Forty-Fifth Annual

Geoscience Day

April 26, 2019
HUB Monongahela Room

Indiana University of Pennsylvania
Geoscience Department

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Program and Abstracts

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Program Schedule

8:55 Opening Remarks by Dr. Steve Hovan

Session 1: Oceanography, Hydrology, and Environmental Geology

9:05 Sara Trio
Analyzing Carbonate Content Present in Sediment Core KN223 10LC2: Building a Time Scale

9:20 Kayla Kroczynski
Researching Stormwater Runoff at the White Township Recreation Complex in Indiana County, Pennsylvania

9:35 Tyler Sharretts
Characterizing the Sedimentary Fluxes and Geomorphological Alterations of Presque Isle Peninsula using Ground Penetrating Radar

9:50 Manuel Aviles-Torregrosa
Finding and Mapping Natural Gas Gathering Lines using Electromagnetic Induction and Ground Penetrating Radar

- Coffee Break and Poster Session -

Session 2: Paleontology and Volcanology

10:15 Heather Furlong
Fragilariopsis kerguelensis: A Quantitative Interpretation of Diatom Growth and Nutrient Recycling

10:30 Rock Brenner
Nutrient Availability and Recycling Rates Over Marine Isotope Stage 31 in the Ross Sea, Antarctica

10:45 Nicole Camarda
Body Mass Estimation of the *Protoceratops* and *Triceratops*

11:00 Copeland Cromwell
Grainsize and Componentry Analysis of Multiple Vents in 2010 from Submarine Volcano NW-Rota 1, Mariana Arc

Session 3: Featured Alumni Presentation

11:15 Patrick Imbrogno '78
He was Just an Above Average IUP Student - No One Special

Analyzing Carbonate Content Present in Sediment Core KN223 10LC2: Building a Time Scale

Sara Trio

The variability of calcium carbonate, CaCO3, in oceanic sediments ranges as a result of several factors. Input caused by biological productivity and dilution by other components influences the relative percentage of CaCO3 deposited in sediments. Carbonate content variations were examined in a subset of the core of about 200 individual samples. These samples were part of a larger collection of core data recovered from the seafloor of the central Atlantic Ocean. The true percentage of CaCO3 was determined through a chemical reaction with hydrochloric acid and compared to a set of bulk physical properties collected along 1 cm intervals throughout the core. Gamma Ray Attenuation (GRA) data provides information about the bulk density of sediments and varies in both composition and degree of sediment compaction. This study will examine the relationship between CaCO3 and GRA to predict the amount of CaCO3 in other sections of the core. If such relationship exists, the analyzed and predicted amounts of CaCO3 will allow for a more detailed examination of changes to the carbonate content during significant climatic cycles observed, during the Pliocene and Pleistocene. Another bulk physical property, magnetic susceptibility, may need to be compared to CaCO3 if GRA data does not yield a significant relationship. A final comparison of δ18O data will show if CaCO3 percentages were either higher or lower in glacial and interglacial periods. The CaCO3 and bulk physical property data compared to the δ18O abundance will create a time scale that will act as a basis for future climate studies.

Researching Stormwater Runoff at the White Township Recreation Complex in Indiana County, Pennsylvania

Kayla Kroczynski

Stormwater runoff is generated from a storm event when rain falls on an impervious surface or exceeds infiltration capacity of soils. Runoff directed through stormwater systems often enters nearby streams with shortened lag times.

Marsh Run is a small watershed (~2 square mile) in Indiana, Pennsylvania which has experienced repeated flooding due to rapid delivery of stormwater during intense rainfall events. The White Township Recreation Complex, located within the headwaters of the watershed, has two large parking lots, multiple paved and semi-paved driveways, tennis courts, basketball courts, and a 1.6 acre arena roof on the property. The complex is located right above a small neighborhood, through which a small headwater tributary of Marsh Run flows. Residents in the neighborhood have complained of both increased frequency and magnitude of flooding due to the runoff from the complex.

The IUP Geoscience Department partnered with the White Township government to investigate stormwater issues related to the WTRC. This project provided opportunities for an applied undergraduate research project focused on a local hazard. The project started as a summer research experience focused on learning ArcGIS, field mapping, and modeling runoff contributions to Marsh Run based on soil properties. Runoff volumes were modeled for common rainfall. Dataloggers were installed in the stream and one of the outflow pipes during the Fall of 2018 to compare the runoff models and evaluate the effectiveness of current stormwater retention and the impact of the WTRC on flooding downstream. Additional plans include working with the township to include green infrastructure retention strategies on-site. Progress updates to the Indiana County Stormwater Education Partnership and White Township supervisors provided experiences on communicating science to a broad audience that could not be truly achieved in a classroom.

Characterizing the Sedimentary Fluxes and Geomorphological Alterations of Presque Isle Peninsula using Ground Penetrating Radar

Tyler Sharretts

Presque Isle Peninsula, situated within the Pennsylvania boundary of Lake Erie, is heavily susceptible to the erosional processes created by the constant movement of wind and water. This oscillatory pattern of lacustrine transgression and regression cycles creates a dynamic pattern of sedimentary fluxes and surface features which are visible throughout the landscape. In this research, GPR data was collected at a series of shore-perpendicular transects across Presque Isle to characterize the subsurface stratigraphy through the identification of sediment interfaces and depositional packages. The sites were chosen to investigate depositional facies variability due to transgressive and regressive episodes and to provide a cross-section of below-ground sedimentary facies. GPR data shows numerous crosscutting and filling depositional sequences, bed thickness variability, dune structure, and overall sediment thickness. This study allows for us understand the link between subsurface structure and surficial processes in a rapidly changing sedimentary environment efficiently and without disturbing the subsurface.

Finding and Mapping Natural Gas Gathering Lines using Electromagnetic Induction and Ground Penetrating Radar

Manuel Aviles-Torregrosa

Pennsylvania's oil and natural gas legacy has created a confusing spiderweb of buried utility lines between 100s of thousands producing and closed gas and oil wells, compressor stations and transmission lines. Perhaps the least documented and the most prevalent lines are known as "gathers," small diameter and low-pressure lines that connect wells to processing facilities. In fact, it is estimated that only 11% of all underground gas lines in Pennsylvania are mapped and somewhat accurately located and many of the "gathers" locations have been lost to time. This is a problem, because abandoned wells can be dangerous to the environment and the surrounding community. Depending on the state of decay, each well is a potential conduit for gas and oil to reach the surface or seep in to the subsurface, causing pollution to both confined and unconfined aquafers. Also, because many of these wells exist in currently unknown locations, they can interfere with modern drilling operations, creating a potential explosion hazard. This research utilizes non-invasive geophysical techniques to locate these lines, identify their construction material, and contribute their locations to a geodatabase. We are focused on an expansive farmland in Indiana County, Pennsylvania, as a test case for determining the fastest and most accurate means of detection.

Fragilariopsis kerguelensis: A Quantitative Interpretation of Diatom Growth and Nutrient Recycling

Heather Furlong

A strong correlation exists between length and width ratios for the diatom Fragilariopsis kerguelensis and iron and silica concentrations in Antarctic sea water. These are significant nutrients, and understanding how their concentrations have changed over time is significant to interpreting marine ecology in the past. This study covers the hypothesized West Antarctic Ice Sheet collapse. The largest F. kerguelensis are from glacial periods with high levels of micronutrients in the water and colder surface temperatures. Consequently, interglacial periods showed smaller measurements with limited micronutrients and increased temperatures. Length and width data was compared to depth and core age to correlate glacial and interglacial periods to growth rates, reconstructing nutrient conditions. Results yielded larger measurements from the glacial periods with high abundance of micronutrients in the water. This research has resulted in a paleoclimate record of the area to study rapid climate change on a smaller scale and understand the effects of a WAIS collapse on iron and silica availability.

Nutrient Availability and Recycling Rates Over Marine Isotope Stage 31 in the Ross Sea, Antarctica

Rock Brenner

The oceans surrounding Antarctica are very important because they can indicate glacial periods. The Scotia Sea has been drilled for core samples to help identify when the West Antarctic ice sheet may have collapsed. Core samples from the Marine Isotope Stage 31 Andrill 1B drilling operation collected samples from various depths to be analyzed for diatom distribution. One specific diatom, Fragilariopsis kerguelensis, is a good indicator of paleoclimatology. These diatoms are key producers of oxygen and energy in the Antarctic food web. They are also important for nutrient recycling in the Antarctic. My research includes using the shape and size distribution of these diatoms, along with the preservation quality to graphically correlate them to the previous glacial maximums and minimums. Correlating the data set to the glacial periods can give a time of when these diatoms lived, and further identify when the ice sheet may have collapsed. The results of this research may indicate when the ice sheet collapsed, and how nutrient recycling was effected from the collapse.

Body Mass Estimation of the *Protoceratops* and *Triceratops*

Nicole Camarda

In ornithischian dinosaurs, on three separate occasions, a rare locomotive shift occurred where whole groups had transitioned from bipedal to quadrupedal. One subgroup of the ornithischian dinosaurs, the ceratopsians, experienced this transition. Center of Mass (CoM) in bipedal organisms is much further back than in quadrupedal organisms, therefore body mass and CoM are fundamental to understanding locomotive behavior. 3D modelling and convex hulling methods will be applied to determine the body mass and CoM for Protoceratops an early, small ceratopsian dinosaur, and Triceratops, a larger and later appearing ceratopsian. Using previously ground proofed methods, we will analyze the models using volumetric body mass estimation technique, convex hulling, implementing the mass estimation equation and associated MatLAB script described in previous studies. Triceratops and Protoceratops are the first taxa of many in a larger study to determine the exact phylogenetic location of this transition from bipedal to quadrupedal ceratopsians.

Grainsize and Componentry Analysis of Multiple Vents in 2010 from Submarine Volcano NW-Rota 1, Mariana Arc

Copeland Cromwell

NW Rota-1 is a submarine volcano located within the Mariana arc. Video captured by the Jason II ROV from 2004-2010 were used to analyze activity ranging from effusive activities to strombolian-style eruptions resulting in build-up and collapse cycles of the conduit. After a collapse, the cone observed in 2009, had collapsed filling the conduit with rubble and redistributing the system into three active vents (Phantom, Brimstone, and Styx). Tephra samples were collected from each vent using the ROV before sieving, sorting by componentry, and weighing to detail tephra morphologies, componentry, and grain-size distribution. All vents have normal grain-size distributions with modes of 1-2 mm, and ranged from blocky, equant morphologies (Brimstone), blocky with major lithics (Phantom), to juvenile, glassy tephra (Styx). Tephra morphologies indicate eruptive styles: blocky, equant clasts occur at vents exhibiting effusive behavior and fluidal and glassy clasts are associated with submarine strombolian-style burst.

NOTES