Prediction of Earthquakes

Topic addressed: The difficulty of predicting earthquakes

Pupil practical or teacher demonstration:
2 Teacher demonstrations

Activity time: a) 10 minutes; b) 10 minutes

The activity in brief: a) a simple demonstration of the build up of stress as house bricks are pulled over each other, using an elastic rope.
b) quantifying the stress required to produce sudden strain in a party popper.

Resource list:
a)
- 4 house bricks, (one with string tied round it)
- Newton meter, (e.g. 50N)
- elastic rope (e.g. luggage bungee)
- G clamp
- Small board e.g. heat-proof mat
- ruler

b)
- Clamp stand
- Clamp boss and arm
- Party popper
- Mass hanger and about 15 x 100g (1 N) masses

Preparation and set-up time: a) 3 minutes
b) 3 minutes

The activity in detail: a) The bricks are set up with two in line, with two more on top of the rear brick. String is tied round the middle brick in the "tower". Explain that this represents two vast rock masses which will come under stress until they start to slide over or past each other. This is what happens in an earthquake.
The front brick should either be held by hand so that it does not move, or restrained by a clamp, as in the photograph.
Gradually increase the tension on the elastic rope attached to the string, until the bricks begin to move. Ask the students to predict at what point this will happen if the activity is repeated and then carry out several runs. The point at which the bricks move is seldom exactly the same as any previous run, either in terms of time taken to apply the tension, or the extension of the elastic rope. This is akin to earthquakes, where it is rarely possible accurately to forecast when a tremor will occur by studying strain gauge data or by judging the interval between seismic events.

This activity may be partially quantified by using a Newton meter in line with the elastic rope.
Measurements of the distance moved by the pile of bricks may also be made.

A simulation of the propagation of seismic waves from the focus of an earthquake may be carried out by placing a shallow dish of water alongside the bricks and watching the ripples as the bricks slide suddenly over each other.


Activity a) – making a "brickquake"

b) To attempt to obtain more measurable data, set up a party popper in a clamp stand, as shown on the next page, and gradually increase the stress by adding 100g (1N) masses until the inevitable happens! This is akin to the steady build up of stress in rock masses until brittle failure takes place and an earthquake happens.
Several groups of students could each be asked to conduct this activity simultaneously and the variability in the results analysed. There is usually wide variation, again simulating the difficulty of predicting exactly when a seismic event will happen.

Watch out for masses falling onto the floor.

Activity b) – the set up for the party popper activity

Leading into the activity: Any discussion of earthquakes and the damage caused, possibly by the showing of a video clip of a recent earthquake. Play "Geobattleships" activity, showing that most earthquakes lie along restricted belts on the Earth's surface.

Following up the activity: Develop ideas about the transmission of seismic waves through the Earth (body waves), and apply their properties to an understanding of the Earth's interior.
Carry out a web search into the frequency of earthquakes in known earthquake areas, e.g.
www.neic.cr.usgs.gov
www.geophys.washington.edu/SEIS/welcome.
www.quake.wr.usgs.gov/QUAKES/CURRENT/index.
http://neic.usgs.gov/neis/bulletin/

Investigate variations using the bricks in different arrangements e.g. piled on each other to discover the effect of increased vertical pressure. This relates to earthquakes generated at different depths within the crust. Other variables can be changed, such as variations on the surface on which the bricks move.

