

## GLACIAL DEPOSITS IN PINE RIVER VALLEY, COLORADO.

BY

ALBERT B. REAGAN.

The table-flats at Florida, east of Durango, Colorado, on the Denver & Rio Grande Railway and eastward across Pine river to beyond Spring creek at Laboca on that railroad—in fact, the whole area from the bluff-mesas west of Durango to the bluff-mesas beyond Spring creek to the eastward in a curve running to the northeast of Durango and bending far to the southward and southeastward, is covered heavily with glacial drift, except where the country rocks project above it in points, ridges, and buttes in many places. The mesas southwest of Ignacio are also covered with glacial boulders and other glacial material. How much farther the glacier extended is not known to the writer.

A little northeast of Durango in the Animus valley there are heavy morainic deposits, associated with extensive outwash deposits. The same phenomenon appears on the Florida, above and in the vicinity of the station of the same name. At Oxford the outwash material, loess, etc. is ten feet deep, superimposed on a bed of boulders often from ten to twenty feet in depth. West of Ignacio the outwash material butts up against the mesas, being often twenty feet thick in the valleys. At Ignacio and at the Southern Ute Boarding School a mile to the northward, the outwash and upper till loess and adobe clay is from five to ten feet deep back from the mesa's edge of the first bench. Immediately underneath this are from five to twenty-five feet of boulders underlain in places by lower till. At Laboca only outwash material was seen, there often forty feet thick, as is shown in the valley cuts of the present washes.

Three miles north of the present Indian school on Pine river, the stream has cut completely through the debris, which here shows no lower till, but twenty-five feet of boulders on which are superimposed outwash till and loess. The bench west of the boarding school, to which a part of the school land extends, is one hundred feet above Pine river in elevation, but at no place in the slopes from the river to its crest is the original rock shown. On top of the bench are five feet of adobe, beneath which are twenty-five feet of boulders, and under this till to an unknown thickness. At Bayfield, ten miles north of Ignacio, the outwash material is of immense thickness, overlying boulders; while to the southeast of that city over a small ridge of jutting, original country rock buttes, is a pocket of glacial deposits of a similar nature. Also from Bayfield northward on Pine river for many miles, outwash material is very conspicuous. The valley fillings seem to be composed wholly of it.

The glaciers that made these deposits seem to have had two or more centers. The glacier in the vicinity of Durango appears to have come down the Animus river channel. The rest of the glaciers seem to have had their origin in the lake country above the junction of Vallecieto creek and Pine river in the high peaks of the San Juan range. Pushing downward from

the heights, they appear to have collected in a basin in the Vallecieto district of the upper Pine, now a magnificent valley from a mile to several miles wide and several miles in length, blocked in by mountains and ridges which rise one thousand feet above the valley floor. Here the glacier pushed southward, spreading out both eastward and westward into a huge fan as it reached the valley flats, even crawling over the lower ridges of the foothills and beginning to spread extensively before reaching the latitude of Bayfield. The writer can not say whether the Spring Creek glacier was a branch of the Pine River glacier, or came from another glacier center in the same mountains. This much is sure, at Laboca they formed a continuous ice sheet and the outwash materials coalesced. Extensive glacial debris was also noticed about Pagosa Springs fifty miles east of Bayfield.

As the boulders overlie the mesas south of Ignacio, it would seem that they were carried there when the glacier was higher and more extensive than when it deposited the great boulder deposits in the lower benches at Oxford, northeast of Durango, at Ignacio, and in the lower valley of the river near the latter place. Whether two glacial stages are here represented could not be determined with the data obtained.

Since glacial times the river and its confluents have cut entirely through the drift at most places all the way to bed rock and have also widened out a very considerable inner-valley flood plain.