

## Activity 7: Properties of the Mantle – potty putty™

### Topic addressed:

A demonstration of the elastic, plastic and brittle properties of Potty Putty™, showing that the behaviour depends on the scale and duration of the applied stress.

### Curriculum for Excellence Sciences and Social Studies Experiences and Outcomes:

SOCIAL SCIENCES		
SECOND LEVEL	People, place and environment	<b>SOC 2-07a</b> I can describe the major characteristic features of Scotland's landscape and explain how these were formed.
THIRD LEVEL	People, place and environment	<b>SOC 3-07a</b> Having investigated processes which form and shape landscapes, I can explain their impact on selected landscapes in Scotland, Europe and beyond.
FOURTH LEVEL	People, place and environment	<b>SOC 4-07a</b> I can explain how the interaction of physical systems shaped and continue to shape the Earth's surface by assessing their impact on contrasting landscape types.
SCIENCES		
SECOND LEVEL	Materials	<b>SCN 2-17a</b> (Earth's Materials) Having explored the substances that make up Earth's surface, I can compare some of their characteristics and uses.
THIRD LEVEL	Planet Earth	<b>SCN 3-05a</b> (Processes of the planet) By contributing to experiments and investigations, I can develop my understanding of models of matter and can apply this to changes of state and the energy involved as they occur in nature.
FOURTH LEVEL	Forces, electricity and waves	<b>SCN 4-11a</b> (Vibrations and waves) By recording and analysing sound signals, I can describe how they can be manipulated and used in sound engineering.
	Topical Science	<b>SCN 4-20b</b> Having selected scientific themes of topical interest, I can critically analyse the issues, and use relevant information to develop an informed argument.

### Student practical or teacher demonstration:

Either

### Activity time:

5 minutes

**The activity in brief:** Potty Putty™ is used as an analogy for the rocks of the mantle. Students investigate its elastic, plastic (ductile) and brittle properties.

**Student learning outcomes:** Students will appreciate that, under different scales and durations of stress a solid material can behave:

- in an elastic way (and could therefore transmit earthquake waves);
- in a plastic/ductile way (and can therefore flow or creep) and
- in a brittle way (and can therefore fracture, which could create an earthquake).

### Resource list:

Potty Putty™ (or Silly Putty™) from toy shops, or made from PVA glue and borax to recipe on <http://www.esta-uk.net/jesei/index.htm>

**Preparation and set-up time:**

2 minutes

**The activity in detail:**

- Break up a lump of Potty Putty™ into small pieces (e.g. 1cm diameter) and distribute to group members.
- Invite members to roll the putty into a ball and gently bounce it on the bench (elastic deformation).
- Ask them to pull it out and let it droop under its own weight (plastic deformation)
- Ask them to roll it up again and try to snap with a short sharp pull (brittle deformation).
- Optional - demonstrate shattering of the putty when hit by a hammer (use a safety screen and collect all the shattered pieces. Do not allow the pieces to fall on carpet or clothing as it will flow into the material and can never be removed!)
- Ask them to roll it into a ball and leave it on the bench/desk for the rest of the lesson, the ball will collapse into a round blob – ask if this is demonstrating elastic, plastic or brittle behaviour (*plastic*) and what is causing the stress (*gravitational forces*).
- Gather up all the Potty Putty™ and return it to its container. Warn students not to put it into their pockets as it will flow into the material and be there for ever!

**Leading into the activity:** Any discussion of the mantle:

- being able to transmit earthquake body waves (by elastic deformation);
- allowing movement of plates above (by plastic deformation);
- being the source of earthquakes, down to about 700km (by brittle deformation).

Seismic wave properties – P-waves (primary wave) can be transmitted through both solids and liquids, but S-waves (secondary wave) through solids alone.

**Following up the activity:** discussion of the rate of movement of plates: convection of the mantle is slow, but possible even though mantle is NOT liquid.



Bounce it (elastic deformation)  
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Bend it (plastic deformation)  
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Snap it (brittle deformation)  
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Shatter it (brittle deformation)  
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**Source of activity**

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