



# CALIFORNIA STATE SCIENCE FAIR

## 2009 PROJECT SUMMARY

Name(s) <b>Catherine B. Rowen</b>	Project Number <b>J0712</b>
Project Title <b>Bam! The Strength of Rocks</b>	
<b>Objectives/Goals</b> I chose to study rock fracture because the San Francisco Bay Area is a major earthquake center. An experiment on the strength of rocks would help us understand earthquakes and understand ways of building structures to withstand them. I tested the fracture strength of four rock types: granite, soft granite, marble and slate, to investigate the question, "What type of rock can withstand the most pressure before fracturing?" My hypothesis was that granite would withstand the most pressure without breaking.	<b>Abstract</b> The strength of a rock is the amount of pressure it can withstand without breaking. There are three kinds of forces in breaking of materials: tension (pulling apart), compression (pushing together) and shear (sliding apart). When a bar of material is pushed down, the bending causes compression on the top and tension on the bottom. One standard measure of strength of a material, independent of the size of the sample, is the "modulus of rupture." It indicates the strength of the rock when a bar of rock is pushed down until it breaks in half, based on the dimensions of the rock and the force required to break it. I weighed and measured each of 24 rock samples, 6 each of granite, soft granite, slate and marble. I broke rock samples, each about 30cm long, 2.5cm wide and 2.5cm deep, on a frame made of steel pipes resting on a scale, by having a person gradually increase the weight on the rock until it fractured. I recorded the breaking weight then corrected for the dimensions of the rock to calculate the modulus of rupture.
<b>Results</b> The results show that slate was by far the strongest of the four rock types. The data shows that slate is most definitely the strongest material of the four, and that the marble is on average the weakest. The fracture weights of the slate and soft granite are spread out on the graph up and down, indicating a wide range of strengths, as opposed to the marble and granite showing consistent strength.	
<b>Conclusions/Discussion</b> My project compared the breaking strengths of different kinds of rocks. The data shows that slate was drastically stronger than the other types of rock. On average it is more than five times stronger than marble, the weakest on average. Our hypothesis was that granite would be the strongest and it is strong - more than twice as strong as marble - but it is much weaker than slate. Two types of rock, the marble and the granite, showed little variation in strength within the rock type. However, the slate and the soft granite, showed more variation in strength. One possible reason for the variation in the slate strength is weak points in along the bedding planes in the rock. One possible reason for the variation in the soft	
<b>Summary Statement</b> My project tested the breaking strength of four types of rocks, by calculating the modulus of rupture for marble, slate and two types of granite	
<b>Help Received</b> My father helped me set up the equipment, provided weight to break the rocks and did some typing. Lyons Marble and Tile supplied the cut rock samples.	