



International Commission on Stratigraphy Subcommission for STRATIGRAPHIC INFORMATION

ANNUAL REPORT 2009

TITLE OF CONSTITUENT BODY

ICS Subcommission for Stratigraphic Information

Submitted by James Ogg, chair

1. OVERALL OBJECTIVES, AND FIT WITHIN IUGS SCIENCE POLICY

Mission Statement

The Subcommission for Stratigraphic Information promotes and coordinates the gathering of selected stratigraphic information worldwide and organizes logically its presentation through the ICS website. The Subcommission's 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 1). A streamlined version was adopted in 2003, with a simplified task set (diagrammed in Appendix 1)

SSI 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, as assigned in 2002, 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

During 2009, the Subcommission strove to attain an extended international and thematic membership. It must be emphasized that this subcommission is task-oriented, and it is expected that the membership will be active in undertaking those tasks. A detailed current and pending list with addresses and expertise is in Section 10 of this report.

Officers and current Voting Members

Name	Office or Expertise	Country (Institution)
Ogg, James G.	<i>Chair</i> ; TS-Creator database and visualization	USA (Purdue University)
Ogg, Gabi M.	<i>Secretary/Webmaster</i> ; graphics, GSSP tables	USA (Purdue University)
Crampton, James S.	<i>Vice-Chair</i> , Global Change Through Time Programme of GNS	NEW ZEALAND (Inst. Geol. Nucl. Sci.)
Asch, Kristine	OneGeology Europe; Chair IUGS Comm. Geoscience Information	GERMANY (BGR)
Fan, Junxuan	Geobiodiversity database	CHINA (Nanjing Inst.)
Filipescu, Sorin	Web design; Microfossils (Ceno-Mesoz.)	ROMANIA (Babes-Bolyai Univ.)
Galeotti, Simone	Microfossils ; co-founder of 2002 subcommission	ITALY (Univ. Urbino)
Howe, Richard	Global stratigraphy	USA (Chevron)
IODP (Jamus Collier)	Information and Data Manager	JAPAN (IODP)
Koren', Tat'yana N.	Head of Russian stratigraphy (bio, litho, etc.) database group;	RUSSIA (All-Russian Geological Research, Institute)
Nowlan, Geoffrey S.	Paleozoic stratigraphy; geo-education	CANADA (Canad. Geol. Surv.)
Van Couvering, John	Microfossil and time-scale databases	USA (Micropress)

We are currently soliciting voting members from Africa, South America, and additional international programs who can contribute to the Subcommission mission.

3. Interfaces with other international projects

(1) **One-Geology** and **One-Geology-Europe** geoinformatics teams. We will be working with One-Geology-Europe program during summer 2010 to interface our database structure with their preliminary one and the lexicons. During the IGC of 2008, a project was initiated 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. This was completed in April 2009.

(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. We are coordinating with CGMW on inter-linking our *TimeScale Creator* databases and different regional lexicons to their geological maps.

(3) National Geological Surveys and Strat Commissions. As of 2009, we have joint

projects (mainly *TimeScale Creator* datapacks) with: Geoscience Australia, New Zealand geologic survey, British Geologic Survey, Norwegian offshore lexicon, Austria Stratigraphy Commission, German Stratigraphy Commission and German Geological Survey (BGS), Russia (biostratigraphy compiled by All Russian Geological Institute). Details of these projects and new ones initiated in late 2009 with China, Canadian Geological Survey, USGS and India are given later.

4. Chief accomplishments and products in 2009

a. Websites and RSS-feeds

Two websites were designed and populated with a wide array of information in 2009:

- (1) The main Subcommittee site, <http://stratigraphy.science.purdue.edu/>, became active in November, 2008:



The SSI website contains:

- (a) GSSPs – The divisions of geologic time, such as Jurassic or Danian, are defined at a Global Boundary Stratotype Section and Point (GSSP) that marks the international reference for their base. We have compiled summary tables and graphics for all ratified GSSPs and pending candidates. The main tables are dynamically generated (see below).

- (b) CHARTS & BOOKS – From the popular page-sized geologic time scale to poster-sized Earth's history, all in official colors.
- (c) STRATIGRAPHIC GUIDE – a concise version of the official manual.
- (d) RESOURCES – including diagrams of inter-regional correlations, links to lexicons (national rock formations), “GeoWhen” database of historic and regional stage names (contributed by R. Rohde; Univ. Calif. Berkeley), and selected links to other Earth history sites.
- (e) Link to our TS-CREATOR public site (see next section).

(2) TS-CREATOR – the *Time Scale Creator* visualization package is a free JAVA program for all platforms to explore Earth history. Details are given in section “c” below. The *TimeScale Creator* site, <http://www.tscreator.org/>, was completely redesigned and became active in January, 2009:

TimeScale Creator

TimeScale Creator, a free JAVA package, enables you to explore and create charts of any portion of the geologic time scale from an extensive suite of global and regional events in Earth History. The internal database suite encompasses over 20,000 biologic, geomagnetic, sea-level, stable isotope, and other events – details are given on the [BUILT-IN DATA](#) page. All ages are currently standardized to *Geologic Time Scale 2004*, and to the *Concise Geologic Time Scale* compilation of the [International Commission on Stratigraphy](#) and its [Subcommission on Stratigraphic Information](#).

How to use the program (briefly; details are on the [MANUAL](#) pages):

Time Scale Creator PRO 1.4.3
 Database coordinators: Jim Ogg, Felix Gradstein
 Software development: Adam Lugowski

TS Creator Pro is for you to create on-screen and downloadable charts of any portion of the geologic time scale with your choice of bio-, magneto-, chemo- and other events in Earth History.
 TSC Pro can load and modify data and has expanded graphic routines.
 See [HELP](#) for Features.

Licensed to James Ogg
 website: <http://www.tscreator.com/releases/ogg>
 username and password can be found in Help->Website.

From Data to finished Chart in 3 simple steps

Step 1: Pick Time interval (by change or by file): Set scale
 Step 2: Select stratigraphy & regional columns
 Step 3: GENERATE on-screen display and Save

click to enlarge

DOWNLOAD the free TimeScale Creator.

See [FAQs](#) for common questions.

TimeScale Creator provides a wealth of information for making charts and posters, such as these [CHARTS](#) produced by the ICS Subcommission on Stratigraphic Information.

Try some of our additional [DATAPACKS](#) of selected regional (e.g., British Isles facies successions, New Zealand range charts) or specialty stratigraphy (e.g., global reconstruction images, Ice cores and archeological culture intervals) from the *TimeScale Creator* library.

In addition to providing the free software and on-line and PDF manuals, the site provides an array of datapacks ranging from British Isles geology to New Zealand fossil ranges (see below).

(3) RSS-Feed:

The ICS was requested by the IUGS and One-Geology Geoinformatics groups to provide a web-based authoritative digital dataport for basic GSSP parameters (stage, ratification status, location, definition, main correlation methods, approximate age, color of stage, etc.). This RSS-feed (or ATOM output) could be automatically queried by other applications; rather than individuals having to search through the ICS sites to see if a GSSP had been defined, revised, etc.

A dynamic feed was created by the Purdue University “VIP” undergraduate engineering project under a “contract” to SSI. In addition, this project provided a dynamic-generation for all GSSP tables and individual stage-level pages on the SSI website, including Google-Earth display of each location.

b. 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, Neflex). Some are joint products to be distributed by UNESCO (Commission for Geologic Map of the World).

Book, ***Concise Geological Time Scale 2008***, (\$35 for the full-color, 160-page, hardback via Cambridge Univ. Press) 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. A plastic timescale card is included in each book. Approximately 1500 copies were sold between Aug, 2008 and Sept, 2009.

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.

2500 copies were printed/distributed during 2007 in Australia

2000 copies were printed/distributed in 2007-09 through Purdue (another 1000 will be distributed in 2010).

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). This is available through the SSI or CGMW websites.

Chart “***International Divisions of Geologic Time***” is freely available through the International Commission of Stratigraphy website (www.stratigraphy.org).

Chart “***Geologic Time Scale 2004***” (A3-sized).

Plastic card “***International Geologic Time Scale***”. Versions were sponsored by Neflex, Chevron, ExxonMobil, ConocoPhillips and ENI.

Mousepad “***International Divisions of Geologic Time***”. This was a joint production with the UNESCO Commission for the Geologic Map of the World. The first printing was sold out at the International Geological Congress (Oslo, August, 2008). The second printing

is available through the CGMW website. A separate printing was done by Geoscience Australia (but including ICS icon) for distribution throughout that country.

Detailed **Charts for each geologic period**. These poster-sized summaries of major biostratigraphic, sea-level and geochemical trends can be downloaded from the SSI website.

c. Global databases and Visualization

“TimeScale Creator” (*Version 4.2 released in August, 2009 – Free JAVA suite*). This is a continuously expanding database-visualization system with hyperlinks to our stratigraphic-information and other websites. It is a collaboration between the Subcommittee, Purdue University and many data providers. 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 Nov’09), 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. On-line “quick-start”, tutorials, exercises and a manual (courtesy of ExxonMobil) provide independent training in usage and developing one’s own datasets for insertion.

Public Version 4.2 (August 2009) has capabilities for lithologic columns, images of paleogeographic maps, range charts, URL-hotlinks, and other valuable 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 below.

Software enhancements added in 2009 (selected):

Basin transect capability with floating labels and pop-ups (and a colorful user manual for self-entry of transects), revised pop-up window system that no longer has 256 character limitations, internal “standard” image set for oil-gas occurrences – impacts - large-igneous provinces, capability for superimposed curves of different colors.

Global datapack enhancements added in 2009 (selected):

Paleozoic Sequence Stratigraphy and Onlap Curve. This includes the recent (October 2008) *Science* paper of Haq and Schutter, plus their on-line supporting documentation tables and charts.

Onlap Curves for Phanerozoic. This is based on SEPM 1998 sequence-stratigraphy and eustacy charts, plus the above paper by Haq-Schutter for Paleozoic; but applying a mathematical model to generate a synthetic onlap curve for margins.

Global Impact, and Large-Igneous-Province Records, plus icons for impacts and eruptions of varying magnitudes. These are sub-grouped into “global” and individual regional events. The events are provided by the International Association of Volcanology and Chemistry of the Earth’s Interior, and to PASSC at Planetary and Space Science Centre, Univ. New Brunswick.

Mars, Moon, and Venus geologic history and stratigraphic units.

Dinoflagellate events were enhanced and linked to Dinoflag2 database; and Paleogene foraminifers linked to the CHRONOS page for each species from the different Paleogene working groups.

Astronomical Solutions for Earth Paleoclimates for past 3 myr and past 100 myr based on calculations provided by Jacques Laskar. These curves of eccentricity, obliquity and precession indicate the variations in solar radiation; of which Pleistocene ice

ages are the most dramatic results. These sets have over 10,000 points; therefore were mounted as separate datapacks.

Cenozoic Oxygen Isotope Trends (and high-resolution marine isotope stages). This includes digital versions of the compilation by Zachos et al (2008, with conversion and interpolations to GTS2004 time scale) and by Raffi et al (2006; for past 25 myr), plus labeled “oxygen-isotope episodes”. A detailed Plio-Pleistocene curve includes labels for all marine isotope stages. These sets have nearly 15,000 points; therefore were mounted as a separate datapack.

Past 10,000 years – Greenland ice core and preliminary “human culture” compilation; provided courtesy of Grace Conyers, Purdue University. This popular datapack will be enhanced during the coming year.

d. Summary of coordination activities by regional database teams

Nov, 2008; Nottingham, England (British Geological Survey) – on-site work to finalize British lithostratigraphy array for TS-Creator visualization (Colin Waters, Jim Ogg).

Dec, 2008; Nanjing, China (Geobiodiversity group) – on-site visit by Purdue Univ. student (Alex Huang, expert with TS-Creator) for presentations and discussions on developing a China-region bio/lithostrat datapack and on-line version of TS-Creator.

March, 2009; Houston, USA – workshop at N.Amer. microfossil conference (SEPM) for TS-Creator to academic and industrial users; and user-feedback was obtained for potential 2009-2011 enhancements to user-interfaces, datasets, and applications.

May-June, 2009; Canberra and Darwin, Australia – on-site collaboration with Geoscience Australia for their flagship Australian geohistory visualization suites (Daniel Mantle of GA, Jim Ogg, Adam Lugowski, et al.)

July, 2009; Lower Hutt, New Zealand – on-site collaboration with GNS (N.Z. geological survey) to complete the biostrat datapacks and initiate an impressive basin-transect system (34 initial transects), plus age-depth conversion software add-ons (Craig Jones, James Crampton, Jim Ogg, Adam Lugowski, et al.).

September, 2009; Calgary, Canada -- on-site collaboration with Geological Survey of Canada to develop integrated biostrat, lithostrat and sequence-strat for Arctic regions (first priority) and mainland of Canada, potentially (Godfrey Nowlan, Jim Ogg, et al.).

October, 2009; GSA Annual Meeting – planning for USGS-coordinated program for a comprehensive offshore and onshore array.

e. Regional Lexicon-linked databases and Other datapacks

NOTE: All regional visualization suites produced directly with geological surveys are freely available as datapacks through the SSI/TSC websites and as special pre-packaged TS-Creator versions through the websites of the individual geological surveys. All of the following projects were put on-line during late 2008 and 2009:

Australian Geo-History – this was developed with Geoscience Australia (the Australian geological survey) during 2007-2008; and greatly enhanced in 2009. In addition to all types of Australian biostratigraphy with full references of calibrations, the datapack for visualization in *TimeScale Creator* has a comprehensive array of lithologic columns (about 200) of all Australian Proterozoic and Phanerozoic basins and subbasins (and even finer detail in some regions), with each formation hot-linked into the GA Oracle database. Images of paleogeographic maps, tectonic maps and facies maps (about 50 of each) provide visual columns on Australian history, and are also hot-linked to additional on-line summaries. The suite also includes reference wells for all major oil-gas reservoirs (hot-linked to appropriate databases). There are over 9000

events/datums/formations. This extensive system is intended to be a model to put the geology of other continents “on-line”.

Russian Biostratigraphy. An extensive (7000 entries) array for visualization in *TimeScale Creator*. This includes most biostratigraphic zones and major bioevents for all regions of Russia through the entire Phanerozoic. The suite is based on a book and extensive charts by T. Koren’ et al (2006).

British Isles Lithostratigraphy. An extensive (ca. 2000 entries) array for visualization in *TimeScale Creator*. 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– An extensive (ca. 3000 entries) array for visualization in *TimeScale Creator*. 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. In 2010, we will add lithostratigraphy and transects for most NZ basins.

Gulf of Mexico Biostratigraphy and Lithostratigraphy– An extensive (ca. 2000 entries) array for visualization in *TimeScale Creator*. This suite integrates biostratigraphy/sequence stratigraphy charts of Shell (provided by Mike Styzen), of Dick Fillon (formerly at Chevron), of PaleoData, of the USA MMS, and lithostratigraphy columns from the Gulf of Mexico DNAG volume (in turn, linked to the USGS Lexicon).

Lithostratigraphy of Russian Hydrocarbon Basins. For visualization in *TimeScale Creator*. This set was mainly compiled from Siberian, Caspian and other regional reports of the U.S. Geological Survey.

Lithostratigraphy of Svalbard and Norwegian Sea. For visualization in *TimeScale Creator*. All formations are tied to entries in Norlex.

Lithostratigraphy of Alaskan and other Arctic Hydrocarbon Basins. For visualization in *TimeScale Creator*. This includes conversions of many regional reports of the U.S. Geological Survey.

Marine Genera ranges. For visualization in *TimeScale Creator*. This is based on the Sepkoski (2002) compilation, as revised and updated by Leif Tapanila. A user selects from 30,000 genera according to phylum and orders. We will enhance this in 2010 by adding major land vertebrates and linking the orders to explanatory websites with images.

5. Chief problems encountered in 2009

During 2009, the many activities listed as achievements “of the subcommission” were essentially accomplished by a core group of dedicated researchers and students, who devoted their academic 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.

The Geoscience Australia team was the only one that made extensive in-house datasets for distribution by the Subcommission as TS-Creator datapacks. 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. To this end, in 2010, we will investigate the possibility of “wiki” systems for public contributions of datasets. As the Subcommission products, especially aiding in developing the TS-Creator visualization suites, become more widely used and volunteer contributions are promoted, it is anticipated that a larger audience will begin to directly provide packages and enhancements. Our goal is for the SSI system to be both an exchange

of authoritative stratigraphic compilations as well as a “top-down” suite of guided syntheses.

6. Summary of expenditures in 2009

TOTAL: **\$4000** [*from IUGS via ICS Executive*]

\$3000 – To Purdue’s school of engineering for developing dynamic GSSP tables for the SSI website, plus easy system for updating GSSP databases. This also included a RSS-feed for One-Geology, and a Google-display of GSSP locations. \$1500/semester for Spring’09 and for Fall’09. The Fall’09 projects include a geographic interface and possible full RSS-feed for the global database (~20,000 events).

(*another \$1500 in matching funds for RSS-feed was provided by James Ogg*)

\$500 – Compensation for GSSP graphics and summaries and for web-development, to Gabi Ogg (100 hours)

\$400 – Web-design and graphics software (*Dreamweaver CS4*)

\$100 – Postage for shipping posters/cards/etc; and mailing tubes

NOTE: Nearly all of the *TimeScale Creator* software development and datapack preparations during 2009 were funded through US National Science Foundation, donations by and to Purdue University (especially by Geoscience Australia), and other grants to James Ogg and Felix Gradstein. These funds supported 3 full-time students during summer 2009, 3 half-time students during Spring of academic year 2009, and 5 half-time students during Fall 2009; plus ~\$20,000 paid for programming assistance, and costs of travel to England to work with British Geological Survey, to Australia (Geoscience Australia), to New Zealand (their geological survey), to Calgary (Canadian Geological Survey) and to Portland (GSA annual meeting, to coordinate with OneGeology geoinformatics and USGS). We anticipate similar external donations or contributions during 2010 as we work with the different geological surveys and authoritative teams.

7. Work plan, anticipated results and communications to be achieved in 2010

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. Through Purdue University, we anticipate mailing the remaining 1000 (of a total 3000) “History of the Earth” posters to high-school classrooms. We have placed a free PDF version on-line for people to locally print their own copies, and indicate that the pre-printed quality-paper versions are available for mailing-cost-only. We will continue to provide updated reference cards for the geologic time scale for all audiences.
- Plastic cards – for the 2010 EGU (May in Vienna), the Neflex company will fund printing a revised set of time-scale cards.
- Coordinate a comprehensive “Geologic Time Scale 2012” volume. This book, originally planned for 2010 but delayed to take advantage of major new radiometric standards and cycle-stratigraphy developments during 2009-2010, will be similar (and even expanded) in scope to GTS2004; but in full color. In addition to the new GSSPs, it is important to summarize the major advances in bio-mag-sealevel-geochem stratigraphy of the past decade. There are about 30 authors, including the officers of several ICS subcommissions.

- Coordinate a comprehensive summary of all GSSPs. We are providing standardized descriptions and graphics as these are formally published. A colorful photo-filled booklet would be ideal for reference; and we will work with Stan Finney on a prototype.

b. Digital Material on Earth's History

- Website: We will continue to enhance the SSI website for easy usage and add more content. GSSP documentation/graphics will be continuously updated and enhanced. Links to additional regional stratigraphic lexicons will be provided, where such on-line sources have been made available. We will also link to translated versions of the stratigraphic guide. [*Essentially, strive to accomplish the goals assigned to the Subcommittee 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 website, but enable updating of the critical graphics. At this point, we have only mounted versions of the period-level graphics for this timescale compilation.
- Update and enhance the 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, new summary graphics at the SSI site provide the basic information; but we need to include hot-links to details.
- RMS feed to additional numerical time-scale and stratigraphic information. Having accomplished the basic GSSP-feed, we are considering providing the entire “global” database of TimeScale Creator (about 25,000 datums) with commentary for each item.
- Promote *TimeScale Creator* visualization package for exploring Earth history. Currently, this is very poorly displayed and advertised.
- Place additional 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:

Germany Lithostratigraphy. 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 BGR and German Commission on Stratigraphy in May 2010. All formations are linked to the German stratigraphic on-line Lexicon.

Austria Lithostratigraphy. This is based on charts produced by the Austrian stratigraphic commission and includes the Phanerozoic of basins and mountain belts. The initial data entry was completed in Summer 2008; and we are invited by the Austria Stratigraphic Commission to Vienna for a thorough review before deployment in May 2010. Simultaneously, they will complete the on-line Lexicon for inter-linking.

Europe Lithostratigraphy. Having completed British Isles, Norway offshore, Austria and Germany; we will work in May 2010 with OneGeology Europe to prepare a seamless European suite and visualization.

Russia Lithostratigraphy. 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.

India and Adjacent Regions Lithostratigraphy. This datapack has already been completed; but requires vetting by stratigraphic experts. It 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 (2007). Details on formations (and links) are from publications and the Indian directorate for hydrocarbons.

New Zealand Lithostratigraphy – We will enhance the current biostratigraphy datapack with transects for most NZ basins. This is in conjunction the GNS (N.Z. geological survey), who will contribute to student labor for the transects.

China lithostratigraphy. This project has been discussed with the stratigraphic database team hosted in Nanjing; and a Purdue University student went to Nanjing for presentations and discussions in Dec, 2009. In July, 2010, Jim Ogg will go to Nanjing for a prototype development.

Middle East Lithostratigraphy – This is based on charts produced by GeoArabia and includes the Phanerozoic of basins and mountain belts. The initial data entry was completed in Summer 2009; but requires a thorough review before deployment in May 2010. ExxonMobil and Qatar Petroleum will aid in reviewing this public database.

Human Time Scale (Creator) – This is for an entirely different audience than normal geoscientists (but potentially more numerous!). The initial compilation was completed in 2009, but needs to be reviewed by other archeologists. We plan to develop some “lab modules” around this database (one was already tested in March 2009). John Van Couvering will aid in portions of this review; and we will produce associated on-line summaries for the SSI website on Late Pleistocene and early Holocene “Human-stratigraphy”.

Summary set of Phanerozoic time scales with GTS2012 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 SSI website after *Geologic Time Scale 2012* goes to press. In addition, all the TimeScale Creator datapacks would require updating to the new age scales developed from cycle stratigraphy (Cenozoic-Cretaceous), revised radiometric ages, and new interpolation methods.

- Enhance *TimeScale Creator* capabilities:

Geographic interface for visualization software. The growing suites of regional lithostratigraphy and transect datasets of Earth history require a map-based selection system (and, potentially, a map-based display one). Such a software enhancement is currently being developed by Purdue University (Engineering department) under contract to SSI through its undergraduate research-project “VIP” program.

Evolutionary tree visualization software. In order to dynamically display “evolutionary trees” for public and research usage that include images, we must develop an intelligent display method with appropriate user-menus. The initial “test bed” will be Paleogene foraminifers (courtesy of biostratigraphers at ExxonMobil); but we mainly desire to present an overview of evolution of all major organisms at the family level; and selected ones at the genera level. This “family tree” project will involve collaborations with the Paleobiology database and other geobiodiversity groups.

NOTE: Some of the above projects will undoubtedly require continuation into 2011-2012.

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.

d. Planned coordination activities by regional database teams

- Jan, 2009; Oslo, Norway – workshop with British, Norwegian, Danish and Dutch geological surveys and planning for finalizing a comprehensive North Sea and northernmost Atlantic region dataset (biostrat, lithostrat, transects) for TS-Creator visualization (Colin Waters, Jim Ogg, Felix Gradstein, et al.).
- Feb, 2010; Washington, USA – on-site collaboration with USGS for prototype of USA onshore/offshore datasets (mainly lithostrat)
- March, 2010; Houston, USA – presentations to petroleum industry on TS-Creator, plus finalizing the comprehensive Gulf of Mexico regional dataset (biostrat, lithostrat, potential transects) for TS-Creator visualization (Richard Howe, Jim Ogg, et al.)
- March, 2010; Lower Hutt, New Zealand – on-site collaboration with GNS (N.Z. geological survey) to finalize basin-transect system and enhance the age-depth conversion software extension (Craig Jones, James Crampton, Adam Lugowski, et al.).
- May, 2010; Vienna, Austria -- on-site collaboration with Austrian Geological Survey to finalize the Austria region and Alpine datapack (mainly lithostrat) for TS-Creator visualization (Werner Piller, Jim Ogg, et al.).
- May, 2010; Hannover, Germany -- on-site collaboration with BGR to finalize the German region datapack (mainly lithostrat) for TS-Creator visualization and to develop a OneGeology Europe prototype (Kristine Asch, Jim Ogg, et al.).
- June, 2010; Calgary, Canada – (planned) on-site collaboration with Geological Survey of Canada to finalize datapack for the integrated biostrat, lithostrat and sequence-strat for Arctic regions, and a prototype for the mainland regions (Godfrey Nowlan, Jim Ogg, et al.).
- July, 2010; Nanjing, China -- on-site collaboration with Geobiodiversity Database team for a prototype integrated biostratigraphy/lithostratigraphy data array for Chinese regions (Fan Junxuan, Jim Ogg, et al.).

8. Budget and ICS component for 2010

As in 2009, the Subcommittee is planning a very active program of publications, education outreach and public awareness, web enhancements, 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 2009, we can not count on the extensive support from Purdue University, Cambridge University Press, NSF and Geoscience Australia. Therefore, we are submitting a budget that optimistically presumes that nearly three-quarters of our costs will 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-enhancement and GSSP graphic production	\$ 800
Computer programming (<i>Geographic interfaces for TS-Creator</i>)	\$2000
Printing posters/cards/etc; shipping to conferences; and mailing tubes	\$ 500
Partial student support for datapacks and modules	\$1700
TOTAL PROJECTED EXPENSES (ICS portion only)	\$5000

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

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

The main aspects that we are adding are:

(1) Comprehensive book (GTS2012) 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.

10. Voting members (2009-2012)

ICS Subcommission for Stratigraphic Information

2009-Sept, 2012 – Voting Members

NAME	COUNTRY/Organization	Specialty	Mail address
Asch, Kristine	GERMANY (OneGeology Europe; BGR; Chair IUGS Comm. Geoscience Information)	Compiled "interactive Geological web map of Europe and adjacent areas"	Bundesanstalt für Geowissenschaften und Rohstoffe (BGR), Geozentrum Hannover, Stilleweg 2; D-30655 Hannover, GERMANY
Crampton, James S.	NEW ZEALAND (Inst. Geol. Nucl. Sci.)	Leader, Global Change Through Time Programme of GNS	GNS Science: Postal address: P.O. Box 30-368, 5040, Lower Hutt; Physical address: 1 Fairway Drive, Avalon, 5010, Lower Hutt, NEW ZEALAND
Fan, Junxuan	CHINA (Nanjing Inst.)	Coordinator of Geobiodiversity database (web)	Nanjing Institute of Geology and Palaeontology, Chinese Academy of Sciences, 39 East Beijing Road, Nanjing 210008, P.R. China
Filipescu, Sorin	ROMANIA (Babes- Bolyai Univ.)	Webmaster; microfossils (Ceno-Mesoz.)	Department of Geology, Babes- Bolyai University, Str. Kogalniceanu 1, 3400, Cluj-Napoca, ROMANIA
Galeotti, Simone	ITALY (Univ. Urbino)	Microfossils (Ceno-Mesoz.) ; co-founder of 2002 subcommission	Istituto di Geologia, Università degli Studi di Urbino, Campus Scientifico, Località Crocicchia, 61029 Urbino, ITALY
Howe, Richard	USA (Chevron)	Global stratigraphy	CHEVRON Energy Technology Co., Biostratigraphy Team , 1500 Louisiana St., Houston, TX 77002
IODP (Jamus Collier)	JAPAN (IODP)	Information and Data Manager of IODP	Hokkaido University, CRIS Bldg. 05- 104 & 105; N21 W10, Kita-ku, Sapporo, 001-0021, Japan

Koren', Tat'yana N.	RUSSIA (All-Russian Geological Research, Institute)	Head of Russian stratigraphy (bio, litho, etc.) database group; also Paleozoic graptolites	Head of Paleontology and Stratigraphy Dept., All-Russian Geological Research, Institute (VSEGEI), Srednij Prospect 74, St. Petersburg 199026, RUSSIA
Nowlan, Geoffrey S.	CANADA (Canad. Geol. Surv.)	Paleozoic stratigraphy; past President of the Geological Association of Canada;	Geological Survey of Canada / CGC- Calgary 3303-33rd Street N.W., Room 238 / 3303, 33 rue nord-ouest, pièce 238 Calgary, Alberta, T2L 2A7 CANADA
Ogg, Gabi M.	USA (Purdue University)	Secretary/Webmaster; graphics, GSSP tables	Dept. Earth & Atmos. Sci, Purdue University, 550 State Street, West Lafayette, Indiana, 47907 USA
Ogg, James G.	USA (Purdue University)	Chair; TS-Creator database and visualization; also Mesozoic stratigraphy	Dept. Earth & Atmos. Sci, Purdue University, 550 State Street, West Lafayette, Indiana, 47907 USA
Van Couvering, John	USA (Micropress)	Microfossil databases	Micropaleontology Press, 256 Fifth Ave., New York NY 10001 USA [NOTE: This will move to Queens Univ, NYC]

2010-Sept, 2012 – *invited; not yet formally accepted*

NAME	COUNTRY/Organiz ation	Specialty	Mail address
Cox, Simon	AUSTRALIA (CSIRO)	OneGeology; Geologic mark-up language (GeoSciML)	WAS: CSIRO Exploration & Mining, 26 Dick Perry Avenue, Kensington WA 6151 [PO Box 1130, Bentley WA 6102] AUSTRALIA
Menning, Manfred	GERMANY (GFZ)	Chair of German Strat. Comm.; Devon-Tri paleo database	GeoForschungsZentrum Potsdam; Section 5.2: Climatic Dynamics and Landscape Evolution; Telegrafenberg, C 128; D-14473 Potsdam, GERMANY
Richard, Stephen	USA (Arizona Geol. Survey)	OneGeology (N. Amer. geologic map data model); Geologic mark-up language (GeoSciML)	Arizona Geological Survey, 416 W. Congress St., #100; Tucson, Arizona, 85701 USA
Rossi, P., or J.-P. Cadet	FRANCE (Comm. Geol. Map World)	UNESCO Commission for the Geological Map of the World	CCGM/CGMW; 77, rue Claude-Bernard, 75005 Paris, FRANCE
Soller, Dave (and Nancy Stamm) -- joint	USA (USGS)	Coordinator, USGS National Geologic Map Database [Nancy Stamm is database developer for Geologic names and paleontologic databases)	U.S. Geological Survey, MS 926-A National Center, Reston, VA 20192 USA
Waters, Colin N.	ENGLAND (Brit. Geol. Survey)	Manager of Geoscience Standards & Nomenclature project	British Geological Survey, Kingsley Dunham Centre, Keyworth, Nottingham NG12 5GG GREAT BRITAIN

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