of thinking.

The BDA lies in what is called the Rio Grande Rift zone. The zone consists of a series of elongated valleys or basins which have been

connected by the course of the river and which are characterized by the fact that the central part of the basin is an area which is down-dropped with respect to the ridges or mountains on either side. The depressed areas have been filled by several thousand feet of soil and debris, which washed in from the margins of the basin as the mountains eroded.

Little San Pasqual Peak, lying in the southeast corner of the BDA, and Chupadera Peak, marking the Northwest boundary, consist of much older layered rocks that represent the remnants of the eastern and western ridges whose erosion has filled the Bosque. A close inspection of the rock fragments found on the surface in the Refuge would yield fossil remains that are identical to the fossils found in rocks of both peaks. Drilling and geophysical work in the basin north and south of BDA have found similar rocks at depths of five and six thousand feet below the surface.

At present, the surface of the earth is about 71% water and 29% land. In the past the land surface has been a much smaller percentage, and rarely, a slightly larger percentage. The oldest rocks recognized in New Mexico form a relatively flat surface and are between 1.6 and 1.8 billion years old. During the last six hundred million years the southwest region of the United States has been alternately below sea level and several thousand feet above sea level. Since erosion operates continuously on rocks that are above sea level and deposition occurs when the land surface is below sea level, very complicated patterns may develop and be destroyed throughout successive periods of time.

The rocks of Little San Pasqual Peak and Chupadera Peak were deposited between 180 and 250 million years ago and were subsequently

compressed into tight folds along with much of the southwest region of the U.S. About 60 to 100 million years ago another period of much less compression created broad open folds that were superimposed upon the earlier complicated folding. Sometime between 20 and 30 million years ago, the compressive stresses were relaxed and an interval of tensional stress in the crust occurred which caused the Rio Grande Rift zone to start forming. Literally, the crust was pulled apart along zones from a few miles to as much as 30 to 40 miles wide causing the intervening sections of the crust to collapse into valleys and basins with bordering mountains.

Along the Rio Grande Rift Zone the basins may be as large as the Albuquerque-Belen Basin (30 miles wide, 60 miles long) to nearly circular (perhaps 20 to 30 miles in diameter) such as the San Marcia basin just to the south of the BDA. The course of the river between the basins follows much narrower (a few miles wide to tens of miles long) tensional zones referred to as constrictions. The BDA actually lies in the transition zone between the Socorro constriction and the San Marcial basin. The Rio Grande has formed relatively recently as a major river and has simply availed itself of the depressed areas which were the focus of drainage for the region. When the river became the principal drainage route for the region, the Bosque formed because of the availability of water. Similar areas occur all along the length of the river in New Mexico, some of which have been utilized by the state to form smaller state refuges.

Definitions:

Basin—a broad area of the earth in which the strata dip usually from the sides toward the center.

Fold—a bend or flexure produced in rock by forces operative after the deposition or consolidation of the rocks.

Constrictions— a ductile, non-brittle, type of deformation which occurs slowly and at depth over long periods of time over which nonuniform stresses act.

Compressive stress—Compression stresses cause one block of rock to be pushed up and over the other rock.

Rift— a crack or fissure made by breaking, splitting or separating.

Tensional stress—causes subsidence of a block rock, which results on a large scale, in the creation of a rift valley.