

**UNL Geophysics Team  
newsletter**  
**academic year of 2021-2022**

**GEOFYSICS  
ROCKS!**

**Graduation**



*Kris Guthrie with CG-5 relative gravity meter at the newly established Museum Base Station in front of the Morrill Hall*

base stations to validate Kris’s transferred values. Kris is currently working on a manuscript describing the two new gravity base stations in Lincoln, NE, to be submitted to the Bulletin of the Geological Society of America that sponsored establishing these new gravity markers.

*Morgan Madsen and Jeff Kanney from NOAA with a CG-6 relative gravity meter during NOAA’s visit to the UNL in July 2022*

**Kris Guthrie** successfully defended her MS thesis “[Toward the Understanding of the 2018 Arnold, NE Earthquake Cluster: Relocation of Hypocenters and Establishment of New Gravity Base Stations](#)” in Spring 2022. Kris’s research project was sponsored by the Geological Society of America, the Nebraska Geological Society, and by the American Association of Petroleum Geologists. Kris has transferred absolute gravity values from several vintage base stations located in Hastings, Geneva, and Sioux Falls to two new markers at the UNL City Campus (Museum and Bell Tower gravity stations). Kris’s project was featured in the UNL newspaper in June 2022 “[Guthrie expands gravity research, teaching, outreach opportunities](#)”. This project also sets up our successful collaboration with NOAA, which provided two disks to mark new base stations. Jeff Kanney from NOAA visited Lincoln in July 2022 to measure absolute gravity values at the two newly established

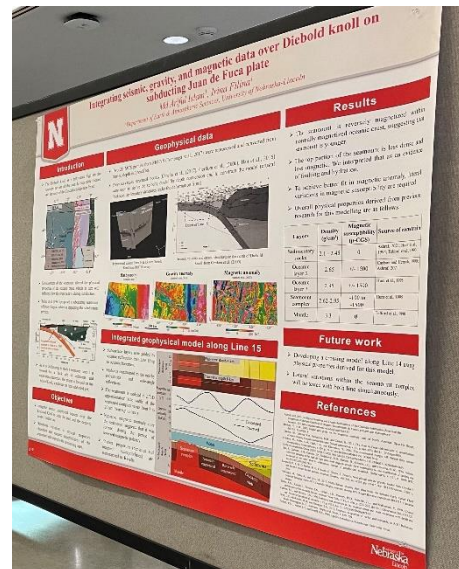


**New Students of the UNL Geophysics Team**



**Md Ariful Islam** joined our team to continue the Cascadia Subduction Zone project after [Asif Ashraf](#) graduated and moved to the University of Oregon to work on his Ph.D. in the Spring of 2021. Ariful started his MS research in August 2021. His project is focused on the Diebold Seamount that resides on the subducting Juan de Fuca plate. Ariful integrates various geophysical data over that seamount to study the origin and tectonic evolution of this enigmatic geologic feature. Ariful has reprocessed the seismic reflection data that was

collected during the RR1718 survey that Dr. Filina participated in. Ariful presented his reprocessed seismic sections at [the UNL research Fair](#) in Spring of 2022, and the initial results of integrated modeling during [the AGU-SEG workshop on active continental margins](#) in July of 2022. In August 2022, Ariful was invited to participate in the seismic [CHINOOK](#) cruise in southern Cascadia led by New Mexico Tech and the Oregon State University.

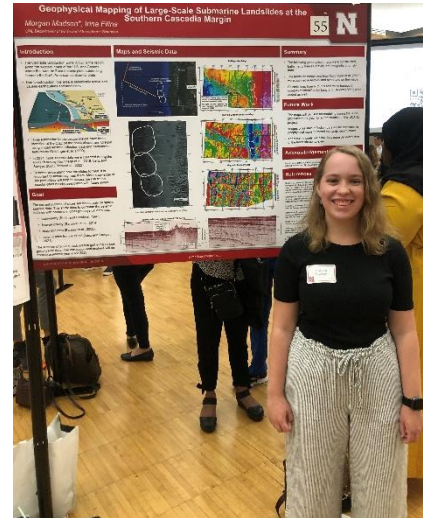


**Alexa Fernandez** started her MS project in August 2021. Alexa graduated from the UNL Geophysics Lab with her BS in Geology and Chemistry in the Spring of 2021. Her [BS thesis](#) was focused on the tectonic evolution of the Bathymetrists Seamounts in the Atlantic Ocean. Alexa continues her research project on the origin and tectonic history of the Bathymetrists Seamounts in collaboration with the University of Hamburg. Alexa’s poster at the [UNL 2022 Spring Research Fair](#) was awarded as one of the best in Physical Sciences. Her talk at the annual meeting of the Nebraska Academy of Sciences in April 2022 also received an award as one of the best student presentations. Alexa is working on the manuscript to be submitted to the Journal of Marine Geophysical Research.



**Morgan Madsen** joined our team as Undergraduate Research Assistant and was awarded the Undergraduate Creative Activities and Research Experience (UCARE) stipend for Summer 2022 and for the academic year of 2022-2023. Morgan studies the slide complexes along the Cascadia Subduction Margin and their expression on various geophysical datasets. Morgan successfully presented

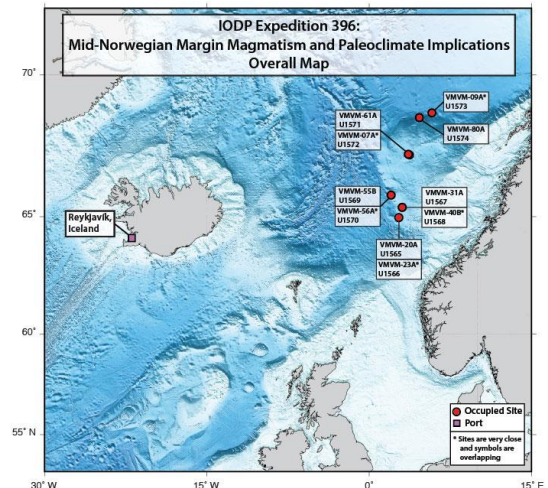
posters at UNL research Fairs (Spring and Summer of 2022) and gave a talk during the annual meeting of the Nebraska Academy of Sciences in April 2022.



**Jonathan Wear** is joining our team in August 2022 after receiving his BS in Geology from the UNL Department of Earth and Atmospheric Sciences in the Spring of 2022. Jonathan will investigate the crustal architecture of the Voring Marginal High in the Norwegian Sea. Jonathan will analyze seismic refraction data in collaboration with the University of Oslo. This project follows Dr. Filina's participation in [the International Ocean Discovery Program \(IODP\) expedition 396](#) in August through

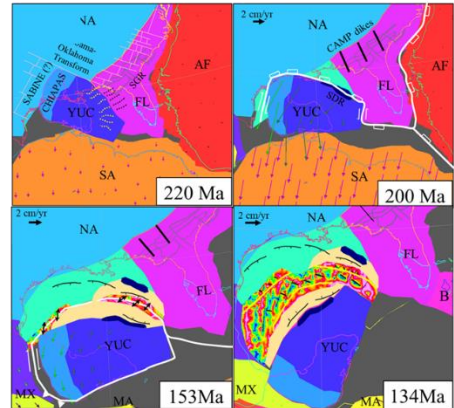
October of 2021. In the Summer of 2022, Jonathan participated in

the seismic cruise in the Norwegian Sea conducted by the Universities of Oslo and Tromso. This cruise collected 2D and 3D seismic data over the northern sites drilled by the IODP396 expedition. Jonathan's research project will be partially sponsored by the U.S. Science Support Program as a post-IODP expedition award.



## Research Highlights

**Tectonics of the Gulf of Mexico:** The crustal architecture of the southern part of the Gulf of Mexico was finally published by the Journal of Marine and Petroleum Geology ([Filina and Hartford, 2021](#)). This research direction is being sunsetted with the publication of the invited review paper in Tectonophysics ([Filina et al., 2022](#)) and with acceptance of the invited book chapter, describing the new tectonic reconstruction of the Gulf of Mexico based on the integration of multiple geophysical data with various geological observations ([Filina and Beutel, 2022](#)).



## **Norwegian volcanic margin:**



[Dr. Filina sailed on the JOIDES Resolution](#) as a part of the IODP expedition 396. The expedition recovered sedimentary and igneous rocks in ten sites over the Norwegian Volcanic Margin. This expedition opened a new research direction for the UNL Geophysics Team, targeting the tectonic history and evolution of the Northern Atlantic Ocean. Two external grants are pending to sponsor this research project.



**Cascadia Subduction Zone:** This research direction was added in 2017 with Dr. Filina's participation in the NSF-sponsored Early Career Seismic Chief Scientist Training Cruise aboard the Research Vessel Roger Revelle (RR1718 survey). To date, the major tectonic features of this complex margin were mapped in one [MS thesis](#), while publicly available geophysical datasets in the area are summarized in the [senior thesis](#). This research resulted in multiple presentations in the professional meetings. One manuscript is currently in revision by the Journal of Geophysical Research: Solid Earth, while the second one is in preparation.

**Bathymetrists Seamounts:** This research direction is being developed in collaboration with the University of Hamburg since 2019. To date, a [senior thesis](#) composed in 2021 is being continued as the MS project. The manuscript is being prepared to be submitted in 2022.

**Nebraska Subsurface Structures:** The team plans to conduct land gravity and drone-based magnetic surveys over the region of sudden seismic activity in central Nebraska. To prepare for that, the drone-based magnetic surveying system was [assembled](#) in 2020 and [successfully tested](#) in 2021, and two absolute gravity base stations were [established](#) on the UNL City Campus in 2022.

## Publications

- Filina, I.** and E. Beutel, Geological and Geophysical Constraints Guiding New Tectonic Reconstruction of the Gulf of Mexico, in *Tectonic Processes: a Global View, Volume 1. Extensional Tectonics: Continental Breakup to Formation of Oceanic Basins*, editors I. Çemen, E. Catlos, published by Wiley-Blackley for AGU, Invited book chapter, in press
- Trehu, A., Tominaga, M., Lyle, M., Davenport, K., Phrampus, B., and **the RR1718 science party**, The hidden history of the south-central Cascadia subduction zone recorded on the Juan de Fuca plate offshore southwest Oregon, *Geochemistry, Geophysics, Geosystems*, in press
- Filina, I.**, Austin, J., Doré, T., Johnson, E., Minguez, D., Norton, I., Snedden, J. and Stern, R.J., **2022**, Opening of the Gulf of Mexico: What we know, what questions remain, and how we might answer them, *Tectonophysics*, v. 822, p.229150, Invited review paper, <https://doi.org/10.1016/j.tecto.2021.229150>
- Filina, I., L. Hartford, 2021**, Subsurface structures along the western Yucatan from integrated geophysical analysis, *Journal of Marine and Petroleum Geology*, v. 127, paper 104964, <https://doi.org/10.1016/j.marpetgeo.2021.104964>

## Presentations

### American Geophysical Union

- Islam, A., Filina, I., 2022**, Integrating seismic, gravity and magnetic data over Diebold Knoll on subducting Juan de Fuca plate, AGU-SEG workshop on active continental margins, 12–14 July 2022, the University of Washington in Seattle, WA.
- Filina, I.**, Beutel, E., **2021**, Temporal variations in magmatic regime during the opening of the Gulf of Mexico, paper T25E-09
- Ashraf, A., I. Filina, 2021**, Assessing the Earthquake Patterns Within the Subducting Juan de Fuca Plate, virtual talk T15D-0194
- Fernandez, A., I. Filina, 2021**, Relationship Between Bathymetrists Seamounts and Sierra Leone Rise from Integration of Several Geophysical Methods, virtual poster T45D-0279
- Guthrie, K., I. Filina, 2021**, Transferring Gravity Readings to Establish an Absolute Gravity Base Station on the University of Nebraska-Lincoln Campus, poster G35B-0299

### Geological Society of America

- Ashraf, A., I. Filina, 2021**, Propagator wakes of the Juan de Fuca plate - are they weaker or stronger than the surrounding oceanic crust, *Geological Society of America Abstracts with Programs*, v. 53, no. 6, 2021, doi: 10.1130/abs/2021AM-370842

### Nebraska Academy of Sciences (142nd annual meeting, 2022)

- Filina, I.**, Overview of complex tectonic of the Northern Atlantic
- Guthrie, K., Filina, I.**, Finalizing new gravity base stations on the UNL City Campus
- Fernández, A., Filina I.**, Comparing satellite vs marine potential fields data over the Bathymetrists Seamounts (one of the best student papers award)
- Madsen, M., Filina, I.**, Summarizing scientific drilling results over Cascadia Subduction Zone
- Islam, A., Filina, I.**, Processing seismic, gravity and magnetic data over Diebold Knoll on Juan de Fuca plate
- Wear, J., Filina, I.**, Analyzing crustal nature of the Voring Plateau from seismic refraction data