Structural Geology & Tectonics Division Spring Newsletter
Volume 17, Number 1
March 1998

From the Editors...

We hope this newsletter finds you happy, healthy, and productive this spring. As you can see, we're still experimenting with different ways to improve your newsletter. As always, you are our primary source of information. If you have any suggestions, ideas, professional and technical opinions, announcements, career changes, not-for-profit offerings and/or industry news, please send them to us! The deadline for inclusion of materials in the next issue will be July 31, 1998. Please send lengthy items on a Mac diskette, as e-mail text, or as an e-mail attachment (Mac Word 5.1 preferred).
A special thanks to our column contributers Vicki, Art, Bob, and the several theme session conveners! In our next issue, be sure to watch for Ben van der Pluijm's Structural Geology & Computers column and a book review of "Earth Structure" by Alec Gates.

Greg & Scott

Chairperson's Message

I start this message with thanks to board members **John Bartley** (*past* Past Chair) and **Art Goldstein** (Secretary-Treasurer), who have given much time, energy and ideas on behalf of the SG&T Division and who now rotate off the boardwe'll miss you guys! I also thank **Terry Pavlis** (Past Chair) for a carrying the Division through an interesting, and sometimes challenging, year and for his continuing work with the Division (among other contributions, he will provide me with advice and guidance in the year ahead!). **Terry**, **Steve** and **I** welcome new board members **Charlie Onasch** (Secretary-Treasurer) and **Jane Selverstone** (Second Vice Chair). As a result of newsletter snafus, new members joined us a little late, and John and Art were tapped past the traditional Halloween transition!
The meeting in Salt Lake went very well by all reports (or at least those that reached my ears!). The Division-sponsored symposium, Exhumation of High- and Ultra-High Pressure Rocks, organized by **Brad Hacker** and **Lothar Ratschbacher,** (thank you, guys!) was very well received. Congratulations to students **Jeff Evans** (Utah State University) and **Paul Kapp** (UCLA) for their award-winning research proposals. Congratulations also to **Peter Molnar**, **Philip England**, and **Joseph Martinod** for the Division's Best Paper Award, given for: "*Mantle dynamics, uplift of the Tibetan Plateau, and the Indian monsoon*" (Reviews of Geophysics). **Greg Houseman** was the citationist, and **Jane Selverstone** accepted the award on behalf of Peter Molnar (reading his comments).
The Division Career Contribution Award was presented to **Hans Ramberg**, who unfortunately could not personally accept the award. **Peter Hudleston** read the citation (written by **Christian Teyssier** and **Peter**), and **Paul Reitan**, a past student and colleague of Hans', accepted the award on behalf of Hans. It was indeed humbling and inspiring to listen to both citation and acceptance,

and to gain small insights into the life of a truly creative mind. It was personally gratifying for me, as the SMU tectonics group recently had been reading anything we could get our hands on with regard to boudin formation, and of course, Hans' work figured prominently in our readings and discussions.

As I look over the past chairs' messages, it is clear that this is not the best of times, but it also is certainly not the worst of times. As a group, we have a lot about which to be optimistic. There are more SG&T job openings than I recall in my professional past, both in industry and academicsan amazing turn of events compared to **Ed Beutner's** letter of 1994, just four short years ago. If this is news to you, check out the Division web page which details presently advertised jobs (among other things)great thanks to **Ben van der Pluijm**! (No, Ben is not hiring, he just keep us all up-to-date on who is). In addition, the number of majors in programs across the country seems to be on the increase, as does the graduate applicant pool.

NSF programs may be undergoing some reorganization. Many of you heard **Ian McGregor** outline changes or potential changes at the board meeting in Salt Lake City. The division has put together an *ad hoc* committee (engineered to be small, but effective, we hope) to provide a means of communication between the Division and NSF, and to suggest positive recommendations for programmatic changes that may affect structural geology and tectonics programs.

Tectonics casts a very broad net indeed, and it is important to support one another in our quest to understand Earth's tectonic processes (processes which we increasingly see are not limited to the lithosphere and solid Earth). With this in mind, I encourage us all to look toward the end of this century as a time to ally ourselves with colleagues in other fields. At the very least, we learn more about a colleague's field in order to extend our understanding of tectonic processes. We also have reached a critical point in our mass media world in which earth (and planetary) scientists need to be their own advocates. What we do is exciting, important, fun, and critical to the growing human population. We need to help our fellow citizens appreciate the relevance of our work. And appreciation comes from understanding. Perhaps each of us can get the word out to our local communities. There are a number of avenues through which to do this. Talk to local school or community groups about what you do in your worklet others experience some of the excitement that you do, help them to appreciate the Earth and to understand how much we still need to learn about how it works. Establish and promote positive contact with science journalists associated with local or regional newspapers. Let your local news station know that you are willing to be contacted about, and to comment on, Earth Science issues.

Sometimes we tend to forget how lucky we are in our work, the places it takes us, the puzzles we wrestle with, the fun of discovery; these are all things that we can share with the folks in our respective communities, and by doing so, it helps the public gain an understanding of, and an appreciation for, what we do, and for the scientific method. There still are too many people that think that geologists just identify rocks. The concept of an *earth scientist* is foreign to them; the concept that their planet has changed through time and continues to do so is foreign to them; the concept that people don't already know everything that we need to know about the Earth has never crossed their minds. Although we all live on this planet, and likely will continue to do so throughout our lives, it is amazing how few people give conscious thought to the Earth. Perhaps this El Nino year can provide each of us an opportunity to introduce how the Earth works to new audiences. I challenge each of us to give talks in our local communities, at any level. We are some 1400 members strong, and we can together make quite an impact on the public's understanding of the Earth. It also is a lot of fun! Rare is the situation that you give a talk and

don't get at least one person excited, at least one person thinking about their world in a different way.
I end with an open invitation to contact any of the board members with comments, questions, thoughts and ideas for how to make the Division better, both long term and short term. All the best.

Cheers,
Vicki Hansen

GSA SG&T Division Management Board Minutes

SALT LAKE CITY - OCT. 21, 1997
Present at the meeting: Terry Pavlis, Vicki Hansen, John Wickham, Wanda Taylor, Steve Marshak, Mark Brandon, Dave Dunn, Don Davidson, Ben van der Pluijm, Art Goldstein
1. Newsletter.
The Newsletter was mailed very late this year because of compounding errors. The Newsletter was submitted to GSA by the Newsletter Editors on time, but GSA and the printer both failed to act in a timely fashion after receiving the manuscript. The biggest problem with this is that members did not receive their ballots before the meeting, making voting difficult and making it impossible to announce the new second vice chair. We discussed electronic publishing of the newsletter on the Division WWW homepage as well as the issue of electronic voting. We decided that the ballots should be mailed traditionally under separate cover to avoid a repeat of the problems that we experienced this year. We also decided to move nominations forward in time to allow more timely distribution of the ballots.
2. Budget. We continue to run a surplus every year with a projected surplus at the end of the year of $15,000. We decided to subsidize undergraduate and graduate student participation in Division-sponsored short courses and field trips at the National Meeting. An award of $100 per student will be made to 10 students based on their application (and then on a first-come, first-served basis). This will be advertised in GSA Today, in the Division Newsletter and on the Division homepage. We also decided to use some Divisional funds to convene a "focus group" to discuss how best to get input to NSF on matters of Divisional concern.
3. US Tectonic Studies Group. **Mark Brandon** asked us to consider the possibility of a Divisional Tectonic Studies Group Meeting separate from the Annual Meeting. This would convene a group intermediate in size between a Penrose Conference and the Annual Meeting. No conclusion was reached.
4. GSA SG&T Input to NSF. Considerable discussion centered on how to better communicate with the staff at NSF. The primary concern surrounds the proposed changes to NSF EAR structure with the possibility of moving the Active Tectonics initiative out of the Structure and Tectonics Program with a resultant loss of budget in the one program of which most Division members make use. We decided that the best thing would be to convene a panel of established, respected scientists from a broad array of sub-disciplines and allow them to make recommendations and speak for the Division. The consensus was that more "marketing" of our goals would be helpful in the attempt to both increase the budget available to Division members and influence direction which NSF might or might not take in both budget allocations and structure of programs.

5. Changes in the format of the Annual Meeting. **John Bartley** and **Don Davidson** informed us of changes in the structure of sessions and symposia at the Annual Meeting. These changes were reported in the September 1997 newsletter.

Art Goldstein,
GSA SG&T Secretary-Treasurer

NSF News

There are not likely to be any financial changes in the Tectonics Program for the 1998 fiscal year, but there is some positive news for Active Tectonics in the long term. In spite of a small increase to the total EAR (Earth Science Division) budget this year, we can expect only flat funding in the tectonics program. We don't know the final figures yet, but the increase to the Division is likely to be EAR-marked (so to speak) for specific foundation-wide initiatives, and not left to the discretion of EAR Division.

The December deadline produced 88 proposals that together requested $10.8 million. By January 15, all proposals were sent out for review, and mail reviews had already started to come in by the end of January. Many thanks to those of you that took the time to do these reviews, and a special cheer to you who got them in early. It does help us when you send they in promptly, because we need to read and think about your comments well before the Panel meetings.

This is the first time that we used the new NSF proposal review forms. The review form that formerly contained a big empty box for your review, now has a bunch of instructions in it. We hope that you are as pleased to be fitting your Summary Statement into the 18 mm space provided as we are trying to read Times New Roman in a #4 font size. It goes without saying that this "new and improved" form was the result of a "task force committee." Hopefully, reviewers will forgive us and continue to contribute their thoughtful reviews, no matter how clumsy our forms appear.

Active Tectonics and some organizational news:... Following a newly revised plan announced by Division Director **Ian MacGregor** in early January, the Active Tectonics Initiative (AT) will be funded through 1999 as a separate entity at about its present level. Another idea floated at the same time is that two new co-equal, but separately administered, Programs covering all multidisciplinary proposals may be created for start up in the year 2000. One would be designed to support studies of the deep earth, and incorporate the old Continental Dynamics Program, along with CSEDI and other initiatives aimed at the earth's interior. A new second, but parallel program, would focus on shallow crustal studies, and subsume the AT initiative, but be expanded in scope to include other interdisciplinary proposals from geology, geochemistry, hydrology, and tectonics, as well as other biological and environmental initiatives. Its budget is being conceived of as coequal with its sister program for deep earth studies, and thus be several times larger than the present AT budget. This is a distinct benefit to any earth science group who, like the AT community, wishes to attack scientific problems with a multidisciplinary approach. Although AT proposals would be competing for funds against proposals in other fields, the larger budget of the new program would open more opportunities.

These ideas are not the final word. A lot of planning has to be done, and a lot of detail has to be filled in. We won't know what these new programs will look like, nor how they will be funded for several more years. However, the input that the tectonics community provided last year was clearly helpful. We will try to keep you informed through this letter and individually at meetings as plans develop. Continued input from the community is welcome and strongly encouraged.

One of the tasks the Earth Sciences Division needs to be doing is to look forward a few years to anticipate what you as researchers are likely to focus on and to look at the Washington scene, including NSF upper management, to try to position the Division favorably in the competition for funds. The first part is being addressed by the start of work on a new "long range plan". The National Academy of Sciences will help in this study, and as its work proceeds, it would be very beneficial if your input is made. The resulting report, expected in 18-24 months, will serve as a blue-print for our preparations, arguments and organization to provide the research community with updated (and hopefully appropriate) services. While it would seem reasonable to wait until the long range plan report is finished to make many changes to the present structure of the Division, some "repositioning" is deemed too urgent to wait that long. In particular, the increased emphasis on collaborative, multidisciplinary research currently in vogue makes it attractive to set up new Earth Sciences Division programs now to have the apparatus ready just in case money so designated appears.

Proposal Procedures

Continuing our discussion from the last several installments of what happens to your proposals after you send them in, we have worked our way through the mail review process, and last time we described the panel review procedure. This time we focus on how the panel and mail reviews are reconciled, or, what we do to arrive at final decisions. The mail reviews each provide a text and a score. We enter the scores in a spread sheet, average them, and rank the proposals by this score. The panel also ranks approximately the upper half of the proposals relative to each other. What we do next is to see how far down these ordered lists of proposals our budget will stretch. At present funding levels, it typically funds about 25-30 % of the proposals. Those proposals in the lower 50 percentile of both review processes are dropped from further consideration. Those proposals that are well within the funding range on BOTH lists, we process for funding at some level. These decisions are really out of our hands, having been approved by both mail ranking and panel blessing.

By this process we create a "gray zone" consisting of those proposals ranked as fundable, but not having the very highest priority. Here is where our job begins in earnest. We, that is both Wright and Wintsch, review the reasons that the panel used for reaching its ranking on any particular proposal, and we review the mail reviews again for anything that we might have missed in the text of the review, and for any sign that the mail review may be biased in one direction or the other. We then independently rerank the "gray zone" proposals using our best call on what the collective intent of the panel and mail reviewers was. Our two rankings are then compared, and we discuss the agreement and disagreement of the lists. Where we completely agree that a proposal is fundable or not fundable, we proceed with recommendations to either fund or decline.

Usually the funds are exhausted by this point, and the remaining proposals are left unfunded. However, there are some instances where "ties" occur within this "gray zone", and in this case, we look for novelty, creativity, and likelihood of success. This really is the only place where the evaluation of the program directors plays a dominant role. As you can see, our primary job is one of administering the reviews, and responding to the rankings of the review process. However, all the decisions that we make, and significantly also these "gray zone" decisions, are unanimous, and we labor diligently for fairness and objectivity.

Finally, the rationale of every decision that we make, both positive and negative, must be outlined in an essay that we draft that becomes part of the permanent record of the proposal. The immediate use of this is to communicate to the Division management the reasons for our recommendations. Furthermore, these essays are read by a "committee of visitors," who evaluates each program, including the tectonics program, every three years. Our decisions and these forms are scrutinized by this committee. More about this next time.

Standing back, there is no question that very strong science goes unfunded every cycle, but the system of peer review is working well in the tectonics program. To keep the playing field as level as possible, mail and panel reviews are the primary decision makers, with the program directors adjudicating only where a tie breaker is needed.

Robert Wintsch
Tectonics Division Program Director

fax: 703-306-0382, rwintsch@nsf.gov

Congratulations to these PI's who received awards since last time:

Active Tectonics Awards for 7/1/97 to 1/1/98

PROP#	PI	INSTITUTION	TITLE
97	Allmendinger	Cornell University-Endowed	COLLABORATIVE RESEARCH: Characterizing Continental Deformation in the Andean Foreland at Multiple Timescales Using GPS Geodesy and the Geologic Record
97	Frank	PA St University Park	COLLABORATIVE RESEARCH: Geochemical and Isotopic Constraintson Mesproterozoic Ocean Chemistry Working Toward a Global Perspective

97	Green	U of Cal Riverside	Collaborative Research: Dehydration Embrittlement of Serpentine at High Pressures: Implications for Intermediate and Deep Earthquakes
97	Isacks	Cornell University-Endowed	Interferometric Sar Measurements of Seismic and Inter- Seismic Strain Near a Major Seismic Gap in the Peru-Chile Convergent Plate Boundary
97	Kellog	U of SC Columbia	Convergent Margin Plate Kinematics and Mechanics: 1998-2000GPS Geodesy in the North Andes
97	Lyons	U of Missouri Columbia	COLLABORATIVE RESEARCH: Geochemical and Isotopic Constraintson Mesoproterozoic Ocean Chemistry Working Toward a Global Perspective
97	Meritts	Franklin & Marshall Col	RUI: COLLABORATIVE RESEARCH: Dynamic Response of Bedrock Fluvial Systems to Tectonic Forcing
98	Miller	Central Washington Univ	Collaborative Research: Dynamics and Kinematics of North America-Juan de Fuca-Pacific Plate Interaction: Constraints from GPS Geodesy and Geophysical Modeling
97	Molnar	MIT	Convective Instability of a Thickened Convecting Boundary Layer (and Thickened Lithosphere)
97	Reinen	Pomona College	Collaborative Research on Dehydration Embrittlement of Serpentine at High Pressures: Implications for Intermediateand Deep Earthquakes
97	Silver	U of Cal Santa Cruz	GPS Study of the Transition Between Subduction and Collisionin Papua New Guinea
97	Whipple	MIT	COLLABORATIVE RESEARCH: Dynamic Response of Bedrock Fluvial Systems to Tectonic Forcing

Tectonics Awards for 7/1/97 to 1/1/98

PROP #	PI	INSTITUTION	TITLE
97	Avelallemant	William Marsh Rice Univ	COLLABORATIVE RESEARCH: Geologic and GPS Strain Study: Displacement Partitioning and Arc-Parallel Extension in the Aleutian Volcanic Arc
97	Bowring	MIT	COLLABORATIVE RESEARCH: Tectonic Reconstructions of Southwestern North America Based on Nd Isotope and U-Pb Zircon Provenance Determinations from Miogeoclinal.....
98	Brandon	Yale University	COLLABORATIVE RESEARCH: Paleogene Collision and Obduction of the Far-Traveled Olyutorsky Island Arc, Northern Kamchatka, Russian Far East
97	Bruhn	University of Utah	COLLABORATIVE RESEARCH: The Fairweather-St. Elias Orogenic System: A Slip Partitioned Transpressional Orogen
97	Bufler	U of Texas Austin	Late Cenozoic Rift Sedimentation, Volcanism and Tectonism in the Southern Red Sea-Northern Danakil Regions, Eritrea
97	Cashman	Humboldt State Univ Fnd	SGER: Feasibility Study for Automated Scanning Particle Size Distributions in Cataclastic Rocks
97	Davis	SUNY Stony Brook	Theoretical and Modeling Studies of Strain Partitioning

98	Davis	U of Southern California	The Yinshan Fold and Thrust Belt of Northern China--An Enigmatic Intraplate Orogen of Jura-Cretaceous Age
97	Dixon	U of Miami Sch Mar&Atmos	COLLABORATIVE RESEARCH: Dynamic Processes Along a Passive Margin: A Geological and Geodetic Study of the Northern Gulf of Mexico
97	Doka	La St U & A&M Coll	COLLABORATIVE RESEARCH: Dynamic Processes Along a Passive Margin: A Geological and Geodetic Study of the Northern Gulf of Mexico
97	Farmer	U of Colorado Boulder	COLLABORATIVE RESEARCH: Tectonic Reconstructions of Southwestern North America Based on Nd Isotope and U-Pb Zircon Provenance Determinations from Miogeoclinal.....
97	Furlong	PA St U University Park	Lithospheric Tectonics of a Transpressional Plate Boundary Fiordland, New Zealand
97	Grunow	Ohio State Univ Res Fdn	COLLABORATIVE RESEARCH: Neoproterozoic-Lower Paleozoic Evolution of the Southeastern New England Avalon Zone AroundBoston, MA: Tests from Geochronology and Paleomagnetism
97	Hirth	Woods Hole Ocean Inst	COLLABORATIVE RESEARCH: Dynamic Recrystallization: Microstructural Constraints on the Dynamics and Kinematics of Tectonic Processes
97	Jones	U of Colorado Boulder	COLLABORATIVE RESEARCH: Relating Gravitational Potential Energy to Present Day Strain Rates in the Western U.S.: Observations and Models

97	Karlstrom	University of New Mexico	COLLABORATIVE RESEARCH: An Integrated Study of Late Proterozoic (1.2-0.7 Ga) Extensional Tectonism, Basin Evolution, and Biological Evolution in the Grand Canyon...
97	Kepezhinskas	U of South Florida	COLLABORATIVE RESEARCH: Tectonics and Paleomagnetism of Kamachatka Peninsula Composite Terranes, Northeastern Russia
97	Kidd	SUNY Albany	COLLABORATIVE RESEARCH: Dating the Initiation of the India-Asia Collision East of Mt. Everest
97	Kirschvink	California Inst of Tech	Cambrian Paleogeography of the West African Craton: An International Paleomagnetic Collaboration
97	Kusky	Boston University	Emplacement of the Ultramafic Massifs of the Kenai Peninsula, Alaska and their Possible Relationship to the Border Ranges Fault System
98	Mayer	Miami Univ	COLLABORATIVE RESEARCH: Active Tectonics of a Young ObliqueRifted Continental Margin, Loreto Area, Baja California Sur, Mexico
98	McNulty	California State Univ	Tectonic Controls on Magmatism and Deformation in the Cordillera Blanca, Peru: Toward a Definitive Model for Andean-Type Magmatic Arcs
97	Miller	Stanford University	Structural and Thermal Evolution of the Sierra Nevada- Basin and Range Transition Zone
97	Oldow	University of Idaho	COLLABORATIVE RESEARCH: Geologic and GPS Study: DisplacementPartitioning and Arc-Parallel Extension in the Aleutian Volcanic Island Arc
97	Opdyke	U of Florida	Paleomagnetism of the Dwyka Series

97	Pavlis	University of New Orleans	COLLABORATIVE RESEARCH: The Fairweather-St. Elias Orogenic System: A Slip-Partitioned Transpressional Orogen?
97	Pollard	Stanford University	The Evolution of Normal Fault Systems in Three Dimensions
97	Rowley	University of Chicago	COLLABORATIVE RESEARCH: Time of Initiation of the India- Asia Collision East of Mount Everest
97	Sisson	William Marsh Rice Univ	Exhumation of two Constrasting High-Pressure Metamorphic Belts in Venezuela: Implications for Caribbean Tectonics
97	Sonder	Dartmouth College	COLLABORATIVE RESARCH: The Role of Gravitational Potential Energy in the Deformation of the Western United States
97	Thompson	Wellesley College	COLLABORATIVE RESEARCH: Neoproterozoic-Lower Paleozoic Evolution of the Southeastern New England Avalon Zone aroundBoston, MA: Tests from Geochronology and Paleomagnetism
97	Tullis	Brown University	COLLABORATIVE RESEARCH: Dynamic Recrystallization: Microstructural Constraints on the Dynamics and Kinematics of Tectonic Processes
97	Umhoefer	Northern Arizona Univ	RUI: COLLABORATIVE RESEARCH: Active Tectonics of a Young Oblique-Rifted Continental Margin, Loreto Area, Baja California Sur, Mexico

97	Williams	U of Massachusetts Amherst	Processes of Folding and Cleavage Development and the Use of Compositional Imaging in Fabric Analysis
97	Wiltschko	Texas A&M Research Fdn	GPS Investigation of the Active Southern Taiwan Fold and Thrust Belt
97	Wiltschko	Texas A&M Research Fdn	Fluid Flow in a Deforming Thrust Terrane
97	Yeats	Oregon State University	Earthquake Hazards in the Himalayan Foothills of Northwest India

REPORT ON THE ACTIVE TECTONICS CONTROVERSY AND PLANNED REORGANIZATIONS AT NSF

SG&T Management Board

The SG&T Business and Awards Meeting in Salt Lake City was a bit livelier than most and this section of the newsletter is a report on some of the events that developed as a result of that meeting. For those who were not at the meeting, there was a rather heated discussion following an informal presentation by **Ian MacGregor** (head of EAR at NSF) outlining administrative changes at the Earth Sciences division of NSF. The primary issue was the fate of the Active Tectonics initiative in a planned reorganization.

We think that all present were very grateful to Dr. MacGregor for his willingness to discuss the plan openly, particularly given that his presentation was not planned until ~2 hours before the business meeting! The plan was not very popular among Division members, however, and following the business meeting, numerous Division members requested that we poll the membership on the issue of the planned fate of the Active Tectonics initiative. Time was too short to conduct this poll by normal mail, and thus, we did everything through an e-mail poll, the text of which is copied below. For the ~40% of the division members who did not receive this poll, we apologize, but e-mail was most practical given the immediacy necessary to have an impact.

The results follow in the second note below. Membership response was strong. Most people also responded with comments, many of them thoughtful and magnificently worded. We distilled the

comments into a few key points--the text of the third note below. We thank everyone for their efforts in preparing these comments.
Dr. MacGregor responded with a very thoughtful letter that is reproduced at the end of this section. As you can tell from his letter, Division members' input has been taken seriously and your efforts have had a real impact. As an example of this impact, read paragraph 5 of Dr. MacGregor's letter and then refer to recent updates in the "NSF News" section of this newsletter prepared by Tom Wright and Bob Wintsch.
We hope this has been useful to the community and we want to again thank everyone who responded to the poll. Dialog with NSF is continuing. The Division has formed an *ad hoc* committee to look into critical issues of how we can promote tectonics and produce a more united front in the community. If you have any thoughts on this subject, please pass them on to Terry Pavlis and I'll forward them to the committee.

MEMBERSHIP POLL ON NSF ISSUES

An important issue came up at the SG&T Business Meeting at the Salt Lake City GSA meeting and the issue raised a lot of controversy. Based on subsequent discussions at the meeting, we felt that input from Division members was needed and this letter is the result.

The NSF has proposed, and is in the process of implementing, changes that directly affect the Tectonics community. Ian MacGregor summarized these changes at the SG&T Business Meeting, so those who were at the meeting can skip this attempt at a summary of what was said and just vote below.

The Earth Science division at NSF is going through another administrative change in program structure. The major effects of these changes to the tectonics community are the relative distribution of resources for the Tectonics and Continental Dynamics programs through reorganizations that affect three recent initiatives: Active Tectonics, CSEDI(Cooperative Studies of the Earth's Deep Interior), and ESH (Earth System History). The proposal is to take the funds from these initiatives and combine them with the Continental Dynamics program to form a new program (title still uncertain, but probably something about Earth Systems) with the task of dealing with the bulk of the large multi-institutional, multidisciplinary programs within EAR. The reorganization will effectively take funds from the individual investigator programs and place them into a program for multidisciplinary projects. Note that the AT, CSEDI, and ESH initiatives were started without any new money.

Because these changes are an indirect way of redistributing funds from individual investigator programs to multidisciplinary programs, many individuals have expressed a concern that this change may not be in the best interest of the community. It is largely for this reason that we poll the membership on this issue. Before you make a decision, consider some of the following points that were raised in the discussion at the meeting last week:

PRO: In terms of the Active Tectonics initiative, this change could be a major boost to the program. One of the problems with Active Tectonics was that it was underfunded from the beginning, and as a result the main goals of the program could never be met. That is, the program announcement emphasized the importance of an integrated, multidisciplinary approach to

solving active tectonic problems, but investigators who tried to follow those guidelines were caught in a catch-22 where the budget of a multidisciplinary program quickly exceeded the total funds available in the program. By combining the program with the Continental Dynamics program, these types of multidisciplinary efforts are now possible under the large resources of that program. In addition, it can be argued that multidisciplinary science produces a larger impact on the scientific community with splashy results that have a "trickle down" effect of increased funding through increased visibility of the science. In order to encourage those kind of programs--including programs like Active Tectonics--the foundation needs to put resources behind those efforts. Large projects have allowed us to learn things about the earth that would never have been possible under single investigator programs, and the same should be true of studies of active tectonics.

CON: The structure and tectonics community devoted a huge amount of effort to the Active Tectonics initiative, and the reward for that effort is transferring funds from the Tectonics program into a program that is widely viewed as "closed shop" devoted primarily to programs with a large seismology component and funding restriction to a few highly visible institutions. Thus, active tectonics projects may not get a fair hearing in this type of program. The original intent of the Active Tectonics initiative was to use the societal relevance of the program as a hook for new funding to the EAR division, not to reallocate existing resources. This change effectively transfers resources from small project (one to a few investigators) programs to large project programs. In addition, the present CD Program is primarily a tectonics program, but by incorporating ESH and placing all multidisciplinary programs under this umbrella, there is a danger that the focus of this program could be diverted from tectonic studies. Information should be gathered to evaluate the impact of this kind of change on education and human resources. For example, many large projects make extensive use of postdoctoral researchers and students do not always get first priority. The NSF needs to consider if this is the ideal use of funds. Similarly, is there any hard data to indicate that large projects generate greater scientific benefit for the dollar? Data could be gathered from NSF final reports and citation indices to evaluate this question. Similarly, how does EAR compare to other NSF divisions in terms of dedication of resources to single investigator vs. multi-investigator/multi-institutional programs?

THE VOTE:
Given this background, please respond with a vote on this issue (votes will simply be tallied and no record kept of the source of the vote). Please respond by e-mail to this address (tlpgg@uno.edu) by Nov. 3, 1997. If you wish to comment on this issue, and don't mind being identified, please send your comment directly to Ian MacGregor at NSF. Otherwise, send your comments to this e-mail address and I'll put them together and forward them to NSF:

I. Should the Earth Sciences Division of NSF reconsider its reorganization decision until such time as a complete study can be made on the merits of increasing funding to large interdisciplinary projects at the expense of single investigator/small group projects? (Y or N)

II. Information questions (optional)

a) Have you ever been a PI or co-I on a Continental Dynamics project?

b) Have you ever had NSF funding from the Earth Sciences Division (excluding support as a graduate student)?

c) Are presently affiliated with an academic institution?

d) Are you a student?

III. Write Comments Below:

POLL RESULT SUMMARY
sent to: Ian MacGregor with copies to EAR program directors, head of GEO, and N. Lane (head of NSF)

I am sending this note as a representative of the Structure and Tectonics Division of GSA. This note and two following notes are simply an attempt to present information and I will try to avoid any commentary.

I have been receiving a deluge of e-mail after the Salt Lake meeting. This deluge of mail was brought about by your discussion at the SG&T business meeting--I don't know if I thanked you sufficiently at the time for doing that, but I think everyone who was there was really pleased that you were willing to discuss these issues openly. To say the least, the issue of the fate of Active Tectonics and the other initiatives got people very stirred up. After the SG&T business meeting, several people approached me to discuss the issue and there was a strong sentiment that we should, as an organization, poll the SG&T membership on the issues raised by your presentation. Given that sentiment, I drafted a summary of the discussion at the SG&T meeting and then had the SG&T management board as well as half a dozen other people read that document for additions and deletions. I hope we summarized the PRO's and CON's of the proposed changes adequately--please let me know if you think our presentation of the information was biased and I will pass that on to the membership.

At any rate, the result of our effort is the document below, which was sent out to the SG&T membership for their input. The message was sent to approximately 730 division members for whom we had e-mail addresses, and I got back 171 responses. If you consider that about 75 messages never made it to recipients for various reasons, that is a response rate of about 26%.

Among those who responded, the response was nearly a unanimous "yes" to question I:
Should the Earth Sciences Division of NSF reconsider its reorganization decision until such time as a complete study can be made on the merits of increasing funding to large interdisciplinary projects at the expense of single investigator/small group projects? (Y or N)

The actual vote was 157 yes, 14 no (note: even this number of no votes is slightly inflated because 4 people probably really meant yes based on their comments).

To give you an idea of who voted, part II asked background questions. 18 declined to answer these questions for a sample of 153. Of the 153, 18 had a history of CD funding, and all of these individuals voted yes on question I. There were 10 students (voted 9Y, 1N). 24 of the 153 were not affiliated with academic institutions, and of the remaining 129 academics, 93 had a record of NSF funding. These statistics indicate that the response was heavily weighted towards academics who receive or have received NSF funding; not surprising, since this is the community directly affected by this decision. Considering the proportion of responses from people who have had NSF money, the results of the poll likely represent the sentiment of the audience that will be most directly affected by NSF's change in policy.

We hope these numbers are of value to you and can be considered in the policy debate.

Best Regards,
Terry Pavlis
Past Chair,
Structure and Tectonics Division,
Geological Society of America

SUMMARY OF MEMBER COMMENTS FROM THE POLL
(prepared by the SG&T management board with editorial assistance from other division members)
sent to: Ian MacGregor with copies to EAR program directors, head of GEO, and N. Lane (NSF director)

I'm e-mailing you another file that contains all the comments that people included with the SG&T poll on the plans for reorganizations at NSF. That document is long and is simply in the order the messages were received. Many people repeat the same theme, so we have attempted to summarize the comments and provide our impressions of the message these comments convey. Please look at the comments, however, because there are some very thoughtful statements.

Point 1: This group leaves no doubt that they strongly oppose taking funds from the soon to be defunct AT, CSEDI, and ESH initiatives and rolling them into a revised CD program. There is a clear consensus that single investigator programs need to be protected. Whereas most people agreed that programs like CD have produced critical results that could not have been done under normal single investigator programs, the concern is that resources are being diverted more and more to those kind of programs at the expense of the small projects. In the absence of new funding, this is viewed as a threat to the community. You know this is a recurring theme, and is not new. To quote one of the members:
"Recall what cyberneticist Norbert Wiener had to say in a clipping I kept from almost half a century ago out of the Bulletin of the Atomic Scientists (Nov. 4, 1948, p. 338-339):`We are raising a generation of young men who will not look at any scientific project which does not have millions of dollars invested in it . . . We are for the first time finding a scientific career well paid and attractive to a large number of our best young go-getters. The trouble is that scientific work of the first quality is seldom done by the go-getters, and that the dilution of the scientific milieu makes it progressively harder for the individual worker with any ideas to get a hearing . . . .The

degradation of the position of the scientist as an independent worker and thinker to that of a morally irresponsible stooge in a science-factory has proceeded even more rapidly and devastatingly than I had expected.' "

We echo this member's concern and sincerely hope that NSF will study the potential consequences of the proposed changes before launching these changes.

Point 2: Despite the clear consensus that small programs need to be protected, most people support the need for "big science" projects to accomplish goals that could not be completed under the regular program structure. The key theme that runs through these notes is that people want to see the best science done with the resources available and that requires a balance among small and big programs. One impression we get from these notes is that the small vs large science issue may not be as important as a simple issue of a potential threat to tectonics in general. Presently tectonic studies have a clear focus in three separate program elements within EAR--the Tectonics Program and AT for small to intermediate size projects and CD for large projects--and equivalent numbers of programs in Ocean Sciences. If all EAR multidisciplinary projects get lumped into a new "big science program", will this program lose its focus on tectonic problems? There is a serious concern here that NSF could potentially kill the "goose that laid the golden egg" if management loses sight of the contributions tectonics has made to science. A recurring theme in these notes is that tectonics is already, by its very nature, a multidisciplinary program. Tectonics IS the integrator of diverse information in the earth sciences. If the proposed reorganization is trying to accomplish an increase in multidisciplinary science, this seems to be the wrong move. One division member stated this exceptionally well:

"And it's fairly clear that right now, the air is pretty heavy with 'systems' rubric. Most practitioners of, say, 'earth system science' or 'global change,' are doing interesting work. But the systems/global change banner has, perhaps inadvertently, taken on the status of a 'revolution,' even though it is impossible to identify anything radically new that these fields have to say about either the earth or how we should go about studying it, at least not beyond the standards of the last four decades. It has nonetheless been taken a basis for claiming that certain programs (read: tectonics) are in a torporous state and in need of intellectual rescue. The idea running along just below the surface is that the tectonics community, in the wake of plate tectonics (and certainly, prior to plate tectonics), is not thinking in terms of complex, interacting systems, and is now grudgingly being forced to see the "systems" light. This regretable bit of revisionism is undermining our opportunity to highlight our historical TRADITION of seeking unanticipated links between disparate earth processes as a basis for funding. As tectonicists, the range of tools we bring to bear on a problem (seismology, geodesy, thermochronology, isotopic tracers, thermobarometry, geologic mapping and structural analysis, paleomagnetism, paleobotany, paleoclimate, etc.) is an interesting experiment all by itself, and extraordinary compared with any other branch of science funded by NSF. Nowhere is it better seen in action than in the CD and Tectonics programs. Even the pre-plate tectonics discourse (e.g., investigators trained in biology and paleontology wandering the western Alps, using expertise in ammonites to piece together the sea-level history, paleogeography, and several phases of compressional history that gave rise to the nappe stack) was spectacularly holistic and 'systems' oriented. The claim that we are only now learning that unrelated pieces of the elephant must be viewed as connected, and that this constitutes a vital new approach in the earth sciences, is an hysterical insult. Rather than continuing to feed this baloney to NSF management, our message should be that because of our historical willingness to consider disparate observations as

potentially connected, we have consistently been responsible for some of the finest moments in all of science. This has to be said over and over. We should ask for support on the basis of our most recent successes, stressing that they resulted from this approach. We must always be on the lookout for hyperbolic claims that needlessly divide us. If we allow them to 'succeed,' we lose twice, because the "revolution" will fail to deliver and be exposed, while the majority of us distracted by the rigors of making real progress are wrongly tarred with the brush of complacency."

There is little to say beyond this member's statement, except perhaps that we hope that something can be done to communicate the importance of tectonic studies in science. An underlying reason for frustration among our membership is that many thought the AT initiative was a program that would carry the banner for tectonic studies. What more natural program to present to Congress as a major science project with societal relevance? Nonetheless, it appears that banner was never unfurled. In the past there has been more finger pointing than action on this issue, and it is our sincere hope that this communication will at least reopen the discussion on the importance of tectonic studies.

Point 3: A personality factor related to program directors is an underlying theme in many of the submitted comments. The group strongly supports Tom Wright's work in the Tectonics program and is suspicious of Leonard Johnson and the CD program. This echoes George Davis' statement at the SG&T meeting in Salt Lake City in which he expressed the perception of CD as a "closed shop". Some of us know both Leonard and Tom quite well, making this subject somewhat awkward. Nonetheless, we suspect that the negative perceptions result from poor communication to the community by Leonard. Tom Wright routinely writes notes to the SG&T division newsletter about developments in the Tectonics program and perhaps if Leonard did something similar there would be less suspicion of the CD program within the community.

In summary, we hope you can find the time to read these thoughtful comments from Division members. The magnitude of this response indicates the community's concern and we urge NSF to thoroughly study the "big science vs small science" issue and to thoroughly explain to the tectonics community how the proposed reorganization will promote better integrative and multidisciplinary research than is being carried out under the current programs. Several Division members indicated a willingness to assist in obtaining critical information necessary to evaluate this issue, so please call on us if you need assistance.

We are in the process of forming a new blue ribbon committee to examine some of these issues and to develop science plans for the tectonics community. The committee will want to communicate with NSF closely, and we hope NSF will work with them. We all share the goal of getting the most science from available resources, and we hope the Division as well as the Geological Society can assist in reaching that goal.

Finally, we hope this message serves to open a channel of communication between the Structural Geology and Tectonics community and NSF. We look forward to hearing your thoughts on these matters.

Management Board
Structural Geology and Tectonics Division, Geological Society of America
Terry Pavlis (past chair)
Vicki Hansen (chair)
Stephen Marshak (1st Vice Chair)
Art Goldstein (past Secretary/Treasurer)
Charles Onasch (Secretary/Treasurer)

Ian MacGregor Reply

Dear Dr. Pavlis,
I want to thank you for the somewhat precipitous opportunity to talk to the Structural Geology and Tectonics Division of GSA. Our "reorganization" is really just a confirmation of a management structure that has been in place in the Division for many years. There are some reorganizations of program lines which are primarily managerial, but as indicated in the GSA discussion, one significant change is the plan to expand the scope of the Continental Dynamics (CD) program. Correspondingly, it may be useful to spend a little time discussing the background for the planned changes.
Over the past twenty years, we have seen a significant change in the character of Earth Science research. At the onset, research was primarily disciplinarily based on the use of relatively simple inexpensive technologies that were readily distributed. This led to a Division that responded solely through disciplinary programs that distributed funds for research and the full range of infrastructural support. Over time, it became apparent that this management structure was not effective in dealing with the distributed needs for instrumentation and facilities that cut across the disciplines, nor in providing support for meritorious larger multidisciplinary, multi-institutional projects. The review of the Division through the Board on Earth Sciences' (BES, 198_) report, "Opportunities for Research in the Geological Sciences" emphasized this point. Thus in 1984, Continental Lithosphere (CL) and the Instrumentation and Facilities Programs were started. Both programs have been very successful in achieving many of the goals outlined in the original BES report.
As a preliminary focus, the workshop report, titled "A National Program for Research in Continental Dynamics: CD/2000", provided the primary intellectual guidance for the content of CL whose name was changed to Continental Dynamics (CD). CD has also had added responsibilities for other larger facility-related support, such as support for continental drilling, and provided support for larger proposals in disciplinary areas that extend beyond the stricter limits of Continental Dynamics.
In 1993 the Advisory Committee for Earth Sciences recommended two high priority areas for new research. This resulted in workshops held by the Active Tectonic (A.T.) and CSDEI communities to develop science plans. The groups also hoped to secure external funding for these areas of research, rather than to depend on redirected funds from within the Division. The latter goal was not successful. At the time when the initiatives were being developed, new funds came to the Division only through funds for special initiatives identified by Congress and there was little flexibility to promote research initiatives that stemmed from research community reports. Thus, what transpired was a redirection of EAR funds to enhance support for CSEDI and A.T. This process is tantamount to accepting the ACES judgement that these two areas of research provide a particularly critical threshold of opportunity that such redirection is warranted. The implementation decision resided primarily within NSF as an administrative decision and neither initiative was further evaluated within a peer-reviewed framework of other competitive options.
The current plan is to now formally expand the scope of CD to include access to all disciplines in the Earth Sciences that have need for larger scale, problem-focused multidisciplinary studies. For

convenience in this discussion, it may be useful to use the more generic term Multidisciplinary Programs (MP) to categorize the expanded CD. Associated with the expanded scope is the plan to fold the Active Tectonics and CSEDI initiatives into the new program. Researchers submitting proposals to these protected initiatives can continue to compete for funds in the core disciplinary programs and MP. Should the science advocate, and the quality of its practitioners be competitively excellent, researchers from both groups could stand to gain significantly over the more limited, currently protected budgets. The newly structured MP will now allow the multidisciplinary proposals that are an important part of each initiative to be normalized through the peer the review process rather than through administrative decisions.

As part of the clarification for this discussion, it must also be explained that both the Active Tectonics and CSEDI initiatives were started with funds reprogrammed internally from across all the disciplinary programs supported by the Division of Earth Sciences (EAR). The new plan will see the return of the funds set aside for CSEDI and A.T. to the general EAR budget. Critical to the change is the management of MP. Its significantly expanded scope will require broader cooperation amongst the disciplinary programs and a more comprehensive shared leadership. This latter issue has yet to be discussed, but will be a critical component to the success of the new MP.

For convenience in structuring my response, I will deal with the issues as categorized in your letter. The first point is the clear consensus that single investigator programs need to be protected. This point of view is one that would be endorsed by all disciplines supported by EAR and is central to the recommendations of external advisory groups that have provided advice over the years. Advisory group recommendations also reflect the view of the community in emphasizing the need to maintain balanced support for the physical, intellectual and educational infrastructure needed to maintain progressive research based on excellence. Correspondingly, it is necessary to deal with the more difficult task of balancing the needs of different disciplines, single investigator versus smaller or larger groups of researchers, multidisciplinary versus disciplinary research, the need for instrumentation and major facilities, the balanced role of encouraging the integration of research and education and the judgement of how to continue with the support of traditional research strengths while starting or emphasizing new approaches that may lead to the significant paradigm shifts that mould the vitality and relevance of the Earth Sciences. Much of this balancing act must be accomplished within the constraints of budgets whose purchasing power remains essentially constant.

A summary commentary on the first point is to acknowledge the importance of the single investigator, but recognize the balanced needs of other components required for a healthy research enterprise. At present, the combination of the CD program and the A.T.and CSEDI initiatives are allocated up to 11% of EAR funds. Although a management plan has yet to be completed, we would expect to see comparable support for the expanded scope of MP. The balance of funds provides for the research needs of single, or small groups of independent researchers, and the associated needs for the instrumentation, facilities and educational infrastructure.

Your second point includes a mix of concerns that include a potential threat to tectonics research, and an emphasis that tectonics is already an integrative, multidisciplinary science.

Concerning the potential threat to tectonics research, the changed structure will provide individuals or groups interested in tectonic studies at least two programs for submitting proposals for research funding. The first is the existing Tectonics Program and the second the new Multidisciplinary Program. It is correct that the merging of A.T. into MP will change the nature

of the competition for those with larger scale research ambitions, but the outcome as to whether funding for A.T.-style research will increase or decrease will depend on the merit of the proposals compared across all the disciplines supported by the Division. Single investigators or small collaborative groups can continue to submit to the Tectonics Program or other core programs as appropriate.

Like tectonics, much of the research supported by all disciplinary programs in the Division support a range from disciplinary to multidisciplinary studies. Tectonics has no monopoly in this regard. In a similar way, other groups of disciplines, like tectonics, have the need for conducting larger scale projects that cross disciplines and institutions and have been difficult to fund out of the core disciplinary programs. MP is meant to cover the same need.

The last point raised was the personality factor. Your comments are most disturbing. There are three levels of response.

The first concerns the management of CD. Triennial external reviews through the Committee of Visitors process has favorably reviewed the science and management of the program. My response is that CD has been managed effectively and examination of its awards show that it has supported a number of successful projects covering a wide range of the earth science disciplines. Comparable evaluations of the Tectonics Program have also resulted in complimentary reviews. When informed groups that have access to all the data are evaluating their performance, both programs are rated as similarly successful. In this context, I see no cause for alarm.

Secondly, on the issue of communication, it must be realized that the interests of researchers interested in tectonics may be more readily focused through the SG&T and Tectonophysics Sections of GSA and AGU, respectively. This focus has made it easier to link the Tectonics Program to its research community. Since the CD community is much more broadly based than that served primarily by the Tectonics Program, the problem of communication is more dispersed. This difference gives credence to George Davis' comments that poor communication has led to problems, although the source of information leading to the perception that CD is a closed shop is puzzling. As indicated in your summary letter and confirmed by the list of CD-funded projects, CD supports, or has supported, a number of awards that focus on the study of active tectonic systems.

The third concern is the personality factor of the Program Directors involved. This critique is colored by *ad hominem* attacks from a poorly informed base. It is important to realize that this problem stems from strong differences of opinion, within the Division, of the balanced need for special programs and facilities for larger projects, and associated indelible personality differences. Both factors lower the resolution to separate constructive critiques from personal *ad hominem* attacks. I fear that there has been too one-sided a promulgation of the differences of opinions that surround this issue. Extreme caution is required to sift the substantive from the invective. Obviously one message that is reaching the tectonics community is that CD is somehow negatively disposed to tectonic studies. The mix of proposals supported by CD and the intellectual guidance from the CD/2000 report would not support this allegation. In an environment where there is not adequate data for a public debate, I would suggest that wisdom dictates that we put this issue aside.

In addressing your summary comments, I urge you to move away from the simplistic notion of "big versus small" science. There is a comparable range of quality and significance in both big and small science, and in the earth sciences this must be scaled against the 10% to 11% fraction dedicated to larger sized awards. Each style provides an essential service to the dynamic intellectual growth of the earth sciences. What is needed is to maintain opportunities for both

types of science to flourish in a balanced manner so that there is a uniformity of excellence with associated care to maintain the vitality of both styles of research. The planned change is primarily designed to expand the opportunities for larger scale, problem-focused multidisciplinary science to all the subdisciplines, and to bring the existing interdisciplinary programs and initiatives together in an intellectually consistent manner. Merging A.T. and CSEDI into MP is one way unifying the intellectual competition. PIs planning research in A.T. and CSEDI areas will still have competitive environments where they may continue to seek funds for their research.

Our previous experience has shown that within the continuum of scales of multidisciplinary research, the separation of a program like CD, and now MP, has been essential to allow fair access for the larger, more expensive aggregations. As we work on the management strategy for the new program, I hope that we can develop a structure where all Programs can share in having a broad vision for the earth sciences overall as well as a narrower responsibility for single disciplines. Whether these changes will promote better integrative, multidisciplinary research is still up for debate. We have the experience that CD has been successful in supporting such a style of research, and for the future there are clear indications that many other disciplines now have competitive ambitions to conduct comparable studies. It is important to provide the enhanced opportunities to all the earth sciences.

In any system of management, setting up boundaries within a continuum is problematic, and in a sense, artificial. We have disciplinary boxes, infrastructure boxes, education boxes and now an expansion of a more explicit box for larger scale multi-disciplinary research. Our experience shows that it helps to pay explicit attention to these different modes of support to ensure that all categories have advocates who help play a balanced role in the mix of funding needed to support a vigorous scientific venture. At present we are starting a discussion on the details of managing MP and hope to make a full transition over the next one to two years. This will give adequate time to phase out the A.T. and CSEDI initiatives and prepare the community for the new MP program. In practice it will mean that A.T. and CSEDI will have had access to special funds for a three to four year and four to five year period, respectively. The temporary allocation of protected funds to both initiatives is in agreement with the philosophy of giving both communities a period of enhanced funding to stimulate new research styles and opportunities.

One of our major goals over the next two years is the development of a new Long-Range Plan. The Board on Earth Sciences and Resources (BESR) of the National Research Council has agreed to take on the task of assessing a priority framework across all earth science disciplines with their associated infrastructure needs. Your blue ribbon group could be a great help in this process.

I have read all the responses that buttress your summary. Many are very thoughtful and provide valuable insights that must be carried into this debate. However, in order to provide a timely answer, I have restricted my responses to your summary points interpreting that these are the issues of major concern. I would very much like to thank you for the opportunity to talk to the SG&T group, and the effort that your members put into assembling your collective opinions. I see this letter as the beginning of what I hope will be a constructive conversation. EAR will be holding a poster session on Tuesday morning at AGU. I hope that a significant number of our staff will be available to discuss this and other issues. You may want to alert your community of this opportunity.

I will be at the AGU meeting in San Francisco from Monday through Thursday and would be willing to get together with the GSA/SG&T group or possibly link with members from AGU's

Tectonophysics Section. Should you wish to plan a meeting, please e-mail me (imcgreg@nsf.gov) to arrange a schedule.

Ian MacGregor
Director, Division of Earth Sciences
National Science Foundation
4201 Wilson Blvd.
Arlington, VA 22230

Have You Heard...

It's a pleasure to begin this issue's column by announcing the names of those Division members whom GSA has honored as "50-year Fellows" ("GSA Today", November). The prestigious list is made up of **John C. Crowell, Raymond C. Gutschick, Warren B. Hamilton, L. F. Hintze, Samuel T. Martner, Robert B. Neuman, Howard J. Pincus, John J. Prucha, Howard H. Waldron,** and **Joseph L. Weitz**. Just think of the collective wisdom, experience, and contributions to our science of these ten individuals! Congratulations guys!

As is customary, a significant number of honors and awards have recently come to Division members. **Tanya Atwater** of UCSB is the latest member of our Division to join the National Academy of Sciences. At the same time, **John Dewey**, Oxford, was elected as a foreign associate of the Academy. Last summer, **Clark Burchfiel** traveled to Beijing as a guest of the Chinese government to receive a rare "Friendship Award". This is the highest award given to foreigners and was given to Clark for his scientific contributions to the People's Republic. China President Li Peng attended the reception to honor the awardees. **Richard Hoppin** and **Bennie Troxell** were recipients last year of GSA's Distinguished Service Award, and **Stephen G. Wells** was a co-winner of the Kirk Bryan Award of GSA's Division of Quaternary Geology and Geomorphology). **Parke Snavely Jr.**, a USGS geologist for 53 years and now emeritus, became the 4th recipient of the Thomas Dibblee Medal, which recognizes excellence in geologic mapping. Named for the legendary **Tom Dibblee**, who is still mapping California at the age of 85, the Medalist is selected annually by the Dibblee Foundation (external nominations are welcome; cf. http://dibblee.geol.ucsb.edu). The medal honors Snavely's mapping in the Cenozoic Coast Ranges of Washington and Oregon over many decades. Among those attending the awards ceremony in the field was **Tom Dibblee** himself, **Ray Wells** of the USGS, and Parke's son, **Parke, III**, who accepted the award in his Dad's absence because of illness. **Bob Yeats**, Earth Consultants International and emeritus prof from Oregon State, will receive the Michel T. Halbouty Human Needs Award on May 17th at the annual meeting of the AAPG in Salt Lake City. Our counterpart division in the Geological Association of Canada announces that their 1997 Best Paper Award by Canadian author(s) or on a Canadian topic goes to **Joe C. White** for his 1996 JSG paper "Transient discontinuities revisited: pseudotachylites, plastic instability, and the influence of low pore fluid pressure on deformation process in the mid crust," v. 18, p. 1471-1487.

News from academia is always a bit scanty in mid-academic year most new appointments are announced in the Spring. However, we have learned that **Becky Dorsey** has left the lofty Colorado Plateau of Arizona for the lowland greenery of Oregon's Willamette Valley. She has joined the faculty of the University of Oregon as a replacement for **Sam Boggs**, who is in the final states of a phased retirement. **Brendan McNulty** (UC Santa Cruz Ph.D., 1995, adviser

Othmar Tobisch) began a tenure-track position in structural geology at Cal State University at Dominguez Hills last Fall. Brendan, who had post-doc'ed at UCSC after graduation, is now working in the Cordillera Blanca of Peru. **Meg Coleman** (**Kip Hodges**, Ph.D. advisor) just finished a post-doc with **Tim Byrne** and accepted a one-year faculty position in the Environmental Sciences Department at Eastern Connecticut University. Structural geologist **John Shaw** (Princeton Ph.D., 1993) joined the faculty of Harvard in mid-1997. John left the Houston oil-patch (Texaco's E&P Technology Department) to take the position. Still in Houston, **Joe Satterfield** is now in his second year as a
geology instructor at San Jacinto College. His **John Oldow**-guided Ph.D. was completed at Rice in 1995. From neighboring Louisiana come news of the appointment of **Roy Dokka** as the first "Adophe G. Gueymard Distinguished Professor of Geology and Geophysics" at LSU. **Stuart Hardy** is leaving a post-doc position with **John Suppe's** 3D Structure Project (P3D) at Princeton for a faculty position at Manchester University in the UK. Former P3D posdoc **Delphine Rouby** has been awarded a CNRS scientist position in Rennes, France. Joining the P3D effort is **Gregg Erickson**, a recent Texas A&M Ph.D.

Sad news: **Peter Verrall**, whom many of you encountered during his long time association with Chevron, passed away suddenly last October in San Francisco. He was as vigorous and lively as always until the end. A great teller of tall tales and past adventures around the world always with a twinkle in his eyes he will be missed by his many friends in and out of the industry. Also gone from our ranks is **Jack Henderson** of the Geological Survey of Canada who passed away last July. Because of his years of support of student theses through his Survey mapping projects, the Canadian Tectonics Group has renamed their annual "Best Thesis Award" the "Jack Henderson Award for the Best Thesis."

Have you heard about the spectacular sub-glacial melting of the Icelandic Vatnajokull ice cap in 1996? You have if you've read the praiseworthy account of this event in the Sept. 2nd "EOS" by Pa´ll Einarsson and co-authors, or saw a well-illustrated article in last year's "National Geographic". A 7 km-long fissure eruption of basaltic andesite beneath the hundreds of meters-thick ice cap rapidly melted its base. Meltwater filled a nearby caldera, lifted its floating ice cap, and drained away to the south -- passing under 50 km of glacial cap until emerging as a torrential flood down multiple river valleys. Einarsson and co-authors estimate that 3.5 km 3 of meltwater was released between November 4th and 7th. Peak discharge occurred on the 5th and was "recorded" as ~ 45,000 m 3 /sec! Just how much water is that? Remember the great Upper Mississippi basin floods of the summer, 1993? On August 1, the Mississippi River's maximum flood discharge at St. Louis was measured at ~ 37,000 m 3 /sec -- only about 80% of the maximum flood discharge in Iceland. WOW! But ... the Icelandic flood discharge pales in comparison with estimated maximum discharge rates for the repeated ice dam failures and subsequent drainings of glacial Lake Missoula in the Late Pleistocene. V. R. Baker (1971, 1982) calculated a maximum discharge in the vicinity of Spokane, Washington, for the largest of the multiple "Spokane floods" as 21.3 x 106 m 3 /sec. WOW 3 !!! .

GAD

SG&T in Industry

Happening bunch...

Mobil's structure group is busy these days...not only did they recently hire **Ken Tillman** (UCONN, **Tim Bryne**, Ph.D. advisor) as a Senior Geologist after a 1-year post-doc with them, but they also hired **Rolf Ackermann** (Ph.D. from Rutgers University), who studied fault-population systematics with **Roy Schlische**. The news doesn't stop there, however, Mobil also added **Judith Sheridan** (Ph,D. from University of Oregon, **Ray Weldon**, advisor) as a 2-year post-doc. And, in a nice example of a collaborative effort between academia and industry, **Roy Schlische** is spending a nine-month sabbatical with Mobil, where he's working with **Martha Withjack** and **Gloria Eisenstadt** on a project studying oblique-slip faulting.

Going to the Gulf...

Emily Oatney, who will receive her MS from Oregon State University in June working on active faults and paleoseismology of the Himalayan foothills (**Bob Yeats**, advisor), has accepted a position with Chevron in New Orleans.

Change of pace...

Tim Needham moved from Badley Earth Sciences to BP Exploration in Middlesex, UK this past November. **Bill Shea** will be practicing his Norweigan come this March as he moves from Exxon Production Research to the Reservoir Technology sector of StatOil's Research Center in Trondheim.

A Division Loss...

Peter Verrall, a structural geologist who spent a long career with Chevron, died of a heart attack in his San Francisco home in November. His life and career were full and varied, and those of us who knew him well were often regaled with his warm and witty stories that included experiences climbing mountains and driving medical supplies during the Chinese civil war, and traveling throughout the world, including bungy jumping at age 70.

Peter's Ph.D. was from Princeton, after which he worked for Chevron in Trinidad and in Calgary; then in Spain, in Denver, and Iran. In Calgary, he was an integral part of the group that developed the use of balanced cross sections as a constraint on structural interpretations in thrust belts. He took over teaching the Chevron structural geology schools and, through the years, over 1000 Chevron geologists benefited from his knowledge and enjoyed his company. He continued to work on new ideas and was also a leader in developing the ideas of balancing extensional structures. He may have been one of a very few workers to be at the forefront of balancing sections in both thrusting and extension. Like many in industry, he did not publish extensively, but his insights and contributions have had a profound, indirect impact on a large number of structural geologists. Those of us that knew him, and had the chance to enjoy traveling with him, will miss him. We'll miss his good humor and his fine taste in wine. Along with us, those who didn't have the pleasure to know Peter have benefited from his numerous contributions and keen insights in structural geology.

Chuck Kluth
cklu@chevron.com

THE RESOURCE BIN

BOOKMARKS FOR INTERESTING WEB SITES

(why not e-mail the editors your favorites?)

Canadian Geoscience Council (look for "Newsnotes"):
uwaterloo.ca/earth/cgc.html

Canadian Tectonics Group:
craton.geol.brocku.ca/ctg.html
U. Texas (Austin) Perry-Castaneda Library Map Collection:
lib.utexas.edu/Libs/PCL/Map_collection/Map_collection.html
U. S. city/residence maps:
maps.yahoo.com/yahoo/
U. S. State Dept. travel information:
stolaf.edu/network/travel-advisories.html
travel.state.gov/travel_warnings.html
Center for Disease Control travel health advisories:
cdc.gov/travel.html
General earthquake information:
Southern California Earthquake Center:
Main page: **scecdc.scec.org/eqsocal.html**

Time-lapse animations of s. California seismic activity:
scecdc.scec.org/bymonth.html
Recent earthquake activity in northern and southern California:
scecdc.scec.org/recentqs
California seismic hazard maps:
consrv.ca.gov/dmg/shezp/maps.html
U.S.G.S.:
http://geology.usgs.gov/quake.html
National Earthquake Information Center:
http://gldss7.cr.usgs.gov/
U.S.G.S. Response to an Urban Earthquake-Northridge '94:
http://geohazards.cr.usgs.gov/northridge/
Recent quakes with a great map viewer:
civeng.carleton.ca/cgi-bin/quakes
U. S. geohazards:
geohazards.cr.usgs.gov/
Geodetic information (IGPP & Scripps Orbit and Permanent Array Center):
http://lox.ucsd.edu
JPL earth imaging radar:
southport.jpl.nasa.gov/
EarthRISE (Space Shuttle earth photo database):
earthrise.sdsc.edu/
National Geographic Society (worldwide geographic maps):
nationalgeographic.com/resources/maps
U. S. weather, The Weather Channel:
weather.com/twc/homepage.twc
WXP, the Weather Processor
(satellite images of Earth's cloud cover updated hourly):
wxp.atms.purdue.edu
NASA:
nasa.gov/

Earthwatch (environmental concerns):
earthwatch.org
Structural geology on the Web:
hercules.geology.uiuc.edu/~schimmri/geology/structure.html
Structural geologists on the Web:
home.earthlink.net/~schimmrich/structure/structure.html

Announcements

SG&T Division Short Course & Field Trip Scholarships
The SG&T Division announces a scholarship program to help defray student (undergraduate and graduate) costs for enrolling in SG&T Division-sponsored short courses and Division-sponsored field trips offered at GSA National Meetings. Ten $100 scholarships will be awarded. Division members will be given priority.
To apply, e-mail or FAX the following information in the following format to Division Chair Vicki Hansen (vhansen@mail.edu.smu; FAX 214-768-2701).

Name: _____
Institution: _____
Class (fresh, soph, junior, senior, M.S., Ph.D.):_____
Your major or specialty: _____
Are you a member of the SG&T Division?: _____
Are you presenting a poster or talk at GSA?: _____; if yes, provide title below.
_____
Title of short course or field trip.
_____

Write a one-paragraph rationale for taking the course/trip.
Applications will be accepted by e-mail or FAX begining at 4 pm EST September 7, 1998, and will be accepted until 4 pm EST September 11, 1998. Recipients will be notified on or before September 21.
Belt Association Research Grants for Students
Applications are invited for funds for geologic research by senior undergraduate students and graduate students conducting research on the Belt Supergroup. Grants are awarded on a competitive basis and usually range between $200-$1000. Policies, forms for grant applications, and the application deadline (usually in April) can be obtained by writing to the Belt Association, P. O. Box 1816, Spokane, Washington 99210.
Graduate Student Research Grants, Colorado Scientific Society
The Colorado Scientific Society announces the availability of research grants for M.S and Ph.D. earth science students involved in field-oriented studies in Colorado and the Rocky Mountain region or who undertake topical or field research in engineering geology. Approximately eight grants will be awarded in the $500-$1000 range, and one grant is available for an engineering geology thesis or dissertation with no geographic specifivity. Policies, procedures for grant applications and awards, and the application deadline (usually in April) can be obtained from:

The Chairman, Memorial Research Funds, Colorado Scientific Society, P. O. Box 150495, Lakewood, CO 80215-0495.

"Last Conference of the Millenium", Specialist Group in Tectonics and Structural Geology, Geological Society of Australia, February 14-19, 1999

Our Australian counterpart, the Specialist Group in Tectonics and Structural Geology of the down-under GSA, announces a conference to be held in the Grampians, Victoria, Australia. Papers will be presented on a wide range of topics in structure and tectonics, with some attention being given to reviewing progress in these disciplines ("The ghosts of structural geology -- past, present, and future"). There will be a pre- and post-conference field trip led by Chris Wilson across the Lachlan Fold Belt from west to east. The conference is sponsored by the Australian Geodynamics Cooperative Research Centre. For information, contact: Gordon Lister; gordon@artemis.earth.monash.edu.au; or Sarah Vaughn; sarah@earth.monahs.edu.au

"Evolution of Structures in Deforming Rocks"

26-27 September 1998 Canmore, Alberta, Canada

This international conference, to be held in honor of **Paul F. Williams**, is sponsored by the Geological Association of Canada (NUNA conference) and the Canadian Tectonics Group. It will provide a forum for discussion of the processes, mechanisms, and implications of the evolution of structures at different scales and in different geological settings. Contributions in all aspects, either theoretical, experimental or field-based, are welcome. A collection of papers presented at the conference will be published as a special issue of the *Journal of Structural Geology*. The conference will be followed by a two-day field trip in the Canadian Cordillera.

Contact:

Shoufa Lin, Manitoba Energy and Mines, Box 25-59, Elizabeth Drive, Thompson, Manitoba. Tel: (204) 677-6880; Fax: (204) 677-6888;

E-mail: slin@gsc.nrcan.gc.ca. Web-site:www.nrcan.gc.ca/ess/cgd/ctg98

Theme Session Summary

EXTREME CONTINENTAL EXTENSION: EXAMPLES FROM AROUND THE WORLD AND NEW INSIGHTS FROM QUANTITATIVE MODELING

Conveners: Richard Ketcham and Gabor Tari

John Hopper opened the session with a description of the modeling work that he and **Roger Buck** have been doing, in which the strength of the lower crust can be the principal factor in determining the large-scale structural expression that extreme extension will take. In their formulation, as the lower crust becomes weaker (due to being at higher temperature or composed of weaker material), the style of rifting naturally proceeds from narrow to wide to core-complex type. This talk largely set the stage for the rest of the morning, as it became apparent that the once-esoteric concept of lower crustal flow has solidly entered the mainstream of scientific opinion on how the lower crust accommodates extreme extension in core-complex settings.

Most of the overseas examples of extreme continental extension were presented by European colleagues working in the Alpine system. The Neogene-Recent extension in this broad area resulted in a number of very characteristic examples showing metamorphic core complex style

extension, quite similar to those described from the western United States. **Giovanni Bertotti** used numerical models to explore the behavior of the crust in the Tyrrhenian Sea, which features a progression from thinned crust in the north to crustal separation in the south. His group's results indicate that overall extension is best described by pure shear, but with a SE-migrating locus of stretching**. Pierre Gautier** surveyed a number of localities in the Aegean Sea, documenting a range of faulting styles that can be unified under a primary intense event in which a ductile lower crust rises and becomes brittle. **Roland Oberhaensli** and **Erdin Bozkurt** discussed the implications of new discoveries of high-pressure rocks and multiple deformational phases in the Menderes massif on the interpretation of extension in that western Turkey region. **Wolfgang Frisch** used palinspastic reconstruction to infer 55% extension in the eastern Alps, expressed as a "puzzle of rigid blocks" that was rearranged into an elongate shape. He also combined fission-track data with sediment mass balance to trace the details and modes of the differential uplift history across the region. **Luigi Ferranti** described hinterland extension that accompanied Neogene contraction in the southern Apennines. **Istvan Dunkl** presented a new thermal model that concentrates on the near-surface evolution of heat flow above a forming core complex, linking the results to apatite fission-track and vitrinite reflectance data in the eastern Alps. **Gabor Tari** presented perhaps the first example of a core complex without any surface expression, that was detected and interpreted exclusively using subsurface data. Other, very interesting examples of metamorphic core complex style extension were shown from New Zealand (**Spell**) and the Canadian Cordillera (**Vanderhaeghe**). **Terry Spell** described the Paparoa core complex, which occupies the unique tectonic setting of being related to extreme extension that ultimately led to seafloor spreading. **Olivier Vanderhaeghe** emphasized that large-scale extension in the Shuswap metamorphic core complex, as well as other localities in the Canadian Cordillera, is best understood as being the final stage of a long-term process that begins with thickening of cool crust, followed by thermal maturation, weakening and failure.

The afternoon began with talks with a more local flavor. **Kurt Constenius** described new work in the Wasatch Mountains that led him and his co-workers to suggest a reapportionment of deformation in the area. Rather than relying exclusively on the Wasatch normal fault for the exhumation of the range, **Constenius** found that a large component of their uplift may have come due to earlier movement on the Deer Creek Detachment system. **Michael Petronis** illustrated the use of paleomagnetic data to verify inferred tilting and rotation of the Silver Peak range of west-central Nevada. This talk marked the continuing expansion of the importance of paleomagnetic data in working out the often-complicated three-dimensional movement history of simultaneously evolving structures in core complex zones.

The focus of the session returned to modeling with a talk by **Ketcham** on the thermal state of the southern Basin and Range before extension. In what turned out to be the only talk presented in the session that diverged from the crustal-flow line, **Ketcham** argued that the available evidence indicates that the crust of the region was probably at a relatively "normal" temperature immediately prior to core-complex extension in the area. Insofar as numerical studies to date (such as **Hopper and Buck's**) require a very hot lower crust for large-scale flow of material, **Ketcham** suggested that the venerable megaboudinage core complex model might deserve a closer look in such situations.

This talk also produced the most vigorous exchange during the question-and-answer period.

Brian Wernicke took issue with **Ketcham's** statement that, while some workers were of the "opinion" that all core complexes are topographic lows, at least in some places they seem to be as high as they look. In particular, crustal roots and local block faulting associated with some core complexes, such as the Santa Catalina-Rincon, strongly implies that they are indeed locally compensated topographic highs. **Wernicke** cited his research findings that when regional topography was considered, core complexes are found to be low at the scales of flexural compensation. While his use of the word "opinion" was unfortunately undiplomatic, **Ketcham** expressed some skepticism of the study in question, as the regional topographic map that was used was constructed from a weighted moving average of elevation within a 3x3 grid of 15-minute quads. **Ketcham** thus pointed out that this map, constructed from sparse data on a non-square grid based on the curvature of the earth, is not the ideal basis for linking topography, flexural strength, and crustal thickness. This dispute is not an insignificant point, as gravity is the driving force of all lower-crustal flow models that seek to explain the relatively flat Moho. If the core complex remains a locally compensated topographic high, then this driving force is absent.

Nathan Niemi presented new data from the Caltech group on extreme extension in the Death Valley region. Fault offsets of 80-100 km continue the trend of huge surface displacement in the Basin and Range, and their estimated overall extension magnitude of 500% may be a new record. **Tom Hoisch** presented a new finite-difference thermal model of core-complex development that was able to simulate both fault-bend-fold and simple shear modes of characterizing the uplift of a core complex footwall over a shallowly-dipping rolling hinge. Application of his model to thermochronological data from the Raft River detachment provided further corroboration that a rotating-hinge geometry provides good approximation of the near-surface development and expression of detachment faulting.

Finally, **Karah Wertz** showed the results of an Al-in-hornblende geobarometric study that inferred the dip of the Chemehuevi detachment fault to be 33· (20· while it was active). This adds another element to the growing consensus based on paleomagnetic data that detachment faults in the southern and central Basin and Range initiated as and remained low-angle structures.

Theme Session Summary

ISOTOPIC MAPPING: THE "706 LINE" TWENTY YEARS LATER -- A TRIBUTE TO RONALD W. KISTLER
Conveners: Allen Glazner, Drew Coleman, and G. Lang Farmer

One of the most enduring lines on the map of the western United States has been the 87Sr/86Sr isopleth (the "706 line") defined in a landmark paper by **Ron Kistler** and **Zell Peterman** in 1973 ("Variations in Sr, Rb, K, Na, and initial 87Sr/86Sr in Mesozoic granitic rocks and intruded wall rocks in central California," Geol. Soc. Am. Bull., v. 84, p. 3489-3512). Since the original definition of the "706 line", it has been recognized as a fundamental isotopic, structural and paleogeographic boundary, and has served as a launching point for a plethora of additional isotopic mapping projects. A theme session to pay tribute to the contributions of **Kistler** and to explore new directions in isotopic mapping was organized for the 1997 National GSA Meeting.

The session was started by co-conveners **Drew Coleman** and **Allen Glazner** who took a brief look at the history of the "706 line" and suggested that isopleths mapped in the western US were reflections of variations in upper mantle chemistry rather than crustal chemistry. This also led them to conclude that the mantle could exert significant control on granite chemistry; a theme later echoed by **Andy Barth** and **Bill Nash**. The next talk by **Mihai Ducea**, **Jason Saleeby** and **Hugh Taylor** took a detailed look at the Sr, Nd and O isotope geochemistry of the roots of the Sierra Nevada batholith using crustal xenoliths. These authors concluded that the deep root of the batholith formed during generation of the exposed granites. Furthermore, although there is a crustal contribution to the root, it is significantly less abundant than previously thought. **Kistler** and **Duane Champion** presented the next paper. **Kistler** demonstrated that he still has his hand in isotopic mapping and showed reconstructions of Salinian plutons that revealed a zoned intrusive suite similar to those in the Sierras. **Barth**, **Dick Tosdal** and **Joe Wooden** presented data from the Transverse Ranges consistent with the idea that Mesozoic upper crustal rocks could not have inherited there Sr isotope geochemistry from their wall rocks, but mostly reflect their Proterozoic mantle lithosphere source. The session then concentrated on the Peninsular Ranges batholith with three talks by **Ian Ridley**, **Kistler**, **Doug Morton** and **Lee Silver**. These three talks provided an excellent summary of the continuation of **Kistler** and **Peterman's** original isopleths to the south, and demonstrated remarkable correlations between isotopic, trace element, structural and geophysical data sets in the Peninsular Ranges batholith. **Edwin Schauble**, **Taylor** and **Jim Wright** presented the last of a series of talks on plutonic rocks. These authors showed new oxygen isotope data combined with Sr and Nd isotope data for granitoid plutons in the Great Basin and concluded that the rocks had a crustal source. However, temporal variations in that source indicated that the structure and chemistry of the crust evolved quickly during Mesozoic and Cenozoic magmatism.

The next series of talks in the session concentrated on volcanic rocks in the western US. **Glazner** and **Jonathan Miller** started these off by presenting evidence for an east-west oriented boundary through the Coso Range that is apparent in the isotope geochemistry of young basalts, seismicity and regional topography. The origin of this boundary remains problematic, but promises to be an interesting subject of future research. **Allen Dodson**, **Don DePaolo** and **B. Mack Kennedy** presented a regional summary of new noble gas isotopic data for Tertiary basalts from the western US. They interpret their data to reflect distinct differences in the subcontinental mantle across the region with the west characterized by a more depleted signature (perhaps as a result of extensive Mesozoic and Cenozoic melt extraction) than the east. **Eric Christiansen** also noted east-west variations in the chemistry of volcanic rocks. He attributed the regional variations to reflect variations in a lithospheric "contaminant" and reemphasized the notion that two different lithosphere types are juxtaposed across the "706 line." **Robert Leighty**, **Steve Reynolds** and co-convener **Lang Farmer** showed data indicating that the source of basalts at the Colorado Plateau - Basin and Range transition zone also varies with time, progressing from LIL-enriched to LIL-depleted sources through three distinct episodes of Neogene extension. The series of talks on volcanic rocks ended with a talk by **Nash, Michael Perkins, John Christensen, Der-Chuen Lee and Alex Halliday** in which they showed a remarkable Nd and Hf isotope data set for air-fall tuffs from the Yellowstone hotspot. They document the motion of the hotspot from accreted terranes onto the craton between 16 and 14 Ma as evidenced by evolution of the isotope geochemistry of the tuffs. Furthermore, they suggested that the mantle had significant influence on the chemistry of the silicic tuffs.

The final three talks of the session explored the distribution of Proterozoic and Archean rocks in the western US. **Paul Mueller**, **Wooden**, **Ann Heatherington** and **Allen Nutman** started by presenting geochronologic and isotopic data indicating that Phanerozoic accreted terranes west of the Archean Wyoming craton are separated from the craton by Proterozoic rocks with geologic histories similar to well-defined Proterozoic sequences exposed much farther south. The next talk by **Wooden**, **Kistler**, **Tosdal**, **Allen Robinson** and **Wright** introduced Pb isotopic data into the mix. These authors presented a huge database and demonstrated that detailed isotope studies could be used to refine our understanding of lithospheric structure on local as well as regional scales. **Bob Fleck** and **Wooden** concluded the session with Sr, Nd and Pb data that demonstrate that the influence of Archean crust on the chemistry of Mesozoic and Cenozoic igneous rocks in the northwest US extends much farther west than recognized previously.

It is clear from the papers presented in this session that isotopic mapping promises to continue as a fruitful area of research, providing insight into problems ranging from the origin of the continental crust to regional lithospheric structure. The number and variety of papers presented was only a small tribute to **Ron Kistler**, but they demonstrate that his impact on Earth Science will be recognized for years to come. Thanks Ron!

Drew Coleman, **Allen Glazner, and G. Lang Farmer**

Theme Session Summary

Triassic-Jurassic structural and stratigraphic record of Cordilleran tectonics: Linking processes from the active margin to the Colorado Plateau

Convenors: Ron Blakey, Tim Lawton, Jim Wright, & Sandra Wyld

This session, sponsored by the Structural Geology/Tectonics and Sedimentary Geology Divisions, arose from two parallel theme-session concepts, one by **Ron Blakey** and **Tim Lawton** to explore the orogenic implications of Mesozoic Colorado Plateau stratigraphy and another by **Jim Wright** and **Sandra Wyld** to investigate the effects of Jurassic orogenesis from the active volcanic arc to the foreland. **John Bartley**, Technical Program Chair for the Salt Lake annual meeting, suggested blending the concepts, and the topic suggested by the title above grew from a blizzard of e-mail messages.

An important emerging theme of the session is that the nature of Jurassic orogenesis in the Cordillera depends upon whether one is considering the western or the southwestern margin of North America. The session opened with three papers that considered the southwestern margin, which was dominated by a strike-slip or transtensional tectonic style. **Bayona and Lawton** drew parallels between the late Mesozoic stratigraphy of the Southwest and Colombia to demonstrate that the breakup of Pangaea was a dominant influence on regional tectonic style. **Lawton et al.** presented evidence for magmatism associated with up welling asthenosphere during transtensional deformation along the international boundary between southeastern Arizona and Nuevo Leon and depicted fluvial drainage from an elevated rift shoulder onto the Colorado Plateau. **Bassett and Busby** postulated strike-slip basin formation during and following continental-arc magmatism along the southwestern margin of North America and suggested that a coeval transition from hyperarid to temperate climatic conditions is recorded in the volcaniclastic facies of the strike-slip basins and by a shift from eolian to fluvial deposits of the Colorado Plateau.

Three subsequent papers dealt with the record of deformation in the arc terrane of the western margin of North America, where crustal shortening dominates the mid-Mesozoic record. **Kays et al.** described long-term contractional deformation of the Blue Mountains island arc and Baker forearc terrane of Oregon prior to their accretion to the margin in the Late Mesozoic. **Fagan et al**. showed that the magmatic history of the Slate Creek arc and ophiolite complex in the northern Sierra Nevada of California took place over a protracted period of time from 200 to 160 Ma and that major episodes of magmatism were interrupted by a quiescent interlude marked by deposition of deep-basinal facies. **Hanson et al.** described rapid development of the continental-margin arc in the Northern Sierra Nevada during Middle Jurassic (Bajocian-Callovian) time in a setting marked by regional contractional deformation.

Two papers in mid-session synthesized early Mesozoic patterns of orogenesis from the arc to the foreland. **Wyld and Wright** summarized a pattern of inward-sweeping contraction through the Cordillera from Early to Late Jurassic time (200-150 Ma) and suggested that shortening migrated toward the foreland as crustal thickness of marginal terranes was progressively increased by contractional strain. **Blakey** illustrated the Triassic-Jurassic paleogeographic evolution of the Cordillera with a series of spectacular, you-are-there shaded relief maps that look like classic Rand-McNally images (does not constitute a trademark endorsement; see **Blakey**'s web site).

Several papers then considered the effect of marginal orogenesis and uplift on sequence stratigraphy and regional-scale depositional systems of the Colorado Plateau. **Marzolf and Reuter** suggested that deformational episodes along the western and southwestern margins of the craton created four unconformity-bounded tectonosequences in the Triassic and Jurassic of the Colorado Plateau region. **Marzolf and Steiner** suggested that the tectonosequences resulted from various causes, including waning and waxing of magmatic activity along the southern margin of the continent, contraction associated with geographic expansion of the arc, and terrane translations along the Mojave-Sonora megashear. **Riggs et al.** presented detrital-zircon data that show that Chinle river systems of the Late Triassic flowed westward from at least the Amarillo-Wichita uplift, and possibly from as far away as the Appalachians, to a deltaic terminus recorded by the Auld Lag Syne Group in central Nevada; drainage was strongly influenced by uplift along the southern margin of Pangaea.

Two succeeding papers cited evidence for foreland-migrating patterns of subsidence and uplift ahead of an advancing retroarc thrust wedge. **Currie** suggested that the Jurassic through Cretaceous sediment-accumulation history of the Western Interior requires a dynamic component of subsidence induced by the subducted lithospheric slab in addition to flexural subsidence induced by the crustal load of the thrust wedge. **Horton et al.** drew a parallel between eastward migration of the Mesozoic foreland-basin system of the North American Cordillera and the Cenozoic central Andean foreland-basin system of Bolivia, suggesting analogous temporal and geographic scales and similar tectonic origins adjacent to over thickened crustal plateaus, represented by the Altiplano and Eastern Cordillera of Bolivia.

The final three papers addressed the plate-tectonic aspects of Cordilleran deformation. **Steiner and Marzolf** linked paleomagnetically defined North American plate motion with the tectonosequences discussed previously and suggested that unconformities correspond to changes in North American plate motion defined by cusps in the APW path. **Sears** presented a mechanical map cut from a tectonic map of the Cordillera printed on an overhead transparency. Blocks that rotate at key pivots and slide past one another along major faults explain major aspects of Cordilleran rotations and displacements during the Late Cretaceous and Paleocene, including sinistral movement along the Lewis and Clark line and development of the Tintina trench. The

anchor paper by **Ward** summarized a four-phase model that explains a cyclic pattern of subduction that has been repeated four times since the beginning of the Triassic. He suggested that repeated cycles of waning subduction, extension, and strike-slip faulting explain cyclic episodes of contraction, batholith emplacement, metamorphic core-complex development, and creation of marginal-basin oceanic crust of the Cordillera.

The Jurassic was a time of significant change in the Cordillera, with crustal deformation and basin formation recording both the break up of Pangaea along its southern flank and ongoing subduction and collision along its western margin. The problem involves three interacting major plates combined with a plexus of smaller players in the form of marginal basins and exotic arc terranes, among others. Moreover, in the view of **Ward**, the subduction on the west margin was accomplished by a succession of different major plates during the Mesozoic and Cenozoic. These plate interactions created the collage we know as the Cordillera. A quarter century has passed since the first plate-tectonic analyses of the Cordillera were advanced to explain the observed evolution of orogenesis and basin formation, yet consensus has not yet been attained regarding the tectonic origins of many key events in the Cordillera. Significant advances have been made in inter-regional stratigraphic correlations and stratigraphic correlation tools, permitting the megapaleogeographic reconstructions such as that presented by **Riggs et al.** for the Late Triassic. Improvements in geodynamic models permit refinement of the comparisons of the Western Interior with analogous extant tectonic scenarios, such as the parallel drawn by **Horton et al.** between Bolivia and Utah. Finally, great efforts in radiometric dating throughout the orogen coupled with improved precision and ability to read through the mask of subsequent thermal events permit syntheses of regional orogenesis and postulates of cause and effect, illustrated by the analysis by **Wyld and Wright.** Each of these approaches provides constraints on possible models and advances hypotheses to test against the abundant data that already exist. What appears to be needed to improve understanding of the tectonic origins of major events in the Cordillera is an "orogenic systems" approach, a continued effort to establish links between coeval crustal deformation and sedimentation patterns over the entire region in order to predict and discriminate what may be rather subtle impacts of orogenesis on the stratigraphic record. This will require improved integration of biostratigraphy and radiochronology, as well as better understanding of potential tectonic analogues in the Recent. Successful construction and integration of diverse geologic data sets will require collaborative efforts by individuals with varied specialties in the Earth sciences, including the fields of geophysics, sedimentology and stratigraphy, structural geology, and igneous and metamorphic petrology

Tim Lawton
New Mexico State University

Geological Society of America Structure and Tectonics Divison 1997 Best Paper Award

Mantle dynamics, uplift of the Tibetan Plateau and the Indian monsoon, by Peter Molnar, Philip England and Joseph Martinod

Citation by Gregory A. Houseman

It is a great pleasure to commend the paper by Peter Molnar, Philip England and Joseph Martinod entitled "Mantle dynamics, uplift of the Tibetan Plateau and the Indian monsoon" (published in 1993 in "Reviews of Geophysics", v. 31, 357-396) for this year's Best Paper award of the Structural Geology and Tectonics Division. This review paper pulls together a

considerable body of evidence to argue the case that events in the mantle at around 8 Ma caused a rapid and widespread uplift of the Tibetan Plateau, the initiation of extensional faulting in the plateau, the strengthening of the Indian monsoon and a decrease in atmospheric CO2. This is an inspirational paper not only because of the broad spread of disciplines that it encompasses, but because of the clear and insightful way in which the arguments are assembled and the causal links are explained.

These authors have previously made major contributions to understanding the dynamical balance that is expressed in the continental collision between India and Asia, beginning perhaps with the 1975 "Science" paper by Peter Molnar and Paul Tapponnier, in which the continental collision is described in terms of the indentation of a plastic sheet. The 1982 "Geophysical Journal" (RAS) paper by Philip England and Dan McKenzie introduced the means to quantitatively calculate the finite deformation field for the collision, using thin viscous sheet models. Since those early days a long sequence of important papers, in which these authors have played a leading role, have shaped our understanding of all aspects of the collision.

It is therefore very fitting that Peter Molnar, Philip England and Joseph Martinod are recognized here tonight for this masterful review paper which builds on a considerable body of theoretical and observational work from many areas of geology and geophysics and, moreover, introduces to a geological audience the body of evidence from climate change and atmospheric physics that also bears critically on this subject. Their review is however, much more than a compilation. The structure of the paper builds to a compelling logical argument that convective thinning of the mantle lithosphere occurred beneath Tibet some 8 Myr ago. This was an event that is beyond the usual scale of direct geological description. There are no direct measurements or observations of the convective thinning process, but it has left a profound mark in the geological record, witness the history of faulting in Tibet, deformation in the Indian Ocean plate, and strengthening of the monsoon. Once again we are reminded of the dependence of our eco-system on the basic geological processes that occur within the Earth.

This paper is obviously well structured and written, but it is a delight to read because of its overall coherence, with each section developed independently, all bringing a different line of evidence to bear on the central theme. The paper does such a fine job of illustrating how science has progressed in this area that I think it should be recommended (if not required) reading for new graduate students in any area of Earth Sciences.

Congratulations Peter, Philip and Joseph ! We look forward to your future contributions.

Response by Peter Molnar (Read by Jane Selverstone)

Thank you, Greg, for your generous remarks and Terry, for reading them in his absence. The paper being honored tonight tells a story of unstable mantle dynamics causing a rapid uplift of 1-2 km of the Tibetan Plateau about 8 million years ago that in turn triggered an abrupt strengthening of the monsoon. That story obviously was, and remains, speculative; we have been under no illusion that it is right. Many people whom we respect had ignored it, and some told us it could not be right. We saw its virtues as including the integration of seemingly disparate observations and the tying them together with simple, quantitative physical arguments. What more could one expect of such a paper, overtly written as a review of work largely by others? Thus, despite doubts of its veracity, this paper had already given us much satisfaction. Its recognition here tonight implies that others appreciate the merits of using simple quantitative

arguments to understand separate processes and to tie them together, even where the link between the basic observations and the final deduction is tenuous. Whether our paper is worthy of the attention you give it here is for you to decide, but we certainly agree that such an approach is necessary if we are to push the forefront of science forward a bit.

It is customary for recipients of awards to thank the many people who have made their work possible. As our paper was a review paper with citations to the work on which it is based, and because it contains a long acknowledgment with thanks to many people, I will break with that tradition and indulge you with a few details of the paper's origins, which share some commonality with noteworthy papers, but which also differ.

Like all speculative ideas, the roots of ours were well in place for a long time, but needed a trigger to pry them loose. Like most, the trigger was a criss-crossing of two seemingly non-intersecting perspectives. First, a talk given by Mark Harrison in December 1992 on aspects of the work that he had done with Peter Copeland, Bill Kidd, and An Yin on Tibet (and published in *Science*) spelled out most of the correlated phenomena that we exploited. Second, Joseph Martinod had just written a draft of a paper discussing the force per unit length needed to deform the Indian Ocean lithosphere. Joseph had circumvented the large uncertainties in "strength" inherent in laboratory measurements of rocks and minerals, uncertainties that when ignored permit a spectrum of mutually exclusive models to account for the same phenomena. It suddenly was clear that we could test cause-and-effect relationships among the phenomena that Harrison and his colleagues had correlated. When I contacted Philip, it was obvious that he had figured a lot of this out already.

Our paper needed another timely ingredient - freedom. As has been sung repeatedly for 25 years, freedom is synonymous with "nothing left to lose." In my case, "nothing" included funding. I would have been faced with a pink slip, if Tom Jordan, our Department Head, had not already recognized the likelihood of my going in the red and set aside funds to pay me. Suddenly, I not only had 3 months to work on what I chose, but also something interesting to pursue. (Of course, Tom may have subtly suggested how I might optimize this "free" time, but those of you who know us both surely realize that my oblivion to subtlety exceeds his mastery of that art.)

More bluntly, the message here is that this paper would have been very different, and perhaps not written at all, if it had been necessary to write (and rewrite) a proposal to NSF to do the work and then wait the requisite six months to a year to start. Roentgen discovered X-rays in November, 1895 and realized what he had in December. His paper was delayed by the Christmas holidays and not published until December 28, 1895. Our ponderous system clearly obstructs our freedom to pursue what turns us on. Students! Stay that way as long as you can; you may never experience such freedom again.

I would like to conclude by calling attention to another fortunate circumstance that made it possible to carry the development of our paper to its conclusion, the Indian monsoon. The center of the Earth Sciences in the 19th Century was fossils. In the first half of the 20th, it was rocks, but over the last 50 years, isotopes, seismograms, and magnetic anomalies have advanced our field most. The 21st Century will see the fluid earth become the intellectual focus of our science, not just the atmosphere, oceans, and core, but also water in the crust, the convecting mantle, and even the (albeit very viscous) continental lithosphere. I cannot stress enough the virtue of having strong programs in meteorology and oceanography *within* our department at MIT, and especially the presence of scientists eager to understand how atmospheric and ocean circulation affect climate, *before* they try to integrate these processes into a complicated model. This is the future.

Thank you again Structural Geologists and Tectonicists. Thank you, Greg, both for your kind words and for the contributions you have made to this subject. We asked you to write a citation, because we felt that if anyone should share in the recognition given to this work, it should be you. Finally, thank you Jane for reading this on our behalf.

Congratulations to **Hans Ramberg** for receiving the 1997 Division Career Contribution Award! See GSA Today for presentation details.

Please don't forget to submit nominations for both the career contribution award and the best paper award for 1998 (see enclosed forms).

Future Meetings, Conferences, & Courses

[Notices of future events of interest to Division members are welcomed by the editors]

1998

Mar 16-18: Seismological Society of America Ann. Mtng.: Boulder, CO. Sponsor: SSA; phone: (510) 525-5474; fax: (510) 525-7204; email: snewman@seismosoc.org

April 7-9: GSA Cordilleran Sect. Mtng., Cal. State University, Long Beach, California.

Apr 18-20: Geological Association of Canada-Mineralogical Association of Canada Annl. Mtng.: Quebec City, Canada.

April 27-30: Modern preparation and response systems for earthquake, tsunami and volcanic hazards: Santiago, Chile. Contact: Bruce Bolt, Dept. of Geology and Geophysics, UC Berkeley; fax: (510) 845-4816; email: boltuc@socrates.berkeley.edu

April 29-May 4: Pre-Variscan terrane analysis of Gondwanan Europe: Dresden, Germany. Contact: Bernd D. Erdtmann, TU Berlin, Institut fur Andewandte Geologie II; fax: 49-30-314-21107; email: erdt0936@mailszrz.zrz.tu-berlin.de

May 11-15: International workshop on the geology and geophysics of Tenerife: Tenerife, Canary Islands. Contact: Joan Marti, Institute of Earth Sciences, Barcelona, Spain; phone: 34-3-330-27-16; fax:34-3-411-00-12; email: joan.marti@ija.csic.es

May 17-20: AAPG Ann. Mtng.: Salt Lake City. Phone: (918) 560-2679; fax (918) 560-2684.

May 18-21: GAC/MAC annual meeting: Quebec. Contact: Conference Secretariat Quebec 1998, Universite´ Laval, Quebec; phone: (418) 656-2193; fax: (418) 656-7339; email: quebec1998@ggl.ulaval.ca.

May 20-21: Response of the Earth's lithosphere to extension: London. Sponsor: The Royal Society of London. Contact: R. B. Whitmarsh, Challenger Seafloor Processes Division, Southampton Ocenaography Centre, European Way, Southampton SO14 3ZH, U. K.; phone: +44-(0) 1703-596564; fax:+44-(0)1703-596554; email: bob.whitmarsh@soc.soton.ac.uk

May 21-Jun 4: 6th U.S. National Conference on Earthquake Engineering: Seattle, WA. Sponsors: Am. Soc. of Civil Engineers; Earthquake Engineering Research Cntr. Contact: E. Arscott, EERC, 499 14th St., suite 320, Oakland, CA 94612-1934; phone: (510) 451-0905; fax: (510) 451-5411; email: eeri@eeri.org. Abstract deadline has passed.

May 25-26: GSA Rocky Mtn. Sect. Mtng., Northern Arizona University, Flagstaff, AZ.

May 26-29: AGU Spring Meeting: Boston. Contact: email: meetings@kosmos.agu.org

June 4-12: Evolution of ocean island volcanoes (GSA Penrose Conference): Galapagos Islands, Ecuador: Contact: Dennis Geist, Dept. of Geology, Univ. of Idaho; phone: (208) 885-6491; fax: (208) 885-5724; email: dgeist@uidaho.edu
June 28-July 3: The Interior of the Earth: Henniker, N.H. Contact: M. Gurnis, Seismology Lab, Caltech, Pasadena, CA 91125; phone: (818) 395-6979; fax: (818) 564-0715.
Jun 28-Jul 5: Gondwana 10: Event stratigraphy of Gondwana (international conference): Rondebosch, South Africa. Contact: Organizing committee - Gondwana 10, Dept. of Geological Sciences, Univ. of Cape Town, Rondebosch 7700, South Africa; fax: 27 21 650-3167; email: gondwana@geology.uct.ac.za; http://www.uct.ac.za/depts/cigc
June 29-July 2: 15th Caribbean Geological Conference: Kingston, Jamaica. Contact Trevor Jackson, c/o Dept. of Geography & Geology, Univ. of the West Indies, Kingston 7, Jamaica; fax: (809) 977-6029 or (809) 927-1640.
July 4-11: Processes of crustal differentiation: crust-mantle interactions (GSA Penrose Conf.): Verbania, Italy. Contact: T. Rushmer. Dept. of Geol., Univ. VT; trushmer@zoo.uvm.edu
July 6-11: Evolution of the deep crust in the central-eastern Alps: Padua, Italy. Sponsor: Univ. of Padua; contact: Sylvana Martin; phone: ++39-49-827-2054; fax ++39-49-827-2070; email: silvana@geol.unipd.it; www.unipd.it/wwwgeol/convegni/deepcrust

July 11-17: IAVCEI International Volcanological Congress '98: Rondebosch, South Africa.Information: Secretariat, IAVCEI 1998, Dept. of Geol. Sciences, Univ. Cape Town, Rondebosch;fax:27-21-650-3783; email:ivc98 @geology.uct.ac.za; http://www.uct.ac.za/depts/geolsci/ivc98/
July 21-25: Western Pacific Geophysics Meeting: Taipei, Taiwan. Contact AGU Meetings Dept., 2000 Florida Ave., Washington, DC 20009; phone: (202) 462-6900; fax: (202) 328-0566; email: meetinginfo@kosmos.agu.org
Aug. 10-16: Generation and emplacement of ophiolites through time (int'l. symposium, field trip): Oulo, Finland: Contact: J. Vuollo, Dept. of Geology, University of Oulo, FIN - 90570 Oulu, Finland; fax: 358-81-5531-484; email: vuollo@ sveka.oulu.fi

Aug. 17-20: 5th International Symposium on the Jurassic System: Vancouver, B. C. Contact: Paul L. Smith, Earth and Ocean Sciences, Univ. British Columbia, 6339 Stores Rd., Vancouver, V6T 1Z4; phone: (604) 822-6456; fax: (604) 822-6088; email: psmith@eos.ubc.ca; http://www.eos.ubc.ca/ jurassic/announce.htm
Sept. 10-20: IGCP Project 367 final meeting and INQUA Shorelines and Neotectonics Commissions: Corinth and Samos, Greece. Contact: Stathis Stiros, Inst. of Geology and Mineral Exploration, 70 Mesoghion St., Athens 11527; fax: 30 1 775 2211; email: stiros@prometheus.hol.gr; or, Anton io Pirazzoli; email:pirazzol@cnrs-bellevue.fr
Sept. 7-11: Early warning systems for the reduction of natural disasters (conference): Potsdam, Germany. Contact: EWC98, email: ewc98@gfz-potsdam.de
Sept. 26-27: Evolution of structures in deforming rocks: Canmore, Alberta, Canada. Contact: Shoufa Lin, c/o Geol. Survey of Canada, Ottawa; fax: (613) 995-7997; email: slin@gsc.nrcan.gc.ca; http://www.nrcan.gc.ca/ess/cgd/ctg98/
Oct. 4-8: The geologic record of natural disasters: Portland, OR. Contact: Judy Tarpley, SEPM; phone (918) 493-3361, ext. 22 (outside No. Am.); (918) 865-9765, ext. 22 (No. Am.); fax: (918) 493-2093; email: cemeet@galstar.com

Oct. 19-23. Precambrian-Paleozoic interactions between Laurentia and Gondwana: Oaxaca, Mexico. Contact: J. D. Keppie, Instituto de Geologia, Universidad Nacional Autonoma de Mexico; phone: 52-5-622-4303; fax: 52-5-622-4269; email: duncan@servidor.dgsca.unam.mx
Oct. 26-29: Geological Society of America Annual Meeting, Toronto. Abst. deadline: 7/13.
Dec. 1-3: Origin of the Earth and Moon (conference): Monterey, California. Sponsors: Geochemical Society, Lunar and Planetary Institute, NASA. Contact: LeBecca Simmons, Lunar and Planetary Institute, Houston, Texas; phone: (281) 486-2158; fax: (281)486-2160; email: simmons@lpi.jsc.nasa.gov. Deadline for hard-copy abstracts, Aug. 28; for electronic abstracts, Sept. 4; for preregistration, Oct. 30.

1999

Feb 15-19: "The Last Conference of the Millennium", Halls Gap, Victoria, Australia. Sponsor: SGTSG. Contact: Sarah Vaughan, email: sarah@earth.monash.edu.au.
April 26-28: Thrust Tectonics 99, Royal Holloway University, London, Egham, Surrey. Contact: Dr. Ken McClay, email: ken@gl.rhbnc.ac.uk
Jun 6-9: Vail Rock '99 Symposium, "Rock Mechanics for Industry", Vail, CO. Sponsor: ARMA. Contact: ExpoMasters, phone: (303) 771-2000; fax: (303) 843-6212; email: mcramer@expomasters.com.

1997-1998 Structural Geology and Tectonics Division

Chair
Vicki L. Hansen
Department of Geological Sciences
3225 Daniel Ave.
Southern Methodist University
Dallas, TX 75275-0395
ph: 214-768-4179; fax: 214-768-2701
vhansen@mail.smu.edu

First Vice Chair
Stephen Marshak
Department of Geology
University of Illinois
1301 West Green St.
Urbana, IL 61801
ph: 217-333-7705; fax: 217-244-4996
smarshak@uiuc.edu

Second Vice Chair
Jane Selverstone
Dept. of Earth & Planetary Sciences
Northrop Hall
200 Yale Blvd. NE
University of New Mexico
Albuquerque, NM 87131-1116

ph: 505-277-6528; fax: 505-277-8843
selver@unm.edu
Secretary-Treasurer
Charles M. Onasch
Department of Geology
Bowling Green State University
Bowling Green, OH 43403
ph: (419) 372-7197; fax: (419) 372-7205
conasch@bgnet.bgsu.edu
Past Chair
Terry Pavlis
Department of Geology and Geophysics
University of New Orleans
New Orleans, LA 70148
ph: 504-280-6797; fax: 504-280-7396
tpavlis@geology.uno.edu
Newsletter Co-Editors
Greg Davis
Department of Earth Sciences
University of Southern California
Los Angeles, CA 90089
ph: 213-740-6726; fax:213-740-8801
gdavis@usc.edu
Scott Wilkerson
Department of Geology & Geography
DePauw University
Greencastle, IN 46135
ph: 765-658-4666; fax: 765-658-4732
mswilke@depauw.edu
This newsletter is published biannually by the Structural Geology & Tectonics Division of GSA.