
Origin of the Drummond Flat, Garfield County, Oklahoma¹

J. E. BARCLAY, U. S. Geological Survey.

INTRODUCTION

Near Drummond, Okla., in Tps. 21 and 22 N., R. 8 W., Turkey Creek crosses an extensive alluvial flat that is disproportionately large for the stream. Furthermore, this flat or basin is not long and narrow like other valley bottoms in the area but is roughly oval, being about 6 miles long and 3 miles wide. The basin was studied by the writer in the summer of 1950 during an investigation of the ground-water resources of the terrace deposits lying along the northeast side of the Cimarron River in Alfalfa, Major, Garfield, and Kingfisher Counties. Turkey Creek enters the basin flowing southward and midway across changes its course abruptly and flows northeastward for 2½ miles before bending sharply to the east and leaving the basin. A northward flowing barbed tributary joins the main stream at the point where it bends sharply toward the northeast; its course, if reversed, would be the logical continuation of the main stream.

¹Publication authorized by the Director, U. S. Geological Survey, and the Director, Division of Water Resources, Oklahoma Planning and Resources Board.

This abnormal drainage pattern suggests that Turkey Creek once flowed south in approximately what is now the upstream direction of the tributary before it was diverted northeastward and eastward in its present course.

THEORY OF ORIGIN

It is suggested that the unusually large flat and the peculiar drainage pattern are due to the filling of a lake produced by collapse of near surface rocks after the removal in solution of soluble layers in the bedrock. Logs of oil wells filed with the Oklahoma Corporation Commission reveal considerable soluble material in rocks of the area at depths of less than 2,000 feet. For example, a well in sec. 29, T. 22 N., R. 10 W. penetrated shale and salt between 1,265 feet and 2,020 feet, and another well, in sec. 24, T. 21 N., R. 7 W., penetrated a 3-foot bed of gypsum only 320 feet below the surface. In addition to the salt and gypsum, whose removal in solution may be regarded as the principal cause of the Drummond Flat, the Permian bedrock contains much calcium carbonate, both as cement and as thin layers. This carbonate is also soluble, although less so than gypsum and salt. Its removal, by migrating ground water, would allow settling and compaction of the overlying rocks, and would thus contribute to the forming of the basin.

Slope wash and the sediments deposited by Turkey Creek during flood have obscured the original surface irregularities of the basin. Irregularly shaped areas within the Drummond Flat (apparent on aerial photographs) have proved, on field examination, to be nearly imperceptible depressions which can be clearly defined only when they are filled with water after a rain. These are regarded as evidence of recent subsidence due to the same causes that are responsible for the entire flat.

ORIGIN OF PRESENT DRAINAGE PATTERN

The present drainage pattern suggests two processes by which it could have been formed. If collapse were to occur across the course of southward-flowing Turkey Creek, the gradient of a short segment of the stream on the downstream side of the new depression would be reversed and contribute to the creation of a lake which would rise and eventually overflow at the lowest point of the basin rim, thus breaching the basin and diverting the flow of the creek. The shortened and reversed creek would become a barbed tributary on entering the now northward-flowing Turkey Creek.

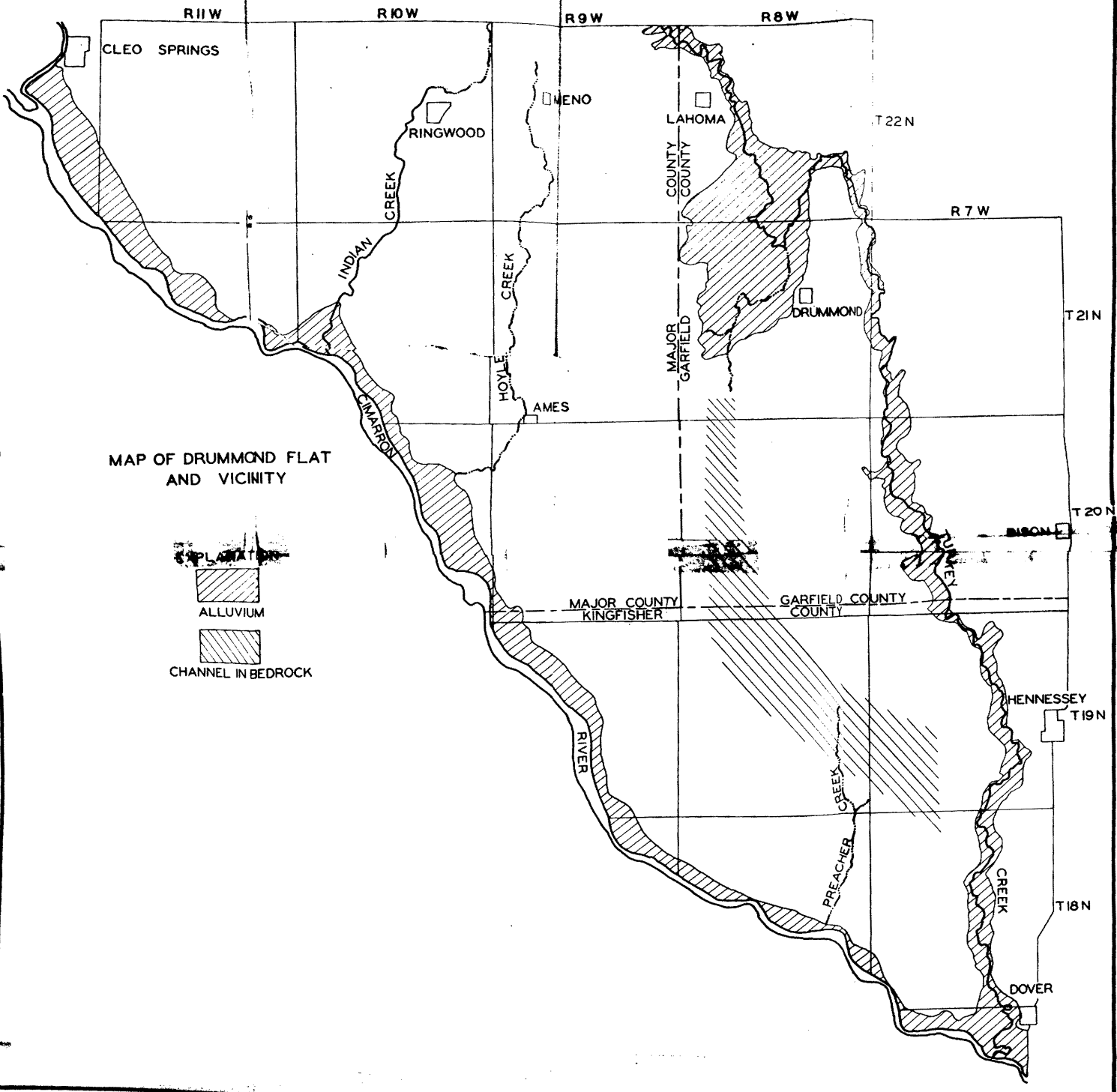
If evaporation and infiltration from the lake were greater than inflow to the basin, the lake would not overflow, a salt lake would be formed, and some other process would be necessary to form the present drainage pattern. If, for example, a stream adjacent to but outside the basin and actively growing headward were to capture the drainage within the basin the situation of the Drummond Flat would be met. The segment of the present Turkey Creek downstream from the east side of the basin (approximately sec. 24, T. 22 N., R. 8 W.) meets that requirement. The captured stream is the segment of Turkey Creek upstream from the Drummond Flat, and the segment cut off and reversed by the collapse is the barbed tributary from the south, which now joins the main creek midway of the basin.

Remaining is the question: Why is the barbed tributary so short? Two answers appear plausible. Possibly the ancient Turkey Creek emptied into the Cimarron River near the place where the barbed tributary now heads. Subsequently, the Cimarron migrated southwestward, and the small segment of Turkey Creek downstream from the basin was not able to overcome the drifting sand and follow the Cimarron. Likewise, the barbed stream was not able to grow headward through the dunes. Another alternative is that ancient Turkey Creek emptied into the Cimarron River at some place near the river's present course, but, having been made feeble

MAP OF DRUMMOND FLAT AND VICINITY

EXPLANATION

- ALLUVIUM
- CHANNEL IN BEDROCK



by the collapse and reversal upstream, it was choked off and obscured by drifting sand dunes. Hence, the present-day barbed tributary is the part of the old stream that was on the southern slope of the basin.

The Drummond Flat is separated from the Cimarron River by a belt of dune sand that ranges from 7 to 10 miles in width. Between the towns of Cleo Springs and Dover, a distance of about 40 miles, the Cimarron River has only one tributary that heads within the dune area; apparently, tributary streams are unable to extend themselves headward through the loose, shifting sand and irregular topography. The one tributary is Preacher Creek which heads about 10 miles south and 3 miles east of the upstream end of the barbed tributary of Turkey Creek. Preacher Creek is an effluent stream, which does not seem to be lengthening itself headward. Its position suggests that it could be the remnant of ancient Turkey Creek that was beheaded by collapse upstream. The fact that it is the only tributary that originates within the dune topography indicates some such explanation.

ECONOMIC SIGNIFICANCE

If ancient Turkey Creek emptied into the Cimarron River at a point near the Cimarron's present course, some evidence of the old channel could be present on the surface of the bedrock underlying the terrace deposits. Such a channel was revealed by test drilling in 1950. It starts near the south end of the barbed tributary, trends southward for about 8 miles, then curves southeastward and parallels the present course of the Cimarron River. Available data do not show whether this channel was made by ancient Turkey Creek or by the Cimarron River, and the fact that it underlies the assumed course of ancient Turkey Creek may be a coincidence. It has been filled with alluvial sediments, which in turn have been covered by windblown sand. The maximum recorded thickness of sediments in the channel is 120 feet. Considerable thickness of gravel and coarse sand are included, and the channel, therefore, is one of the most favorable locations in the entire region for developing a supply of ground water.
