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

![Graph showing the number of families over geological time](image)

**Figure 3**

The history of diversity of each of the three "evolutionary faunas" (Figure 2) in the marine fossil record, with illustrations of major terms. (From Sepkoski 1984)
Figure 4. Comparison of diversity curves for the total marine fauna computed from the 1962 and 1992 familial compendia. Although the 1992 curve is higher than the older 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; +15.6%). The diversity curves were compiled straight from the data, with no interpolations of ranges within orders with discontinuous fossil records (e.g., Ctenopoda); such interpolation would have increased the apparent change over the Permian.
From Alroy et al., PNAS (2001)

Fig. 5. Marine data consisted of samples assessed for sampling intensity by using four different subsampling algorithms (Table 2) and two methods of counting genera. Each data point represents the median estimate of a single subsampling algorithm, with error bars showing the 10th and 90th percentiles. Arrows show the effect of increasing sampling intensity. All marine data are individual analyses that used the same subsampling algorithms and ecological constraints. The primary and secondary axes of the sampling intensity are shown between 200 and 500 bp. The 10th and 90th percentiles of the subsampling algorithms are shown in parentheses. The number of occurrences in each bin is shown. The number of occurrences in each bin is shown. The number of occurrences in each bin is shown.
Figure 1.1. Sepkoski's spillover diagram representing the family diversity of various marine taxa through geologic time. Cm, Cenozoic; M, Mesozoic; P, Paleozoic; Md, late Precambrian (" Vendian" or "Ediacaran"). (From Sepkoski, 1982.)
Figure 6. Three solutions to the three-phase linear model shown in Fig. 3 with topographic parameters describing the timing of the Pliocene marine fossil record. 1. A single, severe episode linked to the timing and magnitude of the Last Pliocene mass extinction. 2. The situation is such that an additional potential linked to the Pliocene mass extinction. 3. The situation is such that an additional potential linked to the Pliocene mass extinction.
Cambrian Period
543 - 490 million years ago
Late Cambrian  514 Ma

Cambrian Trilobites
Archaeocyathids

Cambrian seascape, painting by Zdenek Burian, ca. 1960
Ordovician Period

490 to 443 Million Years Ago

Middle Ordovician  458 Ma

PANTHALASSIC OCEAN

PALEO-TETHYS OCEAN

IAPETUS OCEAN

[Map showing geological features and periods]
Ordovician Brachiopods

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

Leviceraurus

Asaphus

Ordovician Trilobites

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

*Triarthrus*, Ordovician, New York
Ordovician Nautiloids

Kentucky

Ohio

Minnesota
Giant nautiloid
Rayonnoceras solidiforme
Mississippian, Fayetteville, ARK
Ordovician crinoids
www.emc.maricopa.edu/faculty/farabee/BIOBK/tord04b.gif

Ordovician vertebrates
Harding Sandstone, Utah
Ordovician seascape
http://www.ucmp.berkeley.edu/ordovician/ordovicsea.gif

Ordovician seascape
www.emc.maricopa.edu/faculty/farabee/BIOBK/1ord04b.gif
Silurian Period
443 to 417 Million Years Ago

Middle Silurian  425 Ma
Silurian Trilobites

Arctinurus

Bumastus

Dalmanites

Eurypterids (sea scorpions)
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”

Dunkleosteus
Carboniferous Period
354 to 290 Million Years Ago
Late Carboniferous 306 Ma

Carboniferous Crinoids
Carboniferous Corals

Tabulate  

Rugose

Permian Period

290 to 248 Million Years Ago
Permian reef

Late Permian 255 Ma

[Map showing geographical locations and geological features]
FIGURE 2

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)