Kusnerik

Title: Paleoecology of the Sundance Seaway: Marine Paleocommunity Formation in the Jurassic U.S. Western Interior

Hypothesis and Objectives: (*728 of 1,000)*

The Sundance Seaway was a Jurassic epicontinental seaway, approximately the size and dimensions of the Red Sea. It formed and filled in 40 million years, and its geologically short existence makes it an ideal natural experiment on how species colonize new habitat and organize into communities. First, I will test whether the seaway faunas were sourced from northern latitudes, as implied by most paleogeographic reconstructions, or whether they were sourced from multiple latitudes, including temperate to even subtropical. Second, I will quantitatively test the driving environmental factors of community development (water depth, substrate, temperature, salinity, etc.) to discern the primary force driving that development.

Significance: (1,292 of 2,500)

This study is significant in that it address how faunal communities form, and how those communities change through time in response to the environment. Compared to previous studies, this study will track community changes over the entire lifespan of a marine basin rather than focus only on community development in an already existing ecosystem (Holterhoff, 1996; Tang and Bottjer, 1996; Stanton and Dodd, 1997; Holland and Patzkowsky, 2004; Scarponi and Kowaleski, 2004;).

The source of a basin's fauna, and with it how a biogeographic province is formed, remains an almost unexplored question. This study offers a methodological model to answering these questions through the combination of fieldwork and the Paleobiology Database, which may be subsequently applied to other basins. Building this model of community organization and development in the

Sundance Seaway will also allow us to test hypotheses on a variety of paleoecology questions currently debated, including habitat tracking (Brett et al., 2007), evolutionary stasis (DiMichele et al., 2004), and community stability. Lastly, this model may be applied to faunal studies of the entirety of the Sundance Seaway basin including sites in British Columbia, Alberta, Montana, North Dakota, South Dakota, Wyoming, Idaho, and Utah.

Methods: (1,522 of 2,500)

Fieldwork will be conducted in the Bighorn Basin of Wyoming during late June to July, 2014. Ten fossilferous samples from each formation or member that makes up the marine Jurassic record (Gypsum Spring Formation, Canyon Springs Member, Stockade Beaver Shale, Hulett Member, Redwater Shale, and Windy Hill Sandstone) will be collected for a total of fifty samples. For each sample, abundances will be tallied by identifying individuals to the genus and, where possible, species level.

Nonmetric-multidimensional scaling in R will be used to identify faunal community gradients within the entire marine Jurassic of Wyoming and within individual time slices. These faunal gradients will be compared with known information on environmental factors, such as facies and lithology, and taxon ecology to identify the underlying factors controlling community composition. These driving factors will be compared with previous studies of the Sundance Seaway's paleoecology, along with that of the global Jurassic record where possible, to test the factors driving Jurassic marine community formation.

These bulk samples will be combined with a literature database to create a more complete faunal record of the Sundance Seaway. With this record, the taxa can be compared to global recorded taxon distributions in the Paleobiology Database in order to track the biogeographic provenance of species present in the Sundance Seaway. This will allow for analysis of where the Sundance fauna originated and how it likely entered the seaway.

Budget:

Gas (6000 miles @ 20 mpg *$3.60/gallon) $1080

Shipping (500 lbs of samples at $20 per 50 pound package +$150 for boxes, tape, etc.) $350

Camping ($20 per night for 10 nights) $200

General Field Supplies (hammers, collection bags, etc.) $100

Justification: (841 of 1,200)

Travel from Athens, Georgia to the Bighorn Basin is approximately 2000 miles. Combined with the return trip and with travel in the field area brings a total estimated travel of 6000 miles. The car to be used runs at approximately 20 mpg. Gas is estimated to be $3.60/gallon for June 2014, giving a total of $1080.

Samples will need to be shipped to the University of Georgia via library mail, costing $20 per 50 lb box. The total estimated weight of the samples will be 500 lbs (average 10 pounds per sample).

Camping during fieldwork will be primarily on BLM land at no cost. Funding is requested for lodging on the trip from Athens, Georgia to the Bighorn Basin, Wyoming and for those few nights necessary during fieldwork.

General field supplies (bags, notebooks, hammers) will need to be bought for collection at an estimated cost of $100.

References: (2,025 of 2,500)

Blakey, R., 2014, Western Interior Seaway- Jurassic and Cretaceous Epicontinental Seas of North America, http://cpgeosystems.com/wispaleogeography.html

Brett, C.E., A.J.W. Hendy, A.J. Bartholomew, J.R. Bonelli, Jr., and P.I. Mclaughlin, 2007. Response of shallow marine biotas to sea-level fluctuations: a review of faunal replacement and the process of habitat tracking: PALAIOS, v.22, n.3, p.228-244

DiMichele, W.A., A.K. Behrensmeyer, T.D. Olszewski, C.C. Labandeira, J.M. Pandolfi, S.L. Wing, and R. Bobe, 2004, Long-term stasis in ecological assemblages: evidence from the fossil record: Annual Review of Ecology, Evolution, and Systematics, v.35, p.285-322

Holland, S.M. and M.E. Patzkowsky, 2004, Ecosystem and structure: Middle Upper Ordovician of central Kentucky, USA: PALAIOS, v.16, p.205-217

Holterhoff, P.F., 1996. Crinoid biofacies in Upper Carboniferous cyclothems, mid-continent North America: Faunal tracking and the role of regional processes in biofacies recurrence: Palaeogeography, Palaeoclimatology, Palaeoecology, v.89, p.197-226

Scarponi, D. and M. Kowaleski, 2004, Stratigraphic paleoecology: Bathymetric signatures and sequence overprint of mollusk associations from the late Quaternary sequences of the Po Plain, Italy: Geology, v.32, p.989-992

Stanton, R.J. and J.R. Dodd, 1997, Lack of stasis in late Cenozoic marine faunas and communities, central California: Lethaia, v.30, p.239-256

Tang, C. and D.J., 1996. Long-term faunal stasis without evolutionary coordination: Jurassic marine benthic paleocommunities, Western Interior, United States: Geology, v.29, p.815-818

Education

2015 M.S. student in Geology, University of Georgia, current GPA 3.33
Concentration: Paleobiology, Advisor: Dr. Steven Holland

2013 B.S., Geology and Government, The College of William & Mary, Geology GPA 3.42
Thesis: Reconstructing the late Pleistocene paleoenvironment of Holland Point, Virginia from a *Crassostrea virginica* reef, Advisor: Dr. Rowan Lockwood

Awards

2012 Stofan Geology Fellowship

Abstracts

Lockwood, R., Bonanni, S.I., **Kusnerik, K.M.**, and Grant, A.N., 2014, Reconstructing population demographics and paleoenvironment of Pleistocene oyster assemblages: Establishing a baseline for Chesapeake Bay Restoration?: North American Paleontological Convention *Abstract Book*, v.13, p.81

Kusnerik, K.M., Grant, A.N., and Lockwood, R., 2013, Reconstructing the late Pleistocene paleoenvironment and population ecology of the Eastern Oyster (*Crassostrea virginica*) at Holland Point, Virginia: Geological Society of America *Abstracts with Program*, v.45, n.2, p.65

Field Experience

April 2013 Excavation near Yorktown, Virginia with Dr. Alton Dooley, Virginia Museum of Natural History

Summer 2012 Thesis research along the James, York, Rappahannock, Piankatank, and Potomac Rivers, Virginia, focus at Holland Point, Virginia with Dr. Rowan Lockwood and Dr. Buck Ward, Virginia Museum of Natural History

Spring 2012 Tropical carbonate environments course, San Salvador, Bahamas