



CHRONOS

Mesozoic/Cenozoic paleoceanography and paleogeography workshop

University of South Florida, St. Petersburg

Location:

Karen A. Steindiger Auditorium, Florida Marine Research Institute

Dates:

October 27-28, 2004

Goals of the workshop were:

1. To help shape the continued development of the CHRONOS System by inputting data and doing, to the extent possible, hands-on testing of the web sites, portals, and interfaces.
2. Critique and suggest improvements for the sedimentary geochemistry/chemostratigraphy database module. The Chemostratigraphy working group, under Ethan Grossman's leadership, is developing the criteria for a geochemical database/module. Pat Diver is taking the lead on working with the PaleoStrat team to develop a module for this as part of the larger PaleoStrat database effort.
3. Discuss the current toolkits (CONOP, ADP), and identify additional tools that need to be developed, including various approaches to paleogeographic reconstructions.
4. Have wide-ranging discussions on educational and outreach activities.

Summary of workshop achievements

- Data used for paleoceanographic research are largely included in the sedimentary geochemistry database module developed for PaleoStrat following the Geochemical Cycles workshop in San Antonio; bio-data (assemblage data), physical property and sedimentological data are also required;
- Paleoceanographers need access to modern data used for calibration and interpretation of past data of all types;
- Dynamic paleogeographic maps, age models, data conversion and manipulation tools are essential for paleoceanographers;
- CHRONOS should develop an active education and outreach program in partnership with existing organizations such as COSEE, NESTA, etc.;
- Usability surveys of Age Depth Plotter (ADP), the CHRONOS web site, and the portal should be expanded and made accessible on line to broaden the user feedback base.

WORKSHOP REPORT

After initial welcomes, the workshop was kicked off by Ethan Grossman who gave a summary of the geochemical cycles workshop and by Pat Diver, who presented the draft of the geochemical database module for PaleoStrat that he has been working on following the specifications and data examples provided by the participants to the geochemical cycles workshop. Participants commented on the draft and gave immediate feedback to Pat Diver.

Breakout discussions on data needs for paleoceanography

1. What data are needed for paleoceanography?

- Geochemical data identified by GC workshop and in schema (with modifications proposed below)
- qualitative biostratigraphic data such as presence/absence, 'expert opinion'
- current data (environmental parameters) to compare deep-time records and for calibration
- to define nature of ocean-climate forcing, to interpret ocean-climate history, and for modeling the following data are needed: age models, high temporal and spatial resolution, and location (present and past) for all data points

Deep Time Proxies*

Extra-terrestrial	Weathering and crustal cycling	Temperature	Salinity and ice volume	Atmospheric chemistry & ocean pH	Local and Global redox	Productivity and biosphere	Ocean circulation
$^3\text{He}/^4\text{He}$ $^{187}\text{Os}/^{188}\text{Os}$ Ir REEs	$^{11}\text{B}/^{10}\text{B}$ $^7\text{Li}/^6\text{Li}$ $^{13}\text{C}/^{12}\text{C}$ $^{18}\text{O}/^{16}\text{O}$ $^{30}\text{Si}/^{28}\text{Si}$ $^{34}\text{S}/^{32}\text{S}$ $^{44}\text{Ca}/^{40}\text{Ca}$ $^{56}\text{Fe}/^{54}\text{Fe}$ $^{87}\text{Sr}/^{86}\text{Sr}$ $^{97}\text{Mo}/^{95}\text{Mo}$ Hf isotopes $^{187}\text{Os}/^{188}\text{Os}$ $^{143}\text{Nd}/^{144}\text{Nd}$ Pb isotopes Sr/Ca Mg/Ca	$^2\text{H}/^1\text{H}$ $^{18}\text{O}/^{16}\text{O}$ $^{44}\text{Ca}/^{40}\text{Ca}$ Sr/Ca Mg/Ca Alkenones Fluid inclusions in salt	$^{18}\text{O}/^{16}\text{O}$ $^{87}\text{Sr}/^{86}\text{Sr}$	$^{11}\text{B}/^{10}\text{B}$ $^{13}\text{C}/^{12}\text{C}$ $^{34}\text{S}/^{32}\text{S}$, $^{33}\text{S}/^{32}\text{S}$	$^{13}\text{C}/^{12}\text{C}$ $^{34}\text{S}/^{32}\text{S}$ $^{97}\text{Mo}/^{95}\text{Mo}$ REEs	$^{13}\text{C}/^{12}\text{C}$ $^{15}\text{N}/^{14}\text{N}$ $^{56}\text{Fe}/^{54}\text{Fe}$ $^{30}\text{Si}/^{28}\text{Si}$ $^{34}\text{S}/^{32}\text{S}$ Cd/Ca Ge/Si H/C, O/C Ba Biomarkers	$^{13}\text{C}/^{12}\text{C}$ $^{143}\text{Nd}/^{144}\text{Nd}$ Pb isotopes

*Growing by the day

BIOTIC DATA	SEDIMENT DATA	PHYSICAL PROPERTY & PALEOMAGNETICS
Assemblages	<u>Lithology</u>	
foraminifera (p & b)	Color	MST data
nannoplankton	Grain size	Porosity
<u>radiolaria</u>	<u>Sed. structures</u>	<u>Resistivity</u>
diatoms	Total organic carbon	Conductivity
<u>palynomorphs</u>	% carbonate	Magnetic suscep.
macrofossils		Gamma ray
vertebrates	Methodologies	Dry bulk density
<u>Zonation scheme used</u>	Expert opinion	Velocity
<u>Datums</u>		
Preservation		Logging data
		Seismic data
Methodologies	GEOCHEMISTRY	
Expert opinion		Declination
	XRF <u>microscanner data</u>	Inclination
	Pore water chemistry	
		Methodologies
	Methodologies	Expert opinion
	Expert opinion	

2. Comment the sedimentary geochemistry data model

- Include multiple biostratigraphic zonations with subzones and references to zonation schemes and the datums used to define those zonation schemes;
- Paleogeography with open database structure and software, age model documentation for paleomagnetic data
- Add fission-track dating to methods
- Tool to convert $\delta^{18}\text{O}$ values to paleo-temperature estimates using various equations

In the afternoon we continued with presentations and discussions on tools. David Becker presented the current status on the modifications to the Janus database that will allow it to be networked by groups like CHRONOS. Dietmar Mueller showed examples of Gplates paleogeographic reconstructions of the ocean floor, and Frits Hilgen gave a summary of the techniques used to astronomically calibrate sequences of sediments and an update on the calibration of the Cenozoic/Mesozoic time scale.

Breakout group discussions on tools

1. What tools do paleoceanographers need?

- Data visualization tools (age depth plotting, splicers, plate and point rotations, map, sections, microfossil atlases)
- Teaching tools
- Data manipulation tools (time scale conversion, correlations, library of calibration equations, interactive contouring, workspace at CHRONOS)
- Teaching tools
- Access to data from other fields, including primary data, taxonomic dictionaries, data, publications, modern datasets

2. How do we link paleoceanography and paleogeography – data and tools?

- Need paleogeographic maps with:
 - paleobathymetry
 - sediment type and accumulation rates
 - + need to plot evolution of cross-sections across gateways

What is required:

- We have paleo-basement depth, but need to plot decompacted sediment on top
- Requires **CHRONOS ODP metadata base** that includes post-cruise data (i.e. especially revised ages)
- Required web interface would be expanded version of OSDN (www.odsn.de)

- Need to merge GCM model outputs with observations (especially paleoclimate proxies derived from ODP)

What is required:

- **Library of GCM model outputs**
- temp, wind, currents, geochemistry, O and C-isotope proxy formation models (e.g. potential distribution of carbonates at given time)

3. How do we link marine data from terrestrial sections to marine sections?

- Data are mostly the same (geochemical, stable isotopes, faunal/floral lists, sediment descriptions)
- Locality for land-based sections requires more metadata and can be much more variable: needs at least geographic coordinates and reference point within section
- Stratigraphic correlation with biozones, paleomagnetic boundaries, chemostratigraphy – chronostratigraphy recommended to bypass diachroneity problems with land formations
- Need information on preservation (how to standardize?), abundance, and standard nomenclatures (rock vs sediment classification, ODP schemes).

The remainder of the afternoon was spent with a **usability survey of ADPapp**, CHRONOS's Java-based age vs depth plotting tool. In general, the users found the tool very useful and made some recommendations to implement in future versions.

The second day of the workshop was dedicated to education and usability tests of the CHRONOS web site and portal. Dogan Seber gave an overview of DLESE and GEON's activities on education. Frank Ireton presented the National Earth Science Teacher Association (NESTA) and the National Science Teacher Association meetings. Three breakout groups discussed then about education.

Breakout group discussion on education

1. Linking existing efforts (COSEE, DLESE, GEON, NASA, USGS, PaleoPortal, others) - how do we do it?

- Identify list of relevant projects and contact people in each
- Identify specific projects following NASA goals
- CHRONOS as participants in education workshop organized e.g. by NASA
- Develop the CHRONOS visiting seminar series
- Advertise activities in CHRONOS newsletters
- Representatives attending COSEE council (Centers for Ocean Sciences Education Excellence, cosee.net)
- CHRONOS-COSEE formal educational activities
- Posters at Educational meetings (K-T boundary poster!)
- Public Service Announcements
- EarthScope educational linkages related to Earth history
- Get involved in in-service teacher programs at universities
- Register/upload CHRONOS tools with DLESE (Digital Library for Earth Systems Education, dlese.org) and COSEE web sites
 - IODP education and CHRONOS communication (identify IODP contact)
 - Develop a workshop where people bring their ideas and project goals and learn from each other.
- Joint proposal developments for educational activities
- Professional associations as well as publishers (web presence)

2. How can your research become part of the education-outreach efforts?

- Get involved with K-12 teaching through mentoring, teacher-training program, classroom visits, hands-on activity development, email relationship with teachers, development of web-based activities made accessible through CHRONOS, DLESE, COSEE etc
- Give public lectures
- Publish in popular science journals
- Learn about state science curriculum standards to give teachers what they need and present it in an understandable language
- Emphasize societal relevance of our research
- Create tools that allow students to submit queries to the CHRONOS

database, visualize and manipulate the data as part of a problem-based learning activity.

- Create a module that explains how understanding of geologic time is used by nonscientists (energy industries, coastal developers, etc.)
- Offer educational component along with your data – “How can educators use these data?”
- Create modules that CHRONOS can link to or upload
- Create and advertise discussion forums on CHRONOS web site
- Offer outreach to museums, offer help developing exhibits, posters
- Create web-based registry of scientists offering answers, data, help
- Create web-based registry of teachers looking for collaborations, materials, data

3: Innovative tools for education and outreach - can dreams become reality?

- The strengths of CHRONOS in education and outreach are:
 - Well suited to project based education
 - Most examples are interdisciplinary: climate change on geological timescales, paleoenvironmental reconstruction, etc...
 - Other topical strengths: stratigraphy and correlation, ocean history, evolution, geochronology
 - Makes available a wealth of data
 - Provides a structured template for data collection and organization.
 - Provides a vehicle for inquiry, hypothesis testing and the scientific method
 - Powerful visualizations of time-continuous paleogeography/environmental change
- Targeted education/outreach programs for CHRONOS
 - Key CHRONOS research areas (mass extinctions etc)
 - Portable CHRONOS exhibit
 - CHRONOS lecture series
 - Geological perspective on climate change – the science behind the issues (for policy makers)
 - CHRONOS online forum for students
 - CHRONOS press information officer
 - Ask Dr. CHRONOS – or the ‘Cronies’ ☺
 - CHRONOS fellowships and/or internships
 - REU – Camp CHRONOS

The remainder of the workshop was dedicated to usability surveys of the CHRONOS web site and portal.

WORKSHOP AGENDA

Wednesday 27 October, 2004

- 8:30 AM Welcome (Ben Flower and Dean Al Hine, USF)
8:40 AM NSF perspective on geoinformatics as an interdisciplinary platform
(Walt Snyder, NSF)

Part I: Data

- 9:00 AM CHRONOS Geochemical Cycles workshop and working group (Ethan Grossman, TAMU)
9:30 AM The sedimentary geochemistry database (Pat Diver, CHRONOS)

10:00 AM Coffee break

- 10:20 AM Breakout sessions:
1. What data are needed for paleoceanographic research?
2. Analyze and critique the geochemistry data model.
3. Which datasets could be quickly captured for CHRONOS (K/T boundary and beyond)?

12:00 noon Summary of results of breakout group discussions

12:30 PM Catered lunch

Part II: Tools

- 1:30 PM JanusLegacy: what it is and what does it mean for CHRONOS (David Becker, IODP/USIO TAMU)
1:50 PM Paleogeographic reconstructions: the Paleomap project (Chris Scotese, UTexas, Arlington)
2:10 PM Paleogeographic reconstructions: GPLates (Dietmar Mueller, Univ Sydney)
2:30 PM Cyclostratigraphy and time scale calibration tools (Frits Hilgen, Utrecht Univ)

2:50 PM Coffee break

- 3:10 PM Breakout sessions:
1. what tools do paleoceanographers need?
2. How do we link paleoceanography and paleogeography – data and tools?
3. How do we link marine data from terrestrial sections to marine sections – differences in data and metadata; tools to do such?

4:15 PM Test CHRONOS ADP tool (hands-on activity)

4:45 PM Summary of results of breakout group discussions

Thursday 28 October, 2004

Part III: Education and outreach

- 8:20 AM DLESE and GEON's E&O efforts (Dogan Seber, SDSC)
8:40 AM NESTA and other examples of educational activities (Frank Ireton, SESTA)
9:00 AM Breakout group discussion: brainstorming on education for CHRONOS and the paleoceanography community
1. Linking existing efforts (COSEE, DLESE, GEON, NASA, USGS, PaleoPortal, others) - how do we do it?
 2. How can your research become part of the education-outreach efforts?
 3. Innovative tools for education and outreach - can dreams become reality?
- 10:00 AM *Coffee break*
- 10:20 AM Summary of breakout group discussions

Part IV: Testing web resources

- 11:00 AM CHRONOS web site and interfaces (Josh Reed, CHRONOS)
11:20 AM Usability test of CHRONOS web site
12:30 PM *Catered lunch*
1:30 PM Usability test of CHRONOS portal and web interface
3:00 PM *Coffee break*
3:30 PM Summary of observations on usability test (Doug Greer, SDSC)
4:00 PM Closing remarks (Ben Flower, Ethan Grossman, Mark Leckie, Brian Huber)

Participants

First

Name	Last Name	Institution
David	Becker	IODP/USIO Texas A&M University
Karen	Bice	Woods Hole Oceanographic Institution
Katharina	Billups	University of Delaware
Paul	Bown	University College London
Cinzia	Cervato	CHRONOS/Iowa State University
Tracy	Chistner	Florida COSEE
Robert	DeConto	University of Massachusetts

Patrick	Diver	CHRONOS
Ben	Flower	University South Florida
Tracy	Frank	University of Nebraska-Lincoln
Teresa	Greely	University South Florida
Douglas	Greer	San Diego Supercomputer Center
Ethan	Grossman	Texas A&M University
Pamela	Hallock	University South Florida
Peter	Harries	University South Florida
Frits	Hilgen	Utrecht University
Al	Hine	University South Florida
Dave	Hollander	University South Florida
Michael	Howell	University South Florida
Brian	Huber	Smithsonian Institution
Frank	Ireton	Science Systems and Applications, Inc.
Linda	Ivany	Syracuse University
Mimi	Katz	Rutgers Univ.
H. Richard	Lane	National Science Foundation
Cindy	Leard	Florida COSEE
R. Mark	Leckie	University of Massachusetts
Jackie	Lees	University College London
Mitchell	Lyle	Boise State University
Ken	MacLeod	University of Missouri
Ellen	Martin	University of Florida
Dietmar	Muller	The University of Sydney
Bette	Otto-Bliesner	National Center for Atmospheric Research
David	Rea	University of Michigan
Josh	Reed	CHRONOS/Iowa State University
Dogan	Seber	University of California, San Diego
Walt	Snyder	National Science Foundation
Barbara	Spector	Florida COSEE
Ellen	Thomas	Wesleyan University

Breakout groups

Part I: data (27 October, AM)

Group 1: What data are needed for paleoceanographic research?

Group 2: Analyze and critique the geochemistry data model.

Group 3: Which datasets could be quickly captured for CHRONOS (K/T boundary and beyond)?

Group 1	Group 2	Group 3
Bice	Becker	DeConto
Billups	Diver	Bown
Flower	Grossman	Frank
Greer	Ireton	Huber
Hilgen	Lees	Katz
Ivany	Lehnert	Lyle
Leckie	Rea	MacLeod
Mueller	Scotese	Martin
Thomas	Seber	Otto-Bliesner
Hallock-Muller	Hollander	Reed
Hine	Howell	Harries
Pyrtle	Poore	

Part II: Tools (27 October, PM)

Group 1: What tools do paleoceanographers need?

Group 2: How do we link paleoceanography and paleogeography – data and tools?

Group 3: How do we link marine data from terrestrial sections to marine sections – differences in data and metadata; tools to do such?

Group 1	Group 2	Group 3
Bice	DeConto	Becker
Billups	Frank	Bown
Flower	Greer	Diver
Hilgen	Ireton	Grossman
Ivany	Katz	Huber
Leckie	Lehnert	Lees
Lyle	Martin	MacLeod
Otto-Bliesner	Mueller	Rea
Reed	Scotese	Thomas
Hallock-Muller	Seber	Harries
Howell	Hine	Hollander
Poore	Pyrtle	

Part III: Education (28 October, AM)

Group 1: Linking existing efforts (COSEE, DLESE, GEON, NASA, USGS, PaleoPortal, others) - how do we do it?

Group 2. How can your research become part of the education-outreach efforts?

Group 3: Innovative tools for education and outreach - can dreams become reality?

Group 1	Group 2	Group 3
Flower	Billups	Becker
Greer	Bice	Bown
Huber	Diver	DeConto
Ireton	Frank	Grossman
Lehnert	Hilgen	Ivany
Martin	Katz	Lees
Otto-Bliesner	Leckie	Lyle
Seber	MacLeod	Rea
Scotese	Mueller	Reed
Spector	Thomas	Greely
Harries	Hine	Hallock-Muller
Howell	Pyrtle	Hollander
Chistner	Poore	Leard