Paleozoic Time Scale and Sea-Level History chart

Main sources of stratigraphic columns

The columns are a selected subset of the extensive internal data suite within *TimeScale Creator* (versions 1.3.5 through 1.4). The majority of these columns are also diagrammed in *The Concise Geologic Time Scale* (Ogg, Ogg, Gradstein, 2008) [***Concise GTS08***].

Numerical ages of biostratigraphic datums are consistent with *Geologic Time Scale 2004* (Gradstein, Ogg, Smith, 2004) [***GTS04***], with the exception of some adjusted scalings within the Cambrian and Carboniferous (see *The Concise Geologic Time Scale* for details). Ages of chronostratigraphic stages and sequences are mainly derived from those biostratigraphic datum assignments.

(1) Chronostratigraphy

Nomenclature is according to the International Commission on Stratigraphy (www.stratigraphy.org) as summarized in *The Concise Geologic Time Scale* (2008).

(2) Geomagnetic Polarity

Late Permian = Steiner (2006)
Early Permian-Devonian = modified slightly from compilations in *GTS04*.
Ordovician-Late Cambrian = Pavlov and Gallet, 2005.
Middle and Early Cambrian = Kirschvink and Rozanov, 1984; Kirschvink, 1978.

(3) Paleozoic Sequences

(a) Haq and Schutter (2008, Science, v.322, p.64-68).

NOTE: The names for sequences in Haq and Schutter (2008) are according to their numerical ages (e.g., "***SB 284.4***") as derived from the biostratigraphic ages in *TimeScale Creator*, v. 1.3.5; or *The Concise Geologic Time Scale*. I (Jim Ogg) have attached a nomenclature derived from their relationship to international stages (e.g., Sequence ***Art-1*** for the first sequence in the Artinskian), following the nomenclature system of the Mesozoic-Cenozoic charts by Hardenbol et al (*SEPM Spec. Publ.* **60**, 1998). The "intermediate-term" sea-level curve is an averaged sea-level derived from the estimated magnitudes of sea-level oscillations and the envelope of the maximum highstands (the long-term sea-level curve) as given by Haq and Schutter.

(b) Other Studies column

This is a compilation of other published sea-level curves that are commonly used or cited for different intervals, or some recent syntheses (e.g., by Bruce Wardlaw and Phil Heckel). The Permian-Devonian T-R Cycles column highlights the major sequence boundaries and highstands within each stage according to those authors.

Permian = Ross-Ross (1995)
lowermost Permian = Bruce Wardlaw (unpubl., written commun. to J. Ogg, June, 2006)
Upper Carboniferous = Heckel, 2006; Heckel et al., 2007, 2008; and Heckel in *Concise GTS08*. The high-resolution, ~100 kyr, oscillations are not shown.
Lower-Middle Carboniferous = Ross-Ross (1987, 1988)
Devonian = Johnson et al. (1985)
Silurian sea-level and intervals = Johnson, 2006
Ordovician sea-level curve and events = Nielsen, 2004

(4) Ammonoid Zonation

Permian = Henderson, 2005
Carboniferous = "standard scale" of Koren' et al. (2006)
Devonian = Becker and House (2000)

(5) Conodont Zonation

Permian = Mei and Henderson (2001), updated by Henderson, 2005.
Carboniferous = "standard scale" of Koren' et al. (2006), modified by Heckel (in *Concise GTS08*)
Devonian = House and Gradstein (*GTS04*)
Silurian = Melchin et al. (*GTS04*), with modifications by Johnson (2006)
Ordovician (North Atlantic) = Figure 2.2 in Webby et al. (2004)

(6) Benthic Foraminifer and Fusulinid Zonation

Permian = Davydov in Wardlaw et al. (*GTS04*)
Carboniferous = "standard scale" of Koren' et al. (2006)

(7) Graptolite Zonation

Silurian-E. Devonian = Melchin et al. (*GTS04*)
Ordovician = Australian zones, as scaled by Cooper and Sadler (*GTS04*)

(8) Trilobite zones and early Cambrian zones = Peng and Babcock (*Concise GTS08*)

Left column = South China
Middle column = Australia
Right column = Siberia

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NOTE: Items cited as "GTS04" refer to authored chapters in Gradstein et al., 2004.

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