

## 2017 US Hydro Conference

### Academic Poster Abstracts by College of Charleston BEAMS Program students

#### 1) Evalynn Barbare and Dr. Leslie Sautter

##### **Using Multibeam Sonar to Identify Potential Deep Sea Coral Habitat on Northwest Hawaiian Island Seamounts**

In 2016, the Obama Administration expanded the Papahānaumokuākea National Monument, located in the Northwestern Hawaiian Islands which includes numerous seamounts. During the early summer of 2014, Dr. Christopher Kelley led a bathymetric survey of this area to identify important structures for research of deep sea corals, fish and other animal habitats. Multibeam sonar and backscatter intensity data were collected on the Schmidt Ocean Institute's *R/V Falkor*, and were post-processed in CARIS HIPS and SIPS 9.1. Bathymetry, slope and backscatter intensity surfaces were used to determine which areas would be ideal for deep coral habitat, such as high slope areas with hard substrate. Three study sites were selected, including Pioneer Tablemount, Maro Reef and Raita Bank. Each site was subdivided for comparison of depth, slope and backscatter intensity. High intensity areas did not correlate with high slope, as predicted. Additional research should be conducted to examine areas of similar slope to aid in the identification of potential deep-sea coral habitats.

#### 2) Alexandra Dawson and Dr. Leslie Sautter

##### **Geomorphological Analysis of Sand Waves at Lucifer Shoals, Ireland**

During July and August of 2009, hydrographers associated with the Geological Survey of Ireland and Marine Institute of Ireland sailed aboard the *R/V Celtic Voyager* on the southeast coast of Ireland approximately 7 km east of Wexford Harbour. A complex suite of large sand bodies with depths ranging 12 to 30 m, Lucifer Shoals was surveyed using a Kongsberg EM3002 multibeam echosounder. CARIS HIPS 9.1 was used to process the multibeam data, which revealed a convoluted system of sand waves measuring ~14 km along their east-west crests, with crest to crest wavelengths ranging from ~ 200 to 300 m. The purpose of this study is to determine the geomorphology of the sand waves, including their length, width, height, and specific orientation in order to identify the water velocity and direction in this area. Backscatter intensity images generated will be used to identify differences in areas of sand and exposed underlying limestone.

#### 3) Rachel Fein and Dr. Leslie Sautter

##### **Trends in Slope and Spreading Rates of the Southern Reykjane Ridge, North Atlantic**

The Southern Reykjane Ridge is a small portion of the Mid-Atlantic Ridge starting at the Bight Fracture Zone and extending northward to Iceland. Multibeam sonar data were collected in 2013 on the *R/V Marcus G. Langseth* with a Kongsberg EM122, and bathymetry post-processing was conducted using CARIS HIPS and SIPS 9.1. Five west-east bathymetric profiles were perpendicular to the ridge axis in order to characterize and understand the geomorphic trends of the ridge flanks. West and east flanks were examined for depth, slope, and distance to the 10.9 Ma magnetic anomaly, and spreading rates were calculated. Characterizing this small southern end of the Reykjanes Ridge revealed that the west flank had steeper slopes and faster spreading rates as compared to the east flank. These methods can be used on other portions of the Mid-Atlantic Ridge to compare and understand ridge geomorphology with spreading rate.

#### **4) Treyson Gillespie and Dr. Leslie Sautter**

##### **Bathymetric Analysis of Glaciokarstic Limestone Substrate on the Western Irish Coast**

Bathymetric surveys were conducted just offshore of Inis Mór Island on Ireland's west-central coast, by the Marine Institute of Ireland and Geological Survey of Ireland as part of the INFOMAR project. Data were collected from May to June 2014 using a Kongsberg EM2040 multibeam echosounder aboard the R/V *Celtic Voyager*. Data were post-processed using CARIS HIPS and SIPS 9.1 to create both 2D and 3D bathymetric and backscatter intensity surfaces. The study site is a glaciokarstic limestone landscape formed by a shallow sea during the Carboniferous period, 359 Ma. Marine sediments have been exposed above sea level, eroded, and weathered since the Neogene period, 23 Ma. Glaciers smoothed the exposed surfaces from 2 Ma to 18,000 ybp. Faulting and fracturing along the continental shelf showcases the limestone, highlighting its glaciokarstic characteristics. The purpose of this study is to use bathymetric analysis to map and characterize the submerged limestone strata that are seen exposed subaerially.

#### **5) Ryan Hawsey, Howard Meyers, and Dr. Leslie Sautter**

##### **Comparative Analyses of Water Column Data: Investigating Shipwreck Sites off the Irish Coast**

During two research cruises in May and July of 2016 multibeam bathymetry and water column data were acquired from the western and southern coasts of Ireland in an average of 100 m water depth. These areas were surveyed and mapped by the Marine Institute of Ireland and Geological Survey of Ireland as part of INFOMAR using the R/V *Celtic Voyager* outfitted with a Kongsberg EM2040 echosounder. During this cruise more than ten shipwrecks, some of which were previously uncharted, were mapped in high resolution for the first time. Water column data were collected over the wrecks in addition to standard bathymetry data. CARIS HIPS 10.0 and QPS Qimera software were used to post-process both the bathymetric and water column data. Water column data were added to the gridded surface, over the wreck sites to accurately find least depth soundings. This process is done to provide a more complete and accurate image of the wreck site beyond what bottom tracking alone could detect. This poster will compare the workflow and end products produced by QPS Qimera 1.4 and CARIS HIPS 10.0.

#### **6) Homer Hiers and Dr. Leslie R. Sautter**

##### **Geomorphic Characterization of Submarine Canyons at Glovers Reef, Belize**

Multibeam sonar data from Glovers Reef atoll were collected by the NOAA Coastal Center for Environmental Health using a Kongsberg EM302 onboard the *E/V Nautilus* in August of 2014. Glovers Reef atoll is part of the Mesoamerican reef and is just south of Lighthouse Reef and Turneffe Reef atolls. 2D and 3D bathymetric images were generated using CARIS HIPS 9.0. This study

focuses on utilizing quantitative indices to characterize Glovers Reef canyon geomorphology. Characterization analysis focuses on indices using length, channel relief and area. Submarine canyons extend from the atoll's edge at depths of approximately 50 m to 2900 m where the areas and widths increase significantly. Geomorphologic characterization of submarine canyons can yield new information about canyon formation and sediment transport.

#### **7) Quincy Hoffer and Dr. Leslie Sautter**

##### **Morphological Analysis of Tablemounts Near Wake Island, Western North Pacific**

NOAA's Office of Ocean Exploration and Research collected multibeam sonar data south of Wake Island, Pacific Ocean in March 2016. Data were collected by the NOAA Ship *Okeanos Explorer* using a Kongsberg EM302 and post-processed with CARIS HIPS 9.1 software to create 2D and 3D bathymetric surfaces for interpretation. Ten seamounts were mapped, including 4 with extremely flat tops, referred to as tablemounts or guyots. These seamounts are remarkably similar in their general morphology. Within the survey area, most have their shoalest points at a depth of approximately 1.1 km, with some as deep as 2 km. Five tablemounts from the expedition were examined in detail. Each has a broad, flat top with flank slopes no greater than 6°. Since no ground truthing data were available, only quantitative measurements of the slope and symmetry of the tablemounts were measured and interpreted. This research serves as a window into little-known bathymetric features that are in close proximity to major islands of the western North Pacific and indicates the need for more research to be conducted in these areas.

#### **8) Luke M. Hollahan and Dr. Leslie R. Sautter**

##### **Substrate Geology of the Continental Shelf off Bertraughboy Bay, Ireland**

The continental shelf surrounding Ireland has been vigorously surveyed within the last decade by the Marine Institute of Ireland and the Geological Survey of Ireland as part of the INFOMAR program. Bertraughboy Bay, on Ireland's western coast just north of Galway Bay was an area surveyed in the summer of 2014 using a Kongsberg EM2040 Multibeam echosounder aboard the R/V *Celtic Voyager*. The bay's nearby terrestrial geology in County Galway indicates that the seafloor is primarily comprised of granites and igneous intrusive rocks with small clusters of Ordovician volcanic rocks which include pillow basalts. The hard bathymetric features may be fractured and extruded from layers of softer substrate sediments similar to the Galway Bay area giving way to complex geomorphological features. Sonar data were post-processed using CARIS HIPS and SIPS 9.1 in order to create bathymetric and backscatter intensity surfaces. The purpose of this study is to characterize the geomorphology and possible underlying geology of Bertraughboy Bay.

#### **9) Victoria Houston and Dr. Leslie Sautter**

##### **Geomorphologic Characterization of Fish Habitat on the Mid-Continental Shelf off Savannah, GA.**

In late April of 2016, students from the College of Charleston BEAMS Program collaborated with the SC Dept. of Natural Resources' MARMAP Program to conduct a hydrographic survey of a 50 km<sup>2</sup>

area on the mid-continental shelf off Savannah, GA. Data were collected aboard the Skidaway Institute of Oceanography's R/V *Savannah* utilizing a Kongsberg EM2040c multibeam echosounder. Bathymetric data at two mid-shelf sites revealed elongate sand bodies adjacent to known hard-bottom fish habitat. One site reaches a depth of 36 meters and includes a sand body 10.6 km in length, similar in scale to a nearby barrier island. The second site has a depth range of 26-40 m and includes a sand body roughly 6 km in length. Backscatter mosaics help differentiate between hard and soft substrate of sand and rock features in the study areas. This study will provide information on hard- and soft-substrate areas of known fish habitats.

#### **10) Timothy Howard and Dr. Leslie Sautter**

##### **Tectonic Geomorphology of Mud Mounds West of the Northern Mariana Trench**

NOAA's Office of Ocean Exploration and Research collected sonar data on the Philippine Plate on the western side of the northern portion of Mariana Trench between May and June, 2016. Data collected with a Kongsberg EM302 multibeam echosounder from on board the NOAA Ship *Okeanos Explorer* were post-processed with CARIS HIPS 9.1 to create both 2D and 3D bathymetric and backscatter intensity surfaces. This study site lies adjacent to the Mariana Trench and exhibits bottom depths ranging 2400 to 6900 m. The area's geomorphology was investigated using quantitative and qualitative methods, aimed towards classifying the distribution and composition of seafloor features such as mud mounds and seamounts which exhibit a variable degree of vertical relief. By investigating the various geomorphological expressions associated with this section of the Mariana Trench, a more detailed understanding can be drawn of the tectonic and sedimentary processes predominating in this area.

#### **11) Robert Kozich and Dr. Leslie R. Sautter**

##### **Investigating Submerged Glacio-Karst Limestones off the Aran Islands, Ireland**

As part of the Marine Institute and Geological Survey of Ireland's INFOMAR Program, bathymetric data were collected from May to August 2014 in the northwest channel off Inishmore, Ireland, one of the Aran Islands. The vessel used to collect these data was the R/V *Celtic Voyager* equipped with a Kongsberg EM2040, and bathymetric and backscatter surfaces were created using CARIS HIPS and SIPS 9.1. During the Carboniferous Period a warm, shallow sea formed in this area, causing the formation of limestones that make up today's Aran Islands and the adjacent Irish shoreline. This area has been greatly affected by the sea level rise and fall, and during the Pleistocene Epoch glaciers eroded the exposed limestones. Glacio-karst features are now submerged and were examined to characterize their geomorphology on the seafloor.

#### **12) William Oksen and Dr. Leslie Sautter**

##### **Analysis of Rogatien Ridge and Gardner Pinnacle in the Northwest Hawaiian Islands for Potential Deep Sea Coral Environment**

In May of 2014, the Schmidt Ocean Institute gathered multibeam sonar bathymetric data of the Papahānamokuākea National Monument including Rogatien Ridge and the areas surrounding Gardner Pinnacle. Prior to this cruise, minimal amounts of research had been conducted in this area to explore

its potential for deep sea coral habitats. Deep sea corals have been found just west of Gardner Pinnacles at depths from 1000 to 2000 m. Using CARIS HIPS and SIPS 9.1, CUBE BASE surfaces and backscatter mosaics were generated to analyze five study sites for their potential as coral environment. Deep sea corals have been known to thrive in areas of high slope and high backscatter intensity, which the sonar data indicate are found in areas north, northeast, and west of Gardner Pinnacles as well as the east and west banks of Rogatien Ridge.

### **13) Graham Schertz and Leslie R. Sautter**

#### **Characterization of Bathymetric Geomorphology West of the Sangihe Islands**

A bathymetric survey in June – August of 2010 was conducted by NOAA scientists, aboard the NOAA Ship *Okeanos Explorer* using a Kongsberg EM302 multibeam echo sounder on the east side of the Celebes Sea in the Western Pacific. The study area is located west of the Sangihe Islands, a volcanic arc. Post-processing of bathymetric data was completed using CARIS HIPS & SIPS 9.1 to create 2D and 3D bathymetric and backscatter intensity surfaces. The purpose of this study is to characterize the area's geomorphology that is resultant of tectonic activity. The Sangihe Islands range from an elevation of 1320 m, to seafloor depths of nearly 6 km. These islands are also situated very close to the connecting intersection of the Eurasian, Philippine, Pacific, and the Australian Plates. Heavy tectonic activity that formed the volcanic island arc also formed interesting bathymetry in the surrounding area, described in this study.

### **14) William Woody Thomas and Dr. Leslie Sautter**

#### **Deep Sea Coral Habitat Throughout Perth Canyon, Australia**

In March 2015 scientists from the University of Western Australia led an expedition to map Perth Canyon, Australia on board the Schmidt Ocean Institute's R/V *Falkor*. Little was known about Perth Canyon prior to this expedition. The researchers wanted to learn more about the bathymetry and benthic marine life throughout the canyon, with a particular emphasis on examining deep coral habitats. With the use of CARIS HIPS and SIPS 9.1, bathymetry and backscatter surfaces were generated from multibeam sonar data in order to characterize and classify the canyon's seafloor. Based on the backscatter intensity and depth ranges of seven known coral locations, ArcGIS was used to produce a map showing additional potential deep sea coral habitat sites.

### **15) Wesley S. Tucker and Dr. Leslie Sautter**

#### **Campeche Escarpment Submarine Canyon Geomorphic Characterization**

Bathymetric surveys were conducted in the southern Gulf of Mexico along the Campeche Escarpment, north of the Yucatán Peninsula, by the Monterey Bay Aquarium Research Institute in March 2013. Multibeam sonar data were collected onboard the R/V *Falkor* and were post-processed using CARIS HIPS and SIPS 9.1. Numerous submarine canyons were observed along the length of the escarpment, previously undetected by earlier seismic surveys. In this study, three of the larger submarine canyons were characterized using cross-channel profiles along each canyon's axis and measuring variations in channel width and symmetry at selected depths above the thalweg. The

canyons were found to be strikingly different in size and geomorphology, and canyon widths were found to fluctuate as distance from the canyon head increased. The method of submarine canyon characterization used by the study displays the geomorphological uniqueness of these features; additional investigations of the canyons along Campeche Escarpment would provide further understanding of the geologic history of the Gulf of Mexico.

## **16) Mallory McCormack and Dr. Leslie Sautter**

### **Analysis of Axial Valley Width at the Bight Transform Fault, North Atlantic**

The Bight Transform Fault (BTF) is the first transform fault on the Mid-Atlantic Ridge (MAR) south of Iceland and marks the reorganization from the obliquely spreading Reykjanes Ridge north of the BTF to the prominently perpendicular spreading of the MAR immediately south of the BTF. The objective of this study was to measure and analyze the axial valley width just north, south, and directly on the fault zone. Bathymetric data were acquired aboard the Lamont-Doherty Earth Observatory's ship *R/V Marcus G. Langseth* in August-September of 2013 using the Kongsberg EM-122 and post-processed in CARIS HIPS and SIPS 9.1.