Oral Session I, Saturday April 7, 2018, 10:20 AM – 12:00 PM

10:20 AM

1. A Bottom-Up Method to Estimate Species Specific Primary Production Rates on Coral Reefs

Daniel Owen*, William K. Fitt, Matthew H. Long, Brian M. Hopkinson, *University of Georgia*

Coral reefs are known to have extremely high rates of primary production as determined by geochemical approaches such as eddy covariance and the boundary layer method. However, these geochemical methods cannot distinguish which organisms are responsible for primary production. Corals visually dominate the landscape on pristine reefs, but primary producers on coral reefs are diverse and include corals (through their symbiotic algae), fleshy algae, turf algae, and gorgonians. Here we describe a "bottom-up" approach to estimate the contribution of different types of primary producers to total primary production on coral reefs based on scaling up taxon-specific rates of production by the abundance of those taxa in the environments. First, photographic 3D mapping was employed to build high resolution 3D images of the benthic ecosystem. Next, primary producers and their surface area were determined in the 3D reconstruction using machine learning tools. Chamber measurements of photosynthetic rates of the major sessile components of a reef benthic community were then obtained as a function of irradiance, the primary short-term driver of photosynthesis. The metabolic rates of individual reef community members were combined with their surface areas obtained from the 3D benthic maps and a light model to estimate of total reef metabolism and partition total reef productivity among community members. Our primary study site was Little Grecian Reef in the Florida Keys where we have obtained measurements of photosynthetic rates on the dominant primary producers and have generated 3D reconstructions of sections of the reef. Future plans include pairing "bottom-up" estimates of primary production with eddy- covariance approaches to put better constraints on the "bottom-up" estimates and identify potential sources of error.

10:35 AM

2. Fine scale benthic invertebrate megafaunal assemblage structure on the north pacific seamount Mokumanamana

Nicole Morgan*, Savannah Goode, E. Brendan Roark, Amy R. Baco, *Florida State University*

Changes in megafaunal assemblage structure have been found across gradients of environmental variables for many deep-sea habitats, including seamounts (e.g. Schlacher et al. 2014, Long and Baco 2014). The goal of this project was to assess the scales of variability in benthic communities on a smaller scale of within a single seamount and to assess environmental drivers of assemblage changes. As part of a larger project examining recovery of seamount benthic communities from trawling, replicate 1 km transects were conducted at 50m intervals from 200-700m depth using the AUV Sentry from multiple sides of 10 seamounts in the Northwestern Hawaiian Islands and Emperor Seamount Chain. From these we selected Mokumanamana, in the Papahānaumokuākea Marine National Monument, as the seamount of focus because it is a site with no known trawling history and had the most even coverage of the targeted depth intervals on three sides of the explored feature. Replicate transects were analyzed for invertebrate megafauna. Substrate parameters were also collected from imagery (i.e. substrate type) and multibeam data as well as water column data collected by the AUV Sentry. The dominant megafaunal taxa were sponges, sea pens, and corallimorpharians. Octocoral and Scleractinian cup corals were also abundant. Communities varied by substrate type, with soft substrates being somewhat less diverse than hard substrate areas. Overall, abundance of megafauna increased with depth, and assemblage structures suggested three main clusters defined by "shallow" (200-350), "mid-depth" (400-500), and "deep" (550- 700), but also different assemblages between the north and west sides of Mokumanamana for the mid- depth and deep groups. The deep groups also have a higher overall diversity while the mid-depth group was lowest. Depth and sandiness were the main factors correlated with assemblage change over, but depth was also highly correlated to many other environmental variables which could instead be driving these changes.

10:50 AM

3. Spatial data shift algorithm for 3-oxygen-probe aquatic eddy covariance system

Alireza Merikhi*, Peter Berg, Markus Huettel, *Florida State University*

With the aquatic eddy covariance method, benthic oxygen fluxes can be measured non-invasively using synchronized high resolution current velocity and oxygen concentration. We used a newly developed aquatic eddy covariance instrument with three oxygen optodes mounted such that they were pointing to the same measuring volume from different directions, with 120° angle between the optodes. The sensors were located 1.5-2 cm apart from measuring volume of an Acoustic Doppler Velocimeter (ADV). This produces a time lag between oxygen and velocity data that can produce inaccurate flux estimates. Traditionally for eddy covariance method, scientists shift the data in the time domain to produce synchronized oxygen and velocity data. Because of the continuous variation in current and wave motion, using time shift in the time domain might introduce errors. The arrangements of sensors help estimate the oxygen value in the measuring volume of the ADV using shift in space domain. We tried to derive arithmetic relations that can produce oxygen concentration in the measuring volume using oxygen concentration of the sensors that were reading beside the measuring volume of the ADV (i.e. shift in space domain). The instrument was deployed in a back reef area with carbonate sand in the Florida Keys. Fluxes calculated from each of the oxygen optodes were similar, but in some instances, differed between optodes. We found out that the fluxes calculated using shifted data in space domain are more realistic but comparable to those calculated using shift in the time domain.

11:05 AM

4. What sets the vertical structure of the ocean deoxygenation in warming climate?

Daoxun Sun*, Taka Ito, *Georgia Institute of Technology*

Observational and modeling studies show that dissolved oxygen (O_2) declines as the ocean heat content increases under the anthropogenic climate warming. However, the vertical pattern of ocean heating and O_2 loss are largely different. While the temperature increase primarily occurs in the upper ocean, the O_2 decline is relatively uniform throughout the water column. In this study, we analyze the 21st century projections of a subset of CMIP5 models forced by the RCP8.5 scenario. In the upper ocean, the O_2 decline is mostly driven by the warming-induced decrease in solubility. Below 1,000m the primary mechanism is the increase of apparent oxygen utilization (AOU) accompanied by the accumulation of phosphate (PO_4) in the deep water. A theoretical framework is developed to understand the vertical re- distribution of PO_4 linked to the deep AOU increase, which is determined by the relative strengths of vertical circulation and the rate of biological PO_4 utilization at the surface. Weakening of the vertical circulation and an increase in biological efficiency (defined as organic export per available nutrient) together drive the depletion of upper ocean nutrient and enrichment in the deep water. Even though the order of power law relationships varies among different models, the correlation between PO_4 distribution and these two factors remain valid in all models. Between the two mechanisms, the changes in biological efficiency is more uncertain factor in predicting future marine O_2 change.

11:20 AM

5. Origins of Life Chemistry: Prebiotic Metabolite Production in Simulated Hydrothermal Vent Environments

Arthur Omran*, Oliver Steinbock, *Florida State University*

Hydrothermal environments could be the setting for where life originated. Hydrothermal vent chimneys such as black and white smokers can be simulated in the lab using pump injected chemical garden tubes. The hydrothermal vent chimneys are examples of chemical gardens themselves. To simulate white smoker hydrothermal vents, we have synthesized calcium carbonate and barium carbonate chemical garden tubes, by injecting calcium chloride and barium chloride respectively, into sodium silicate solution. To simulate black smoker hydrothermal vents, we have synthesized iron (II) sulfide chemical garden tubes, by injecting iron (II) chloride into sodium silicate solution containing sodium sulfide. We have characterized these precipitation products spectroscopically and with x-ray diffraction. We then expose these tubes to hydrothermal conditions and added formaldehyde. Various products were formed that are associated with metabolism. We found that these tubes act as a heterogeneous catalyst for the formose reaction and produce various sugars associated with the reaction. Furthermore, we found that at lower starting pH values for our system the calcium and barium tubes act as a catalyst for the Cannizzaro reaction, producing formic acid and methanol; additionally, the iron sulfide tubes catalyze the production of glyoxylic acid. We verified the products of these reactions using 1H NMR. Moreover, the presence of organic species in the system does not inhibit the precipitation formation of the chemical garden tubes. Finally, we demonstrate that the carbonate tubes evolve a bicarbonate buffer. We believe that synthesis and transport in a hydrothermal environment could form, and subsequently protect via buffering, biomonomers setting the stage for further chemical evolution.

Oral Session II, Saturday April 7, 2018, 1:00 PM – 2:30 PM

1:00 PM

6. Microbial Community Assembly in Marine Phytoplankton-Bacteria Model Systems

He Fu*, Mary Ann Moran, *University of Georgia*

Marine bacteria are recognized to play vital roles in global biogeochemical cycles, yet little is known about the factors that determine how bacterial communities assemble in the surface ocean, and how specific biogeochemical functions are distributed among community members. Here, using metabolite suites released by marine phytoplankton as substrates, we examined how resource supply shapes the structure and function of these communities. Natural seawater bacteria were inoculated into 96-well microtiter plates containing either diatom- or dinoflagellatederived metabolites suites, with each suite consisting of five distinct compounds that were presented to the bacteria in different combinations. The well-mixed liquid cultures (n=4 for each substrate combination) were transferred every 24 h for 8 d to select for communities adapted to the metabolite mixtures. We then analyzed the final composition of the bacterial community as well as the initial inoculum by sequencing 16S rRNA gene amplicons using the Illumina Miseq platform. Most final communities are dominated by OTUs from Alphaproteobacteria (*Rugeria, Loktanella*), Gammaproteobacteria (*Vibrio, Marinobacterium, Oceanspirillaceae*), Cytophagia or Flavobacteriia. Overall, Rugeria was the most abundant genus, but oligotyping analysis revealed fine-scale variation in the dominant member of this genus among treatments. Functional trait distribution and expression is currently being examined by high-throughput metagenomic and metatranscriptomic sequencing. Bacterial strains were isolated from the final communities, and will be analyzed for metabolic capabilities, substrate uptake parameters, and growth rates on the phytoplankton metabolites.

1:15 PM

7. ABC Transporters Mediated Multidrug Resistance in Prostate Cancer Cells

Toluleke O. Famuyiwa*, Joubin Jebelli, Elizabeth Ramirez, Allen Reilly, Christopher Pecille Dr. Kumi-Diaka, *Florida Atlantic University*

Prostate cancer is the second most diagnosed cancer. This study focuses on overcoming ATP Binding Cassette (ABC)-mediated drug resistance in prostate cancer treatment. Objective of study: This study aims to (i) investigate the interaction between 3-BPA and SC-514, (ii) reduce treatment- induced ABC-mediated multidrug resistance(MDR), and (iii) investigate the signaling pathways involved in ABC transporter mediated MDR. Method: We utilized Poly Lactic-co-Glycolic Acid (PLGA) nanoparticles as a co- delivery system for SC-514 and 3-Bromopyruvate (3-BPA) in LNCaP cells. The impact of varying concentrations of these drugs on LNCaP cells was studied. Bioassays used included Trypan Blue, MTT, and NBT. Florescence microscopy was performed. Results: A One-way ANOVA was conducted to compare 3-BPA, SC-514, and the combination of 3-BPA and SC-514 after 24 hours of treatment. The result show that the p-value= 0.00023. Regression analysis of the results from the time dependent experiments were performed. The regression analysis showed the following p-values: 24hrs (0.00023), 48hrs (0.00003), 72hrs (0.000000152), 96hrs (0.000000049). ROS levels of LNCaP cells treated with 3-BPA (r=-0.5), SC-514 (r=- 0.72) and 3-BPA + SC-514 (r=-0.58) were compared using one-way ANOVA. The result showed no significant difference in ROS modulation (p=0.54). Conclusion: There is a weak to moderate correlation between ROS levels and cell death. Additionally, there was a positive correlation between the drug concentrations and cell death.

1:30 PM

8. Expanding the Structural and Phylogenetic Diversity of Conductive Geopili

Marcus S. Bray*, Bianca F. Costa, Jieying Wu, Cory C. Padilla, Frank J. Stewart, David A. Fowle, Cynthia Henny, Sean A. Crowe, Jennifer B. Glass, *Georgia Institute of Technology*

Microbial Fe(III) reduction is important to both biogeochemistry and biotechnology. Many Fe(III)-reducing microbes belong to the order Desulfuromonadales within the Deltaproteobacteria. To mediate extracellular electron transport to Fe(III)-oxide particles, Geobacter spp. use conductive type IV pili (or "geopili"), which are assemblies of pilin monomers containing >9.5% aromatic amino acids. The environmental importance and phylogenetic distribution of conductive type IV pili are largely unknown. In this study, novel pilin genes were characterized from a metagenome of an incubation of anoxic, Fe(III)-rich lake sediments from Lake Matano, Indonesia, an Archean ocean analog. Two genes encoding putative conductive type IV pilin monomers (55 and 187 amino acids with 14.5% and 9.6% aromatic amino acids) were studied with in silico modelling. Structural models showed that both putative pilins form pili with aromatic residues positioned down their lengths in a spiral structure with 2-12 Å spacing. Surveys of marine and freshwater sediment metagenomes identified putative conductive geopilins from Betaproteobacteria, Deltaproteobacteria, and various candidate phyla, suggesting a widespread environmental role for conductive geopili. More studies are needed to characterize the role that these "geopili" play in the environment (e.g. mediating Fe(III) reduction or other functions, such as direct interspecies electron transfer).

1:45 PM

9. High depth resolution of methanogenic estuarine sediments reveals ANME-1 as sole methanogen

Richard Kevorkian*, Sean Callahan and Karen G. Lloyd, *University of Tennessee*

Difficulty measuring growth and diversity of microbes in marine sediment limits our ability to assess putative metabolisms, in situ growth rates, and niches of uncultured taxa. We sampled sediments from the White Oak River estuary at 1-cm resolution down to 72-cm, encompassing the full sulfate-methane transition zone. Of sequences belonging to methanogen-like archaea, 99.24% were ANME-1, which increased to 99.95% in the methanogenic zone. Some operational taxonomic units (OTUs) of ANME-1 and all putative sulfate reducing bacteria from SEEP-SRB1 had correlating peaks at the base of the anaerobic methanotrophic zone. ANME-1 was the only group of methane-like archaea that increased in relative abundance in the methane production zone. No sulfate or iron reducing bacteria or increased in this zone. Using a novel method of calculating doubling time for slow-growing microbial taxa measured from the change in the product of relative read abundance and cell counts, we were able to determine the doubling time of microbes present in the anaerobic methanotrophic and methanogenic zones. Our results suggest that ANME-1 can grow as either methanogens or methanotrophs, with a subset of ANME-1 OTUs only increasing in the anaerobic methanotrophic zone, a different subset increasing only in the methanogenic zone, and a third subset increasing in both zones.

2:00 PM

10. Role of Mn(IV) oxides in abiotic nitrous oxide production

Amanda Cavazos*, Martial Taillefert, Yuanzhi Tang, Jennifer Glass, *Georgia Institute of Technology*

Manganese (Mn) oxides can react with short-lived nitrogen intermediates to "bypass" bacterial pathways of nitrogen transformations. One such reaction is the oxidation of the nitrification intermediate hydroxylamine (NH_2OH) by birnessite (hereafter NH_2OH chemo-oxidation) to produce the potent greenhouse gas, nitrous oxide (N_2O). This study is the first to characterize the kinetics and mechanism of NH2OH chemo-oxidation using a particulate Mn oxide (birnessite) and a N_2O microsensor to acquire real- time data. The reaction was found to be overall first order with respect to NH_2OH with a rate constant of $0.009 \pm 0.002\ s^{-1}$. The reaction is fast, with complete NH_2OH consumption occurring within 3 minutes. Addition of a nitroxyl scavenger reduced N_2O yields and production rates by 52-60%, indicating that nitroxyl is an intermediate during NH_2OH chemo-

oxidation. The proposed mechanism of NH_2OH chemo- oxidation involves two one-electron transfer steps from NH_2OH to MnO_2 to first produce an aminoxyl radical, followed by the formation of nitroxyl, which then undergoes dimerization to produce N2O. Decreased rates of N_2O production with faster NH_2OH consumption and with increasing birnessite concentrations suggests that the produced nitroxyl is being adsorbed onto the birnessite surface. Our findings suggest a complex, “cryptic” coupling between the nitrogen and manganese cycles, with interactions occurring so rapidly, they are nearly impossible to measure in situ. Given the ubiquity of manganese oxides and nitrogen-metabolizing microbes, NH_2OH chemo-oxidation has the potential to contribute to global N_2O emissions.

Oral Session III, Saturday April 7, 2018, 2:50 PM – 4:20 PM

2:50 PM

11. Investigating a unique open ocean geochemical record of the end Triassic mass extinction from Panthalassa

Selva Marroquín*, Benjamin Gill, *Virginia Polytechnic Institute and State University*

The end-Triassic mass extinction (~201 Ma) was a time of intense disturbance for marine communities. This event is estimated to have produced as much as a loss of ~80% of known marine species. The protracted interval of elevated extinction rates is also characterized by a major carbon cycle perturbation and potentially widespread oxygen deficiency within the oceans. While the causes of extinction and environmental feedbacks are still debated it is hypothesized to have been triggered by massive volcanism associated with the Central Atlantic Magmatic Province flood basalts. However, our understanding of the Latest Triassic-Earliest Jurassic interval is limited due to the lack of well-preserved stratigraphic successions outside of the Tethys Ocean (present day Europe), with most of the records from epicontinental and marginal marine settings. To expand our understanding of this critical interval, our study seeks to document biological and environmental changes elsewhere. Specifically, we document and reconstruct these changes in the equatorial Panthalassan Ocean. We will present new data from a sedimentary succession preserved in the Wrangell Mountains of Alaska that spans the Late Triassic through Early Jurassic. The sedimentary succession represents a mixed carbonate-siliciclastic ramp that was deposited at tropical latitudes, adjacent to an island arc in the open Panthalassan Ocean. This succession affords a unique view of open marine conditions, and also holds the potential for excellent temporal control as it contains abundant ash layers throughout, as well as, key ammonite and bivalve fossil occurrences that provide biostratigraphic control. We will present an integrated geochemical and paleontological record from this site using several geochemical proxies (carbon, d13C and % total organic carbon, sulfur, d34S, as well as pyrite contents and iron speciation) along with ammonite and bivalve occurrence data to reconstruct the record of environmental and biological change within the open Panthalassan Ocean, and relate these data to existing marine records of the end-Triassic extinction.

3:05 PM

12. A comparative assessment of the role of anoxia during the Cambrian SPICE event

Matthew LeRoy*, Benjamin Gill, *Virginia Polytechnic Institute and State University*

The Cambrian SPICE (Steptoean Positive Carbon Isotope Excursion) is recognized as a major oceanographic event recorded as positive shifts in the marine carbon (d13C), and sulfur (d34S) isotopic records. These trends are thought to result from an increase in the areal extent of marine anoxia, a process that enhances the burial effi ciency of organic matter and pyrite. However, direct sedimentary (e.g., abundant black shale) and geochemical (e.g., redox proxy) evidence for such a change is scant. While the antiquity of this event is likely responsible for the loss of much of this evidence, through destructive tectonic processes, a number of stratigraphic successions suitable for investigating this hypothesis exist. Here, three such successions are compared to explore the relationship between local redox conditions (tracked using iron speciation as a proxy) and the isotopic trends of the SPICE. The units studied are: the Nolichucky Formation of Laurentia (Ohio and Kentucky), the Alum Shale of Baltica (Sweden), and the Outwoods Shale of Avalonia (U.K.). Our iron speciation analyses indicate oxygenated conditions prior to the SPICE along Laurentia, with Avalonia intermittently, and Baltica persistently anoxic. During the onset of the SPICE (positive shift in d13C), anoxic conditions developed in Laurentia, and intensified in Avalonia and Baltica, developing into persistent euxinia (anoxia with free H_2S) at the later location. These redox changes were coupled with an increase in pyrite abundance, d34S and total organic carbon (TOC) at each location. While large differences in nutrient availability and sedimentation rates are likely responsible for between-site differences in TOC, the shift to more reducing conditions during the SPICE is the most likely cause of the observed within-site increases. The data presented here provide compelling geochemical evidence for increased anoxia and organic carbon and pyrite burial associated with the SPICE while also illustrating important differences in its localized stratigraphic expression.

3:20 PM

13. Assessing gas transfer velocity in a shallow, microtidal estuary

Bryce Van Dam*, Craig Tobias, James Edson, *University of North Carolina at Chapel Hill*

Gas exchange across the air-water interface (F) is proportional to the air-water concentration gradient (ΔC), and a gas transfer velocity (k), such that F~k×ΔC. The largest source of variability in determining F is related to the parameterization of gas transfer velocity. k is reasonably well constrained through its empirical relationship with wind speed in open ocean systems, but is complicated by additional factors such as, bottom-generated friction, turbidity, wave breaking, biological surfactants, and water-side thermal convection in coastal and estuarine systems. Hence, global estimates of estuarine carbon dioxide emissions are challenged by uncertainty in k. In this study, we directly measure the gas transfer velocity (k) by an eddy covariance approach, and assess its physical forcing. We did find a relationship between wind speed and k, but found that it varies significantly between night and day, a difference that may be attributed to variations in water-side convection. This is a novel finding for estuaries, and should serve to better inform global estimates of estuarine carbon dioxide emissions. When compared with k parameterizations derived from the literature, ours generate similar carbon dioxide emissions on an annual scale, but diverge when assessed over shorter time-scales. It appears that it may be sufficient to use a single, average k value when gas exchange is assessed over months to years, but specific physical forcing must be accounted for when fluxes are determined at shorter time scales.

3:35 PM

14. The role of priming effects on the conversion of blue carbon to CO2 in the coastal zone

Elise Morrison*, N. Ward, A. Arellano, Y. Liu, A. Rivas-Ubach, A. Ogram, T. Osborne, D. Vaughn, T.S. Bianchi, *University of Florida*

Coastal ecosystems are recognized as valuable but vulnerable carbon (C) sinks, and the C stored in these systems is often referred to as blue C. These systems face many threats, particularly along low-relief coastlines such as Florida, which are susceptible to erosion and C loss as sea levels rise. Peat-derived organic matter (OM) may be degraded within downstream estuarine systems, and its degradation may be enhanced in the presence of labile algal-derived OM via microbial priming effects. To investigate the role of microbial priming effects on the degradation of peat-derived blue C, incubations were established and a suite of analyses were conducted to evaluate changes in peat-derived OM, CO2 production, metabolites, and microbial communities (via metagenomic sequencing) over the course of the experiment. Four treatments were established: seawater with peat and algal leachate (SWPA), seawater and peat leachate (SWP), seawater and algal leachate (SWA), and seawater alone (SW). Over the course of the incubation, CO2 concentrations increased in all treatments, with the highest CO2 levels in treatments with algal- derived DOM (SWA and SWPA). Metagenomic sequencing revealed that there were differences in microbial community composition and functional gene abundance between treatments. We found that members of the Gammaproteobacteria were most abundant in the primed treatment (SWPA) and have previously been described as important DOM-cyclers in aquatic systems. Unique functional genes for the degradation of aromatic compounds were also seen within the primed treatment, suggesting that there may be greater potential for lignin degradation with primed conditions. Overall, these findings suggest that there is an increase in microbial degradation of peat when in the presence of algal-derived DOM, which may drive the conversion of blue carbon stocks to CO2 when exported to estuarine systems.

3:50 PM

15. Characterization and Degradation of Hydrocarbons Buried in Dry Pensacola Beach Sand

Ioana Bociu*, Markus Huettel, *Florida State University*

Following the 2010 Macando blowout, a significant amount of released oil was transported from surface water to the shoreline of Pensacola Beach. Some of the weathered oil became embedded in Pensacola Beach sand

and it was unknown how this oil would be degraded. To address this, a time series study was initiated that investigated the fate of oil buried at different depth in dry beach sand. The primary objectives of the study were (i) to determine the loss over time and depth of total hydrocarbons (ii) to investigate the degradation rates of hydrocarbons in the buried oil. Oil-sand aggregates were collected from Pensacola Beach. Afterwards, known amounts of the homogenized material was encased in stainless steel mesh balls and buried over three years at different depths in the beach where the material was removed. Initial and final weights of the oil-sand samples were taken to assess the loss of material. Straight chain alkanes and PAHs of interest were analyzed to evaluate details of the degradation process.

4:05 PM

16. Dissolved Organic Matter Throughout the Georgia Coastal Ecosystems LTER Domain: Sources, Distribution and Biodegradation

Maria Letourneau*, Sylvia C. Schaefer, Patricia M. Medeiros, *University of Georgia*

Estuaries are hotspots of dissolved organic matter (DOM) processing and cycling and are an important link between the terrestrial and marine environments. In these systems, DOM composition is controlled by the relative contribution of many different DOM sources as well as by complex interactions of physical, chemical and biological processes that affect DOM distribution, transformation and degradation. In this context, we used a combination of bulk, optical and molecular analyses to identify sources and characterize processing of DOM in the Georgia Coastal Ecosystems LTER domain (USA). Through seasonal sampling (April, July, October 2017 and January 2018) across 15 stations throughout the entire expanse of the Altamaha River and Estuary, dissolved organic carbon (DOC) concentration and DOM composition were investigated over the course of a year. Short- and long-term dark incubations were conducted to observe bacterial degradation over different time scales and to assess changes in biodegradation rates by season and by location throughout the estuary. Our preliminary results showed that DOC concentrations were highest in all seasons in the upstream part of the estuary and decreased towards the ocean. Optical data showed that the section of the estuary near the Altamaha River had the highest aromatic content (lowest spectral slope) in all seasons and decreased downstream and further from the river. Interestingly, October samples had the highest DOC contents, lowest spectral slopes (highest terrestrial inputs), and highest DOM biodegradation rates, indicating the remobilization and input of different organic matter source(s) to the estuarine area.

Oral Session IV, Sunday April 8, 2018, 9:00 AM – 10:30 AM

9:00 AM

17. Wastewater remediation coupled with fuel production from the cultivation of oleaginous algal micro-organisms native to Tallahassee, FL

Lowell Collins*, Ashvini Chauhan, *Florida A&M University*

This study sought to identify novel species of algae native to the microbial ecology of wastewater in Tallahassee Florida for producing bio-fuels and materials from algal lipids. The study tests selected strains for neutral lipid production, growth rates and their ability to compete in the wastewater environment. The end goal is to produce neutral lipids for domestic fuel production and phytoremediation benefits to the water treatment process. In conventional algal cultivation, algal producers face barriers that include; a steady and cost-effective supply of nutrient, freshwater and an algal strain that endures the environmental pressures associated with open-air production methods. The application of algal sourced bio-fuel and the co-production of material is limited by the ability to produce algal biomass in suffi cient commercial quantities. Industrial production of algal oil that would be competitive with the current petroleum oil model has not yet been achieved. This research isolated both eukaryotic algal strains and prokaryotic cyanobacterial strains from wastewater treatment plant holding tanks. The strains were characterized by growth rates, cellular pigment, and genetic sequencing as well as neutral lipid profiling. Following characterization, the strains selected for their ideal qualities were cultivated with water from two main aspects of the water reclamation process: raw influent and treated effluent. The strains were monitored during a ten-day trial to determine their ability to remediation nutrients and maintain a stable colony under open-air conditions and weather changes.

9:15 AM

18. The response of microbially-mediated organic matter decomposition to elevated temperature in peatlands

Tianze Song*, Jose L. Rolando, Max Kolton, Rachel Wilson, Jason Keller, Scott Bridgham, Jeff Chanton, and Joel E. Kostka, *Georgia Institute of Technology*

Northern peatlands store approximately 30% of terrestrial carbon, and act as a substantial source for a potent greenhouse gas (GHG), methane (CH_4). Since anoxic peatlands harbor low concentrations of inorganic electron acceptors, methanogenesis is considered as the dominant terminal electron accepting process (TEAP) coupled to organic matter degradation; however, the stoichiometry of the belowground carbon cycle often does not support this assumption. To quantify anaerobic organic matter decomposition to CO_2 and CH_4 with presence of dissolved organic carbon (DOC) and under warming conditions, we anaerobically incubated fresh peat from S1 bog of Marcell Experimental Forest (Minnesota, USA) amended with either DI or porewater under 3 temperatures (4 ℃, 14 ℃ and 25 ℃). Headspace gas production was sampled and analyzed regularly. In both treatments, environmental warming resulted in a substantial increase in CH_4 and CO_2 production rates. Under elevated temperature conditions (14 ℃, 25℃), porewater treatment stimulated gas production twofold relative to DI water treatment. The CO_2:CH_4 ratio decreased with elevated temperature, indicating that organic matter decomposition shifts toward methanogenesis as a TEAP. Peat incubations within DI water resulted in lower CO_2:CH_4 ratios in comparison to porewater treatments, suggesting CH_4 served as a predominant electron sink in DI water. Overall, a significant stimulation of peat methanogenesis under warming conditions was observed. Gas production appears to be stimulated by porewater, perhaps due to the presence of additional carbon sources in DOC. However, porewater DOC appears to compensate for the increase of overall GHG production by moderating methanogenesis as a TEAP. This dual effect of DOC under warming conditions may play a crucial role in balancing carbon emission from peatland ecosystems.

9:30 AM

19. Polysaccharide Complexes in Sphagnum Moss Promote Decarboxylation and Mitigate CH_4 Production in Catotelm Peat

Alexandra Cory*, Rachel Wilson, Beth Holmes, Claire Wilson, Jeffrey Chanton, *Florida State University*

Thermodynamic models of the anaerobic, saturated region of peatlands (catotelm) predict a 1:1 CO_2:CH_4 production ratio. We observe this production ratio in fens—dominated by grasses and sedges—but bogs—dominated by Sphagnum moss—significantly exceed this ratio. Fermentation alone cannot account for >>1 CO_2:CH_4 production ratios because it requires an electron sink to prevent excess buildup of H_2. We investigate the potential role of galacturonic acid (GalA), a major component of Sphagnum cell walls, in both sustaining >>1 CO_2:CH_4 ratios and limiting decomposition rates. To examine the CH_4 and CO_2 production response to GalA, we performed 100-day anaerobic incubations on GalA-amended and unamended bog peat. GalA additions suppressed CH_4 production substantially and elevated CO_2 production slightly, yielding substantially elevated CO_2:CH_4 production ratios. Further analyses will be conducted to determine the degree of abiotic control over GalA-induced decarboxylation and amine- immobilization reactions.

9:45 AM

20. Assembly, ecological function and evolutionary conservation of the Sphagnum core microbiome across the North America continent

Max Kolton*, Jonathan Shaw, David Weston, Joel E. Kostka, *Georgia Institute of Technology*

Peat mosses of the genus *Sphagnum* are among the oldest of terrestrial plants. *Sphagnum* dominates the primary productivity of northern peatland ecosystems and plays a crucial role in global nitrogen and carbon cycles. While the physiology and ecology of *Sphagnum* have been well-studied, the recruitment of microbial populations and holobiome evolution are poorly understood. Applying a multi-omic approach to analyze the composition and activity of *Sphagnum*-associated microbiomes across the North American continent (from New York to Alaska), we confirmed that geographical location is the primary determinant of *Sphagnum* microbiomes. Nevertheless, analysis of the core microbiome suggests that approximately 60% of microbial populations are shared among *Sphagnum* individuals regardless of geographical location. Interestingly, the nitrogen-fixing, core microbiome consisted almost exclusively of 2 genera, taxonomically affiliated with *Nostoc* (symbiotic cyanobacterium) and *Methyloferula* (an obligate methanotroph). Finally, taxonomic and functional analysis indicated that the nitrogen-fixing cyanobacterial genus *Nostoc* represents 27% of total annotations in metagenomes sampled from representative *Sphagnum* species. Results suggest a critical role for Nostoc and *Methyloferula* in *Sphagnum* physiology, and emphasize the ecological importance of the core microbiome for plant performance in response to abiotic stressors. Finally, high conservation of a core microbiome points to coevolution with *Sphagnum* plants over their 400 million year history.

10:00 AM

21. Ozone deposition to forests degrades water-use efficiency across multiple ecosystems

Jason Ducker*, Christopher D. Holmes, Trevor Keenan, Silvano Fares, Allen Goldstein, Ivan Mammarella, William Munger, Jordan Schnell, *Florida State University*

We develop and evaluate a method to estimate O_3 deposition and stomatal O_3 uptake across networks of eddy covariance flux tower sites where O_3 concentrations and O_3 fluxes have not been measured. The method combines standard micrometeorological flux measurements, which constrain O_3 deposition velocity and stomatal conductance, with a gridded dataset of observed surface O_3 concentrations. Measurement errors are propagated through all calculations to quantify O_3 flux uncertainties. We evaluate the method at three sites with O_3 flux measurements: Harvard Forest, Blodgett Forest, and Hyytiälä Forest. The method reproduces 83% or more of the variability in daily stomatal uptake at these sites with modest mean bias (21% or less). At least 95% of daily average values agree with measurements within a factor of two and, according to the error

analysis, the residual differences from measured O_3 fluxes are consistent with the uncertainty in the underlying measurements. The product, called synthetic O_3 flux or SynFlux, includes 43 FLUXNET sites in the United States and 60 sites in Europe, totaling 926 site-years of data. This dataset, which is now public, dramatically expands the number and types of sites where O_3 fluxes can be used for ecosystem impact studies and evaluation of air quality and climate models. Across these sites, the mean stomatal conductance and O_3 deposition velocity is 0.03-1.0 cm s^{-1}. The stomatal O_3 flux during the growing season (April-September) is 0.5-11.0 nmol m^{-2} s^{-1} with a mean of 4.5 nmol m^{-2} s^{-1} and the largest fluxes generally occur where stomatal conductance is high, rather than where O_3 concentrations are high. The conductance differences across sites can be explained by atmospheric humidity, soil moisture, vegetation type, irrigation, and land management. These stomatal fluxes suggest that ambient O_3 degrades biomass production and CO_2 sequestration by 20-24% at crop sites, 6-29% at deciduous broadleaf forests, and 4-20% at evergreen needleleaf forests in the United States and Europe.

10:15 AM

22. Using Functional Traits to Assess the Influence of Burrowing Bivalves on Nitrogen Removal in an Unregulated Lowland River in Central Alabama

Zachary L. Nickerson*, Behzad Mortazavi, Carla L. Atkinson, *University of Alabama*

The introduction of excess nutrients from point- and nonpoint-sources has degraded freshwater ecosystems across the globe, and is detrimental to sensitive aquatic plants and animals. In a healthy ecosystem, these plants and animals contribute to system resiliency by regulating energy and nutrient flow through food web dynamics and biogeochemical cycling. Alabama contains some of the highest aquatic biodiversity in the world, and a large component of this high biodiversity is Alabama's freshwater mussels. Freshwater mussels are long-lived, filter-feeding organisms that thrive in dense, speciose aggregations in benthic ecosystems. It is no coincidence that Alabama's undeveloped watersheds host the highest aquatic biodiversity, and that in most of these watersheds there are thriving populations of freshwater mussels. Mussels are known to significantly influence benthic biogeochemical processes due to their unique functional traits. We examined the indirect influence of freshwater mussel functional traits (movement, burrowing, ammonium excretion, organic matter biodeposition) on nitrogen removal processes in a lowland river in the southeastern US. We hypothesized that mussels indirectly stimulate nitrogen removal in the benthos through the interaction of their functional traits with the biotic and abiotic characteristics of the surrounding sediment. To test our hypothesis, we employed a combination of ex situ chamber incubation experiments and an in situ density and community composition manipulation experiment. This multi-fold approach allowed us to model the biogeochemical influence of mussel functional traits on the individual- and community-scale, respectively, with the added variable of community structure (mussel abundance, species diversity) examined in the in situ experiment. Our research adds to the growing knowledge of the functional role these important, yet globally imperiled organisms play in freshwater ecosystems.

Poster Session, Saturday April 7, 2018, 4:20 PM – 6:20 PM

1. Parametric uncertainty quantification of Mercury chemical Speciation modeling

Nur Ahmed*, Ming Ye, *Florida State University*

Mercury (Hg) is a heavy metal which is neurotoxic and bioaccumulates in the food network, endangering humans and aqueous environment. Aqueous speciation modeling is a vital tool for assessing the availability of Hg and menthylmercury (CH_3Hg) species in the environment. This study is focused on quantifying uncertainties in the thermodynamic parameters needed for mercury speciation modeling. Independent Gaussian distributions of input constraints can lead to skewed output distributions of species concentrations. Gaussian input uncertainties of 10% can lead to much larger output uncertainties (pM over 2 log units). The propagation of uncertainty in aqueous equilibrium calculations is examined using Monte Carlo simulations. I present a new method for the quantification of thermodynamic parameter uncertainty and ionic strength correction model uncertainty using Markov Chain Monte Carlo (MCMC) methods. Quantification of parametric uncertainty is the selection of likelihood functions of parameters or, equivalently, probability distributions of residuals (difference between observations and corresponding model simulations). Gaussian likelihood functions have been used in Bayesian uncertainty quantification or as the objective functions in maximum likelihood method. The results may indicate that incorporating correlation among related thermodynamic parameters into the uncertainty model is necessary to correctly quantify the overall system uncertainty. This result may also indicate the superiority of MCMC estimation methods over traditional Monte Carlo methods when available data are used to estimate parameter uncertainty in systems with closely related model parameters.

2. Iron and Sulfate Reducers in Response to Arctic Climate Change

Brandy Barber*, *University of Tennessee*

There is a cause for concern in the Arctic environments, currently, as a result of the changes in CO2 emissions. This results in a rise in temperature that is melting the fjords and glaciers. The microorganisms in these areas are not adapted to the abrupt changes in the environment and how this will affect their ways of survival. The receding perimeters, as a result of the melting glaciers, leave room for things such as sunlight and animals to get into places are normally not accessible to them. In order to view the cellular activity in these regions of concern, samples were taken by a coring device of different depths of marine sediment. These samples were then diluted and stained using DAPI to see all live cells in the samples. This is useful to see what cells are thriving in different depths with the resources provided. Samples of sediment were then taken and incubated for different amount of time. The specific cells that are of interest are the iron and sulfate users, to see how they respond to the increase of resources from the melting glaciers. To view these precise microorganisms that reduce iron and sulfate, biorthogonal non-canonical amino acid tagging (BONCAT) was used. This technique is coupled with fluorescence in situ hybridization (FISH) to insert fluorescent probes into the cell and then visualize under the microscope. Click-dye was also added in order to confirm the active cells in the sample. Different microscope filters were used to compare the different fluorescent dyes at the same time. So far, there is evidence of sulfate reducers in these sediments that are live and active in the environment shown from this BONCAT-FISH method. The activity of the cells recorded by DAPI have also produced evidence of the decrease of live cells as the depths increase.

3. Expansion of anoxia/euxinia as driver for early Silurian extinction events: New geochemical proxy data from Sweden

Emily Benyoun*, Jeremy Owens, Olle Hints, Tonu Martma, Seth Young, *Florida State University*

The early Silurian was characterized by global oceanographic and biotic turnover associated with survival/recovery from one of the largest mass extinctions in the Phanerozoic. Lower Silurian (Llandovery) strata contain evidence for widespread anoxia, continued glaciation, and three positive carbon ($\delta^{13}C$) isotope excursions: Early Aeronian, Late Aeronian, and Valgu. However, mechanisms capable of causing widespread climactic and oceanographic changes that can be linked to biotic events are poorly understood. Conodont and

graptolite biostratigraphy records Silurian episodes of biotic extinction, coincident with major perturbations in the carbon cycle. Previous studies have proposed major oceanographic circulation and climatic changes as the driver for these marine extinction events and changes in marine lithofacies patterns. This study presents new geochemical data using redox proxies such as iron speciation and trace metal geochemistry along with pyrite-sulfur ($\delta^{34}S_{pyr}$) and organic carbon ($\delta^{13}C_{org}$) from a Llandovery deeper water shale sequence within the Baltic Basin. In parallel, this study presents preliminary inorganic carbon ($\delta^{13}C_{carb}$) and carbonate associated sulfur ($\delta^{34}S_{CAS}$) data from a Llandovery shallow shelf carbonate sequence within the Baltic Basin. Preliminary results record positive shifts in $\delta^{13}C_{org}$ ranging from +2‰ to +4‰, in magnitude, for two globally recognized carbon isotope excursions through the Aeronian to the Telychian as well as positive shifts in corresponding $\delta^{34}S_{pyr}$ during these carbon cycle perturbations. In conjunction, preliminary iron speciation and trace metal geochemistry data present implications for local water column and global oceanographic conditions. Results thus far link several Llandovery moderate extinction events, recorded in many marine taxonomic groups, to evidence for a local water column that was predominantly anoxic and intermittently euxinic, and a possible global expansion of euxinia during the early Silurian. Expansion of this basinal to global pool of sulfidic waters into shallow shelf settings provides a unique mechanism to tie biotic turnover events to perturbations of the global C and S cycles.

4. Geochemical evidence for widespread anoxia-euxinia during the Late Silurian Lau Extinction Event

Chelsie Bowman*, Claudia Richbourg, Jeremy Owens, Seth Young, *Florida State University*

The Silurian is characterized by recurrent extinction events, alternating periods of widespread argillaceous sedimentation to prolific carbonate production in low to mid latitude shelf settings, and multiple coincident perturbations of the global carbon cycle. The late Ludlow Lau event is recognized as the largest of the Silurian biotic events and has associated anachronistic facies and faunal turnovers previously only seen with the “big five” Phanerozoic mass extinctions. We propose widespread anoxic to euxinic (sulfidic) conditions as a primary driver for the late Ludlow marine mass extinction event due to coincident positive excursions in $\delta^{13}C_{carb}$ and $\delta^{34}S_{CAS}$ (carbonate-associated sulfate). Here we present a multi-proxy data set to reconstruct late Silurian paleo-redox conditions by examining both shallow-water carbonate platform strata of Gotland, Sweden alongside coeval deeper, basinal mudstones from Latvia. Coeval positive excursions in both the $\delta^{13}C$ and $\delta^{34}S$ data are inferred to reflect enhanced fluxes of organic matter and pyrite burial under euxinic water columns. Novel thallium isotope ($\varepsilon^{205}Tl$) data from the basinal mudstones independently indicate an increase in the extent of global anoxia immediately prior to and throughout coeval positive excursions in $\delta^{13}C$ and $\delta^{34}S$. These results characterize this late Ludlow interval as an example of intense oxygen scarcity in the late Silurian oceans. Thus, suggesting a return to a redox state similar to that of later Cambrian and/or Proterozoic oceans, indicating that widespread anoxia may have continued to be a dominant environmental factor and influence on animal evolution in Silurian oceans.

5. Depth-stratified marine microbial communities exhibit distinct enzymatic responses to high-molecular weight organic matter addition

Sarah Brown*, Adrienne Hoarfrost, J.P. Balmonte, Sherif Ghobrial, Carol Arnosti, *University of North Carolina at Chapel Hill*

Microbial community composition and activities of extracellular enzymes vary with depth in the ocean, evidence of functional differences among these distinct communities. The specific responses of these different communities to inputs of complex organic matter, however, is not well studied. To measure the enzymatic capabilities of distinct microbial communities – and in particular, to determine whether and how their enzymatic capabilities change in response to addition of high molecular weight (HMW) organic matter – we added moderate quantities (25 mg L^{-1}) of HMW organic matter derived from Thalassiosira weissflogii to triplicate 20L carboys containing water from 3 depths (surface, oxygen minimum zone, and bottom) at 2 stations in the northwest Atlantic Ocean. Bacterial community composition and activities of polysaccharide hydrolases, peptidases, and α- and β-glucosidases were compared in mesocosms containing water from each depth. Amended mesocosms generally showed a broader spectrum and considerably higher rates of enzyme activities than unamended mesocosms. At each station, enzymatic activity exhibited distinct patterns at each

depth. The rate and spectrum of peptidases, glucosidases, and polysaccharide hydrolases was greatest in surface water mesocosms. Oxygen minimum and bottom water mesocosms had considerably lower peptidase and glucosidase activities; however, the rate and spectrum of polysaccharide hydrolase activities in oxygen minimum mesocosms was similar to that of surface water mesocosms. Initial bacterial community composition was similar at comparable depths at the two stations; the community composition at each depth was unique. Addition of HMW organic matter resulted in changes in bacterial community richness, abundance, and bacterial community composition; however, the community composition of surface, oxygen minimum, and bottom water mesocosms remained distinct from one another. Depth-stratified microbial communities at two different locations exhibit unique responses to identical inputs of HMW organic matter; the depth at which such substrates are remineralized thus has consequences for carbon cycling.

6. Investigating feedbacks between chemistry and biology: Insights from Southern Ocean incubation experiments

Shannon Burns*, Kristen Buck, *University of South Florida*

Trace metals act as important micronutrients and toxicants to marine phytoplankton, yet few studies have measured them in phytoplankton growth experiments. Phytoplankton are bottom-up controls on marine food webs. Additionally, they are vital to global health given that they are the major suppliers of oxygen to Earth's atmosphere. This is a baseline study of the feedbacks between phytoplankton growth and the concentrations of bioactive trace metals in a series of shipboard incubation experiments. Incubations were conducted in austral spring (September-October) of 2016 using coastal and open ocean surface waters from the Southern Ocean. Incubations included up to six treatments: (1) unamended water, (2) +1 nM 57Fe, (3) +4 nM 57Fe, (4) +10 nM 57Fe, (5) +600 pM Vitamin B12, and (6) +4 nM 57Fe with 600 pM Vitamin B12. Filters were used to size-fractionate the samples into large phytoplankton (>3 μm), free-living bacteria (0.4-3 μm), and dissolved metals (<0.4 μm). Samples were acidified and shipped back to the University of South Florida for chemical analysis. Here, results are reported for the dissolved fraction concentration feedbacks of Mn, Fe, Co, Ni, Cu, Zn, Cd, and Pb for two incubations. This work aims to improve understanding of the biogeochemical feedbacks between phytoplankton communities and trace element chemistry. Such improved understanding will aid the interpretation of natural elemental distributions found in global coastal and oceanic environments. This baseline study will also provide context for future studies as climate change alters marine nutrient distributions and primary productivity.

7. Effects of Wind on Oceanic Submesoscale Processes

Xu Chen*, William Dewar, Mark Bourassa, *Florida State University*

In recent years, a richness of submesoscale (O(0.1 – 10 km)) structure and processes in the upper ocean has been revealed by high-resolution ocean models. Many studies identify the crucial roles played by the submesoscale in the oceanic mixed layer restratification, vertical fluxes of tracers, as well as the energy cascade. Nowadays, submesoscale processes are coming into focus as an important component of air- sea interactions. This research is aimed at understanding how the atmospheric elements respond to the sea surface submesoscale structures as well as the influence of wind stress on the evolution of submesoscale processes. Numerical experiments have been designed to investigate this study on three aspects: the magnitude of wind stress, the nonlinear Ekman dynamics, and the wind-stress adjustment to the ocean surface.

8. Endolith diazotrophy, and its physiological effects on host crustose coralline algae

Ethan Cissell*, *Florida State University*

Endolithic microorganisms occupy lithic substrates, including the calcified substrates produced by coral and crustose coralline algae (CCA). While known to be important bioeroders on reefs, these endolithic microorganisms may also be important members of reef nitrogen cycling and provide a source of nutrients for parrotfish, and for their host CCA or coral. Endolithic cyanobacteria may be diazotrophic (nitrogen-fixing) and

assimilate nitrogen into a endobiont-driven nitrogen cycle that supplies host CCA with useable nitrogen. Due to the importance of nitrogen in protein, DNA, and photopigment anabolism, determining sources of useable nitrogen for CCA is important for predicting CCA physiological resilience and response to anthropogenic stressors. I propose a laboratory isotopic labeling experiment to test my hypothesis that there are diazotrophic members of CCA endolithic communities, and that nitrogen cycling from these endolithic bacteria provides an important source of nitrogen for host CCA anabolism. CCA samples will be collected from reef sites in the Florida Keys National Marine Sanctuary and offshore of The Florida State University Coastal and Marine Lab. Following incubation in isotopically labeled seawater using the dissolved ^{15}N method, CCA tissue samples will be screened for the fraction of ^{15}N present using mass spectrometry. The results from this study will A) demonstrate whether or not there are diazotrophic members of CCA endolithic communities, and B) show what fraction of total CCA nitrogen uptake can be provided by these endolithic diazotrophs in a controlled laboratory setting. This experiment primarily looks for the presence of nutrient interactions that provides an important baseline for looking at ecological relevance of endolithic nitrogen cycling, and response of this nutrient interaction to anthropogenic stress, using in situ experimentation.

9. Turmeric Adulteration by Lead Paint

Mary E. DesRosiers*, Peter L. Morton, Maitreyi Mazumdar, and Kelsey Gleason, *Florida State University*

Lead (Pb) is a toxic metal with no safe level for humans, but some foods imported to the US contain high concentrations of Pb. Building on a previous study that discovered high concentrations of Pb in turmeric from Bangladesh, we have used high resolution ICP-MS techniques to determine the concentrations of a suite of potentially toxic elements and the isotopic compositions of Pb in 20 turmeric samples collected from Bangladeshi homes. Turmeric Pb concentrations were 5-420 ppm and occurred in a 1:1 (±20%) molar ratio with chromium (Cr), another toxic metal. Furthermore, the Pb isotopic composition in these samples does not match the Pb isotopic compositions of industrial aerosols from nearby India, but they are similar to isotopic compositions observed in marine and aerosol samples from the western North Pacific Ocean. The evidence presented here suggests intentional adulteration of ground turmeric with lead chromate ($PbCrO_4$), a bright yellow paint pigment that we speculate could be mixed with turmeric to enhance its color and value.

10. Carbon Flux of Heterotrophic-Autotrophic Interactions in Surface Ocean Bacteria

Frank Ferrer-Gonzalez*, Mary Ann Moran, *University of Georgia*

Oceanic photosynthesis contributes half of the global primary production; this is cycled within days by billions of bacteria living in each liter of surface seawater. Remarkably, there is insuffi cient information on the metabolites and interactions that occur between heterotrophs and autotrophs in the surface ocean carbon cycle. By studying bacterial gene expression in a co-culture system, we can target unknown metabolites important in heterotrophic-autotrophic interactions. Four different ecologically relevant bacteria (Ruegeria pomeroyi DSS-3, Stenotrophomonas sp. SKA14, Polaribacter sp. MED152 and Dokdonia sp. MED134) were individually co-cultured with the diatom Thalassiosira pseudonana CCMP1335 to study their transporter transcriptional patterns and identify candidate metabolites. Co-cultures were grown in L1 medium, at a salinity of 20 with a light interval of 16:8 h at 160 micromol photons m^2 s-1 Diatoms were grown axenically for a period of 2 weeks until a density of 105 cells/ml was achieved. Bacteria were grown to exponential phase and added to the diatom culture at a concentration of 106 cells/ml for a period of 8h. The control was bacterial cells grown on 2.5 μM glucose served as a carbon source. Filtered medium was collected for exometabolite analysis. Nucleic acid was extracted using a phenol, chloroform, and isoamyl extraction, rRNA was removed, and mRNA libraries sequenced using the Illumina HiSeq2500 platform (50 bp, SE). Transcripts data are being analyzed for differential expression between bacteria co- cultures. Metabolic data are being analyzed by NMR and MS techniques. Findings between the different treatments can help us better understand roles bacteria play within oceanic photosynthesis.

11. Double Trouble: Tracking (Late Wenlock) Silurian Sulfur and Carbon Perturbations associated with the Mulde Event from Tennessee and Nevada

Randall Funderburk*, Seth Young, *Florida State University*

Despite its short duration, the Silurian period is defined by many marine biotic turnover events. The Late Wenlock Mulde (~429-428Ma) positive carbon isotope excursion (CIE) is one of seven major perturbations in the Silurian. The uniqueness of this particular excursion lies in its dual-peaked behavior and remains one of two of this type throughout the Paleozoic. High-resolution carbon isotope data has previously been produced for both field sites investigated here for this project: sections from the Simpson Park Range, Nevada and McCrory Lane, Tennessee. Oceanographic and climactic drivers for Silurian CIE's and extinction events are poorly understood, however, this project aims to pair δ34SCAS, δ34Spyr with δ13Corg , δ13Ccarb data to test hypotheses put forward for this CIE that are related to purported changes in oceanographic conditions that should have corresponding changes in paleoredox state of marine environments. For the first time, we present Late Wenlock paired δ34SCAS, δ34Spyr, δ13Corg, and δ13Ccarb data from two separate paleocean basins that record the Mulde CIE. Preliminary δ34SCAS data from Tennessee show a positive excursion of up to 9‰ magnitude coinciding with the onset and first positive δ13Ccarb shift of the Mulde. The δ13Corg data covary with previously published δ13Ccarb data showing two positive shifts of 1–2‰ magnitude. Broad scale trends in $\delta 13C_{org}$ data show a similar shift in δ13Corg values ~2‰ lighter after the return to baseline values during the Mulde CIE.. Trends from the Nevada stable isotope data sets also demonstrate that we have likely only recorded data from the second positive shift and return to baseline values of the Mulde CIE. [Pyrite-S] and δ34Spyrite values are being generated from the Nevada sequence to assess any potential CAS contamination issues and local paleoredox conditions from this area of the Great Basin during the Late Wenlock. Regardless of any pyrite contamination issues, these new data do suggest that the extinction interval and onset of the CIE in the Late Wenlock are linked to expansion of reducing conditions in the global oceans that led to enhanced organic matter and pyrite burial.

12. Magnitude and variability of reactive silica in Mississippi River plume sediments

Aislyn M. Galford*, William C. Dobbins, Rebecca A. Pickering, Sydney Acton, Jeffrey W. Krause, *Dauphin Island Sea Lab, The University of Alabama, The University of South Alabama*

The land-sea interface sequesters more silicon than any other marine region despite being ~10% of ocean area. Approximately 50% of global diatom burial occurs in these zones and recent work suggests even more silicon may be sequestered due to reverse weathering processes. Previous work in the Mississippi River Plume (MRP) sediments confirmed the presence of authigenically altered biogenic silica (bSi) from reverse weathering, which was estimated to represent 40% of the regional sedimentary silica storage. However, the magnitude and variability of authigenically-altered bSi across the MRP remains largely unknown. The present study reports sediment reactive silica concentrations (i.e. bSi and authigenically- altered forms) in the MRP during periods of high and low river discharge. We confirmed that the presence of metal hydroxides and other diagenetic products systematically reduced the quantifiable bSi when using traditional analysis methods by, on average, a factor of four and within a larger area than previously considered. As reactive silica associated with metal hydroxides increased, the remaining silica digested by subsequent alkaline digestion, increased on average 35% faster. This suggests that metal-hydroxide- associated silica is bound to surfaces while the remaining reactive silica is locked within the diatom frustule, consistent with the expected 33% increase in the volume-to-surface-area ratio as particle size increases. When comparing the operationally-defined reactive pools of silica to previous studies, the observed spatial and vertical variability in MRP sediments spanned nearly the same magnitude as that observed in the global data set. Whether this high degree of variability observed within the MRP sediments is reflective of most major river-plume systems should be assessed in future work. If so, then the spatial extent to which these reverse-weathering processes and the magnitude of silicon sequestration, may require revision in other systems.

13. Characterizing the overall microbial community structure including two novel Thaumarchaeota in the annual northern Gulf of Mexico hypoxic zone

Lauren Gillies Campbell*, J. Cameron Thrash, Kiley W. Seitz, Brett J. Baker, Nancy N. Rabalais, Olivia U. Mason, *Florida State University*

Rich geochemical datasets generated over the past 30 years have provided fine-scale resolution on the northern Gulf of Mexico (nGOM) coastal hypoxic (≤ 2 mg of O_2 L^{-1}) zone. When hypoxic conditions prevail, the lack of commensurate resolution on the microbial ecology impedes contextualization of these geochemical datasets in relevant microbial space. Here, we hypothesized that the extent of the hypoxic zone is a driver in determining microbial community structure and metabolic roles, in particular, the abundance of ammonia-oxidizing archaea (AOA). Samples collected across the shelf at the same time point over two consecutive years (2013 and 2014) were analyzed using 16S rRNA gene sequencing, oligotyping, microbial co-occurrence analysis and quantification (qPCR) of thaumarchaeal 16S rRNA and archaeal ammonia-monooxygenase (*amo*A) genes. These datasets revealed that hypoxic conditions were a significant driver in influencing microbial ecology in the nGOM. While Thaumarchaeota were enriched and inversely correlated with DO in both years, the less expansive, shallower 2014 hypoxic zone compared to that of 2013 did result in differential abundances of other microbes, for example in 2014 the relative abundance of Cyanobacteria, Actinobacteria; ac1 and Proteobacteria were higher. Oligotyping analysis of *Nitrosopumilus* 16S rRNA gene sequences revealed that one oligotype was significantly inversely correlated with dissolved oxygen (DO) in both years. To further evaluate the role of this abundant ammonia-oxidizing Thaumarchaeota, two genomes were reconstructed and analyzed from the whole community metagenomic data in the 2013 nGOM hypoxic zone and metatranscriptomic sequences were mapped to measure gene and genome activity. Taken together, the data revealed that hypoxic conditions influence patterns in microbial community structure and gene activity, with the yearly nGOM hypoxic zone emerging as a low DO adapted AOA niche where the dominant Thaumarchaeota have the potential to actively influence nitrogen cycling in the nGOM hypoxic area.

14. Using thallium isotopes in the ~2.63 Ga Jeerinah Formation from Hamersley Basin, Western Australia, to constrain ancient seafloor oxygenation

Brett Holdaway*, Jeremy D Owens, Ariel D Anbar, Chadlin M Ostrander, Sune G Nielson, *Florida State University*

Understanding the chemical and biological innovation and evolution of the global ocean is pivotal in understanding the processes for how early life on Earth and potentially habitable planets advanced. Previous research on early-Earth oxygenation has revealed a rise in atmospheric [O_2] ~2.32 billion years ago, coined the Great Oxidation Event, or GOE. Many lines of evidence, however, suggest continental oxidative weathering as early as ~3.0 Ga, with possibilities of complementary ocean oxygenation. Modeling of the geochemical data suggests small oxygen “oases” prior to whiffs of O_2, or even widespread oxygen-rich margins. However, constraining the extent and timing of oceanic oxygenation is difficult as proxies fall short in detecting early ocean oxygenation. Importantly, the formation and preservation of manganese (Mn) in the form of manganese-oxides requires an oxygenated water-column that penetrates the sediment-water interface. Until recently, tracking the global burial of Mn-oxides was very difficult, largely compounded by an incomplete ancient geologic record. Here we use thallium (Tl), a new and novel isotope system to better constrain marine [O_2], specifically by constraining the global burial of Mn-oxides. Recently, it has been shown that modern seawater Tl isotope composition is faithfully recorded in anoxic to euxinic (anoxic and sulfidic) sediments. Nearly all isotopic inputs: riverine, dust, volcanic, hydrothermal, and benthic recycling of Tl into the ocean are constant with ε205Tl -2. In contrast, the two primary outputs impart significant fractionations, these outputs being the burial of Mn-oxides (ε205Tl +12) and altered oceanic crust (ε205Tl -10). Thus, seawater is mainly dictated by the mass balance of the outputs (Mn- oxides and altered oceanic crust) which, for short-term events, is likely driven by the amount of Mn-oxide burial. Tl isotope analyses of the dominantly euxinic ~2.5 Ga Mt. McRae Shale from the Hamersley Basin, Western Australia, suggest oceanic oxygenation penetrated minor expanses of the global sediment-water interface, coeval with a “whiff” of O_2 at ~2.5 Ga. Here we probe deeper into the ancient rock record prior to the “whiff”, applying high resolution Tl isotope measurements to the anoxic and euxinic 2.63 Ga Roy Hill Shale.

15. Mapping Marine Trace Metal and Macronutrient Remineralization Following a Phytoplankton Bloom

Adrienne Patricia Hollister*, Kristen Buck, *University of South Florida*

Marine trace metals (Fe, Zn, Cu, Mn, Co, Ni, and Cd) act as important nutrients and/or toxicants to phytoplankton and other microorganisms in the oceans. Thus, in addition to macronutrients like nitrogen and carbon, phytoplankton also incorporate trace metals into their cells as they grow. When phytoplankton die and sink, they release these stored elements back into the water column in a process known as remineralization. In the oceans, this process happens with depth in the water column, yet it is commonly observed that subsurface macronutrient and trace metal maxima occur at different depths- suggesting a decoupling between these elements during the course of remineralization. To address this experimentally, natural phytoplankton assemblages from the Gulf of Mexico were incubated with macronutrient and Fe additions to achieve high biomass then placed in the dark to decay, simulating the process that occurs naturally in the water column. The relative timing of trace metal and macronutrient remineralization from these communities was measured in dissolved and particulate phases over the course of six months. Here we present the dissolved macronutrient and trace metal concentrations results from this experiment and highlight ongoing studies with phytoplankton species of interest from this system.

16. Carbon deposition and burial in estuarine sediments of the contiguous United States

Jack A Hutchings*, Thomas S Bianchi, Raymond Najjar, Maria Herrmann, Michael Kemp, *University of Florida*

Estuaries represent the primary linkage between the terrestrial and marine carbon cycles, and estuarine processing of riverine and coastal carbon results in a disproportionately large role in the global carbon cycle despite their relatively small area. In addition, carbon burial within estuarine systems can govern atmospheric carbon levels on geologic time scales. However, knowledge of the rate of organic carbon deposition and burial in estuarine sediments is lacking at regional scales. A review of recent literature was undertaken to collect surficial total organic carbon, linear sedimentation, and bulk density of estuarine sediments to estimate carbon deposition in estuarine sediments along the contiguous United States (CONUS). An estuarine typology based on geomorphological characteristics was used to classify 115 CONUS estuaries into five different typology categories. Missing data within an estuary was gap-filled using the mean value for that estuary's assigned typology. Despite strong differences in mass accumulation rate and organic carbon content, typologies had mean carbon deposition rates that were comparable within an order of magnitude with a mean organic carbon deposition rate of 115 g C m–2 yr^{-1} and an area-integrated organic carbon deposition rate for CONUS of 12.4 Tg C yr^{-1}. Comparing with regional and global studies, we find that organic matter deposition is likely a large term in the estuarine carbon budget, probably similar to CO_2 outgassing and at least a third of primary production. However, a large portion of deposited material is remineralized within the mixed, oxic layer prior to burial. Burial estimates will also be presented; these estimates are based on application of literature-derived first order decay model coefficients to estimate the amount of deposited C that remains after early sedimentary diagenesis and, thus, a more realistic estimate of organic carbon that is removed from the decadal to centennial carbon cycle within estuarine sediments.

17. The search for novel gas hydrate inhibitors

Abbie M. Johnson*, Frank J. Stewart, Piyush Ranjan, Brook L. Nunn, Jennifer B. Glass, *Georgia Institute of Technology*

Gas hydrates form at high pressure and low temperature when natural gas is trapped in a solid water lattice. Because gas hydrates often clog natural gas pipelines, companies often try to inhibit their formation using hydrate growth inhibitors, typically non-biodegradable synthetic chemicals such as PVP (polyvinylpyrrolidone). Recently, there has been a movement towards greener, biodegradable "Kinetic Hydrate Inhibitors" (KHIs including antifreeze ice-binding proteins (IBPs). IBPs have evolved in many eukaryotic and bacterial lineages, some of which have been tested for their efficiency as KHIs. We hypothesize that IBPs produced by natural microbial populations living in gas hydrates may be more effective "green" KHIs than other IBPs. In this study, we identified potential novel bacterial IBPs using meta-omics techniques from the gas hydrate stability zone beneath Hydrate Ridge, offshore Oregon. Understanding the role of IBPs produced by hydrate-dwelling

bacteria may yield insight into hydrate stability, which affects the extractable volume of methane for energy use and the potential amount of released methane as a result of rising ocean temperatures.

18. Pharmaceuticals and Personal Care Products in the Effluent of Septic Tanks and in Groundwater beneath Septic Drainfields in Eastern North Carolina

Bailey King*, Listecki A, Mitra S, Humphrey CP Jr., Iverson, G, *East Carolina University*

Pharmaceuticals and personal care products (PPCPs) are substances that are regularly used in every household. Though they are beneficial for society, they are discharged into surface waters and groundwaters on a regular basis and are environmental contaminants. In coastal regions, wastewater is often treated using septic systems which discharge septic tank effluent into drainfield trenches in the subsoil. In this study, PPCPs were isolated from several school septic tanks and in groundwater beneath drainfields and a wastewater treatment plant in the coastal plain of NC. The PPCPs that were most frequently detected in groundwater beneath drainfields were acetaminophen (analgesic), caffeine (stimulant), dextroamphetamine (stimulant), cephalexin (antibiotic), and cetirizine (antihistamine). The maximum concentrations of acetaminophen, caffeine, cephalexin, and cetirizine that were detected across all sites were 6,934, 9,468, 742, 1,042, and 381µg/L, respectively. Moreover, across all sampling locations, the endocrine disrupting compounds, 17□-estradiol + estrone (birth control), were detected at a concentration range of < 1 µg/L to 36.7 µg/L. These findings suggest that over-the-counter and prescription medications may be abundant in groundwater of coastal plain regions that use septic systems.

19. Sequence Stratigraphic Analysis of the Evan's Ferry Roadcut, TN: A New Prospective for Late Ordovician (Sandbian) Sea Level from the Appalachian Basin

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A megasequence boundary (Sauk-Tippecanoe) occurs within the Middle Ordovician strata in North America that represents a global sea level lowstand followed by renewed transgression and sea levels reaching a Paleozoic apex in the Late Ordovician. There are few areas globally that record continuous sedimentation through this transition in eustatic sea level which also coincides with ongoing biodiversification in marine faunas worldwide. The Evan's Ferry section of northeastern Tennessee provides a unique prospective for Upper Ordovician sea level reconstruction as this section contains one of the most expanded latest Darriwilian-Sanbian sequences in North America. The carbonate-dominated strata from Evan's Ferry were deposited within the Appalachian Foreland Basin, during the Taconic Orogeny. This section, containing six formations, deposited under a wide variety of conditions, as recognized by lithofacies analysis and lower order stratigraphic stacking patterns. Meter to decimeter scale sequence stratigraphic analysis suggest four third order depositional sequences are present within the Evan's Ferry section. Ideally, each third order sequence begins and ends at a Lowstand Systems Track (LST), however, many Falling Stand Systems Track (FSST) and LST are either missing at sequence boundaries or covered. Accompanied with the sequence stratigraphic analysis, stable isotopic analysis of carbon and oxygen were used aid in the identification of sequence boundaries/exposure surfaces. When exposed to meteoric diagenesis, δ13Ccarb and δ18Ocarb signatures show a significant lightening in their isotopic values. Several lower order exposure surfaces, especially in LST show correlation between exposure surfaces and geochemical signatures of meteoric influences, however transgressive and highstand systems tracks (TST and HST, respectively) show little to no correlation between parasequence or sequence boundaries and isotopic signatures. This study's pairing sequence stratigraphy and chemostratigraphy in the Appalachian Basin show how changes in eustatic sea level and local accommodation space may have produced environments that were ideal for the continued intense biodiversification seen throughout this time during the Ordovician.

20. The impact of nutrient loading on nitrate removal in a *Juncus roemerianus* and *Spartina alterniflora* dominated saltmarsh in the northern Gulf of Mexico

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We are conducting a field study in a salt marsh located on Dauphin Island, AL, where we are increasing inputs of nitrogen (N) and phosphorus (P) in plots dominated by *J. roemerianus* and *S. alterniflora* by 20 g N m-2 yr-1/ 1.25 g P m-2 yr-1, or 40 g N m-2 yr-1/2.5 g P m-2 yr-1. We are measuring seasonal rates of denitrification, anaerobic ammonium oxidation (ANAMMOX), and dissimilatory nitrate reduction to ammonium (DNRA) alongside monthly measures of CO2 fluxes to better understand the link between carbon and nitrogen cycling in salt marsh ecosystems. Half way through the 1-year study, denitrification rates did not significantly increase in either *J. roemerianus* or *S. alterniflora* dominated plots. In *S. alterniflora* dominated plots, DNRA rates were ~5 fold higher in low fertilization plots than ambient (p=0.010). There were no visible treatment effects in *J. roemerianus* dominated plots. ANAMMOX rates were negligible (> 1 μmol N kg-1 hr-1). CO2 fluxes varied between each vegetation type with *J. roemerianus* plots exceeding the productivity of *S. alterniflora* plots by nearly 28% (p=0.003). *J. roemerianus* plots were temporally variable (p=0.006) with GPP and NEE being the highest in October, but there were no significant differences between treatments in *J. roemerianus* plots. In contrast, CO2 fluxes in *S. alterniflora* plots were similar temporally but showed a treatment effect. GPP was ~60% higher in the high treatment plots compared to low and ambient treatment plots (p=0.024). Our results suggest that *S. alterniflora* tend to remove N at higher rates than *J. roemerianus* when introduced to increased nutrient loading, and both species act as net carbon sinks with *J. roemerianus* dominated plots having higher carbon processing rates.

21. A thallium isotope record of ocean oxygenation during the Lomagundi Event

Zijian Li*, Christopher T. Reinhard, Noah J. Planavsky, Jeremy D. Owens, *Georgia Institute of Technology*

The Paleoproterozoic Lomagundi Event is characterized by a markedly positive carbon isotope excursion (> 10‰) recorded in carbonates deposited worldwide between ~2.2-2.0 billion years ago (Ga). This enigmatic event represents one of the largest carbon cycle perturbations in Earth's history. It has been proposed that the enhanced organic carbon burial implied by the positive $\delta^{13}C$ values would have resulted in the production of vast quantities of oxygen, with atmospheric oxygen values potentially approaching or exceeding those seen the modern atmosphere. However, the magnitude of this oxygen cycle perturbation is poorly constrained, as are changes in ocean redox conditions during the Paleoproterozoic more broadly. Thallium (Tl) stable isotopes are a new and potentially powerful paleo-redox proxy. Thallium strongly adsorbs to manganese (Mn) oxides with a large positive isotope fractionation factor, with the burial of Mn oxides in marine sediments rendering seawater isotopically light. On timescales of million years, the marine Tl isotopic composition is thus primarily controlled by global Mn oxide burial. Thallium isotope ratios obtained from the authigenic portion of euxinic black shales has been proposed to capture the $\varepsilon^{205}Tl$ values of contemporaneous seawater, providing the potential to reconstruct deep ocean oxygenation on a global scale. Here, we present Tl isotope compositions of organic-rich pyritiferous shales from the Sengoma Argillite Formation deposited in the Bushveld Basin, Botswana. This shale sequence, deposited in an open marine euxinic environment during the Lomagundi Event, provides a unique opportunity to assess the impact of this perturbation to Earth's carbon and oxygen cycling on large-scale ocean oxygenation and may provide insight into potential ecological constraints on emerging eukaryotic life.

22. Historical Profiles of Organic and Soot Carbon in White Pond, South Carolina

Ashlyn Listecki*, Bailey King, Siddhartha Mitra, David Mallinson, Christopher Moore, Chad Lane, Kimberly Duernberger, *East Carolina University*

A 2.6 meter sediment core was collected from White Pond, South Carolina, to reconstruct regional climate during the latest Pleistocene to Holocene. The core is characterized by a basal mottled mud unit that grades upward to an organic-rich mud and a muddy peat. The peat unit occurs over 2.3 m and is characterized by alternating medium brown and dark brown layers, suggesting alternating depositional conditions and/or

differences in organic matter composition, both of which may reflect environmental changes. Sediments were analyzed for particulate organic carbon and soot carbon concentrations (OC, soot C) and their stable isotopic signatures ($\delta^{13}C_{OC}$, $\delta^{13}C_{sootC}$). OC was isolated by drying and acidifying in 2N hydrochloric acid. Soot was isolated by slow thermal oxidation of the OC at 375 ^{o}C (i.e. the CTO-375 technique). Downcore trends in each variable observed throughout the core and their relationship with regional proxies from other systems will be discussed.

23. The influence of mesoscale and submesoscale circulation on sinking particles in the northern Gulf of Mexico

Guangpeng Liu*, Annalisa Bracco, Uta Passow, *Georgia Institute of Technology*

Mesoscale eddies and fronts in the ocean greatly impact lateral transport and in turn the trajectories of sinking particles. Such influence was explored for April and October 2012 in the Gulf of Mexico using numerical simulations performed with a regional model at 1-km horizontal resolution. Results are compared qualitatively to field samples from two sediment traps located at GC600 (27o22.5 N, 90o30.7 W) and AT357 (27o31.5 N, 89o42.6 W), 81 km apart. In April the traps collected a comparable amount of material, while in October the flux at GC600 greatly exceeded that at AT357. Through inverse calculations, several thousand particle trajectories were reconstructed multiple times from the ocean surface to the depth of the traps (approximately 1,000 m) using a range of sinking velocities, 20–100 m d–1. Taken together, model results and trap data indicate that cross-shore transport of riverine input induced by mesoscale eddies, and convergence and divergence processes at the scale of a few kilometers, significantly impact the trajectory of sinking particles. The large majority of modeled particles reach the bottom faster than would be expected by their sinking speeds alone. This finding is associated with submesoscale-induced horizontal convergence in the mixed layer that aggregates particles preferentially in downwelling regions, accelerating their descent. Furthermore, this study confirms that the cone of influence of vertical fluxes is highly variable in both space and time in the presence of an energetic eddy field, especially for particles with sinking velocity of 50 m d–1 or less. It also demonstrates that the variability of vertical fluxes in the Gulf of Mexico is highly complex and can be understood only by considering the mesoscale circulation and seasonal cycle of primary productivity, which in turn are linked to riverine inputs, wind forcing and the seasonal cycle of the mixed-layer depth.

24. The role of parrotfishes in the bioerosion of crustose coralline algae with increasing ocean acidification

Joshua C Manning*, Sophie J McCoy, *Florida State University*

Crustose coralline algae (CCA) contribute significantly to coral reef frameworks. Their abundance is often positively correlated with the abundance of herbivores, as herbivory prevents overgrowth of CCA thalli by epiphytes. However, ocean acidification is increasing the susceptibility of CCA to herbivory, while reducing net calcification and the ability to recover from wounding. OA could, therefore, alter the role of CCA as important framework builders on coral reefs. To model potential ocean acidification effects on calcium carbonate production by CCA, we first need data on the frequency and intensity (i.e., amount of tissue removed) of herbivory on these algae. I propose to quantify the frequency and intensity of parrotfish herbivory on common CCA in the Florida Keys, as well as net calcification of these CCA in situ. Additionally, I will perform laboratory ocean acidification experiments to quantify the potential interactive effects of herbivory and ocean acidification on CCA physiology. This data, paired with data on parrotfish abundances, would allow me to model the contribution of CCA to net accretion of calcium carbonate on coral reefs in the Florida Keys, and how ocean acidification may alter this process in the future.

25. Influence of energy availability on the carbon isotopes of methane and biomarkers during hydrogenotrophic methanogenesis

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The isotopic signatures of organic molecules in the environment are widely used to identify microbial metabolic processes and to track the cycling of carbon. The lipid biomarkers of methane cycling archaea are of particular interest as they are unique, preserved over geologic time scales, and reflect processes that impact an important greenhouse gas. Their isotopic compositions have been used to distinguish regions where archaea produce and anaerobically consume methane. Previous work has demonstrated that energy availability impacts the stable carbon isotopes of methane during microbial synthesis from H_2 and CO_2. Here, we investigated whether this relationship could be extended to lipids and amino acids. The isotopic distributions of carbon metabolized and synthesized by the hyperthermophile *Methanocaldococcus jannaschii* were quantified following growth at 82°C in a chemostat with high (~80 µM) and low (15-27 µM) H_2 concentrations. As expected, the stable carbon isotope fractionation factors for CH_4 were >15‰ larger in low H_2 experiments than in high H_2 experiments. Lipid biomarkers and amino acids were similarly impacted, with approximately 10‰ larger fractionation factors under low H_2 conditions. Simultaneously, substantial changes were observed with the relative amounts of carbon shunted to catabolic (CH_4) versus anabolic (amino acids, lipids, biomass) pathways. These data can be used to assess the underlying mechanisms that determine the isotopic composition of long-lived biomarkers and, therefore, provide constraints for interpreting these signatures in the environment.

26. Impacts of microbial community structure on denitrification rates in the rhizosphere of *Juncus roemerianus* and *Spartina alterniflora* in a mixed marsh in the Northern Gulf of Mexico

Rachel Petet*, Loren Knobbe, Patrick Chanton, Behzad Mortazavi and Olivia U. Mason, *Florida State University*

Marshes are particularly important ecosystems, providing long-term soil carbon storage, flood protection and nutrient filtering. Nutrient filtering, such as nitrate removal, is largely the result of belowground microbially mediated denitrification. To determine belowground denitrification rates and to characterize the microbial community composition, we sampled a mixed grass community composed of *Spartina alterniflora* and *Juncus roemerianus* collocated at the same elevation in a saltwater marsh located in Alabama, USA. Slurry experiments were carried out to determine denitrification rates. In these same soil samples microbial community composition was determined using iTag sequencing of 16S rRNA gene amplicons. Analysis of the 16S rRNA sequences revealed that amplicon sequence variants (ASVs) were not significantly different from one another per grass type, although oscillations in the abundance of some microorganisms was observed. While the composition of the microbiome was highly similar in the rhizosphere of these two grasses, denitrification rates were consistently higher in *J. roemerianus*. Collectively, our data suggested that the higher denitrification rates in *J. roemerianus* compared to *S. alterniflora* are likely the result of different plant characteristics coupled with changes in microbial abundances, rather than a taxonomic shift. This may indicate that both taxonomic composition and metabolic function are conserved, regardless of grass type, but that abundance and activity of particular microorganisms oscillates, resulting in higher denitrification rates in *J. roemerianus*. Our findings can aid in restoration efforts by potentially increasing nutrient filtering by maximizing nitrate removal via microbial denitrification, which is mediated by plant-microbe interactions.

27. Diatoms and dissolved trace metal/nutrients ratios in the Southern Ocean

Kaitlyn Renegar*, Peter L. Morton, William M. Landing, *Florida State University*

Marine phytoplankton productivity and abundance are influenced by several factors, including the nutrient concentrations. In the Southern Ocean, diatoms are abundant despite potentially growth-limiting concentrations of dissolved silica or iron. A comparison of dissolved major and trace nutrients in samples collected during the CLIVAR 2011 S04P cruise reveals distinct regions with different nutrient ratios. Across the cruise transect, dissolved Fe concentrations appeared to be limiting with respect to nitrate (low Fe/NO_3^-). The greatest concentrations of fucoxanthin (a pigment associated with diatoms) were found where the dissolved

Si/N ratios were ~1-2 mol/mol. Subsurface dissolved Zn/Si ratios were consistent with global averages (~60 nmol Zn/umol Si), but surface ratios of dissolved Zn/Si were lowest where diatom abundances were highest. Overall, diatom growth was not limited by low dFe concentrations but nevertheless may imprint a lower dZn/Si signature on surface waters during blooms.

28. New Late Silurian (Ludfordian) ^{13}C and ^{34}S Analyses from Western Tennessee: An Outer Ramp Perspective on the LAU CIE and Extinction Event

Claudia Richbourg*, Chelsie Bowman, Seth Young, *Florida State University*

The Lau/Kolzlowskii extinction (LKE) was the last in a series of moderate extinction events that occurred during the Silurian. This event is defined by a global reduction in conodont and graptolite faunal diversity, among many other marine taxa. Records of this event may be seen in localities from Scandinavia, Eastern Europe, North America, and Australia. Coinciding with the LKE, was a major positive carbon isotope excursion (CIE), the Lau CIE. The causes and consequences of the Lau CIE and exact relationship to the extinction event are not well understood. Most investigations invoke changes in the global carbon cycle, oceanic redox conditions and/or eustatic sea level as a driver for the CIE. Here we report new paired carbon (δ13Ccarb, δ13Corg) and sulfur (δ34SCAS : carbonate-associated sulfate) isotope data from the Ludfordian Brownsport Formation, Tennessee, which has been previously studied in shallow-carbonate ramp settings from nearby outcrops. Our new data from the Bath Springs section will be used to assess completeness of shallower sequences, local redox changes within this carbonate ramp setting, and global marine redox changes. The alternating mudstone/wackestone and shale lithofacies along with trilobite- nautiloid biofacies indicate a deeper-water setting of the Bath Springs section. Data from this locality will help to further test the hypotheses put forward for the Lau CIE, with coincident positive δ13Ccarb and δ34SCAS excursions supporting global increases in the burial flux of organic matter and pyrite. Widespread anoxic to euxinic (no oxygen + sulfide) conditions would be necessary to induce these changes in burial fluxes of C and S. Furthermore, this hypothesis provides a critical link of the Lau CIE to the extinction events via spread of reducing conditions within marine environments globally. Conversely, if no major positive shift in δ34SCAS is documented in concert with the Lau CIE this may support a carbonate weathering hypothesis rather than an oceanographic/marine redox hypothesis.

29. The Biogeochemistry of Canvasback Lake

Jennifer Rogers*, Rob Spencer, *Florida State University*

The Arctic is warming at twice the rate of mid-latitude regions. This warming will impact the transport and cycling of organic matter by changing the length of the ice-free period, the vegetation cover, and presence of permafrost in northern high latitude lakes. To evaluate changes in the source and processing of dissolved organic matter (DOM), representative vegetation samples were collected from Canvasback Lake in the Yukon Flats National Wildlife Refuge, Alaska. Vegetation found surrounding or within the lake were leached and analyzed for chromophoric DOM (CDOM), molecular composition using fourier transform ion cyclotron resonance mass spectrometry (FT-ICR MS), and dissolved lignin phenols, a biomarker for vascular plants, to evaluate the sources contributing to Canvasback lake DOM. In addition, abundant zooplankton within the lake were incubated and analyzed by absorbance, fluorescence, and FT-ICR MS to evaluate the contribution of small aquatic organisms to the DOM pool. Lignin phenol concentrations and chemodiversity data from FT-ICR MS were utilized to understand the degradation processes of DOM by comparing the seasonal vegetation cover and changing sources. These data will be used to better understand how sources contribute to lake DOM and can become a reference point for future changes within Arctic inland waters where shifts in vegetation cover and the length of seasons changes the sources and processing of DOM.

30. Evaluating the sensitivity of subsurface microbial metagenome assembled genome properties as a function of metagenomic shotgun sequencing depth

Taylor Royalty*, Andrew Steen, *University of Tennessee*

Subsurface microbial communities are often taxonomically and metabolically diverse. This diversity has direct implications towards global biogeochemical cycles. Nonetheless, characterization of these microbial communities is hindered by subsurface microbes which are resistant to isolation in pure culture. The emergence of next-generation sequencing (NGS) has provided a tool for overcoming issues with characterization of isolation resistant microbes; however, nuances pertaining to the amount of sequencing necessary for accurate taxonomic assignment and gene identification for a given microbe community has not been explored for NGS. Under-sequencing samples may lead to overlooking genes of metabolic significance or marker genes used in taxonomic assignment. Over-sequencing samples will theoretically lead to diminishing returns in these genes and, more importantly, introduce an unnecessary financial constraint. Here, a pipeline for generating metagenome assembled genomes (MAGs) was developed to explore the optimal Illumina metagenomic shotgun sequencing necessary for characterizing different subsurface microbe communities. The pipeline randomly sub-sampled input Illumina reads in triplicate to 100%, 95%, 90%, 80%, 60%, 40%, 20%, and 10% of the original data set size as a means of simulating different degrees of sequencing depth. Randomly sub-sampled reads were then assembled into contigs and clustered into MAGs using BinSanity software according to an automated process. The resulting MAGs were evaluated for total number of retrieved MAG bins, MAG completeness and contamination, and relative abundance of phyla as a function of sequencing depth. Genes within MAGs were identified and translated into protein sequences using the software, Prodigal. Translated proteins were compared against Pfam for inferring the metabolic potential of MAGs as a function of sequencing depth. Publicly available Illumina runs for estuarian sediment and prairie soil were downloaded from NCBI's Sequence Read Archive (SRA) and analyzed with the MAG pipeline.

31. Regional differences in aerosol trace element composition and solubility during the CLIVAR A16N and A16S campaigns (2013-2014)

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Atmospheric deposition provides essential bioactive elements, as well as pollution-derived elements, to the surface ocean. The North Atlantic basin receives the highest aerosol (dust) input of all the oceanic basins due to its proximity to the Sahara Desert. Yet even in the North Atlantic, outside of the influence of the Saharan plume, dust supply is several orders of magnitude lower (e.g. Fe, Saharan-sourced aerosols 10e4 ng m-3; Remote Marine aerosols 10e-1 ng m-3). In the South Atlantic there are fewer significant dust sources, and as a result, this basin receives only about one tenth that of the North Atlantic. Furthermore, moisture in the atmosphere scavenges TEs from dust particles, delivering TEs in a soluble, and readily bioavailable form. Thus, in some regions wet deposition may be the dominant source of trace elements (TEs). To investigate regional differences in aerosol TE composition and solubility, we collected aerosol samples during the CLIVAR A16N and A16S campaigns in 2013-2014. Starting at Reykjavik, Iceland (68 °N) and ending in Punta Arenas, Chile (most southerly station sampled at 52 °S), we traversed numerous biogeochemical provinces, from sub-Polar to the subtropical gyres, the Intertropical Convergence Zone and equatorial waters. A five order of magnitude range in aerosol Al concentrations (0.08 – 1400 ng m-3) was encountered which infers a similar range in total atmospheric dust loading. The highest concentrations were observed during a Saharan dust event (~15-16 °N in Sept. 2013). For Fe, Al and many other trace elements (TEs) we observed an inverse relationship between atmospheric loading and fractional solubility. This relationship can be used to estimate the soluble flux of atmospheric TEs.

32. The Effect of Surface Dispersant Application on Oil Degradation

Cathrine Shepard*, Samantha Joye, *University of Georgia*

In an attempt to disperse the 750 million liters of oil released into the Gulf of Mexico following the 2010 Deepwater Horizon oil spill, approximately seven million gallons of chemical dispersant were applied to the spill’s plume and surface slicks. Previous microcosm studies have indicated that direct plume dispersant application negatively impacts the surrounding microbial community's ability to degrade oil, citing inhibited hydrocarbon oxidation and microbial activity. The present work investigates the possible effects of surface dispersant application to oil slicks as well as areas not yet contaminated. Surface water was preconditioned for one week with additions of water accommodated fraction (WAF), chemically enhanced water accommodated fraction (CEWAF), dispersant, and elevated nutrient amended treatments. After one week, two milliliters of crude oil were added to all microcosms and allowed to incubate for thirty-two hours at which point microcosms were subsampled and analyzed for changes in nutrient geochemistry, hydrocarbon composition, potential hydrocarbon oxidation rates, bacterial production, and microbial community composition. The dispersant elevated nutrient amended treatment resulted in significantly higher initial hexadecane oxidation rates. Elevated hexadecane oxidation rates were later observed in the elevated nutrient control microcosm following the seven day preincubation period and thirty two hour post oil addition incubation. In contrast naphthalene oxidation rates were highest in CEWAF and nutrient amended WAF amendments. Following investigations will address microbial community shifts within these preconditioned microcosms as well as their changing hydrocarbon profiles.

33. Investigating marine chromophoric dissolved organic matter transformations with organic geochemical proxies in a growth and degradation experiment

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The origin and mechanisms driving the formation of chromophoric dissolved organic matter (CDOM) and fluorescent DOM (FDOM) in the open ocean remain unclear. Although recent studies have attempted to deconvolve the chemical composition and source of marine CDOM, these studies have been qualitative in nature. Here, we investigate these transformations using a more quantitative biomarker approach in a controlled growth and degradation experiment. In this experiment, a natural assemblage of phytoplankton was collected off the coast of North Carolina and incubated within roller bottles containing 0.2 µm-filtered North Atlantic surface water amended with f/2 nutrients. Samples were collected at the beginning (day 0), during exponential growth (day 13), stationary (day 20), and degradation (day 62) phases of the phytoplankton incubation. Amino acids, pigments and carotenoids, and phenolic compounds of the dissolved (DOM) were measured in conjunction with enzyme assays and bacterial counts to track shifts in OM quality as CDOM formed and was then transformed throughout the experiment. The results from the chemical analyses showed that the OM composition changed significantly from the initial and exponential phases to the stationary and degradation phases of the experiment. The percentage of aromatic amino acids to the total amino acid pool increased significantly during the exponential phase of phytoplankton growth, but then decreased significantly during the stationary and degradation phases. This increase was positively correlated to the fractional contribution of the protein-like peak in fluorescence to the total FDOM fluorescence. An increase in the concentration of amino acid degradation products during the stationary and degradation phases suggests that compositional changes in OM were driven by microbial transformation. This was further supported by a concurrent increase in total enzyme activity and increase in "humic-like" components of the FDOM. These findings link the properties and formation of CDOM and FDOM to the overall quality and diagenetic state of marine OM and to the marine carbon and nitrogen cycles.

34. Potential activities of extracellular glycosyl hydrolases, peptidases, alkaline phosphatase, and sulfatase in sediments of the White Oak River, NC

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Extracellular enzymes represent a potential rate-limiting step for the oxidation of high molecular weight organic matter by microorganisms. Here, we report hydrolysis rates of fluorogenic substrate proxies we used to assay the potential activities of extracellular glycosyl hydrolases (which catalyze the hydrolysis of polysaccharides), peptidases (which catalyze the hydrolysis of proteins), alkaline phosphatase, and sulfatase, at 3-cm depth increments along a 60-cm sediment core collected from the White Oak River in North Carolina. The White Oak River is an estuary with rapidly-accumulating sediments, in which oxygen is depleted within millimeters of the sediment-water interface, and sulfate depletion within ~30 cm. For these assays, substrate was added at near-

saturating concentrations to a slurry mixture consisting of 3 g sediment in with 150 ml artificial seawater buffered at pH 7.5 with borate. In general, enzyme activities decreased with increasing core depth. Relative activities shifted from glycosyl hydrolases closer to the sediment-water interface to sulfatases at depth. We will discuss the implications of these potential activities for the microbial ecology and organic carbon processing in these sediments.

35. Turnover and Priming of Terrigenous Dissolved Organic Carbon in Permafrost-Influenced Streams of Central Alaska

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Permafrost thaw due to accelerated climate warming in northern latitudes has prompted concern over changes in stream biogeochemistry that affect the fate of terrigenous dissolved organic carbon (tDOC). Permafrost-influenced streams may be sites of 'priming effects' as previously unexposed, biolabile permafrost DOC mixes with relatively modern, stable stream DOC upon thaw. We conducted 28-day bioincubation experiments of stream, vegetation-, and soil-derived DOC from discontinuous permafrost regions of Central Alaska amended with biolabile organic carbon substrates (i.e. primers). Microbial utilization of background stream DOC was 6.6 ± 5.2% on average while leachates lost between 8.8 and 66.1% DOC. Nutrient availability rather than priming was an overriding control on DOC remineralization, while seasonal effects were site-dependent. Biodegradability followed a continuum from highly biolabile vegetation-derived DOC to comparatively stable stream DOC. This was also reflected in our analysis of dissolved organic matter (DOM) composition using ultrahigh resolution mass spectrometry, which revealed that minimal compositional changes occurred in stream DOM compared to leachate DOM over the bioincubation period. Mineral soil DOM had the highest proportion of condensed aromatics (high molecular weight compounds) and polyphenolics (plant-derived compounds). Vegetation, organic soil, and permafrost DOM had large relative contributions of energy-rich aliphatic compounds. The relative abundance of aliphatics and sugar-like compounds in these DOM pools decreased with depth while condensed aromatic and polyphenolic compounds were more prevalent with depth, suggesting patterns of selective microbial utilization or preservation within organic soil horizons. In permafrost DOM, 50-56% of energy-rich aliphatic compounds were preferentially consumed by stream microbes. Our findings imply that climate-driven changes (e.g. temperature, nutrient supply, and vegetation) will modify the net ecosystem carbon balance of discontinuous permafrost regions.

36. Tracking Early Jurassic marine (de)oxygenation

Theodore R. Them II*, Benjamin C. Gill, Andrew H. Caruthers, Darren R. Gröcke, Selva M. Marroquín, Jeremy D. Owens, *Florida State University*

It has been suggested that the carbon cycle was perturbed during the Toarcian OAE (T-OAE) as observed in the carbon isotope record, and more recently numerous other elemental cycles (e.g., Hg, Mo, Os, S). The most widely accepted hypothesis focuses on the emplacement of the Karoo-Ferrar large igneous province, outgassing of greenhouse gases, and subsequent feedbacks in the Earth system, which caused severe environmental change and biological turnover. Feedbacks to elevated atmospheric pCO2 include enhanced weathering rates, dissociation of biogenic methane clathrates, increased terrestrial methanogenesis, and widespread marine anoxia. The sequence of events related to the development and duration of marine anoxia are not well constrained for this time interval due to a lack of open-ocean geochemical records. In order to reconstruct the timing of marine deoxygenation during the Early Jurassic T-OAE, we have utilized thallium isotopes, a novel geochemical proxy from multiple anoxic basins in western North America and Germany. Three sites representing a basin transect from the Western Canada Sedimentary Basin, and one site from the South German Basin, were chosen to reconstruct the thallium isotopic composition (ε205Tl) of the ocean. The ε205Tl composition of sediments deposited under anoxic and euxinic water columns records the global seawater ε205Tl composition, a function of the amount of manganese oxides that are precipitated. Increased geographic extent of marine anoxia will cause a decrease in manganese oxide precipitation and perturb the thallium system. Importantly, the inputs of thallium are nearly identical, thus changes in these fluxes cannot drive the observed perturbation. Our new Early Jurassic ε205Tl records suggest that the onset of marine deoxygenation occurred concurrently with Karoo-Ferrar magmatism in the late Pliensbachian and continued

until after the T-OAE. These new data support a Karoo-Ferrar trigger of the T-OAE. However, thallium isotopes also suggest that widespread marine deoxygenation was prevalent before and after the carbon isotope-defined T-OAE, which suggests significant oxygen consumption through carbon remineralization pre- and post-OAE. Thus, the OAE actually represents the interval of minimum oceanic oxygen and maximum euxinia, which primes the system for maximum organic carbon burial.

37. Field and culture studies of factors contributing to variability in the isotope effect of nitrate assimilation

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Nitrate (NO_3^-) is an essential macronutrient for phytoplankton growth. Enzymes, and in particular, nitrate reductase (NAR), have been shown to discriminate against the isotopically heavier form of NO_3^-, such that phytoplankton will preferentially assimilate $^{14}NO_3^-$ rather than $^{15}NO_3^-$. This preference to assimilate the isotopically lighter form of NO_3^- (quantified as the isotope effect, here "□") has been shown in phytoplankton culture studies to range from 1-27‰, although in the field □ typically ranges from 1- 10‰, and is often taken to be ~5‰. It was suggested that light and iron stress may contribute to the variability of □ observed in the field. Constraining both the magnitude of the range in □ in the field and the underlying mechanisms for its variability are important for interpreting the paleoceanographic record. In particular, understanding causes for variation in the □□ for □□□□assimilation is critical for constraining the role of the biological pump in the Southern Ocean over the past 100 kya. Here, we present NO_3^-isotope data for diatom cultures grown under different light conditions and find that increased light stress leads to higher □ values, which range from 8-11‰. Additionally, we present field data from the Southern Ocean with □ values ranging from 1-9‰ and offer potential explanations for the observed variations.

38. The effects of crude oil on northern Gulf of Mexico salt marsh nitrogen cycling

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The objectives of our study were to determine (i) the extent to which denitrification and DNRA are affected by oil spills in marshes, and (ii) if the contamination history of sites impact denitrification and DNRA with the addition of new oil. One site was moderately oiled (Chandeleur Islands, LA) following the 2010 Deepwater Horizon oil spill, while marshes at the other sites were not affected (Dauphin Island, AL; Dog River, AL). Sediments from each site were incubated with and without crude oil or water accommodated fraction (WAF) of oil and denitrification and DNRA were measured with the isotope pairing technique on sediment slurries. Denitrification rates were lower in 100% WAF than in control or 25% WAF at Dauphin Island in July ($p < 0.05$) and lower in 100% WAF than in control in November ($p < 0.05$), but were similar across treatments at the Chandeleur Islands and Dog River ($p > 0.05$). In contrast to DNRA, denitrification rates varied temporally in control samples at Dauphin Island ($p < 0.05$). DNRA rates were similar across treatments for all sampling periods ($p > 0.05$). These results suggest that the introduction of oil may affect denitrification in salt marsh sediments, but sites that were previously oiled appear to be more resilient.

39. A geochemical analysis of Rare Earth Elements (REEs) associated with significant sedimentary phosphorite deposits of West-Central Florida

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Rare earth elements (REEs) such as the lanthanide series as well as yttrium and uranium are an important industrial resource for expanding technological sectors; therefore, demand and production will continue to increase. Increased market prices resulting in decreased demand has led to new exploration for REE mineral resources in North America. Phosphorite deposits are being investigated as a possible supply but the overall concentrations, depositional environments, and ages are relatively unexplored. Phosphorite is commonly associated with ocean floor sediment deposition and upwelling; however, it may also form in estuarine and supratidal zones with low wave activity, present along Florida's west coast. Interestingly, it seems that major ancient phosphorite deposits are often, if not always, associated with major icehouse conditions (widespread

glaciations) and rarely observed during greenhouse conditions. By analyzing a set of sonic drill cores, spatiotemporal REE concentrations can be better constrained for a wide-age range of the Miocene-Pliocene aged Bone Valley Member of the Peace River Formation, the largest North American phosphate deposit. We present concentrations from a depth-transect of samples collected in West-Central Florida, showing the phosphatic sands and silts of the area are highly enriched sedimentary archives for REE, yielding concentrations up to 200 ppm for some REE. The weathering and transport of igneous and metamorphic minerals from the southern Appalachians to the Florida coast where a series of winnowing events occurred may explain the enrichment seen by our data. Sediment cores showing well-rounded quartz sands, dolomitic silts, teeth, bones, and marine fossils commonly found in a near shore depositional environment support this hypothesis. Previous analysis of phosphate grains, teeth, bones, and bulk sediment indicate REE are not associated with and/or sourcing from biogenic components, but rather entering the lattice structure of the phosphate grains through secondary diagenetic processes (Emsbo et al., 2015). Though concentrations do not reach values as high as other mining sources, the relative ease of extraction from sedimentary deposits may make them a valuable source.

40. Blue carbon sequestration within a northeastern Florida intertidal wetland - response to climate change and Holocene climate variability

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Intertidal forests and salt marshes represent a major component of Florida's coasts and are essential to the health and integrity of coastal Florida's ecological and economic systems. In addition, coastal wetlands are recognized as highly efficient carbon sinks with their ability to store carbon on time scales from centuries to millennia. Although losses of salt marshes and mangroves through natural and anthropogenic forces are threatening their ability to act as carbon sinks globally, the poleward encroachment of mangroves into salt marshes may lead to regional increases in carbon sequestration as mangroves store more carbon than salt marshes. For Florida, this encroachment of mangroves into marshes is prominent along the northern coasts where fewer freeze events have coincided with an increase in mangrove extent over the past several decades. Soil cores collected from a northeastern Florida wetland allow us to determine whether the recent poleward encroachment of mangroves into northern Florida salt marshes has led to an increase in belowground carbon storage. The soil cores, which are approximately two to three meters in length, will also provide the first known record of carbon storage in a northern Florida wetland during the Holocene. Initial results from the top 20cm, which represents ~100 years based on210Pb/137Cs dating, suggest more carbon is being stored within the transition between marsh and mangrove than in areas covered by salt marsh vegetation or mangroves. Additionally, all three Holocene records show a possible change in vegetation around 0.5m that may be related to changes in climate and/or sea-level.

41. Peatland Organic Matter Chemistry Trends Over a Global Latitudinal Gradient

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Peatlands contain a significant amount of the global soil carbon, and the climate feedback of carbon cycling within these peatland systems is still relatively unknown. Organic matter composition of peatlands plays a major role in determining carbon storage, and while high latitude peatlands seem to be the most sensitive to climate change, a global picture of peat organic matter chemistry is required to improve predictions and models of greenhouse gas emissions fueled by peatland decomposition. The objective of this research is to test the hypothesis that carbohydrate content of peatlands near the equator will be lower than high latitude peatlands, while aromatic content will be higher. As a part of the Global Peatland Microbiome Project (GPMP), around 2000 samples of peat from 10 to 70 cm across a latitudinal gradient of 79 N to 53 S were measured with Fourier transform infrared spectroscopy (FTIR) to examine the organic matter functional groups of peat. Carbohydrate and aromatic content, as determined by FTIR, are useful proxies of decomposition potential and recalcitrance, respectively. We found a highly significant relationship between carbohydrate and aromatic content, latitude, and depth. Carbohydrate content of high latitude sites were significantly greater than at sites near the equator, in contrast to aromatic content which showed the opposite trend. It is also clear that

carbohydrate content decreases with depth while aromatic content increases with depth. Higher carbohydrate content at higher latitudes indicates a greater potential for lability and resultant mineralization to form the greenhouse gases, carbon dioxide and methane, whereas the composition of low latitude peatlands is consistent with their apparent stability. We speculate that the combination of low carbohydrates and high aromatics at warmer locations near the equator could foreshadow the organic matter composition of high latitude peat transitioning to a more recalcitrant form with a warming climate.

42. V isotope composition in modern marine hydrothermal sediments

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Vanadium is multivalence transition metal with two isotopes (51V and 50V) that are suggested to have fractions to occur under low temperature redox states (Wu et al., 2015 EPSL). Recent work has shown that large V isotope variations do occur with oxygen variations in modern sediments (Wu et al., 2016 and 2017 Goldschmidt Abstracts). Thus, provides the potential as a promising proxy for determining low oxygen conditions. However, the development of V isotopes as a proxy to probe past redox conditions requires a comprehensive understanding of the modern oceanic isotopic mass balance. Therein, the scavenging of V by iron oxides hydrothermal fluid has been shown to be an important removal process from seawater (Elderfield and Schultz, 1996 Annu. Rev. Earth Planet. Sci.) but remains unquantified. In this study, we analyzed V isotopic compositions of metalliferous sediments around the active TAG hydrothermal mound from the mid-Atlantic Ridge (26° degrees North) and the Eastern Pacific Zonal Transect (GEOTRACES EPZT cruise GP16). The TAG sediments deposited as Fe oxyhydroxides from plume fall-out, and have δ51V values (δ51V = ((51V/50V)sample/(51V/50V)AA standard - 1) × 1000) between -0.3 to 0‰. There is no relationship between their δ51V values and sampling locations. In addition, a good correlation between Fe and V for these metalliferous sediments indicate that the accumulation of V in these samples is directly related to the formation and deposition of Fe oxyhydroxides. Thus the V isotope composition of these metalliferous sediments is mainly controlled by the adsorption/co-precipitation of V with Fe oxyhydroxides. The EPZT samples cover 8,000 km in the South Pacific Ocean with sedimentary areas that underlie the Peru upwelling region and the well-oxygenated deep South Pacific Ocean influenced by hydtorthermal plume material from superfast- spreading southern East Pacific Rise (EPR). The sediments collected at the east of the EPR have δ51V values between -1.2 to -0.7‰, similar to previous V isotope data oxic sediments (Wu et al., 2017 Goldschmidt Abstracts). In contrast, the sediments from the west of the EPR have δ51V values (-0.4 to 0‰) similar to hydrothermal sediments from the mid-Atlantic Ridge, indicating the long transportation (more than 4,000 km, Fitzsimmons et al., 2017 NG) of Fe and Mn from hydrothermal plume and their incorporation into sediments have a major impact on the cycle of V in the ocean. The fingerprint of δ51V between oxic sediments and hydrothermal flux are significantly different and should be easily discernible in the geologic record. Consequently, our results show that the removal of V from hydrothermal sediments has an important influence on the marine V cycle, which needs to be considered for future modern and paleoclimatic studies.

43. Internal Nutrient Loads in a North Carolina Reservoir Lake

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Jordan Lake is a reservoir in central North Carolina which serves as a drinking water source for much of the triangle region. The lake was constructed between 1973 and 1983 and has a long history of impaired water quality since shortly after its construction. This study seeks to understand the contribution of the sediments to internal nutrient loading. The aims of this study are three-fold: 1) Constrain the sediment contribution to internal nutrient loading under both oxic and anoxic conditions 2) Explore the geographic variability of this contribution, and 3) Investigate the impacts of sediment capping technology such as Phoslock™, a Lanthanum-bentonite clay, on these nutrient fluxes. In order to address these questions, sediment cores were collected periodically from July 2017 to February 2018, in varying locations centered around a particular site that was also monitored monthly by NCDEQ for water quality. After sectioning the cores, the porewater was extracted and analyzed for Phosphate, Ammonium, and Nitrite + Nitrate, and the results were used to model potential nutrient fluxes between the sediment and the water column. To support these modeled nutrient fluxes, we also conducted a series of core incubations under varying redox conditions, wherein experimental measurements of nutrient

fluxes were made by sampling the overlaying water for Phosphate, Ammonium, and Nitrite+Nitrate at known time intervals. Additional flux experiments to investigate the impact of Phoslock™ on nutrient fluxes are ongoing.

44. Short- and long-term response of phytoplankton to ENSO in Prydz Bay, Antarctica

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An integrated study was conducted to the field measured phytoplankton and Chl-a historical data collected during the Chinese Antarctic Research Expedition in Prydz Bay from 1990 to 2002. The results showed that during the El Niño/La Niña, the sea surface temperature, salinity, nutrients, and oxygen content in Prydz Bay have undergone significant variation. In particular, phytoplankton biomass (Chl-a concentration) and community structure changed significantly. During El Niño, the relative proportion of diatoms increased and dinoflagellates decreased, whereas during La Niña, the proportion of diatoms decreased, and chrysophyceae and cyanobacteria increased. Satellite remote-sensing data from 2002 to 2011 (December to March) showed significant differences in the onset and end times of the Chl-a inter-monthly change in Prydz Bay, which corresponded with sea-ice ablation, El Niño/La Niña events, and normal years. In El Niño years, phytoplankton bloomed before increases in SST; while in La Niña years, phytoplankton bloomed after increases in SST. The timing of enhanced phytoplankton abundance on the adjacent continental shelf off Prydz Bay also corresponded to the ablation of sea ice (the size of the water area), which has important implications for predicting the onset of ENSO. These results showed that sedimentary records of marine lipid biomarkers indicated that during El Niño, the relative abundance of diatoms increased with a decrease in dinoflagellates, in contrast to periods during La Niña years, when both algal classes showed the opposite trends.