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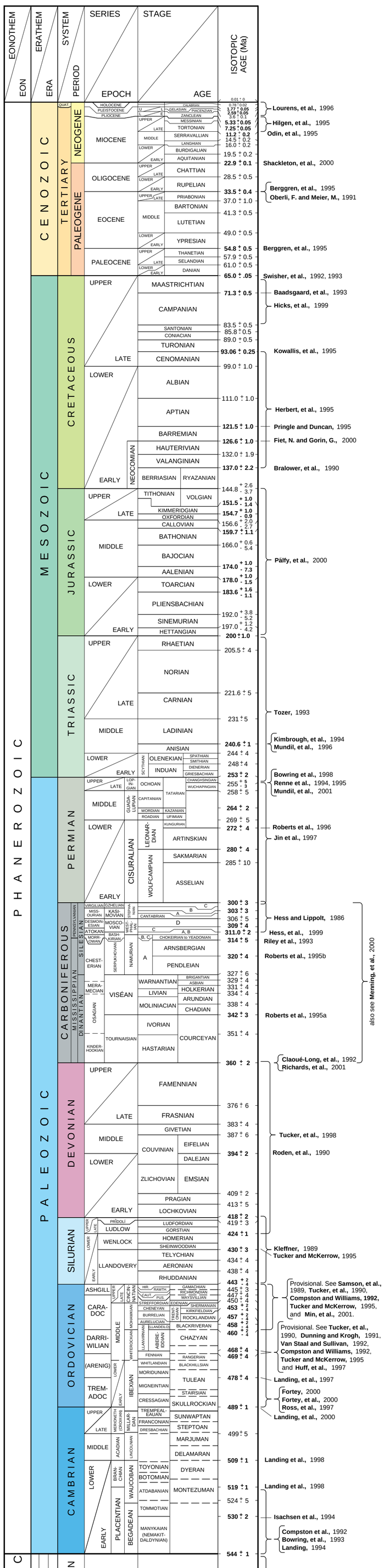

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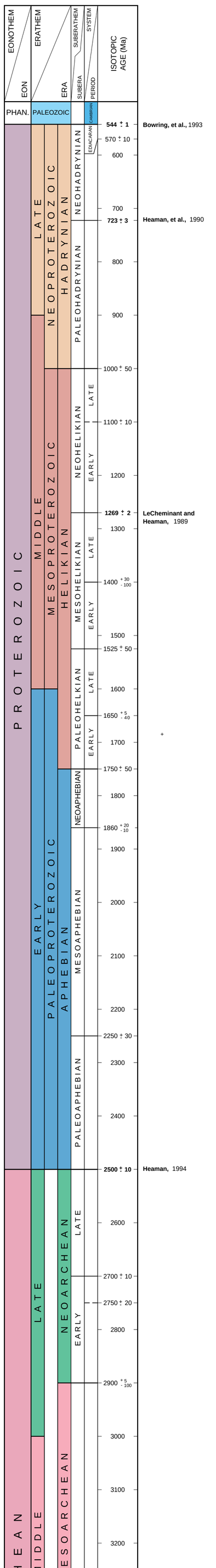

REMARKS

The integration of stratigraphic, paleontologic and radiometric data has traditionally required various statistical treatments because of imprecise isotopic dating techniques, unstable mineral and isotope systems, poorly defined relationships among isotopically dated units and fossiliferous strata, and insufficient numbers of dates. Lord Rutherford remarked that "If your experiment requires statistics, you should have done a better experiment." Better experiments have been and continue to be done and provide a growing body of data that permit frequent refinement of the geological time scale.

These charts are intended for use in compilations of bedrock geology at 1:1 000 000 scale for the Geological Atlas of Canada and as the temporal standard for the National Bedrock Geology Database, and will be revised regularly as new data become available. The charts incorporate dates derived primarily from stable isotopic systems in minerals extracted from strata with closely constrained paleontological ages. These tie points are in bold font and are directly referenced. Other dates are derived by interpolation and statistical analyses in compilations by Berggren et al. (1995), Gradstein et al. (1995) and Gradstein and Ogg (1996). More recently obtained tie points were used to proportionally adjust intervening ages. Unwarranted assumptions about uniform rates of sedimentation or seafloor spreading, or uniform durations of fossil zones were avoided wherever possible.

The Precambrian time scale is derived from the International Subcommision's definition of the Archean-Proterozoic boundary and three definitions of eras shown in columns from left to right by Palmer (1983), Plumb (1991) and Okulitch (1987), respectively. In the ten years since their publication, the formally approved chronometric subdivisions and nomenclature of the Proterozoic (Plumb, 1991) have been widely ignored and are therefore not included; subera and period definitions are from Okulitch (1987). Modifications to that scale have begun using criteria proposed by Douglas (1980) and Okulitch (1987), namely large mafic dyke swarms which are precisely dated, temporally restricted and spatially widespread.

Assignment of uncertainties to the boundary ages has not been done consistently largely because the accuracy of the available data decreases with increasing age. For the Neogene, cross-correlation among $^{40}Ar/^{39}Ar$ geochronology, astrochronometric analysis of stratigraphic sequences, magnetochronology and biochronology reduces uncertainties to the duration of orbital cycles and radio-isotopic precision (0.1 my or less) (cf. Berggren et al., 1995).

For the Paleogene, although the base and top are well constrained, two tie points have larger uncertainties because dated strata are not coincident with series boundaries, hence they and interpolated stage boundaries are assigned conservative uncertainties of 0.5 my.

The statistical treatment of Gradstein et al. (1995) is accepted for the Cretaceous, and that of Pláfy (1997) for the Jurassic. Uncertainties for tie points bounding and within the Triassic are taken from published data. Intervening stage boundary ages have been proportionally adjusted from those given by Gradstein et al. (1995) and retain the large (ca. 4 my) values they determined.

For the Paleozoic, except for a few tightly constrained boundaries, tie point uncertainties are a combination of laboratory error associated with dated strata and estimates of the time span between these and nearby boundaries. Those spans are usually based on estimates of sedimentation rates or fossil zone durations and are therefore large.

For the Precambrian, uncertainties should only be considered crude estimates based on the chronolithologic relationships described by Okulitch (1987). The two boundary ages defined by large mafic dyke swarms are laboratory errors from published data.

The dual (time/rock) nature of the Phanerozoic scale reflects tradtional usage and the melding of the concept of superposition of strata with that of isotopic ages of strata, intrusive or metamorphic bodies of rock. As precise dating of both intrusive and stratified rocks advances, emphasis may shift to a united temporal nomenclature and systems, series and stages will pass out of use except for historical reference.

The inclusion of some obsolete nomenclature is mandated by the need to provide cross-reference to terms in former use in the literature utilized in compilations of maps and correlation charts for the Geological Atlas, and for information in the National Bedrock Geology Database. A few units under review and likely to be altered or eliminated from international standards are in brackets (e.g. Arenig).

The colour scheme of the chart reflects the general standards for rock unit colours of the Atlas. The time scales are linear: 1 mm:1 my for the Phanerozoic, 1 mm:5 my for the Precambrian, to better illustrate temporal relationships and duration of events.

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