Building the Himalayas

Presenter(s) Students from the Earth & Planetary Science Department at UC Berkeley

Grade Level 6th Grade **Standards Connection(s)** Plate tectonics, Shaping the Earth's Surface

Teaser:
Build the Himalayas in 30 seconds! Make a miniature fold mountain range in an empty box. Modeling how lateral pressure can squeeze rocks into folds and faults, and imitating the way in which fold mountain ranges are formed.

Objective: Pupils can:

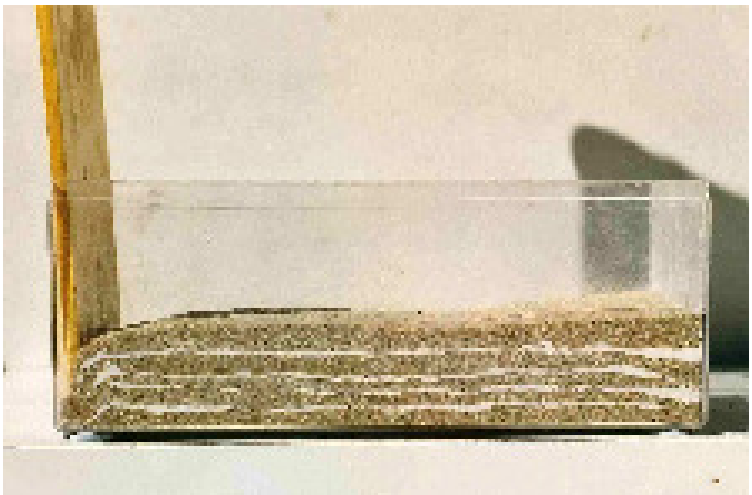
- describe how lateral forces can produce folds and faults in layered materials;
- explain how a mountain range might have been formed from layered rocks if the forces were big enough. (Not all will easily be able to make the link between this activity and the Earth itself.)

Materials: *What will you bring with you?*

- a piece of board to fit snugly into the box small transparent plastic or glass box, e.g. a component tray, or a rectangular plastic container, such as a milk container, cut in half
- a piece of board to fit snugly into the box
- dry sand
- flour, or any powder of contrasting colour to the sand
- spoon, measuring cup etc for adding the sand and powder to box
- printed directions for each volunteer (see last 3 pages)

Classroom Visit

1. Set the cardboard cutout to stand on one side of the container.
2. Measure ½ cup of sand and divide it evenly in the bottom of the container. This is your first sedimentary layer.
3. Now measure ¼ cup of flower and sift it on top of the sand. Try to divide it evenly.
4. Repeat the sand layer and the flour layer three more times. **Add 2 or 3 "fossils" as you do this**. Try not to fill up the container more than half way (shown by the water mark). Your set-up should now look like this →



Mountain-building:

- Have one person hold the container. Somebody else can *very carefully* push the cardboard cutout across the container. Observe what happens to the layers.

Discuss with your team:

- What happened with the fossil? Where is it compared to sea level?
- In the case of the Himalayas, what does the cardboard that pushes up the mountain represent?
- What do the folds in the rock look like? Can you see Z-folds?
- If you want, sketch the folds from your experiment on a piece of paper

Background Information

Underlying principles:

- Forces produce deformation of the rocks that they are acting upon.
- When there is movement, the force working on the board overcomes friction within the sand, causing it to fold, and also works against gravity, causing uplift.
- Force x distance = work done. It requires less work to move the sand particles nearest the board than at a distance from the board. (Distance in the equation is the amount of movement of the board).
- This is why an asymmetrical fold is produced by two equal and opposite forces.
- Folding (plastic deformation) normally precedes faulting (brittle deformation).
- The reverse faulting produced by compression is called thrusting, if it is at a low angle.
- The sand layers are deformed on a particle by particle basis: this is akin to the deformation of rocks on a molecule by molecule basis.

Thinking skill development:

- A pattern is established of folding and faulting being produced by compression.
- There is a direct bridging link with fold mountains, although the concept may be difficult for younger pupils to grasp.
- Pupils face a challenge (cognitive conflict) when they think about the origin of other mountain ranges, e.g. the Andes, Rockies, where there is no second continent to "squeeze" the rocks. (In these cases, the continental plate where the mountains are located is being forced against the adjacent oceanic plate).

Useful links: 'Make your own folds and faults' and other activities involving deformation, in 'The Dynamic Rock Cycle', on the Earth Science. Education Unit website: http://www.earthscienceeducation.com/

Source: Earth Science Teachers' Association (1992) Science of the Earth 11 – 14: Earth's Surface Features. Sheffield: Geo Supplies Ltd.

Follow-up – After Presentation

- Ask pupils to draw pictures of the folds at intervals as they are formed – to produce a sequence of the deformation effects.
- Try a web search for details of fold mountains and how they are formed.
- Find pictures of other folded and faulted rocks and ask pupils to say in which directions the forces came that created the structures.
- Discuss the connection between mountain ranges and plate tectonics, with older pupils.

Building the Himalayas

Check if your team has everything it needs:

- See-through container
- Cardboard Cutout
- Measuring cup
- Sift
- Sand
- Flour

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Set-up

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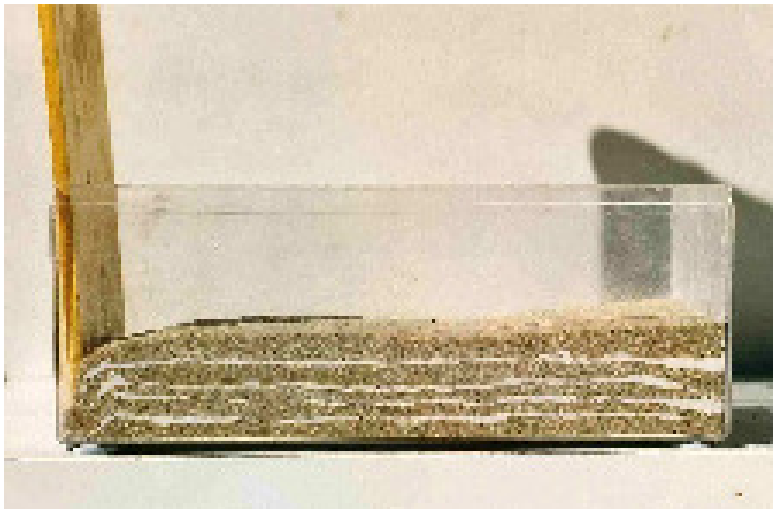

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Z-fold

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