

LETTER TO THE EDITOR

Thank you again for another outstanding issue of GeoArabia (vol. 11, no. 1, 2006). There is absolutely no doubt that GeoArabia is the best stratigraphic journal in the world. This is for the simple reason that the geoscience described in this journal directly uses and directly refers to *Stratigraphy* in all its aspects and in a very comprehensive manner. The published papers are outstanding and serve the upstream industry, as well as scientific research and educational institutions.

The International Commission on Stratigraphy (ICS) is presently working on improving the highly popular program Time Scale Creator (TS-Creator[®]) that can be downloaded freely from the ICS website. This data base is coordinated by Jim Ogg and the program was developed by Adam Lugowski. It provides large bio-, magneto-, chemo- and chrono-sequence stratigraphic charts for specific basins and specific time intervals.

The ICS would like to extend this work to the Middle East basins by working closely with geoscientists from your region. In this regard we thank GeoArabia for explaining the studies conducted by the ICS to the Middle East geoscience community by publishing the feature on the ICS (vol. 11, no. 1, p. 159–160) and the following article. We look forward to hearing back from interested Middle East stratigraphers.

Felix Gradstein
Chair, International Commission on Stratigraphy

TS-Creator[®] - Chronostratigraphic data base and visualisation: Cenozoic-Mesozoic-Paleozoic integrated stratigraphy and user- generated time scale graphics and charts

Felix Gradstein and James Ogg

Summary

The International Commission on Stratigraphy (ICS) has produced an electronic version of the international standard Cenozoic-Mesozoic-Paleozoic bio-magneto-sequence, time-scale charts. This JAVA package, called TS-Creator[®], can be freely downloaded from the ICS website (www.stratigraphy.org).

Background

The calibration of the geologic time scale to numerical ages is an essential tool for Earth Science. There has been a progressive improvement of both the inter-calibrations of types of paleontology, sea-level oscillations and other events of Earth history, and of the assignment of numerical ages from radiometric dating and orbital-cycles tuning (= Milankovitch-type climate oscillations reflected in sediments).

In 1998, a team of specialists led by Jan Hardenbol (Exxon) published a detailed set of large-format charts summarizing the Mesozoic-Cenozoic correlations and ages of biostratigraphic (dozens of types), sequence stratigraphic, geomagnetic and other events through the Mesozoic and Cenozoic eras of the past 250 million years (Graciansky et al., 1998). These charts were scaled to the numerical age scales of 1995 (SEPM Spec. Vol. 54). Now these charts are being updated and re-calibrated to Geologic Time Scale 2004 (GTS2004).

The time-scale summary charts posted on the ICS website (www.stratigraphy.org) had attracted much attention and usage. These included the international divisions of geological time, and selected

time-scale charts from Gradstein, Ogg et al. (2004), referred to as GTS 2004 (Geologic Time Scale 2004). In 2005, the ICS undertook the conversion and enhancement of the extensive Hardenbol et al. charts, plus inclusion of Paleozoic stratigraphic data. The project was sponsored by the U.S. National Science Foundation, BP, Chevron, ExxonMobil and Shell.

Present Stratigraphic Products

Paleozoic, Mesozoic and Cenozoic Sequence Charts under development by the International Commission on Stratigraphy (ICS) include:

(1) Tables of Cambrian through Holocene stratigraphic events calibrated to Geologic Time Scale 2004 (GTS2004) ages. There are nearly 10,000 biostratigraphic, sea-level, and magnetic zones and datums, plus a suite of geochemical curves. Documentation of zonal definitions, relative age assignments, and how these events were recalibrated to the 2004 time scale was also compiled. This included updating cross-correlations and enhancing detail for selected stratigraphic methods (e.g., trilobites, conodonts, graptolites, ammonoids, fusulinids, chitinozoans, megaspores, nannofossils, foraminifera, dinoflagellates, radiolarians, diatoms, strontium-isotope and C-org curves, etc.).

Paleozoic sea-level sequences included the global compilation prepared for the *GeoArabia* journal's Cambrian-Triassic Arabian Platform Cycle Charts of Sharland et al. (2004), and Haq and Al-Qahtani (2005). Numerical ages are calculated within the database using the calibrations; therefore, all ages can be automatically recomputed when control ages are improved in future time scales. Regional scales of selected areas (e.g., Russia, China, North America) are also included.

(2) Charts that display all of these events recalibrated to the GTS 2004 scale (Figure 1). These are in a similar format (but in color) as the original Hardenbol chart series (Graciansky et al., 1998).

(3) The recalibrated ages of Paleozoic, Mesozoic and Cenozoic events are compiled as a database for digital input to other databases and look-up tables. This enabled the powerful TS-Creator® display package (Figures 2 and 3).

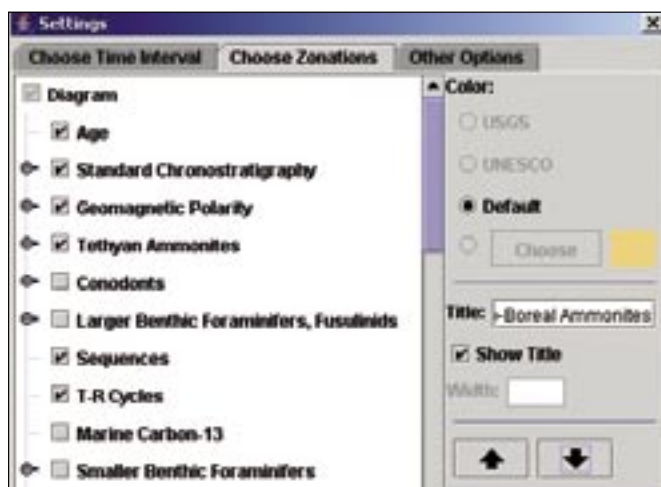


Figure 2: Time-Scale Creator (TS-Creator) lets users create any portion of the geological time scale with choice of bio-magneto-chemo and other events in Earth History, including sequence stratigraphic patterns, regional stages, etc. All data are strictly peer-reviewed by the International Commission on Stratigraphy (ICS). The program can be downloaded under www.stratigraphy.org. Charts generated are in SVG format and automatic input in standard drafting software.

Figure 3: Setting screens for Time-Scale Creator in which the user selects the desired time interval, and picks zonations and datums (only a small subset of the approximately 50 columns are shown here).



The TS-Creator[®] Visualization Package

User-Generated Time-Scale Graphics include:

(1) An application (in JAVA programming language) called TS-Creator[®] has been designed that automatically takes the reference database, gets instructions from the user on the stratigraphic interval and stratigraphic information to be displayed, and then generates both on-screen and scalable-vector graphic (SVG) renditions that directly input into Adobe Illustrator and other drafting programs. As explained above, when future enhancements are made to the database of stratigraphic scales or ages, then new graphics can be instantly produced.

(2) Query-capable on-line charts. Click on a value, zone or boundary, and a window opens with an explanation of the calibration, definition and interpolated age. This “hot-linked” chart suite is currently a back-looking reference to information in the source tables, but in the future will also provide links to other tables and text from the Geologic Time Scale 2004 book, images of stage-boundary sections and taxa, and the additional enhancements anticipated during the “Geologic Time Scale 2008” update.

A Geologic Time Scale 2004

Edited by Felix M. Gradstein (Universitetet i Oslo), James G. Ogg (Purdue University, Indiana) and Alan G. Smith (University of Cambridge).

Paperback (ISBN-13: 9780521786737 | ISBN-10: 0521786738); Publisher: Cambridge University Press (CUP) <http://www.cambridge.org/uk/catalogue/catalogue.asp?isbn=0521786738>. Price: £40.00

Quotation from the publisher

An international team of over forty stratigraphic experts has helped to build the most up to date international stratigraphic framework for the Precambrian and Phanerozoic. This successor to A Geologic Time Scale 1989 by W. Brian Harland et al. (CUP 0521 387655) begins with an introduction to the theory and methodology behind the construction of the new time scale. The main part of the book is devoted to the scale itself, systematically presenting the standard subdivisions at all levels using a variety of correlation markers. Extensive use is made of isotope geochronology, geomathematics and orbital tuning to produce a standard geologic scale of unprecedented detail and accuracy with a full error analysis. A wall chart summarizing the whole time scale, with paleogeographic reconstructions throughout the Phanerozoic, is included in the back of the book. The time scale will be an invaluable reference source for academic and professional researchers and students.

Contents

Part I. Introduction: 1. Introduction; 2. Chronostratigraphy - linking time and rock;

Part II. Concepts and Methods: 3. Biostratigraphy; 4. Earth's orbital parameters and cycle stratigraphy; 5. The geomagnetic polarity time scale; 6. Radiogenic isotope geochronology; 7. Stable isotopes; 8. Geomathematics;

Part III. Geologic Periods: 9 and 10. The Precambrian: the Archaen and Proterozoic eons; 11. The Cambrian period; 12. The Ordovician period; 13. The Silurian period; 14. The Devonian period; 15. The Carboniferous period; 16. The Permian period; 17. The Triassic period; 18. The Jurassic period; 19. The Cretaceous Period; 20. The Paleogene period; 21. The Neogene period; 22. The Pleistocene and Holocene epochs;

Part IV. Summary: 23. Construction and summary of the geologic time scale; Appendices; References.

A Geologic Time Scale 2008

A Geologic Time Scale 2008 (GTS2008) is presently in preparation. It will be a full colour, fully updated, improved and expanded version of GTS2004. The book will be online under www.stratigraphy.org as a standard PDF file, plus a sophisticated search and browsing front menu. There are more

chapters than in GTS 2004, including potential chapters on Planetary scale, Cryogenian-Ediacaran Periods scale, Prehistoric scale, Sequence Stratigraphic scale, and more emphasis on stable isotope chemostratigraphy. Use will be made of the most modern insights in error analysis of radiogenic isotope analysis for age dating; orbital tuning will be extended from Neogene downward into Paleogene and Cretaceous. Significant scale updates do not come so much from new age dates but from much progress in ICS with the formal definition of the boundaries of stages and periods in the Phanerozoic. For quick and easy use of GTS 2008 a pocket edition, not unlike an atlas of the Geologic Time Scale is also under planning by ICS.

ACKNOWLEDGEMENTS

Gabi Ogg, James' wife and fellow stratigrapher, was responsible for most of the graphics on the ICS website and the GTS 2004 book. The project was supported by ICS, Chronos, NSF and Purdue University, and sponsored by the U.S. National Science Foundation, BP, Chevron, ExxonMobil and Shell.

REFERENCES

- Gradstein, F.M., J.G. Ogg, A.G. Smith, F.P. Agterberg, W. Bleeker, R.A. Cooper, V. Davydov, P. Gibbard, L. Hinnov, M.R. House (†), L. Lourens, H-P. Luterbacher, J. McArthur, M.J. Melchin, L.J. Robb, J. Shergold, M. Villeneuve, B.R. Wardlaw, J. Ali, H. Brinkhuis, F.J. Hilgen, J. Hooker, R.J. Howarth, A.H. Knoll, J. Laskar, S. Monechi, J. Powell, K.A. Plumb, I. Raffi, U. Röhl, P. Sadler, A. Sanfilippo, B. Schmitz, N.J. Shackleton, G.A. Shields, H. Strauss, J. Van Dam, J. Veizer, Th. van Kolfschoten and D. Wilson 2004. A Geologic Time Scale 2004. Cambridge University Press, 589p.
- Graciansky, P., J. Hardenbol, Th. Jaquin and P.R. Vail 1998. Mesozoic and Cenozoic Sequence Stratigraphy of European Basins. SEPM Special Publication no. 60, 786 p.
- Haq, B.U. and A.M Al-Qahtani 2005. Phanerozoic cycles of sea-level change on the Arabian Platform. *GeoArabia*. v. 10, no. 2, p. 127-160 and 2 charts.
- Hardenbol, J., J. Thierry, M.B. Farley, Th. Jaquin, P.C. Graciansky and P.R. Vail, 1998. Mesozoic and Cenozoic Sequence Chronostratigraphic Framework of European Basins. SEPM Special Publication no. 60, 8 charts.
- Sharland, P., D.M. Casey, R.B. Davies, M.B. Simmons and O.E. Sutcliffe 2004. Arabian Plate Sequence Stratigraphy. *GeoArabia*. v. 9, no. 1, p. 199- 214, and 2 charts.

ABOUT THE AUTHORS



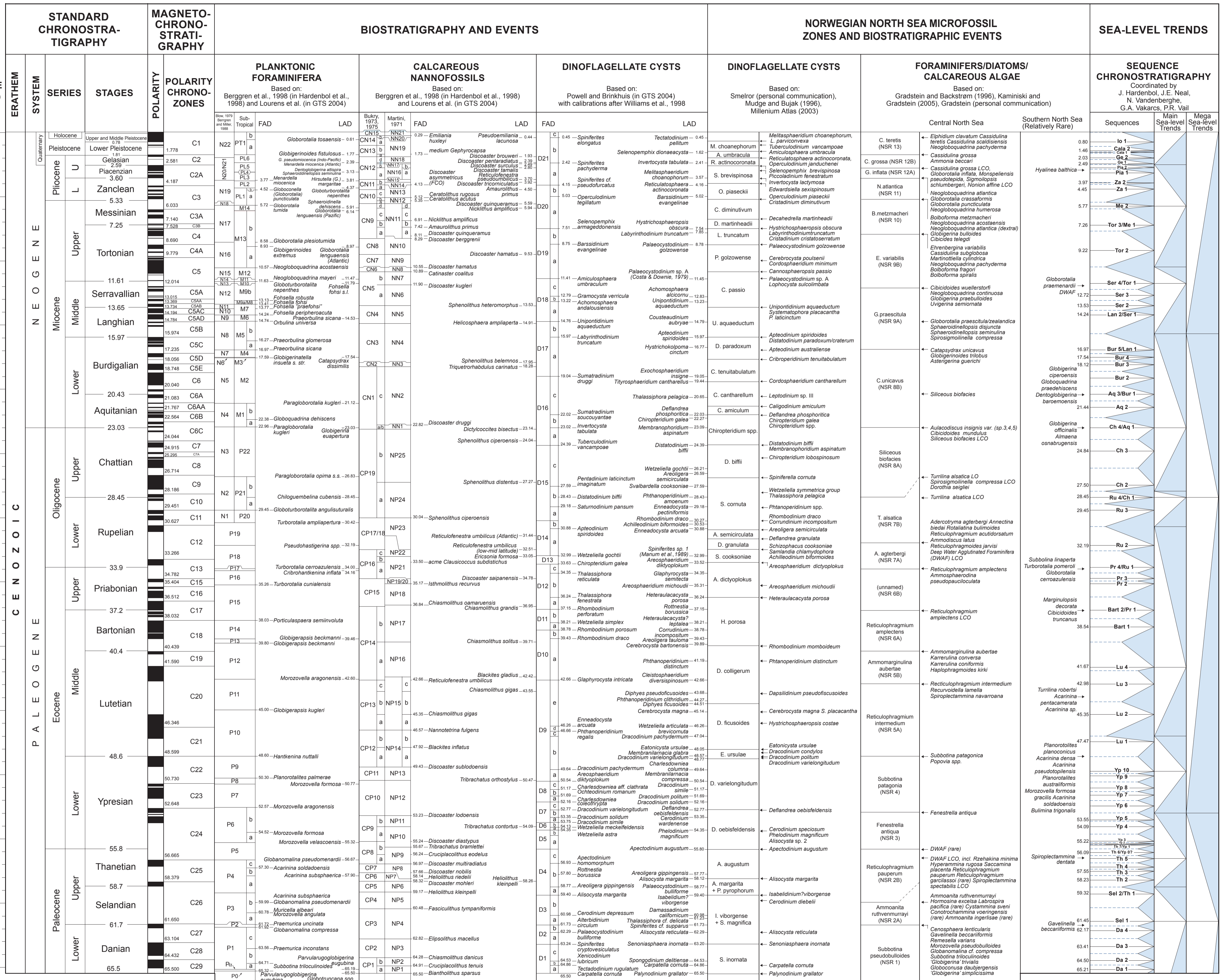
James Ogg (left) and Felix M. Gradstein

Felix M. Gradstein is Chair of the International Commission on the Stratigraphy. Following retirement from the Geological Survey of Canada and Saga Petroleum Norway, he joined the Natural History Museum, University of Oslo as stratigraphy/micropaleontology professor, where he is developing relational stratigraphic databases for offshore Norway. His activities have included quantitative stratigraphy (he chaired previous IGCP and IUGS programs). Ocean Drilling Program legs in the Atlantic and Indian oceans, and coordinating compilation of Mesozoic and Phanerozoic geologic time scales. He is an avid skier and offshore sailor.

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James Ogg is a Professor of Stratigraphy at Purdue University in Indiana USA, and has been serving as Secretary-General of the International Commission on Stratigraphy of IUGS since 2000. His research concentrates on the Mesozoic and Paleogene, especially paleoceanography (including ten DSDP-ODP drilling cruises), time scales of cyclic sedimentation and magnetic polarity chrons, and integrated Earth history.

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Global chart based on updated version by James G. Ogg and Gabi Ogg to: GEOLOGIC TIME SCALE 2004 (F. Gradstein, J. Ogg, A.G. Smith et al.; Cambridge University Press); North Sea microfossil event data compiled by Felix M. Gradstein. Based on: Cenozoic Biostratigraphy: Jan Hardenbol, Jacques Thierry, Martin B. Farley, Thierry Jacquin, Pierre-charles De Graciansky and Peter R. Vail, 1998. Mesozoic and Cenozoic Sequence Stratigraphic Framework of European Basins in: Pierre-charles De Graciansky, Jan Hardenbol, Thierry Jacquin, Peter R. Vail and Martin B. Farley, Eds.; Mesozoic and Cenozoic Sequence Stratigraphy of European Basins, SEPM Special Publication 60.