# **Grain Size Analysis of Oligocene Loess Deposits**

#### ABSTRACT

The analysis of loess deposits is critical in the reconstruction of paleoclimate as the mean grain size and grain-size distribution are specific to various transport mechanisms. Therefore, changes in mean grain size and distribution can indicate shifts in climate. While loess deposits of the late Eocene-Oligocene age have been identified in western North America, there have been few detailed studies. This project aims to examine the Oligocene loess deposits in northeastern Colorado. A total of 156 samples were collected from two sites near Pawnee Buttes (labeled PB and PBE) and analyzed using a Mastersizer Laser Diffraction analyzer. Samples from both the PB and PBE sites are consistently poorly sorted, showing very finely skewed and leptokurtic distributions. Most samples from the PB site show a bimodal distribution, however, samples from the PBE site are mostly unimodal. PBE samples have consistent U-ratios near 1.5. Although PB samples shows some fluctuations between 3.15 to 0.74 U-ratios, they generally remain around 1.5. The stable ratios indicate that the depositional environment remained largely consistent during deposition.



Geologic map of the study area, with white stars at the focus site (PB) and two previous study sites

### METHODS

**Sample Preparation:** Samples were ground in a mortar and pestle, then strained through a 1mm sieve. 0.5 grams of each sample was measured out, then treated first with H<sub>2</sub>O<sub>2</sub> to remove organic matter, then HCl to remove carbonates. pH was neutralized with multiple washes and dispersant was added before sonication. Sample Analysis: Samples were analyzed using a Malvern Mastersizer 3000 at Baylor University.

**Proxies Used:** U-ratio  $\left(\frac{16-44\mu m}{5.5-16\mu m}\right)$ , Twin Peaks ratio  $\left(\frac{30.1-63.4\mu m}{11.8-27.4\mu m}\right)$ , and Grain Size Index  $(\frac{20-50.4 \mu m}{20})$ <20µm

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consistent during deposition.

U-ratio shows cyclic patterns suggesting repeated warming and cooling cycles. Lower U-ratios may be caused by stronger pedogenesis or weaker winds in warm climate (Újvári et al, 2016). Both TP-ratios and follow the same pattern as U-ratios.

U-ratio and GSI are positively correlated. This is expected as they are both ratios of the abundance of larger vs smaller sediment sizes. The U-ratio and GSI of the samples are not strongly correlated with the median diameter.

## **REFERENCES AND AKNOWLEGDEMENTS**

Újvári, Gábor, et al. "The physics of wind-blown loess: Implications for grain size proxy interpretations in quaternary paleoclimate studies." Earth-Science Reviews, vol. 154, Mar. 2016, pp. 247–278, https://doi.org/10.1016/j.earscirev.2016.01.006.

Authors acknowledge Baylor University for the use of the Mastersizer Grain Size Analyser and the UTA EES Undergraduate research fund.

#### **DISCUSSION AND CONCLUSIONS**

All three proxies remain largely consistent throughout the stratigraphic column. This indicates that the depositional environment remained largely

