Lab 10. Balanced Tectonic Cross Sections

Figure 12 (a.) Restored structure of cross-section D-D' (Plate 2b).
(b.) Structural relief diagram comparing C8h unit for current and restored alignments.


Herman, G.C. 1984,
Figure 18 Progressive collapse of footwall ramp builds up the duplex. This is a measured graphical experiment, assuming plane strain and kink folding, with angles and ratios of dimensions typical of natural examples. Roof thrust sheet undergoes a complex sequence of folding and unfolding, seen by following black half dot (from Boyer and Elliott, 1982).
Figure 19  Precambrian Belt Supergroup, comprising Waterton (W), lower Altyn (fine stipple), mid and upper Altyn (uA), Appekunny (Ap), Grinnell (G), and Siyeh (S), is thrust over Cretaceous siliciclastics (K, with pebble pattern) by Lewis thrust. Mount Crandell thrust (MCT) is roof and Lewis thrust is floor to duplex, and folded horse just northwest of Mount Crandell suggests that duplex developed toward foreland. Cross section is balanced (with current distance L' between points recording a shortening of S), and is based on excellent control provided by over 2 km of local relief (Modified from Douglas 1952 from Boyer and Elliott, 1982).
Figure 10. - Part of P.G.S. cross section c-c’ - current and restored state

Note the 'flat-on-flat' solution for the Juniata Culmination in the current state and the inverted fracture array pattern and missing section in the restored diagram.
PASSIVE ROOF BLIND-THRUST DUPLEX
TABLE 3
Crinoid columnal measurements

<table>
<thead>
<tr>
<th>Sample</th>
<th>Axial ratios (h:a)</th>
<th>Sample</th>
<th>Axial ratios (h:a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Or 1-1</td>
<td>9.0:8.6 - 1.05</td>
<td>Or 1-1</td>
<td>9.0:8.6 - 1.05</td>
</tr>
<tr>
<td>&quot;</td>
<td>8.2:7.7 - 1.06</td>
<td>&quot;</td>
<td>7.3:6.8 - 1.04</td>
</tr>
<tr>
<td>&quot;</td>
<td>7.3:6.8 - 1.04</td>
<td>&quot;</td>
<td>7.3:6.8 - 1.04</td>
</tr>
<tr>
<td>Or 1-1a</td>
<td>9.5:9.1 - 1.04</td>
<td>Or 1-1a</td>
<td>9.5:9.1 - 1.04</td>
</tr>
<tr>
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<td>&quot;</td>
<td>8.8:8.5 - 1.04</td>
</tr>
<tr>
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<td>&quot;</td>
<td>9.0:8.8 - 1.02</td>
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<td>&quot;</td>
<td>10.1:9.5 - 1.06</td>
</tr>
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<td>&quot;</td>
<td>6.5:5.9 - 1.10</td>
</tr>
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<td>&quot;</td>
<td>6.8:6.6 - 1.03</td>
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<tr>
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<td>&quot;</td>
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<td>1.0:1.0 - 1.00</td>
</tr>
<tr>
<td>&quot;</td>
<td>8.7:8.3 - 1.05</td>
<td>&quot;</td>
<td>8.7:8.3 - 1.05</td>
</tr>
</tbody>
</table>

range: 1.00 - 1.23 Note: the axial lengths
mean: 1.08 are relative lengths
mode: 1.05 from the graduated cross

Error in measurement resulting from columnal
inclination to plane of measurement:

Average columnal width: 0.7 mm.
Average columnal diameter: 2.8 mm.

Maximum error results at maximum
inclination (\( \theta = \cot^{-1} 0.7/2.8 = 14.04^\circ \)).
At 14.04\(^\circ\) inclination, the apparent
diameter = 2.8/\cos \theta = 2.89.

An apparent diameter of 2.89 equals
an apparent columnal axial ratio of
1.03 (2.89:2.80). The maximum error
resulting from measuring an inclined
columnal is thus taken to be 0.03.
Figure 4. - Diagram showing wedge faulting and the structural coordinate system

Modified from Cloos and Broedel (1943, p. 1381). The inward movement of wedges has contracted and heightened the block.
Figure 10. - Part of P.G.S. cross section c-c' - current and restored state

Note the 'flat-on-flat' solution for the Juniata Culmination in the current state and the inverted fracture array pattern and missing section in the restored diagram.
Stiff layer:
180 km - 82 km
contraction & translation

Cover layer:
180 km = 108 sbl +20 pt
+18 cf +32 pLPS
Neotectonic map of the eastern USA, mid-Atlantic region showing generalized bedrock geology, isopleth contours of current, vertical crustal motions based on GPS data (NASA JPL), the direction of current, horizontal plate motions (black open arrows), the interpreted direction of impact for the Chesapeake Invader (purple arrow), structural contours for the top of pre-Cambrian basement in Ohio (Ohio Geological Survey), the direction of the contemporary, horizontal component of crustal stress based on underground mine roof spalls ( ), earthquake focal mechanism solutions (G, Sb, and A), shear planes based on seismic stress tensors (red structure symbols with dip values), and late-stage shear fractures in the Newark basin (black structure symbols from OPTV borehole analyses). Green hatched polygons are Early Mesozoic extensional basins, dark-gray polygons are pre-Cambrian rocks, and light gray polygons are Lower Paleozoic rocks. Some Great Lakes are shown with light-blue hatches. GPS stations are color coded blue for negative vertical motions and brown for positive, respectively. Station numbers and motion isopleth values in mm/yr.