

2011 Tolna Coulee Project

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In 1997, the North Dakota State Water Commission asked the North Dakota Geological Survey if there was a scientific method to determine the amount of sediment that had been deposited in the Jerusalem Outlet and Tolna Coulee since the time of statehood, that is, since 1889. The Jerusalem Outlet extends from East Devils Lake into Stump Lake and the Tolna Coulee leads from Stump Lake into the Sheyenne River. Because we had earlier undertaken studies of Cretaceous rocks utilizing palynology (study of fossil pollen) and had studied the stratigraphy of playa lakes in northwestern North Dakota, we knew from available literature that historians and agricultural scientists agreed that settlers to North Dakota, at or around the time of statehood, inadvertently carried with them seeds of Russian thistle (*Salsoa*). Because Russian thistle quickly spread across the state, the deepest appearance of its pollen in undisturbed sediment marks the approximate time of statehood for North Dakota.

In March 1997, the ND Geological Survey collected sediment samples in the Jerusalem Outlet and the Tolna Coulee for pollen analysis and radiocarbon dating. We determined that Russian thistle extended down six inches (15 cm) in the Jerusalem Outlet and one foot (30 cm), to an elevation of 1,458 feet (~440 m), in the Tolna Coulee (Murphy et al., 1997). Using these results, the City of Devils Lake removed sediment down to an elevation of 1,458 feet at two locations in the Tolna Coulee in 2010.

During their June 21, 2011 meeting, the North Dakota State Water Commission approved a motion directing the State Engineer to re-examine the data that was used in the 1997 study to determine the elevation of the Tolna Coulee at the time of statehood. As a result, the State Engineer asked us to do a follow-up study. On July 13, 2011, we collected samples from a dozen locations in Tolna Coulee (figs. 1 and 2). Those samples were dried, processed at Global Geolabs in Medicine Hat, Alberta, and analyzed by playnologist R. Farley Fleming of Denver, Colorado. This was the same consulting group we worked with in the 1997 study as well as a 2002 pollen study of a potential Black Slough outlet coming from East Devils Lake.

In mid-November, we received Farley's results, incorporated them into the final report, and submitted it to the ND State Water Commission. Although we had very good pollen preservation (8 out of 10 sediment samples were good) in our 1997 study of the Tolna Coulee, the pollen preservation in the sediment samples collected in 2011 was very poor (67 out of 69 were poor). Most importantly, no Russian thistle pollen was found in this year's samples. As a result, no conclusions could be drawn regarding the position of the 1889 surface at the dozen core sites (Murphy et al., 2011). Although it was disappointing that we could not shed additional light on this subject, it was not all together surprising because we knew from past experience that pollen preservation can be spotty across a landscape. The 2002 Black Slough study was also inconclusive because all 50 sediment samples had poor pollen recovery (Murphy and Fleming, 2002).

References

- Murphy, E.C., Fritz, A.M.K., and Fleming, R.F., 1997 (revised 2002), The Jerusalem and Tolna Outlets in the Devils Lake Basin, North Dakota: North Dakota Geological Survey Report of Investigation no. 100, 36 p.
- Murphy, E.C., and Fleming, R.F., 2002, The Black Slough Outlet Devils Lake, North Dakota: A report submitted to the North Dakota State Water Commission, November, 19 p.
- Murphy, E.C., Anderson, F.J., and Fleming, R.F., 2011 Tolna Coulee project: A report submitted to the North Dakota State Water Commission, November, 17 p.



Figure 1. Fred Anderson (NDGS) pushing a core barrel (with an interior plastic sleeve) through organic-rich sediment in the Tolna Coulee.



Figure 2. Aerial photograph of the Tolna Coulee study site. The areas outlined in red are where the City of Devils Lake removed sediment down to an elevation of 1,458 feet; the 1997 trenches are yellow squares, and the 2011 core sites are shown as numbered black squares.