Paleozoic Life in the Seas

- Environmental variables to watch
  - Sea level
  - Positions of land and sea (continents & oceans)
  - Climate
- Patterns of diversity
- Mass extinctions
- Cast of characters
The "Sepkoski Curve"

From Sepkoski, Paleobiology, 1982
The Big 5 Mass Extinctions

Figure 1: The history of diversity of each of the three "evolutionary stages" (Figure 2) in the marine fossil record, with illustrations of major forms. (From Sepkoski 1984)
Figure 4. Comparison of diversity curves for the total marine taxa computed from the 1982 and 1992 (Alroy et al.) compendia. Although the 1992 curve is higher than the 1982 curve, the two are very similar in shape. The graph for the percentage of change shows that the greatest proportional increase in diversity has occurred over the Cambrian and the least over the Permian. (The dashed line in the graph is the median level of change, +13.3%) The diversity curves were compiled straight from the data, with no interpolations of ranges within orders with discontinuous fossil records (e.g., Octopoda); such interpolation would have increased the apparent change over the Phanerozoic.

Fig. 1. Diversity curves compare ten subsets of sampling intensity by using four different subsampling algorithms (Table 1) and two methods of counting genera. Each data point represents the median value from among 1,000 subsamples (Table 1). Standard errors are included where data fell to meet the standards of sampling points. Median values were used as the actual occurrence of genera (Table 1). The total number of genera is greater than the total number of genera observed in a particular sample. The following genera were included in the analysis: Amphiopoda, Euarthropoda, Alroy et al. (2001).
Figure 1.1. Sepiolis spindle diagram representing the family diversity of various marine taxa through geological time. (From Brenchley, 1981.)
Figure 5: Three regions on the clorophyll biomass model illustrated in Fig. 1 with time-specific permacalcs (dashed lines are inferred values) packing the major new production of the photosynthetic zone. B and C further illustrate the major new production of the photosynthetic zone in the time specific permacalcs (dashed lines are inferred values) packing the major new production of the photosynthetic zone. C. The relation is 8 with time-specific permacalcs corresponding to the photosynthetic zone in the time-specific permacalcs (dashed lines are inferred values) packing the major new production of the photosynthetic zone.
Cambrian Period

543 - 490 million years ago

Late Cambrian  514 Ma
Cambrian Trilobites

Archaeocyathids
Ordovician Period
490 to 443 Million Years Ago
Brachiopods, Ordovician, Ohio
Ordovician Corals

Rugose

Tabulate

www.humboldt.edu/~natmus/Exhibits/Life_time/Ordovician.web/55b.jpg

Maclurites at Crown Point, Lake Champlain, NY
Ordovician Trilobites

The largest known trilobite *Isotelus rex*, Late Ordovician, northern Manitoba
Triarthrus, Ordovician, New York

Kentucky

Ordovician Nautiloids

Minnesota

Ohio
Giant nautiloid
Rayonnoceras solidiforme
Mississippian, Fayetteville, ARK

Ordovician crinoids
www.emc.maricopa.edu/faculty/farabed/BIOBK/1ord04b.gif
Ordovician vertebrae
Harding Sandstone, Utah
Ordovician seascape
www.pbs.org/wgbh/nova/link/images/hist_img_03_ordo.jpg

Ordovician seascape
http://www.ucmp.berkeley.edu/ordovician/ordovicsea.gif
Ordovician seascape
www.emc.maricopa.edu/faculty/farabee/BIOBK/1ord04b.gif

http://news.bbc.co.uk/2/hi/science/nature/4433963.stm
Silurian Period

443 to 417 Million Years Ago
Silurian Trilobites

Eurypterids (sea scorpions)
Silurian seascape
Painting by Zdenek Burian

Devonian Period
417 to 354 Million Years Ago
Devonian Brachiopods
Devonian Trilobites

- Odontochile formosa
- Phacops rana
- Dipleura dekayi
- Greenops
- Terataspis

Devonian Rugose Corals
Devonian seascapes

“The Age of Fishes”

Placoderms

Acanthodians

Sharks
**“The Age of Fishes”**

<table>
<thead>
<tr>
<th>Period</th>
<th>Fish Groups</th>
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<tbody>
<tr>
<td>Cenozoic</td>
<td>Jawless Fishes, Placoderms, Sharks</td>
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<tr>
<td>Cretaceous</td>
<td>and their Relatives, Acanthodians</td>
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<td>Jurassic</td>
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<td>Ordovician</td>
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<td>Cambrian</td>
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*Dunkleosteus*
Carboniferous Period

354 to 290 Million Years Ago
Carboniferous Crinoids
Carboniferous Corals

Tabulate

Rugose

Permian Period

290 to 248 Million Years Ago
Permian reef
Figure 1. Framework-supported reef intervals during Phanerzoic related to family diversity, community ecology, and extinction. Reef intervals are shown with boundary points, representing periods of mass extinctions. Solid lines represent intervals of high family diversity, while dashed lines represent intervals of low family diversity. The graph illustrates the changes in family diversity over time, with peaks and troughs indicating periods of mass extinctions and recovery. Each interval is labeled with a letter, A to G, corresponding to different ecological phases.

Figure 2. Graph showing the number of families over geologic time. The x-axis represents geologic time in millions of years (Myr), and the y-axis represents the number of families. The graph illustrates a significant increase in the number of families over time, with two distinct phases labeled P1 and P2. The shaded areas represent different ecological communities, with red and blue indicating two distinct communities. The peak in family diversity is marked with an arrow at 1900 Myr. The graph highlights the dynamic changes in biodiversity over geological time.
FIGURES 1

The history of diversity of each of the three "evolutionary faunas" (Figure 2) in the marine fossil record, with illustrations of major forms. (From Sepkoski, 1984)