**Demystifying Walther’s Law: Large Pickleball Models and Tabletop Challenges to Stratigraphic Column Interpretation**

**Abstract:**

Many students find the application of Walther's Law a temporal-spatial challenge. In this demonstration a set of large plastic tubes represents geographically separated locations (ultimately stratigraphic columns) for laterally adjacent environments. Brightly colored pickleballs are used to represent sediment deposited in each environment. As sea-level is lowered or raised, sediment (pickleballs) is deposited, producing a color-coded record of sedimentation. Students use this visual and interactive demonstration to practice interpreting the record of sea-level change from sedimentary sequences. A parallel table-top activity allows students to challenge each other to interpret the sea-level change history using colored beads and test-tubes, drawing facies boundaries on plexiglass. This activity scaffolds into stratigraphic column interpretation exercises for marginal marine and glaciomarine environments where students can validate their interpretations using the large or table-top models.

The models at AGU 2005  
  
A picture containing flower, colorful, set

Description automatically generatedLarge Class Demo – Ready to go!

Large Class Demo – Transgression followed by regression

  
Tabletop Challenge – Ready to go!

**In-Class Use:**

I use this activity in several ways:

* When I am introducing sedimentary environments, the stratigraphic record, Walther’s law, lateral and vertical facies changes, transgressions, regressions, stratigraphic columns, and correlation in both introductory AND advanced classes
* When I am teaching students about how we learn about past climates from sediments deposited on the Antarctic margin
* When I am working with teachers or students to understand the sedimentary sequence in the Twin Cities and SE Minnesota

**Why it works:**

* Students enjoy putting their pens down and just being slightly goofy
* The large colored pickleball 'columns' are easy to understand, and don't come with all the intimidating 'baggage' of geological symbols
* Students can go back to the models and use them to test their understanding

**Large Classroom Demonstration:**

* **See-through Tubes:** I ordered mine from <http://www.mcmaster.com/> <https://www.mcmaster.com/rods/fabrication~cast/clear-scratch-and-uv-resistant-cast-acrylic-tubes/> ‘Clear Scratch- and UV-Resistant Cast Acrylic Tubes’ and cut on a table saw (depending on length purchased). Mine are far too wide (6” diameter - expensive to buy materials to fill them); they crack easily too... I’d suggest 4” diameter at the widest.
* **Colored Objects (‘Pickleballs’):** I did a volume/cost determination and decided on “mini porcupine balls” from Oriental Trading ([www.orientaltrading.com](http://www.orientaltrading.com)) item # 39/983, 72 per bag, $12.99/bag. They were still really pricey (# bags required depends on column width). <https://www.orientaltrading.com/mini-porcupine-ball-assortment-72-pc--a2-39_983.fltr?keyword=porcupine+balls>
* **Bags to keep color-sorted porcupine balls in (easier to manage):** ziplock bags
* **Something to form ‘basement’ at bottom of tube:** cardboard, old material, foam rubber…….
* **Position of Sea-level:** meter stick
* **Camera:** cell phone

**SUPPLIES / equipment fOR LARGE CLASS DEMONSTRATION**

In the Large Class Demonstration (most suited to a lower-level class, or speed-review in an upper-level class) colored pickleballs are the proxy for sediment deposited adjacent to a simplified continental margin. Students review Walthers Law and sedimentation adjacent to a continental margin prior to demonstration.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Stream (= fluvial)** | **Beach** | **Shelf & Slope** | **Ocean Basin** | **Distal Basin** |
| **Particle size of sediment deposited** |  |  |  |  |  |
| **Color of porcupine ball representing sediment** |  |  |  |  |  |

Students record sea-level changes during the demonstration:

|  |  |  |  |
| --- | --- | --- | --- |
|  | Sea Level (SL) | Sea level up or down? | Did location of beach sediments move west (left, landward) or east (right, basinward)? |
| SL 5 |  |  |
| SL 4 |  |  |
| SL 3 |  |  |
| SL 2 |  |  |
| SL 1 - start |  |  |

Students draw and interpret the data they have collected:



**Tabletop Challenge:**

* **Tubes:** These are the ‘stratigraphic columns’. I used the *‘Unbreakable Super Tubes with Stopper’*, set of 10, product # 96-1987, $19.95, from <http://www.carolina.com>. If not available, try ‘Steve Spangler’s Large Plastic Test Tubes & Rack’ on Amazon ($13.86).
* **Colored Beads:** I used ‘Pony bead mix. Opaque multicolored, 9x6mm, sold per package of 900 beads, cost $14.17 / pkg, I used 10 packages, from <https://www.firemountaingems.com/itemdetails/h201678pb> I then had to bribe friends and family to sort them by color.
* **Containers for sorted beads:** Plastic containers from the back of your kitchen cupboard or a hardware store
* **Measurer:** Five small ‘pourable’ containers that can easily measure ~ 5ml beads for each ‘setup’ (old medicine cups)
* **Perspex / Plexiglass ‘Holder’:** I got Perspex, cut to ‘legal size paper (8.5” x 14”) at the hardware store, where I also got the wood and screws to stand them up.
* **Template:** print out and use bulldog clips to hold on stand
* **Something to form ‘basement’ at bottom of tube:** black beads, old material, sand…..

Camera: phones

**SUPPLIES / equipment fOR**

**Tabletop**

**challenge**

I use the Tabletop Challenge in advanced classes, often as a follow-up ‘Lab’ or in-class activity after having reviewed Walthers Law, transgressions and regressions via the larger demonstration. Sometimes I follow the student handout verbatim, other times I focus on giving the students the opportunity to challenge their classmates.

The set-up is similar to that used for the large demonstration, but uses beads and test tubes, and more importantly a Perspex ‘cover’ or laminated sheet that students can draw facies boundaries on.

A picture containing indoor, wall, counter, kitchen appliance

Description automatically generated

In addition to the interpretation of Minnesota stratigraphy (also used in the Large Demo), this exercise includes additional follow-up questions.

A screenshot of a computer program

Description automatically generated with low confidence

**Link to real situation:**

In both activities the students advance from using the model data to applying their understanding to a real-world situation (Adapted from Minnesota at a Glance ‘Ancient Tropical Seas – Paleozoic History of Southeastern Minnesota (<https://conservancy.umn.edu/handle/11299/59447> ). They interpret changes sea level.

Diagram

Description automatically generatedDiagram, schematic

Description automatically generated

**References and Links:**

Minnesota Geological Survey, Minnesota at a Glance ‘Ancient Tropical Seas – Paleozoic History of Southeastern Minnesota (<https://conservancy.umn.edu/handle/11299/59447> )

Smith C.,**Pound, K.S**., Jones, M.H., Schmitt, L., Campbell, K., 2005, [Classroom Demonstration and Interactive Model of Sea-Level Control on Lateral and Vertical Facies Changes](http://abstractsearch.agu.org/meetings/2005/FM/ED52A-05.html)[abs], EOS Trans. AGU, 86(52), Fall Meeting Suppl., Abstract ED52A-05.

Pound, K., Earth and Atmospheric Sciences Dept., St. Cloud State University, Modeling Sea Level: Lateral; and Vertical Facies Changes On the Cutting Edge Peer Reviewed Teaching Activities Collection <https://nagt.org/nagt/teaching_resources/teachingmaterials/11402.html> (includes instructions)

Pound, K., Earth and Atmospheric Sciences Dept., St. Cloud State University, Sea Level & Lateral and Vertical Facies Changes, NAGT / SERC website <https://nagt.org/nagt/teaching_resources/teachingmaterials/11383.html> (I don’t know why there are two separate NAGT pages, I need sort that out, this page provides less info than the one above!)

Calendar

Description automatically generated A picture containing line, several

Description automatically generated

Student work: dry-erase pen on laminated sheets Regression followed by a transgression