Blocks Module Content Guide

This guide covers the basics of the content within the "Interactive 3D Geologic Blocks" Module. The content guide is intended to assist you, the teacher, in creating effective lesson plans, preparing additional activities, and constructing appropriate assessments. Brief definitions and descriptions of the types of layers, folds, faults, and intrusions along with descriptions of unconformities will be presented. A general description of the geology associated with each type of geologic feature will is also given. Words in bold are key words that students should recognize and understand by the end of a lesson. A table at the bottom of each section shows examples of the described features. Each picture in the table is labeled with a number and letter. Numbers correspond to the feature (layers: 1, folds: 2, faults: 3, etc.) and letters correspond to specific types of each feature and are listed at the end of each description.

1. Layers

- **Horizontal** – layers of this type were **deposited** on surfaces and no other geologic events have occurred since their deposition. (1a)
- **Gentle** – layers of this type were deposited on a surface and then **tilted** at a gentle angle. (1b)
- **Moderate** – layers of this type were deposited on a surface and then tilted at a moderate angle. (1c)
- **Steep** – layers of this type were deposited on a surface and then tilted at a steep angle. (1d)
- **Oblique** – layers of this type were deposited on a surface and then tilted at an angle oblique to the sides of a block. (1e)

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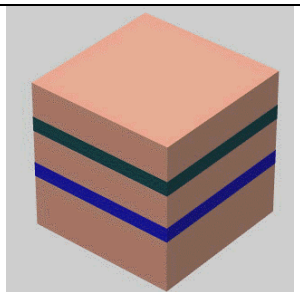
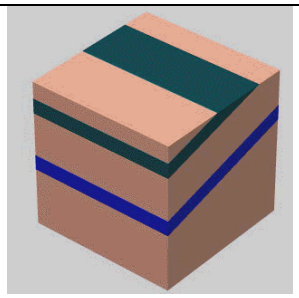
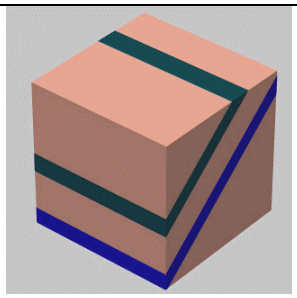
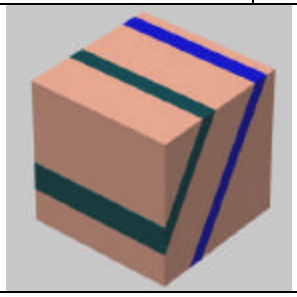
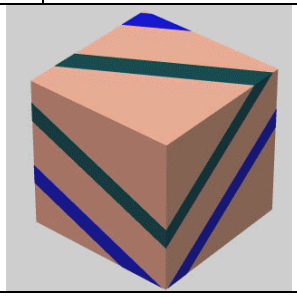
<tr><td>  </td><td>  </td><td>  </td></tr>
<tr><td>1a – Horizontal Layers</td><td>1b – Gently Tilted Layers</td><td>1c – Moderately Tilted Layers</td></tr>
<tr><td colspan="2">  </td><td>  </td></tr>
<tr><td colspan="2">1d – Steeply Tilted Layers</td><td>1e – Oblique Layers</td></tr>
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2. **Folds** – layers that have been folded up (syncline) or down (anticline). Folds can also be tilted to slight (plunging) or extreme (vertical) degrees.

- **Horizontal Syncline** – layers have been folded by forces pushing the outside edges of the layer upward. You can offer students pneumonic devices to differentiate between syncline and anticline folds. One is to relate the "y" in the word syncline to the shape of the fold; the layers fold up like the top half of the "y". Students can also remember the shape of an anticline because the layers fold down like the top of an "A". (2a)
- **Plunging Syncline** – syncline folds that have been tilted. (2b)
- **Horizontal Anticline** – layers that have been folded by pushing the outside edges of a layer downward. Here, the layers fold down like the "n" in the word anticline. (2c)
- **Plunging Anticline** – anticline folds that have been tilted. (2d)
- **Vertical** – folds that have been tilted to vertical. With these folds, there is no differentiation between syncline and anticline. (2e)

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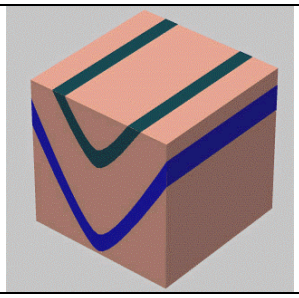
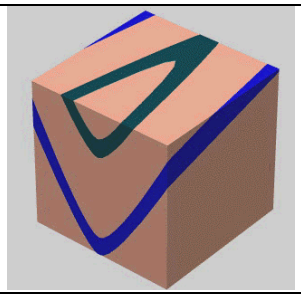
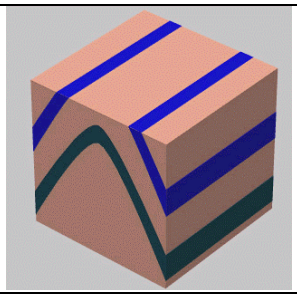
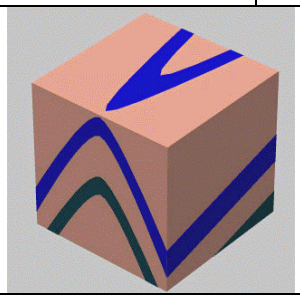
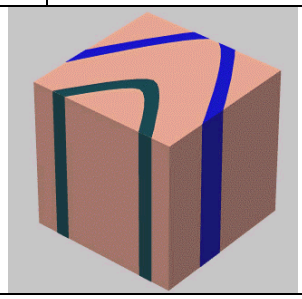
<tr><td>  </td><td>  </td><td>  </td></tr>
<tr><td>2a – Horizontal Syncline Folds</td><td>2b – Plunging Syncline Folds</td><td>2c – Horizontal Anticline Folds</td></tr>
<tr><td colspan="2">  </td><td>  </td></tr>
<tr><td colspan="2">2d – Plunging Anticline Folds</td><td>2e – Vertical Folds</td></tr>
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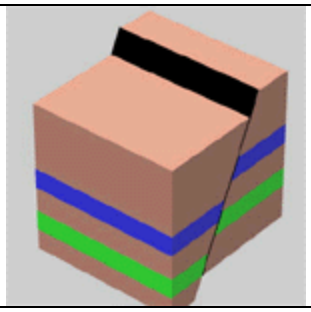
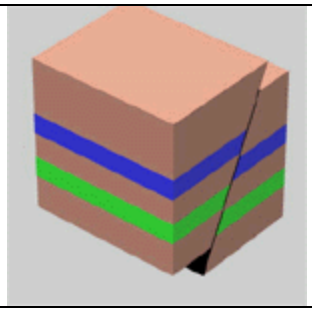
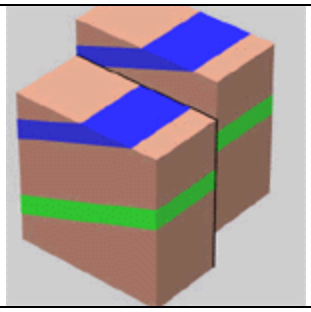
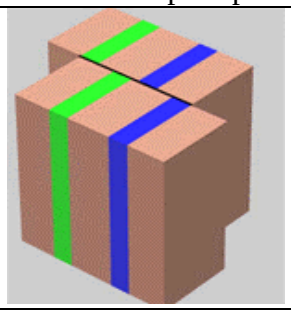
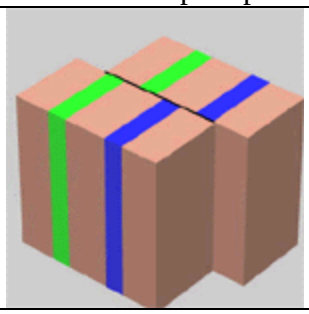
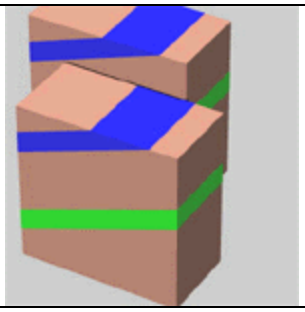
3. **Faults** are fractures that allow blocks on either side of the fracture to move with respect to each other. There are three main types of faults shown in this section, as well as the effects these types of faults have on layers and folds.

- **Dip-Slip faults** – the movement is up or down the **dip** (slope) of the fault.
  - **Normal** – It seems *normal* for the block above the fault to slip down this way. The **hanging wall** moves down relative to the **foot wall**. (3a – shown with horizontal layers)
  - **Reverse** – The block above the fault moves up with respect to the block below the fault – the reverse of what seems normal. The hanging wall moves up relative to the foot wall. (3b – shown with horizontal layers)
  - **Vertical** – Since there is no upper or lower block, we cannot call the fault normal or reverse, simply a **vertical dip-slip fault**. One block moves up relative to the other block. (3c – shown with gently tilted layers)

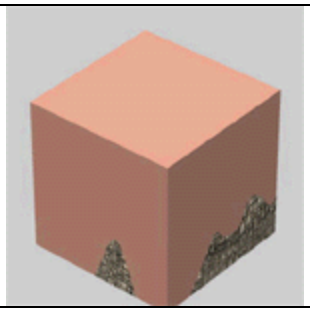
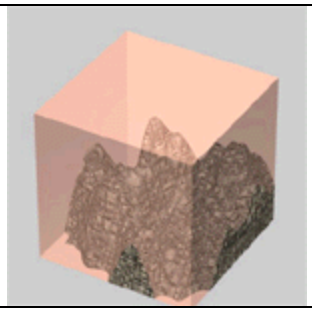
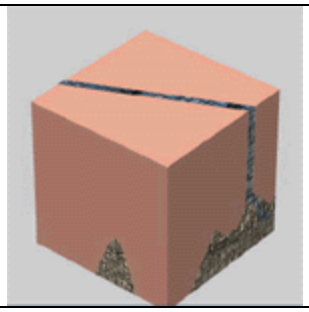
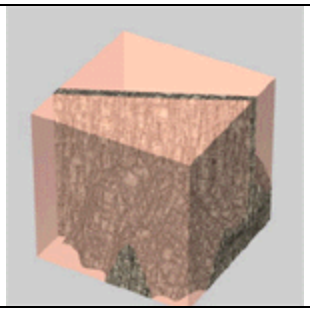
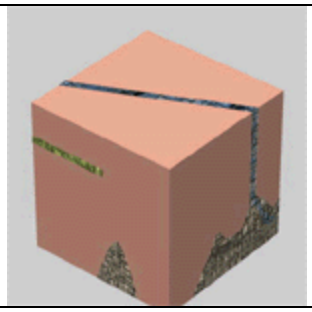
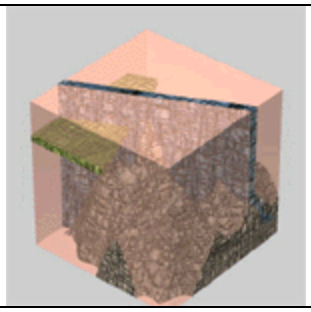
- **Strike-Slip faults** – the movement is parallel to the strike (a horizontal line) of the fault.
  - **Left-Lateral** – specifically identified as left lateral because as you stand at the fault line (on either side), the block on the opposite side has been shifted to the left. (3d – shown with vertical layers)
  - **Right-Lateral** – same idea as the left-lateral strike-slip fault; right lateral because as you stand at the fault line (on either side), the block on the opposite side has been shifted to the right (3e – shown with vertical layers)

- **Oblique fault** – the movement is a combination of up or down and side to side. Movement is oblique (at an angle) to the strike and dip. (3f – shown with gently tilted layers)

		
3a – Normal Dip-Slip Fault	3b – Reverse Dip-Slip Fault	3c – Vertical Fault
		
3d – Left Lateral Strike-Slip Fault	3e – Right Lateral Strike-Slip Fault	3f – Oblique Fault

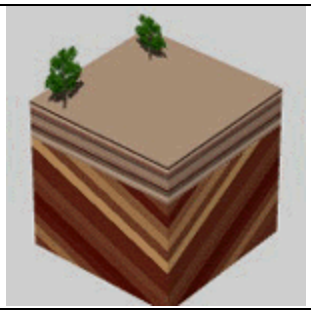
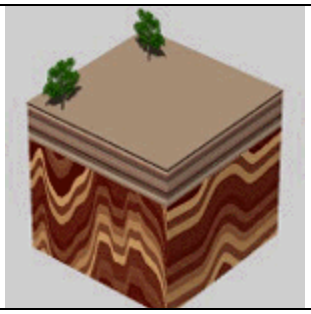
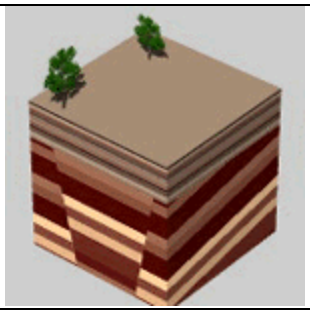
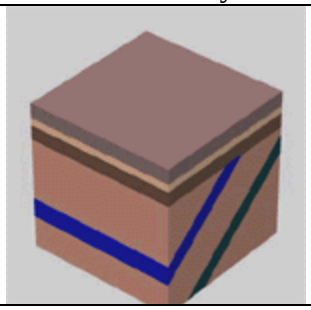
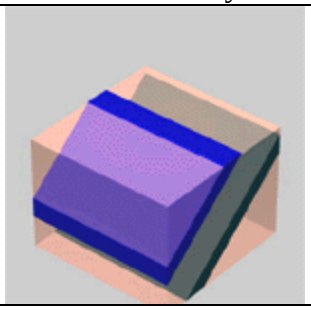
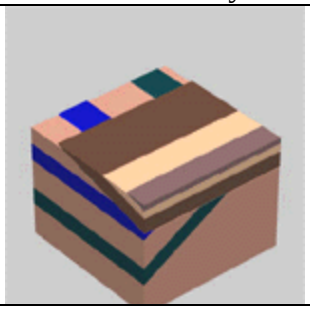
4. **Intrusions** – bodies of igneous rock formed by the solidification of magma after it intrudes upward into older country (host) rock.

- **Pluton** – irregular shaped feature composed of igneous rock. (4a – opaque block with intrusion as it would appear on the surface; 4b – partially transparent block, irregular shape of an intrusion below the surface)
- **Dike** – an intrusion in which magma has forced open and filled a fracture. Dikes are oriented vertically. (4c – opaque block; 4d – partially transparent block)
- **Sill** – magma branches out from a dike to form a horizontal layer of intruded magma. Students can remember this name by thinking of a horizontal window sill. (4e – opaque block; 4f – partially transparent block)

		
4a – Opaque Block with Pluton	4b – Partially Transparent Block with Pluton	4c – Opaque Block with Pluton and Dike
		
4d – Partially Transparent Block with Pluton and Dike	4e – Opaque Block with Pluton, Dike, and Sill	4f – Partially Transparent Block with Pluton, Dike, and Sill

5. **Unconformities** – provide a distinct time boundary between one set of geologic events and another. Pictures 5a through 5c show examples of horizontal unconformities. In each picture a series of geologic events occurred before the erosion of a horizontal surface and deposition of new layers. The unconformity is the boundary between old (e.g., tilting, folding, etc.) and new (e.g., deposition) geologic events.

- **Horizontal** – the unconformity is horizontal. One possible sequence of events that would result in a horizontal unconformity is: deposition of layers, tilting of layers, and erosion of a horizontal surface followed by deposition of new layers. (5d – opaque block with horizontal unconformity; 5e – partially transparent block with unconformity revealed)
- **Tilted** – the unconformity is tilted. One possible sequence of events that would result in a tilted unconformity would be deposition of layers, tilting of layers, erosion of a surface, and tilting of a section followed by deposition of new layers. (5f – tilted unconformity)

		
5a – Horizontal Unconformity with Tilted Layers	5b – Horizontal Unconformity with Folded Layers	5c – Horizontal Unconformity with Faulted Layers
		
5d – Horizontal Unconformity	5e – Partially Transparent Block with Unconformity Revealed	5f – Tilted Unconformity