XXVI. A STREAM VALLEY TYPE OF OKLAHOMA.

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A type of stream valley common in Oklahoma is one having a broad flood plain with a trench winding through it which is so deep and narrow as to suggest on superficial examination that the stream is in an early stage of rejuvenation. The ratio between the width of the trench and the width of the valley varies greatly but in general the flood plain is perhaps 20 to 30 times the width of the trench. On an average of one to three times per year the flood plain is covered with water for short periods of time but during most of the year the water of the stream flows within the trench. That this trench has not been formed as a result of stream rejuvenation is shown by the fact that the typical trench and valley flat is found in many streams that are known to be aggrading. For instance, the South Canadian River in the eastern two-thirds of Oklahoma is an aggrading stream yet almost without exception its tributaries in this part of its course have this flood plain and trench. Again Middle Otter Creek in the west end of the Wichita Mts. flows for a part of its course across the granite mass to the northwest of Mt. Radzdaminiski. This mass has been uplifted since the Middle Otter Creek first flowed in its present channel and as a result it has deposited material to a depth of at least twenty or thirty feet on the north side of the granite. Its flood plain here is over one and one-half miles wide, yet the stream flows through it in a deep, youthful appearing channel except in times of high water. In a number of cases excavations in Middle Otter Creek and Little River have shown that the flood plain is of alluvial material deposited by flood waters. The trench which may be found in any part of the flat is usually rather crooked and there is often evidence of its having frequently changed its course.

If the shape of these stream valleys is not due to rejuvenation we must evidently seek the cause by studying the conditions under which erosion and deposition takes place in Oklahoma, or in other words by studying the conditions which control stream flow in this region. The chief factors controlling run-off are rate of rainfall, topography, nature of the rocks and soil, and vegetation. The climate is semiarid in the western part of Oklahoma where this type of valley is most evdient. In a

semiarid climate the rainfall is very heavy for short periods of time. The storms come suddenly and are often followed by long periods with little or no precipitation during which the rate of evaporation is high. Thus the conditions are such as to bring about sudden floods followed by long periods of moderate or little runoff. Also the rocks lie in nearly horizontal layers, are sufficiently impervious so they do not take up large amounts of moisture quickly, and there is comparatively little vegetation to retard runoff. It is seen that the conditions are favorable for short periods of very high water followed by long periods during which the streams are running only part full. It is largely the result of these conditions that cause the building of the broad flat flood plain cut by a relatively deep narrow trench. This type of stream valley is found in most of the arid and semi-arid regions of the United States and might be called the intermittent stream valley type.

In order to describe the way in which such a stream valley develops let us consider the case of a young consequent stream of the region. As long as the conditions are those of ordinary stream flow the valley will develop much the same as it would in a humid region but when a period of excessive precipitation and runoff occurs such as usually comes one or more times a year the stream which is heavily loaded with sediment overflows its banks and deposits a layer of sediment over the flooded area. In a short time the flood waters drop suddenly causing further heavy disposition on the flood plain because of diminishing velocity due to rapid decrease in volume. While the flood is at its height it causes cutting to occur in the trenched part of the stream bed, but on the overflowed flats deposition is much greater than erosion. As the flood goes down deposition occurs to some extent in the trench as well as on the flats but the total result so far as the trench is concerned is cutting rather than filling except probably in a few cases where the stream is aggrading with very great rapidity. The reason for this is that the total amount of material picked up or deposited by a stream depends not only on the rate at which work is being done but also on the length of time the process goes on. The trench is usually flowing nearly full for some time before the flat is overflowed and is also filled nearly to capacity for a relatively long time afterward. In other words, when considered in a broad way a stream of this type, whether it is aggrading or degrading, is depositing on the flood plain and cutting in the trench, and where the stream is short enough to be subject

to the same floods for its whole length the general appearance of the stream valley will be the same whether the stream is aggrading or dgrading. In either case cutting occurs in the trench and deposition on the flood plain but in the case of the degrading stream the total amount of cutting in the trench over a long period of time is greater than deposition on the flood plain; while in an aggrading stream the total amount of deposition on the flood plain is greater than the cutting in the trench.

Since the material of the flood plain is soft and easily eroded the position of the trench is changed easily and frequently with the result that it is often very crooked and there are also frequent cut-offs which tend to give it the appearance of a meandering and entrenched stream. It is during this cutting from side to side that the stream picks up and moves the material of the flood plain down stream and also at times planes off the surface rocks beneath the flood plain, and so tends to keep the bottom of the whole valley at approximately the same level. When considered over a long period of time the true stream-bed is the whole surface beneath the deposited material of the flood plain. Of course this of itself would tend to produce wide stream valleys but the chief cause of the great width in valleys in this region is mostly due to the sapping processes, as stated in my paper "Some Processes in the Formation of the Stream Valleys of the Interior Plains of the United States" which was presented to the Academy last year.