Mantle convection moving plates: the golden syrup / hobnob teacher demonstration

How convection currents in the mantle may be responsible for plate movement -the Golden Syrup and biscuit demonstration.

Learning objectives:

- currents of solid but ductile **mantle** move beneath the **lithosphere** carrying the **plates**
- where plates collide one is taken down into the mantle and 'destroyed'; where they move apart, new lithosphere is created.

Timing: 15 minutes from the start of heating

Preparation time: the syrup needs to be in the freezer for at least 1 hour in advance

Health and safety: the syrup gets very hot

Apparatus:

- large tin of Golden Syrup
- large beaker, 5 dm^3
- packet of thin biscuits
- Bunsen burner, tripod and heatproof mat
- access to a freezer

Pour the syrup into the beaker and leave in the freezer for 1 hour. Do not allow it to freeze, simply reduce the temperature to gain maximum viscosity.

Break a biscuit in half carefully and place the two halves, touching, on the surface of the syrup. The biscuit halves need room to move apart, so ensure that the two halves are not too big (nibble pieces off the edges if necessary).

Place the beaker and contents on a tripod without a gauze in place to ensure localised heating.

Heat the beaker using a low blue flame directed at the centre of the beaker's base. Slowly the central cone section of the syrup will change in colour as its temperature rises and its viscosity falls.

Close observation will clearly show convection taking place in this region. After around 10 minutes (depending on the speed of heating and quantity of syrup used) the biscuit halves will have been driven apart by the convection currents.

Convection currents in the mantle were thought, for many years, to be solely responsible for plate tectonic movements, with the movement taking rocks down at destructive margins and new rocks forming when plates spread. It is now thought likely that there are three possible driving mechanisms for plate tectonics:

- Movement of mantle convection currents as above
- The mass of the subducted plate (the sinking slab) at the **subduction zone** dragging the surface part of the plate across the surface
- At **constructive margins**, the new plate material sliding off the higher **oceanic ridges**.