COLLEGE of CHARLESTON

SCHOOL OF SCIENCES AND MATHEMATICS

# Geology Abstracts

32nd Annual Poster Session Abstracts – April 21, 2021

Click each project title to view each oral presentation on YouTube.

11. **Mission Proposal to Titan with Orbital, Aerial, and Lander Components to Investigate Planetary Dynamics and Biological Potential**

Joe Tidwell[1], Logan Oxener[1], Jaime Wright[1], Aly Nida[1], Dr. Jon Hakkila[1], Hannah Cunningham[2], Dr. Cassandra Runyon[2] and Jacob McDaniels[3]
[1]Department of Physics and Astronomy, College of Charleston
[2]Department of Geology and Environmental Geosciences, College of Charleston
[3]Department of Computer Science, College of Charleston

Titan, the largest moon of the Saturnian system, is one of the most perplexing worlds in the solar system. With dynamic surface features (including liquid methane-ethane lakes) and a stratified atmosphere, it is analogous to Earth in many respects and a prime candidate in the search for biological life. The College of Charleston's NASA design team proposes an extended mission to Titan with 3 synergistic probes: orbiter, aerial, and lander. The mission will develop a clear picture of how Titan functions as a dynamic system and determine if Titan currently or potentially supports biological life. A complete mission proposal and traceability matrix are available upon request.

18. **Developing a Mobile Application for Flood Warning in the Charleston, SC Region**

Connor Cozad, Cole Westbrook, Norman Levine and Lancie Affonso
Department of Geology and Environmental Geoscience, College of Charleston
Department of Computer Science, College of Charleston

As the sea level rises, flooding is becoming increasingly common in coastal areas, including in the Charleston region. The goal of this project, funded by the South Carolina Sea Grant Consortium, is to develop a map application that shows current and predicted street flooding across Charleston County, South Carolina. We evaluated multiple sources of near-real-time current and predicted tide height data for use in the app. Once identifying these sources, which included products generated by NOAA's National Ocean Service and National Weather Service, we developed Python code that retrieves this data in near-real-time. We have also started planning and developing the app's user interface, a critical

aspect in making our street flooding maps easily accessible for anyone. This is an ongoing project that is projected to be completed in early 2022.

### 28. Incomplete Mixing of Andesite and Dacite Magmas in the Lassen Volcano Eruption of 1915

Emily Lowe and Dr. John Chadwick
Department of Geology and Environmental Geosciences, College of Charleston

Lassen Volcano in northern California last erupted in 1915. The lava is not homogenized but consists of a variable mixture of low-silica (andesite) and high-silica (dacite) lavas. We analyzed the mineral phenocrysts in a 1915 lava sample and found olivine from the andesite and quartz from the dacite, and these minerals show disequilibrium textures that indicate they are not stable in the hybrid magma. To study the magnitude of magma mixing, we dissolved samples in hydrofluoric acid and separated Pb, Sr, and Nd isotopes using chromatographic resins. A standard (BCR-2) and a blank were also run for comparison and quality control. Multiple cuts were taken to refine the lab resin protocols for Sr and Nd. The separated isotope samples were sent to the University of Florida for analysis on their mass spectrometer. The isotope data reveals the magnitude of mixing in the magma chamber prior to the 1915 eruption.

### 34. Time Series Analysis of Harmful Algal Blooms in the Great Lakes Using High Resolution Satellite Sensor

Jordan James and Dr. Adem Ali
Department of Geology and Environmental Geosciences, College of Charleston

The Great Lakes represent a vital resource for the fishing industry, tourism, and recreational activities, especially in Saginaw Bay, Michigan. Fertilizer runoff and warm water temperatures exacerbate harmful algal blooms (HABs) in Saginaw Bay, which negatively impact local economies. HABs are difficult and expensive to track by traditional field sampling methods, but high resolution satellite sensors provide a cost effective alternative to monitor HABs over large regions such as Saginaw Bay. The Sentinel-2 MSI satellite sensor was utilized to develop optical based water quality indices for Saginaw Bay. In this study, the predictability of chlorophyll using empirical formulas from spectral band ratios was analyzed in comparison to extracted chlorophyll values. Results indicated that the $R_{rs}490/R_{rs}560$ band ratio provided the best relationship with the chlorophyll variability in Saginaw Bay with model performance displaying a $R^2$ of 0.77 and a RMSE of 0.42.

### 38. Hot or Not? Evaluation of the Hot Needle Test

Adriana Apintiloaiei and Dr. Barbara Beckingham
Department of Geology and Environmental Geosciences, and Environmental and Sustainability Studies, College of Charleston

Microplastics are small (<5 mm) synthetic polymers that are ubiquitous in indoor and outdoor environments and may affect human and ecological health. The hot needle test (HNT) helps researchers identify suspected microplastics under the microscope by probing their melt behavior with a heated metal tool, and is a method considered accessible enough for widespread use. However, the accuracy of this test hasn't been confirmed. The HNT response of 9 fibers, an assortment of synthetic, natural, or

semi-synthetic materials, were observed and then a single-blind trial was prepared with these fibers randomly arranged on a grid to test the ability of researchers (N=8) to characterize them using their preferred HNT conditions. Synthetic and some natural fibers were identified correctly over 70% of the time. Cotton and semi-synthetic fiber results were less consistent (<55% correct). Future work will aim to update HNT conditions and to improve its application in microplastic research.

45. **Monitoring Lassen Volcano Subsidence with Interferometric Synthetic Aperture Radar**

Josh Premak, Reece Hammond and Dr. John Chadwick
Department of Geology and Environmental Geosciences, College of Charleston

Lassen Volcano in Northern California is on the southern end of the Cascade Volcanic Arc, a string of large volcanoes that extends through Oregon, Washington, and British Columbia. Lassen last erupted in 1915, but as a dormant stratovolcano, it will likely erupt again. One way to monitor volcanoes for signs of renewed activity is to measure subsidence of the land around them. As new magma intrudes beneath a volcano, the surrounding terrain will slowly warp downward in response, creating a low topographic "moat." We compared pairs of Sentinel satellite Synthetic Aperture Radar (SAR) images that were taken several years apart, and used SNAP interferometry software to look for this subtle deformation. We generated topographic change interferograms and compared the terrain surface from the different years. Our results show several centimeters of subsidence, with an average of 0.7 cm/year at Lassen between June 2015 and September 2020.

64. **Tombstone Weathering in Charleston**

Kate Wells, Dr. Erin Beutel and Dr. Teddy Them
Department of Geology and Environmental Geosciences

Extremes in moisture, temperature, and salt lead to the deterioration of stone within the built environment. Due to the lack of load-bearing stone available in the South when the majority of the historic structures in Charleston were built, the most abundant stone features available to study are tombstones. Noninvasive methods will be used to study tombstone weathering in Charleston and include 1) measuring changes in thickness from base to top; 2) measuring changes in the depth of letters; 3) calculating differences in the linearity of the surface; and 4) noting the grave marker's appearance, location, and surroundings. Stone from an associated quarry or debris from existing tombstones will be analyzed in the laboratory for a more comprehensive understanding of gravestone weathering in Charleston. The controls of weathering intensity on related stones within the urban setting may have implications regarding the durability and practicality of stone use in the South.