

Geologic Time Scale 2020, with special reference to the Cretaceous Period

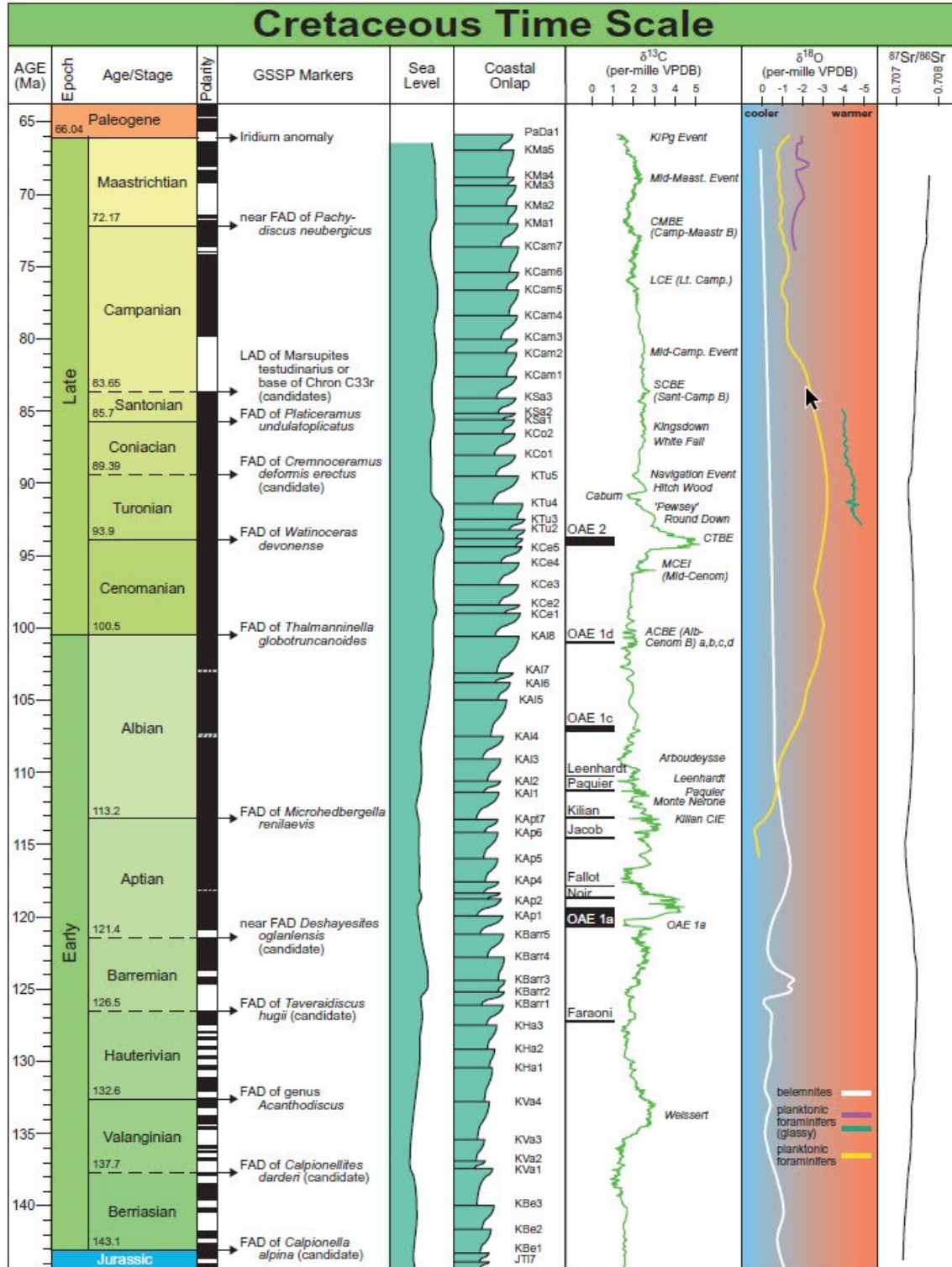
F.M. Gradstein, Oslo, Norway

The time scale method used in Geologic Time Scale 2020 (GTS2020) to calculate zonal and stage boundary ages for the majority of Phanerozoic periods and stages and other relevant chronostratigraphic levels is based on cubic spline curve fitting (see Agterberg et al., 2020). Standardized radiogenic isotope ages (over 330 ones, as listed in GTS2020) are plotted on the y-axis, against relative stratigraphical position (x-axis). The x-axis scale for the Cretaceous (Gale et al., 2020) with over 30 detailed and precise radiometric ages, also uses several floating scale segments with 405 kyr Milankowitch cyclicity and the relevant marine magnetic anomaly scale in km spacing. The reliability of the Cretaceous linear scale is augmented by the precise and accurate linear age of the base Cenozoic spline anchor level, the good linear age date for base Cenomanian, and good proxy ages for base Turonian, base Aptian and base Hauterivian. No spline curve smoothing was necessary, since the best fit is a straight line, indicating a good stratigraphic interpolation model. Error bars (2 sigma) are plotted for all ages using error boxes and crosses. The uncertainty thus generated provides a check on how well the original data accord with the best-fitting spline curve. On average about 5% of the crosses do not intersect the curve. The timescale thus developed with this mathematical model, in use for GTS2004, GTS2012 and now for GTS2020, effectively takes the mean or near mean values of numerous radiometric dates, orbital ages and their error bars. In the near absence of precise radiometric dates that are exactly on the ratified stage boundary, the objective method used in GTS2020 is more reliable than subjective interpolation of limited local data in the neighbourhood of stage boundaries, or methods like Bchron that emphasize radiogenic isotope ages to the detriment of cyclo-and composite standard stratigraphic scaling.

References:

F.P. Agterberg, A-C. Da Silva and F.M. Gradstein. Geomathematical and Statistical Procedures. In: F.M. Gradstein et al., 2020, p. 402-425. Elsevier publ. Co., Amsterdam, NL.

A.S. Gale, J. Mutterlose and S. Batenburg, The Cretaceous Period. In: F.M. Gradstein et al. Geologic Time Scale 2020, p. 1023-1087. Elsevier Publ. Co, Amsterdam, NL.



The Cretaceous Geologic Time Scale. Gale et al., 2020. In: F.M.Gradstein et al. Geologic Time Scale 2020, p. 1023-1087. Elsevier Publ. Co, Amsterdam, NL.

