Navigate

Some new questions from our last class:

Note to teacher: Use this space to write in some of the questions students developed in their last class period.

With your class

How might answering these questions help us understand why most earthquakes appear to happen near plate boundaries, while others, like what happened in Afar in 2005, do not?

Moving Our Thinking Forward

On your own

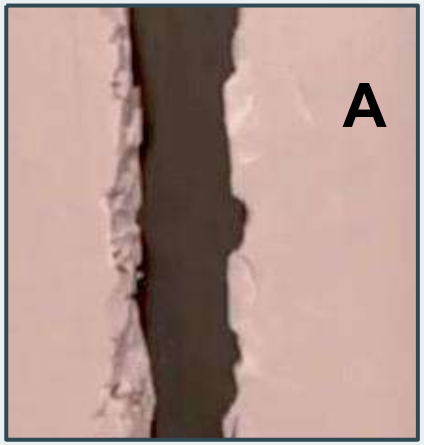
What do you want to try to do in your discussions over the next 2 days that could really help push both your thinking and others' thinking forward?

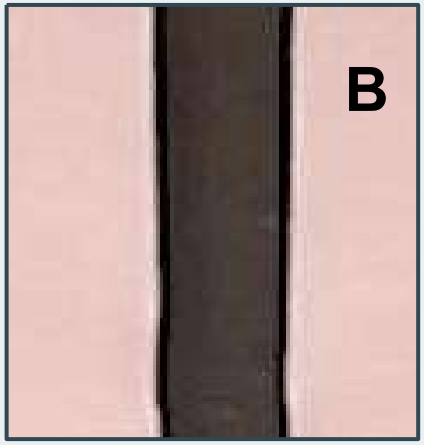
Simulate Plate Interactions along Boundaries

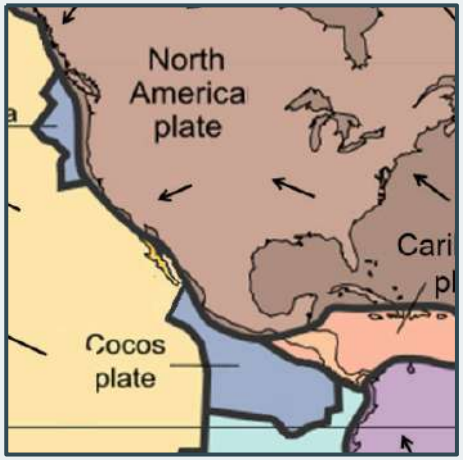
Prepare to use a model to simulate the interactions we think are happening between two plate boundaries.

With your class

How do the edges of the foam in image A better represent the structure of the plates along their edges than image B?







USGS, Scott Nash

Evaluating Models

Every model has advantages and limitations. Understanding these can help us move more flexibly between different types of models for explaining how and why phenomena occur.

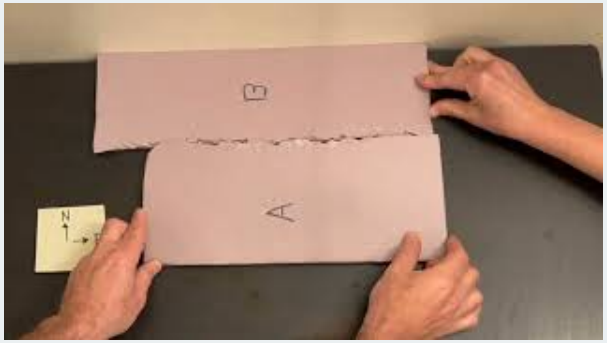
On your own

- Record the phenomena that we are trying to explain (listed on the board) on the top of your handout.
- Come up with a name for the first model you are preparing to use, and record it.
- Decide and record which lens you want to use to evaluate this first model.

Develop and Use a Model

With your class

- Play the video
- Turn the captions on
- Pause the video when each prompt is displayed.



Turn and Talk

- Discuss your answers to each prompt

➔ Be ready to share your ideas with the class

Identify Model's Advantages and Limitations

On your own

- First take a moment to consider how Model 1 helps us explain how/why any of our listed phenomena occur.
- Then evaluate the model's advantages and limitations for helping to explain these phenomena through the particular lens you selected.

Identify Model's Advantages and Limitations

Plates can suddenly slip along where they are in contact with each other. The video claimed that this is the cause of many earthquakes along plate boundaries.

With your class

- What must be happening to the matter at points of contact between the plates right before this occurs?
- Why, in most cases, would breaking, fracturing, or cracking tend to occur at points along the edge of the plate instead of farther back, away from the edge?

Recall Prior Explanations

With your class

How did thinking about the particles in the system help us better explain a phenomenon in our prior unit?

Recall Particle Ideas from Prior Lessons

Particles is a general name for the smallest pieces of matter represented in a model we develop or use.

With your class

What names have we used to refer to those particles in our prior modeling work in science class?

Switch to Small-Scale Interactions

Turn and Talk

What is happening at the particle level within a solid that helps explain either of these behaviors of matter? (You pick.)

- All solids elastically deform up to a point.
- Pieces of a solid can break off when the matter reaches its elastic limit.

Compare Models of Bonds

Bonds between atoms or molecules are often used to help explain some of the properties of matter.

With your class

Take a poll: What does your own model suggest about what the bonds between the particles in a solid are like?

- They are like strings.
- They are like springs.
- They are like rigid sticks.
- They are like _____.

Recall Charge Interactions

Smaller particles make up atoms. Some have a charge.

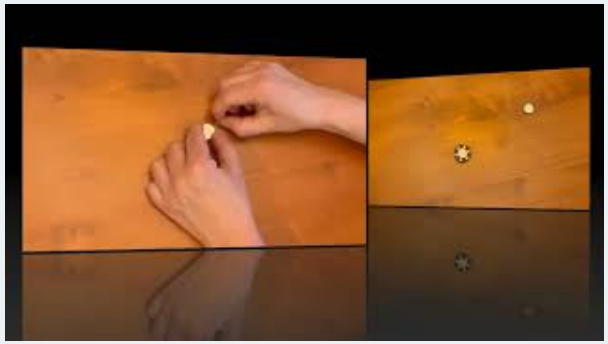
With your class

- Which of these particles would repel each other?
- Which of these particles would attract each other?

Develop and Use a Model

With your class

- Play this video.
- Turn the captions on.
- Pause the video when each prompt is displayed.



Turn and Talk

- Discuss your answers to each prompt.

➔ Be ready to share your ideas with the class.

Identify Model's Advantages and Limitations

On your own

- Take a moment to consider how Model 2 helps us explain how/why any of the phenomena listed on the top of our sheet occur.

- Record which lens you are using to evaluate Model 2.
- Evaluate the model's advantages and limitations for helping to explain these phenomena through the lens you selected.

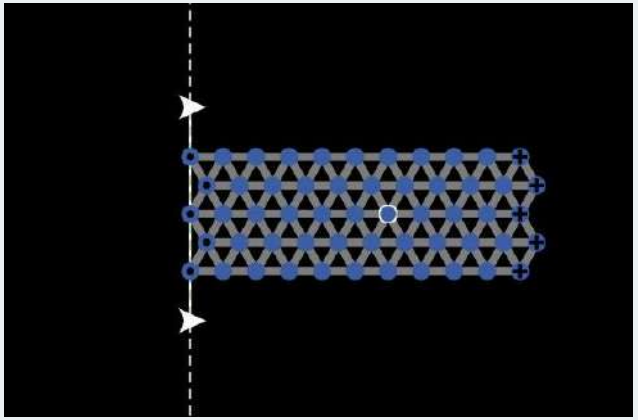
Navigate

With your class

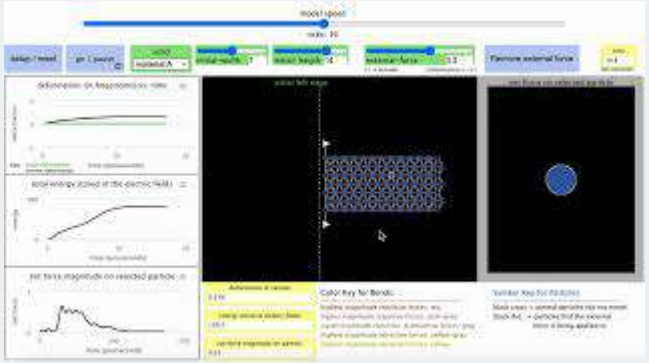
- What parts and interactions would we need/want in a particle-level simulation to make progress on our questions?
- What characteristics of the matter could affect some of these interactions?
- What would we want to be able to visualize or measure in that simulation?

Plan to Carry Out an Investigation

With your class

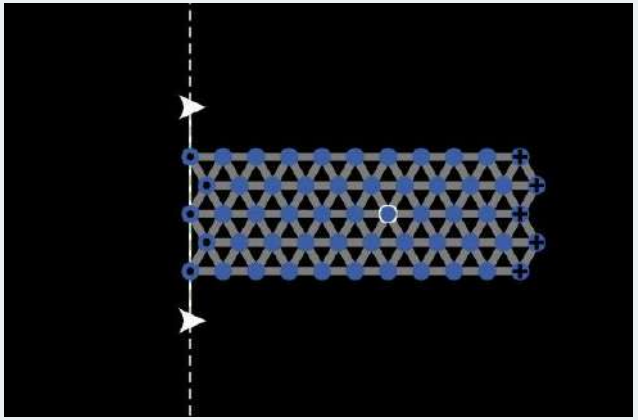


Orient to the assumptions, representations, and variables built into the simulation.

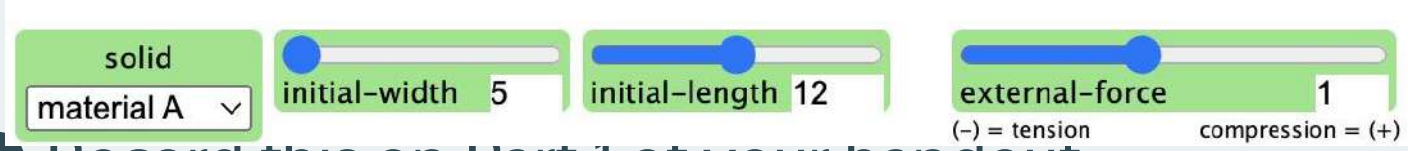


Plan to Carry Out an Investigation

With your group



- Decide which independent variable each person will investigate.



- Record this on Part 1 of your handout.

Carry Out an Investigation

On your own

- Review your investigation plan.
- Carry out Investigations 1-4 and record your results.

Prepare for a Scientists Circle

With a partner

How did changes in your independent variable affect the outcomes in the simulation?

Develop a Consensus Model

Scientists Circle

- Meet in a Scientists Circle to develop a consensus model that represents what we figured out from our investigations.
- Bring your *Particle Investigations* handout with you.

Develop a Consensus Model

Scientists Circle

- Consider whether forces acting on particles are balanced or unbalanced in the following conditions:

1) No external forces are acting on the foam.
2) Forces start bending the foam.
3) Forces stop bending the foam, but keep it bent.
4) Forces continue bending the foam, and cracks appear.
5) The foam breaks in 2 pieces.

- What is happening to the particles along this sequence?

Develop a Consensus Model

Scientists Circle

What causes all changes in motion, whether the motion is at the particle level or macroscopic?

Develop a Consensus Model

Scientists Circle

- Where do we think the foam will break?
- How do the number of particles across this section compare to the rest of the sample?
- Why would this lead to a higher magnitude of internal force per particle in this section, compared to other parts of the matter?

Develop a Consensus Model

Scientists Circle

- What kept the matter from breaking apart along where it cracked before we reached its elastic limit?
- What types of forces between protons and electrons produce those bonds?
- Do those same types of forces help explain why all solids, including the plates, could elastically deform up to a point?

Develop a Consensus Model

Scientists Circle

- What was the relationship between changes in the distance between particles and changes in the energy stored in the electric field(s) in the simulation?
- Can we store unlimited amounts of energy in those electric fields, or was there a limit?

Develop a Consensus Model

- How does the scale of a plate, and the number of particles that make up its matter, affect the amount of energy that can be stored in the electric fields between the particles before part of the plate reaches its elastic limit?
- We know the motion of the plates is relatively slow. What does that tell us about why there are periods of apparent stability between earthquakes in any given region?

Develop a Consensus Model

Scientists Circle

Update the Scale Chart poster and the M-E-F poster using our ideas about particle-level interactions.

Complete an Exit Ticket

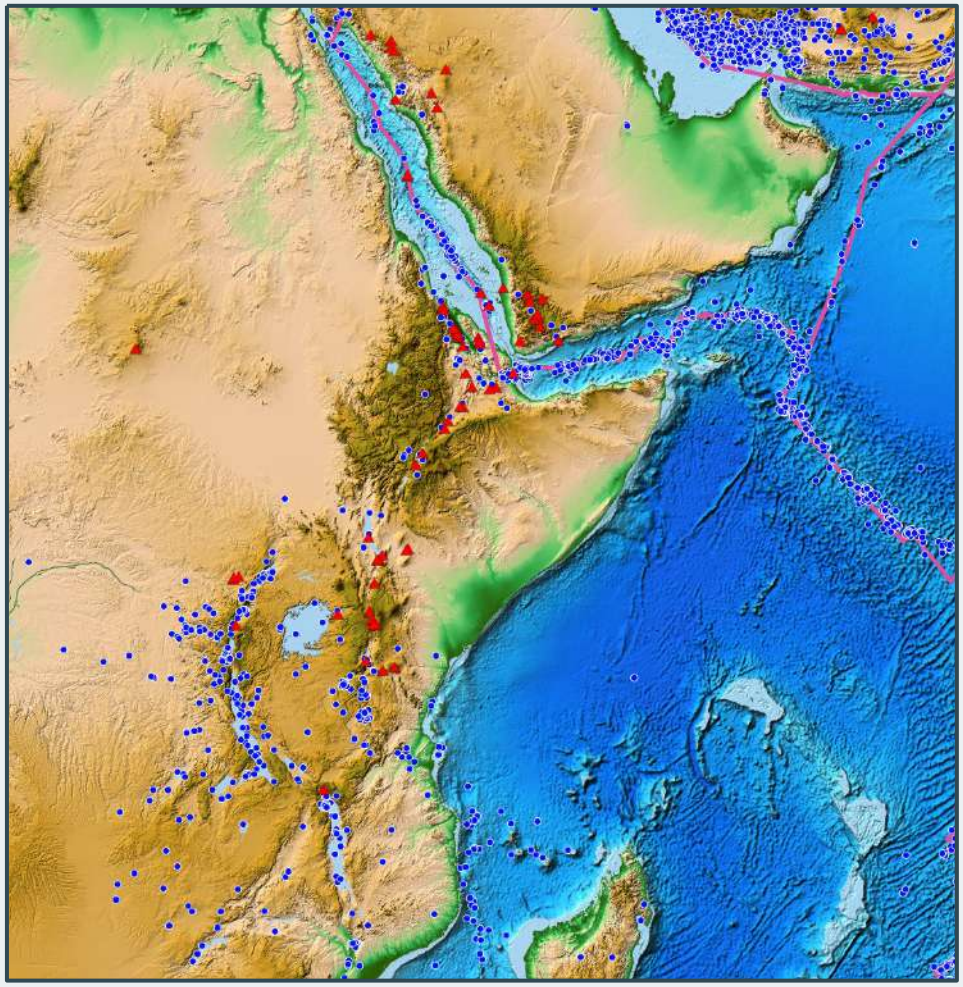
On your own

Complete the Exit Ticket.

Navigate

With your class

Take a poll: Can we fully explain what is happening at Afar, or do we need more information/data?



Home Learning and Personal Glossary Entry

Home Learning

- Identify the advantages and limitations of the simulation by filling in the last row of your *Evaluating Models* handout.
- If desired, add meanings of new terms to your Personal Glossary.

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