Measuring the Density of Granite
TA: Bill Berner
Section: MISEP Cohort 2
Date: June 27, 2006
Names: Chris, Isabel, Rick, Ken

Abstract: We will be determining if the Earth is comprised of granite by comparing the density of a block of granite to the density of the Earth. We will determine the volume of the block of granite by measuring length x width x height, and determine the mass of the granite with a triple beam balance. The volume and mass of the Earth were given.

Data:

dimensions of the block:	0.105m
	0.062m
	0.078m

mass of the block	1.3248kg

mass of the Earth	6.0 x 10^24kg
radius of Earth	6.4 x 10^3km = 6.4 x 10^6km

The significant digits in the data measurements reflect the systematic error inherent in the measuring tools used.

Analysis:

volume of the Earth $\underline{4\pi r^3} = \underline{4\pi(6.4 \times 10^6m)^3} = 1.1 \times x10^{21}m^3$
           3   3

density of the Earth $\underline{6.0 \times 10^{24}kg} = 5500$ kg/m^3
           1.1 x 10^21 m

volume of block   0.105m x 0.062m x 0.078m = 5.0778 x 10^-4m^3

density of block $\underline{1.3248\ kg}$ = 2600 kg/m^3
           5.0778 x 10^-4m^3

Summary:

From the results obtained in the lab the Earth is not comprised exclusively of granite. It was determined that the average density of the Earth is more than 2 times as dense as granite.

One source of error found was that the block did not have perfectly rectangular sides. At least three measurements were taken to find the average for each dimension. The error that is compounded by multiplying the dimensions of the block is mitigated by our use of significant digits. The fact that two significant digits were used to calculate the density of the Earth and the density of the block gives an accurate representation of their comparative densities.

Conclusion:

The Earth is not made of solid granite because the density of the Earth is a value that is much greater than the density of the granite block. An assumption that must be made in order to support this conclusion is that the density of the Earth is correct. There is no systematic error in calculating the density of the Earth in this lab exercise, but there is systematic error in the measuring of the density of the block. The systematic error in the measuring of the granite block is negligible because the digits that are used to calculate the density of the block are known to high degree of accuracy. The uncertain digits were rounded to the whole centimeter and are insignificant to the answer because the difference between the density of the Earth and the block is 1900 kg/meters cubed.