CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
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Project Number
S0718

Project Title
Probabilistic One-dimensional and Spherical Models for the Evolution of Plate Tectonic Systems

Abstract

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.

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.

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.

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.

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.