



International Commission on Stratigraphy Subcommission for STRATIGRAPHIC INFORMATION

ANNUAL REPORT 2008

TITLE OF CONSTITUENT BODY

ICS Subcommission for Stratigraphic Information

[formerly called “*Stratigraphic Information System (SIS)*” subcommission]

Submitted by James Ogg, chair

1. OVERALL OBJECTIVES, AND FIT WITHIN IUGS SCIENCE POLICY

Mission Statement

The Subcommission for Stratigraphic Information aims to promote and coordinate the gathering of selected stratigraphic information worldwide and to organize logically its presentation through the ICS website. The Subcommission first priority is to enable the world geoscience community to have quick and free access to a vast amount of stratigraphic information, thus helping to spread the knowledge and foster the advancement of the science globally.

Goals

The Subcommission was established in 2000, and assigned an extensive set of goals (Appendix). A streamlined version was adopted in 2003, with a simplified task set (diagrammed in Appendix)

SIS goal is to gather selected stratigraphic information (such as databases, compilation of biozonal schemes, regional time scales, stratigraphic standards, and geohistory teaching modules) and develop a method of classification to organize, logically, the databases and related links, and make easy search and use of the contents through its website to the world scientific community. The Subcommission primarily aims to promote scientific cooperation and the advancement of the science worldwide, and to maintain the leading role of ICS in the stratigraphic information network. The four-fold set of tasks are:

- (1) Geologic time scale information (from posters and cards to multi-author compilations)
- (2) Stratigraphic database center and links (with visualizations; links to lexicons, etc.)
- (3) Stratigraphic standards (GSSP information, stratigraphic code in different languages)
- (4) Geohistory education and links

2. Organization

Officers

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Regional Vice-Chairs	James S. Crampton (<i>Asia-S.Hemis.</i>) and Simone Galeotti (<i>Europe</i>)	Institute of Geological and Nuclear Sciences, Gracefield Research Centre, 69 Gracefield Road, Lower Hutt, New Zealand; <u>and</u> Istituto di Geologia, Università degli Studi di Urbino, Campus Scientifico, Località Crocicchia, 61029 Urbino, Italy	Email: j.crampton@gns.cri.nz <u>and</u> s.galeotti@uniurb.it
Secretary; Webmaster	Gabi Ogg	<i>Same mailing address as Jim Ogg</i>	Tel: 1-765-743-0400; E-mail: gabiogg@hotmail.com
Assistant webmaster	Sorin Filipescu	Professor, Department of Geology, Babes-Bolyai University, Str. Kogalniceanu 1, 3400, Cluj-Napoca, Romania	E-mail: sorin@bioge.ubbcluj.ro

Qualifications of new officers:

James Ogg was Secretary-General of ICS (2000-2008), co-editor of *Geologic Time Scale 2004*, developer of ICS's TimeScale Creator databases and visualization system, and lead author for *Concise Geologic Time Scale* (2008).

James Crampton was a coordinator for the New Zealand Geological Time Scale program, and specializes in Mesozoic stratigraphy, and helped with the previous Stratigraphic Information subcommission.

Simone Galeotti works on global aspects of Cenozoic environmental change, and helped with the previous Stratigraphic Information subcommission.

Gabi Ogg, a micropaleontologist, was illustrator for *Geologic Time Scale 2004* and for the *Concise Geologic Time Scale* (2008). She has done all the graphics and GSSP-summaries for the ICS website; and the various ICS time-scale charts

The Subcommission had been dormant, without an official membership, from 2003 to 2008. Therefore, a regular subcommission membership will need to be established for the 2009-2012 term and beyond. The Subcommission will be soliciting an initial core membership, who will then propose an extended international and thematic membership until a full voting and corresponding membership is attained. It must be emphasized that this subcommission is task-oriented, and it is expected that the membership will be active in undertaking those tasks.

3. Interfaces with other international projects

(1) **One-Geology** and **One-Geology-Europe** geoinformatics teams. During the IGC of 2008, a dedicated evening planning was undertaken with Simon Cox (coordinator of One-Geology geoinformatics) to provide an RSS-feed of the main ICS standards, especially GSSP definitions and approximate ages, to the One-Geology program. We will be working with One-Geology-Europe

program during summer 2009 to interface our database structure with their preliminary one and the lexicons.

(2) **UNESCO Commission for the Geologic Map of the World (CGMW).** We have worked with CGMW in Paris on standardizing the CMYK and RGB colors for chronostratigraphic units, and co-produced a poster with these colors and GSSPs. The TimeScale Creator database system was demonstrated to the CGMW Council meeting at the IGC in Oslo, and we will be coordinating with CGMW on inter-linking our databases and lexicons to their geological maps.

(3) **National Geological Surveys and Strat Commissions.** As of 2008, we have joint projects (mainly TimeScale Creator datapacks) with – Geoscience Australia, New Zealand geologic survey, British Geologic Survey, Austria Stratigraphy Commission, German Stratigraphy Commission, German Geological Survey (BGS), Norwegian offshore lexicon, Russia (stratigraphic database group coordinated by Tatyana N. Koren', All Russian Geological Institute (VSEGEI), St. Petersburg, Russia). We hope to soon add China (stratigraphic database group coordinated from Nanjing) after we give a formal presentation there in Dec 2008. This list will expand after we complete the first set of demonstration products on regional database-lexicon linkages and visualization.

4. Chief accomplishments and products in 2008

a. Printed Material on Earth's History

We have concentrated on global distribution of free or “at cost” teaching resources for Earth History. Funding for production, printing and distribution of these products have been sponsored by EAS/Purdue, the International Union of Geological Sciences (IUGS, headquartered in Norway), Australian National University, Geoscience Australia, and a consortium of petroleum companies (ExxonMobil, ChevronTexaco, BP, Statoil, Shell, ENI, Conoco). Some are joint products to be distributed by UNESCO (Commission for Geologic Map of the World).

Book, ***Concise Geological Time Scale 2008***, is a comprehensive review of all geological time divisions and the associated absolute (millions of years) time scale. As with the 2004 version, this program involves a large global network of geoscientists contributing their expertise. IUGS reviewed the contents, especially guidance on their preferred way to display the Quaternary in diagrams and text, .

Poster “***History of the Earth***” (geologic time scale, life-through-time, and global reconstructions). This was one of our contributions for the United Nations 2008 “International Year of Planet Earth”. The target audiences are secondary schools. The IYPE reviewed and approved the product.

500 copies were printed/distributed in March-April 2007 through Australian National University (who funded it)

2000 copies were printed/distributed in summer 2007 through Geoscience Australia (who funded it).

3000 were printed/distributed in Nov’07-May’08 through EAS/Purdue (funded by EAS, with partial support from IUGS) – 500 at GSA 2007, 300 at AGU, 300 for Indiana geoscience teachers conference, 500 at GSA 2008, and 1000 intended for national distribution through AGI or NAGT.

Another printing with both English and French versions will be done by IUGS and the UNESCO Commission for the Geologic Map of the World for the United Nations 2008

“International Year of Planet Earth”. We were invited to Paris (March, 2008) to prepare this with the UNESCO commission.

Poster “***A Geologic Time Scale 2008***” (3x2 feet; prepared and printed in coordination with UNESCO Commission for the Geologic Map of the World). The first printing was sold out at the International Geological Congress (Oslo, August, 2008).

Chart “***International Divisions of Geologic Time***” is freely available through the International Commission of Stratigraphy website (www.stratigraphy.org). [During 2006, this was also in Chinese translation in a review journal in that country]. This chart is now included in Encyclopedia Britannica and other reference/textbooks. IUGS provided guidance on their preferred way to display the Quaternary (dual dashed lines).

Chart “***Geologic Time Scale 2004***” (A3-sized). During late 2007, a new printing was sponsored by Idemitsu for distribution during 2008.

Plastic card “***International Geologic Time Scale***”. During 2007 and 2008, new versions were sponsored by Neflex, Chevron, ExxonMobil, ConocoPhillips and ENI. The versions printed by ExxonMobil and Chevron are distributed to their employees and interviewed students.

Mousepad “***International Divisions of Geologic Time***”. We were invited to Paris in March and in June 2008 by the UNESCO Commission for the Geologic Map of the World to produce a new version for the 2008 “International Year of Planet Earth”. The first printing was sold out at the International Geological Congress (Oslo, August, 2008).

Bookmark “***International Geologic Time Scale***”.

b. Databases and Visualization

“***TimeScale Creator***” (Version 4 released in March, 2008 – Free JAVA suite). This is our continuously-expanding “flagship” database-visualization system with hyperlinks to our stratigraphic-information website (www.stratigraphy.org). The major “versions” are a new software package, but database updates/enhancements are mounted approximately every three months.

This free JAVA-based visualization application has a built-in database of approximately 25,000 biologic, magnetic and other major events in Earth’s history (status in Dec’08), plus an extensive set of geochemical and sea-level curves. The user selects the interval of time, chooses the type of data to be displayed, and this windows into Earth’s history appears on the screen, or can be downloaded as an SVG or PDF file for use in popular graphics programs.

Public Version 4 (March 08) included capabilities for lithologic columns, images of paleogeographic maps, range charts, URL-hotlinks, and other requested features. The extension to regional geology has produced joint public products in coordination with Geoscience Australia, New Zealand geologic survey, British Geologic Survey, Austria Stratigraphy Commission, etc.; as summarized next:

c. Regional Lexicon-linked databases and Other datapacks

Australian Geo-History – this is a version of the geological *Time-Scale Creator* that we developed with Geoscience Australia (the Australian geological survey) during 2007-2008. In addition to the standard international suite, this version contains lithologic columns (about 100) of all Australian Phanerozoic basins, with each formation hot-linked into the GA Oracle database. Images of paleogeographic maps (about 50)

provide a column on Australian history. The suite also includes reference wells for all major oil-gas reservoirs. This system is intended to be a model to put the geology of other continents “on-line”.

Phanerozoic Biostratigraphy of Russian Basins. An extensive (7000 entry) Excel table, and formatted/annotated output for *TimeScale Creator* usage. This includes the entire Phanerozoic, with most biostratigraphic groups of all regions of Russia, and is based on a book and charts by T. Koren’ et al (2006).

Lithostratigraphy of Russian Hydrocarbon Basins. Excel table, and formatted/annotated output for TimeScale Creator usage. This includes Siberian, Caspian and other regional reports of the U.S. Geological Survey.

Lithostratigraphy of British Isles. Excel table, and formatted/annotated output for TimeScale Creator usage. This includes the Phanerozoic of all British basins, and has been vetted by the British Geological Survey. All formations are tied to the Lexicon of BGS.

New Zealand Biostratigraphy Database – Excel table, and formatted/annotated output for *TimeScale Creator* usage. This includes the main and all secondary biostratigraphic events and ranges for this region. Palynology events are linked to the NZ-hosted pollen-spore database.

Lithostratigraphy of Svalbard and Norwegian Sea. Excel table, and formatted/annotated output for TimeScale Creator usage. All formations are tied to entries in Norlex.

Lithostratigraphy of Alaskan and other Arctic Hydrocarbon Basins. Excel table, and formatted/annotated output for TimeScale Creator usage. This includes conversions of many regional reports of the U.S. Geological Survey.

Paleozoic Sequence Stratigraphy and Onlap Curve. Excel table, and formatted/annotated output for TimeScale Creator usage. This includes the recent (October 2008) Science paper of Haq and Schutter, plus their on-line supporting documentation tables and charts.

Onlap Curves for Cenozoic and Mesozoic. Excel table, and formatted/annotated output for TimeScale Creator Pro usage. This is based on SEPM 1998 sequence-stratigraphy and eustacy charts; but applying a mathematical model to generate a synthetic onlap curve for margins.

Cenozoic Oxygen Isotope Trends (and high-resolution marine isotope stages). Excel table, and formatted/annotated output for TimeScale Creator usage. This includes digital versions of the compilation by Zachos et al (2008), with conversion and interpolations to GTS2004 time scale, plus labeled “oxygen-isotope episodes”. A detailed Plio-Pleistocene curve includes labels for all marine isotope stages.

Global Impact, Large-Igneous-Province, and Major Volcanic Episode Records. Excel tables, and formatted/annotated output for TimeScale Creator usage, plus icons for impacts and eruptions of varying magnitudes.

d. ICS Website

The ICS web site with a wealth of information is www.stratigraphy.org has a wealth of information. The ICS website was originally part of the Subcommittee on Stratigraphic Information, and has been listed under activities of this subcommittee from 2001 through 2008. The majority of the authoritative free charts and “state-of-the-GSSP” updates and standardized graphics are compiled by Gabi Ogg. We (mainly James and Gabi Ogg). From late 2008 onward,

the subcommission will only be maintaining the stratigraphic information portions (GSSPs and standardized graphics, *TimeScale Creator*, Lexicon linkages, regional summary charts, time-scale graphics, etc.)

5. Chief problems encountered in 2008

During 2008, the activities listed as achievements “of the subcommission” were essentially accomplished by a core group of dedicated researchers and students, who devoted their entire sabbatical and summer time to accomplishing these products. In order to maintain this level of activity, it is essential that more researchers and students, especially in other nations, become actively involved in a coordinated suite of tasks. We think that the benefits of providing a central and organized source of authoritative information and visualization on Earth history and its regional manifestations will provide such volunteers a sense of fulfillment, albeit with low monetary compensation for their devoted time.

6. Summary of expenditures in 2008

TOTAL: **\$3900** [*nearly all for ICS web support and graphics*]

\$1000 – Web support compensation to Dr. Sorin Filipescu (webmaster; 50 hours)

\$ 400 – Adobe Illustrator CS2 for Dr. Sorin Filipescu (webmaster)

\$1000 – Compensation for GSSP graphics and summaries, to Gabi Ogg (100 hours)

\$1500 – To Purdue’s school of engineering to develop ICS’s RSS-feed for One-Geology
(*another \$1500 in matching funds for RSS-feed was provided by James Ogg*)

NOTE: *TimeScale Creator* software development and datapack preparation was mainly funded through US National Science Foundation, donations by and to Purdue University and University of Oslo, and other grants to James Ogg and Felix Gradstein. This supported 4 full-time students during summer, 2008; and 3 half-time students during the rest of the academic year 2007-08; plus \$10,000 paid for programming assistance, and costs of travel to Paris to coordinate with UNESCO Commission for Geologic Map of the World (CGMW) and to Australia to work with Geoscience Australia.

7. Work plan, anticipated results and communications to be achieved in 2009

a. Printed Material on Earth’s History

- School-level educational posters and cards in both printed and Internet form for the final months of INTERNATIONAL YEAR OF PLANET EARTH. Purdue University will fund us to print and mail about 1500 “History of the Earth” posters for high-school classrooms. We will continue to provide updated reference cards for the geologic time scale for all audiences.
- Coordinate a comprehensive “Geologic Time Scale 2010” volume. This will be similar (and even expanded) in scope to GTS2004; but in full color. Most of this will be a summary of bio-mag-sealevel-geochem stratigraphy, which has boomed in the past decade. The revision of Ar-Ar monitor standards imply that all Mesozoic ages need to be shifted older by about 1%, plus the Triassic and other periods have undergone major improvements in cycle/radiometric stratigraphic control. Therefore, a full exposition is warranted. The

publication date of 2010 is based on the one-year lag between initial manuscript/graphics preparation (during all of 2009 by about 30 contributors) and final editing/printing.

- Coordinate a comprehensive summary of all GSSPs. We are providing standardized descriptions and graphics as these are formally published; and a colorful photo-filled booklet would be ideal for reference.

b. Digital Material on Earth's History

- Website: Redesign the stratigraphic-information portion of the ICS website for easier usage and adding more content. Maintain the GSSP documentation/graphics updating. Set up links to relevant stratigraphic lexicons and translated versions of the stratigraphic guide.
[Essentially, strive to accomplish the goals assigned to the Subcommission in this area.]
- Establish an on-line “booklet” for the geological time scale. The publication of time-scale books is fine for quick browsing; but can’t be easily updated. We would like to place the main contents of our “Concise” book onto the ICS website, but enable updating of the critical graphics
- Provide summaries of the correlation of “regional stages” to the international scale. The current “Geowhen” (provided by R. Rohde, at Univ. Calif. Berkeley) is now out-of-date, and we would either revise it or remove it. For now, summary graphics will provide the basic information.
- RMS feed to provide updated GSSP and numerical time-scale and stratigraphic information to national geological surveys. We plan to have a version working in late November, 2008 (contract with Purdue school of Engineering) for testing by the One-Geology geoinformatics team. Official deployment within the ICS website is planned for March, 2009. The current “GSSP table” on the ICS website would be replaced with a real-time graphic using this RSS feed.
- Promote *TimeScale Creator* visualization package for exploring Earth history. Currently, this is very poorly displayed and advertised.
- Place databases on-line to support “hot-link” version of TimeScale Creator, and create an academic “Pro” version with research applications.
- Add more datapacks to TimeScale Creator for public usage. Several of these have been compiled, but need to be reviewed by specialists in the different regions:

Australian Geo-History on-line – this will be developed with Geoscience Australia (the Australian geological survey) during May-June 2009. We are striving to have a web-based version of TimeScale Creator to display all Australian basin stratigraphy, with each formation hot-linked into the GA Oracle database. Images of paleogeographic maps (about 50) are hot-linked into on-line text of Australian history. The suite also includes reference wells for all major oil-gas reservoirs. This system is intended to be a model to put the geology of other continents “on-line”, and we will coordinate the next phase with the new One-Geology program and the UNESCO Commission for the Geologic Map of the World.

Lithostratigraphy of Germany. Excel table, and formatted/annotated output for TimeScale Creator usage. This includes the Phanerozoic of basins and mountain belts, and is based on charts produced by the German stratigraphic commission. The initial data entry was completed in Summer 2008; but review/deployment will occur in conjunction with the German Commission on Stratigraphy in 2009. All formations are linked to the German stratigraphic on-line Lexicon.

Lithostratigraphy of Austria. Excel table, and formatted/annotated output for TimeScale Creator usage. This includes the Phanerozoic of basins and mountain belts, and is based on charts produced by the Austrian stratigraphic commission. The initial data entry was completed in Summer 2008; and we are invited to Vienna for a thorough review before deployment in 2009. Simultaneously, they will complete the on-line Lexicon for inter-linking.

Lithostratigraphy of Europe. Excel table, and formatted/annotated output for TimeScale Creator usage. Having completed British Isles, Norway offshore,

Lithostratigraphy of Russia. Excel table, and formatted/annotated output for TimeScale Creator usage. This project has already been discussed with Tanya Koren, who will coordinate the difficult task of assembling the information as part of state-supported project; and we will provide the digitization/visualization.

Lithostratigraphy of India and Adjacent Regions. Excel table, and formatted/annotated output for TimeScale Creator usage. This includes the Phanerozoic of all onshore and offshore basins and mountain belts of the Indian subcontinent, and is based on charts produced by Rao et al.

Lithostratigraphy of China. Excel table, and formatted/annotated output for TimeScale Creator usage. This project has been discussed with a stratigraphic database team hosted in Nanjing. We have already prepared visualization system for outcrops with PaleoStrat (Univ. Boise), and the China program is making a database consistent with PaleoStrat. However, the goal is not just to display outcrop-based material, but regional “geohistory” columns.

Human Time Scale (Creator) – this is a version of the geological Time-Scale Creator that has records of all major cultures, prehistoric tool “zones”, ice core data and other environmental data. This is for an entirely different audience than normal geoscientists (but potentially more numerous!). The initial compilation was completed in summer 2008, but needs to be reviewed by other archeologists. Therefore, the first version will be released for audience testing in Spring 2009. We plan to develop some “lab modules” around this database (one was already tested in Spring 2008). John Van Couvering will aid in portions of this review; and we will produce associated on-line summaries for the ICS website on Late Pleistocene and early Holocene “Human-stratigraphy”.

Summary set of Phanerozoic time scales with GTS2010 calibrations. A suite of poster-sized figures for each geologic period will be made with major biostratigraphic zonations, sea-level trends, relevant geochemical events, etc. These could be downloaded from the ICS website after *Geologic Time Scale 2010* goes to press. In addition, all the TimeScale Creator datapacks would require updating to the new age scales.

c. Educational Material on Earth’s History

- Work with geoscience educators on creating modules for exploring Earth history, and link to existing ones.
- Create a “educational” version of TimeScale Creator with more graphics, plus material that is mainly aimed at a high-school or early undergraduate level. We will apply for an NSF grant to accomplish this important prototype, testing-feedback and deployment; but ICS/IUGS support and matching funds would be essential.

8. Budget and ICS component for 2009

As in 2008, the Subcommittee is planning a very active program of publications, education outreach and public awareness, web enhancements (indeed, a complete revamping; plus RSS-feeds), regional and thematic databases for research and public usage, and extensive international linking. Accomplishing this involves supporting students for the database preparation, web-related expenses, paying a programmer for visualization software enhancements, etc.

However, unlike in 2008, we can not count on the extensive support from University of Oslo, Purdue University, Cambridge University Press, NSF and Geoscience Australia. Therefore, we are submitting a budget that presumes that nearly three-quarters of our costs will be covered by external donations/grants and internal support; but one-quarter will need ICS/IUGS budgeting:

PROJECTED “ICS-SUPPORTED” EXPENSES (a fraction of the actual total)

Web-design software (<i>Dreamweaver CS4</i>); GSSP graphics (20 @ \$20)	\$ 800
Computer programming (<i>RSS-feed</i> ; <i>TS-Creator</i>) – 25% of this category	\$2000
Printing posters/cards/etc; shipping to conferences; and mailing tubes	\$ 700
Student support for datapacks and modules – 25% of this category	\$1200
TOTAL PROJECTED EXPENSES (ICS portion only)	\$4700

9. Objectives and Work Plan for the Next 4 Years (2009-2012)

Much of this topic was originally laid out in the original Subcommittee mission, as summarized in the Appendix.

The main aspects that we are adding are:

(1) Comprehensive book (GTS2010) and website that summarizes all aspects of global stratigraphy, inter-regional correlations, and estimated numerical ages.

(2) Our major *TimeScale Creator* database and visualization system to place all Earth history onto a convenient framework that is accessible to both the general public and to specialty researchers. At this point, everyone is delighted to contribute, and we give adequate credit (or blame) to all those who provide the data and correlations. It is intended that this program will morph to fit different audiences; and become an important tool for both geoscience research and for public exploration. The databases and visualization package are envisioned as a convenient reference tool, chart-production assistant, and a window into our planet’s fascinating history.

Appendix:

Original task suite (2001) established for the Stratigraphic Information

In 2001, a suite of proposed objectives were established for the Subcommittee on Stratigraphic Information which included brief indications of their importance to the global geoscience community. It was planned that most of these components will be accessible through the ICS/SSI Web site at www.stratigraphy.org.

(1) ICS/SIS Website

- Develop a method of classification to organize, logically, the data-bases, related links and make easy search and use of the contents.
- Open forum: Electronic discussion group (SIS-Net ?). In addition to the Web site, a link to a thematic discussion group (electronic mailing list) could be set up for SIS. Its purpose would be to make it possible to exchange useful information quickly and efficiently. Scientific comments, debates, and discussions of problems within the areas of interest, announcements and specifically addressed questions, would be all encouraged, as long as they are of relevance to SIS. Maps and stratigraphic charts are of obvious interest and photographs of taxonomically significant and/or problematic fossils could be launched for discussion among specialists.

(2) Biostratigraphy Zonations and Stratigraphic Lexicons

- Regional biozonal schemes: with definitions of zones and type-sections (link to the iconographic atlases of index fossil species).
- Regional lithostratigraphic frameworks and time scales, with definitions of individual lithostratigraphic units, photos of type-sections, chronostratigraphic correlations, and references.
- This would have the enormous advantage of making easily accessible the regional lithostratigraphic and time scales of basins worldwide, with links to related data-bases.

(3) Geohistory Data-bases.

- Facies Stratigraphy: Data base of outcrop and core sections. Iconographic atlases showing types of siliciclastic and carbonate macro- and micro-facies, diagnostic sedimentary structures, ichnofossils/ichnofabrics and ichnofacies, etc., including, wherever possible, interpretations, paleogeographic facies models, and references.
- Paleogeographic and Paleoclimatic Maps. The data base for the paleogeographic maps, sourced from the published literature, ongoing research, and from still unpublished M.Sc./Doctorate research results, could be collected and plotted on base paleogeographic maps (e.g., <http://www.scotese.com>).
- Continental Ecosystems. Stratigraphic correlations, distribution of paleoclimatic indicators, and the relationship (depositional and time-equivalence of events) of continental ecosystems with adjacent marginal marine basins.
- Marine Ecosystems. Paleoclimatic belts, approximate paleobathymetric contour curves, areas of paleo-upwelling, phosphate deposits, black shales, carbonate platforms, turbidites, major trends of surface and bottom currents.

(4) Iconographic Atlases.

- Index fossil species: systematics, biostratigraphy and paleoecology. Iconographic atlases of stratigraphically significant fossil groups (ammonites, inoceramids, foraminifers, ostracodes, radiolarians, calcareous nannofossils, palynomorphs), to be accompanied by biostratigraphic frameworks for the various basins worldwide.
- Biostratigraphy in thin-sections. Atlas of index fossil species (e.g., foraminifers, radiolarians, pithonellid calcispheres, calpionellids, roveacrinids) examined in thin sections, illustrating the diagnostic features.

Biostratigraphic and paleoecological data are indispensable to establish an integrated stratigraphy for interbasinal correlation. While an enormous amount of data exist based mainly on outcrop sections and on thousands of oil exploration boreholes, surprisingly few recent synthetic biostratigraphic and paleogeographic studies have actually been published. In addition, many of the published data are in need to be brought up to date.

To be able to acquire these, it would be necessary to determine and illustrate (with good SEM photographs), if not all, at least the index species and these illustrations along with the stratigraphic distribution of these species. Simply giving stratigraphic charts without illustrations is not sufficient, as diverse forms are often used as index species under the same name.

The final aim would be, among others, the publishing of iconographic atlases of index fossils for the various sedimentary basins around the globe.

In some offshore basins, with well established stratigraphic scales, the solution would be simple, if oil companies active in the area allow the release of existing data and make possible to present these in published format through the ICS/SIS website. The first step could be to approach individually prospective authors, who could accept to collaborate and, if necessary, contact officially their company.

To maximize application, the biostratigraphic frameworks, to be included as part of the Taxonomic, Iconographic and Biostratigraphic Atlases of Index Fossil Species, have to be presented per study basin, thus reflecting differences in regional tectono-sedimentary characteristics and biogeographic differentiation.

(5) Quantitative Biostratigraphy Programs

- Interest in quantitative biostratigraphy is flourishing, and there is demand for teaching modules of key techniques and its computer programs. Compact demonstration modules will be prepared of the three methods Unitary Association (UA), Ranking and Scaling (RASC) and Constrained Optimization (CONOP) that can be downloaded via the ICS master website.

(6) Teaching & Research.

- Easy-to-follow teaching guides: quantitative techniques of stratigraphic interpretation, chemostratigraphy, cyclostratigraphy, and Sr-stratigraphy, applied techniques to sequence stratigraphy: state-of-the-art, among others.
- Virtual field-trips to key type-sections: stratotypes, GSSPs, stage boundaries' sections: with location map; photos and zoom showing details of beds down to thin sections; stratigraphic charts with litho-, magneto-, isotope-, chemo-, and biochronostratigraphy; distribution charts of fossils, composite graphic correlation of key markers, etc.; published references and non-published theses on the area.

Stratigraphic Information Services

Geologic Time Scale Information

Geologic time scale subdivisions and GSSPs
Age dates, Orbital cycles, and Absolute time scale
Stable isotope and Geochemical curves
Magnetic and Sequence chronology

Stratigraphic Database Center & Links

Stratigraphic tools (statistics, temporal-spatial
GIS-type displays, links to paleogeography)
Integrated Stratigraphic Network and links
Biostratigraphic and evolutionary databases

Stratigraphic Standards

Stratigraphic Code (on-line) -- with short-term
working groups for revisions, as required
Geochronology and other standards

Geohistory Education Site & Links

New discoveries and concepts
What is the geological time scale
Adventures in geo-time (with links)
Stratigraphic applications and methods