species frequencies are equitably distributed, and all surface samples share >3% *Bulimina aculeata*, *Epistominella levicula*, and *Rutherfordoides mexicanus*.

The distributions of live specimens in the un-oiled and heavily oiled sites are distinctly different and mirrored by the macrofauna. The depth of habitation is 2 times greater at the un-oiled site, but the standing stock is 1.5 times greater at the heavily oiled site. The H' diversity index is greater throughout the depth of habitation of the un-oiled site compared to the heavily oiled site. Tentatively, the trends in density, standing stock, and diversity appear consistent with the point source pollution model (Alve, 1995) as though from patches of oil on the seafloor (although the heavily oiled site is not yet ruled out as natural seep). The depth of habitation is also useful for recognition of pollution effects.

23-7   **10:25 AM**   Hollabaugh, Curtis L.

THE EFFECT OF STEADY STATE DEPOSITION OF LEAD WHEEL WEIGHTS ON LEAD DISTRIBUTION IN THE ENVIRONMENT

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Lead is a dense (11.34g/cm³), easy to work, soft, durable metal that has long been the preferred metal to balance wheels on cars and light trucks. A good number of events can cause the lead wheel weights to be released onto roads and berms. These events include sudden stops, bumps, hitting curbs and potholes, and auto accidents. While on the road, lead wheel weights are broken, flattened, and ground into smaller and smaller particles. These particles are mixed into roadside soil, washed into drainage ditches and streams, and ground into lead dust. Eh-pH diagrams of lead indicate that under both low and high pH conditions, that lead is soluble in surface and groundwater.

Our research deals with the fate of lead wheel weights in the environment and the most efficient methods to remove lead wheel weights from the environment. Based on methods developed by Root (2000) we have been experimenting on the most efficient method for manual removal of lead wheel weights from roadways, sidewalks, berms and yards near busy urban streets. Training and motivation of volunteers are required to remove lead wheel weights trapped between the curb and the road. Several large finds of lead wheel weights were collected by students after they became aware of the authors efforts to remove lead from roads. For example, one student in one hour found 100 lead wheel weights (2,845 g) along one mile of sidewalk in Whitesburg, Georgia. Four months later when much of the road was repaved only nine (194 g) wheel weights were found. Two years later when Whitesburg was revisited 35 lead wheel weights (939g) were collected and one iron wheel weight was found. Each time we have collected from an area there was always a range of degrees of breakdown of the weights – from weights that were untouched to those that were broken into small thin flakes. After our collection of wheel weights from a road, when we return after weeks or months there are abundant new deposits of wheel weights in various stages of breakage.

23-8   **10:45 AM**   Schifman, Laura A.

ENHANCED STORMWATER CONTAMINANT REMOVAL USING MODIFIED SORBENTS IN TREE FILTERS

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Stormwater runoff, particularly in urban areas, contains several groups of contaminants that negatively impact surface- and groundwater quality if left untreated. Contaminants in runoff are often addressed by structural best management practices (BMP) that capture and treat runoff before discharging it. Many BMPs, such as tree filters, act as primary filtration devices that attenuate total suspended solids, nutrients, and heavy metals from runoff; but typically these BMPs are not designed to treat bacteria and have only minor petroleum hydrocarbon (PH) treatment capabilities. To address this shortcoming, two materials (red cedar wood chips, expanded shale) were modified with either Quaternary Ammonium Silane (QAS) or Silver Nanoparticles (AgNPs) to provide antimicrobial properties to the matrix and/or exploit their affinity to sorb PH, particularly polycyclic aromatic hydrocarbons (PAH). Results show that of the two materials investigated, wood chips exhibit the highest sorption capacity for QAS, making this material favorable for treating bacteria, while at the same time attenuating PAHs and metals by sorption processes. In case of AgNP amendments to wood, less QAS uptake and more desorption from the wood matrix was observed. Relative to wood, expanded shale exhibited less affinity for QAS and AgNP. Batch isotherm studies show that PAH, metal, and bacteria removal is higher with QAS amended wood chips than with AgNP amended wood chips. In this presentation, the contaminant removal efficiency of all modified and unmodified materials will be discussed on the background of how these materials may find use in enhanced treatment of stormwater in tree filter BMPs.

23-9   **11:05 AM**   Sarajlic, Semir

CONTAMINANT HYDROGEOLOGY ONTOLOGY: INTEGRATION WITH THE LINKED OPEN DATA CLOUD

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Large volumes of hydrogeochemical data originate from a diverse and distributed set of instruments that measure the geochemical constituents of surface and groundwater. These rapidly growing contaminant hydrogeology data are stored in isolated and networked databases. Accessing and integrating the heterogeneously structured data from these databases are difficult and time consuming. One way to overcome the data integration and software interoperation is to develop ontologies that formally and explicitly represent the knowledge in the domain (e.g., contaminant hydrogeology). The Contaminant Hydrogeology Ontology (CHO) is developed, applying the Protégé editor, to manage hydrological data for Georgia, USA.

CHO is a conceptual knowledge model for the contaminant hydrogeology domain in which concepts (classes, e.g. Contaminant, Aquifer), their relationships (properties, e.g. contaminates), and constraints are defined using the OWL constructs. CHO models the knowledge about the interaction of contaminants, their source, and how the aquifer properties affect the contaminant transport in the groundwater. CHO consists of top level classes (e.g., WaterQuality) that extend SWEET ontologies (e.g., phenEnvirImpact), from which additional concepts from the contaminant hydrogeology domain are created as subclasses (e.g., PrimaryContaminant). The consistency of the ontology was tested and maintained using the Pellet reasoner. Classes from CHO are associated with data from public databases (e.g., GA EPD's HSI and LUST), allowing data to inherit the relationships established in CHO and making them discoverable on the Web by software agents.

Integration of CHO with the Linked Open Data (LOD) Cloud, which is presently underway, will enable access to the CHO represented data from mobile devices (e.g., smartphones and tablets)

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that use DBpedia Mobile client. This is done by integrating (linking) the class and property URIs from CHO with DBpedia ontology's class and property URIs based on the Linked Open Data principles.

SESSION NO. 24, 8:00 AM

Thursday, 21 March 2013

Multidisciplinary Paleontology Research

Caribe Hilton, Flamboyan Room

24-1   **8:05 AM**   Kowalewski, Michal

BATHYMETRIC VARIATION IN TIME-AVERAGING ACROSS A MODERN SHELF

KOWALEWSKI, Michal[1], DEXTER, Troy A.[1], KAUFMAN, Darrell S.[2], KRAUSE, Richard A. Jr[3], ROMANEK, Chris S.[4], YANES, Yurena[5], HUNTLEY, John Warren[6], and SIMOES, Marcello[7], (1) Florida Museum of Natural History, University of Florida, Gainesville, FL 32611, kowalewski@ufl.edu, (2) School of Earth Sciences & Environmental Sustainability, Northern Arizona University, Flagstaff, AZ 86011-4099, (3) Geosciences Institute, Johannes Gutenberg University, Johann-Joachim-Becher-Weg 21, Mainz, 55128, Germany, (4) Department of Earth and Environmental Sciences, University of Kentucky, 101 Slone Research Building, Lexington, KY 40506, (5) Department of Geology, University of Cincinnati, 500 Geology-Physics Building, Cincinnati, OH 45221, (6) Geology Department, St. Lawrence University, 23 Romoda Drive, Canton, NY 13617, (7) Instituto de Biociencias, Universidade Estadual Paulista-UNESP, Distrito de Rubiao Junior, CP. 510, Botucatu, 18.618-000, Brazil

In a series of projects focused on time-averaging (age mixing), we have assembled a time-series of individually dated shells collected across a depth gradient along the southern Brazilian shelf. This dataset provides an opportunity to assess if temporal mixing in bivalve assemblages varies significantly with water depth.

Shells of the infaunal bivalve mollusk *Semele casali* were collected from surficial sediments at multiple sites on the Southeast Brazilian Bight, a sub-tropical passive-margin shelf. A total of 275 specimens were individually dated using amino acid racemization [AAR] methods calibrated against 35 radiocarbon dates. The resulting time series revealed a relatively continuous age distribution with shell ages ranging from modern to ~10,600 yrs BP. The age distribution is right skewed with a slowly tapering tail of older specimens extending back to the earliest Holocene. The substantial presence of old shells spanning multiple millennia is suggestive of a long residence time near or at the sediment surface, as would be expected for this sediment-starved shelf that has experienced low net accumulation rates during the Holocene.

Sites were grouped into three bathymetric datasets (<20 m, 20–30 m, and >30 m). The three resulting age distributions are remarkably comparable in terms of skewness (1.32, 1.52, and 2.48), median shell ages (968, 845, and 648 years), and inter-quartile ranges (2467, 1840, and 1777 years). The distributions are indistinguishable statistically using non-parametric rank tests. Monte Carlo simulations suggest that variations observed across the three distributions are comparable to those generated by random resampling of the pooled data under the null model of homogenous time-averaging.

The results suggest that time-averaging is remarkably invariant across the sampled depth gradient. This is a promising outcome suggesting that the temporal resolution of fossil assemblages may be comparable across depositional profiles of sedimentary basins representing shallow-water open shelf settings. Comparative studies of time-averaging across bathymetric gradients are needed for other depositional settings to develop a more robust understanding of spatial variability in temporal resolution of fossil assemblages.

24-2   **8:25 AM**   Deline, Bradley

CHARACTER SELECTION AND THE QUANTIFICATION OF MORPHOLOGY

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Morphologic patterns and trends in disparity are strongly linked to a priori choices in the methodology used to quantify organismal form. Variation in the perceived patterns can be caused by differences between methodologies (e.g. landmark, outline, or discrete characters) as well as the choices made within a method. These choices are often justified based on the particular question being asked, but the role of potential biases needs to be explored. This is particularly true when using discrete characters to quantify morphology because the choice of characters, the amount of character dependence, the resolution of character states, and the number of characters can all potentially influence the results.

The effect of varying the number of characters used in the quantification of morphology was examined with a morphological dataset of early Paleozoic crinoids. A set of characters was recently compiled as part of the Assembling the Echinoderm Tree of Life project and includes 178 multistate and binary characters that encompass the entire skeletal morphology of the organisms (holdfast, stem, calyx, tegmen, and arms). Two hundred early Paleozoic crinoids were coded and the resulting matrix was analyzed to produce a morphospace using principal coordinate analysis. A rarefaction analysis was conducted on the dataset in which a subset of characters was randomly chosen, analyzed, and the structure of the resulting morphospace was then compared to the morphospace built using the original character matrix in terms of the position of taxa along the primary axis, the amount of variance, and the relative distance between taxa. The results indicate that with this character suite, similar results can be obtained using only 10-15% of the character matrix, i.e. 20-30 characters out of 178. Therefore, large character sets may not be required to detect the major morphologic patterns that are of interest in paleontological studies.

24-3   **8:45 AM**   Smith, Kathlyn M.

EVOLUTION, DISPERSAL, AND HABITAT PREFERENCE OF *BASILOSAURUS* (MAMMALIA: CETACEA) IN THE SOUTHEASTERN UNITED STATES: NEW EVIDENCE FROM THE EOCENE OF SOUTHWEST GEORGIA

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Archaeocetes are primitive cetaceans that originated during the early Eocene in Indo-Pakistan. By the end of the Eocene, archaeocetes were distributed worldwide. Semiaquatic protocetid archaeocetes were the first to reach North America during the early middle Eocene, followed by fully aquatic basilosaurids in the late Eocene. The archaeocete *Basilosaurus* reached lengths of up to 70 feet and is characterized by elongated posterior thoracic, lumbar, and anterior caudal

vertebrae. *Basilosaurus isis* is known from Egypt and Jordan, whereas *Basilosaurus cetoides* is known principally from North America. The two taxa are distinguished mainly by the slightly larger size of *B. cetoides*. Most occurrences of *Basilosaurus* in North America are within the Gulf Coastal Plain. Fewer specimens have been found in the Atlantic Coastal Plain. In Georgia, there are only three confirmed reports of *Basilosaurus*, two of which are of skeletal fragments. Here we report a new specimen of *Basilosaurus* found on the banks of the Flint River in Albany, Georgia. This specimen appears to be the most complete *Basilosaurus* known from Georgia, consisting of a series of elongated vertebrae and some probable rib fragments. Upon initial discovery, the specimen included five nearly complete vertebrae and fragments of two more, but three vertebrae have since been stolen. The excavation is ongoing, and there is potential for recovery of additional material beyond what is currently excavated. The fossil is encased in the Ocala Limestone, a fine-grained, white to cream colored limestone that formed during the late Eocene (Priabonian: 37.2-33.9 Ma) in the shallow open waters of the continental shelf. The distribution of *Basilosaurus* in North America is limited to marine deposits, but it is unclear why the taxon is abundantly known in Mississippi and Alabama and underrepresented in neighboring Georgia. Here we investigate the facies, temporal, and geographic distribution of *Basilosaurus* in North America in order to identify paleoenvironmental and geographic limitations to its distribution. Elucidation of these patterns will ultimately provide a better understanding of the timing of dispersal and habitat preference of *Basilosaurus*, with important implications for the evolution of archaeocetes in southeastern North America.

24-4   9:05 AM   Korpanty, Chelsea A.

LIVE-DEAD FIDELITY OF MOLLUSCAN ASSEMBLAGES IN ANTHROPOGENICALLY IMPACTED SEAGRASS HABITATS, NORTH CAROLINA

KORPANTY, Chelsea A., Geography and Geology, University of North Carolina Wilmington, 601 South College Rd, Wilmington, NC 28403, cak9515@uncw.edu and KELLEY, Patricia H., Department of Geography and Geology, University of North Carolina Wilmington, 601 South College Road, Wilmington, NC 28403-5944

Molluscan live-dead fidelity studies investigate the influences of anthropogenic activities on marine ecosystems by comparing the taxonomic composition of a local living community to the local death assemblage. Kidwell (2007) hypothesized that environments subjected to anthropogenic stresses yield low fidelity (discordance) in rank-order abundance between living and death assemblages. This live-dead approach was applied to three intertidal, siliciclastic seagrass environments of North Carolina impacted by different human activities: 1) Oyster Creek (OC), agricultural/terrestrial runoff and trash; 2) Bogue Sound (BS), freshwater runoff and clam harvesting; and 3) Chadwick Bay (CB), boat traffic and dredging of the Intracoastal Waterway.

At each site, bulk sediment samples were collected from the upper 40 cm of the substrate at 10m intervals along three 30m transects. Spearman's rank correlation was used to compare the rank-order abundance of genera within the living and death assemblages at and among sites. When bivalve and gastropod assemblages are pooled, there are significant rank correlations between living and dead assemblages at all sites (OC: r_s=0.3492, p<0.0004; BS: r_s=0.4288, p<0.0008; CB: r_s=0.2801, p<0.0006). Death assemblages for each site are also significantly correlated to one another (OC vs. BS: r_s=0.6962, p<<0.0001; OC vs. CB: r_s=0.4438, p<<0.0001; BS vs. CB: r_s=0.3212, p<0.0014). Living assemblages are not significantly correlated among sites. Rarefaction analyses indicate that living and dead assemblages at Chadwick Bay are enriched compared to the other sites and that Oyster Creek yields the lowest diversity and abundance (95% confidence interval). Death assemblages at all sites are enriched in comparison to corresponding living assemblages. Significant live-dead fidelity contradicts our hypothesis. However, similarity of death assemblages and disparity of living communities among the three sites suggest that different anthropogenic pressures may yield specific ecologic responses by and consequences for molluscan assemblages. Field observations suggested that Chadwick Bay is the most stable, least impacted environment and Oyster Creek is the most stressed. Significant rank correlations and rarefaction results support these inferences.

24-5   9:25 AM   Casebolt, Sahale N.

LONGITUDINAL TRENDS IN THE EVENNESS OF BIVALVE ASSOCIATIONS ACROSS PACIFIC ISLAND REEFS

CASEBOLT, Sahale N., KOWALEWSKI, Michal, and PAULAY, Gustav, Florida Museum of Natural History, University of Florida, Gainesville, FL 32611, scasebolt@flmnh.ufl.edu

Bivalves are important to paleontologists because they are one of the most dominant groups of macro-organism found in the fossil record. Consequently, their evolutionary history has contributed significantly to geologists' understanding of past climate and geography. Although extremely high bivalve diversity in the modern Indo-Pacific is well documented, certain aspects of this diversity are still poorly known, and some localities display unique patterns in bivalve community compositions due to historical factors and local environmental variables.

Using bulk sampling of fore reef sediments, we estimated bivalve diversity from Indo-Pacific island localities along a longitudinal transect. These samples were obtained from comparable latitudes and reef sub-environments, but varied in longitude. In order to ensure that both small and large bivalve specimens were collected, the sediment was sieved into three size fractions and bivalves were picked proportionally from each size fraction.

The samples not only differ in species richness, showing the well-documented trend of declining species richness eastward away from the Indo-Pacific biodiversity hotspot, but they also vary considerably in evenness. For example, a sediment sample from the Gilbert island archipelago contains over 70 bivalve species, with specimen abundances being relatively evenly distributed across species. In contrast, a sample from the Palmyra fore reef (of the Line island archipelago) contains only ~50 bivalve species and is dominated by two species: a lucinid bivalve *Ctena bella*, and a giant clam *Tridacna maxima*.

This difference in species dominance patterns across the sampled sites points to the magnitude of the underlying complexity of the Indo-Pacific biodiversity hotspot. Both historical and local factors may have played a role in shaping these patterns, and need to be taken into account in conservation paleobiology studies in which modern ecosystems are used as a benchmark for past ecosystem biodiversity.

24-6   10:05 AM   Sheffield, Sarah L.

THE MORPHOLOGY OF *ERISOCRINUS TYPUS*: A STUDY USING ARCGIS©

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Cladid crinoids have among the highest disarticulation rates of all Paleozoic crinoids, but *Erisocrinus typus* has been shown to be an exception. A large number of specimens were collected from the crinoid Lagerstätte in the Barnsdall Formation (Upper Pennsylvanian) exposed near Copan, Oklahoma, including a growth series consisting of eight complete crowns ranging in size from 1.1 to 7.5 cm.

A digital growth study using these eight crowns of *E. typus* was performed using standard heads-up digitization methods in ArcGIS©. The sutures between all the plates of the crown were traced from high-resolution, two-dimensional photographs. Topological constraints that were put into effect prevented the digitized lines from overlapping and facilitated conversion into polygons. The perimeters, areas, and other measurements of these polygons, represented as individual plates, were automatically calculated by the software.

Features identified through traditional methods can be evaluated more accurately by using ArcGIS© such as the proportional area of the basal plates, a feature upon which different species of *Erisocrinus* have been established. Selected plates can be followed through the eight specimens of the series to produce graphs showing ontogenetic changes in size and shape. Plate addition can also be tracked using this method. Ongoing studies of the systematics of the genus will benefit from close analysis of the changes in the basal plates and other growth features used as defining characteristics in the numerous *Erisocrinus* species that have been described.

A previous study of the ontogeny of this species concluded the growth of the cup to be isometric. However, results from this study concerning the relative rates at which plates are changing size and shape show that *E. typus* grew anisometrically. The anisometric growth of the cup can also be traced from the upflared infrabasals present in the juvenile stage to the distinct basal concavity seen in the adult.

The methods utilizing ArcGIS© allow for a much more accurate growth study, as compared to one that can be performed via traditional methods. Because of the rarity of complete cladid specimens that can be used in growth studies, this study will have far-reaching implications in better determining the ontogeny and systematics of cladid crinoids.

24-7   10:25 AM   Tyler, Carrie L.

UTILITY OF MARINE BENTHIC ASSOCIATIONS AS A MULTIVARIATE PROXY OF PALEO-BATHYMETRY: A DIRECT TEST FROM RECENT COASTAL ECOSYSTEMS OF NORTH CAROLINA

TYLER, Carrie L. and KOWALEWSKI, Michal, Florida Museum of Natural History, University of Florida, Gainesville, FL 32611, ctylersa@flmnh.ufl.edu

Marine benthic associations from present-day habitats can not only provide quantitative insights into community ecology and conservation biology, but also aid in assessing and developing paleoecological and paleoenvironmental proxies applicable to the fossil record. Systematic quantitative sampling of the live marine benthos in coastal North Carolina was conducted to evaluate macro-faunal associations along an onshore-offshore gradient and determine their informative value as paleo-bathymetric indicators.

Multivariate ordinations were used to determine whether modern benthic marine invertebrate communities can be effectively used to extrapolate bathymetry. Samples were analyzed using detrended correspondence analysis (DCA). The DC1 scores of samples correlate tightly with the actual depth values of the samples, confirming that samples ordinate along an axis that primarily reflects bathymetry and its environmental correlatives. Moreover, when the DC1 scores are calibrated with modern ecological data, the resulting estimates of sample depths are a robust proxy of their actual bathymetry.

In coastal ecosystems of North Carolina, bathymetry appears to be a primary controlling factor, with faunal assemblages changing predictably in terms of their taxonomic composition with depth. This relation is remarkable also because coastal habitat variation and anthropogenic effects may act as confounding factors here, particularly in inlets, harbors, and estuarine settings.

Although it is arguable that individual case studies such as this one can support broader generalizations, these results are promising and consistent with multiple paleontological studies. Fossil communities may provide robust quantitative estimates of bathymetry with potential applications to paleoecology and stratigraphy.

24-8   10:45 AM   Rindsberg, Andrew K.

HERBERT H. AND DAISY W. SMITH: COLLECTORS AND CURATORS FROM BRAZIL TO ALABAMA

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Herbert H. Smith (1851-1919) is credited with collecting over a quarter of a million natural history items, including fossils as well as modern plants, insects, birds, mammals, and freshwater mollusks from tropical Latin America and the Southeastern United States. These objects included many type specimens; they were in demand among private collectors as well as public museums and are of continuing value to researchers. Unpublished notes and correspondence have also been preserved. Unfortunately, Smith's Brazilian field notes are lost, but his travel book about the Amazon is still consulted for its insights on local culture. Weekly letters posted from Alabama to two shell collectors (George Clapp and Bryant Walker) still exist, as well as other materials from Smith's years as the Alabama Museum of Natural History's Curator (effectively, its head). These illuminate not only Smith's progress as a scientist, but also the environmental conditions along Alabama's rivers before they were irrevocably changed by the erection of dams in the twentieth century. The Smiths' collections of now-extinct freshwater mollusks and fossil mollusks from now-submerged outcrops along Alabama's rivers are irreplaceable.

The role of Herbert Smith's wife, Amelia "Daisy" W. Smith, in collecting and processing the collections was downplayed at the time, though Herbert made it clear to his employers that they were really getting two collectors for the price of one. She accompanied him as a working partner on collecting trips as well as in the museum. Daisy's contribution became clear after his untimely death in 1919; she was employed for several years as the head ("Assistant Curator") of the museum to continue his unfinished work. She ensured that their collections were studied and published by others such as Calvin Goodrich and Bryant Walker. The importance of Herbert and Daisy Smith's contributions to science is becoming apparent as unpublished materials resurface.

24-9   11:05 AM   Klompmaker, Adiël A.

AN OVERVIEW OF PREDATION EVIDENCE FOUND ON FOSSIL DECAPOD CRUSTACEANS, WITH NEW EXAMPLES OF DRILL HOLES

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Predators of extant decapod crustaceans are fairly well-known, but not much is known about predation on decapods in the fossil record in contrast to many other fossil invertebrate groups. We provide the first overview of evidence of predation on decapods from the fossil record and show that it is perhaps more common than currently recognized. Examples thus far are mainly drill holes in the exoskeleton of decapods and decapod remains preserved as stomach contents; bite marks, incisions or irregular holes, and possible regurgitated material are minor categories of predation. The unambiguous predators of decapods in the fossil record are fish, plesiosaurs, ammonites, and gastropods. We further provide new examples of drill hole predation in Neogene