

Geology

The Decade of North American Geology 1983 Geologic Time Scale

Allison R. Palmer

Geology 1983;11;503-504

doi: 10.1130/0091-7613(1983)11<503:TDONAG>2.0.CO;2

Email alerting services click www.gsapubs.org/cgi/alerts to receive free e-mail alerts when new articles cite this article

Subscribe click www.gsapubs.org/subscriptions/ to subscribe to *Geology*

Permission request click <http://www.geosociety.org/pubs/copyrt.htm#gsa> to contact GSA

Copyright not claimed on content prepared wholly by U.S. government employees within scope of their employment. Individual scientists are hereby granted permission, without fees or further requests to GSA, to use a single figure, a single table, and/or a brief paragraph of text in subsequent works and to make unlimited copies of items in GSA's journals for noncommercial use in classrooms to further education and science. This file may not be posted to any Web site, but authors may post the abstracts only of their articles on their own or their organization's Web site providing the posting includes a reference to the article's full citation. GSA provides this and other forums for the presentation of diverse opinions and positions by scientists worldwide, regardless of their race, citizenship, gender, religion, or political viewpoint. Opinions presented in this publication do not reflect official positions of the Society.

Notes

The Decade of North American Geology 1983 Geologic Time Scale

Compiled by

Allison R. Palmer

Centennial Science Program Coordinator

Geological Society of America, P.O. Box 9140, Boulder, Colorado 80301

Preparation of the 27 synthesis volumes of *The Geology of North America* for the Decade of North American Geology (DNAG) is now in progress. In order to encourage uniformity among DNAG authors in the citation of numerical ages for chronostratigraphic units of the geologic time scale, an ad hoc Time Scale Advisory Committee was established by the DNAG Steering Committee in 1982. This advisory committee, consisting of Z. E. Peterman (Chairman) and J. E. Harrison, U.S. Geological Survey; R. L. Armstrong, University of British Columbia; and W. A. Berggren, Woods Hole Oceanographic Institution, was asked to evaluate numerical dating schemes that were either recently published or in press and to provide recommendations for the best numbers to use in preparation of a DNAG time scale. The chart on the opposite side of this page was developed from the recommendations of the Time Scale Advisory Committee.

Geochronometric ages (Ma, Ga) assigned to chronostratigraphic boundaries are subject to several uncertainties in addition to those introduced by the numerical dating methods themselves; boundary stratotypes for many units are not yet chosen, so disagreement exists about exact biostratigraphic placement and correlation of a boundary; and many materials that can be numerically dated are not known in good context with biostratigraphic data, so extrapolation to a chronostratigraphic boundary is commonly required. Furthermore, with respect to the late Mesozoic and the Cenozoic, differing numerical age calibrations of the magnetic polarity-reversal scale based on differing choices of scattered isotopically dated tie points, differing interpretations of the positions of biostratigraphic boundaries with respect to the polarity-reversal scale, and uncertainties in the meaning of isotopic ages derived from glauconites lead to disagreement about ages assigned to some chronostratigraphic boundaries.

With these caveats, the numerical ages given in this chart represent interpretations acceptable to the DNAG Time Scale Advisory Committee. The uncertainty bars for Paleozoic and Mesozoic ages are from data in Harland and others (1982). Uncertainty bars for the Cenozoic are not available.

Sources for the numerical ages and for the chronostratigraphic nomenclature are given below.

CENOZOIC

Berggren, W. A., Kent, D. V., and Van Couvering, J. A., 1984, Neogene geochronology and chronostratigraphy; *in* Geochronology and the geologic record: Geological Society of London (in press).

Berggren, W. A., Kent, D. V., and Flynn, J. J., 1984, Paleogene geochronology and chronostratigraphy, *in* Geochronology and the geologic record: Geological Society of London (in press).

MESOZOIC

Base of Campanian to end of Cretaceous

Berggren, W. A., Kent, D. V., and Flynn, J. J., 1984, Appendix, *in* Geochronology and the geologic record: Geological Society of London (in press).

Base of Aptian to base of Santonian

Harland, W. B., Cox, A. V., Llewellyn, P. G., Picton, C.A.G., Smith, A. G., and Walters, R., 1982, A geological time scale: Cambridge, Cambridge University Press, 128 p.

Base of Hettangian to base of Barremian (dating and chronostratigraphic correlation of the "M" series)

Kent, D. V., and Gradstein, F. M., 1984, A Jurassic to Recent chronology, *in* Tucholke, B. E., and Vogt, P. R., eds., The Western Atlantic region, Volume M of The geology of North America: Boulder, Colorado, Geological Society of America (in press).

Note: Rhaetian has been eliminated from the Late Triassic chronostratigraphic scale following Tozer, E. T., 1979, Latest Triassic ammonoid faunas and biochronology, western Canada: Geological Survey of Canada Paper 79-1B, p. 127-135.

Base of Ladinian to base of Norian

Armstrong, R. L., 1982, Late Triassic-Early Jurassic time scale calibration in British Columbia, Canada, *in* Odin, G. S., ed., Numerical dating in stratigraphy: New York, John Wiley & Sons, p. 509-513.

Base of Scythian to base of Anisian

Webb, J. A., 1982, Triassic radiometric dates from eastern Australia: *in* Odin, G. S., ed., Numerical dating in stratigraphy: New York, John Wiley & Sons, p. 515-521.

PALEOZOIC

All numerical ages except those for the upper and lower boundaries of the Paleozoic are derived from Harland and others (see above, 1982, p. 52-55). Late Carboniferous numbers are for continentally based ages (N = "Namurian"; W = Westphalian; S = Stephanian). The marine-based ages are from Harland and others (1982, Fig. 5.6). The earlier estimate for the base of the Cambrian at 570 Ma is retained.

PRECAMBRIAN

Harrison, J. E., and Peterman, Z. E., 1982, North American Commission on Stratigraphic Nomenclature, Report 9, Adoption of geochronometric units for divisions of Precambrian time: American Association of Petroleum Geologists Bulletin, v. 66, p. 801-802.



DNAG

DECADE OF NORTH AMERICAN GEOLOGY 1983 GEOLOGIC TIME SCALE



GEOLOGICAL SOCIETY OF AMERICA

CENOZOIC					MESOZOIC					PALEOZOIC					PRECAMBRIAN												
AGE (Ma)	MAGNETIC POLARITY	PERIOD	EPOCH	AGE	PICKS (Ma)	AGE (Ma)	MAGNETIC POLARITY	PERIOD	EPOCH	AGE	PICKS (Ma)	UNCERT. (m.y.)	AGE (Ma)	PERIOD	EPOCH	AGE	PICKS (Ma)	UNCERT. (m.y.)	AGE (Ma)	EON	ERA	BDY. AGES (Ma)					
0.01	C1	QUATERNARY	HOLOCENE	CALABRIAN	0.01	66.4	C33	CRETACEOUS	LATE	MAASTRICHTIAN	66.4		245	PERMIAN	LATE	TATARIAN	245	20	750	PROTEROZOIC	LATE	570					
1.6	C2	PLIOCENE	PLEISTOCENE	PIACENZIAN	1.6	74.5	C32		JURASSIC	NEOCOMIAN	LATE	74.5	4		EARLY	KAZANIAN	KAZANIAN	253	20			MIDDLE	900				
3.4	C3		ZANCLEAN	3.4	84.0	4.5	LATE					PENNSYLVANIAN	EARLY				SAKMARIAN	ARTINSKIAN	258					24			
5.3	C4		MESSINIAN	5.3	87.5	2.5												LATE	GZELIAN					ASSELIAN	GZELIAN	263	22
6.5	C5		TORTONIAN	6.5	88.5	2.5																			LATE	KASIMOVIAN	MOSCOVIAN
11.2	C6	MIOCENE	SERRAVALLIAN	TORTONIAN	11.2	97.5	2.5					EARLY	BASHKIRIAN	MOSCOWIAN			MOSCOWIAN	286	12								
15.1	C7			LANGHIAN	15.1	113	4								EARLY	SERPUKHOVIAN	VISEAN	VISEAN	288		12						
16.6	C8			BURDIGALIAN	16.6	119	9												EARLY		TOURNAISIAN	FAMMENIAN	FAMMENIAN	296	10		
21.8	C9			AQUITANIAN	21.8	124	9								EARLY	FRASNIAN	FRASNIAN	FRASNIAN						315	20		
23.7	C10	OLIGOCENE	CHATTIAN	AQUITANIAN	23.7	131	8					LATE	GIVETIAN	EIFELIAN					EIFELIAN		320	22					
30.0	C11			RUPELIAN	30.0	138	5	LATE							EMSIA	SIEGENIAN	SIEGENIAN	333		22							
36.6	C12			PRIABONIAN	36.6	144	5		LATE	GEDINNIAN	GEDINNIAN	GEDINNIAN	352	8													
40.0	C13			BARTONIAN	40.0	152	12	MIDDLE					PRIDOLIAN	LUDLOVIAN	LUDLOVIAN	360	10										
43.6	C14	EOCENE	LUTETIAN	BARTONIAN	43.6	156	6		MIDDLE	WENLOCKIAN	LLANDOVERIAN	LLANDOVERIAN				367	12										
45	C15			LUTETIAN	LUTETIAN	156	15	EARLY					ASHGILLIAN	CARADOCIAN	CARADOCIAN	374	18										
52.0	C16					YPRESIAN	52.0		163	15	EARLY	LLANDEILAN				LLANVIRNIAN	LLANVIRNIAN	377	18								
57.8	C17			PALEOCENE	THANETIAN	YPRESIAN	57.8	169	34	EARLY			ARENIGIAN	TREMADOCIAN	TREMADOCIAN			380	18								
60.6	C18	THANETIAN	THANETIAN			176	34	EARLY	TREMADOCIAN		TREMADOCIAN	TREMADOCIAN				387	28										
63.6	C19					UNNAMED	UNNAMED			176			34	EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN	387	28								
66.4	C20	DANIAN	66.4					183	34	EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN					394	22								
	C21			187	34	EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN					401	18												
	C22			187	34					EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN	408	12												
	C23			193	28	EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN					408	16												
	C24			198	32					EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN	414	12												
	C25			204	18	EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN					421	12												
	C26			208	18					EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN	428	8												
	C27			225	8	EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN					438	12												
	C28			230	22					EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN	448	12												
	C29			235	10	EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN					458	16												
	C30			240	22					EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN	468	16												
	C31			245	20	EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN					478	16												
	C32			250	10					EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN	488	20												
	C33			255	10	EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN					498	20												
	C34			260	10					EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN	505	32												
	C35			265	10	EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN					523	36												
	C36			270	10					EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN	540	28												
	C37			275	10	EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN					540	28												
	C38			280	10					EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN	540	28												
	C39			285	10	EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN					540	28												
	C40			290	10					EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN	540	28												
	C41			295	10	EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN					540	28												
	C42			300	10					EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN	540	28												
	C43			305	10	EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN					540	28												
	C44			310	10					EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN	540	28												
	C45			315	10	EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN					540	28												
	C46			320	10					EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN	540	28												
	C47			325	10	EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN					540	28												
	C48			330	10					EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN	540	28												
	C49			335	10	EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN					540	28												
	C50			340	10					EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN	540	28												
	C51			345	10	EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN					540	28												
	C52			350	10					EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN	540	28												
	C53			355	10	EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN					540	28												
	C54			360	10					EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN	540	28												
	C55			365	10	EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN					540	28												
	C56			370	10					EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN	540	28												
	C57			375	10	EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN					540	28												
	C58			380	10					EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN	540	28												
	C59			385	10	EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN					540	28												
	C60			390	10					EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN	540	28												
	C61			395	10	EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN					540	28												
	C62			400	10					EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN	540	28												
	C63			405	10	EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN					540	28												
	C64			410	10					EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN	540	28												
	C65			415	10	EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN					540	28												
	C66			420	10					EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN	540	28												
	C67			425	10	EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN					540	28												
	C68			430	10					EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN	540	28												
	C69			435	10	EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN					540	28												
	C70			440	10					EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN	540	28												
	C71			445	10	EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN					540	28												
	C72			450	10					EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN	540	28												
	C73			455	10	EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN					540	28												
	C74			460	10					EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN	540	28												
	C75			465	10	EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN					540	28												
	C76			470	10					EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN	540	28												
	C77			475	10	EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN					540	28												
	C78			480	10					EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN	540	28												
	C79			485	10	EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN					540	28												
	C80			490	10					EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN	540	28												
	C81			495	10	EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN					540	28												
	C82			500	10					EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN	540	28												
	C83			505	10	EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN					540	28												
	C84			510	10					EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN	540	28												
	C85			515	10	EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN					540	28												
	C86			520	10					EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN	540	28												
	C87			525	10	EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN					540	28												
	C88			530	10					EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN	540	28												
	C89			535	10	EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN					540	28												
	C90			540	10					EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN	540	28												
	C91			545	10	EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN					540	28												
	C92			550	10					EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN	540	28												
	C93			555	10	EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN					540	28												
	C94			560	10					EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN	540	28												
	C95			565	10	EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN					540	28												
	C96			570	10					EARLY	TREMADOCIAN	TREMADOCIAN	TREMADOCIAN	540	28												
	C97			575																							