

# WINONA STATE UNIVERSITY UNDERGRADUATE STUDENT RESEARCH & CREATIVE PROJECTS FINAL REPORT

**Submit this complete form and a copy of the project end product(s) no later than ten (10) days after the completion of the project. Submit items as email attachments to Grants & Sponsored Projects ([grants@winona.edu](mailto:grants@winona.edu)).**

For more information, go to the [Student Grants webpage](#).

## Final Report Checklist

The final report **MUST** include this form and the end product (*check to verify inclusion of each component*):

- This final report fully completed
- A copy of the project end product. Indicate the format of your final product (*select all that apply*):
  - Research Report
  - Presentation
  - Poster
  - Other – Please describe: [Click or tap here to enter text.](#)

**Note:** A copy of the project end product will be forwarded to Krueger Library for archival purposes.

## Project Information

Title of Project: <a href="#">Structural and Compositional Assessment of the Estes Unconformity, Black Hills, South Dakota</a>	
Student Name (PI): <a href="#">Christian Laing</a>	Student Email: <a href="mailto:Christian.laing@go.winona.edu">Christian.laing@go.winona.edu</a>
Co-Investigators Names: <a href="#">Click or tap here to enter text.</a>	
Faculty Sponsor: <a href="#">Dr. Stephen Allard</a>	Faculty Department: <a href="#">Geoscience</a>
Was this a capstone, senior thesis, or other degree culminating project? <a href="#">No</a>	

## Project Abstract

*What was the purpose of this research? What were the planned outcomes? What did you do to achieve them? What were the actual outcomes?*

**Abstract:** [Precambrian metasedimentary rocks in the Nemo area of the Black Hills, South Dakota are currently interpreted as having been deposited during two distinct depositional events with an angular unconformity separating them, requiring deformation of the older rocks prior to deposition of the younger rocks. An evolving model developed by the Winona State Black Hills research group argues that the map pattern in this area does not require an earlier deformation. This research aimed to replicate work done by prior Winona State researchers in a more focused area immediately surrounding the Estes Unconformity. Extensive field mapping and sample collection were performed in the Nemo area of the Black Hills, South Dakota. Significant samples were processed into thin sections to observe microstructures and identify textures and mineral phases. Corresponding powdered samples were sent out to be processed via laser ablation, and the resultant bulk geochemical data was used to confirm petrographic mineral identification and modal abundance calculations. Due to COVID restrictions on lab access and the uncertainty of additional geochemical and thin section processing, this portion of the overall project was incomplete. Nonetheless, compositional assessment proved to be an important supporting argument in the structural assessment of the Estes Unconformity. Uncertainty was introduced to the compositional criteria previously used to support prior deformation and an unconformity. Structural and compositional evidence were both used to support a single extended deformational event affecting the Nemo area rocks. This research establishes a good foundation for future work in the area. Samples collected in the Nemo area could be used for banded iron chemical signature analysis or detrital zircon age dating.](#)

