Ostracod Body Size as a Variable of Biomass

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Abstract

When one looks throughout the rock layers, they aim to find either fossils or petroleum. Our project encompasses both. We are looking at ostracod fossils throughout the continental United States in an attempt to link environmental factors to a larger body size. In our research the environmental factor we studied was biomass. In essence our project seeks to find a trend towards larger body size in locations where, prehistorically, there was a lot of food. You may wonder where petroleum comes into this. Our indicators of biomass are the many oil wells throughout the United States. We used location data provided to us and found all fossils within the same layer and a 100 kilometer radius of our oil wells. We compared the size of those ostracods to those that were still within the radius (in an effort to avoid data from other unknown oil wells within the same oil basin) but not from the same time period. Our results indicated a clear size difference between the ostracods within the oil difference. The ostracods were larger by approximately 1 millimeter on our log scaled graphs. Our hypothesis was clearly supported by this data through time.

Methods

Our Ostracod data was compiled from 27 volumes of the Catalogue of Ostracoda. We obtained source rock petroleum data (biomass proxy) from Dr. Noel Heim. We then used the computer program R to:
1. Plot the locations of different oil wells and ostracod fossil sites, for visual reference,
2. Graph the frequency in the various lengths of ostracods in both the data set of ostracods in environments of a lot of biomass and the ostracods that lived in environments without a lot of biomass,
3. and finally, plot the mean of the data sets on a graph combining both sets of data.

Background

Ostracods are tiny marine or freshwater crustaceans that have a bivalve shell. They are found commonly in bodies of water around the world. They have a wide variety of diets depending on their location; some are filter feeders, while others are omnivores, carnivores, and herbivores. Ostracods are considered to be the most common arthropods found in the fossil record, as well as the most diverse. Over 2000 species of ostracods have been discovered. Fossils range from the Cambrian period until now. Petroleum is the raw form of gasoline. It is vital in many human activities today, such as in gas-powered vehicles and other useful tools. Petroleum is found deep in the rock layers on Earth’s surface, and requires a lot of effort to remove from the ground. The pressure which original biomass is put under produces petroleum hydrocarbons (what humans need to power their world), which therefore makes it a good proxy for biomass.

Results

Our results showed us that there was an obvious trend towards a larger body length amongst ostracods that resided in environments of large biomass. It is seen in our histograms that there is, in fact, a larger mean body size between the two groups of ostracods. Our logarithmically scaled graphs showed us bell curves that were clearly centered in two separate areas. Our results showed a difference of approximately 1 millimeter in log scale between the mean size of both of the groups of ostracods. The t-test revealed a mean value of -0.14493761(with biomass) and -0.05811414(without biomass) while also revealing a p value of 1.654e-13. This means that there was a significant and relevant difference between the two groups.

Conclusion

Our data successfully proved our hypothesis. It proved that the presence of a lot of biomass in a certain environment has the effect of increasing the overall body size (length) of ostracod species. Our data can lead us in many directions. The first of which is the potential that smaller Mesozoic ostracods could have been the main data in our environments lacking biomass, while the larger Paleozoic ostracods could have made our size data within the oil wells seem larger. However upon separation of these two time periods along with a histogram of the Cenozoic, we saw limited data within the Mesozoic, and results similar to our large scale results in both the Paleozoic and the Cenozoic. Additionally there is the argument that it is not the food that is making plants grow bigger but rather the excess oxygen produced the environment. That is our subject of further inquiry at this point and it will have to be tested in a manner by which living organisms through generations would somehow need to be put under high oxygen while another set needs to be put under a high food content environment. In addition to that necessary further research, we would need to fully understand our results in a real world context. Our main purpose of this experiment was to see if the biomass (indicated by petroleum) could predict a larger body size, so that we could use that data to search for more petroleum. Essentially using body size as an indicator for petroleum. This is still a topic that needs to be studied more precisely however, since there is no specific ratio of size to oil content within our project.

Map of Oil Wells and Ostracod Fossils

Blue-Oil Wells

Red-Ostracod Fossils

Source: Ellis and Messina 1952-1964 Catalogue of Ostracoda

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