

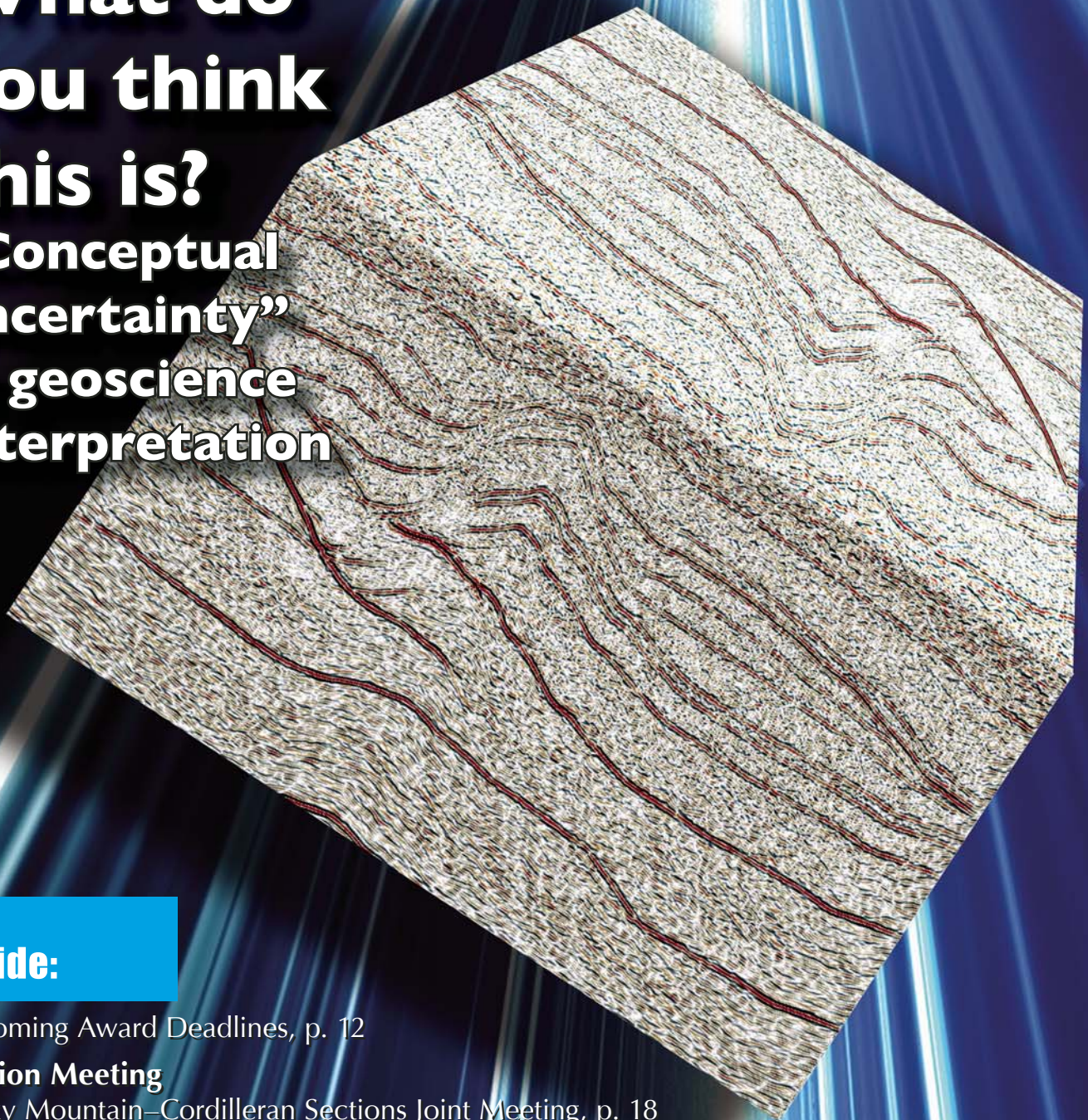
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NOVEMBER 2007

**What do
you think
this is?
“Conceptual
uncertainty”
in geoscience
interpretation**



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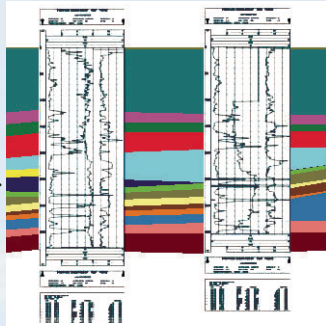
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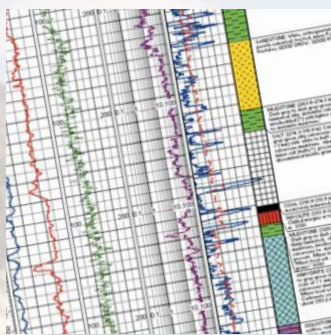
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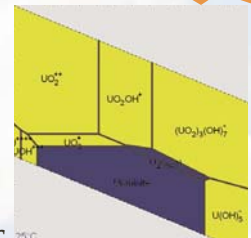
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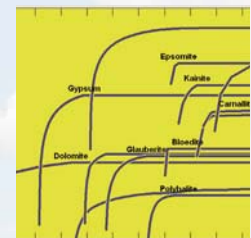
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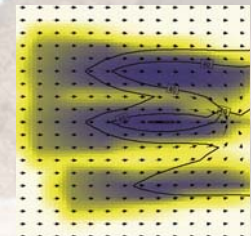
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Cover: 2-D seismic section used in the study at the heart of this month's science article. See "What do you think this is? 'Conceptual uncertainty' in geoscience interpretation" by Bond et al., p. 4–10.

SCIENCE ARTICLE

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What do you think this is? “Conceptual uncertainty” in geoscience interpretation

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ABSTRACT

Interpretations of seismic images are used to analyze subsurface geology and form the basis for many exploration and extraction decisions, but the uncertainty that arises from human bias in seismic data interpretation has not previously been quantified. All geological data sets are spatially limited and have limited resolution. Geoscientists who interpret such data sets must, therefore, rely upon their previous experience and apply a limited set of geological concepts. We have documented the range of interpretations to a single data set, and in doing so have quantified the “conceptual uncertainty” inherent in seismic interpretation. In this experiment, 412 interpretations of a synthetic seismic image were analyzed. Only 21% of the participants interpreted the “correct” tectonic setting of the original model, and only 23% highlighted the three main fault strands in the image. These results illustrate that conceptual uncertainty exists, which in turn explains the large range of interpretations that can result from a single data set. We consider the role of prior knowledge in biasing individuals in their interpretation of the synthetic seismic section, and our results demonstrate that conceptual uncertainty has a critical influence on resource exploration and other areas of geoscience. Practices should be developed to minimize the effects of conceptual uncertainty, and it should be accounted for in risk analysis.

INTRODUCTION

Geoscientists are required to make predictions from geological data that are often sparsely distributed or incomplete. For example, boreholes and seismic surveys sample limited volumes and have a limited resolution. Geoscientists use these data to produce geological framework models (3-D representations of stratigraphic horizons and fault planes) and to determine properties such as lithology and permeability. Components of these framework models will always be characterized by some uncertainty due to the inherent incompleteness of geological data sets. Quantifying this uncertainty is important because geological framework models are often used as the basis for assessments and decisions that have important social and commercial implications (e.g., resource extraction, ground-

water supply, CO₂ and nuclear waste storage, solute transport, and earthquake and other geological hazard predictions).

Quantification of uncertainty in geological framework models in petroleum geoscience has concentrated on such parameters as the petrophysical properties of reservoirs (e.g., Egermann and Lenormand, 2005) and the resolution and processing of seismic data (e.g., Jones et al., 2007). In petrophysical models, predictions of reservoir permeability are based on water saturation data (Aguilera, 2004), pressure measurements, log data, well cores (Yan et al., 2006), and the like. These data are used to predict heterogeneities in reservoir properties and to calculate uncertainty parameters for flow simulations. Geostatistics, particularly in reservoir modeling, is widely used to aid in reservoir forecasting, uncertainty calculations, and risk analysis for decision making. Understanding the limitations in geostatistics is critical if it is to be used as a decision-making tool (Deutsch, 2006). Defining the limitations of geostatistics and uncertainty in interpretation is important for (1) acknowledging and assessing possible alternatives to a single interpretation; (2) highlighting areas within an interpretation that are less well constrained; (3) propagating uncertainties into further modeling or risk assessments; (4) combining and rationalizing different, seemingly inconsistent data sets and/or types; and (5) educating management, politicians, and the general public about scientific uncertainty.

We have called the range of concepts that geoscientists could apply to a single data set conceptual uncertainty. Geoscientists use their training and experience (i.e., their prior knowledge) to apply a concept (or rarely, to generate a new one) to data to construct an interpretation and, ultimately, to produce a framework model. We suggest that the initial geological framework model is a fundamental source of uncertainty because it is dependent on the tectonic paradigm or concept used in its construction. We argue that conceptual uncertainty can be more important than the uncertainty inherent in the positioning of horizons or fault planes in a framework model or in the subsequent populating of these features with petrophysical properties.

In this study, we have attempted to quantify conceptual uncertainty from 412 interpretations of a single synthetic seismic data set. In collating the interpretations of a large number of geoscientists with different backgrounds and experience, we have effectively constrained the range of concepts that could be applied to the synthetic seismic. In effect, we have defined the “conceptual uncertainty space” of that data set. We have examined the role of prior knowledge in seismic data interpretation and have highlighted examples in which the prior knowledge of individual geoscientists appears to have affected their interpretational choices and final outcome. In particular, we looked at examples of how expertise in particular tectonic settings, length of experience, and type of training and interpretational techniques used may have affected interpretational

behavior. We also considered the influence of the broader contextual information a geoscientist uses in his or her interpretation. In the Discussion section of this paper, we make suggestions for more rigorous studies of conceptual uncertainty and discuss the significance for interpretation and prediction in geoscience.

Use of prior knowledge is the main method by which scientific disciplines progress and evolve (e.g., Levi-Strauss, 1966; Kuhn, 1962), and commonly described human biases form part of the way we use prior knowledge to interpret data (e.g., Frodeman, 1995). Cognitive bias commonly results from using heuristics or rules of thumb based on experience (prior knowledge). In cases of interpretational uncertainty, bias from prior knowledge is well documented in other disciplines, such as economics. In these disciplines, theories, such as elicitation theory, are used to mitigate against bias from prior knowledge. Baddeley et al. (2004) noted that heuristics are often used when making quick decisions or in instances when data are difficult to process or are limited in extent. Curtis and Wood (2004 and references therein) have provided examples and discussions of the use of prior knowledge in geoscience. However, few actual studies of the effects of prior knowledge in geoscience have been undertaken, with the exception of a study by Rankey and Mitchell (2003), who undertook an experiment to document the variation in interpretation of a data set by six seismic interpreters.

EXPERIMENT DESIGN AND PROCEDURE

To document the range of potential interpretations from a single data set and to test whether prior knowledge is important for interpretational outcomes, we asked geoscientists to produce a single interpretation of a seismic section. Rather than ask geoscientists to interpret a real section for which the “answer” is unknown, we created a synthetic seismic section from a 2-D geological model. Forward modeling enabled us to produce a geological model from an initial layer-cake stratigraphy so we could define the model input parameters and evolution, allowing us to compare interpretations against a “correct”

answer. The synthetic seismic section (in two-way time) was printed as an A4 color plate (Fig. 1) with a series of questions on the reverse.¹ In 2005 and 2006, we asked 412 geoscientists (*participants*) to make interpretations (*answers*) at conferences, workshops, and universities. These events took place in Europe, North America, and the Middle East. We questioned participants on factors we thought might have influenced their interpretations, including the participant’s educational level, length of experience, background expertise, and perception of his or her ability in structural geology and seismic interpretation. If you would like to try the interpretation experiment for yourself, bear in mind that Figure 2 and the next paragraph contain the “answer” to the synthetic seismic section.

We forward modeled an inverted growth fault (i.e., extension followed by thrusting on a single structure; Figs. 2A–2D). The model was designed so that a number of realistic interpretations could be made from the single synthetic seismic data set (Fig. 2E). Details of the model and synthetic seismic generation can be found in the GSA Data Repository (see footnote 1). In the experiment, participants were deliberately given little information about the seismic section and its generation. However, if the participants had taken the time to carefully read the information on the reverse of the seismic image, they would have learned that the seismic section they were being asked to interpret was synthetic. The introduction to the questionnaire included the sentence, “The section overleaf has been created by forward modeling using known assumptions.” However, few of the participants who engaged in conversation about the exercise appeared to appreciate this fact.

We wanted to test the *range* of concepts that would come out of a simple interpretation exercise. We therefore did not ask the participants how they would have tested their interpretations. In a real geological situation, once a preliminary model or hypothesis has been generated, it is generally tested by collecting further data or by checking the validity, for instance, by restoring the section. In our study, the participants were only asked to produce a single interpretation and were given no further information than that on the questionnaire. This precluded

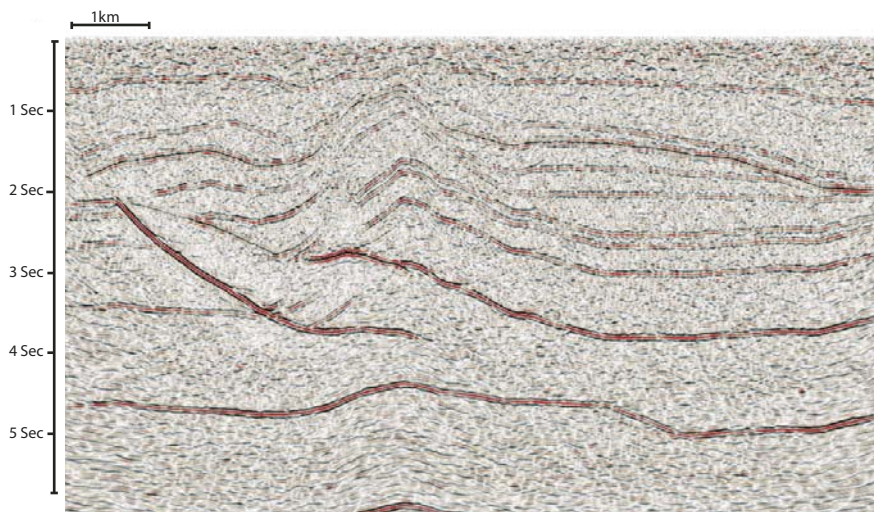


Figure 1. What do you think this is? The uninterpreted synthetic seismic section used for this study. The synthetic seismic and questionnaire given to participants can also be found in the GSA Data Repository (DRI; see text footnote 1).

¹GSA Data Repository item 2007280, Uninterpreted seismic section and example questionnaire (DRI) and geological model details and synthetic seismic generation (DR2), is available at www.geosociety.org/pubs/ft2007.htm. You can also obtain a copy by writing to editing@geosociety.org.

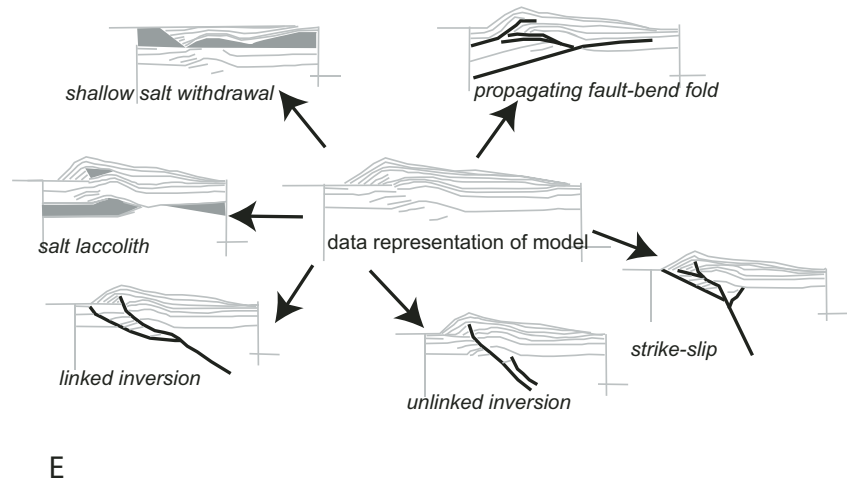
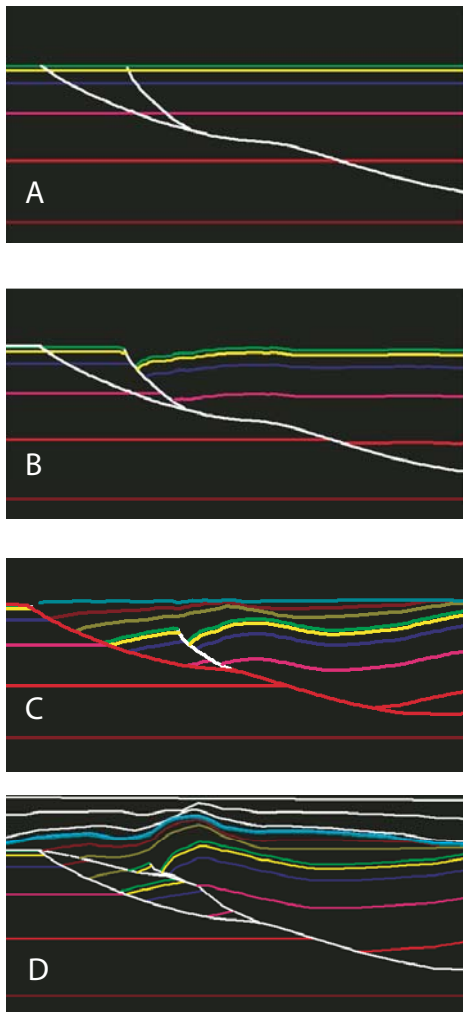


Figure 2. Production of the geological framework model. (A–D) show stages of the forward modeling in 2DMove (the model used the inclined shear algorithm, and isostasy and compaction were assumed not to have first order effects). Details of the forward modeling are found in the figure and in the GSA Data Repository (DR2; see text footnote 1). (E) Examples of interpretations of the synthetic seismic image, proposed prior to the experiment.

participants from forming multiple models that could then be compared and rejected based on such testing.

RESULTS

We sorted the returned interpretations into the following tectonic setting categories: extension, thrust (shortening), inversion, strike-slip, diapirism (salt or mud), other (geological setting identified but not included in the list), and unclear (tectonic setting could not be identified). Many answers contained more than one of these tectonic setting elements; in these cases, the dominant or main tectonic setting was chosen. Strict selection criteria (horizon offsets, arrows or labels to define fault motion, and/or written annotations) were used to categorize the answers to reduce our own bias in the sorting procedure. Because of these strict sorting criteria, 32% of participants' answers had to be classified as unclear. One reason for the small number (2%) of strike-slip answers returned is that out-of-plane displacement cannot be seen in a vertical seismic section. None of the participants annotated in- or out-of-plane movements, even those who explicitly stated they had a strike-slip interpretation. For the “apparently” strike-slip answers, we considered the geometric arrangement of faults, but only classified the answer as strike-slip in cases where there was no ambiguity. The 5% of answers in the “other” category fell out-

side the range of the common tectonic settings categories we had chosen.

The range of tectonic settings implied by the interpretations is summarized in Figure 3. The answers span all five tectonic concept categories (inversion, strike-slip, extension, shortening

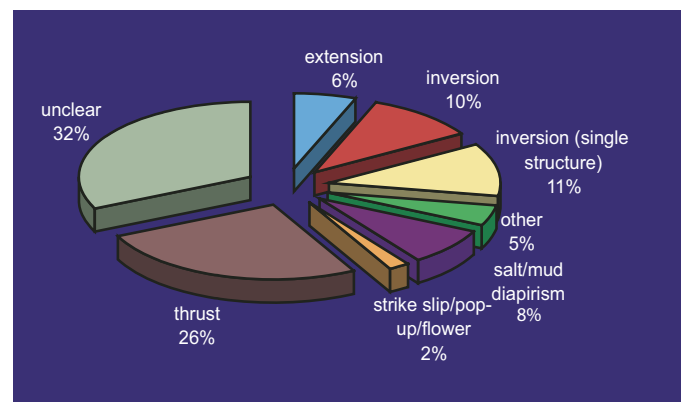


Figure 3. Pie chart showing the relative proportions of interpretations by tectonic setting. Thrust-based interpretations were the most common, accounting for 26% of the total. Inversion of a single structure, as in the forward model, accounted for only 10% of answers. Overall, inversion within the section was recognized by 21% of participants.

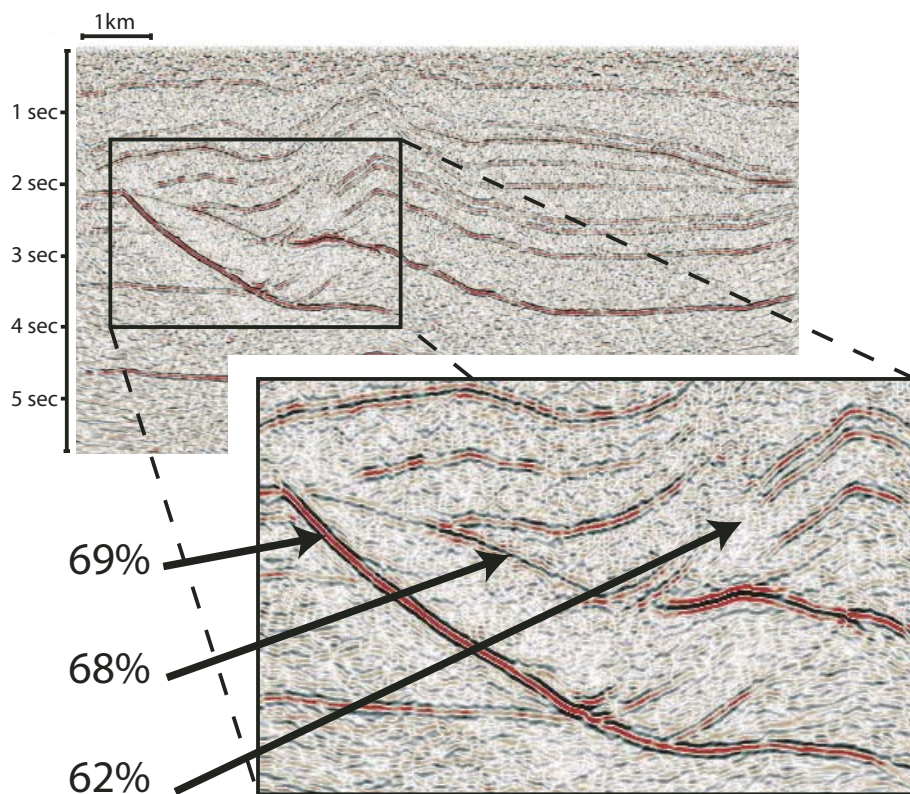


Figure 4. The uninterpreted synthetic seismic section with the three most frequently interpreted features annotated (inset). Percentages refer to the percentage of participants that highlighted each feature.

[thrust], and diapirism). Participants also applied nontectonic concepts to their interpretation, such as carbonate reefs and sequence stratigraphy concepts (5%), further extending the conceptual uncertainty for the data set. Only 10% of answers showed the “correct” inversion model, as produced in the forward model. This increases to 21% if we include participants who showed both extension and thrusting in their interpretation. In the rest of this article, inversion is classified as extension and thrusting anywhere in the section, for instance, extension on one fault and shortening on another. Across all the tectonic setting expertise groups the most common interpretational answer (26%) was a thrust (shortening) tectonic setting. The results show that 79% of the participants applied the wrong concept in their interpretation and that the most common answer was not the “correct” scenario created in the forward model.

The features most commonly singled out in the seismic image were areas of high- or low-intensity signals. High-intensity features would normally indicate an acoustic impedance contrast and therefore a geological feature or change in rock

property (e.g., Brown, 1986). The two main fault segments, areas of high-intensity signals on the image, were highlighted by 69% and 68% of participants, respectively. The next most common feature interpreted, highlighted by 62% of participants, is an area of almost no data (Fig. 4). In the original model, this area of no data is a small fault splay in the hanging wall to one of the main faults. Many participants annotated diapirism or a gas chimney in this area.

In the following sections, we look at examples in which the prior knowledge of individual geoscientists appears to have directly influenced the concepts they applied in their interpretations of the seismic image. We show examples of how expertise, experience, and training influenced the concepts applied and hence the final interpretation. Finally, we consider the reliance of interpreters on a breadth of geological and geographical information to support their interpretations of a data set.

Expertise (Tectonic Setting)

Participants were provided with a list of tectonic settings (extension, inver-

sion, thrust, salt, strike-slip, and other) and asked to indicate their dominant field of expertise. Some participants indicated more than one expertise category; the following analyses do not include these participants. Twenty-nine percent of the participants who indicated thrust tectonics as their dominant field of expertise interpreted the section as thrust faults, while 27% of participants with some other expertise also produced a thrust fault answer. Of the participants with dominant expertise in inversion, 25% produced an inversion interpretation, whereas of those without inversion expertise 20% produced an inversion interpretation. Participants with dominant expertise in extension and diapirism were more likely to produce an answer that matched their expertise than participants with some other dominant expertise (extension expertise 10% as compared to 3% other expertise; diapirism expertise 13% as compared to 7% other expertise). The only group in which the dominant expertise negatively correlated with interpretational outcome, when compared to other geoscientists, was strike-slip (strike-slip expertise 0% as compared to 3% other).

Examples can be found for all settings where those with a specific expertise appear to have allowed this to dominate their interpretations. Figure 5 shows two examples from students who described their expertise as salt tectonics and sequence stratigraphy, respectively, and who produced interpretations that appear to be based directly on their expertise. In Figure 5B, a master’s student in sequence stratigraphy has used classic sequence stratigraphy interpretation techniques: maximum flooding surfaces, onlaps and truncations to interpret a reef build-up. In Figure 5A, a Ph.D. student in salt tectonics shows doming associated with salt mobilization. Although these participants have honored the data, they have chosen to interpret it in a way that fits with their dominant expertise and knowledge. By applying these dominant concepts to the data set, they have produced an “incorrect” interpretation. In other examples, interpreters have not honored the data, perhaps due to inexperience in seismic interpretation.

Tectonic setting expertise seems to have influenced the concepts some participants brought to their interpretation.

However, the percentage differences between the expertise categories are not all statistically significant, and the examples of interpretations that match dominant expertise are not seen across the group as a whole. The results suggest that one or more other factors also influenced the concepts applied to a data set by an individual. It is important to note that we asked for the participants' dominant expertise rather than their breadth of expertise, and, additionally, we did not take into consideration how proficient each participant may have been in seismic interpretation.

Experience (Length)

To evaluate how length of experience affects conceptual uncertainty, interpreters were asked to choose the length of time that they had technical experience, from none, student, 0–5 years, 5–10 years, 10–15 years, and 15+ years. In the study group, students were just as likely to produce an “incorrect” answer (76%) as participants with 15+ years experience (76%). Like the student examples in Figures 5A and 5B, two professionals with the same level of experience (15+ years) interpreted the seismic image at a petroleum industry conference and produced answers that matched their dominant tectonic setting expertise (Figs. 5C and 5D). Both marked the same features in the top part of the section as faults. The first interpreter, with dominant expertise in

thrust tectonics, interpreted the features as thrust faults. The second interpreter, with extensional expertise, marked the features as extensional faults. Neither of these features are faults in the original model (Fig. 2D). These results indicate that participants with a greater number of years of experience did not necessarily produce more “right” answers.

Interpretational Techniques

We classified the answers according to the interpretational techniques applied to analyze and interpret the data. We defined five technique classifications from the interpretations: (1) identification of features, in which the participants had highlighted features such as faults, gas chimneys, unconformities, etc., by drawing along them; (2) identification of horizons, where participants had drawn along horizon reflectors and/or identified sediment packages; (3) drawing “sticks”—participants simply drew straight lines on the seismic section; (4) annotation, where participants used arrows and writing to annotate features and horizons; and (5) sketches and/or writing, where participants wrote a description of their interpretation of the seismic section or drew sketches to show the evolution of their interpretation through time. Examples of the different classifications can be seen in Figure 6. The different styles have an effect on the identification of specific features

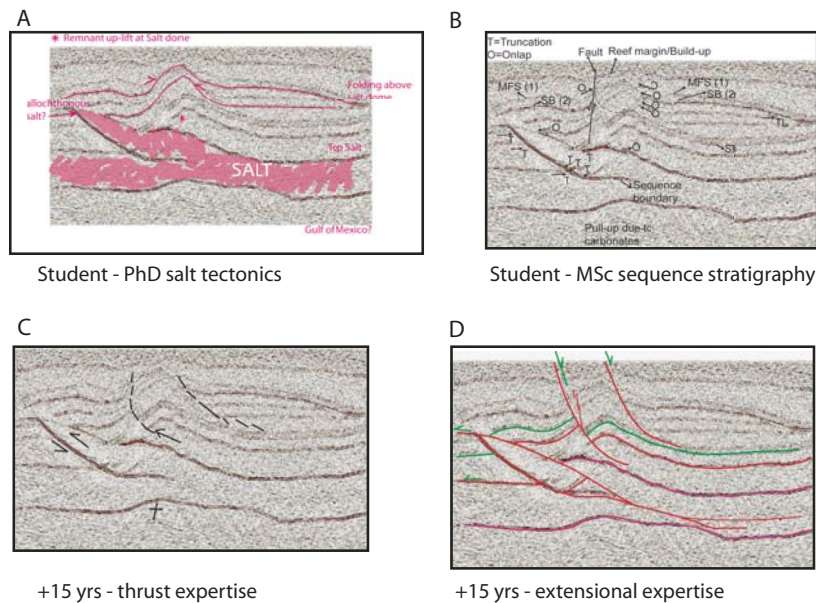


Figure 5. (A and B) Digitized examples of the interpretations of two students who have experience in sequence stratigraphy and salt tectonics, respectively; (C and D) different participants each with +15 years experience interpreted the same structures as thrust and extension faults. Their fields of expertise were thrust and extension tectonics, respectively.

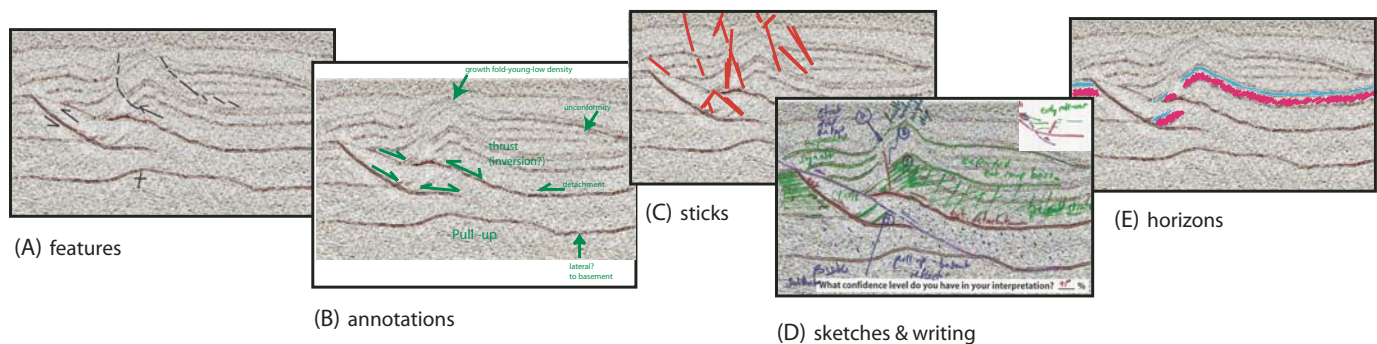


Figure 6. Digitized answers showing the range in interpretational styles of the participants. Each example corresponds to one of the technique classifications: features, annotations, sticks, sketches and writing, and horizons.

(e.g., participants whose interpretational style included feature identification were ~30% more likely to identify the main fault strands than participants who just identified horizons). Table 1 groups the participants by the number of techniques they used to complete their answer. The participants who used the most techniques were most likely to get the “correct” interpretational answer. Both of the two participants who used 4 out of the possible 5 techniques produced the “correct” answer.

DISCUSSION

We have documented the breadth in conceptual uncertainty for a single data set. The interpretation produced most often was a thrust-based interpretation rather than the “correct” forward modeled scenario of inversion. There are several non-unique and geologically sound solutions to the data set (Fig. 1E); therefore the small percentage (21%) of correct interpretational answers that matched the forward model and the range of concepts applied to the data set is perhaps not surprising.

Observations of participants’ interpretations suggest that they used a range of prior knowledge to undertake the interpretation exercise. In some cases, but significantly not all, prior knowledge based on dominant tectonic setting expertise appears to have biased the concepts participants applied to the data set (Fig. 5).

These observations contrast with those of Rankey and Mitchell (2003) who concluded that interpretations are likely to be based on previous experience and preconceived notions. Our results suggest that other factors, such as an individual’s training and the techniques used to interpret the section, may have more influence on interpretational outcome than tectonic expertise. How we define prior knowledge is important when comparing our results to those of other workers.

It is interesting to note that participants with more experience (measured as number of years of experience) did not necessarily produce more “correct” answers. This suggests that type of experience is more significant than length of experience alone. How participants defined their own length of experience was not constrained (i.e., did participants who were two years into a Ph.D. count themselves as students or as having two years post-degree experience?). Similarly, we asked participants for their dominant expertise rather than their breadth of expertise, and it is likely that a participant with expertise in more than one tectonic setting may be better able to distinguish between likely interpretations. These initial results suggest that more than one controlling factor influences conceptual uncertainty; therefore, a full multivariate statistical analysis is required to establish significant relationships.

TABLE 1. NUMBER OF TECHNIQUES PARTICIPANTS USED IN INTERPRETATIONS AND PERCENTAGE OF PARTICIPANTS IN THESE SUBGROUPS WHO MADE A “CORRECT” INTERPRETATION

Number of techniques used	Number of participants using each technique	Percent who produced a “correct” answer (inversion)
4	2	100
3	31	52
2	202	25
1	176	13

Note: Out of five possible techniques (features, annotations, sticks, sketches and writing, and horizons), the maximum number of techniques used was four. The more interpretational techniques used, the more likely the participant was to interpret the seismic image correctly, with those using four or more techniques achieving 100% success at the “correct” interpretational answer.

Participants used a range of interpretational techniques that led to different styles of answers. Our results show that the greater the number of techniques used by individual participants, the greater their chances of producing a “correct” interpretation. We believe that the number of techniques used serves as a proxy for the intensity with which each participant queried the data. Those who used the most techniques may have scrutinized the data more thoroughly than participants who used fewer techniques. However, some techniques, such as feature identification, also appear to be more effective than others at identifying key elements within the seismic section.

The effect of the techniques employed and interpretational style applied to the interpretation of the data set have implications for training and education.

Interpretations of the synthetic seismic image focused on areas of high- and low-intensity signals. Areas of low-intensity responses in seismic images are often caused by disruption of layering due to diapirism or gas percolation through the overlying strata (e.g., Bouriak and Akhmetjanov, 1998; Veerayya et al., 1998), and many participants marked such features in an area of poor data quality, even though this part of the section was not crucial to the overall tectonic interpretation. Sixty-two percent of participants focused their interpretations on an area of no data (i.e., an area of high uncertainty). Annotating gas or diapirism in this area, a direct hydrocarbon indicator, could be critical in a commercial situation. The need to interpret the part of the synthetic seismic image with the least data perhaps says something about human nature, but it also suggests that participants were drawn to anomalous areas with the highest and lowest intensity data.

In the following, we consider the influences of different types of prior knowledge and bias for our study in the context of definitions from psychology. In cognitive psychology, biases are commonly divided into types. The most relevant bias types for this study are described here, but see Krueger and Funder (2004) for a full discussion of bias types and their origins. *Availability bias* occurs when interpreters use the model or interpretation that is most dominant in their minds. For example, a geoscientist interpreting a new data set having just spent six months looking at fold and thrust belts will have the concepts for fold and thrust belt terrains most readily available in his or her mind. *Anchoring bias* is the failure to adjust from experts’ beliefs, dominant approaches, or initial ideas. In this case, interpreters may know that a seismic section is from, for example, the Gulf of Mexico, and will therefore have the concept of salt tectonics in their minds because this is the accepted interpretational concept for the Gulf of Mexico area. Interpreters will not consider other concepts in their interpretations. *Confirmation bias* involves actively seeking out opinions and facts that support one’s own beliefs or hypotheses. For example, when a geoscientist believes that the seismic section is from an extensional terrain, he or she will identify features that support this belief and ignore information that does not corroborate or correspond to an extensional interpretation.

Examples of bias based on dominant tectonic setting expertise can be found at all levels of experience. Individual participants with 15+ years experience anecdotally show evidence of *availability* and *anchoring* bias in the same way students do. Participants do, however, require some experience to undertake the exercise because an interpreter has to be able to apply relevant knowledge and concepts to the data to produce a realistic

interpretation. Many participants asked “where in the world?” the seismic section was from. Participants were effectively asking for *confirmation*, provided by such context, for their interpretations. Alternatively, they may have been seeking a starting point on which to base their interpretations. Typically, when interpreting geological data, the geographical location and, hence, broad tectonic setting of the data is known and interpreters use this prior information to aid their interpretations. Therefore an *anchoring* bias may operate because interpreters expect to see a particular type of structure in a given setting.

We suggest that the synthetic seismic image may have been effectively biased toward a thrust tectonic setting interpretation because this setting received the highest number (26%) of answers. Conversely, the 2-D seismic section was negatively biased toward a strike-slip interpretation, the tectonic setting category with the lowest number (2%) of interpretational answers. As discussed earlier, many answers that we classified as strike-slip may have fallen into the unclear category due to the selection criteria used to categorize the results. This suggests that we may be seeing elements of both *confirmation* bias and *disconfirmation* bias (the use of features as evidence *against* a particular hypothesis or model) within the participant group: participants confirming thrust features, but disconfirming strike-slip features.

Interpreting geological data is generally an under-constrained problem, requiring knowledge of geological analogues and an ability to apply these to new problems and areas. Frodeman (1995) set geology apart from classical sciences, such as physics, because of the scientific reasoning required in geological science. Frodeman argued that such scientific reasoning skills will become increasingly crucial for issues like global warming, assessing uncertainty and risks in hazard prediction, solute transport, and resource management. In earth and environmental science, scientific uncertainty has an important impact on public policy formation. Pollack (2007) argued that scientific uncertainty should not be seen as a barrier to public policy development but as an opportunity for creative and competitive solutions that can be continuously developed. Assessing uncertainty and risk requires accurate geological framework models from which predictions can be made. Therefore, as geoscientists, acknowledging and evaluating conceptual uncertainty must be a critical factor in maximizing the effectiveness of the geological reasoning process and hence for informing public policy. Understanding more about the factors affecting the concepts that geoscientists apply to information-limited data sets will improve our predictions and the assessment of risk associated with those predictions.

CONCLUSIONS

Conceptual uncertainty is likely to be a major risk factor for sciences in which decision making is based on the interpretation of data sets containing limited information. Our experiment has quantified the range in conceptual uncertainty for a single data set and shown that conceptual uncertainty can have a large effect on interpretational outcome. The interpretational answers of participants in our study show evidence for bias due to their prior knowledge. A range of factors affects how an individual's prior knowledge and hence concepts are applied to data sets. These factors include an interpreter's tectonic expertise and/or breadth of expertise, the length of his or her experience, and the type of techniques an interpreter uses to interpret a section. Distinguish-

ing between these different factors and putting practices in place to elicit intelligent information while mitigating against the unconscious negative use of prior knowledge is a key challenge. Conceptual uncertainty, once quantified, can be used in combination with petrophysical models and other uncertainty calculations to increase the predictability of petroleum and other geological systems and their properties. How an individual geoscientist's prior knowledge may influence his or her interpretation and hence affect the collective conceptual uncertainty for the data set has important implications for training, team building, risk analysis, and decision making. Our results emphasize that a geological interpretation is a model that needs testing.

ACKNOWLEDGMENTS

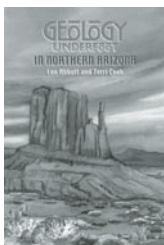
This work was supported by Midland Valley Exploration Ltd and the Scottish Executive SCORE scheme. Midland Valley's 2DMove software was used for forward modeling. Mike Goodwin and GX Technology are thanked for creating the synthetic seismic image using GXII software. The work could not have been completed without the support of individuals within the geoscience community who took part in the interpretation exercise. Andrew Curtis, Glen Stockmal, and Andy Calvert provided thorough and constructive reviews.

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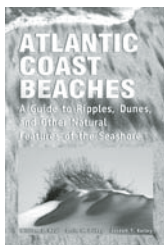
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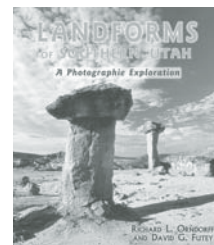
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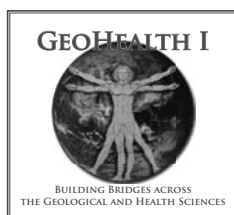
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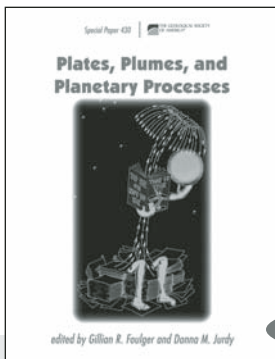
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If you click on "About GSA" on the Geological Society of America Web site, you'll find both a mission and vision statement describing the focus for our Society. Points from these statements note that GSA is "promoting the geosciences in the service of humankind" and "supporting the application of geoscience knowledge and insight to human needs, aspirations, and stewardship of the Earth."

This acknowledges that many geologists are not teaching or conducting research in geology; rather, they are applying it as staff for environmental, engineering, hydrogeology, mineral development, and energy exploration firms. Many are also involved with policy and planning organizations or as specialists for national, state, or local governmental agencies.

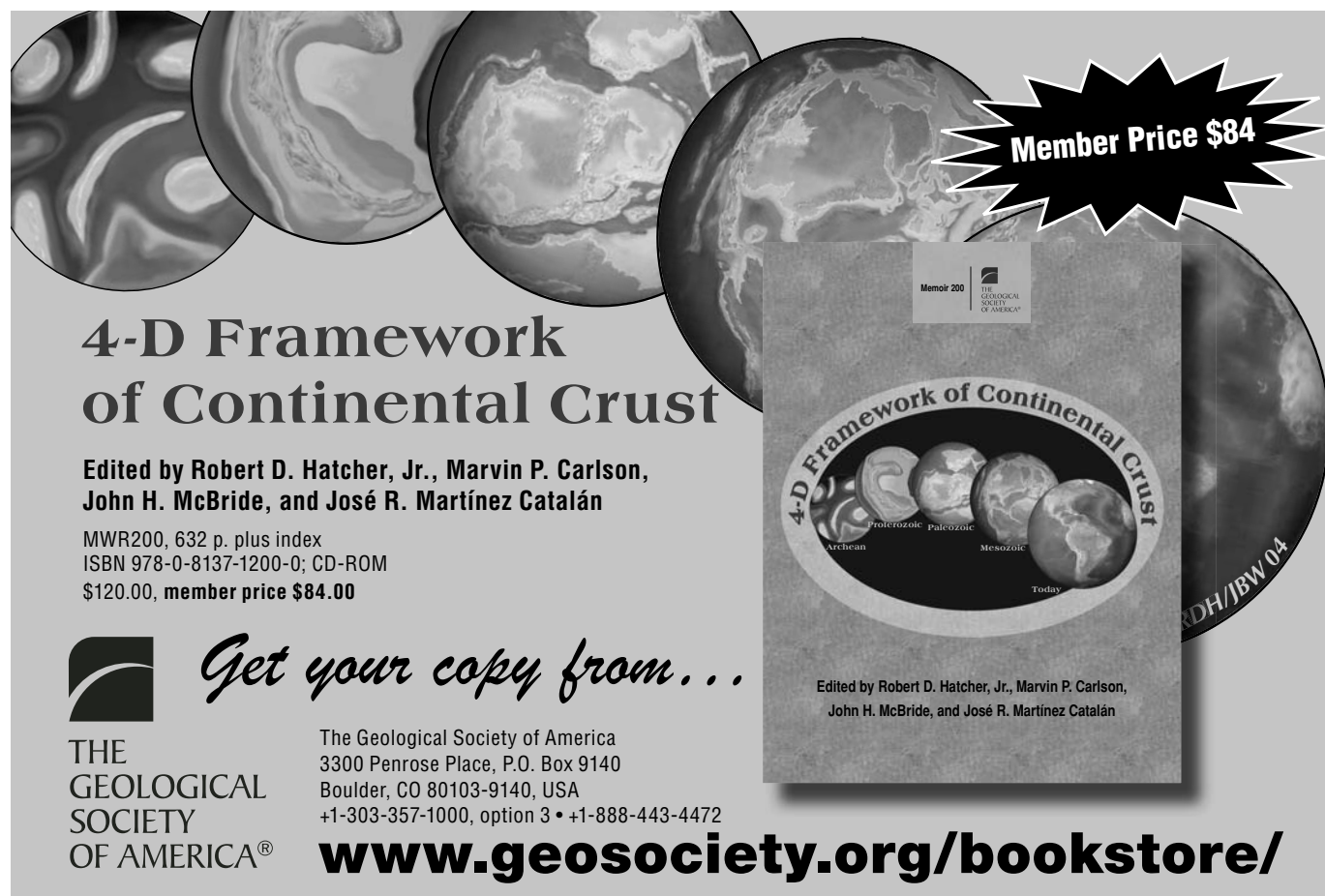
About four years ago, GSA Council recognized that we could do a better job ensuring that geologists working in applied areas would perceive the Society as meeting their professional needs. The Academic and Applied Geoscience Relations (AAGR) Committee was formed and charged with making this happen.

THE ROLE OF THE COMMITTEE

The AAGR Committee is striving to take advantage of GSA's premier role in understanding our geological world in a way that improves and supports the work of those applying geology to everyday needs in society. Communication is a key component and includes conveying new knowledge and understanding as well as different scientific ways of thinking. It is also a chance for exploration of still unresolved questions and the need to make the application of geology more effective in addressing societal issues. On a practical level, it involves better integration of applied and academic science in our meetings, publications, short courses, field trips, and education and outreach programs.

The on-going work of the AAGR Committee will lead to changes that will ultimately help GSA move closer to achieving its mission and vision. The AAGR Committee encourages members with an interest in this area to consider applying to serve on the committee. Any member with ideas on how to better carry out our charge to "strengthen and expand the relations between GSA Members in the academic and applied geosciences" is encouraged to share them with us!

Jerome V. DeGraff, USDA Forest Service, 45nyutca@sbcglobal.net
Chair, AAGR Committee (through October 2007)



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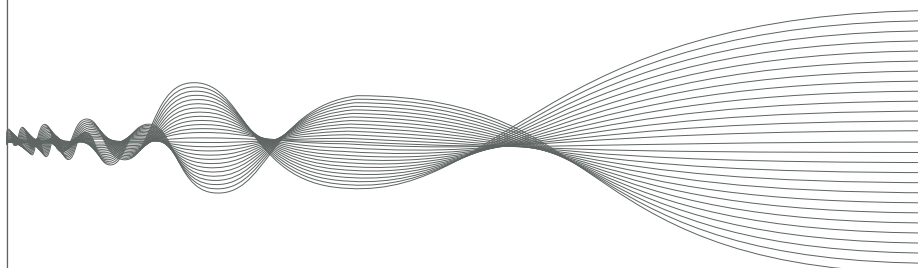
GROUNDWORK FURTHERING THE INFLUENCE OF EARTH SCIENCE

GSA Today seeks articles that lay the groundwork for furthering the influence of earth science on education, policy, planning, and funding. Articles can include in-depth geoscience commentary, short observations and analyses of hot topics, and discussion of policy news and issues.

CHARACTERISTICS OF A "GROUNDWORK" ARTICLE:

- 1 The printed article should be a **complete, stand-alone article**. (Ongoing or serial commentary or meetings summaries are not appropriate for this series.)
- 2 Supplemental information may be included as a **GSA Data Repository item**.
- 3 **Length:** No longer than 1400 words with two small figures or 1600 words with one figure. The philosophy behind this is twofold: (1) keeping an article short can increase the clarity and quality of the writing; and (2) a short article encourages readers to engage and seek more information.
- 4 **Color figures** may be included at no cost to authors.
- 5 *GSA Today* science editors will be responsible for **review and acceptance** of the articles.
- 6 **Frequency:** Accepted articles will be published on a space-available basis.

To submit a "Groundwork" article, send your manuscript and figures via e-mail to *GSA Today* Science Editors Stephen Johnston, stj@uvic.ca, and David Fastovsky, defastov@uri.edu.



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JOINT MEETING

104th Annual Meeting, GSA Cordilleran Section
60th Annual Meeting, GSA Rocky Mountain Section
Las Vegas, Nevada, USA

19–21 March 2008

Complete and up-to-date information about this meeting is online, www.geosociety.org/meetings.

Questions? Please contact the general meeting co-chairs, Rod Metcalf, +1-702-895-4442, rod.metcalf@unlv.edu, and Larry Middleton, +1-928-523-2429, larry.middleton@nau.edu.



View looking west at the Spring Mountains, Red Rock Canyon National Conservation Area, Nevada, USA. Photo by Rod Metcalf.

REGISTRATION

Early Registration Deadline: 18 February 2008

Cancellation Deadline: 25 February 2008

Register online: www.geosociety.org/meetings

REGISTRATION FEES

	Early	Standard
Professional Member—full meeting	US\$160	US\$190
Professional Member—1 day	US\$100	US\$110
Professional Nonmember—full meeting	US\$180	US\$210
Professional Nonmember—1 day	US\$120	US\$130
Student Member—full meeting	US\$65	US\$80
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Student Nonmember—1 day	US\$65	US\$80
K–12 Teacher or Student—full meeting	US\$30	US\$35
K–12 Teacher or Student—1 day	US\$20	US\$25
Guest	US\$50	US\$60
Field Trip or Workshop only	US\$30	US\$40

CALL FOR PAPERS

Abstract Deadline: 11 December 2007

Submit abstracts online: www.geosociety.org/meetings

Abstract submission fee: US\$10

Contact Nancy Wright at GSA, +1-303-357-1061, nwright@geosociety.org, if you have any problems with the electronic submission of abstracts.

FIELD TRIPS

This meeting offers 13 field trips ranging in length from one to three days. Field trip descriptions are posted at www.geosociety.org/sectdiv/cord/08mtg/, or can be obtained by contacting the field trip leaders or field-trip committee members Eugene Smith, gene.smith@unlv.edu, and Ernie Duebendorfer, ErnieD@nau.edu.

STUDENT MENTOR PROGRAMS

These mentor programs are sponsored by GSA Foundation. **Questions?** Contact Jennifer Nocerino, jnocerino@geosociety.org, +1-303-357-1036.

Roy J. Shlemon Mentor Program in Applied Geoscience: Thurs.–Fri., 20–21 March, 11:30 a.m.–1 p.m. *Free meal included.*

The John Mann Mentors in Applied Hydrogeology Program: Thurs., 20 March, 5–6:30 p.m. *Free meal included.*

Call for Nominations 2008 Biggs Award

Nomination Deadline: 1 February 2008
(*new date*)

Beginning in 2008, the **Biggs Award for Excellence in Earth Science Teaching** will become a Geoscience Education Division named award. Division-named awards are among the most prominent awards given by GSA.

The Biggs Award recognizes innovative and effective teaching in college-level earth science. Earth-science instructors and faculty members from any academic institution engaged in undergraduate education who have been teaching full-time for 10 years or fewer are eligible. (Part-time teaching is not counted in the 10-years-or-fewer requirement.) Both peer- and self-nominations are accepted for this award.

The US\$750 award is made possible as a result of support from the Donald and Carolyn Biggs Fund, the GSA Geoscience Education Division, and GSA's Education and Outreach Program. An additional travel reimbursement of up to US\$500 is available to the recipient to enable him or her to attend the award presentation at the GSA Annual Meeting.

To access the nomination form and additional information, please go to www.geosociety.org/awards/biggs.htm. All nomination material should be sent to Eric J. Pyle, James Madison University, Dept. of Geology & Environmental Science, MSC 7703, Harrisonburg, VA 22807-0001, USA, pyleej@jmu.edu, by **1 February 2008**.

Special Paper 427

The Geology and Paleontology of the Late Cretaceous Marine Deposits of the Dakotas

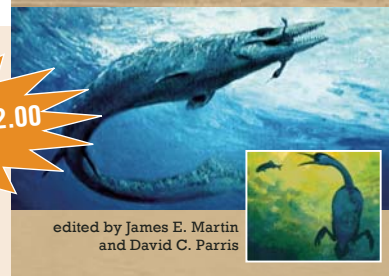
edited by James E. Martin
and David C. Parris



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Special Paper 427
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2007 Biggs Awardee Named



Congratulations to **Joe T. Elkins**, assistant professor in the geology department at Bowling Green State University, who has been named the 2007 Biggs Award recipient.

The Biggs Award encourages and rewards excellence in teaching among college-level earth-science faculty who are at the early stages of their careers. The award of US\$750 is made possible through support from the Donald and Carolyn Biggs Fund, the GSA Geoscience Education Division, and GSA's Education and Outreach Program. These funds are managed by the GSA Foundation.

Joe T. Elkins





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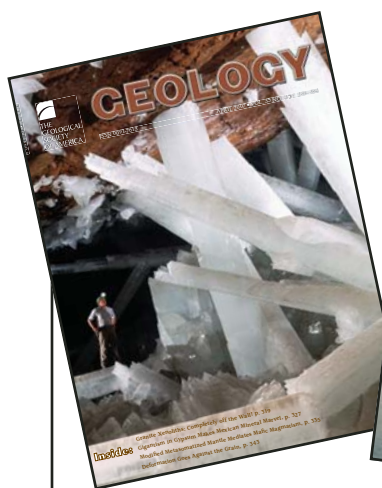
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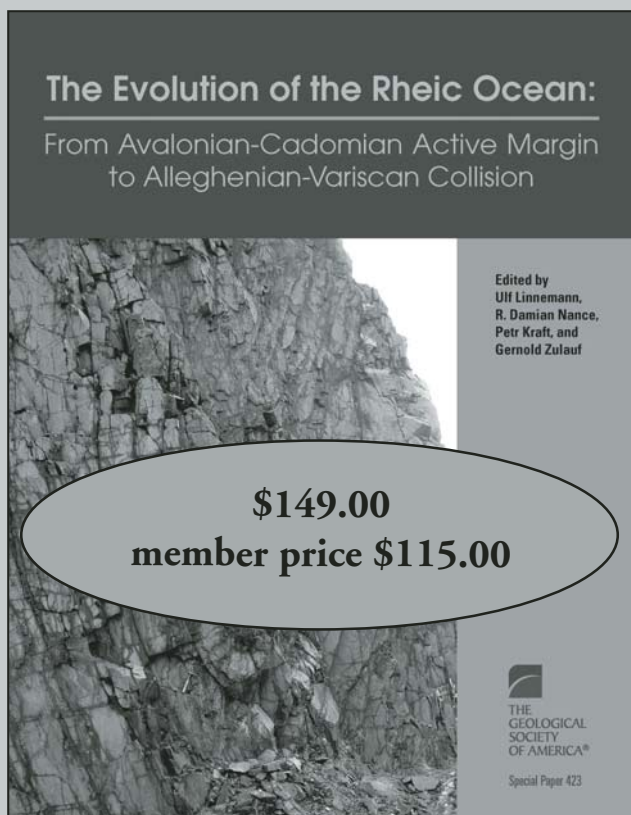
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The Evolution of the Rheic Ocean:

From Avalonian-Cadomian Active Margin to Alleghenian-Variscan Collision

edited by Ulf Linnemann, R. Damian Nance, Petr Kraft, and Gernold Zulauf

This Special Paper includes 29 papers presented at several meetings of the International Geoscience Programme (IGCP) Project 497: "The Rheic Ocean: Its origin, evolution and correlatives." The Rheic Ocean was one of the dominant oceans of the Paleozoic. Its origin can be traced to the Avalonian-Cadomian orogenies in the Latest Neoproterozoic. Closure of the Rheic Ocean began in the Lower Devonian and ended with the assembly of the supercontinent Pangaea. Its history involves North and South America, Africa, Baltica, and a number of peri-Gondwanan terranes. Papers mirror the history of the Rheic Ocean and document a chain of global events and produced orogenic belts that extend discontinuously from México to easternmost Europe. The ocean's evolution was responsible for the formation of a wide variety of sedimentary basins; it significantly impacted the history of life, and it profoundly influenced contemporary paleoclimate and global environmental conditions. Fields of research involved in its study range widely and, as this book illustrates, include stratigraphy, sedimentology, paleontology, paleogeography, paleoceanography, igneous and metamorphic petrology, tectonics, structural geology, provenance analysis, geochemistry, geochronology, and paleomagnetism. Despite decades of research, aspects of the evolution of the Rheic Ocean remain controversial. With this book, the authors hope to answer a number of important questions and to encourage further research.



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GEOCORPS AMERICA™

Honoring Our 2007 GeoCorps Participants

GSA recognizes the following outstanding GSA Members for their contributions to the GeoCorps America™ program this year. Their dedication facilitated the completion of crucial geoscience projects to reach the management goals of the National Park Service, the U.S. Forest Service, and the Bureau of Land Management (BLM). GeoCorps America places GSA Members in summer jobs within these agencies in locations known for beauty and outstanding geology across the United States. This year, the program offered 43 summer positions.



Kathryn Barnard, Oregon Caves National Monument.



Tiffany Rivera, Craters of the Moon National Monument.



Michael Smith, Grand Canyon Parashant National Monument.

2007 GSA GeoCorps Participants

Amy Edwards	Antietam National Battlefield, Maryland
Cory Redman	Bryce Canyon National Park, Utah
Joel Allen	Bryce Canyon National Park, Utah
Christine Dektor	Capulin Volcano National Monument, New Mexico
Tiffany Rivera	Craters of the Moon National Monument, Idaho
Laurel Stratton	Denali National Park, Alaska
Lisa Fay	Denali National Park, Alaska
Eva Lyon	Florissant Fossil Beds National Monument, Colorado
Kathryn Dick	Fossil Butte National Monument, Wyoming
Leif Anderson	Grand Canyon National Park (North Rim), Arizona
Michael Smith	Grand Canyon Parashant National Monument, Utah
Drew Dittmar	Gulf Islands National Seashore, Florida
Rachel Landman	Mount Rainier National Park, Washington
Christina Gooch	Mount Rainier National Park, Washington
Kathryn Barnard	Oregon Caves National Monument, Oregon
Emory Nelkie	Oregon Caves National Monument, Oregon
Raul Ochoa	Petrified Forest National Park, Arizona
Johanna Lanter	Rocky Mountain National Park, Colorado
Diane Escobedo	Rocky Mountain National Park, Colorado
Sarah Stosick	White Sands National Monument, New Mexico
Kevin Donegan	Huron-Manistee National Forest, Michigan
Carisa Bomberger	Kaibab National Forest, Arizona
James Hartley	Kaibab National Forest, Arizona
Nancy Calhoun	Klamath National Forest, California
Jennifer Murphy	Lewis and Clark National Forest, Montana
Andrew Bartell	Ozark–St. Francis National Forest, Arkansas
Brian Mullen	Sierra National Forest, California
Jacob Vossenkemper	Sierra National Forest, California
Tyler Ladinsky	Sierra National Forest, California
Sean Hulburt	White River National Forest, Colorado
James Martin	White River National Forest, Colorado
Andrew Neal	BLM, Butte Falls Resource Area, Oregon
Charles Shaw	BLM, California Coastal National Monument, California
Laura Bordelon	BLM, Grand Staircase–Escalante National Monument, Utah
Michael Knell	BLM, Grand Staircase–Escalante National Monument, Utah
Tonia Rucker	BLM, Gunnison Gorge National Conservation Area, Colorado
Chas Fricke	BLM, Nevada, Winnemucca District, Nevada
Andrew Olivi	BLM, Nevada, Winnemucca District, Nevada
Derek Roy	BLM, Public Lands Center & Canyons of the Ancients National Monument, Colorado
Angela Bondy	BLM, Royal Gorge, Colorado
Matthew Dawson	BLM, Upper Missouri River Breaks National Monument, Montana
Katelyn Huffman	BLM, Washington Office, National Landscape Conservation System, Washington D.C.

For more information about GSA's GeoCorps program, go to www.geosociety.org/geocorps. Jobs for 2008 will be posted on the Web in early December 2007.



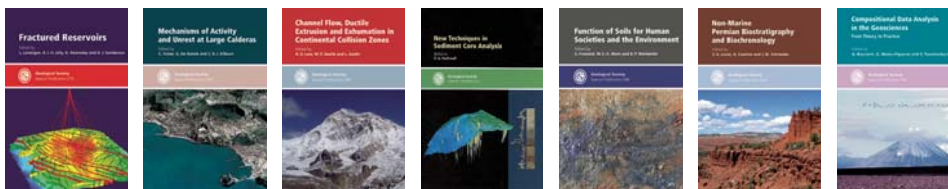
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The Department of Geological Sciences invites applications for a tenure-track appointment at the assistant professor level in Geoscience Education. We are particularly interested in candidates who focus on improving learning of science by non-science majors. We seek an outstanding teacher and researcher to lead instruction of our Department's lower-division courses in physical science and earth sciences and upper-division science experience capstone course, and to engage in ongoing improvements in their design, implementation, and assessment. A record and/or strong promise of creativity in teaching methods is desired, with the goal of adapting cutting-edge pedagogy for undergraduate science courses. The appointee also will be encouraged to design and teach an upper division elective course in his/her area of earth science expertise. Preference will be given to applicants with a demonstrated history of research funding, industry experience, and/or research interests that complement and enhance existing departmental strengths in geoscience education, tectonics, volcanology, sedimentology, paleontology, marine geology, and geophysics. The successful candidate will supervise undergraduate and MS student research. A Ph.D. in any area of Earth Sciences is required at the time of appointment.

To apply, mail a curriculum vitae, statements of teaching and research interests, names and addresses of at least three references, and copies of recent publications to Dr. Doug Yule, Dept. of Geological Sciences, California State University, 18111 Nordhoff Street, Northridge, CA 91330-8266. Review of applications will begin 1 January 2008 and continue until position is filled.

For additional information see: www.csun.edu/geology. The University is an EO/AA educator and employer. Candidates will be expected to provide effective instruction to students of diverse backgrounds in a multicultural setting.

ASSISTANT PROFESSOR, STRUCTURAL GEOLOGY/ CONTINENTAL TECTONICS, DEPT. OF GEOLOGY UNIVERSITY OF CALIFORNIA AT DAVIS

We seek a creative, field-based geoscientist whose research quantitatively addresses continental deformation and its relationship to crustal rheology and/or surface processes within the evolution of orogenic systems. Areas of interests include, but are not limited to, the use of the geologic record to quantify the rheological evolution of continental crust, crust-mantle coupling, mass redistribution, the development of landforms related to deformation, and the fundamental structural architecture of mountain belts.

This tenure-track appointment will begin July 1, 2008, at the Assistant Professor level. The successful candidate is expected to develop a dynamic, externally funded research program, effectively mentor and teach at both undergraduate and graduate levels, and engage in professional service. For more information about the UC Davis Department of Geology, see www.geology.ucdavis.edu.

A Ph.D. or equivalent degree in geological sciences is required at the time of appointment. To ensure full consideration, applications should be received by December 21, 2007. Applicants should submit a PDF file containing a letter of application, curriculum vitae, a statement of research/teaching interests, and contact information (including e-mail) for at least three references to: tectonics-search@geology.ucdavis.edu.

UC Davis is an affirmative action/equal employment opportunity employer and is dedicated to recruiting a diverse faculty community. We welcome all qualified applicants to apply, including women, minorities, individuals with disabilities and veterans.

ENVIRONMENTAL GEOCHEMISTRY COLLEGE OF WILLIAM & MARY

The Geology Department at the College of William & Mary invites applications for a tenure-track assistant professorship beginning August 2008. The successful applicant will teach courses in introductory geology and/or environmental science and policy, environmental geology and aqueous geochemistry, and supervise undergraduate research while maintaining an active research program. We desire research expertise in low-temperature aqueous geochemistry, chemical hydrogeology, contaminant fate and transport in surface or groundwater, or a similar specialty with an environmental focus. A portion of the successful candidate's teaching and advising will be in the College's Environmental Science and Policy program. Preferred qualifications include a demonstrated record of research, evidence of publication potential, successful teaching experience, and ability to complement existing departmental strengths. In addition, we seek a colleague eager to interact with undergraduates in an environment in which teaching and research are emphasized. Ph.D. required by time of appointment. Applicants should submit their application electronically using the procedure provided at www.wm.edu/geology/jobs.php. Contact Gregory Hancock, Search Chair, at gshanc@wm.edu with questions. Review begins November 26, 2007, and will continue until the position is filled. The College of William & Mary is an EEO/AA university.

WESTERN KENTUCKY UNIVERSITY DEPARTMENT OF GEOGRAPHY AND GEOLOGY ASSISTANT/ASSOCIATE PROFESSOR ENVIRONMENTAL GEOSCIENCE

Western Kentucky University, Department of Geography and Geology, is seeking applicants for an **Assistant/Associate Professor of Environmental Geoscience**. This is a tenure-track assistant or associate professor position beginning August 2008. The successful candidate will be expected to contribute to research and education programs of the University's Hoffman Environmental Research Institute, which may include affiliation with major Institute programs including the China Environmental Health Project and Center for Cave and Karst Studies.

Qualifications:
Earned Ph.D. in Geology, Physical Geography, or a related environmental field is required.

Must demonstrate a commitment to (or for Associate level appointment show a proven record of) excellence in teaching and research at the undergraduate, master's, and post-doctoral levels.

Will be expected to develop (or for Associate level appointment show a proven record of) a strong externally funded research program in one or more environmental areas related to the mission of the Institute, including but not limited to hydrology, water resources, shallow-earth geophysics, geochemistry, or geomorphology. Research experience in karst aquifer/landscape systems is desirable but not required. The Hoffman Institute's mission statement can be found at <http://hoffman.wku.edu/mission.html>.

Collaborative and interdisciplinary research is encouraged.

Prospective candidates should obtain additional information at www.wku.edu/geoweb/, <http://hoffman.wku.edu>, and <http://artp.wku.edu>.

Interested candidates must submit a letter of application, curriculum vita, unofficial transcripts, the names of three references, and separate statements of 1) teaching and 2) research philosophy to: Department of Geography and Geology, Environmental Geoscience Search

Committee, Western Kentucky University, 1906 College Heights Blvd #31066, Bowling Green, KY 42101-1066.

Review of applications will begin November 15, 2007. Position will remain open until filled.

All qualified individuals are encouraged to apply including women, minorities, persons with disabilities and disabled veterans.

Western Kentucky University is an Affirmative Action/Equal Opportunity Employer.

EARLHAM COLLEGE: TENURE TRACK ASSISTANT PROFESSOR, ENVIRONMENTAL GEOCHEMISTRY/HYDROGEOLOGY

The Department of Geosciences at Earlham College invites applications for a tenure track position beginning Fall 2008 in the general area of hydrogeology/environmental geochemistry. Course responsibilities include participation in introductory geoscience and environmental science courses, as well as upper-class courses such as hydrogeology, geochemistry, field methods, GIS, or other upper-level specialty courses. We expect that the candidate will participate in the Environmental Science program, supervise undergraduate student research projects, and participate in the senior capstone seminar. A Ph.D. is required and previous teaching experience at the undergraduate level is preferred. Women, underrepresented minorities, and Quakers are especially encouraged to apply. Interested candidates should send curriculum vitae, a statement of teaching philosophy, and a statement about how your research interests will enhance the education of undergraduate students, along with the full contact information of at least three references to: Dr. Meg Streeper, Department of Geosciences, Earlham College, 801 National Rd. West, Richmond, IN 47374, +1-765-973-2168. Applications may be submitted electronically to streeem@earlham.edu. To ensure full consideration, please submit applications by November 30. For expanded information, please visit the departmental Web site at www.earlham.edu/geosciences.

LECTURER POSITION, DEPT. OF GEOSCIENCES GEORGIA STATE UNIVERSITY

The Department of Geosciences at Georgia State University invites applications for an anticipated non-tenure track Lecturer in Introductory Geosciences. Policy describing review and promotion of Lecturers can be read at www.cas.gsu.edu/lecturer_policy.aspx. We seek candidates who have demonstrated an interest and ability to teach introductory courses in: Physical Geology (internal and external processes), Physical Geography (Landforms, Weather and Climate), and Introduction to Human Geography. Possibility exists to teach a course at the upper division undergraduate level in Geology or Geography depending on the candidate's area of interest and the needs of the department. Applicants must have attained a Ph.D. degree in Geology, Geography or related discipline.

Candidates should submit a letter describing their teaching background and interests, CV, evidence of teaching effectiveness and three letters of recommendation to: Chair, Search Committee for Lecturer Position in Introductory Geosciences, Georgia State University, P.O. Box 4105, Atlanta, GA, 30302. Candidates may submit an electronic copy of this material followed by a required hard copy with signature. For further information contact the Chair of the search committee at geoser@langate.gsu.edu or +1-404-413-5757. The departmental Web site is <http://monarch.gsu.edu/geosciences/>. Deadline for receipt of materials is November 15, 2007, and applications will continue to be accepted until the position is filled. Georgia State University, a unit of the University System of Georgia, is an Equal Opportunity Educational Institution and an EEO/AA employer.

UNIVERSITY OF WEST FLORIDA ASSISTANT PROFESSOR, GEOLOGY

The Department of Environmental Studies, University of West Florida, invites applications for one tenure-track assistant professor position beginning August 2008, pending budgetary approval.

Position: Geology, specialization open. Areas of expertise should complement departmental strengths. Application of geomorphology or geology to environmental issues is strongly preferred. Ability to utilize and teach GIS or quantitative methods is desirable, as is interest in community outreach.

Applicants are expected to develop an active research program and should be committed to peer-reviewed publication. Applicants must have an appreciation for undergraduate education. A Ph.D. in Geology or related discipline is required at the time of appointment. Salary is commensurate with qualifications and experience.

The Department of Environmental Studies offers a Bachelor of Science degree, and a Certificate in

Geographic Information Science. Over 100 majors specialize in tracks in natural science, environmental policy, and geography. A master's program started in Fall 2004 has over 20 active graduate students. The department maintains the university-wide GeoData Center, which has extensive GIS capabilities. Personnel include 7 full-time faculty, several adjunct faculty, and a GIS Coordinator. For more information on the department see <http://uwf.edu/environmental/>.

Applicants should apply online at <https://jobs.uwf.edu> and be prepared to attach a statement of research and teaching interests and experience, a curriculum vitae, and transcripts to the online application. This position requires a criminal background screening. Three letters of reference, and/or inquiries, should be sent directly to Search Committee Chair Dr. Johan Liebens, Department of Environmental Studies, University of West Florida, 11000 University Parkway, Pensacola, FL 32514 (+1-850-474-2065, fax +1-850-857-6036, or e-mail liebens@uwf.edu).

Review of applications will begin December 14, 2007, and will continue until the position is filled.

The University of West Florida is an Equal Opportunity/Access/Affirmative Action Employer. Minorities and women are encouraged to apply.

OPEN RANK POSITION IN COAL GEOLOGY SOUTHERN ILLINOIS UNIVERSITY-CARBONDALE

The Department of Geology at Southern Illinois University Carbondale invites applications for a tenure-track position in coal geology, starting Aug. 16, 2008. Research emphasis may include paleobotany, coal petrology, coal basin analysis, coal bed methane and carbon sequestration, or other coal-related fields. Rank is open and will depend on the experience of the successful candidate. Requirements: Ph.D. in Geology or closely related field or show that they will complete all degree requirements by the time of appointment. Assistant Professor rank: Post-doctoral experience is preferred. The applicant should demonstrate the existence of, or potential for developing, an internationally recognized externally funded research program; Assoc. Prof.: an established record of teaching and of peer-reviewed publications and significant grant activity commensurate with tenure; Full Prof.: exceptional candidates with an international reputation and a long standing record of peer reviewed publication and substantial current grant activity and an established record of teaching. Please visit our Web sites www.siu.edu/~affect and www.science.siu.edu/geology/coalposition.html for more information. Review of applications will begin February 15, 2008, and continue until the position is filled. Applicants should submit curriculum vitae, a statement of teaching and research interests, and the names and addresses of at least three references to: Dr. Ken Anderson, Search Committee Chair, Department of Geology, Mail Code 4324, Southern Illinois University Carbondale, 1259 Lincoln Drive, Carbondale, IL 62901. Fax: +1-618-453-7393. E-mail: kanderson@geo.siu.edu. SIUC is an affirmative action/equal opportunity employer that strives to enhance its ability to develop a diverse faculty and staff and to increase its potential to serve a diverse student population. All applications are welcomed and encouraged and will receive consideration.

TENURE TRACK POSITION IN MINERALOGY TEXAS TECH UNIVERSITY

The Department of Geosciences at Texas Tech University invites applications for a tenure track, Assistant Professor position in mineralogy to begin in Fall 2008. A Ph.D. in earth sciences is required at the time of appointment.

We seek a person with research and teaching interests in the broad field of mineralogy & earth materials. The successful applicant will be expected to establish and maintain an innovative externally funded academic research program in their discipline, develop upper division and graduate courses in their specialty, direct M.S. and Ph.D. student research, and assist with freshman geology courses. Candidates must be able and willing to teach undergraduate courses in "Earth Materials" and/or "Crystallography & Optical Mineralogy."

Review of applicants will begin on December 1, 2007. Applications should be submitted through the Texas Tech University Employment Website: www.depts.ttu.edu/personnel/applicant-information.aspx, referencing requisition #75045. A letter of application, a concise description of teaching philosophy and research objectives, curriculum vita, and names and contact information, including e-mail addresses, of at least three professionals who will write letters of recommendation should accompany the application. These materials and any additional material the applicant may wish to send may be uploaded as attachments during the electronic application process, or may be mailed to: Mineralogy Search Committee, Department of Geosciences, MS 1053, Texas Tech University, Lubbock, TX 79409-1053.

Texas Tech University is located in Lubbock, TX and has 28,000 undergraduate and graduate students. The Geosciences Department at TTU has 20 faculty with research interests in atmospheric sciences, geochemistry, GIS & remote sensing, exploration and solid earth geophysics, paleontology & biostratigraphy, igneous petrology, petroleum geology, sedimentology & stratigraphy, and structural geology & tectonics. Analytical equipment available in the Department includes equipment for light stable isotope analysis, x-ray diffraction, SEM/TEM imaging, ICP-AES, and LA-ICPMS. A high-resolution SEM with EDS and EBSD is housed in the Experimental Sciences building. Potential collaboration with the Dept. of Chemistry and Biochemistry, which recently acquired state-of-the-art powder and single-crystal XRD instruments, is encouraged. Additional information about the department, including a description of laboratories, facilities current research programs, and guidelines for promotion and tenure may be found at www.gesc.ttu.edu. General information about Texas Tech University can be found at www.ttu.edu.

Texas Tech University is an Affirmative Action/Equal Opportunity Employer and encourages applications from women and minorities.

UNIVERSITY OF KENTUCKY, GEOPHYSICS

The Department of Earth and Environmental Sciences at the University of Kentucky invites applications for a tenure-track faculty position in Geophysics, beginning August 15, 2008. We are seeking candidates who use field and/or computational modeling approaches to interdisciplinary research in crustal-scale and/or hazard-evaluation geophysics, complementary to our existing programs in near-surface geophysics, engineering seismology, global to local-scale potential-fields geophysics, planetary geophysics, hydrogeology, tectonics, and energy resources. The applicant should demonstrate the ability to develop externally funded research, as well as challenging coursework at the introductory undergraduate and graduate levels. A broad range of opportunities also exists for cooperation with other departments and agencies on campus (e.g., UK's Kentucky Geological Survey, Department of Civil Engineering, Kentucky Transportation Center, Water Resources Research Institute, Center for Applied Energy Research, and the Tracy Farmer Center for the Environment). Learn more about the Department's faculty and degree programs, as well as the university's location, profile, and aspirations by visiting our Web site.

Interested applicants should submit their curriculum vitae, a brief statement of research and teaching interests, copies of relevant research publications, and at least three letters of recommendation to: Dr. Edward W. Woolery, Search Committee Chair, Department of Earth and Environmental Sciences, 101 Slone Research Building University of Kentucky, Lexington, KY 40506-0053. Or E-mail: woolery@uky.edu.

The committee will begin to review the applications on October 15, 2007. The University of Kentucky is an Affirmative Action employer, and applications from minority and female applicants are particularly encouraged.

DIVISION DIRECTOR DIVISION FOR EARTH SCIENCES

NATIONAL SCIENCE FOUNDATION, ARLINGTON VA
NSF's Directorate for Geosciences (GEO) seeks candidates for the position of Division Director in the Division of Earth Sciences (EAR). This position will be filled as a career appointment, a one-to-three year Limited Term Appointment, or on an Intergovernmental Personnel Act (IPA) assignment basis.

The Division Director's primary responsibilities include providing leadership and direction for research and education in the earth sciences, which include geology and environmental geochemistry, hydrologic sciences, sedimentary geology and paleobiology, geomorphology and land use dynamics, geophysics, petrology and geochemistry, tectonics and instrumentation and facilities, continental dynamics and EarthScope. The Division Director allocates resources and oversees the evaluation of proposals and recommendations for awards and nominations, and represents the NSF to relevant external groups. Information about EAR and its programs may be found at www.nsf.gov/geo/ear/about.jsp.

Applicants must possess a Ph.D. or equivalent professional experience in the earth sciences plus substantial research contributions and strong evidence of scholarship in the earth sciences or a closely related field. Also required are demonstrated broad knowledge of the impact of diverse fields of science on the earth sciences and demonstrated experience with strategic planning for budget, staffing and/or facilities operation and maintenance.

Announcement S20070111, with position requirements and application procedures, is located at www.nsf.gov/about/career_opps/vacancies/executive.jsp.

www.nsf.gov/about/career_opps/vacancies/executive.jsp.

Applicants may also obtain the announcements by contacting the Executive and Visiting Personnel Branch at +1-703-292-8755 (hearing impaired individuals may call TDD +1-703-292-8044). For information about the EAR Division, call Dr. Margaret Cavanaugh, Deputy Assistant Director, GEO, at +1-703-292-8500, e-mail: mcavanaugh@nsf.gov. Applications must be received by November 26, 2007.

NSF is an Equal Opportunity Employer.

UNIVERSITY OF NORTH CAROLINA-CHAPEL HILL GLOBAL HYDROLOGY

The Department of Geological Sciences at the University of North Carolina at Chapel Hill invites applications for a tenure-track faculty position in the area of global hydrology. We seek candidates whose interests lie in understanding Earth's water cycle, its response to changing climate, and its interaction with the lithosphere. Particular areas of interest include: response of the hydrosphere and cryosphere to climate change; quantification and calibration of hydrologic processes in global climate models; exchange of water among major Earth reservoirs; the forecast of sea level rise, droughts and floods; interactions of surface processes and the biosphere with the hydrologic cycle; and geochemical signatures of hydrologic processes in the lithosphere.

Applicants must hold a Ph.D. at the time of appointment and postdoctoral and teaching experience is highly desirable. The successful candidate will be expected to establish a vigorous, externally funded research program and to demonstrate excellence in teaching at both the undergraduate and graduate levels.

Applicants must submit (print and PDF format on CD) a letter of application, names, addresses, e-mail and phone numbers of four references, statements of teaching and research interests, and curriculum vitae to: Chair, Search Committee for Global Hydrology, University of North Carolina, Department of Geological Sciences, 104 South Road, Chapel Hill, NC 27599-3315. Review of applications will begin on December 17, 2007, and will continue until the position is filled. Members of the department will be present at the fall GSA and AGU meetings; please contact Patricia Bigelow (pcbigo@e-mail.unc.edu) to arrange an informal interview. For more information on the department and the University please visit our web page at www.geosci.unc.edu.

The University of North Carolina at Chapel Hill is an equal opportunity/affirmative action employer. Women and minorities are encouraged to apply.

CLEMSON UNIVERSITY PROFESSOR AND DEPARTMENT CHAIR

The Department of the Environmental Engineering and Earth Sciences (EEES) at Clemson University is seeking applications for a department chair position. Applicants must have an earned doctorate in environmental engineering, earth sciences, or a closely related field; an outstanding record of scholarly research and publication; a commitment to excellence in teaching; and strong leadership and communication skills. Consideration will be given only to those who merit appointment as a Full Professor with tenure.

EEES was recently created through a merger of the Departments of Environmental Engineering & Science and Geological Sciences. EEES is a vibrant academic community with 21 full-time faculty members and over 60 graduate students. The graduate program is consistently ranked among the top 25 environmental engineering and science programs nationwide. Research areas include environmental process engineering, hydrogeology, environmental health physics and radiochemistry, environmental chemistry, and sustainable systems and environmental assessment. The undergraduate program offers BA and BS degrees in Geology. Details are available at www.ces.clemson.edu/eees.

EEES is looking for an energetic Chair who will coordinate efforts to acquire research funding that draws upon the diverse capabilities of EEES faculty and demonstrates leadership in advancing the department's educational missions. Candidates with a compelling vision will be encouraged to fill additional faculty appointments.

Applicants should submit a curriculum vitae, a list of at least five references with complete contact information, and a statement of research interests. Electronic submissions (PDF files) to eeesCHR@clemson.edu are preferred, but applications and nominations may also be mailed to EEES Chair Search, Box 340919, Clemson University, Clemson, SC 29634-0919. Application material should be received by November 16, 2007, to receive full consideration, though the search will remain open until the position is filled.

Clemson University is an AA/EEO employer and does not discriminate against any person or group on

the basis of age, color, disability, gender, national origin, race, religion, sexual orientation or veteran status.

**TENURE-TRACK FACULTY POSITION
PHYSICAL GEOGRAPHY, UNIVERSITY OF KANSAS
DEPARTMENT OF GEOGRAPHY**

The Department of Geography (www.geog.ku.edu) at the University of Kansas invites applications for a tenure-track, Assistant Professor position in Physical Geography expected to begin August 18, 2008. Specific teaching and research interests are to focus on soils and geomorphology. Applicants are expected to hold a Ph.D. degree in Geography (or a closely related discipline) by the start date of appointment. Applicants must provide evidence of independent research capabilities in soils and geomorphology; the ability to develop and sustain a high-quality, externally-funded research program; and teaching, mentoring and communication skills. Specific duties for the position include: (1) engaging in scholarly activity/research, (2) teaching at the undergraduate and graduate levels, and (3) service and advising responsibilities normally expected of university faculty. The successful candidate will be expected to secure external funding to support his or her research program. Research opportunities will include potential collaboration with a variety of other organizations at the University of Kansas including the Kansas Geological Survey, Kansas Biological Survey, Kansas Applied Remote Sensing Program (KARS), NSF Center for Remote Sensing of Ice Sheets (CREGIS), Keck Paleoenvironmental and Environmental Stable Isotope Laboratory (KPEISIL), and other programs within the Geography Department and at the University of Kansas. Salary is competitive with those at other research universities.

For a copy of the full position announcement, see <http://www2.ku.edu/~clas/employment/>. A letter of interest (including teaching and current research interests), vitae, graduate transcripts, selected publications/papers, teaching portfolio if available (with evaluations or summaries), and three letters of reference should be sent to: William C. Johnson, Chair, Physical Geography Search Committee, Department of Geography, University of Kansas, 1475 Jayhawk Blvd., Rm. 213, Lawrence, KS 66045-7613, +1-785-864-5143. Initial review of applications begins November 15, 2007, and will continue until the position is filled. Women and minority candidates are specifically invited and encouraged to apply. EO/AA Employer.

NORTH DAKOTA STATE UNIVERSITY

The Department of Geosciences at North Dakota State University invites applications for a tenure-track appointment to begin August, 2008. We seek a colleague with research expertise in Quaternary sedimentology, Quaternary geology, and/or surface process geology to expand and complement our existing strengths in Quaternary geology.

Research at NDSU is considered a vital component of both undergraduate and graduate education. The successful candidate will contribute to this research-teaching effort by developing a vigorous, externally funded, research program, and by supervising students in an Environmental Sciences graduate program. Applicants must possess strong English oral and written communication skills, and will demonstrate the qualifications and/or adaptability to teach courses in sedimentology-stratigraphy, structural geology, and introductory geology. A Ph.D. is required at the time of appointment, and postdoctoral experience is preferred. Applicants should submit a CV, a description of research goals, a statement of teaching interests/qualifications, academic transcripts, and the names and addresses of three referees to: Dr. Kenneth Lepper, Search Committee Chair, Department of Geosciences, NDSU, Fargo, ND, 58105-5517. Screening will begin December 10, 2007. North Dakota State University is an affirmative action/equal opportunity employer. Members of groups under-represented in STEM are encouraged to apply. For further information on the department and its faculty, visit www.ndsu.edu/geosci/.

**GEOLOGY, TENURE TRACK
UNIVERSITY OF ST. THOMAS**

The University of St. Thomas Geology Department, St. Paul, MN, invites applicants for a new tenure track faculty position. Ph.D. in geology or related field required (ABD will also be considered), with expertise in biogeochemistry or environmental geochemistry and hydrogeology. Successful candidates should show proficiency in earth system modeling, geographic information systems, and applied aspects of environmental science. You will be expected to teach introductory and upper-level geoscience courses and develop an undergraduate research

program, as well as to help establish and teach courses in a new interdisciplinary environmental science program. You should be able to demonstrate the capacity to undertake or have a proven track record in collaborative undergraduate research. Strong teaching capabilities are requisite. For the complete job listing and to apply visit <http://jobs.stthomas.edu>. AA/EEO

**BRIDGEWATER STATE COLLEGE, DEPT.
OF EARTH SCIENCES, ASSISTANT PROFESSOR**

The Department of Earth Sciences at Bridgewater State College invites applications for a tenure track position in Sedimentology/Paleontology/Stratigraphy at the Assistant Professor level starting in September, 2008. We desire a dynamic individual who is broadly interdisciplinary within the "soft-rock" realm of the geological sciences, who complements the research initiatives of our existing faculty, and is interested in developing professional interactions with colleagues in the other scientific disciplines. The successful applicant will develop a junior level course in Sedimentology/Stratigraphy, a senior level, writing intensive course in Paleontology, advanced course/s in the applicant's area of expertise as well as introductory geology courses. Mentoring undergraduates in research activities is expected and a strong field orientation is preferred. Other responsibilities include advising students and service on College-wide committees. A Ph.D. is required for consideration of the application.

Required Minimum Qualifications: A completed Ph.D. degree in the Geological Sciences with a specialization in Sedimentology / Paleontology.

Preferred Qualifications: Ability to develop undergraduate courses in the 'soft-rock' realm.

Research mentoring of undergraduate students.
Strong field orientation.

Applicants should be strongly committed to excellence in teaching and advising, and to working in a multicultural environment that fosters diversity. They should also have an ability to use technology effectively in teaching and learning, the ability to work collaboratively, evidence of scholarly activity, and a commitment to public higher education.

Special Instructions to Applicants: Please attach the following documents to your on-line application: Cover Letter, Resume, A Teaching Philosophy statement.

Salary: Salary commensurate with qualifications.

To Apply: Please apply on-line at <http://jobs.bridgew.edu>.

**HYDROLOGIST, FACULTY POSITION
MIDWESTERN STATE UNIVERSITY**

Geosciences Assistant/Associate Professor- tenure track Start: Spring 2008. Required: Ph.D. in geosciences with a broad professional background. Preferred: teaching and field experience, and refereed publication record. Teach Introductory Geology, Hydrology, GIS, Remote Sensing, and Geomorphology. MSU, a member of COPLAC, is a comprehensive public university serving more than 6000 students. Send application letter, vita, and contact information of three references to: Dr. Brent Elliott, Department of Geosciences, Midwestern State University, 3410 Taft Blvd., Wichita Falls, TX 76308. E-mail: brent.elliott@mwsu.edu. Screening starts immediately. Applications will be taken until position is filled. EEO/ADA. www.mwsu.edu.

**ASSISTANT PROFESSOR -HYDROLOGY
EARTH AND PLANETARY SCIENCES
UNIVERSITY OF NEW MEXICO**

The Department of Earth & Planetary Sciences at the University of New Mexico seeks applications for a tenure-track faculty position in Hydrology. The tenure-track appointment (which is probationary until the tenure decision) is anticipated at the Assistant Professor level, to commence Fall 2008. The successful applicant must have a Ph.D. in Hydrology or closely related area of the Geosciences by the time of the appointment. We require a candidate with demonstrated research abilities in hydrology. The successful candidate will be expected to develop an externally funded research program, and be an effective teacher and mentor at the undergraduate and graduate levels (MS and Ph.D.). Preference will be given to applicants with demonstrated background and research experience in at least one of the following areas: (a) hydrogeophysics; (b) groundwater-surface water interaction; (c) integration of atmospheric, surface, and subsurface hydrologic processes at the watershed scale; (d) groundwater flow and transport. The selected candidate will teach undergraduate and graduate courses in Earth & Planetary Sciences and will have the opportunity to participate in the department's Environmental Science BS degree program. The hydrologist may participate in collaborative research in related areas of strength, including

UNIVERSITY
OF WYOMING

ENERGY-RELATED
GEOPHYSICS - OPEN RANK

The Department of Geology and Geophysics at the University of Wyoming invites applications for a faculty position in the Department and in the newly created School of Energy Resources (SER) at the University of Wyoming, an institute dedicated to energy-related teaching and research in support of State, national, and international energy-related activities. This appointment may be made at any rank. The position can begin as soon as January 1, 2008.

We seek an individual who will establish a well-recognized, externally funded research program in geophysics, with a preference toward reflection seismology, petrophysics, or potential fields as applied to energy-related research. Applicants should complement and/or expand on departmental strengths in geophysics, structure geology and tectonics, sedimentology, and/or crustal studies. We seek a person with the ability to cooperate productively with other SER faculty in geology and geophysics, mathematics, chemical and petroleum engineering, economics, and other energy-related fields. The successful candidate will be involved in the undergraduate and graduate teaching mission of the Department of Geology and Geophysics. The SER is an ambitious, state-funded institute that seeks innovative researchers working on new approaches at the forefront of the expanding fields in energy research. Information about the School of Energy Resources is available at uwyo.edu/SER. Additional information on the Department Geology and Geophysics can be obtained at <http://home.gg.uwyo.edu/>.

Applications should include a statement of research and teaching interests and accomplishments, curriculum vitae, and the names and contact information for three individuals who can provide letters of evaluation. Review of completed applications will begin October 1, 2007; however, applications will be accepted until the position is filled. Send an electronic copy of your application to: Ms. Carol Pribyl at cpribyl@uwyo.edu; if you have additional application materials to send, please direct them to the Geophysics Search Committee, Department of Geology and Geophysics, University of Wyoming, 1000 East University Avenue, Dept. 3006, Laramie, WY 82071-2000.

The University of Wyoming is an equal opportunity/affirmative action employer.

but not restricted to hydrostratigraphy, hydrogeology/freshwater sciences, climate dynamics, hillslope and fluvial geomorphology, geochemistry and biogeochemistry, and water resources. Opportunities for collaboration exist with the UNM-administered Long-Term Ecological Research site and the UNM Water Resources Program, which offers a professional Master's degree.

For more information about our program, please see our Web site at URL <http://epswww.unm.edu>.

To apply, send a signed letter of interest, current CV, statements of research and teaching goals, and names and contact information of four potential referees, to: Dr. Gary Weissmann, Chair, Hydrology Search Committee, Earth & Planetary Sciences Dept. MSC 03-2040, 1 University of New Mexico, Albuquerque, NM 87131.

For best consideration apply by November 30, 2007.

UNIVERSITY OF CALIFORNIA, SANTA CRUZ TENURE-TRACK POSITION IN GEOLOGY

The Department of Earth and Planetary Sciences (EPS) seeks applicants for a tenure-track position in Geology. POSITION AVAILABLE: Fall 2008. Open until filled. For full consideration, applications must be postmarked by December 1, 2007. For full details, see our Web site: Refer to position #357-08 <http://www.es.ucsc.edu/about/jobs/index.html> or contact Judy Van Leuven (judy@pnc.ucsc.edu; +1-831 459-4478) AA/EEO Employer. <http://www2.ucsc.edu/ahr/>.

TENURE-TRACK PALEOCLIMATOLOGY DEPARTMENT OF GEOLOGY BAYLOR UNIVERSITY

The Department of Geology at Baylor University invites applications for a tenure-track open-rank (Assistant to full Professor) faculty position in the general area of paleoclimatology, beginning August 2008. A Ph.D. in Earth Sciences, or in a related field, is required at the time of appointment. The Department currently consists of 13 geoscientists (please see the Department Web site at www.baylor.edu/Geology/ for further information).

Research: The Geology Department seeks an individual with a strong research agenda that includes field and laboratory studies of terrestrial climate records archived within fluvial (river and floodplain), eolian (loess and sand dune), lacustrine (lake), and coastal systems. The individual must be able to communicate and collaborate with a subset of five Geology faculty members that are currently engaged in studies in the general area of paleoclimatology, and to carry out a vigorous research program that involves both undergraduate and graduate students. Possible areas of specialization to be considered are those identified in the major strategic proposal for enhancement of the Terrestrial Paleoclimatology Research Program at Baylor University including **paleobotany, palynology, paleomagnetism, and organic geochemistry. We currently project a total of three new faculty hires in these areas, staged over five years.** Research space for terrestrial paleoclimatology is available in the three-year-old, 500,000-square-foot "state-of-the-art" Baylor Sciences Building, and startup funds associated with this position are highly competitive.

Teaching: The Department seeks an individual with a strong commitment to excellence in teaching, and who can contribute significantly to both the undergraduate B.S. Geology and B.A. Earth Science programs by teaching a freshman course, an undergraduate core or elective course, as well as contribute to the graduate programs in Geology by teaching graduate courses in his/her areas of specialization.

Application Process: Send letter of application, including statement of teaching and research interests, curriculum vitae, copies of transcripts, and the names and contact information for three references to: Dr. Zhaodong (Jordan) Feng, Search Committee Chair, Department of Geology, Baylor University, One Bear Place #97354, Waco, TX 76798-7354 (Tel: +1-254-710-2361; e-mail: Zhaodong_Feng@baylor.edu). The review of applications will begin December 1, 2007, and will be accepted until the position is filled. To ensure full consideration, application must be completed by January 1, 2008. Baylor is a Baptist university affiliated with the Baptist General Convention of Texas. As an Affirmative Action/Equal Opportunity employer, Baylor encourages minorities, women, veterans and persons with disabilities to apply.

DARTMOUTH COLLEGE EARTH SCIENCES

The Department of Earth Sciences at Dartmouth College invites applications for a tenure-track faculty position. This position is open at the assistant professor level, but consideration may be made at the associate professor level for candidates of exceptional merit. The success-

ful candidate will have demonstrated an ability to build a strong, field-centered program focused on physical processes at the earth's surface and their interactions with tectonics and/or climate. The successful candidate will also possess a broad background in physical geology, and will complement existing strengths of the Department and College including our commitment to excellence in undergraduate and graduate education and research. We especially welcome candidates who can contribute to a valued tradition of mentoring students of Earth processes and history in the field.

Send curriculum vitae, description of teaching and research interests and objectives, reprints or preprints of up to three of your most significant publications, and the names, address (including street address), e-mail address and fax/phone numbers of at least three references to: Search Committee, Department of Earth Sciences, Dartmouth College, 6105 Fairchild Hall, Hanover, NH 03755, e-mail: earth.sciences@dartmouth.edu, Web pages: www.dartmouth.edu/~earthsci.

Review of applications will begin November 15, 2007, and continue until the position is filled. The appointment will be effective July 1, 2008.

Dartmouth College values innovative scholarship, creative practice, and excellent teaching. It is an equal opportunity/affirmative action employer with a strong commitment to diversity. We particularly encourage applications from a broad spectrum of people, including women and minorities.

MIAMI UNIVERSITY

TENURE TRACK FACULTY POSITION, GEOBIOLOGY

The Department of Geology at Miami University invites applications for a tenure-track faculty position at the Assistant Professor level, beginning August 2008. Applicants must have a Ph.D. degree at the time of appointment. The successful applicant will be expected to teach effectively at the undergraduate and graduate levels, supervise student research at the undergraduate, M.S. and Ph.D. levels, initiate and maintain a vigorous, externally-funded research program, and provide service to the university.

We seek an outstanding candidate who is undertaking significant field and/or laboratory-based research in Geobiology. The particular research emphasis, for example high-resolution biostratigraphy, paleobiology/paleontology, paleoecology, paleobiogeochemistry, or paleoclimatology, should complement current program strengths indicated below. It is anticipated that this new position will expand our interdisciplinary research and teaching capabilities and will enable us to address important questions pertaining to the interactions between life and Earth systems through geologic time.

The successful applicant will join an active department that consists of ten faculty members, three research/technical staff members, thirty undergraduate and twenty-five graduate students. The department maintains active research programs in geomicrobiology, geomorphology, geophysics, hydrogeology, igneous petrology, isotope geochemistry, low-temperature geochemistry, mineralogy, paleoclimatology, sedimentology and stratigraphy, structural geology, tectonics, volcanology, and Quaternary geology. The department also maintains modern teaching, research, and instrumentation laboratories, and portable instrumentation in support of the above. Please visit www.muohio.edu/geology for additional information.

Miami University, with 16,000 students, is located in a small-town setting adjacent to the Cincinnati and Dayton urban areas. Interested candidates should submit a packet containing a letter of application, curriculum vitae, statement of teaching and research objectives and accomplishments, transcripts, and arrange three letters of reference to be sent to: Geobiology Search Committee, Department of Geology, Miami University, 114 Shideler Hall, Oxford, OH 45056 (fax: +1-513-529-1542). Review of applications will begin on November 27, 2007, and will continue until the position is filled.

Miami University is an affirmative action / equal opportunity employer. Women and minorities are encouraged to apply. For information regarding campus crime and safety, visit www.muohio.edu/righttoknow.

BLOOMSBURG UNIVERSITY OF PENNSYLVANIA DEPARTMENT OF GEOGRAPHY AND GEOSCIENCES

Bloomsburg University of Pennsylvania (BU) invites applications for a full-time, tenure-track position at the Assistant Professor level (AA# 41-7-39) to teach upper level courses in Groundwater Hydrology, Geomorphology, and introductory level geoscience courses to complete a 12 contact-hour per semester teaching load. Ph.D. is required; exceptional ABDs near completion will be considered.

The preferred candidate will have a strong commitment to excellence in teaching at the undergraduate level in an outdoor field setting and an interest in supervising student research. Finalists for this position must communicate well and successfully complete an interview process, as judged by the department faculty. Recommendation for hiring is needed by the majority of the regular, full-time department faculty. The successful candidate must demonstrate an ability to work with diverse populations.

Please submit an application packet including a letter of application addressing qualifications for the position and research interests, a curriculum vitae, and contact information for three professional references to Dr. Joseph Hill, Search Committee Chair, Geography and Geosciences, Bloomsburg University, 400 East Second Street, Bloomsburg, PA 17815 (e-mail acceptable to jhill@bloomu.edu). Three letters of recommendation, transcripts, and evidence of successful teaching will be required for prefinalists.

For full consideration, completed applications must be received by November 16, 2007.

BU encourages applications from historically underrepresented individuals, women, veterans, and persons with disabilities and is an AA/EEO employer. Visit our Department Web site: <http://departments.bloomu.edu/geo/>.

EARTH SYSTEM SCIENCE—LEHIGH UNIVERSITY

The Department of Earth and Environmental Sciences has a tenure-track opening at the Assistant Professor level for an Earth System Scientist who conducts research in the near-surface environment where biological, geological, hydrological, atmospheric and human processes interact. We seek an individual doing innovative research, ideally with observations and modeling directed toward understanding the processes that control the behavior of the global environment and its response to natural and anthropogenic forcing at geologic to modern time scales. Fields of interest include, but are not limited to biogeochemistry, climatology, oceanography, glaciology, geobiology, and ecosystem ecology. We expect the successful candidate to develop a vigorous externally funded research program, teach a course in their field of expertise, contribute to our undergraduate and graduate curricula, and mentor Ph.D., M.S., and undergraduate students. This position is one of several new hires in Earth and Environmental Sciences, engineering, and the social sciences expected to participate in a university wide, multidisciplinary initiative focusing on the environment. To receive full consideration, applicants should submit by November 15th a letter of application, curriculum vitae, statement of research and teaching interests, up to 3 reprints, and the names of three referees to Prof. Dork Sahagian, Search Committee Chair, Department of Earth and Environmental Sciences, 31 Williams Drive, Lehigh University, Bethlehem, PA 18015. For further information about the EES Department, see: www.ees.lehigh.edu/. Lehigh University is an Equal Opportunity Affirmative Action Employer. The College of Arts and Sciences at Lehigh is especially interested in qualified candidates who can contribute, through their research, teaching, and/or service, to the diversity and excellence of the academic community.

TENURE TRACK FACULTY POSITION(S) STRUCTURAL GEOLOGIST AND GEOPHYSICIST PHYSICS DEPARTMENT

The Physics Department at Cal Poly, San Luis Obispo is seeking one or two geoscientists for full-time, academic year tenure track position(s) beginning 09/08/08. **STRUCTURAL GEOLOGIST**—We seek one individual capable of teaching structural geology, field-geology methods, and geologic mapping to science majors. The primary duties and responsibilities of the structural geologist position also include teaching introductory-level geology courses, with the possibility of teaching seismology to engineering majors and students pursuing a Geology Minor. **GEOPHYSICIST**—A second position may be filled by a geophysicist capable of teaching seismology to engineering majors and students pursuing a Geology Minor, and who is willing and able to teach introductory Physics courses and laboratories. Candidates for either position must have a Ph.D. in Geology or related field. All requirements for the Ph.D. must be completed prior to 09/08/08. Candidates must provide evidence of potential for high quality teaching. Both positions require directing undergraduate research projects complementing the candidates' own professional development program. Structural geologists having experience in teaching and conducting research based on field-geologic mapping and interested in seismology, as well as geophysicists interested in classi-

cal physics are encouraged to apply. The successful candidate(s) will contribute to the Geology Minor and Earth Sciences Major programs at Cal Poly, and will interact with a quaternary geologist/geomorphologist, as well as Earth and Soil Sciences Department faculty. Salary is commensurate with qualifications and experience. To apply, please visit www.calpolyjobs.org, complete a required on-line faculty application and apply to Requisition #101415. Attach a cover letter, your resume, and a statement of professional goals. Make sure to link your on-line application specifically to the Physics Department requisition. Please see on-line posting for instructions for mailing three letters of recommendation. Positions are open until filled; review of applications will begin 12/3/07. Applications received after this date may be considered. On campus interviews with finalists are expected to commence in mid-January 2008. For information about the Physics Department please see www.calpoly.edu/~phys. For questions please contact the Physics Dept. at +1-805-756-1752, or physics@calpoly.edu. Cal Poly is strongly committed to achieving excellence through cultural diversity. The university actively encourages applications and nominations of all qualified individuals. EEO.

HYDROLOGIST/HYDROGEOLOGIST FACULTY POSITION, UTAH VALLEY STATE COLLEGE

The Department of Earth Science at Utah Valley State College (to become Utah Valley University in July 2008) seeks to hire a hydrologist/hydrogeologist in to a tenure-track position to begin in August 2008. The successful candidate will teach courses in hydrology and environmental geology, and other courses of the candidate's choice as agreed upon with the Department Chair (possibly including courses in introductory geology, introductory meteorology, GIS, environmental law, and natural resources management). The successful candidate will also be expected to stay active and up to date in the field of hydrology/hydrogeology through some combination of research, supervision of undergraduate research, professional work, activity in professional organizations, and/or continuing education.

The position requires a Ph.D. in hydrology, hydrogeology, or a closely-related field. The successful candidate

will have knowledge of both surface water and ground-water processes, knowledge of environmental issues related to hydrology, and skills applying computer modeling and GIS to hydrologic investigations. Demonstrable commitment to undergraduate education, undergraduate research, and practical experience will be considered in our assessment of candidate qualifications.

The Department of Earth Science at UVSC offers a Bachelor of Science in Earth Science, with concentrations in geology and environmental management (see www.uvsc.edu/ssh/eath/index.html for details). Our campus is very well-suited for conducting hydrologic research and for incorporating hydrologic field work into courses. There are five ground water monitoring wells on our campus, as well as a wetland area with seasonal surface flow. Within 45 minutes of campus are hot-water and cold-water springs, in both bedrock and alluvium, and a variety of streams in alpine and valley settings. The UVSC Earth Science faculty has strong ties with other colleges and universities in the area (including the University of Utah and Brigham Young University) and with the professional hydrologic community in Utah.

To apply for the position, visit www.uvsc.jobs. Click on "Search Postings" and then choose "Earth Science" from the department drop-down menu. Applications will be reviewed starting on December 17. Contact Dr. Daniel Horns (hornsd@uvsc.edu) for more information. UVSC is an affirmative action/equal opportunity employer, with a strong commitment to diversity. Women, minorities and individuals with disabilities are encouraged to apply.

ASSISTANT PROFESSOR IN GEODYNAMICS UNIVERSITY OF FLORIDA

The Department of Geological Sciences, University of Florida, invites applications from outstanding scientists for a tenure-track faculty position in geodynamics at the Assistant Professor level, to start fall 2008. We seek a creative scientist committed to high standards in research and teaching to complement Departmental research in tectonics, geomagnetism, seismology, geochemistry, and surficial processes. The successful candidate will have an established record of publication in peer-reviewed scientific journals, clear potential to lead an externally-funded research group, and enthusiasm

for research involving highly talented and broadly diverse graduate and undergraduate students. We especially encourage applicants with expertise in any aspect of physical or chemical geodynamics, from core to surface, involving integration of quantitative modeling and field observations. For more information visit <http://web.geology.ufl.edu/search.html>.

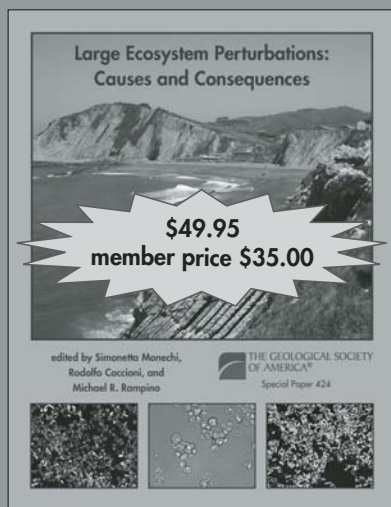
Applicants should hold a Ph.D. at the time of application, and supply (a) a curriculum vitae, including publication list and details of current research funding; (b) a statement of teaching experience and interests; (c) a summary of current research activities and future goals, including a statement describing potential links with existing programs in the Department of Geological Sciences at UF; (d) complete contact information for at least three established scientists who are willing to supply letters of reference.

To ensure full consideration, applications should be submitted by 19 Dec. 2007 to the Search Committee chair, R. M. Russo, rrusso@ufl.edu, Department of Geological Sciences, P.O. Box 112120, 241 Williamson Hall, University of Florida, Gainesville, FL, 32608, USA; phone +1-352-392-2231; fax +1-352-392-9294. Evaluation of candidates will begin on the closing date and continue until the position is filled.

The University of Florida is an equal opportunity institution dedicated to building a broadly diverse and inclusive faculty and staff.

GEOSCIENCES, SKIDMORE COLLEGE FULL-TIME TEACHING ASSOCIATE

Description: The Geosciences Department invites applications for a full-time Teaching Associate to begin Fall 2008. This position requires teaching four sections of GE 101: Earth Systems Science laboratories in the Fall Semester and three sections of GE 102: The History of Earth, Life, and Global Change laboratories in the Spring. The Department seeks a candidate with strong teaching skills who will engage students in the laboratory classroom and in the field. A three-year renewable contract is attached to this position. Skidmore College is a liberal arts institution of approximately 2,200 students and 200 full-time faculty, located in upstage New York. Preference will be given to those candidates with teach-



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ing experience who have a minimum of a Bachelor's degree in the geosciences or related field. The review for this position will begin December 1, 2007. Candidates should send vitae, evidence of excellence in teaching, and three letters of recommendation to: Katharine A. Cartwright, Chair, Geosciences Department, Skidmore College, Saratoga Springs, NY 12866.

Skidmore College is committed to being an inclusive campus community and, as an Equal Opportunity Employer, does not discriminate in its hiring or employment practices on the basis of gender, race or ethnicity, color, national origin, religion, age, disability, family or marital status, or sexual orientation.

GEOSCIENCES, SKIDMORE COLLEGE FULL-TIME ASSISTANT PROFESSOR

Description: The Department of Geosciences invites applications for an opening in Climate Sciences at the level of Assistant Professor to begin Fall 2008 (pending budgetary approval). The Department seeks a candidate with strong teaching skills who will build and maintain an active research program with students. For this position we seek a teacher/scholar with background in climatology, oceanography, geochemistry, or geophysics as related to one or more of the following: climate dynamics, geochemical cycles, ocean-atmosphere interaction, climate diagnostics and analysis, and basic processes in atmospheric and oceanic dynamics. Course coverage includes Introduction to Oceanography, Climatology, and upper-level courses in the candidate's area of expertise. The position also involves contribution to all-college requirements, e.g., by way of an Interdisciplinary Seminar (topic open) for first year students. The College offers competitive start-up funds, pre-tenure sabbaticals and internal grants, however, the successful candidate is also expected to seek and obtain external research funding. Skidmore College is a liberal arts institution of approximately 2,200 students and 200 full-time faculty, located in upstate New York.

Qualifications: Preference will be given to those candidates with teaching experience who have a Ph.D. in the geosciences or a related field. The review process for this position will begin December 20, 2007.

Apply to: Candidates should send a vitae, evidence of excellence in teaching and scholarship, and three letters of recommendation to: Katharine A. Cartwright, Chair, The Department of Geosciences, Skidmore College, Saratoga Springs, NY 12866.

Skidmore College is committed to being an inclusive campus community and, as an Equal Opportunity Employer, does not discriminate in its hiring or employment practices on the basis of gender, race or ethnicity, color, national origin, religion, age, disability, family or marital status, or sexual orientation.

HYDROGEOLOGIST EARTH & ENVIRONMENTAL SCIENCES AT CALIFORNIA STATE UNIVERSITY—EAST BAY

The Department of Earth & Environmental Sciences at California State University—East Bay invites applications for an assistant professor tenure-track position in Environmental Hydrogeology to begin in Fall of 2008. Responsibilities include teaching undergraduate and graduate courses in the applicant's areas of expertise in the Geology and Environmental Science programs and other courses. Applicants should have a Ph.D., outstanding teaching skills, and a commitment to pursue an active research program involving undergraduate and graduate students. For additional information, visit our department's Web site (www.sci.csueastbay.edu/earth). Review of applications will begin December 17, 2007. Please submit a letter of application; a complete and current vita; graduate transcripts; copies of major publications; and three letters of recommendation to Dr. Jeffery Seitz, 08-09 EES-ENV/HYDROGEOL-TT, Department of Earth & Environmental Sciences, California State University, East Bay, 25800 Carlos Bee Blvd., Hayward, CA 94542-3088. CSUEB is an Equal Opportunity Employer.

COLBY COLLEGE—TENURE-TRACK ASSISTANT PROFESSOR OF GEOLOGY MINERALOGY/GEOCHEMISTRY

The Department of Geology invites applications for a tenure-track Assistant Professorship in Mineralogy with complementary expertise in either geochemistry, low or high-temperature diagenesis, or petrography/petrology, beginning 1 September 2008. We are seeking a candidate with instrumental and analytical expertise that will be incorporated into majors' courses and student-research projects. The successful applicant will be expected to teach five undergraduate courses annually, including a 100-level introductory lecture, a 200-level Mineralogy with laboratory, and upper-division courses designed to complement existing faculty expertise in

and outside of the department. Additionally, the successful candidate will direct independent research projects as senior capstone experiences. Colby is a highly selective liberal arts college recognized for excellence in undergraduate education and for close student-faculty interaction. Ph.D. with teaching experience at time of employment preferred. Applicants should submit a letter of application, curriculum vitae, transcripts, statements of teaching and research interests, teaching evaluations, and three letters of reference to Dr. Robert A. Gastaldo, Chair, Department of Geology, 5807 Mayflower Hill Drive, Waterville, ME 04901. Review of applications will begin on 26 November 2007 and will continue until the position is filled. Colby is an Equal Opportunity/Affirmative Action employer, committed to excellence through diversity, and strongly encourages applications and nominations of persons of color, women, and members of other under-represented groups. For more information about the College, please visit the Colby Web site: www.colby.edu.

COLBY COLLEGE—TENURE TRACK ASSISTANT PROFESSOR OF GEOLOGY STRUCTURE/REMOTE SENSING

The Department of Geology invites applications for a tenure-track Assistant Professorship in structure/tectonics and geophysics/remote sensing, beginning 1 September 2008. The department is seeking a candidate who combines empirical and remotely sensed data in his/her research program, and who will translate these skills into the classroom. The successful applicant will be expected to teach five undergraduate courses annually, including a 100-level introductory lecture, a 200-level laboratory-based structure course, and upper-division courses designed to complement existing faculty expertise inside and outside of the department. Additionally, the successful candidate will direct independent research projects as senior capstone experiences. Colby is a highly selective liberal arts college recognized for excellence in undergraduate education and for close student-faculty interaction. Ph.D. with teaching experience at time of employment preferred. Applicants should submit a letter of application, curriculum vitae, transcripts, statements of teaching and research interests, teaching evaluations, and three letters of reference to Dr. Robert A. Gastaldo, Chair, Department of Geology, 5807 Mayflower Hill Drive, Waterville, ME 04901. Review of applications will begin on 26 November 2007 and will continue until the position is filled. Colby is an Equal Opportunity/Affirmative Action employer, committed to excellence through diversity, and strongly encourages applications and nominations of persons of color, women, and members of other under-represented groups. For more information about the College, please visit the Colby Web site: www.colby.edu.

W.M. KECK PROFESSORSHIP IN GEOPHYSICS DEPARTMENT OF GEOLOGY, BAYLOR UNIVERSITY

The Department of Geology at Baylor University invites applications for the W.M. Keck Professorship in Geophysics, beginning August 2008. A Ph.D. in Geophysics, Geology or a related field is required at the time of appointment. The Department currently consists of 13 geoscientists, including geologists, geophysicists and geographers (please see the Department Web site at www.baylor.edu/Geology/ for further information).

Research: The Department seeks a nationally recognized individual who has a strong research agenda in geophysics or the use of geophysical data. Potential areas of interest may include, but are not limited to, earthquake or reflection seismology, potential fields, geodynamics, or geophysically oriented aspects of petroleum geology. We encourage communication and collaboration with a subset of the Geology faculty members that are currently engaged in studies in the general areas of petroleum geology, stratigraphy, structural geology, hydrogeology, and environmental geology and geophysics, and the successful candidate is expected to carry out a vigorous research program that involves both undergraduates and graduates. Research space is available in the 500,000 ft² "state-of-the-art" Baylor Sciences Building.

Teaching: We seek an individual with a strong commitment to excellence in teaching, and require that he/she contribute significantly to both the undergraduate programs in Geology and Earth Science by teaching a freshman course, a senior-level course, as well as contribute to the graduate (M.S. and Ph.D.) programs in Geology by teaching graduate courses or seminars in his/her areas of specialization. A laboratory that includes high-performance computers and software, as well as two large plotters, is available for both instruction and research.

Application Process: Send letter of application, including statement of teaching and research interests, curriculum vitae, copies of transcripts, and the names and contact information for three references to: Dr. Steven Dworkin, Geophysics Search Committee Chair, Department of Geology, Baylor University, One Bear Place #97354, Waco, TX 76798-7354 (+1-254-710-2361; e-mail: Steve.Dworkin@Baylor.edu). The review of applications will begin December 1, 2007, and applications will be accepted until the position is filled. To ensure full consideration, application must be completed by December 15, 2007. Baylor is a Baptist university affiliated with the Baptist General Convention of Texas. As an Affirmative Action/Equal Opportunity employer, Baylor encourages minorities, women, veterans and persons with disabilities to apply.

TENURE-TRACK HYDROGEOLOGIST DEPARTMENT OF GEOLOGY, BAYLOR UNIVERSITY

The Department of Geology at Baylor University invites applications for a full-time, tenure-track Assistant or Associate Professor in hydrogeology, beginning in August 2008. We seek a dynamic person with expertise in groundwater flow dynamics and processes involving such aspects as quantitative modeling, groundwater geochemistry, geomicrobiology, and basin-scale fluid flow. Experience with field-based research in groundwater pollution and contaminant transport is highly desirable. Preference will be given to candidates whose expertise complements existing departmental teaching and research areas. The successful candidate will be expected to pursue a vigorous externally-funded research program, aspire to teaching excellence, and engage in interdisciplinary collaboration. Teaching of both undergraduate and graduate level courses, including hydrogeology, environmental geology, and in area of expertise, is required. A Ph.D. in Hydrogeology or related area is required.

The Department offers undergraduate degrees in Geology and Geography and MS and Ph.D. degrees in Geology (www.baylor.edu/Geology/). Candidates should submit CV, letter of intent including statements of research and teaching interests, examples of published work, teaching evaluations (if available) and contact information (with e-mail addresses) of three references to: Dr. Joe C. Yelderman, Jr., Hydrogeology Search Committee Chair, Dept. of Geology, One Bear Place #97354, Baylor University, Waco, TX 76798-7354 (Joe.Yelderman@baylor.edu). Review of applications will begin on 1 December 2007, and applications will be accepted until the position is filled. To ensure full consideration, application must be completed by January 15, 2008. Baylor is a Baptist university affiliated with the Baptist General Convention of Texas. As an Affirmative Action/Equal Opportunity employer, Baylor encourages minorities, women, veterans and persons with disabilities to apply.

DEPARTMENT OF GEOLOGICAL SCIENCES COLLEGE OF NATURAL SCIENCE & MATHEMATICS CALIFORNIA STATE UNIVERSITY—FULLERTON

Hydrogeochemist, Tenure Track

The Department of Geological Sciences at California State University—Fullerton invites applications for a tenure-track, Assistant Professorship that will begin August 2008. The successful candidate is expected to develop an active, field-based, externally-funded research program in Hydrogeochemistry involving undergraduate and master's students and must be committed to excellence in teaching the diverse student population at CSU Fullerton. A Ph.D. in Geological Sciences is required at the time of appointment.

Teaching responsibilities will include general education classes (e.g., oceanography, physical geology) and upper-division/graduate courses (e.g., aqueous geochemistry and/or contaminant transport, hydrogeology/hydrology) in the candidate's field of expertise. The department places a strong emphasis on field-based instruction in all class offerings. For a complete description of the requirements, go to <http://diversity.fullerton.edu/>.

The Department currently has approximately 80 undergraduate majors, 25 MS students and 12 full-time faculty. Fullerton's location offers convenient access to coastal, mountain, and desert environments, providing many opportunities for field-based research and instruction. Abundant collaborative research and teaching opportunities exist within the Departments of Geological Sciences, Biological Sciences, Chemistry and Biochemistry and the Environmental Studies Program. Applicants are encouraged to visit <http://geology.fullerton.edu/> for additional information regarding research and curriculum.

To apply, please send (1) a detailed curriculum vita; (2) a letter of application; (3) a teaching statement that

includes: a discussion of relevant course work and/or experience in preparation for teaching, a list of courses you would feel comfortable teaching, and a statement of your teaching philosophy; (4) a statement of your future research plans and goals; and (5) letters of recommendation from at least three references familiar with your teaching and research potential. Applicants and referees should send materials directly to: Search Committee Chair, Department of Geological Sciences, California State University, 800 N. State College Blvd., Fullerton, California 92834-6850.

Applications will be accepted until the position is filled. To insure full consideration, submit all application materials by November 19, 2007.

CSU Fullerton is an Equal Opportunity/Title IX/503/504/VEVRA/ADA Employer.

BOISE STATE UNIVERSITY HYDROLOGIC SCIENCES

The Department of Geosciences at Boise State University invites applications for a new tenure-track (Associate or Assistant Professor) faculty position in hydrologic sciences. Applicants should have demonstrated expertise in climate impacts on the water cycle and modeling atmospheric, surface and/or subsurface water systems at the watershed to regional scale. We seek a colleague eager to establish a cross-disciplinary research effort while adding to our existing strengths in watershed hydrology, hydrogeology, geomorphology and biogeochemistry. The candidate will contribute to curriculum at the undergraduate and graduate levels. A Ph.D. in the hydrologic sciences, or a related discipline, is required at the time of appointment; previous teaching and/or post-graduate research experience are considered strong assets. Information about the Department of Geosciences and the University can be found through our Web site: <http://earth.boisestate.edu/>.

Applicants should send a Curriculum Vita, Statement of Research and Teaching Interests, and contact information for at least three referees to Search Committee, Department of Geosciences, Boise State University, 1910 University Drive, Boise, ID 83725. Please reference Search Number AS-0013-78. Review of applicants will begin December 1 and continue until a qualified applicant pool is established. Email correspondence (questions or submission of application materials) can be sent to dwilkins@boisestate.edu.

Boise State University is an EOE/AA institution and is strongly committed to achieving excellence through cultural diversity. The University actively encourages applications from women, persons of color, and members of other underrepresented groups. Veteran's preference.

TENURE-TRACK POSITION AQUEOUS GEOCHEMISTRY, UNIVERSITY OF MAINE

The Department of Earth Sciences at the University of Maine invites applications for a tenure-track position as an assistant professor in low temperature aqueous geochemistry. We seek candidates with interests that include applying environmental geochemistry to interdisciplinary and collaborative ecosystem-based research.

The successful applicant will be responsible for (1) teaching an undergraduate environmental geology course and two other courses on aqueous geochemistry at undergraduate and graduate levels, (2) supervising graduate and undergraduate research projects, and (3) maintaining an externally funded research program. This position has historically been a critical position for research on environmental geochemistry of surface waters and watersheds with close ties to state and federal regulatory agencies, and it has enjoyed both a national and international reputation. The successful applicant is expected to continue this record of achievement through external funding relying on the many field and laboratory research facilities available at The University of Maine. Examples include: the Bear Brook Watershed in Maine, a 20+ year paired watershed experiment utilized for multidisciplinary environmental research, The Sawyer Environmental Chemistry Research Laboratory (a fully instrumented modern environmental chemistry facility), the Senator George J. Mitchell Center for Environmental and Watershed Research (an institute focused on water and watershed issues), and the Climate Change Institute (a research unit focusing on variability of the earth's climate, ecosystems, and other environmental systems). Additional information on related programs can be viewed at www.geology.um.maine.edu.

A Ph.D. at the time of appointment is required. Applicants are invited to submit a curriculum vitae, a complete list of publications, up to 3 reprints/preprints of work that exemplifies their scientific methods and

interests, a written statement of research and teaching interests, and the names and addresses of at least three references to: Andrew Reeve, Chair; Search Committee, Department of Earth Sciences, Bryand Global Sciences Center, University of Maine, Orono, Maine, 04469. The anticipated starting date is September 1, 2008. Review of applications will begin December 1, 2007, and will continue until the position is filled. The University of Maine is an Equal Opportunity/Affirmative Action employer.

GLACIOLOGY, UNIVERSITY OF KANSAS

The Department of Geology and the Center for Remote Sensing of Ice Sheets (CREStS) at the University of Kansas seek applications for an academic year, tenure-track faculty position in the field of glaciology. We seek an outstanding colleague whose research addresses fundamental problems related to glaciology and the motion of glacial ice, who will participate in the CREStS research mission, and who will complement existing programs in behavior of ice sheets, rates of geological processes, and climate change. Individuals with expertise in numerical modeling of ice sheets, remote sensing of ice sheets, landscape evolution, cosmogenic nuclide dating, and ocean-ice-atmosphere modeling are particularly encouraged to apply. The successful candidate will be expected to establish an externally funded research program, direct graduate students, and participate in teaching graduate and undergraduate students, including courses in glaciology. Refer to www.geo.ku.edu and links for additional information about the department and the University of Kansas. This faculty position will directly support the mission of CREStS—to understand and predict the role of polar ice sheets in sea-level change. CREStS is an NSF-funded Science and Technology Center established in 2005—see www.crests.ku.edu for additional description of that effort. The academic affiliation is expected to be with the Department of Geology, but appointment in a different academic department would be possible. Appointment is expected to begin August 18, 2008.

Applicants are expected to have a Ph.D. or terminal degree in geology or a related field by the start date of the appointment. For full position announcement, see <http://www2.ku.edu/~clas/employment/> or <http://www.geo.ku.edu>. A letter of application outlining research and teaching interests, a complete curriculum vita, and names and contact information of at least three persons, who can be contacted for letters of reference, should be sent to Doug Walker, Department of Geology, 1475 Jayhawk Blvd., Rm. 120, Lindley Hall, University of Kansas, Lawrence, KS 66045-2124 (+1-785-864-2735, fax +1-785-864-5276, e-mail: jwalker@ku.edu). Initial review of completed applications will begin on January 15, 2008, and will continue until the position has been filled. EO/AA employer. The University is committed to increasing the ethnic and gender diversity of its faculty, and we strongly encourage women and minority candidates to apply.

UNIVERSITY OF MICHIGAN FACULTY POSITION, SOLID EARTH GEOPHYSICS

The Department of Geological Sciences at the University of Michigan invites applications for a tenure-track position in Geophysics, pending final approval, to complement the existing strengths in its research on the structure and dynamics of the Solid Earth. The preferred starting date is Fall 2008. The successful candidate will have a standard 9-month academic appointment. We encourage applications from researchers who use observational, theoretical, or experimental approaches with specific focus on Lithosphere Structure and Dynamics and/or Mineral Physics. The appointment is intended at the level of assistant professor but an appointment to a higher rank may be considered for qualified candidates.

Successful candidates are expected to establish independent research programs and contribute to undergraduate and graduate teaching. Applicants should send curriculum vitae, statement of current and future research plans, statement of teaching philosophy, experience, interests, and evidence of teaching excellence, as well as the names and contact information of three to five referees. Additional information about the Department can be found at www.geo.lsa.umich.edu.

Applications should be sent to: Geophysics Faculty Search Chair, Department of Geological Sciences, 1100 N. University Avenue, University of Michigan, Ann Arbor, MI 48109-1005. Inquiries are welcomed at geophysics-search@umich.edu.

For full consideration applications should be received before December 1, 2007. The University of Michigan is an equal opportunity/affirmative action employer. Women and minorities are encouraged to apply. The University is supportive of the needs of dual career couples, and has a very active ADVANCE Program.

GEOLOGIST

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Ecology and Environment, Inc., a leading environmental engineering firm, is seeking a Geologist in our Dallas Office.

Responsibilities: Multimedia environmental sampling; Soil boring logging; Drilling and well installation oversight; Writing sampling and work plans; Analyzing and presenting data; Report preparation.

Requirements: Bachelors degree in geology or a closely related field; 2-5 years experience; working knowledge of environmental regulations.

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GLACIAL/QUATERNARY GEOLOGIST UNIVERSITY OF WISCONSIN-MILWAUKEE

The Department of Geosciences at the University of Wisconsin-Milwaukee invites applicants for a tenure track position in glacial/Quaternary geology at the rank of Assistant or Associate Professor with a start date of August 2008. Applicants must hold a Ph.D. in geology or related field at the time of appointment, and have demonstrated research experience in glacial/Quaternary geology. Post-doctoral experience is desirable. The successful candidate is expected to conduct an active, internationally recognized, externally funded research program. The successful candidate will teach an undergraduate/graduate course in glacial/Quaternary geology (processes, deposits, and landforms), introductory and upper level undergraduate and graduate level courses in his or her field of expertise, and advise graduate student thesis projects. A normal teaching load is 3 courses per academic year. Information is available on-line regarding the Department of Geosciences at www.uwm.edu/Dept/Geosciences/ and the College of Letters and Sciences at www.uwm.edu/letsci/jobs/index.html.

Applications should be postmarked by January 18, 2008. Candidates must mail a curriculum vitae, a statement of teaching and research interests/philosophy, examples of published work, and names and contact information of at least three current references to Dr. John L. Isbell, Search Committee Chair, Department of Geosciences, University of Wisconsin-Milwaukee, P.O. Box 413, Milwaukee, WI 53201 (Fax: +1-414-229-5452; e-mail: jisbell@uwm.edu). The University of Wisconsin-Milwaukee is an Equal Opportunity/Affirmative Action Employer.

The University of Wisconsin-Milwaukee is a large research oriented institution located on the north side of Milwaukee. The Department of Geosciences offers B.S./B.A., M.S., and Ph.D. degree programs and is staffed by 12 full-time faculty. Southeastern Wisconsin has easy access to many classic Quaternary glacial sites.

ASSISTANT PROFESSOR ENVIRONMENTAL GEOLOGY/GEOGRAPHY SOKA UNIVERSITY OF AMERICA ALISO VIEJO, CALIFORNIA

Soka University of America (SUA) seeks an Assistant Professor of Environmental Geology/Geography to be part of a new interdisciplinary Environmental Studies program. The successful candidate should have expertise in student-centered learning with a focus on preparing undergraduate students to be life-long learners and will teach courses in earth and environmental sciences. Such courses may include introductory earth sciences, soil science, environmental geology, geomorphology, atmospheric science, global climate change, urban and regional geography, geological field methods and other courses according to the applicant's background and expertise. The ability to teach courses in GIS would be an asset. A strong commitment to undergraduate education and a program of faculty/student research is expected. A research focus on the environmental dimensions of Earth Systems science is a plus and preference will be given to candidates with a broad, multidisciplinary approach to environmental questions.

Applicants must hold a Ph.D. in an appropriate area yet be versatile enough to teach courses outside his/her areas of specialization. All faculty are expected to teach one or more courses in an interdisciplinary general studies program. This is a full-time faculty position. Start date for this position is mid-August 2008.

Soka University of America offers a challenging program in the liberal arts with a focus on the Pacific Rim. The university is committed to a vision of an integrated inter- or multidisciplinary approach to education. The university aims to foster close intellectual relations between faculty and student by encouraging mentoring

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on the part of the faculty. An appreciation of the centrality of peace, freedom and human rights to the happiness of the individual and the world provides the founding impetus for the university and its mission.

Job Qualifications: Applicants must hold a Ph.D. in an appropriate area yet be versatile enough to teach courses outside his/her areas of specialization.

Benefits/Salary: Salary is determined on an open scale based on rank and years of relevant experience. All regular faculty members are eligible for full medical, dental and retirement benefits.

Deadline for applications is November 30, 2007. A letter of application, curriculum vitae, unofficial transcripts, a one-page statement of teaching philosophy, a one-page statement of research, evidence of teaching effectiveness, and three letters of references should be sent to: **Environmental Geology Position c/o:** Edward M. Feasel, Ph.D., Dean of Faculty, Soka University, 1 University Drive, Aliso Viejo, CA 92656. E-mail: feasel@soka.edu, +1-949-480-4133, fax: +1-949-480-4027.

Please see our Web site at www.soka.edu for more information.

Soka University of America is an equal opportunity employer.

NEOTECTONICIST/STRUCTURAL GEOLOGIST CALIFORNIA STATE UNIVERSITY, LOS ANGELES

The Department of Geological Sciences seeks to fill a tenure-track position in neotectonics/structural geology, at the assistant professor level, with a starting date of September 2008 and at an initial salary commensurate with qualifications and experience. Applicants must have an expertise in one or more of the following: Quaternary geology/surficial processes, structural geology, geomorphic processes, neotectonic development, history of southern California, paleoseismology, and soil development and stratigraphy. A Ph.D. in geology/geophysics from an accredited institution of higher education is required. The successful applicant must demonstrate a potential for or a record of research, scholarly and/or creative activity involving students whenever possible, and a potential for effective teaching using a variety of methodologies. A demonstrated ability

and/or interest in working in a multi-ethnic, multicultural environment and proficiency in oral and written communication are also required. Duties will include teaching introductory and advanced courses at the undergraduate and graduate level. We seek applicants capable of integrating classroom and field instruction. Maintaining an active research program, mentoring and advising students at the undergraduate and graduate level, and participating in University Service are expected. Applicant documentation should include a statement of teaching and research interests, a detailed curriculum vita, three letters of recommendation, and transcripts from institution awarding highest degree. Employment is contingent upon proof of eligibility to work in the United States and completion of the University's Application for Academic Employment form. Review of applications will begin on December 1, 2007, and will continue until the position is filled. Address applications, required documentation and/or requests for information to: Dr. Pedro Ramirez, Search Committee Chair, California State University, Los Angeles, 5151 State University Drive, Los Angeles, CA 90032-8203, pramire@calstatela.edu, +1-323-343-2417. Department Web Page: www.calstatela.edu/dept/geology.

Opportunities for Students

GDL Foundation Scholarships in Structure and Diagenesis. The GDL Foundation supports study and research that looks at chemical and mechanical interactions, or *structural diagenesis*, in sedimentary basins. Practical applications of this work are of particular interest.

We are currently seeking applications from M.S. and Ph.D. candidates for one-year scholarships up to \$5,000. Amounts awarded are based on specific proposals for research as well as participation in professional meetings and conferences where this work is shared with others.

Completed applications are due on or before November 26, 2007. Successful applicants will be notified by December 10, 2007.

Applications available at: www.gdlfoundation.org. Direct questions to info@gdlfoundation.org.

Graduate Student Opportunities: The Department of Geological Sciences at Case Western Reserve University (www.case.edu) is seeking qualified students for its graduate program. Current research strengths in the department include: surface processes, soil erosion, sediment transport, geologic sequestration of carbon, geochemistry, planetary materials, planetary geology and geophysics, and high-pressure mineral physics and chemistry. Financial assistance may be available for qualified applicants interested in pursuing M.S. or Ph.D. degrees. For more information, please see <http://geology.case.edu> or contact the department at geo-gradinfo@case.edu.

Applications for graduate study at Case are accepted on a rolling basis, though students requesting financial assistance in Fall 2008 are encouraged to apply by February 1, 2008.

Case is committed to diversity and equality. Students from all backgrounds are encouraged to apply.

New Mexico Highlands University, Graduate Assistantship. Graduate assistantships are available for students wishing to pursue an MS in Geology beginning Fall 2008 term. The NMHU Environmental Geology Program offers a field-intensive curriculum emphasizing earth materials, mineral-rock-water interactions, environmental geophysics, and natural geologic hazard assessment. Program strengths are in mineralogy, petrology, geochemistry, rock-paleomagnetism, structural geology, volcanology, and collaborative endeavors with the Forestry Program and the new Forest and Watershed Restoration Institute. Nestled in the foothills of the Sangre de Cristo Mountains, Highland's campus has been cited as one of New Mexico's best-kept secrets. A low student:faculty ratio, state-of-the art laboratory facilities, and committed faculty provide students with a superior learning experience. The graduate assistantship includes a stipend of \$10,100 and tuition waiver per academic year. Application review begins 01/15/08. For more information, contact Dr. Michael Petronis, Department of



USGS Mendenhall Postdoctoral Research Fellowship Program (Fiscal Year 2009)

The U.S. Geological Survey (USGS) invites applications for the Mendenhall Postdoctoral Research Fellowship Program for Fiscal Year 2009. The Mendenhall Program provides opportunities to conduct research in association with selected members of the USGS professional staff. Through this Program the USGS will acquire current expertise in science to assist in implementation of the science strategy of its programs. Fiscal Year 2009 begins in October 2008.

Opportunities for research are available in a wide range of topics including: shale-gas resource potential; climate change; karst geomorphology and hydrology; greenhouse gas fluxes from the land/sea margin; coastal change; mapping 3D distribution of hydrogeologic properties; geological materials and human health; applications of airborne gravity gradient measurements; petroleum system processes; unconventional energy resources; earthquake simulations; uncertainty assessments; tsunamigenic earthquakes; detection of anomalous hydrothermal and volcanic activity; rates of magma production; geologic storage of carbon dioxide; modeling debris flows and rock avalanches; urban hazards; slip rate indicators; risk and vulnerability of communities to natural hazards; applied remote sensing; dynamics of volcanic tephra plumes; landforms associated with active faults; landscape change; valuating landscape and ecological services.

The postdoctoral fellowships are 2-year appointments. The closing date for applications is November 9, 2007. Appointments will start October 2008 or later, depending on availability of funds. A description of the program, research opportunities, and the application process are available at <http://geology.usgs.gov/postdoc>. The U.S. Geological Survey is an equal opportunity employer.

Program Contacts: Dr. Rama K. Kotra, rkotra@usgs.gov, 703-648-6271; Ms. Sarah Griffin-Bemis, sgriffin@usgs.gov, 703-648-7395.

U.S. Department of the Interior
U.S. Geological Survey

Natural Sciences, New Mexico Highlands University, Box 9000, Las Vegas, New Mexico 87701, mspetro@nmhu.edu. For disabled access or services call +1-505-454-3513 or TDD# +1-505-454-3003. EOE. Graduate Student Opportunities, Ohio University. The Department of Geological Sciences at Ohio University is seeking qualified students for its graduate program. Positions are available beginning April or September 2008. The department offers a competitive program leading to an MS degree in Geological Sciences with areas of emphasis including hydrogeology, geochemistry, geomorphology, paleontology, stratigraphy/sedimentology, planetary geology, geophysics, and tectonics. Prospective students are encouraged to contact faculty directly to discuss potential research topics. Qualified students are eligible to receive teaching assistantships that carry a tuition waiver and a stipend of \$12,150/year. For program and application information, visit the department Web site at www.ohiou.edu/geology/ or contact the graduate chair, Greg Springer (springeg@ohio.edu), for additional information.

Graduate Student Opportunities, Ohio University. The Department of Geological Sciences at Ohio University is seeking qualified students for its graduate program. Positions are available beginning April or September 2008. The department offers a competitive program

leading to an MS degree in Geological Sciences with areas of emphasis including hydrogeology, geochemistry, geomorphology, paleontology, stratigraphy/sedimentology, planetary geology, geophysics, and tectonics. Prospective students are encouraged to contact faculty directly to discuss potential research topics. Qualified students are eligible to receive teaching assistantships that carry a tuition waiver and a stipend of \$12,150/year. For program and application information, visit the department Web site at www.ohiou.edu/geology/ or contact the graduate chair, Greg Springer (springeg@ohio.edu), for additional information.

Jonathan O. Davis Scholarship, Division of Earth and Ecosystem Sciences, Desert Research Institute. The family and friends of Jonathan O. Davis, a prominent U.S. geologist and geochronologist, and a DRI faculty member, have established an endowment that provides a yearly national Jonathan O. Davis Scholarship, as well as a stipend, for a University of Nevada-Reno student.

Jonathan was tragically killed in an automobile accident in December 1990. It is the wish of his family and friends to support graduate students working on the Quaternary geology of the Great Basin, research close to Jonathan's heart. The national scholarship is \$4,000 and the University of Nevada-Reno stipend is \$1,500.

The national scholarship, administered by the Division of Earth and Ecosystem Sciences of the Desert Research Institute, is open to graduate students enrolled in an M.S. or Ph.D. program at any university in the United States. The stipend, also administered by the Division of Earth and Ecosystem Sciences, is open to graduate students enrolled in an M.S. or Ph.D. program at the University of Nevada-Reno. Quaternary geology, as used here, encompasses a wide range of topics normally considered as part of the Quaternary sciences. The research, however, must have a substantial geologic component or demonstrate a strong reliance on geological techniques and must be focused on the Great Basin.

Applications should include: A cover letter explaining how the individual qualifies for the award. Please include your social security number and state whether you are applying for the national scholarship or for the UNR stipend. A current résumé or vitae. A two-page, single spaced description of the thesis/dissertation research, which also clearly documents the geological orientation and research significance. Figures, tables, and references do not count against the two-page limit; A short statement on how funding would be used. A letter of recommendation from the thesis/dissertation supervisor, which emphasizes the student's ability and potential as a Quaternary scientist.

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2008

Call for Field Trip Proposals

Do you have an idea for an interesting and educational field trip beginning or ending near Houston? GSA encourages you to submit your field trip proposals online at <http://gsa.confex.com/gsa/2008am/fieldtrip.htm>. Trips can be anywhere from half a day to three days long. Questions? Contact Eric Nocerino, +1-303-357-1060, enocerino@geosociety.org.

Field trip proposal deadline:
4 December 2007.

Call for Short Course Proposals

YOU too can run a GSA short course! Share your unique knowledge and experience with peers, students, or earth science teachers in our dynamic annual meeting setting. Learn how to submit your short course proposal at www.geosociety.org/meetings/2008/scProposals/. Questions? Contact Jennifer Nocerino, +1-303-357-1036, jnocerino@geosociety.org.

Short course proposal deadline:
4 December 2007.



Big Bend National Park, Texas. Photo courtesy of the National Park Service.

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Crop Science Society of America

Gulf Coast Association of Geological Societies
with the Gulf Coast Section SEPM

Hosted by the Houston Geological Society

2008 GSA ANNUAL MEETING & EXPOSITION

Applications must be post-marked by February 2, 2008. Proposal reviews will not be returned to applicants. Applications should be addressed to: Executive Director, Division of Earth and Ecosystem Sciences, Desert Research Institute, 2215 Raggio Parkway, Reno, NV 89512.

If you have further questions regarding the awards or the application process, please contact Barbara Jackson at +1-775-673-7454 or bj@dri.edu.

Fellowship Opportunities

GDL FOUNDATION FELLOWSHIPS STRUCTURE AND DIAGENESIS

The GDL Foundation supports study and research that looks at chemical and mechanical interactions, or *structural diagenesis*, in sedimentary basins. Practical applications of this work are of particular interest.

We are currently seeking applications from post-doctoral researchers for one-year fellowships up to \$10,000. Amounts awarded are based on specific proposals for research and participation in professional meetings and conferences where this work is shared with others.

Applications due on November 26, 2007. Successful applicants will be notified by December 10, 2007.

Applications available at www.gdlfoundation.org. Direct questions to info@gdlfoundation.org.

UNIVERSITY OF WYOMING

Aqueous and Environmental Geochemistry

The Department of Geology and Geophysics at the University of Wyoming invites applications for a tenure-track Assistant Professor position in the broadly defined area of aqueous and environmental geochemistry beginning in August 2008.

We are interested in promising scientists in fields of research including, but not restricted to, aqueous and environmental geochemistry, mineral-fluid interface geochemistry, microbiological geochemistry, reactive and contaminant transport, watershed chemistry and weathering, and ground-water geochemistry. The successful candidate will be involved in the undergraduate and graduate teaching mission of the Department of Geology and Geophysics, and will be expected to develop an active externally funded research program that complements and expands upon departmental strengths.

The Department of Geology and Geophysics has well-equipped and staffed laboratories for SEM, XRD, EPMA, TIMS for radiogenic isotopes, and a full range of aqueous geochemical analyses from automated titrations to ICP-MS. Several user facilities on campus afford easy access to a wide variety of analytical techniques, from stable isotope analysis to PCR. The Department of Geology and Geophysics is working closely with the newly created School of Energy Resources (SER), an institute dedicated to energy-related teaching and research in support of state, national, and international energy-related activities (including carbon sequestration, environmental impact, and renewable energy resources). The Helga Otto Haub School of Environment and Natural Resources and William D. Ruckelshaus Institute also offer venues for integrating research across disciplinary boundaries. Additional information on the Department Geology and Geophysics can be obtained at <http://home.gg.uwyo.edu/>. Information about the School of Energy Resources is available at <http://uwacadweb.uwyo.edu/SER/> and the Haub School and Ruckelshaus Institute at <http://www.uwyo.edu/ENR/enrschool.asp>.

Applications should include a statement of research and teaching interests and accomplishments, curriculum vitae, and the names and contact information for three individuals who can provide letters of evaluation. Review of completed applications will begin November 1, 2007; however, applications will be accepted until January 31, 2008. Send an electronic copy of your application to: Ms. Carol Pribyl at cpribyl@uwyo.edu; if you have additional application materials to send, please direct them to the Geochemistry Search Committee, Department of Geology and Geophysics, University of Wyoming, 1000 East University Avenue, Dept. 3006, Laramie, WY 82071-2000.

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YALE UNIVERSITY: INTERDEPARTMENTAL POSTDOCTORAL FELLOWSHIP, GEOSCIENCES

The Department of Geology and Geophysics at Yale University (www.geology.yale.edu) seeks applicants for a postdoctoral fellowship in research that links geosciences (studies of the solid earth, oceans, atmosphere, climate, and the evolution of life) with other sciences, including, for example, astronomy and astrophysics; environmental studies; physics; chemistry; biology; engineering; anthropology; medical science and public health; economics and political science.

This Postdoctoral Associate position is awarded for two years, contingent on satisfactory progress, and provides a stipend (\$48,000/yr) and base research funds (\$5,000/yr), plus health care benefits and expenses for relocation.

The Interdepartmental Postdoctoral Fellowship will have at least two faculty collaborators: the primary sponsor will be from Geology and Geophysics, while others are from one or more other Yale departments. Interested candidates should first contact a faculty member in Geology and Geophysics to define a research theme and to identify other appropriate faculty collaborators.

Applicants should submit a curriculum vita, a list of publications, an interdisciplinary research proposal (2-3 pages, in which the Yale collaborators are identified), and a brief letter of endorsement from each of the Yale faculty collaborators. Applicants should also arrange for three reference letters to be sent directly to the Department. The deadline for receipt of all application materials is January 2, 2008, and decisions will be announced by February 29, 2008. Successful candidates are expected to begin their program at Yale between July 1 and December 31, 2008.

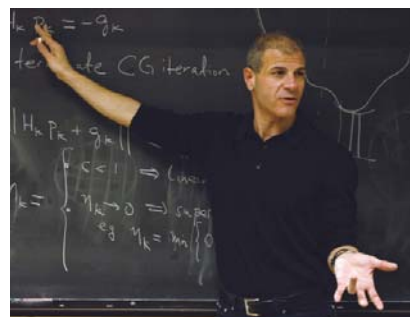
Application materials and reference letters should be sent by e-mail to interdepartmental.fellowship@geology.yale.edu or by post: Interdepartmental Postdoctoral

Fellowship, Yale University, Department of Geology and Geophysics, PO Box 208109, New Haven, CT 06520-8109. Yale University is an equal opportunity/affirmative action employer; applications from women and minority scientists are strongly encouraged.

YALE UNIVERSITY: BATEMAN POSTDOCTORAL FELLOWSHIPS IN GEOSCIENCES

The Department of Geology and Geophysics at Yale University (www.geology.yale.edu) announces an annual competition for one or more Bateman Postdoctoral Fellowships. We welcome applicants with research interests across the full range of disciplines within the Earth Sciences, including studies of the solid earth, oceans, atmosphere, climate dynamics, geochemistry, paleoclimatology, and the evolution of life. Each of these Postdoctoral Associate positions is awarded for two years, providing a stipend (\$48,000/yr) and base research funds (\$5,000/yr), plus health care benefits and expenses for relocation. Applicants should contact a sponsor in the Department to identify potential research projects, and then submit a short (2-3 pages) statement of research interests and proposed research, a curriculum vita, and list of publications. Applicants should also arrange for three reference letters to be sent directly to the Department. The deadline for receipt of all application materials is January 2, 2008, and decisions will be announced by February 29, 2008. Successful candidates are expected to begin their program at Yale between July 1 and December 31, 2008.

Application materials and reference letters should be sent by e-mail (bateman.fellowship@geology.yale.edu) or by post: Bateman Postdoctoral Fellowship, Yale University, Department of Geology and Geophysics, PO Box 208109, New Haven, CT 06520-8109. Yale University is an equal opportunity/affirmative action employer; applications from women and minority scientists are strongly encouraged.



NEW HIRES IN GEOSCIENCE EDUCATION

The Jackson School of Geosciences seeks individuals attracted to the challenge of geoscience education at the university level. As leaders in geoscience pedagogy, candidates should excel as teachers and developers of courses set in field, laboratory, and lecture environments. The new hires may also contribute to the Jackson School's commitment to educate the wider community of the public and K-12 pre-college students.

We encourage applications from those with proven records of teaching and related experience at the college level. Candidates are expected to hold a PhD degree in the geosciences or a closely related field. Additional credentials may include experience in securing external funding, and a record of publications related to geoscience education. Opportunities exist for appointments as Lecturer, Senior Lecturer, Adjunct Faculty, or tenure-track Faculty, depending upon credentials and interests. Appointments will be primarily within the Department of Geological Sciences, but may include affiliations with the Jackson School's main research units, the Bureau of Economic Geology or the Institute for Geophysics. The schedule of appointment is negotiable.

Send inquiries and applications (cover letter, CV, publications) to: Office of the Chairman / Department of Geological Sciences / Jackson School of Geosciences, The University of Texas at Austin / 1 University Station C1100 / Austin, TX 78712-0254 or jobs@jsg.utexas.edu.

For more information on the school and its hiring program visit us online at www.jsg.utexas.edu/hiring.

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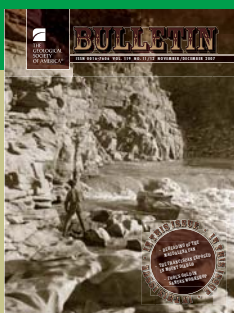
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- 'Kick'em Jenny,' said 231Pa, Excessively
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Coal fires burning around the world: Opportunity for innovative and interdisciplinary research

Glenn B. Stracher, *Division of Science and Mathematics, East Georgia College, Swainsboro, Georgia 30401, USA, stracher@ega.edu*

INTRODUCTION

Coal-bed and culm-bank fires are formidable forces of nature ignited by natural phenomena, including lightning strikes and forest fires, or by human-related activities like mining accidents or burning trash in abandoned mines. Spontaneous combustion due to exothermic reactions in coal exposed during mining is especially problematic, making further mining dangerous, while polluting surrounding communities (Fig. 1; Stracher and Taylor, 2004).

COAL FIRES IN TIME AND SPACE

Uranium-thorium/helium ratios and fission-track dates from detrital zircons in clinker and unconformable relationships between baked and unbaked sedimentary rocks demonstrate that coal fires occurred naturally in the geologic past, dating as far back, for example, as the Pliocene in the Powder River basin of the United States (Heffern and Coates, 2004) and the Pleistocene in northwest China (Kroonenberg and Zhang, 1997).

People have mined coal for heating and cooking for thousands of years. Although written accounts of coal fires date to at least the time of Alexander the Great (Stracher et al., 2005), the worldwide proliferation of these fires has increased dramatically since the industrial revolution, especially in the major coal-producing countries, including China, the United States, India, South Africa, Russia, and Indonesia (Stracher and Taylor, 2004). Currently, thousands of coal fires are burning—some for centuries and many uncontrollably, with flames as high as 20

m and temperatures exceeding 1000 °C—from eastern Asia and northern China into the coal basins of Russia, Europe, Africa, north and south America, and Australia. The economic losses are enormous, estimated at US\$125–250 million in China, and it's projected that over US\$651 million will be necessary to contain or extinguish coal fires in the United States. In India, ~1453 million tons of coal are locked up in 70 fires in the Jharia coalfield alone (Stracher, 2004, 2007a).

THE EFFECTS OF COAL FIRES

Constructive

Coal fires are constructive in that they transform landscapes, frequently generating new chemical products at the same time. Sinkholes, valleys, and slump blocks produced by volume-reduced coal during burning; chemically altered or pyrometamorphic rocks; and paralavas are the most obvious features of ancient and modern fires. Red clinker, used for landscaping and construction, in addition to coal-tar deposits and the mineralized byproducts of combustion like godovikovite and voltaite that encrust active-gas vents and fissures, are the results of complex and poorly understood thermochemical processes (Fig. 2; Stracher et al., 2005; Stracher, 2007b).

Destructive

To most people, coal fires are destructive because they consume a valuable energy resource, destroy floral and faunal habitats, and promote human suffering as a consequence of heat, subsidence, and pollution. Field measurements and laboratory analyses reveal that during burning, these fires spew carbon monoxide, benzene, toluene, and dozens of other toxins into the atmosphere and soil, along with the greenhouse gases methane (during heating of the coal) and carbon dioxide (see recorded



Figure 1. Open-pit mine fire near Dhanbad, Jharia Coalfield, India. Most Jharia fires ignite spontaneously, subsequent to mining. The middle flame is ~7 m (23 ft) high. Source: Daniel B. Sanger, GAI Consultants, Inc., Homestead, Pennsylvania, USA.

values in the GSA Data Repository¹). The per-annum global emissions of the components in coal-fire gas have never been quantified. However, the toxins have made people sick, sometimes fatally. Illnesses include carbon monoxide poisoning, arsenosis, fluorosis, bronchitis, stroke, lung cancer, pulmonary heart disease, and chronic obstructive pulmonary disease (Stracher and Taylor, 2004; Finkelman et al., 2002; Pone et al., 2007).

Acids, aerosols, and toxic-particulate matter released from coal fires may be transported long distances. In China, for example, such pollutants have adversely affected 88 cities, with the effects of acid rain spilling over into Japan, Korea, and the Philippines. Sulfate aerosols released from Jharia, India, fires have reduced by 15% the intensity of solar radiation reaching the Indian subcontinent. Over 200 coal fires in Pennsylvania have contributed to making it one of the leading acid-rain producers in the United States (Stracher and Taylor, 2004).

WHY STUDY COAL FIRES?

“Coal-fires science” has not been at the forefront of geologic research. The fires and their effects offer challenging opportunities for collaborative, innovative, and interdisciplinary research. For example, cost-effective methods for preventing, identifying, and extinguishing coal fires that are difficult or currently impossible to locate in underground workings need to be developed by utilizing current foam, liquid nitrogen, and newly developing fire-fighting technology. This requires collaborative expertise in economics, engineering, remote sensing, and environmental science, at the very least. Additionally, deciphering the origin of mineral assemblages formed from gas exhaled at vents or fissures associated with folded and faulted strata requires collaborative



Figure 2. Fumarolic sulfur (yellow) and salamoniac (white) deposits from an active underground coal fire atop oxidized, pyrometamorphic debris (red) and coal-bearing shale (dark green to black) in a subsidence basin, Falcon Hills, Kuznetsk coal basin, western Siberia, Russia. Source: Ellina V. Sokol, Russian Academy of Sciences, Novosibirsk, and Ekaterina A. Nigmatulina, Novosibirsk State University.

work in geochemistry, thermodynamics, mineralogy and petrology, structural geology, and instrumental analysis.

From a pedagogical perspective, currently active coal fires exemplify the uniformitarian foundation of geology because they can be studied in “real time.” Mineral assemblages nucleated at active-gas vents and fissures, for example, are useful for establishing criteria for identifying paleo-fires (Stracher et al., 2005).

COAL-FIRES RESEARCH

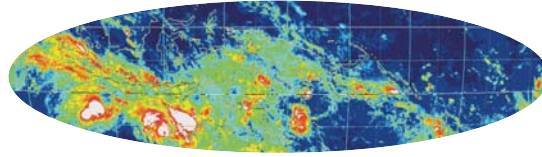
Coal-fires science is gaining international attention, generated by presentations at symposia and by field trips at international meetings, including the American Association for the Advancement of Science (AAAS) in Denver, Colorado, USA, in 2003; the Geological Society of America (GSA) in Denver in 2004, 2005, and 2006; and the International Conference on Coal Fires Research in Beijing, China, in 2005.

In commemoration of the AAAS meeting, a special edition of the *International Journal of Coal Geology: Coal Fires Burning around the World: A Global Catastrophe* presented the scientific and engineering communities in 2004 for the first time with a collection of diverse papers about these fires, including detection and containment procedures and health effects (Stracher, 2004). In December 2007, a GSA *Reviews in Engineering Geology* book: *Geology of Coal Fires: Case Studies from Around the World*, will cover a broader spectrum of topics including spontaneous combustion, greenhouse gases, mineralogy, petrology, the geophysics of coal fires, and public policy. It is my hope that this Groundwork article and these two volumes will serve as a “springboard” for generating interdisciplinary research in coal-fires science.

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¹GSA Data Repository item 2007283 is available at www.geosociety.org/pubs/ft2007.htm. You can also obtain a copy by writing to editing@geosociety.org.



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- How do coastal zone geology, biology, biogeochemistry, and hydrology respond to surficial processes, particularly to sea level change?
- What are the impacts of climate variability/change and land use change on water, nutrient, and sediment cycles?
- What is the integrated result of the interplay between tectonic deformation, climate change, and biota on the Earth's surface and on the supply, distribution, and storage of sediments?
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