



**CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY**

Name(s) Hassan Ahmed	Project Number S0701
Project Title Permanent Uplift of the Mentawai Islands and the Megathrust Earthquake Cycle	
Abstract Objectives/Goals The Sunda megathrust fault off the west coast of Sumatra, Indonesia has experienced big earthquakes in recent history. The section of the megathrust south of these ruptures, beneath the Mentawai Islands, could rupture in the coming decades. The purpose of this project is to study the topography of the Mentawai Islands and create a map of clear uplifted terraces. By mapping the distribution of terraces, I hope to identify the uplift caused by previous earthquakes. I formulated the hypothesis that if the terraces observed on the islands are caused by permanent uplift due to the earthquakes, then there should be apparent stair steps from the edges towards the center of the islands. Methods/Materials The main data set used for this project is the Shuttle Radar Topography Mission (SRTM) data of the Mentawai Islands. This is a set of elevation measurements called a Digital Elevation Model (DEM). I used a Geographic Information System called ArcMap to process the SRTM data to make color contour maps, slope maps, and hillshade maps. After studying these images very closely, I mapped key features like flat surfaces and scarps. Results I did not observe the stair steps of uplifted terraces, so there may be some other cause of the terraces I mapped. I conclude that there is not rapid uplift of the islands that is linked to each megathrust earthquake. Conclusions/Discussion Stair steps of uplifted terraces were not observed, and so there may be some other cause of the uplifted terraces I mapped. This leads to the conclusion that there is not rapid uplift of the islands that is linked to each megathrust earthquake. Instead, it may be that uplift that occurs during each megathrust earthquake is recovered by the sinking of the islands in between each earthquake.	
Summary Statement The purpose of this project is to study the topography of the Mentawai Islands and see if any long term uplifting that might be tied to permanent uplift during great megathrust earthquakes is observed.	
Help Received Used lab equipment at the California Institute of Technology under the supervision of Dr. Richard Briggs.	



**CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY**

Name(s) Courtney Berg; Jessica Blaugrund	Project Number S0702
Project Title Water Pollution Levels at Our Local Beaches	
Abstract Objectives/Goals Our objective was to conduct an experiment that had to do with our local beaches. We decided to do a project on the ocean water. Our goal was to figure out what area in Ventura had the highest pollution level. Methods/Materials We did a few different tests on our water samples. The tests were the Alkalinity test, Iron test, and The Wide Range (Ph) test. The materials that we used were water bottles, plastic containers, water samples from various beach loactions. Test kits included : Phenolphthalein Tablets, CG-MR Indicator Tablets, Alakalinity Titration Tube, Direct Reading Titration, Octet Comparator, Wide Range Indicator, Iron Reagent #1 and #2, Spoon .05g, Test Tube, and an Iron Comparator. Results During this experiment we found that the Ventura River Mouth was the most polluted based on the Wide Range pH level and The Iron level. Suprisingly, Solimar was the least polluted based on the wide range pH and The Iron levels. While testing we found that the sample water had a zero percent of alkalinity. When we were testing the Wide Range pH level and The Iron level the water samples were very similar to each other. Conclusions/Discussion We chose water samples from Surfers Point, Solimar, River Mouth, The Pier, and Harbor Cove. Surfers Point, Solimar, The Pier, and Harbor Cove all had a 0.5 level of Iron. The River Mouth had an Iron level of 1. All of the samples had a level of zero for the Alkalinity Test. The River Mouth and The Pier had a 9.5 Wide Range Ph level. Surfers Point had a 9 and The Harbor Cove had a 8.5. The lowest was Solimar. We concluded that The Ventura River Mouth was the most polluted.	
Summary Statement Our project is about the different water pollution levels at our local and favorite beaches.	
Help Received We used a water testing kit, which we got from our chemistry class.	



CALIFORNIA STATE SCIENCE FAIR 2007 PROJECT SUMMARY

Name(s) Tierney R. Burke	Project Number S0703
Project Title Shear Wave Velocity Determined by Refraction Microtremor Surveys in the Oxnard Plain to Assess Earthquake Risk	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals Variation of geologic materials near the Earth's surface can have a significant effect on ground motions from earthquakes. Shear-wave velocity (V_s) is an appropriate measure of rock or soil conditions for ground motion calculations because it directly affects ground motion amplification. Refraction microtremor (ReMi) method was used in this study to determine shear-wave velocity to evaluate ground motion hazard in the Oxnard Plain.</p> <p>Methods/Materials Refraction microtremor (ReMi) ambient noise recordings made on 140-m-long lines of standard refraction equipment were used to determine 30 meter (100 ft) average shear wave velocities and one-dimensional shear wave profiles down to depths of 100 meters. SeisOptReMi software allowed wavefield transformation data processing. ReMi processing involved: 1) velocity spectral analysis, 2) Rayleigh phase-velocity dispersion picking, 3) shearwave velocity modeling. Measurements were compared with UBC/IBC site classifications and downhole measurements by USGS. A shear wave velocity contour map of the site area was prepared to analyze area variation.</p> <p>Results 43 field test measurements in this study produced shear-wave velocities between 180 and 360 m/sec which classified in the Uniform Building Code (UBC/IBC) class D group. Refraction microtremor method surveys throughout the Oxnard Plain showed shear velocity decrease as you move in a southwestward direction away from the mountains. A higher velocity zone was identified along the course of the Santa Clara River, and a lower velocity zone along the slow-moving Calleguas Creek on the eastern side of Camarillo.</p> <p>Conclusions/Discussion The dense population and active tectonics of southern California necessitate extensive seismic hazard evaluations that include precise earthquake location determinations, path, and site effect studies. Seismic refraction method is well suited for general site investigations for soil dynamics and earthquake engineering purposes. ReMi surveys performed in this study provided a more extensive assessment of shear-wave velocities in the Oxnard Plain than previously reported. Noninvasive refraction microtremor surveys of shear-wave velocities in the Oxnard Plain compared with downhole velocity measurements, and surface map predictions of ground motion hazard.</p>	
Summary Statement Earthquake ground motion hazard risk characterized by shear wave velocity varies across the Oxnard Plain, and is influenced by the general geologic environment.	
Help Received Thomas Blake provided use of his refraction microtremor equipment, and instruction in performing ReMi surveys.	



**CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY**

Name(s) Caitlyn Christensen; Adam Fedak	Project Number S0704
Project Title Water Monitoring of Boulder Creek	
Abstract Objectives/Goals Recently there has been an effort to clean up the San Lorenzo River and reintroduce native fish. In this project we are monitoring Boulder Creek, a tributary of the San Lorenzo River in Santa Cruz Mountains, in order to determine water quality and trends. We are testing the abiotic conditions of the creek to see if it is healthy for aquatic life. Methods/Materials To do this, we are using a Vernier LabPro with appropriate sensors. Results We found that nitrate is present in levels that can affect the environment, but it is nowhere near the minimum standards set by the EPA. Dissolved oxygen has been present in healthy amounts. Conclusions/Discussion Our results show that this creek is healthy enough to support aquatic life. This experiment is important because we can evaluate how people in the San Lorenzo Valley are impacting the streams, creeks, and rivers of their community.	
Summary Statement In this project we are monitoring Boulder Creek, a tributary of the San Lorenzo River in Santa Cruz Mountains, in order to determine water quality and trends to determine if the creek is healthy for aquatic species.	
Help Received Chris Berry and Hugh Dalton with the Santa Cruz City Water Department who helped us by sharing their knowledge of water quality; Mrs. Orbuch, who taught us how to run the tests, and helped us organize data; parents who provided transportation	



**CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY**

Name(s) Samuel J. Coleman	Project Number S0705
Project Title Rethinking the Origins of Aplite Dikes within the Half Dome Granodiorite Using Initial Strontium and Lead Ratios	
Abstract	
Objectives/Goals Problem: What is the origin of the aplitic dikes present in the Half Dome Granodiorite? Hypothesis: I believe that the aplitic dikes result from the squeezing of silicic melt from the surrounding plutonic rocks into cracks that formed as the rock cooled and shrank.	
Methods/Materials Materials: 5 ~300 mg aplite samples; 14 - 15 mL Teflon beakers; 16 waste beakers; well-ventilated hotplate; 100 mL MilliQ water; 50 mL 13N nitric acid; 100 mL 29N hydrofluoric acid; ~150 mL 6N hydrochloric acid; 150 mL 1.1 N hydrobromic acid; 50 mL 2N hydrochloric acid; 100 mL 3.5N nitric acid; 10 mL dilute phosphoric acid; 1 mL silica gel (suspension of silicon in water); 1 mL tantalum chloride; Strontium columns; Lead columns; Eichrom anion resin AG1x8 (for lead columns); Strontium resin; VG Sector 54 Mass spectrometer Methods: Five aplite samples measured; samples dissolved in acid and dried down (three times); each sample redissolved and split in two parts (one for Strontium, one for Lead); each sample centrifuged; Strontium samples run through Strontium column sequence; Lead samples run through Lead column sequence; all samples analyzed in a mass spectrometer	
Results My results consist of data obtained from the mass spectrometer, primarily current ratios of radioisotopes found in the rock samples analyzed. Unfortunately, the data would not make much sense put in this format, so the actual numbers will be omitted.	
Conclusions/Discussion Discussion: The data obtained was used to determine the initial ratios of rubidium and lead in the sample rocks. This was calculated mathematically using the decay equation. This information was used in conjunction with the rubidium decay constant to determine the age of the aplites. The ages of all of the sampled aplites were found to be approximately 81 million years. Using a new decay constant that was only recently calculated and has not yet been fully confirmed, the age was found to be approximately 85 million years. Conclusion: The data obtained proves my hypothesis wrong. There is clearly no correlation between the Half Dome Granodiorite and its aplites. There is a great disparity in ages, which is a clear indicator of the	
Summary Statement The purpose of my project is to determine the veracity of the commonly held theory of aplite emplacement, a theory that to my knowledge has remained largely untested.	
Help Received Mother helped with board layout; used lab equipment at the University of North Carolina - Chapel Hill under the supervision of Dr. Drew Coleman; recieved grant from the Geological Society of America	



**CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY**

Name(s) Terik Daly	Project Number S0706
Project Title Chemical Aspects of the Impact Process	
Objectives/Goals Impact cratering is the most important process affecting the surfaces of solid bodies in the Solar System. Though the physics of the impact process are characterized, its chemical aspects remain poorly understood. Previously (Daly 2005, 2006) I experimentally-induced impact events using a two-stage light gas gun and studied the resulting chemical and physical changes. This work led to the development of a conceptual model describing principles governing the chemistry of the impact process. My model predicted that the chemical changes occurring during the impact process happen primarily in shock-induced melt veins.	
Abstract This year, my model's hypotheses were tested by studying the spatial distribution of trace elements in impacted samples using a spectral high-resolution ion microprobe with reverse geometry (SHIMP-RG). To eliminate sample-preparation-induced artifacts, I developed a novel technique to prepare impactite samples for SHRIMP-RG analysis. Glow discharge mass spectrometry (GDMS) analyses of the projectiles used to induce the impact events were also conducted to test my model. The effort included a statistical analysis of over 5,000 inter-elemental ratios.	
Methods/Materials Analysis of the data provides substantial evidence supporting my model, confirming the composition of the melt veins is different from the composition of the surrounding matrix. The concentrations of Cu, Zn, and, particularly Ni, are distributed heterogeneously, with significantly higher concentrations found in the melt veins than in the bulk target material. This work represents the first application of the SHRIMP-RG technique to chemical studies of the impact process and demonstrates the applicability and usefulness of this approach to studying impact chemistry.	
Conclusions/Discussion Using SIMS and GDMS, I have provided convincing evidence for a model in which the chemical changes occurring during the impact process occur in shock-induced melt veins.	
Summary Statement The SHIRMP-RG was provided by Stanford University. I was trained by Joe Wooden and Frank Mazdab.	
Help Received	



**CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY**

Name(s) Kai Harper; Chris Vita	Project Number S0707
Project Title Sods: The Real Killer	
Abstract Objectives/Goals Our experiment is about measuring test sites for the amount of Sudden Oak Death Syndrome-caused fuel loads and how this disease affects fire danger in certain areas. Sudden Oak Death Syndrome (SODS) is a contagious pathogen that spreads to Tan Oak and other oaks which, in turn, causes death to them. To collect the data for our experiment we had to hike into the woods using map and compass navigation skills. There we performed basic natural and earth sciences by counting and measuring trees; dead and live fuel loads; litter, duff, and soil profiles. They are also responsible for determining the fire danger in forested areas. At the sites we had to apply our knowledge of plants to determine the type of species in each area. Once all our data was collected, my partner and I had to use basic geometric and mathematical skills to find the volume of each tree.	
Methods/Materials Obtain materials; Obtain permission to test in chosen site; Measure out n area 33# by 33#; Chose a corner and use the compass to place the stakes at a straight; Stake it out using the PVC or the stakes and the string; Measure the height of trees out of one#s reach by using the International Log Scale Stick in the area; Measure diameter of those trees using the same Scale Stick if it is over 3# in diameter; Measure trees over 3# that are accessible with the tape measure (somewhere around 25 ft tape measure; Measure the diameter for those trees; Measure the amount of duff and litter on the ground with the tape measure and the garden shovel; Estimate the slope of the area; Collect materials; Hike back and input data into a secure position. Large backpack; International log scale stick; Tape measure (25 ft and 300 ft); Compass; String; PVC pipe or stakes; Yellow flagging tape; Shovel; Clipboard; Charts; Writing utensil; Walkie talkies (optional); Hiking shoes; Permission to enter certain sites.	
Results Sudden Oak Death Syndrome does have an effect on fire danger in Tan Oak areas.	
Conclusions/Discussion Our hypothesis was proven correct and there was more of a fuel load in areas that were affected by the SODS fungus. This is because the SODS fungus kills off trees such as Tan Oaks, which then, creates more of a fuel load. Something that might be interesting to do in the future is to revisit the sites and measure the fuel loads again to determine how much decay and death has occurred over the years.	
Summary Statement Our experiment is about measuring test sites for the amount of Sudden Oak Death Syndrome-caused fuel loads and how this disease affects fire danger in certain Tan Oak areas.	
Help Received Steve Harper gave us help with driving to the sites along wiht providing us with some materials. The Forest service also gave us alot of useful information on SODS	



**CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY**

Name(s) Magnus A. Haw	Project Number S0708
Project Title A Warming Earth: From the Chemistry of a Bench Experiment to Rigorous Statistical Analyses	
Objectives/Goals My project determines whether recent warming in the Earth's atmosphere could be due to random climatic variability while also showing how carbon dioxide affects atmospheric temperature.	
Abstract Methods/Materials I downloaded temperature data from various meteorological sites for the period 1900-2005 for a sample of 16 cities around the globe and used statistical tests to determine whether the observed warming is statistically significant. The sample was designed to be representative of a variety of climates and regions of Earth. I also obtained data for annual days of frost, precipitation, and drought severity to observe how these parameters are changing. Other supporting data I examined over the same period were sea ice coverage (two areas), US hurricane frequency, atmospheric CO(2) concentration, solar flux, and global population. I used significance tests and regression statistics to analyze the trends and significance of temperature and annual frost days. I also performed a bench experiment where I illuminated a bell jar sample of CO(2) and a control jar and measured their equilibrium temperatures.	
Results All but one of the cities showed statistically significant warming over the past century (and the temperature of that city increased but was not significant). The statistical tests show that if the change was a random occurrence, an increase of two degrees C is highly improbable. The other climate data supports this trend: the number of annual frost days decreased at all sites, sea ice coverage decreased dramatically, and drought severity increased. The precipitation data showed no common trend. Atmospheric CO(2) concentrations increased exponentially correlating closely with population growth while solar flux remained in a stable periodic cycle. The results from the bench experiment show that air with a greater concentration of CO(2) has a greater greenhouse effect than unaltered air.	
Conclusions/Discussion My results show that recent increases in global and city temperatures are not due to chance and the warming is causal (caused by an external agent). Because CO(2) has rapidly increased and the bench experiment shows that greater concentrations of CO(2) will increase temperatures, my project suggests that an increasing human population with increasing CO(2) emissions is contributing to recent global warming.	
Summary Statement I statistically analyzed climate data to determine whether recent warming could be due to random climate variability; I also performed a bench experiment to show how carbon dioxide contributes to increases in temperature.	
Help Received Father made pins for globe model; Father and I discussed a new project title after the county fair; Math teacher suggested statistical program to shorten calculations (Minitab)	



**CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY**

Name(s) Annemarie R. Kelleghan	Project Number S0709
Project Title The Ballona Project: A Multi-Year Analysis of Ballona Creek Water	
Abstract Objectives/Goals The objective of this project is to measure the water properties, such as pH, density, and non-volatile residue, at various points along Ballona Creek. The mussel population at each point is correlated to these water properties. The properties studied in the past three years were compared. Methods/Materials Water samples were taken at various points along Ballona Creek. Density, pH, and non-volatile residue (NVR) tests were used to evaluate the amount of salt in the water samples. The samples were tested for turbidity using a homemade turbidimeter. The results were graphed versus the distance inland from the ocean. Mussels were identified and counted at each water testing location along the creek. Four six-inch square test areas were established at each spot and the mussels within each square were counted. The mussel results were graphed against the various water properties to determine if there was any correlation between the mussel population and water properties. Results Mussel population does depend upon some of the water properties I measured. The average mussel count is greater at the outlet of the creek than it is further inland. As salinity increases, mussel count also increases, but mussel count decreases when temperature and nitrite increase. <i>Mytilus galloprovincialis</i> and <i>Mytilus californianus</i> were found and identified in the creek. <i>Mytilus californianus</i> was only found at the first three sampling locations closest to the ocean outlet. Over the three years of repetitive measurements, there was not much variation in the chemical properties of the water that were tested in this project. Conclusions/Discussion <i>Mytilus galloprovincialis</i> and <i>Mytilus californianus</i> are both found in Ballona Creek. The majority of <i>Mytilus californianus</i> mussels were found at the outlet of the creek. Once beyond the region of the creek populated by <i>Mytilus californianus</i> , the water conditions did not have a strong correlation to the mussel population. My comparisons from the last three years also show that the conditions in the creek have remained consistent.	
Summary Statement Ballona Creek water properties, such as salinity, turbidity, and density, were measured to determine changes along the creek, and these properties were correlated with the populations of <i>Mytilus californianus</i> and <i>Mytilus galloprovincialis</i> .	
Help Received Dr. Jayson Smith (Cal. State Fullerton) gave me guidance and assistance in mussel identification.	



**CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY**

Name(s) Travis J. Killmer	Project Number S0710
Project Title Arsenic in Sherwood Valley Aquifers	
Abstract Objectives/Goals The goal of my project was to determine the arsenic content of water in Sherwood Valley, California. Methods/Materials Five different water samples were collected from the Sherwood Valley area. Each of the soils were tested to determine their arsenic content. 100 ml of water were tested during each test. Three spoonfuls of the first reagent were added to the sample and shaken for 15 seconds. Three spoonfuls of the second reagent were then added and the sample was once again shaken for 15 seconds. The sample was then allowed to sit for two minutes. Three spoonfuls of the third reagent were then added to the sample. The sample was then shaken for 5 seconds. After adding the third reagent a test strip was placed inside the reaction cap and the sample was allowed to sit for ten minutes. The test strip was then removed and matched to the color chart, which indicated the arsenic level of the sample. The process was repeated four times for each of the five different samples. Results None of the water samples collected had an arsenic level higher than 2 parts per billion. The arsenic content ranged from 0.5 parts per billion up to 2 parts per billion. Conclusions/Discussion My conclusion is that the arsenic content of aquifers in the Sherwood Valley are not high enough to pose a threat to public health. Although the arsenic levels are extremely low in the tested areas, there could be higher concentrations in some other areas.	
Summary Statement The goal of my project is to determine the arsenic content in the aquifers of Sherwood Valley, California.	
Help Received Mother took pictures of experimentation	



**CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY**

Name(s) Rebecca J. Kim	Project Number S0711
Project Title Beach Pollution in Southern California II: Time and Space Variation of Fecal Indicator Bacteria Concentration	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals To identify where the pollutants are coming from and what the major time and space patterns of beach pollution are in Orange County. I set up three hypotheses, 1) Surface water runoff would be the primary source of pollutant loading to the coastal ocean due to non-point sources, 2) Dominant time variation patterns of beach pollution were highly correlated with rainfall and lunar cycle, and 3) Dominant space variation patterns of beach pollution were mainly affected by direction of coastal current.</p> <p>Methods/Materials I plotted three fecal indicator bacteria (FIB) concentrations (TC, FC, and ENT) in the surf zone to understand the relationship between water quality and storm event. The results can verify Hypothesis No. 1. Then, I plotted and compared FIB concentrations against Santa Ana river discharge records to verify Hypothesis No. 2. Finally, I plotted and compared the FIB concentrations at each monitoring stations to understand the impact of coastal current direction to the beach pollution and to verify Hypothesis No. 3.</p> <p>Results The concentration of FIB was frequently elevated during and after rain events when storm water was discharging from the river. FIB concentrations exhibit positive correlation with stream discharge records implying that land-based sources of fecal pollution to beach water. Along with the seasonal pattern of high FIB concentrations during rainy season, FIB concentrations show two-week period pattern of spring-neap cycle. My results indicate that FIB contaminations events were occur during the spring period with 13.17 days period while reported spring-neap cycle period is 13-15 days. Increased level of all three FIB were observed in the surf zone north of the Santa Ana River than south of it. Overall trend shows that North stations (Huntington Beach) recorded higher concentrations of FIB concentration than South stations (Newport Beach).</p> <p>Conclusions/Discussion The conclusions are 1) long-term data (12 months) analysis confirmed that urban source of beach pollution and two-week lunar cycle, 2) storm water discharge is the main source of pollutant loading to the coastal ocean. Higher levels of beach pollution were recorded around rainfall events, 3) dominant time variation patterns of beach pollutions are seasonal rainfall events and two-week periodicity of lunar cycle, and 4) dominant space variation patterns of beach pollutions are controlled by direction of local coastal current.</p>	
Summary Statement My project is to identify where the pollutants are coming from and what the major time and space patterns of beach pollution are in Orange County.	
Help Received Father helped me to develop methods and derive conclusions.	



**CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY**

Name(s) Christopher Lopez	Project Number S0712
Project Title How Does Water Quality from Sub-watersheds Affect the Compton Creek Environment?	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The goal of this project was to determine the quality of the water entering the Compton Creek from sub-watersheds and how the water from these sub-watersheds differ in their effects on the environment and how the percentage of lifestyle and society area usage (industrial, commercial, residential, ect.), which empty out into the sub-watersheds, compare.</p> <p>Methods/Materials Access to the different sub-watershed test sites in the Compton Creek was aquired from the city, and each test site had three trials on three seperate days. The test sites used where sub-watersheds 3, 7 and 8, and were chosen though to the different land usage areas running off into them. Each test trial consisted of testing for nitrate, phosphate, dissolved oxygen, pH, turbidity, and temperature levels. The results where then compared to that of the control, Sparklets drinking water and to each sub-watershed to distinguish the affects that the different land usages that run off into each sub watershed affected them.</p> <p>Results The sub-watershed with a higher percentage of governmental and commercial land usage had higher levels of pH and more impurities, while the two other sub-watershed test sites with higher residential land usage had more varied results that where affected by other factors(rest of land percent usage, rain, etc).</p> <p>Conclusions/Discussion The conclusion based on the results of the experimental trials was that sub-watersheds with a higher percentage of governmental and commercial land usage would have a bigger chance of having higher levels of pH and impurities, while those that have a higher residential land usage vary depending on other factors. These out comes disprove the original hypothesis, that the sub-watershed with higher residential area runoff would have more impurities and environmental effects.</p>	
Summary Statement This project focuses on the effects that different sub-watersheds emptying out into the Compton Creek have on the water quality and environment based on the different land usages that run off into the different sub-watersheds.	
Help Received I would like to thank Alex Kenefick and Meredith McCarthy from Heal the Bay for thier support in this project and for helping me gain access to the sites so the test could be administered. I would also like to thank my parents for all their support and for helping me in anyway they could, transportation, materials,	



**CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY**

Name(s) Aidan D. McCarthy	Project Number S0713
Project Title Eutrophication and Industrial Effluents: The Contamination of Earth's Most Precious Natural Resource	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals This experiment will identify the major pollutants and possibly pinpoint their source. They will also show the conditions of our so-called 'preserved' urban waterways.</p> <p>Methods/Materials By collecting samples, before and after rainfall, and then analyzing them for predicted pollutants, these concentrations can be compared and contrasted with other samples at different locations, different sources, and after drainage from the surrounding area.</p> <p>Results Increase at Site C (bottom of creek) for Fluorides, Chlorides, Phosphates, Sulfates, Alkalinity, Nitrates. Nitrites showed no concentration whatsoever, due to oxidation. Both pesticides, Bifenthrin and Chlorpyrifos showed an exponential decrease, probably because of the fact they may have been bio-degradable or diluted.</p> <p>Conclusions/Discussion My hypothesis was correct to an extent. The surrounding industry and housing developments did have an effect upon the condition of the creek, although not as profound as predicted. This experiment can be taken to the next level in analyzing different sites or the same creek in different seasons.</p>	
Summary Statement The effects of runoff from industry and housing upon a so called 'preserved' urban waterway.	
Help Received Dr. Jay Gan at UCR and Virginia Godoy at The Water Treatment plant of Riverside - Testing. Michele Hampton - Board design and creation / project development. Parents - Financial Support	



**CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY**

Name(s) Lora J. Roame	Project Number S0714
Project Title How Do Gas Stations Affect the Environment?	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals I am doing my project to see how gas stations affect the soil, and environment around them. I am also doing this to get a better understanding of the environmental problems caused by gas stations.</p> <p>Methods/Materials I used 8 soil test kits from my local garden store to test the soil around 3 different gas stations.</p> <p>Results My results were that the worst gas station soil was at the Circle K on Limonite and Clay street. I found that none of my samples from the gas stations were adequate enough to sustain healthy plant life.</p> <p>Conclusions/Discussion In conclusion, I have found that gas stations in my area do affect the soil quality, and overall stability, thus proving my hypothesis correct.</p>	
Summary Statement My project is about testing soil samples from various gas stations to record their affect on the surrounding environment.	
Help Received my sister helped take the pictures, and was my transprtation.	



**CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY**

Name(s) Christopher Souvey; Micah Wylde	Project Number S0715
Project Title Heating the Rings: The Thermodynamics of the Rings of Saturn	
Abstract Objectives/Goals The intent of our project was to determine the sources of energy in Saturn's rings by writing programs to compute and analyze their temperatures. Methods/Materials We wrote software in C# that analyzed the spectral data from the lit and unlit sides of the rings in order to determine temperature. This was done by fitting them to an ideal blackbody curve. We then plotted the ring temperatures as a function of radius to analyze general trends. We found optical depth data for the rings and plotted it with our temperature graphs. We then computed theoretical temperatures for the lit and unlit sides and compared them with the observed temperatures. Results With the Stefan-Boltzmann law, we calculated the energy that should be coming from Saturn and the Sun, and found that in the optically thick B and C rings those bodies did not explain all of the energy, leaving 7.2K in the B ring and 6.8K in the C ring. Graphing the difference between the actual lit temperature and the calculated temperatures as a function of optical depth showed a direct correlation. We then calculated theoretical temperatures for the unlit side using the optical depth and lit side temperatures to determine the amount of energy making it through the rings to the unlit side. Similarly to our lit side results, we found a direct correlation between the difference of the actual temperature and calculated temperature and optical depth. Conclusions/Discussion As the number of ring particles is directly correlated with optical depth, we concluded from these two correlations that the excess temperatures were caused by collisions amongst the ring particles.	
Summary Statement We investigated the sources of the energy in Saturn's rings and calculated rough ratios of each source.	
Help Received Ian Dobbs-Dixon of USCS mentored us and gave us the project idea	



CALIFORNIA STATE SCIENCE FAIR 2007 PROJECT SUMMARY

Name(s) Samuel C. Spevack	Project Number S0716
Project Title Seismic and Petrographic Analyses of the Victoria Island Structure (Phase II)	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The analyst completed in 2005 a study of 3d seismic and well data in the Sacramento basin that revealed a subsurface, circular, ~5500-m-diameter feature, which is buried 1,490-1,600 m below sea level. The main purpose of the current phase of the study is to acquire the direct evidence of shock metamorphism needed to confirm an impact origin. Additional mapping of the seismic data was also done to confirm the rootless nature and timing of the Victoria Island structure.</p> <p>Methods/Materials Samples were taken from the two wells directly within the structure. Thin sections were made of samples with significant quartz grain populations. Using a petrographic microscope, quartz grains were examined for lineation patterns similar to planar deformation features or PDFs. Quartz grains with potential PDFs were further examined under a universal stage microscope to measure the angle of the possible PDF with respect to the minerals c-axis to confirm whether its Miller index was similar to known PDFs. Seismic horizons were mapped with GeoGraphix# software programs.</p> <p>Results Thousands of likely quartz grains were examined and a total of nineteen grains with potential PDFs were found all within 40 meters of the seismically identified impact surface. Thirty-one out thirty-three of planar microstructures that were found had indices similar to known PDFs. The Basal (0001) index, a typical orientation for PDFs, is the most common, with 11 microstructures or approximately 35% of the total. The total number of grains and measured planer features compare favorably to those found in well cuttings from sedimentary rocks of known impacts. The new seismic maps helped document that the structure is post Domengine (mid-Eocene) in age and is rootless at depth.</p> <p>Conclusions/Discussion The mapping done in this current study has further confirmed the similarity of the dimensions of the Victoria Island structure to known impacts. The petrographic analysis has shown enough evidence of likely PDFs in quartz grains to warrant calling the Victoria Island structure a probable impact. Abstracts of this work have been completed and are now being shared with the impact community. In addition to peer review of this study, further work including conformation of quartz mineralogy with a microprobe and study of additional samples from wells in the area may be required before the structure can be considered a proven impact crater.</p>	
Summary Statement The primary focus of this study was to find the physical evidence necessary to prove whether the Victoria Island Structure was formed by an impact event.	
Help Received Used lab equipment at San Diego State University, department of geological sciences under the supervision of Dr. Jared Morrow; Seismic data and seismic mapping software were provided by ABA Energy; Well samples were provided by ABA Energy and the California Well Sample Repository.	



**CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY**

Name(s) Quinn Y. Stewart	Project Number S0717
Project Title The Effect of Particle Size and Gradation on the Erodibility of Soil	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The objective of the experiment was to investigate the effect of particle size and gradation on the erodibility of soil.</p> <p>Methods/Materials The experiment called for approximately 4 kg of each soil type (well-graded sand; silt; clay; poorly-graded sand), 3 rectangular soil sample pans, 1 water-flow apparatus, 12 circular soil runoff collection pans, 1 electronic precision scale, 1 lead weight, and 1 large oven.</p> <p>An apparatus was built to create consistent soil sample position, slope, and water flow. Three samples of each soil type were massed, then tested for erodibility using the apparatus. When water flowed onto the soil, eroded matter was transported and accumulated in a collection pan. After the three initial soil types were tested, a fourth soil type, poorly-graded sand, was tested for additional comparison. After the erodibility testing, the pans of eroded matter were placed in an oven for ten hours. When the eroded matter was dried, each pan was massed to determine the amount of soil that had been eroded.</p> <p>Results Soil behavior during the erosion tests differed greatly among the samples, as did the mass of eroded soil. Silt was the least erodible, with an average eroded mass of 51.20 g. Clay was the second-least erodible, suggested by an average eroded mass of 75.32 g. Well-graded sand was the most erodible, with an average eroded mass of 218.12 g. The fourth type of soil, poorly-graded sand, had an average eroded mass of 131.12 g. Average deviations less than 10% for silt and both types of sand suggest precise results, while clay's average deviation of 25% indicated lower precision.</p> <p>Conclusions/Discussion As hypothesized, it was concluded that particle size and gradation do play a role in soil erodibility. The hypothesis regarding the erodibility of the soils with respect to each other, however, was not supported. The outcome of this experiment, as well as the research conducted throughout the project, indicated the complexity of relationships between a wide range of soil physical properties and soil behavior. More refined testing to explore the effect of specific properties or variables on soil behavior would require greater experimental detail than achieved in this project.</p>	
Summary Statement This project examines the role of various soil properties in determining soil erodibility.	
Help Received Geomatrix Consultants lent various testing materials for the experiment. Mr. Loc Tran and Mr. Tim Keuscher of Geomatrix helped with gradation tests and offered ideas for creating a consistent, valid experimental design. Mr. Mike Nakaue reviewed the report and provided overall guidance for the project.	



**CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY**

Name(s) Sean M. Wahl	Project Number S0718
Project Title Probabilistic One-dimensional and Spherical Models for the Evolution of Plate Tectonic Systems	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals Out of all the bodies in our solar system only one, Earth, has active plate tectonics. It is not known for certain what drives the system. Some believe that convection currents in the mantle (plutonics) control the plates, while others believe that the system is controlled by geometric principles (platonics) acting on the plates. While many people have created reconstructions of past continents, the general evolution of plate tectonic systems has not been pursued. In the study we propose to develop a probabilistic model in order to evaluate how plate tectonic systems might evolve, from a platonic perspective.</p> <p>Methods/Materials Since I could not find existing methods for the evaluation of the evolution of plates, I decided to create my own probabilistic models in order to predict such events. I used computer programs and hand drawings with general rules of plate tectonic events, which I created from existing research on current and past tectonics. I then predicted how the plates might move and change size, and used this to evaluate the system as a whole.</p> <p>Results The evolution of plate tectonic systems is closely related to the rate of formation of new plate boundaries and the rate of destructive boundary collisions. The amount of continental crust also has an important effect. A system must be dynamic, but can perpetuate, as long it does not surpass a minimum level of complexity, a four-plate system. From this it becomes evident that a pattern of supercontinent formation and destruction is possible, and perhaps necessary for a perpetuating system.</p> <p>Conclusions/Discussion The vacillation between low complexity and high complexity periods is a means by which the Wilson Cycle might exist, which would indicate that my models, and a platonic model, might be a good generalization of Earth-like plate tectonics. It is also important to note that there are points in which a system could cease, as might have occurred on Mars or Venus. Further work on the subject might be able to explain how and why specific systems would evolve.</p>	
Summary Statement My project is an attempt to model how a plate tectonic system would evolve over time.	
Help Received Recieved materials and collaborated with Dr. Stevenson of Caltech; Mother helped proofread report.	



**CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY**

Name(s) Swati Yanamadala	Project Number S0719
Project Title Sourcing and Quantification of Fecal Indicator Bacteria (FIB) in Aquatic Ecosystems: A Four Year Study	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The objective of this study is threefold: firstly, to create and test a mathematical model for fecal indicator bacteria determinations in coastal aquatic ecosystems; secondly, to develop a novel method of bacterial contaminant determinations in sand samples and expand the capabilities of the aforementioned model to fecal indicator bacteria determinations in these samples; and lastly, to see if the API and VITEK testing systems, two procedures never before applied to environmental research, could be effective in identifying bacterial species in natural ecosystems.</p> <p>Methods/Materials Over four years, numerous samples were collected in three unique estuaries, the Ballona Wetlands, Del Rey Lagoon, and Mother's Beach. Samples were processed using YSI, IDEXX, HACH, API, and VITEK testing systems, coupled with tryptic soy agar, blood agar, and eosin methylene blue agar.</p> <p>Results Through regression analysis, t-tests, and two-way analyses of variance, a mathematical model was created and proven to have a high predictive value in both sand and water samples. Furthermore, the API and VITEK systems identified numerous bacterial species, many of which were pathogenic, in the three systems.</p> <p>Conclusions/Discussion This study represents the first mathematical model ever created to describe a coastal aquatic ecosystem, and the model's capabilities as a predictive tool were shown to be far-reaching, not only predicting fecal indicator bacteria levels in different, unique estuary communities, but also in predicting levels in different media, namely water and sand. Finally, this study shows that two testing systems never before used in environmental research, the API and VITEK systems, are extremely effective in determining bacterial species present in aquatic ecosystems.</p>	
Summary Statement This study not only establishes the first mathematical model of an aquatic ecosystem but also provides new methodology for studying and identifying bacterial species in such ecosystems worldwide.	
Help Received Used lab equipment at Loyola Marymount University under the supervision of Dr. John Dorsey	



**CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY**

Name(s) Sunil C. Bodapati	Project Number S0799
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Project Title
Using Bacterial Anchor Molecules to Stabilize Saturated Soil

Abstract

Objectives/Goals
Liquefaction is a phenomenon that has been shown to cause dangerous problems in regards to structural dynamics and engineering of buildings during earthquakes. One potential solution to this problem is with the use of *Flavobacterium johnsoniae*, a bacterium that secretes a sticky biofilm. The current project objective is to determine if the biofilm secreted by *F. johnsoniae* when grown within sand, will bind sand together and thereby increase its compressive strength and decrease the liquefaction that consequently occurs. The engineering goals for this project are to increase the compression strength of sand and decrease the liquefaction that occurs by utilizing bacterial biofilms.

Methods/Materials
To test if the biofilm successfully fulfilled its intended role, the following tests were conducted:
1) Differing concentrations of *S. epidermis* were cultured and injected into the sand. The samples were tested for compression strength over a period of 5 days.
2) A liquefaction test was conducted on the experimental samples which contained different concentrations to better understand the influence/effects of the biofilm on the liquefaction property of sand over a period of 5 days.

Results
For the concentration compression tests, there was a steady increase of strength as the concentration of bacteria was increased. For the fifth day, there was a 16,747% increase in compression strength compared to the control for the highest McFarland. Additionally, as the bacteria had more days to grow, it resulted in an increase of compression strength. For the concentration liquefaction tests, as the concentration of bacteria was higher and the bacteria had more days to grow, less water was being released from the sand indicating a higher compression strength.

Conclusions/Discussion
Because the biofilm-enhanced sand had increased compression strength and underwent less liquefaction, both engineering goals were achieved. The bacteria enhanced sand underwent very little liquefaction at all three concentrations. Further the biofilm enhanced sand withstood a much higher compression force than normal sand. Normal sand withstood 50 grams before falling apart, but the *Staphylococcus epidermis* enhanced sand withstood 15,875.733 grams, clearly showing how the bacteria enhanced sand is much more stable than ordinary sand.

Summary Statement
The project utilizes bacterial biofilms to reinforce liquefaction prone areas to mitigate the damage caused by an earthquake.

Help Received
My mentor supervised while I was in the lab feeding and growing the bacteria.