CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Hassan Ahmad

Project Number
S0601

Project Title
Slip-Rate Determination of the Great Kavir Fault in Northeast Iran

Abstract

Objectives/Goals
The Great Kavir-Doruneh fault in northeast Iran is a poorly studied left lateral strike-slip fault. In order to calculate slip-rates for this fault I needed offset features with known ages and offset magnitudes.

Methods/Materials
I therefore used a 3D visualization software to look at satellite imagery and map the fault trace and locate offset features like alluvial fans and stream channels. I then compared these alluvial fan surfaces to surfaces that have been dated in southern Iran by Regard et al. (2005) and assigned ages for the surfaces mapped along the Great Kavir-Doruneh fault. The length of a given feature offset was divided by the feature age estimate to determine the slip-rate for that part of the fault.

Results
For most of the areas mapped, the slip-rate ranged from less than 2 mm/yr to 6 mm/yr.

Conclusions/Discussion
This low slip-rate determination is consistent with the low GPS rate determined across this fault and the fact that it has not produced a large earthquake in living memory. An important result of this study is the identification of critical field localities where detailed surface mapping and isotopic dating techniques can be applied so that a well constrained slip-rate determination can be made.

Summary Statement
Determine the slip-rate of the Great Kavir Fault by using satellite images.

Help Received
Used lab equipment at the California Institute of Technology under the supervision of Dr. Bernard Guest.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Russell Argenal; Robert Gomez

Project Number
S0602

Project Title
The Effects of Turbidity on Dissolved Oxygen Levels in Various Water Samples

Abstract

Objectives/Goals
The objective of this experiment was to find the effects of turbidity on dissolved oxygen levels in various water samples.

Methods/Materials
Seven water samples were collected from various locations. The dissolved oxygen levels in the water samples were measured by using a dissolved oxygen test; first by fixing the samples, then by measuring the dissolved oxygen concentration by titration. The turbidity was measured using a turbidimeter. The results of the dissolved oxygen tests and turbidity measurements were noted and compared.

Results
The water samples with high turbidity levels had lesser amounts of dissolved oxygen, where as lower turbidity resulted in more dissolved oxygen concentration in the water sample.

Conclusions/Discussion
Turbidity and dissolved oxygen are inversely related. The more turbidity, the less dissolved oxygen there is for living organisms to breath, negatively affecting animal populations. Human impact has played an extensive role in keeping the turbidity levels high in these water samples.

Summary Statement
This project was about finding the effects of turbidity on dissolved oxygen.

Help Received
Father helped drive to the various water sources; Used lab equipment at University of California Riverside under the supervision of Professor Amrhein; Ms. Valero supervised during dissolved oxygen tests

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Anthony Battey; Shayla Smith; Heather Ward

Project Number
S0603

Project Title
Bringing Down the Greenhouse Effect

Abstract

Objectives/Goals
The purpose of this experiment is to compare the amounts of Carbon Dioxide in four common gas sources. The four gas sources were human exhalation, ambient air, pure carbon dioxide, and automobile exhaust.

Methods/Materials
The air contained was later released in a bromthymol blue solution and titrated with ammonia. The bromthymol blue solution would change colors depending on how much carbon dioxide was released. Ammonium was used to bring the bromthymol blue back to its original color.

Results
The human exhalation had the least significant change and did not change colors. The ambient air and pure carbon dioxide had a small change from dark blue to light blue. The automobile exhaust had the highest level of carbon dioxide and the bromthymol blue solution turned a light shade of yellow.

Conclusions/Discussion
Our hypothesis proved correct. This study is significant because our group was able to prove that automobile exhaust has the most pollutants in our environment. Perhaps, having this knowledge will guide our legislators to pass laws that provide a better and friendly environment.

Summary Statement
Our project was designed to test four gases and discern which had the most carbon dioxide--a harmful greenhouse gas.

Help Received
Mrs. Castillo provided us with needed materials such as bromthymol blue solution, test tubes and beakers.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)

Shruthi Bhuma; Swathi Bhuma; Karen Chiu

Project Number

S0604

Project Title

A Comparison of Two Sites in the Rio Guacimal Using Visual Assessment and Aquatic Macro-invertebrates

Abstract

Objectives/Goals

The objective was to determine whether or not human activity was impacting Monteverde#s environment significantly.

Methods/Materials

Using visual assessment and macroinvertebrate study to compare the biodiversity and general health of two sites on the river, Site A in the midst of human activity and Site B not, the effects of human activity on the water quality of the Rio Guacimal were determined. In the NRCS Stream Visual Assessment Protocol, twelve parameters were analyzed on a scale of 1-10 (10= most optimal): Channel Conditions, Hydrological Alterations, Riparian Zone, Bank Stability, Water Appearance, Nutrient Enrichment, Barriers to Fish Movement, In stream Fish Cover, Pools, Invertebrate Habitat, Canopy Cover, and Manure Presence. In terms of the biological indicator study, 12 samples were taken within a 30 meter stretch at the two sites. Samples at each point were taken by kicking up the sediment at the river bottom for 30 seconds. Then, using the D-net, the churned-up water was poured from the net to a large plastic bowl. The water samples were then transferred to appropriately labeled Ziplock bags and taken to the Monteverde Institute. There, books and microscopes were used to taxonomically classify the macroinvertebrates to the order and phylum level.

Results

Visual assessment indicates that though Site B is slightly worse in health, the difference is small. Macroinvertebrate studies indicate that the sites are also similar in species richness; however, the species compositions do differ. The order Diptera had a significantly higher concentration and their predators (such as Plecoptera) were in lower concentration at site B. Because organisms of the order Diptera are more capable of surviving in polluted areas and deprived oxygen settings, there is biological evidence of reduced dissolved oxygen levels at Site B, an indication of pollution. The data gathered in this experiment indicates a negative correlation between human activity and the overall health of natural water sources.

Conclusions/Discussion

It was determined that mankind#s activities eliminate certain tropic levels, causing imbalance in aquatic ecosystems. This is important because reduction of species richness eliminates organisms that potentially could be used in biological research. In order to preserve the environment and diversity of Costa Rica humans should research how to minimize the impact their actions make on the environment.

Summary Statement

Comparing two sites at the Rio Guacimal indicates that human activity does affect aquatic health.

Help Received

Monteverde Institute helped us.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Julia M.M. Biemann

Project Number
S0605

Project Title
The Effect of Latitude on Ocean Salinity in the Antarctic Waters

Abstract

Objectives/Goals
The objective in this project was to determine if the level of salinity changes in the ocean as the latitude decreases, approaching the Antarctic polar ice caps.

Methods/Materials
Samples of ocean water were taken at 14 different latitudes south of Ushuaia, Argentina all the way to the Antarctic Peninsula, with a small bucket and kite string, off the side of a ship. The salinity of a predetermined amount of the sample water was tested and recorded, along with the corresponding longitude, latitude and temperature of each sample.

Results
The data shows a slight decline in salinity as one approach the Antarctic Convergence, which is an area in the region between 50 and 60 degrees south latitude and encircles the continent of Antarctic. At this point, cold surface water moving north away from the continent meets the warmer, southerly moving surface water of the Subantarctic zone. There is an abrupt change in salinity at the Antarctic Convergence. There is also a drastic drop when one is close enough to actually see large ice blocks. This suggests that melting ice can severely affect ocean salinity.

Conclusions/Discussion
The hypothesis was proven to be correct. From this project I conclude that ocean salinity levels can affect many different aspect of our environment, including weather, ocean currents, climate change and therefore the future of all biological organisms.

Summary Statement
My project shows how decreasing salinity levels in our ocean can affect many aspects in our environment, including weather, ocean currents, climate change and therefore the future of all biological organisms.

Help Received
Mother helped find and buy a salinity testing kit; Parents, Uncle, and grandparents provided the trip to Antarctica.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Sunil C. Bodapati

Project Number
S0606

Project Title
Using Bacterial Biofilms to Reduce Liquefaction

Abstract

Objectives/Goals
Building foundations are usually made of steel and concrete, which in turn rely on a solid soil base beneath them for stability. During an earthquake the soil base undergoes liquefaction, which causes the soil to act like a viscous fluid due to compression caused by the shock waves. This in turn makes the soil unstable and allows the building to collapse. By using biofilms secreted from bacteria to create a complex matrix structure inside the soil, the compression strength of the soil increases, thus increasing the stability of the soil and eliminating liquefaction.

Methods/Materials
Three different tests were run to test the liquefaction and compression strengths of bacteria (Flavobacterium johnsoniae) enhanced sand against a control, which was wet sand.
1. Liquefaction Test-Fifteen mL of water was put into bacteria inoculated sand and then tested in an orbital shaker. After shaking for 24 hours, the amount of water that had risen to the top was measured. This test was conducted over a period of five days, with each sample being allowed to grow for a certain period of days.
2. The second test had bacteria growing in the sand at different concentrations for five days. Each sand sample was tested for its compression strength.
3. In the third test, bacteria inoculated sand was allowed to grow at a fixed concentration. The compression strengths of these samples were then measured daily for a period of five days.

Results
In the liquefaction tests, water came out of the sample with the biofilm matrix only on the first day of growth. No more water appeared thereafter. The water in the control (wet sand) samples came out consistently on every day for every test. For both of my compression tests, the samples with the biofilm matrix performed significantly better than the control (wet sand), with their compression strengths more than double that of the control.

Conclusions/Discussion
All of the objectives were met, and the sand samples with the biofilm matrix preformed significantly better than wet sand in every single test. This method of reducing liquefaction can have far reaching affects. During the 1906 earthquake in San Francisco, there was massive damage to buildings caused by liquefaction of the soil. Given that this year is the 100th anniversary of the earthquake, it is appropriate that we look for alternate methods to increase stability of foundations during earthquakes. This project is one such method.

Summary Statement
My project explores a solution to the expensive problem of liquefaction by using bacterial biofilm to fortify the sand.

Help Received
My mother helped create my board; my father gave me inspiration; my mentor guided me through my entire experiment.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Alex Bryant; Michael Greenwald

Project Number
S0607

Project Title
Carbon Dioxide Gas and the Greenhouse Effect

Abstract

Objectives/Goals
The objective of our experiment was to determine if increasing amounts of carbon dioxide in the atmosphere would cause increases in temperature.

Methods/Materials
Carbon dioxide gas was obtained from dry ice which was measured by the displacement of water when the dry ice sublimated as it warmed. Increasing amounts of carbon dioxide gas were sealed in four Erlenmeyer flasks. Another two flasks, one open and one closed, contained no added carbon dioxide gas. The temperature of the air in all six flasks was recorded at thirty second intervals for fifteen minutes during exposure to sunlight.

Results
After exposure to sunlight, the flasks with larger amounts of carbon dioxide gas had correspondingly higher temperatures when the temperatures stabilized. These temperatures were also higher than the flasks which had no added carbon dioxide.

Conclusions/Discussion
The results of the experiment supported our hypothesis that the flasks filled with larger amounts of carbon dioxide gas would produce correspondingly higher temperatures when exposed to sunlight, and would have higher temperatures than the flasks without added carbon dioxide. The results also support the theory that larger emissions of carbon dioxide could cause an increase in atmospheric temperature and therefore be a cause of global warming.

Summary Statement
Our project is about whether increasing the amount of carbon dioxide gas in the atmosphere causes an increase in temperature.

Help Received
Our science teacher allowed us to use school laboratory equipment.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Terik Daly

Project Number
S0608

Project Title
Investigating the Chemical Signatures of Meteorite Impacts

Abstract

Objectives/Goals
Impact cratering plays an integral role in the evolution and formation of planetary systems. Chemical anomalies are accepted phenomena at impact sites, but few, if any, published models adequately describe the kinetics and thermodynamics of impact-induced chemical changes.

Methods/Materials
Utilizing x-ray fluorescence, inductively-coupled plasma mass spectrometry, and variable pressure SEM/EDX, this study analyzed the trace chemical composition of shock-metamorphosed granite and obtained quantitative data, which were further analyzed using parametric frequentist statistics and resampling techniques.

Results
The concentrations of Cu, Ni, Pb, Zn, and Rb changed in a statistically significant manner at the 99% confidence level.

Conclusions/Discussion
Based on chemical and thin section analyses, a cohesive model was developed to describe how impact-induced chemical changes occur. As the impactor collides with the target material, most of the impactor melts. As shock waves and subsequent rarefaction waves move through the target, partial melting of mineral phases begins. Material from the impacting body combines with the partial melt, thereby amalgamating an extraterrestrial component into the target. Characteristics of the amalgamation process are related to the partitioning coefficients, ionic radii, ionic charges, and electron configurations.

Ongoing work focuses on the determination of the relationship between chemical composition and proximity to interstitial boundaries.

Summary Statement
XRF, ICP-MS, and SEM/EDX were used to determine the chemical effects of the impact process; by combining chemical and thin section analyses, a model describing the chemical kinetics and thermodynamics of the impact process was developed.

Help Received
Washington State University provided XRF and ICP-MS equipment; Intel Corporation provided SEM/EDX; Carol Evans, Heidi Black, Susan Lato, and Ann Burrell aided paper and abstract preparation.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Travis J. Killmer

Project Number
S0609

Project Title
Liquefaction in Sherwood Valley Soils

Abstract

Objectives/Goals
The goal of my project is to see how the soils of Sherwood Valley react under earthquake conditions. In addition to this the goal of my project is to see if the soils of Sherwood Valley will exhibit the characteristics of soil liquefaction.

Methods/Materials
Five different soil samples were collected from the Sherwood valley area. The effects of a simulated earthquake were tested by building an earthquake shaker and shaking all the samples. In order to simulate the worst case scenario the soil samples were completely saturated prior to testing. To conduct the shake test the soil samples were placed in a coffee can, then an object of known weight was placed onto the samples which were shaken 15 times. Afterwards the depth which the object sank was recorded. In addition to testing the effects of a simulated earthquake the soils were tested for their composition and their porosity. The composition of the samples was determined by conducting sedimentation tests. To conduct the sedimentation test ½ cup of soil, 3 ½ cups of water and 5 tablespoons of Calgon solution were placed in a jar, shaken for five minutes and the settled soil was measured after 40 seconds, 30 minutes and 24 hours. The soil depth after each time interval was divided by the total depth to determine the percentage of clay, sand and silt in each soil sample. The porosity of the soil was determined by filling a beaker with 350 ml of soil, pouring water into the soil until it reaches the top of the soil and dividing the amount of water used by 350 to calculate the percent pore space.

Results
The soils with the greatest amount of sinking in descending order are field 2, field 3, hill 1, hill 2 and field 1. The soils with the greatest porosities in descending order are hill 2, field 1, field 2, field 3 and hill 1.

Conclusions/Discussion
My conclusion is that the soils of the Sherwood Valley could, under the right circumstances, experience soil liquefaction. This is in part due to the fact that the soils are very high in sand which means that while the soils could experience liquefaction it would require an enormous amount of rain in conjunction with an earthquake. This high proportion of sand also means that the soils drain relatively easily and that flooding and complete soil saturation would be unlikely to occur without torrential rains.

Summary Statement
The goal of my project is to determine the effects of a simulated earthquake on the soils of Sherwood Valley.

Help Received
Mother took pictures; school loaned triple beam balance

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Lauren E. Markgraf

Project Number
S0610

Project Title
Is Stringfellow Contributing to Nitrate Levels Found in Local Wells?

Abstract

Objectives/Goals
The objective of this project is to determine if there is nitrate runoff coming from a dumpsite know as "Stringfellow", and showing up in local water wells.

Methods/Materials
The water samples were taken from three sites using plastic 32oz. sample containers, and chilled at 39 degrees fahrenheit until testing conditions were ready. Approximately 24 hours later the three samples were tested with the equipment used at a facility known as West Municipal Water District where each sample's nitrate ppm (parts per million) was established. They were all tested once with accurate results. Local (Glen Avon) city water was tested as well for comparison,then all four results were plotted on a map of the surrounding area.

Results
Based on data collected from these tests and considering geographical factors,i have found that there is no nitrate plume coming from Stringfellow, but there was a plume coming from somewere south-east of the site.

Conclusions/Discussion
I have concluded that there is no evidence that there is a nitrate plume coming from Stringfellow,but my data shows that there is one that seems to be coming from a source south-east of the site. I plan on furthering my project to find out where this source is and why a plume has formed from it.

Summary Statement
I have determined that there is no evidence that suggests a nitrate plume coming from the toxic waste dump-site known as Stringfellow.

Help Received
History and historical facts, about Stringfellow was received from Mary Burns, Jurupa School Board and Cultural Center; Betty Stinson, Stringfellow Library; Steve Mains, Water Master Support Sevices; Carol Wilson, Fall 2005 Cooperative Well Measuring Program. Additionally, the equipment and facility was

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Bradley Pace; John Pace

Project Number
S0611

Project Title
H(2)O Life Line

Abstract

Objectives/Goals
Our objectives, or goals, were to save the lives of the many off-roaders who have broken down in the desert without materials needed to survive, such as water. We were also trying different ways to obtain water from sources other than natural wells and springs, such as condensation from desert plant life and various types of soil.

Methods/Materials
The first two years of our project we tested the potability of natural wells, springs, rivers, and lakes in the Mojave Desert. Using a test kit we tested over 10 water samples with iodine, chlorine, and natural filtration, finding out that only one was drinkable. This year we attempted to obtain water through condensation from desert plant life and soils. Materials included: water testing kit, water bottles, black trash bags, and desert resources.

Results
Only one water sample was found to be potable without the use of chemicals or filtration. All water samples were drinkable after being treated with chlorine. Iodine was incosistent, and no studies show the effect it will have on a human body. Filtration made absolutely no difference in the potability of the water. Creosote bushes and the various types of soil collected a lot of moisture during the summer, but the creosotes did not collect moisture during the winter.

Conclusions/Discussion
Desert water sources are not drinkable on their own, a chlorine tablet must be added and the water must sit for 20 minutes for the chlorine to dissolve and make the water potable. Condensation is easier to come by in the summer than it is in the winter, but a drip system must be designed to collect enough water to survive on.

Summary Statement
Our project is about finding different ways to collect water from the desert, in order to save the lives of those stranded in the desert.

Help Received
Parents drove us to different water sources in the desert.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Aaron A. Tan

Project Number
S0612

Project Title
Can You Smell the Cancer? A Study of Ozone, Carbon Monoxide, and Nitrogen Oxide Levels in a Parking Garage

Abstract

Objectives/Goals
This project is about determining the quality of air in partially enclosed parking garages and whether it is poor enough to cause health problems such as cancer.

Methods/Materials
To test for nitrogen oxides and carbon monoxide I used a combustion analyzer. The units of measurement were parts per million (ppm).

Results
After testing the air I discovered that there were very low levels of nitrogen oxides throughout the day. Further research showed that nitrogen oxides react with the oxygen in the air (O2) to form ozone (O3). Then I tested the air for ozone, using Schoenbein paper.

Conclusions/Discussion
The results of this experiment showed that at least eight hours of exposure to the air in a partially enclosed parking garage would be detrimental to one#s health. Also exposure of only a few minutes a day or a few minutes a week would eventually cause health problems.

Summary Statement
This project is about determining the quality of air in partially enclosed parking garages and whether it is poor enough to cause health problems such as cancer.

Help Received
Victoria Acquistapace, M. Ed.; Anthony Tan, my dad, who helped with everything; Maria Knorr, my girlfriend, who helped with the testing; Isabelle Tan, my mom, who helped with the photos and production

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)

Swati Yanamadala

Project Number

S0613

Project Title

Sourcing and Quantification of Fecal Indicator Bacteria (FIB) in Aquatic Ecosystems: A Three Year Study

Abstract

Objectives/Goals

The first of three objectives of this study is to compare fecal indicator bacteria levels in two aquatic ecosystems, one with a high bird density and one with a low bird density. The second objective is to see if the API system, a system currently used in hospitals for bacterial identification in patients, can be applied to environmental studies to identify bacterial strains in aquatic ecosystems. The third objective is to create a mathematical model relating turbidity, dissolved oxygen, pH, salinity, time from high tide, bird counts, and levels of fecal indicator bacteria.

Methods/Materials

On four sampling dates, five samples were collected from each station. In the field samples were tested for salinity, dissolved oxygen, pH, and temperature using the YSI 600R Sonde Electronic Probe. In the lab samples were tested for turbidity levels using the HACH 2100N Turbidimeter and for levels of indicator bacteria using the IDEXX system. Then bacterial samples were identified using the API 20E for Enterobacteriaceae system.

Results

Higher bacterial concentrations were associated with higher turbidity levels, lower dissolved oxygen levels, lower salinity levels, a pH closer to 7.4, high tide, and higher bird counts. These factors were related through a mathematical model, and to test the accuracy of this model, hundreds of data points from years one and two of this study were entered into the equation. The formula proved an excellent fit for this data. The API system was successful in identifying bacterial strains in the ecosystems. All of the strains identified are from human sources.

Conclusions/Discussion

This study establishes two new scientific methods. The first of these is the use of mathematical models in environmental research to describe physical environments, which is rarely, if ever, done. This study shows that these models are an extremely useful, accurate, and predictive tool for environmental research. The other new method developed in this study is the application of medical technology, the API system, to environmental research, which is another tool with the potential to greatly improve the understanding of aquatic microenvironments. Furthermore, this study proves that the fecal contamination in aquatic ecosystems is derived not only from naturally occuring factors including birds but also largely from human sources, a problem which must be understood and combated for the betterment of public health.

Summary Statement

The purpose of this study is to identify the sources of fecal contamination in aquatic ecosystems and to create a mathematical model to accurately describe the complex interactions of these systems.

Help Received

Used lab equipment at Loyola Marymount University under the supervision of Dr. John Dorsey