Materials:

A sample of isotropic Elephant Dentin (23.26mm X 17.02mm X 11.60mm)

Cotton swabs

Honey

Latex

Paper Towel

Plastic cylinder (to hold sand)

Rubber bands (2)

Sand

Screwdriver

Ultragel� Ultrasonic Couplant

Ultrasonic Test Apparatus:

Clamp

Gauge Pressure (up to 60 PSI)

James box

LeCroy� 9430 10 bit 150 MHz Oscilloscope

Parametric Transducers (2)

Water

Procedure:

Our initial step was to contact a scientist (our mentor) from the Livermore Lab in order to obtain equipment and access to the facilities.

1.                  Enter the Ulrasonics Lab at Lawrence Livermore National Laboratory.

2.                  Smooth edges on dentin, so it makes contact cleanly onto the transducers.

3.                  Measure and record dimensions of dentin.

4.                  Apply a thin layer of couplant (Ultragel Ultrasonic Couplant) to sides of dentin touching the transducers with cotton swab.

5.                  Insert dentin into ultrasonic test device.

6.                  Fasten dentin into place in test device.

7.                  Record results with no pressure applied.

8.                  Adjust house pressure to proper PSI.

9.                  Take results at 20 PSI, and at increments of 5 PSI up to 60 PSI.

10.             Find time it takes for compressional and shear waves to strike the transducers using oscilloscope.

11.             Using the formula d=vt (distance equals velocity multiplied by time), find velocity of compressional and shear waves.

12.             Calculate constants using compressional and shear wave speeds.

13.             Remove dentin from device; wipe Ultragel couplant off of edges of dentin using paper towels.

This is an image of the elephant dentin specimen which we used to conduct our experiment.  The sample is relatively small because it is necessary to have an isotropic sample.  This means that the density is the same in all directions.  No sample could be perfectly isotropic but by taking a relatively small sample from the edge of the elephant dentin, we obtained a near isotropic medium.  To make the readings more accurate we shaved down the sides of the dentin so it would make smooth contact with the transducers, assuring more contact and fewer gaps with the transducers.

The device we used to conduct our experiment was provided to us by the Lawrence Livermore National Lab.  It consists of two transducers installed adjacent to one another on a clamp platform.  Between the transducers is where the specimen is tested.  Two pistons attached to the gauge pressure push the clamp together to provide variable pressure to the specimen between the transducers.  A James box provides voltage which runs through a wire into the transducers.  When the voltage reaches the transducers it vibrates them producing a sound wave.  The sound wave travels through the specimen and when it reaches the transducer on the opposite side it creates a vibration which turns the sound wave back into voltage.  The voltage then travels into the oscilloscope which plots a graph, where the time to cross through the specimen can be found.