CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
Marianna P. DaRos

Project Number
S0801

Project Title
Preventing Soil Erosion

Abstract

Objectives/Goals
In this experiment, three forms of management practices where tested. The goal of the experiment was to discover the most effective way to slow down soil erosion by water in the conditions that they were set up in.

Methods/Materials
This was done by placing hand compacted garden soil into a PVC gutter on a slope, and applying the allotted management practice as well as simulating rainfall by sprinkling water from above. Afterwards, the dried runoff materials will be weighed and analyzed for the final conclusion.

Results
At the end of the experiment, all of the final weights of each test after three trials where averaged together. The average soil loss for the test with no protection was 1252.86 grams. In the cases of the grass test, there was an average of 208.74 grams of soil lost. The mean amount of soil loss for the chemical stabilizer was 14.93 grams. Finally, with the least amount of soil loss, was jute mat. On average, this practice lost 12.28 grams of soil.

Summary Statement
The goal of this project is to determine the best hillslope erosion preventative to slow down soil erosion by water.

Help Received
Father helped me put together the contraption for the experiment and perform the experiment.

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
Wei Jing; Steven Tan

Project Number
S0802

Project Title
The Effects of Man-Made Structures on Wind Patterns

Abstract

Objectives/Goals
This project aims to analyze urban winds to harness wind power.

Methods/Materials
Two types of experiments were conducted regarding wind patterns. Data was collected from 11 different locations at the Gabrielino High School campus and was compared with model results. At each location, anemometers and timers were used to collect wind velocity in 2 minute intervals.

Results
Data showed that urban structures create localized areas with higher wind velocity. A difference of 3 meters in height between areas A & C and the area B induced an average increase of 1.5 km/hr in wind speed of the higher area. As wind passed over 119m the field, it increased an average of 1.65 km/hr

Conclusions/Discussion
The taller a building is, the stronger the updraft of wind over the structure. Besides height, disparities in temperature were proven to create stronger winds. In analyzing wind trends based on local orography, the knowledge gained will be significant in designing future buildings and cities for generating wind flow that maximizes the release of heat and the usage of natural energy.

Summary Statement
Our focus is on understanding wind patterns in cities to provide a foundation for greener cities in the future.

Help Received
Mr. Escarra, Mrs. Schramm, and Mr. McClure gave suggestions to improve the project; Aiwen Miao designed an excel template for the data chart; Participant in SCJAS Research Training Program; Other students assisted in collecting some data.

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)

Hannah R. Larsen; Zachary J. Larsen

Project Number

S0803

Project Title

Using Fossils from the Mojave Desert to Reconstruct a Miocene Period Ecosystem

Abstract

Objectives/Goals

The purpose of this investigation was to determine if horse bones and other fossils found in the Barstow Formation from the Miocene period could be used to reconstruct the type of environment from that period. We compared Merychippus bones we found to other horse bones from the same period as well as looking at other fossils found in the immediate area such as Pseudolauris (an ancient cat), camel, wood, and root casts. If recovered fossils share characteristics with holotype fossils from the same era, then it is possible to identify the species and reconstruct the ancient California ecosystem that existed approximately 14.8 million years ago. This investigation is important since by revealing the environment of that particular area, we can determine climate, habitat, environmental history, and the animals present during this lush time in southern California's pre-history and get insight into how climate change impacts ecosystems.

Methods/Materials

On separate occasions, with permission from the BLM, we recovered fossils of various ancient animals, algae, and plants from the Barstow Formation in southern California. Following established procedures for fossil recovery and preservation, we removed diagnostic fossils for further investigation. GPS was utilized to precisely determine the location of our fossils. Recovered fossils were then measured and compared to published measurements.

Results

Recovered fossils were found to be similar to documented fossils, thus allowing for identification of the species from which the bones came. Bones recovered were determined to be that of Merychippus, an Miocene era three-toed horse. Other fossils found at the site were determined to be that of Pseudolauris, (an ancient cat), as well as an ancient camel, root casts, and algae. Merychippus hoof print impressions were also found in the general area, further substantiating our hypothesis that this area was a Miocene era grassland ecosystem.

Conclusions/Discussion

Based on our fossil discoveries, we determined that the area in and around Barstow was a lush grassland during the Miocene era. This was supported by our identification of fossils of three different animal species that were indigenous to grassland areas. It is likely that the area that we studied was a place that animals visited for water. Climate change over time led to these areas drying up and transitioning into the desert environment that currently exists.

Summary Statement

This project surveys the fossil record in the Barstow Formation in order to reconstruct the ecosystem found in this region during the Miocene Period.

Help Received

This project was assisted by members of the Inland Empire Geological Society who provided guidance during fossil recovery and identification.

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)

Rose L. Leopold

Project Number

S0804

Project Title

Morphological Disparity during the Ammonoid Recovery after the Permian Mass Extinction

Abstract

Objectives/Goals

The Permian mass extinction caused the elimination of 80% of marine genera. Ammonoids, however, survived the extinction and returned to the levels of diversity that had been seen in the Late Permian within a million years while other groups recovered at a much slower rate.

This project examines how morphological disparity in ammonoid fossils decouples from taxonomic diversity following the Permian mass extinction. I hypothesized that the two diversities would follow the same trends before the extinction, but then break away from each other before once again leveling out.

Methods/Materials

I measured whorl expansion, umbilical diameter, aperture height, aperture shape and ventral acuity from illustrated specimens of 135 genera and used principal components analysis to quantify morphological diversity.

Results

Ammonoid disparity decreased after the extinction, but did not reach its lowest until the Dienerian sub-stage (2 sub-stages after the extinction), unlike taxonomic diversity which was lowest immediately after the extinction. By the Smithian sub-stage (4 sub-stages after the extinction) ammonoids had recovered in both morphological disparity and taxonomic diversity.

Conclusions/Discussion

Morphological disparity of ammonoids decreased after the extinction, but did not reach its lowest point until the next sub-stage. After reaching its lowest level of diversity on the Dienerian, ammonoids recovered at an astounding rate and regained the levels of diversity that were seen before the extinction and then even more. Taxonomically, ammonoids reached their lowest levels of diversity directly after the extinction, but then recovered around the same time as morphological disparity.

This was most likely due to their ecology which allowed them to avoid the deepest waters where oxygen levels were low and due to their high metabolic rate which enabled them to better adapt to ocean acidification. The response of these ammonoids can help us to understand traits like motility that allowed ammonoids to come back successfully from the brink of extinction unlike so many benthic groups.

Summary Statement

I studied how morphological disparity among ammonoid fossils decouples from taxonomic diversity in ammonoids after the Permian Mass Extinction.

Help Received

Professor Clapham at University of California Santa Cruz supervised project

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
Cali Mendoza; David Tenney

Project Number
S0805

Project Title
Using a Weather Balloon Apparatus to Monitor Variables in Space

Abstract

Objectives/Goals
Our objective was to send a weather balloon into space to make observations of key variables that determine how temperature and light change as you increase altitude.

Methods/Materials
In total we launched 52 weather balloons over the course of 2 school years. All balloons were launched at the same launch site (area) and at a consistent time. All balloons collected data that showed us distance, weather patterns (wind direction, humidity), equilibrium, temperature and light intensity.

Results
The 2 hypotheses that were validated were:

Hypothesis #1 As the weather balloon rises in altitude, there will be a decrease in external temperature.

Hypothesis #4 As the weather balloon rises in altitude, there will be a change in direct light.

Conclusions/Discussion
Our conclusion is that as you increase altitude variables in space change. Our distinct conclusions are that as you increase altitude you decrease in external temperature and increase direct light.

Summary Statement
Our project was to send weather balloons into the upper stratosphere to collect scientific data on distinct weather variables.

Help Received
We would like to thank are teachers, Jim Snyder, and Mr. Bagnell for all their wonderful help and support for without them none of this would have been possible.

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)

Virgiline Ongkingco; Ashwarya Sharma

Project Number

S0806

Project Title

Evidence for Oxygenic Photosynthesis 2.75 Billion Years Ago

Abstract

Objectives/Goals

If oxygenic photosynthesis had evolved in the Archean (>2.5 bya) then Archean sedimentary rocks should be rich in organic carbon regardless of their proximity to hydrothermal systems.

Methods/Materials

Shale from a sedimentary succession were collected from drill cores with varying distances from known hydrothermal centers. Shale is placed into the mini jaw crusher to break down the rock. We place the pieces into a carbide mill in a shatterbox and powdered the samples. The powder was placed through a mesh plate to ensure fine powder. The total organic carbon contents of the rock were determined using an Eltra CS200 carbon-sulfur determinator based on the difference between total carbon combustible at 1400C and total inorganic carbon determined by volatilization with HCl addition. It is calibrated and the accuracy and precision are checked using external Geostandards. Blanks were continuously monitored throughout.

Results

We found very high and variable organic carbon concentrations in shales which are 2.7 byo. Organic carbon concentrations varied from 3.2%- 32.8% in the 5 drill cores. These are higher organic carbon concentrations in Archean rocks than what we were able to find. Drill core KL0039 had the highest organic carbon concentrations; from 22.3%- 32.8%. There was no correlation between total organic carbon concentrations and proximity to known hydrothermal centers(R2.<<0.5).

Conclusions/Discussion

Evidence shows the presence of oxygenic photosynthesis in the Archean (>2.5 bya), proving our hypothesis. There are 3 metabolisms that could result in shale with good amounts of organic carbon. They are oxygenic photosynthesis, photosynthetic sulfide oxidation, and methanogenesis. Iron based metabolisms can also produce organic matter but produce particulate iron oxides that can be used to respire it. 2 of the 3 are tied to hydrothermal systems#requiring sulfide and hydrogen. There is no correlation between distance from the known system and the organic carbon. Also, the organic carbon is too great to be produced by the systems. Thus, the organic matter is likely to be linked to oxygenic photosynthesis, proving that the organic carbon in the shale is the first evidence of oxygenic photosynthesis. It provides a minimum age constraint for the evolution of this metabolism at 2.7 bya. This shows that oxygenic photosynthesis was present before the rise of atmospheric oxygen at 2.4 bya.

Summary Statement

We are helping to constrain the origin of oxygenic photosynthesis on Earth by examining the organic carbon distribution in an Archean sedimentary rock succession.

Help Received

Michele Hampton helped organize our project and guide us, Noah Planavsky was our science fair mentor (grad student at UCR) who assisted us with the project and supervised us during the procedures, NASA funded our project, used the lab equipment at UCR biogeochemistry

CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
Hannah J. Washburn

Project Number
S0807

Project Title
Will the Addition of an Alkaline or Acidic Solution to Hydrophobic Soil Affect Its Ability to Allow Water Percolation?

Abstract

Objectives/Goals
The purpose of my project was to determine if saturating hydrophobic soil with an alkaline or acidic solution will help with water percolation. My goal is to find a way to rehabilitate the soil by reducing its hydrophobicity. This is important because hydrophobic soil causes greater water runoff which contributes erosion to precious top soil and post fire mud slides.

Methods/Materials
I collected coarse, upland soil and covered it with dried leaves and wood. With supervision, I burned the organic material for 8 hours and then let it cool. I then did a WDPT test to determine hydrophobicity. I had 4 test soils: untreated soil, hydrophobic soil, hydrophobic soil saturated with alkaline solution, hydrophobic soil saturated with acidic solution. I saturated 12 cups of hydrophobic soil with alkaline solution(water & salt mix pH of 9)then allowed to dry for 5 days. Did the same with an acidic solution(water & vinegar mix pH of 5). 1 cup of test soil is placed in a clear tube suspended over a measuring cup by wire mesh. I had 147ml of water rain into clear tube and measured amount of water to percolate in 15 minutes. I repeated test for a total of 10 trials per test soil.

Results
Untreated soil had an average percolation of 84.2ml of water in 15 minutes. Hydrophobic soil had an average percolation of 2.51ml of water in 15 minutes. Hydrophobic soil saturated with an alakline solution had an average percolation of 20.45ml of water in 15 minutes. Hydrophobic soil saturated with an acidic solution had an average percolation 10.57ml of water in 15 minutes.

Conclusions/Discussion
Hydrophobic soil saturated with an alkaline solution showed the greatest amount of soil rehabilitation in regards to water percolation. All 10 tests allowed a measurable amount of water percolation averaging 17.94ml more than the hydrophobic soil alone. This is important because if the addition of an alkaline solution speeds up the rehabilitation process of hydrophobic soil we may be closer to finding a solution to the problem of erosion due to hydrophobicity. I believe further testing is needed to determine if the addition of the alkaline solution adversely affects plant life or is a danger to aquatic life and if so could an alkaline loving plant leach enough harmful alkaline to offset this.

Summary Statement
The purpose of my project is to determine if the addition of an alkaline or acidic solution to hydrphobic soil will increase water percolation thereby helping rehabilitate post fire hydrophobic soil.

Help Received
Dad supervised the creating of hydrophobic soil; Mom photographed the testing process