Draper Aden Associates

Engineering ◆ Surveying ◆ Environmental Services

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February 25, 2005

Mr. Robert J. Bodnar
Department of Geosciences
University Distinguished Professor, and
C. C. Garvin Professor of Geochemistry
Virginia Tech
Blacksburg, VA 24061

RE: DUSEL

Dear Bob:

I am writing to acknowledge my support for the proposal "Conceptual Design for DUSEL at Kimballton" that is being submitted to NSF. If this proposal is funded, I agree to lead the planning effort to identify existing surface infrastructure availability for the lab as well as additional infrastructure that will be required.

Sincerely,
DRAPER ADEN ASSOCIATES

William A. Aden, P.E.
President and CEO

WAA/ma

cc: Mr. Scott Kroll, P.E., Vice President, Draper Aden Associates

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

College of Agriculture
Interdepartmental Microbiology Program
207 Science I
Ames, Iowa 50011-3211
515 294-1630
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Professor Robert J. Bodnar
Department of Geosciences
University Distinguished Professor, and
C. C. Garvin Professor of Geochemistry
Virginia Tech
Blacksburg, VA 24061

22 February, 2005

Dear Bob:

I am writing to express my great interest in participating in the proposal entitled "Conceptual Design for DUSEL at Kimballton, Virginia" to be submitted to the National Science Foundation by your group at Virginia Tech.

I am very interested in Kimballton as a site for the DUSEL for a number of reasons. I believe it has significant advantages over some of the other sites under consideration because it is sedimentary in nature. For me, it would be ideal site to look for "magnetosfossils"; these structures have been found to be very stable and to last for long periods in limestone formations and sediments. In addition, I would also be interested in isolating microorganisms, both mesophiles and thermophiles, possibly responsible for biomineralization processes and/or metal reduction/oxidation at the site.

Please let me know if I can be of any further help in this matter.

Best regards,

Dennis A. Bazylinski

Dennis A. Bazylinski
Associate Professor
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Professor Jay Benziger
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email benziger@princeton.edu

February 23, 2005

Dear Committee Member,

My field of research is materials chemistry and chemical processing of materials for special applications. I have been collaborating with groups for producing large quantities of materials for large scale low background detectors. I led a group from Princeton University in developing and implementing the scintillator purification for multi-ton quantities of liquid scintillator for the Counting Test Facility of the Borexino Solar Neutrino Experiment, as well as oversaw the design, construction and installation of the scintillator purification for the full scale Borexino Experiment. The Kimballton site offers a excellent location for new research with large scale low background detectors, and I have offered to work as a member of the Kimballton team to help make this a reality.

Kimballton site has great potential because of its ready accessibility. Experiments that require large scale processing of materials in underground locations for low background detectors are well suited for the Kimballton site.

The engineering activities for preparing large quantities of high purity materials I have been involved should be represented in DUSEL. The chemical processing techniques to process large quantities of materials require chemical engineering skills to efficiently scale processes. Professionals with expertise in the chemical process industry and especially purification processing are essential for the success of these ventures. The group at Princeton has this expertise and has worked with groups from Lucent, Virginia Tech, Technical University of Munich, University of Milan and others to go from bench top experiments to process equipment that can process up to 1 ton of material per hour. The Princeton group under Professor Benziger's direction has demonstrated processing capable of achieve backgrounds of $< 1 Bq/m^3$ in liquid scintillators. The availability of this expertise will advance the activities at Kimballton site significantly.

Sincerely,

Jay Benziger

OAK RIDGE NATIONAL LABORATORY
MANAGED BY UT-BATTELLE FOR THE DEPARTMENT OF ENERGY

J.C. Blackmon
Physics Division
P.O. Box 2008
Oak Ridge, TN 37831-6354
(865) 574-7834

February 23, 2005

To whom it may concern:
Re: S-2 Proposal for DUSEL at the Kimballton Mine

I am research staff member in the Physics Division at Oak Ridge National Laboratory. My primary research interests are in the area of nuclear astrophysics, focusing on laboratory measurements of nuclear processes that are important in astrophysical environments. My work involves the development of highly-sensitive detector systems that are combined with state-of-the-art accelerator facilities to allow studies of exotic nuclei, weak nuclear processes, and neutrino-nucleus interactions. The low background environment provided by a Deep Underground Science and Engineering Laboratory (DUSEL) is crucial to allow many measurements of importance for nuclear astrophysics, including measurements of neutrinos from the sun and supernovae and for low-background measurements of small nuclear cross sections using a low energy particle accelerator.

My personal research interests at an underground laboratory are in measurements of low-energy solar neutrinos, as targeted by the LENS collaboration, and in low-background measurements of nuclear fusion cross sections. The Kimballton sight located in Southwest Virginia is very well-suited to both of these areas of research. Much of this research can be conducted at relatively shallow depth. The existing space and infrastructure at Kimballton would allow some scientific results on a rapid time scale and in a quite cost-effective manner. The proximity of Kimballton to ORNL and our special working relationship with Virginia-Tech (an ORNL "core university") would encourage strong collaborations between DUSEL and ORNL scientists. I would like to express my personal support for the DUSEL project and for the Kimballton location. I would be very interested in helping to develop the research opportunities for nuclear astrophysics there.

Sincerely;

Jeff Blackmon

PURDUE
UNIVERSITY

SCHOOL OF CIVIL ENGINEERING

West Lafayette, February 22, 2005

Dear Committee Member,

My fields of research include rock mechanics, fracture mechanics, underground construction, and engineering geology. The Kimballton site offers a suitable location for this research to be pursued, and I will work as a member of the Kimballton team to help make this a reality.

In my research community there is a pressing need to investigate the behavior of rock masses at a very large scale. Theoretical models developed to approximate rock mass behavior and slip along discontinuities have been developed based mainly on experiments at the laboratory scale. There is still a disconnect between the laboratory scale and field observations made at the macroscale.

Kimballton offers the unique opportunity to conduct large scale experiments over long periods of time, and to bring together complementary disciplines that traditionally have been operating separately such as geology, rock mechanics, tunneling, hydrology, and earthquake engineering. The project will be the catalyst to bring in all specialists together, both scientists and engineers, working on different and yet complementary aspects of the problem, creating a synergistic environment conducive to a global and unifying understanding.

Sincerely,

Antonio Bobet
Associate Professor of Civil Engineering

School of Civil Engineering

550 Stadium Mall Drive ■ West Lafayette, IN 47907-2051 ■ (765) 494-2166

Virginia Tech
VIRGINIA POLYTECHNIC INSTITUTE
AND STATE UNIVERSITY

Geosciences

Thomas J. Burbey, Assoc. Professor, Hydrogeosciences
4044 Derring hall, Blacksburg, Virginia 24061
(540) 231-6696 Fax: (540) 231-3386
Email: tjburbey@vt.edu

February 16, 2005

Dear Committee Member,

My field of research is hydrogeology. The Kimballton site represents a preferred location for the many facets of the research to be pursued, and I am working as an active member of the Kimballton team to help make this a reality.

The features of Kimballton which appeal to me are:

- The sedimentary rock environment. A large majority of the world's current ground-water supply comes from sedimentary rocks and our efforts to better understand how water flows through multiple interfaces (bedding planes, fractures, formation boundaries, fault systems) is critical for further understanding the resource potential in such a setting. Furthermore the geochemical processes occurring in fractured carbonate and clastic formations need to be further expanded and more clearly understood.
- Its occurrence in a classic fold and thrust belt. We have the opportunity to investigate *in situ* the nature of a major regional décollement to better understand the modes of deformation and their impact on fracture density and orientation, which impact the nature and direction of flow and transport. Furthermore, we need to discern whether these features tend to compartmentalize flow across the fault plane while possibly enhancing flow parallel to the fault plane on the hanging wall. The opportunity to investigate fault hydraulics is a very important research area in hydrogeology.

The hydrogeoscience research community I am a member of should be represented in DUSEL because:

- It represents a vast hydrologic observatory where a large range of investigations at multiple scales can occur. I believe that the Hydrologic Sciences Directorate at NSF, including CUAHSI, should consider DUSEL as a potential observatory in the coming years. No site in the world will allow us to accomplish *in situ* observational ground-water science like this underground lab.

Sincerely,
Thomas J. Burbey

THE UNIVERSITY OF NORTH CAROLINA
AT
CHAPEL HILL

Department of
Physics and Astronomy
College of Arts and Sciences

The University of North Carolina at Chapel Hill
CB# 3255, Phillips Hall
Chapel Hill, N.C. 27599-3255
artc@physics.unc.edu

February 23, 2005

Dear Committee Member,

My area of research is experimental nuclear astrophysics and I am also the principal investigator of the nuclear physics group at UNC. The Kimballton site is very appealing from both perspectives. On the personal side, I am very interested in the possibility of building an underground accelerator facility, which is under active discussion in the nuclear physics community. Measurements of stellar cross sections are often compromised by backgrounds produced by cosmic ray interactions. By going underground and shielding against the vast majority of cosmic ray events, we greatly increase the sensitivity of these measurements. I am also very interested in the LENS neutrino spectroscopy experiment, which I view as a natural extension of our laboratory work. We have measured some of the nuclear reactions that occur in the sun. LENS will allow us to measure them *as* they occur in the sun. Kimballton is an excellent location for both projects.

As PI, I am actively involved with the evolution of our efforts in the direction of underground science, which is beginning with a new faculty line. This is part of a larger initiative that will ultimately involve researchers from Duke and NC State Universities. From this vantage point, Kimballton seems like an ideal venue. It is close enough for our group to play an active role in all phases of an experiment, which makes it more appealing for students and also provides then with better training. In addition, we could involve undergraduates in this work, which is essentially impossible at a more remote location.

In considering both science and education, it is clear to us that Kimballton is the best site for our activities. I am excited about the possibilities there and will work to help make them a reality.

Sincerely yours,

A.E. Champagne
Professor of
Physics and Astronomy

Dear Committee Member,

My field of research is theoretical particle physics generally, with an especial interest in neutrinos. The Kimballton site offers a location for work that would advance greatly the goals of such kinds of research. I am working as a member of the Kimballton team to help make this a reality.

The features of this site that are particularly appealing include the possibility of siting sufficiently large detectors to study neutrino oscillation phenomena via long baseline techniques, the possibility of doing double β decay experiments, and the possible observation of nuclear instability via neutron oscillation. All of these experiments have direct bearing on the ultimate nature of neutrinos, and their roles in the violation of basic symmetries in particle physics. While other sites are also capable of carrying out such work, the Kimballton site offers the possibility of large caverns as support, and co-location of geoscience work, that offers the option of correlating matter effects on neutrino beams.

Sincerely,

Lay Nam Chang
Professor of Physics
Dean – College of Science
Virginia Tech

Virginia Tech
VIRGINIA POLYTECHNIC INSTITUTE
AND STATE UNIVERSITY

Seismological Observatory

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Homepage: http://www.geol.vt.edu/profs/mcc/

February 16, 2005

Dear Committee Member,

My field of research is seismology. In particular, I am interested in earthquake activity in plate interiors. I have studied the seismicity of the Appalachian region for many years. The area surrounding the Kimballton site has been monitored since 1977 by the Virginia Tech Seismic Network, currently part of the Advanced National Seismic System supported by the U.S. Geological Survey (I am Director of the Virginia Tech component of this program). On the basis of a long history of seismographic monitoring in the site area, I believe that Kimballton offers a unique opportunity for an investigation of the role of transient stress perturbations and fluids on the physical process of seismogenesis in intra-plate regions.

In addition to contributing to a better understanding of natural seismicity in intra-plate North America, the Kimballton site offers an ideal location for study of mining-induced seismicity and seismic wave propagation in the mining environment. On the basis of several years of collaboration with colleagues at the NIOSH research center in Pittsburg, PA, I believe that controlled, underground seismic monitoring experiments at Kimballton can lead to significant advances in this area of seismological research, as it pertains to mining operations in the economically important Appalachian sedimentary basin.

My background and research experience will allow the Kimballton research team to interact effectively with the community of seismologists studying intra-plate North American seismicity as well as the community of engineering seismologists who specialize in the operation of underground seismic arrays for research focused on mining-associated seismicity.

Sincerely,

Martin Chapman
Research Assistant Professor

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An Equal Opportunity/Affirmative Action Institution

Dear Committee Members,

My field of research is rock mechanics and ground control. The Kimballton site offers a suitable location for this research to be pursued, and I will work as a member of the Kimballton team to help make this a reality.

The features of Kimballton which appeal to me are:

1) It is in a limestone formation. I have been studying rock yielding and creeping properties for sometime. Understanding rock yielding and creeping properties will help the design of so-called yield pillars for stress control. This technique will be a very effective tool for deep underground mine ground control. Often time in deep underground mines, high stress concentration and excessive creep become a critical issue that may determine the survivability of a mining panel or even the entire mine. The limestone formation possesses the desirable properties for various experiments. Limestone will creep significantly under stress and may also yield under high stress concentration. An in-situ laboratory in such a formation will be ideal for pillar yielding and stress control study.

2) It is in a sedimentary formation with a syncline structure. Wellbore stability and oil well productivity are important subjects being studied for oil exploration and production. A deep underground laboratory in such a formation will provide unique conditions for wellbore stability and surround rock mass conductivity studies.

The rock mechanics and mining engineering community in which I am a member of should be represented in DUSEL. The deep underground laboratory will provide unique and extremely valuable conditions to conduct experiments and tests that are of high importance to mining and construction industry and that are very difficult to achieve otherwise. Examples of these studies may include rock yielding and rock creeping as mentioned above as well as rock burst under high stress concentration. Some of these are critical issues facing the industry and some others will help us better understand the behavior of the earth materials at great depth under high stress. In-depth understanding of these phenomena will help us to improve our design of structures and have better control of the environments. The conducting of these experiments and studies will require the knowledge, experience and expertise of scientists and engineers in various fields, which may include: mining engineers, civil engineers, physicists, geologists, geophysicists and others.

Sincerely,

Gang Chen, Ph.D., P.E.
Professor of Mining Engineering
Dept. of Mining and Geological Engineering
University of Alaska Fairbanks
907-474-6875 (office)
ffgc@uaf.edu

Dear Committee Member,

My field of research is Environmental Geochemistry. The Kimballton site offers a suitable location for research in this are to be pursued, and I am working as a member of the Kimballton team to help make this a reality.

The features of Kimballton which appeal to me are:
The mine would be located in sedimentary rocks (predominantly limestone and shales).
Low temperature water-rock field experiments can be conducted.
The high pH solutions and water quality of the mine can be evaluated and large-scale field experiments can be conducted.
The potential for evaluating CO_2 controlling reactions in the high pH environment and the formation of secondary minerals in the field.
Evaluation of reactivity of clay minerals with different solutions in the shales.

The research community I am a member of should be represented in DUSEL because:

This is a rare opportunity to do applied and large scale environmental field studies at depth. Investigations would have applications relating to remediation efforts, carbon sequestration by mineral reactions, and radioactive waste disposal.

Switzerland is likely going to be placing their high-level radioactive waste in shales and they likely would be interested in collaborating with our team in designing relevant experiments in the subsurface.

Sincerely,

John Chermak, PhD
Environmental Scientist
Geosciences Department
Virginia Tech
4044 Derring Hall
Blacksburg, VA 24060

THE UNIVERSITY OF TENNESSEE
KNOXVILLE

Center for Environmental Biotechnology
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FAX: (865) 974-8086

February 27, 2005

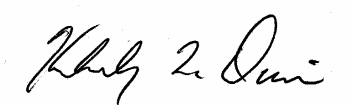
Dear Committee Member,

I am writing to express my interest in working as a member of the Kimballton team. My interest in this project stems from my Ph.D. research in public awareness about environmental science, and my work as an environmental engineer managing and researching the process of pollution control and achievement of environmental sustainability.

I work closely with other researchers at UT's Center for Environmental Biotechnology (CEB) in education and outreach (E&O) programs for area middle-school, high-school and college undergraduate students that would provide excellent resources and serve as working models for the proposed project. A UT E&O colleague, Dr. Susan Pfiffner, has worked with me for the past several years in organizing outreach about science and engineering to middle school girls and on National Science Foundation funded workshops for underrepresented college undergraduates to study geomicrobiology in South Africa. We are also part of the E&O team for the recent NASA-funded Astrobiology Institute, which involves the Department of Energy (DOE), UT, Indiana U. and Princeton. Through CEB's connections with the East Tennessee Science Partnership, I am part of a team to increase the number of students in the *Science, Technology, Engineering and Mathematics* (STEM) pipeline through classroom outreach to middle- and high school students in rural Appalachian communities of east Tennessee. My primary role in this project would be to assist with folding in the proposed Kimballton DUSEL project to these existing organizational structures as conduits for E&O.

I look forward to contributing to this intriguing opportunity to capitalize on established infrastructure and professional relationships of the UT-Battelle team members (Virginia Tech, UT and Oak Ridge National Laboratory) to further STEM E&O in Southern Appalachia.

Sincerely,



Kimberly L. Davis, P.E.
Education and Outreach Coordinator
Center for Environmental Biotechnology and Energy, Environment and Resources Center

UNIVERSITY OF MINNESOTA

Twin Cities Campus

Department of Civil Engineering
Institute of Technology

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Minneapolis, MN 55455

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February 24, 2004

RE: DUSEL – Kimballton

To Whom It May Concern:

This letter is to confirm my interest in the DUSEL-Kimballton project. My research is focused on hydraulic fracturing (a method to stimulate oil and gas reservoirs) and is concerned with scaling laws, numerical models, and laboratory experiments. The Kimballton site is ideal for the conduct of hydraulic fractures experiments that would be designed to verify scaling laws and other theoretical predictions.

Sincerely,

Emmanuel Detournay
Professor

Virginia Tech
VIRGINIA POLYTECHNIC INSTITUTE
AND STATE UNIVERSITY

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200 Patton Hall, Blacksburg, Virginia 24061-0105
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E-mail: jedove@vt.edu

February 19, 2005

The Kimballton Team
Virginia Tech
Blacksburg, VA 24061

Dear Kimballton Team:

It is a pleasure to provide this letter supporting the Kimballton Team and the Kimballton site for research in application of advanced sensor technology to geoengineering problems. The site offers a preferred location for this research to be pursued, and I am currently working as a member of the Kimballton team to help make this a reality.

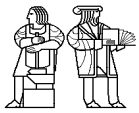
Key site characteristics include repeating, discrete lithology with depth and presence of discontinuities at multiple scales, including bedding and fractures. These features in a DUESL provide the geoengineering community an opportunity to make advances in underground engineering and to propose experiments that answer questions critical to economical development of underground space.

Sincerely,

Joseph E. Dove

Joseph E. Dove, Ph.D., P.E.
Research Professor of Civil and Environmental Engineering

Editorial note: Since this letter was written, Professor Einstein has agreed to serve on the proposal as a co-PI.



DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING
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February 24, 2005

Professor Matthew Mauldon
Virginia Tech – Civil and Environmental Engineering
200 Patton Hall, Mail Code 0105
Blacksburg, VA 24061

Dear Matthew:

As you requested, I am writing you to confirm my strong interest in collaborating with the VT-team in the Kimballton-DUSEL project and specifically in working with you in the upcoming S-2 Phase. My reasons for being interested are threefold:

Rock Mechanics and Engineering. This is the scientific/technologic aspect of my interest. Controlled excavation and access to three-dimensional exposure of rock will make it possible to do advanced research on fracture characterization and flow through fractured rock. More technologically oriented are the possible evaluation of different excavation procedures and, most importantly, the performance of supported and unsupported underground openings. All these are, by the way, not questions which only interest me but most engineering researchers and practitioners working in rock and underground construction.

There is a complex and intriguing risk assessment and management component in this project. It will provide a unique opportunity to systematically assess where uncertainties in planning, construction and operation (including experimentation) may occur and to structure the managerial procedures accordingly. This is along the lines of what I have been doing in other big underground projects, although they were not as complex regarding the operation. What is particularly interesting is the fact that this is not purely application oriented but some good research on risk analysis/management procedures can be conducted in this context.

As an educator, it is particularly intriguing to have the opportunity of such a unique laboratory and collaboration with educators in different technical and scientific fields.

So to summarize, I am very glad that you contacted me and that I was able to work on the S-2 proposal. I am really looking forward to the DUSEL implementation at Kimballton.

Best regards,

Herbert H. Einstein
Professor of Civil and Environmental Engineering

Let/M

PENNSTATE

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www.egee.psu.edu

February 22, 2005

Dear Committee Member:

As a member of the rock mechanics community, and as a practitioner/researcher with an interest in underground science for the past quarter-century, I am declaring my interest in proposing and conducting experiments at the proposed Kimballton DUSEL site. Specifically, my interests are in better understanding the roles of stress and fluid chemistry in controlling the evolution of the strength and fluid transport behavior in fractured rocks. These effects exert important controls on diverse applications including resource recovery (petroleum, gas, water, ores *via in situ* mining, geothermal energy), aquifer remediation, natural hazards (earthquake mechanics), and on the stability of civil and mined structures underground.

In particular, I am interested in conducting large-scale block tests underground – as presented at prior DUSEL workshops. For some of these applications, the Kimballton site presents the greatest geological relevance due to its presence in sedimentary rock – despite a number of current and past US sites in igneous and metamorphic rocks, we still lack a laboratory for underground science in sedimentary rocks. Kimballton offers the possibility to rectify this deficiency.

Yours sincerelv.

Derek Elsworth

Derek Elsworth
Professor

An Equal Opportunity University

OAK RIDGE NATIONAL LABORATORY
MANAGED BY UT-BATTELLE FOR THE DEPARTMENT OF ENERGY

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February 21, 2005

Dear DUSEL Review Committee Member:

My field of research is Experimental Nuclear Physics. I am writing in regards to the S-2 proposal for the Deep Underground Science and Engineering Laboratory (DUSEL) at Kimballton. As chair of the Physics Division Seminar at Oak Ridge National Laboratory, I invited Prof. Raju Raghavan and Prof. Bruce Vogelaar from Virginia Tech to give talks on the Low-Energy Neutrino Spectroscopy (LENS-Sol) detector to measure the neutrino luminosity of the sun and on DUSEL as a multi-disciplinary underground laboratory. The case to locate DUSEL at Kimballton was clearly presented in both seminars and the interest of the topic was evident by the large attendance that included scientists from several divisions of ORNL. An important element of the discussions following the seminars and one especially relevant for this committee related to maximizing the scientific investment in a multi-disciplinary underground science.

Involving the academic and national laboratory research communities in this multidisciplinary endeavor represents a unique opportunity that should strengthen underground science in the U.S. The proximity of Virginia Tech and the mine in Blacksburg, West Virginia, to Oak Ridge National Laboratory, the largest non-defense national laboratory in the U.S., plus the various interaction mechanisms between these institutions that are already in place, such as with the Environmental Sciences Division, make this a potentially strong collaboration ideally suited to fulfill the objectives of DUSEL. This project will help develop advanced experimental measurement techniques in low-energy neutrino science, will help train scientists, and will promote and sustain scientific interactions between the academic community and scientists at DOE laboratories. The location of DUSEL at Kimballton should provide new opportunities to carry out detailed studies of multi-disciplinary underground science. The large limestone mine has extremely large caverns and provides easy access to them. I would like to express my support to this project and if the site is selected, I will work as a member of the Kimballton team to help make this project a reality. I am particularly interested in the development of the LENS-Sol detector designed to measure the real-time low-energy neutrino spectrum from the sun, including the pp-flux.

Sincerely,

Alfredo Galindo-Uribarri
Physics Division

AGU:am

North Carolina State University is a land-grant university and a constituent institution of The University of North Carolina

Department of Marine, Earth and Atmospheric Sciences

NC STATE UNIVERSITY

College of Physical and Mathematical Scier
Campus Box 8208
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919.515.3711
919.515.7802 (fax)

February 21, 2005

R. Bruce Vogelaar
Associate Professor of Physics
313 Robeson Hall, Virginia Tech
Blacksburg, VA 24061

Dear Bruce,

I'm writing concerning my interest in the Kimballton DUSEL S-2 proposal you are submitting to NSF. I am a hydrogeologist and feel that the Kimballton site would offer a unique opportunity for observations and measurements at depths and under conditions which are not generally available to hydrogeologists. The access offered would be useful for studies of rock hydraulic properties (permeability, porosity, specific storage) and related properties/characteristics (stress, fracture aperture/spacing/connectedness, anisotropy), potentially at different scales and in different places (to address heterogeneity). This could present a valuable opportunity to expand hydrogeologic understanding currently based on information obtained closer to the land surface and from limited boreholes. The information obtained could be broadly useful to fundamental questions about fluid circulation deep in the crust and its geophysical and geochemical implications. I am hopeful your proposal will be successful, I am interested in the research possibilities it would open up. Best regards,

David Genereux
Associate Professor

Georgia Institute of Technology
School of Civil and Environmental Engineering

Prof. Matthew Mauldon
Department of Civil and Environmental Engineering
Virginia Tech
200 Patton Hall, Blacksburg, VA 24061, USA

February 27, 2005

Dear Dr. Mauldon:

I am writing this letter on behalf of Prof. Larry Murdoch of Clemson University and myself. My area of research is fracture mechanics, including open and shear fractures in rocks and soils. I have also been involved in studying properties of earth and extraterrestrial materials, micromechanical modeling, mathematical modeling of complex, multi-scale engineering and natural systems, including processes of rock deformation and fracture coupled with diffusion and transport phenomena. Prof. Larry Murdoch's research interests include geomechanics, with particular emphasis on fluid flow and fracture propagation. He has experience with field methods involving excavation and mapping of subsurface experiments, as well as numerical and analytical methods in solid mechanics and flow and transport. His expertise also includes structural geology and field mapping. We share common research interests and have closely collaborated on various projects involving teaching and research for approximately 5 years.

We feel that the Kimballton site offers an excellent location to pursue research in areas of chemical precipitation in natural fracture networks, mineralization of natural veins, seismicity induced by subsurface fluid and thermal manipulation, mechanics of induced fractures, characterizing multi-scale hydromechanical properties, as well as pressure solution effects (quite feasible in limestone formations) on rock fracture phenomena. The possibility of back mining makes the Kimballton project is especially appealing. Last but not least, the project opens a real potential for a direct study of fracture tip issues at scales relevant to industrial and natural applications (e.g., fracture branching and segmentation, fracture toughness mechanisms, and fracture interaction).

Both Prof. Murdoch and I will work as members of the Kimballton team to help make this project a reality. Among many appealing features of this project, we want to mention the possibility of collaboration with bio-scientists on studying colonization of freshly created and mature fractures by microorganisms and on their effects on subsequent fracture development and fluid flow in rock materials.

Sincerely,

Leonid Germanovich
Professor and Director, Center for Applied Geomaterials Research

Cc: Larry Murdoch, Clemson University
Joseph Dove, Virginia Tech

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Atlanta, Georgia 30332-0355 U.S.A.
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A Unit of the University System of Georgia An Equal Education and Employment Opportunity Institution

UMR
UNIVERSITY OF MISSOURI-ROLLA

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Phone: 573.341.4365
Fax: 573.341.4368
vsnelson@umr.edu

Dear Committee Member,

My fields of research are in mining and geological engineering; specifically, mechanical excavation technology, rock fragmentation, the flow of fluids in fractured rock, and extra-terrestrial resource production. The Kimballton site offers a suitable location for research in these areas, and I am working as a member of the Kimballton team to help make this a reality.

The features of Kimballton which appeal to me are:

- The massive nature of the limestone exposed in the Kimballton Mine (low frequency of natural and induced fractures in the rock fabric). This aspect simplifies the constraints that control the flow of fluid in fractures, bridging the gap between laboratory experiments and real-world applications.
- The multiple repetition of stratigraphy in the study area. This may enable evaluation of the effect of depth alone on the response of rock to fragmentation and excavation techniques, and on the fluid-flow behavior of the rock. Rigorous comparison of the effects of different stress states on rock mass behavior is often confounded by the unavoidable inclusion of different rock types and geologic terranes. The utility of this site for such comparisons in repeated rock formations will have to be verified with a thorough site characterization program.
- The layered nature of the rock. The majority of the rock with which engineers must contend is sedimentary, or derived from it, even at depth.
- The potential depth for studies of rock behavior. As near-surface mineral resources are extracted and the Earth's population continues to grow, resources at increasing depth must be mined affordably. Mineral extraction problems associated with great depth in the crust include:
  - At what confining pressure is the anisotropy due to layering overcome?
  - How sensitive is rock at depth to perturbation?
  - Could deviatoric stresses be utilized to reduce the energy cost of rock fragmentation at depth?
  - What is the long-term behavior of an opening at great depth, and how can closure of openings under stress be efficiently mitigated?

The research and engineering communities of which I am a member should be represented in DUSEL because mineral commodities are essential to civilization, yet they are becoming harder to produce. Research performed at DUSEL can help to assure a continued or even enhanced supply of minerals for the maintenance of life as we know it, and as it may become.

Mining engineering and technology research have increased the productivity of miners astoundingly in the past two hundred years. Supported by mining companies, support industries, and mining industry groups, advances such as trackless equipment, low-sensitivity explosives, GPS tracking, rockbolts, and bulk mining methods have been developed and, even more importantly, disseminated among potential users. People with a wide variety of backgrounds

have been vital throughout. More than any other engineering discipline, mining engineering takes a systems approach to the myriad difficulties that must be overcome to produce minerals in an economically and environmentally sustainable manner. Accordingly, research teams tend to be highly multi-disciplinary, varying in size from single investigators to teams of a dozen separate companies.

Another growing area for research is mineral production from extra-terrestrial sources, also called ISRU (for *In Situ* Resource Utilization). Innovative technologies for fragmentation, excavation, and transportation developed for mining at depth will be highly applicable to the remote, hazardous mines of the Moon, Mars, asteroids, and beyond. Definite synergies can be developed between the deep and the final frontiers:

- Autonomous operation of equipment and systems. Full automation of the unit operations of mining is difficult even on Earth, due to the constantly changing nature of operational constraints (travel path, loading parameters, rock properties, *etc.*). It will be imperative in space.
- Innovative mining technologies. Although focused on apparently different environments, mining technology research at DUSEL and for ISRU will share many aspects. Innovative approaches to energy transfer from tool to rock that maximize useful fragmentation and minimize sound, heat, and rock damage will be useful in both areas.
- Environmentally sensitive mining technologies. The environments of the Moon, Mars, and other solar system bodies are very sensitive to disturbance. Technologies developed for low-impact mining at deep levels of the Earth's crust will be applicable off-Earth as well.
- Energy-efficient mining technologies. Much of the energy used in fragmentation and excavation goes to non-productive mechanisms, such as rock damage, which weakens the rock and increases the risk to miners. Gravity has long been used to help move broken rock, but what other "free" energy could be harnessed as well?

Roadmaps for the development of innovative technologies for all the unit operations of resource production are being worked out by teams of industry experts (mining, chemical, biological, mechanical, electrical, civil, and computer engineers and scientists) and NASA professionals. It is a widely held consensus that only research shared among U.S. government agencies and other groups both domestic and international can successfully expand permanent human activity beyond our single, fragile planet. No single entity -- NASA or ESA or the entertainment industry -- can achieve the momentum necessary to make this actually happen.

Accordingly, I support the creation of a DUSEL at the Kimballton Mine. Properly designed and operated, it will enhance the survivability of humanity in a universe full of hazards.

Sincerely,

Leslie Gertsch

Leslie Gertsch
Sr. Research Investigator, Rock Mechanics and Explosives Research Center
Assistant Professor, Geological Sciences and Engineering Department

DEPARTMENT OF THE NAVY
NAVAL RESEARCH LABORATORY
4555 OVERLOOK AVE SW
WASHINGTON DC 20375-5320

IN REPLY REFER TO

22 February 2005

Dear Committee Member,

I am actively involved the development of ultra-low background instrumentation and materials, and in the study of both atmospheric and cosmic dust. The Kimballton site offers a preferred location for this research in the United States, and I will work as a member of the Kimballton team to help make this a reality.

Kimballton has a suitable low background environment for the research and operations that I require, its location within driving distance of the Naval Research Laboratory in Washington, and with direct drive-in vehicle entry (i.e. without elevators) are clear pluses, as is the close association with a University with faculty and students interested in low background technology studies. The low background detector and materials research community must be represented in DUSEL as our work is essential to a broad range of physics experiments that are one of the major reasons for developing an underground facilities. Further, the national security interests, that are part of my operations require an open site in which researchers can advance this low background technology. It should be noted that the technology for detection of minute quantities of radioactive material is also relevant to other fields such as non-proliferation treaty development, archaeology, forensics, and environmental studies to name a few.

My present association, along with my collaborators working in the area of identification of extremely small samples or radioactive materials are presently active at the Italian National Institute of Nuclear Physics' Laboratori Nazionali del Gran Sasso. Although, Gran Sasso is an excellent facility the need for extensive and expensive travel and with other problems relating to operating in a foreign country make us look to the establishment of DUSEL at Kimballton where we expect that our research can be conducted with greater efficiency.

Sincerely,

Frank Giovane
Associate Superintendent
Space Sciences Division

VIRGINIA POLYTECHNIC INSTITUTE
AND STATE UNIVERSITY

The Charles E. Via Jr. Department of Civil and Environmental Engineering

Marte S. Gutierrez, Ph.D.
Associate Professor
200 Patton Hall
Blacksburg, Virginia 24061, USA
Tel: (540) 231 6357, Fax: (540) 231 7532
E-mail: magutier@vt.edu

February 24, 2004

Dear Committee Member,

My fields of research are Rock Mechanics and Engineering, and Underground Openings (tunnels and caverns) in Rocks. The Kimballton site offers a preferred and suitable location for this research to be pursued, and I will work as a member of the Kimballton team to help make this a reality.

The features of Kimballton which appeal to me are: (a) the competent rock and the distinct possibility of building large caverns at great depth, (b) the varied geology which will require a wide variety of tunneling and support techniques, (c) the unique possibility of building large excavations in sedimentary rock.

The Rock Engineering community I am a member of should be represented in DUSEL because it will provide a unique and exciting opportunity to develop, test and validate new and innovative techniques for tunneling. DUSEL will be unique in that it will require the construction of large caverns located at large depths approaching 7500 ft. The construction of the access tunnels and caverns for experimental facilities will pose several challenges that need to be addressed by new technologies for geological characterization, tunnel design, and tunnel excavation and support. Lessons learned from building DUSEL can be used to improve tunneling technology. Rock failure in underground mines and tunnel construction continue to claim lives, and the tunneling industry is still beset by cost overruns and frequent failures. These problems can be reduced by better knowledge of rock mass behavior and improved tunneling technology.

Sincerely,

Marte S. Gutierrez, Ph.D.
Associate Professor

THE UNIVERSITY OF TENNESSEE—KNOXVILLE

A Tennessee Center of Excellence

Robert D. Hatcher, Jr.
UT Distinguished Scientist
and Professor of Geology

Tectonics and Structural Geology Research

Mail:
Department of Earth & Planetary Sciences
University of Tennessee
306 Geological Sciences Building
Knoxville, TN 37996–1410

Office:
511 Science & Engineering Research Center
Phone: (865) 974–6565 or –2238
Mobile (865) 803–6278
Fax: (865) 974–9326
E–Mail: bobmap@utk.edu

URL: http://geoweb.gg.utk.edu/geology/faculty/Hatcher/Hatcher.html

February 17, 2005

Dr. Mark G. McNamee
Office of the Provost and Vice President for Academic Affairs
Burruss Hall
Blacksburg, VA 24061

Dear Dr. McNamee:

My purpose here is to indicate my enthusiastic support for your efforts to bring the proposed NSF-sponsored Deep Underground Science and Engineering Laboratory (DUSEL) to the Kimballton site near Virginia Tech. This is an exciting project that should during its 20- to 30-year lifetime yield world-class results for the physics, earth and biological sciences, and engineering communities. This site will provide a much-needed facility for shielded particle physics experiments. The Kimballton site, however, provides unparalleled opportunities for a greater variety of multidisciplinary process-oriented experiments in the other sciences and engineering than other potential sites, primarily because Kimballton is located in sedimentary rocks in one of the classic fold-thrust belts in the world. A number of fundamental concepts in geological science have already been formulated here. The Kimballton site presents unique opportunities for long-term process-oriented research in a 3-D block of layered crust, with the ability to study natural and artificial processes from within the block.

I very much appreciate the opportunity to participate in the early stages of this project as a co-PI, and wish you every success in bringing the DUSEL to southwestern Virginia.

Sincerely,

Robert D. Hatcher, jr.

Dear Committee Member,

I am writing in support of the proposal covering conceptual design for DUSEL at Kimballton, Virginia. My field of research includes regional structure, stratigraphy and geotechnics of foreland fold and thrust belts. The Kimballton site offers a world-class location for this research to be pursued, and I am working as a member of the Kimballton team to help make this a reality. If Kimballton is accepted by the NSF as an S2 site I intend to participate as an engineering geology consultant in the geological and engineering studies to characterize the site in detail.

The features of Kimballton that appeal to me are: 1. Geographic location near the Appalachian structural front close to a nationally ranked university. 2. The Kimballton site contains multiple thrust sheets of well-defined sedimentary units with known physical and chemical properties and well-documented stratigraphy. 3. Similar lithologic units are repeted at different depths, allowing for different pressure, temperature, and paleostress environments to test different hydrological and mineral resource models both during initial excavation and during the operating life of the facility.

The (research/engineering) community I am a member of should be represented in DUSEL because: it combines both engineers and earth scientists with industrial, exploration and academic research back grounds that have been focused on crucial problems in regional and international energy, mineral, and water resources development . These are all critical areas in today's changing world.

Sincerely,

William S. Henika

Virginia Tech
VIRGINIA POLYTECHNIC INSTITUTE
AND STATE UNIVERSITY

John A. Hole
Department of Geosciences
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hole@vt.edu
http://www.geol.vt.edu/profs/jah/

17 February 2005

Dear Bob, Bruce, et al.,

I have been working in a supporting role for a year towards attracting the DUSEL facility to southwestern Virginia. My expertise is in seismic imaging of the earth, analogous to medical imaging, at scales from meters to hundreds of kilometers. Although my prime research area has been the processes that shape continents, such as faulting and plate tectonics, I also perform site characterization for geotechnical, mining, and petroleum exploration.

In 2004, I led acquisition and interpretation of a seismic survey on Forest Service land over the top of the proposed Kimbalton – DUSEL site. The goal was to improve local and regional geologic characterization of the subsurface to >2 km depth. Although limited by budget and site access, this survey confirmed sub-surface structural relationships deduced from surface geological data. We continue to work with these data to characterize fracture patterns in the area.

If DUSEL were to come to Kimballton, I would be very interested in providing imaging expertise to both construction and research needs. Prior to and during construction, improved characterization of the 3-D volume of the underground facility will be required. This can be performed using a mix of surface, borehole, and underground seismic surveying. Once an underground facility exists, a wide range of geological and geotechnical research opportunities would exist. Each would require knowledge of the rock volume behind the wall, and changes in properties such as stress, fracturing, or fluids. I would be very interested in providing this imaging expertise for such experiments.

The types of experiments that would be of most interest to my own research would involve fault properties – only the Kimballton site has a known major (inactive, ancient) fault in its volume – and micro-earthquakes associated with stress systems and rock mechanics. In situ sub-surface observations of such systems provide important information not available at the surface. Second, a 3-D underground seismic observatory can help image deep in the earth at much higher quality than from noisier 2-D surface arrays. This site should be considered as a permanent seismic observatory. Finally, development of imaging technology is a strong part of my research program. Having full access to a volume of rock provides the capability of calibrating the seismic imaging technologies by drilling or excavating the volume. Many of these potential research projects could be collaboratively undertaken with my colleague Matthias Imhof of Virginia Tech, who has related but complementary seismic research interests.

I will continue to work with you to help make DUSEL at Kimballton a reality and success.

John Hole
Associate Professor of Geophysics

Dear Committee Member,

My field of research is seismic reservoir characterization and the propagation of sound and electromagnetic waves in complex media, mostly with regard to the exploitation of hydrocarbons. The Kimballton site offers the only possible location for this kind of research to be pursued, and I am working as a member of the Kimballton team to help make this a reality.

Kimballton is the only sedimentary site proposed for DUSEL. Nearly all reserves of hydrocarbon (oil, gas, and coal) are located in sedimentary rocks. Exploration for new reserves is typically performed by remote sensing with geophysical techniques, predominantely seismic methods. However, ground truthing and controlled fluid substituion experiments are typically not performed. DUSEL at Kimballton provides a unique opportunity to advance remote-sensing methods for exploration, delineation of reservoirs, and characterization of the petrophysical properties. All other DUSEL locations are useless for any kind of work related to hydrocarbon energy resources! Building DUSEL in a sedimentary environment, however, will virtually guarantee collaboration and financial partnerships with the oil and gas industry. My friends in industry told me that would have not interest at all if DUSEL was built at a nonsedimentary site.

Building DUSEL at a sedimentary site will facilitate exciting collaborative research performed by private enterprises, national laboratories, and academia with funding from the oil and gas industry, the US Department of Energy, and the National Science Foundation to help us quench our societal demand for hydrocarbon energy.

Sincerely,

Matthias Imhof
Associate Professor of
Exploration Geophysics

OAK RIDGE NATIONAL LABORATORY

MANAGED BY UT-BATTELLE FOR THE DEPARTMENT OF ENERGY

Environmental Sciences Division
P.O. Box 2008
Oak Ridge, TN 37831-6037
(865) 574-7374 tel
(865) 574-7287 fax

February 23, 2005

Dr. Robert J. Bodnar
Department of Geosciences
University Distinguished Professor and C. C. Garvin Professor of Geochemistry
Virginia Tech
4053 Derring Hall
Blacksburg, Virginia 24061

Dear Dr. Bodnar:

Letter of Support for the Conceptual Design for DUSEL at Kimballton, Virginia

I am enthusiastic about the potential for collaborative research that could be accomplished at the proposed DUSEL at Kimballton, Virginia. I look forward to helping to put together teams from across the United States and other countries to address geoscience research that can be done only at such a facility. The repeating sequences of highly competent sedimentary formations offer a DUSEL with truly unique research capabilities. I foresee major discoveries in biogeochemical processes, but more than that I see opportunities to address challenges that are critical to the energy independence of the United States. Sequestration of CO_2 in geologic formations is the most promising of all sequestration options for reliably storing amounts of CO_2 that can begin to slow the accumulation of CO_2 in the atmosphere. Current field-scale R&D is focused on demonstrations at "sites of convenience" such as enhanced oil recovery operations, depleted oil and gas fields, or brines in areas of prior exploitation. No studies are being conducted where specific processes are being tested at multiple scales under tightly controlled or monitored conditions. Opportunities for research in the layered formations at the Kimballton site are well aligned with research priorities for CO_2 sequestration in geologic formations as described in DOE R&D plans. In particular, cross-cutting research needs in process understanding, monitoring methods and technology, and pilot field-scale studies are well suited for the Kimballton site.

I look forward to a DUSEL located in Kimballton, Virginia, that will allow multidisciplinary teams to tackle some of the most interesting and important geoscience questions facing us today.

Sincerely,

Gary K. Jacobs, Director
Environmental Sciences Division

GKJ:ajh

Dear Committee Member,

My field of research is neutrino physics, nucleon decay, and neutron-antineutron oscillations. The Kimballton site offers a possible location for these research to be pursued, and I look forward to work as a member of the Kimballton team to help make this a reality. Possibility of construction of long vertical shafts at Kimballton site will be an important feature that will allow high-sensitivity experimental search for neutron-antineutron transition. Construction of a large ~ 100 kton liquid scintillator detector should allow search for (B–L) violating nucleon decay modes, similar to our present searches in 1-kt KamLAND, that are not accessible with alternative detector techniques (water-Cherenkov and liquid Argon). If proposed Double-Chooz experiment (where I am presently involved in) will measure the θ_{13} angle in neutrino mixing to be not very small, then the long-baseline neutrino beam from Fermilab or BNL and 100-kt liquid scintillator detector will provide an exciting possibility to observe for the first time the CP-violation effects with neutrino beams .

I believe that Kimballton laboratory has key capabilities to pursue strong program in Physics, which is aligned with my research interests.

Sincerely,
Yuri A. Kamyshkov
Professor, Department of Physics and Astronomy
University of Tennessee, Knoxville TN 37996-1200

New Mexico Tech
SCIENCE-ENGINEERING-RESEARCH-UNIVERSITY
Biology Department

February 21, 2005,

Robert D. Hatcher, Jr.
UT Distinguished Scientist and Professor
Tectonics and Structural Geology
Science Alliance Center of Excellence
Department of Earth & Planetary Sciences
306 Earth and Planetary Sciences Building
University of Tennessee
Knoxville, TN 37996-1410

Dear Dr. Hatcher,

I am writing this letter in enthusiastic support of your proposal to the National Science Foundation for a DUSEL S2 study of the Kimballton Mine site. I was very impressed with the scientific possibilities when I visited the site in November. In addition to the obvious competency of the rock, which would facilitate the construction of large cavities for physics instruments, the Kimballton site offers excellent possibilities for geological and geomicrobiological investigations.

As a geomicrobiologists, I am excited about the prospect of analyzing deep sedimentary rock samples from Kimbalton as part of your S2 research. Specifically, I would like to quantify the biomass and metabolic activities of microbes in these sedimentary rock habitats and I would like to apply molecular approaches to characterizing the microbial community structure. I look forward to collaborating with you on this project.

Sincerely,

Thomas L. Kieft
Professor

The University of Hawaii, Manoa
Department of Physics and Astronomy
Professor John Gregory Learned

2505 Correa Road
Honolulu, HI 96822 USA
fax: 01-808-956-2930
phone: 01-808-956-2964
email: jgl@phys.hawaii.edu

March 9, 2005

Dear Committee Member,

I have worked in the field of neutrino studies and searches for nucleon decay for more than thirty years. The Kimballton site offers a very attractive location for this research to be pursued, and I would work as a member of the Kimballton team to help make this a reality.

The features of Kimballton which appeal to me are:

The research community of which I am a member should be strongly represented in DUSEL because we do not at this time have a viable program in the US in the major areas of research that are possible in such a facility. This is a great pity since much of this work was begun in the US (particularly in the IMB experiment, of which I was a co-founder), but also in solar neutrino studies and long baseline neutrino experiments. In all these cases the major efforts have moved off-shore, to Japan, to Italy and elsewhere, because a suitable US infrastructure and research funding initiative was not available. We hope that can be turned around with this initiative. As accelerator based research appears to be waning in the US, new activities in particle astrophysics can provide the focus for a thousand or so physicists and several times that many associated technical and support personnel. Efforts such as this are of long-term great importance to the intellectual and economic health of our nation.

Sincerely,

John G. Learned

UNIVERSITY OF ALBERTA

Department of Civil & Environmental Engineering
School of Mining & Petroleum Engineering

3-071 Markin/CNRL Natural Resources Engineering Facility
Edmonton, Alberta, Canada T6G 2W2
Email: derek.martin@ualberta.ca
Tel: +1 780 492 2332 Fax: +1 780 492 8198

February 28, 2005

Robert J. Bodnar
University Distinguished Professor,
and C. C. Garvin Professor of Geochemistry
Department of Geosciences
4053 Derring Hall, Virginia Tech
Blacksburg, VA 24061

Dear Dr. Bodnar;

Subject: NSF Deep Underground Science and Engineering Laboratory at Kimballton

As we discussed, I am available to help with your initiative for designing the DUSEL Facility at Kimballton.

I understand the application is due today, and that this letter will serve as my commitment to the project for the next phase.

Sincerely yours

C. Derek Martin, PhD, PEng, PGeol
Professor (Geotechnical)

RAY E. MARTIN, PH.D., P.E.
CONSULTING GEOTECHNICAL ENGINEER

February 25, 2005

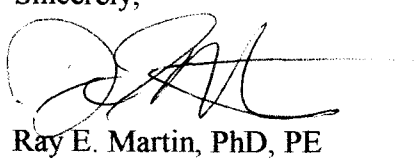
Dear Committee Member,

My engineering field of practice is geotechnical engineering with specialties in building foundations, excavations, dams and groundwater. I was also CEO and later Chairman of the Board of a 300 person strong east coast consulting engineering firm, Schanbel Engineering Associates. Through this experience, I have gained insight into the management of large engineering projects. So in addition to my geotechnical background I believe I can assist the team in developing and carrying out a management plan to successfully complete the S2 scope of work.

From a technical perspective, the Kimballton site is of interest because it contains carbonate rocks and holds promise to better understand issues related of how karst features develop with depth and their impact on fractured media ground water flow, foundation construction, and excavation conditions with depth.

My focus will be to work with the Kimballton team as a senior reviewer during the S2 work with emphasis on developing a plan to manage and operate
DUSEL at Kimballton.

Sincerely,



Ray E. Martin, PhD, PE

RAY E. MARTIN, LLC
114 N. RAILROAD AVENUE • SUITE 300 • ASHLAND, VIRGINIA 23005
804-798-6218 OFFICE • 804-339-3133 CELL • 804-798-6238 FAX
RAYEMARTINENG@AOL.COM

Feb 28 2005

Subject: Proposed DUSEL site at Kimballton, Virginia

Dear Kimballton-DUSEL principal investigators,

This letter expresses my strong personal interest in conducting research at the proposed DUSEL (Deep Underground Science and Engineering Laboratory) site at Kimballton, Virginia

Kimballton is ideally situated for research in applied rock engineering and rock mass characterization. Particular advantages of the site include:

- Layered and repeated geological structure with a wide range of scales of mechanical discontinuities (bedding planes and fractures) and hydraulic pathways.
- Presence of both massive (relatively unfractured) and fractured blocks of limestone.
- Existence of large unsupported caverns at depths of 2000 ft in the existing mine, giving strong support to the feasibility of constructing large chambers at greater depths.
- A heterogeneous rock mass with imprints of multiple tectonic events.

The Kimballton-DUSEL site appears to be feasible from a geomechanical point of view and also will be of considerable interest to researchers in the rock engineering and engineering geology professions.

Sincerely,

Matthew Mauldon
Associate Professor, Virginia Tech

Virginia Tech

VIRGINIA POLYTECHNIC INSTITUTE
AND STATE UNIVERSITY

Virginia Bioinformatics Institute

Bioinformatics I, Washington Street 0477
Blacksburg, VA 24061
(540) 231-2100 FAX: (540) 231-2606
email: biswarup@vt.edu

Date: February 25, 2005

The Proposal Review Committee
The National Science Foundation
4201 Wilson Boulevard
Arlington, Virginia 22230

Proposal Title: Conceptual Design for DUSEL at Kimballton, Virginia

Dear Committee Member,
This is a letter of interest and support for the above-mentioned proposal. Research in my laboratory deals with biochemical basis for microbial diversity. We are investigating the strategies that a deep-sea hydrothermal vent microorganism uses to survive and thrive in the extreme environment that exists in its habitat. In a U.S. Department of Energy (DOE) supported project we are examining the possibility of converting a part of coal to methane by use of microbes isolated from the coal beds. In another DOE supported project we are studying the microorganisms that consume methane under low oxygen tension.

We are very interested in learning the evolutionary processes that occurs in the subsurface. In particular, we are interested in learning the changes that occurred in the mesophilic microorganisms after they descended from hyperthermophilic ancestors. Such an understanding has a very applied relevance. Many of the microorganisms that are currently carrying out important geological processes at the subsurface formations, such as cola beds, are the descendents of early mesophiles that developed on the earth surface. An understanding the evolutionary processes (changes in the genetic make up and physiological characteristics) that made these descendents fit for the environment they live in, will help to design processes such as in situ bioconversion of coal or liquid hydrocarbon to methane or sequestration of carbon dioxide. It is also likely that the knowledge of the novel survival strategies of these organisms will help to develop biotechnological processes of commercial value.

The Kimballton site offers a very preferred location for the above-described research. It has the geological formations that we have been looking for. It has rock layers that at one time were on the surface. Since they have been buried, these layers remain isolated from the changes that occur on the surface. Therefore, the Kimballton site offers a chance of looking into very focused evolutionary processes.

Another attraction of this site is that, it will be investigated by geologists, hydrologists, physicists, material scientists and other biologists. These experts will uncover many aspects of the site that will definitely bring a synergistic effect to our work. For example, we will need information on the changes of the mineral and organic composition and in the physical parameters of the layers and that information will come from the geologists and the hydrologists. Our work will lead to the isolation of novel microorganisms that

may be useful to the experts working on carbon dioxide sequestration and bioremediation. I see a great opportunity of collaboration.

The examples that I presented above also apply to the environmental and evolutionary microbiologists and biochemists at large. I am certain that many of my colleagues will use the Kimballton site for their experiments and will collaborate with other investigating teams. I will work as a member of the Kimballton team to attract this community to the proposed deep surface laboratory.

Sincerely,

Biswarup Mukhopadhyay
Telephone: 540 231 8015
E-mail: biswarup@vt.edu

Università degli Studi di Napoli Federico II

Prof. Stefano Mazzoli
Department of Earth Sciences
Largo San Marcellino 10
80138 Naples, Italy
E-mail: stefano.mazzoli@unina.it

February 25th, 2005

Dr. Mark Pitt
Department of Geosciences
Virginia Polytechnic Institute and State University
Blacksburg, VA 24061

Re: Kimballton site DUSEL

Dear Dr. Pitt,

Following a joint visit we did with Prof. Bruce Vogelaar and Prof. Robert Bodnar to the Italian Gran Sasso underground laboratory last November, I hereby would like to express my great interest and full support to the Virginia Tech proposal concerning the NSF-sponsored Deep Underground Science and Engineering Laboratory (DUSEL), involving its location at the Kimballton site in southwestern Virginia.

Besides the first-class physics, biological and engineering aspects of the project, I am particularly impressed by the multidisciplinary, process-oriented studies that could be carried out in the field of earth sciences at this unique site. This could also generate some very interesting and fruitful cooperative research. In particular, the similar geological setting of the classic Appalachian fold-thrust belt in the Kimballton area and that of the Apennines of central Italy, where the Gran Sasso underground laboratory is located, provides much scope for a comparative study of tectonic styles, fold-thrust structures, fault rock and fracture development and related fluid flow, fault-related compartmentalization of rock volumes, etc., in these two areas. A preliminary agreement on such a comparative study already exists with Prof. Robert D. Hatcher, Jr. (University of Tennessee at Knoxville), and I sincerely hope a successful progress of your proposal will also provide the opportunities to carry it out.

I would very much appreciate to be involved in this project, and wish you success with your proposal and in bringing the DUSEL to the Kimballton site near Virginia Tech.

Sincerely,

Stefano Mazzoli

Dear Committee Member,

My field of research is Astroparticle Physics. The Kimballton site offers a preferred location for this research to be pursued, and I will work as a member of the Kimballton team to help make this a reality.

The features of Kimballton which appeal to me are:
The unique possibility to create an underground laboratory with sufficient space und shielding against cosmic background radiation which would allow to perform a next generation project in the field of low energy neutrino astronomy (LENA), a project we are now developing with an underground site in Europe in mind. Kimballton offers another site of interest to us. Our goal is to set up a new observatory based on a ~50-100kt large liquid scintillator detector. The scientific topics that can be studied in such a detector are:

- search for proton decay modes,
- study of a galactic Supernova type II by detecting the thereby emitted Supernova neutrinos,
- measurement of relic Supernovae neutrinos,
- precise study of solar thermo-nuclear fusion reactions,
- search for small solar neutrino flux variations,
- test of geophysical models by measuring terrestrial neutrinos from the crust, mantle and core.
- Long baseline experiments to study oscillation phenomena of high energy neutrinos from accelerators

Sincerely,
Prof. Lothar Oberauer

Dear Committee Member:

I work in the field of neutrino physics, both theory as well as experiment. The Kimballton mine offers an excellent location for research in neutrino physics, astrophysics and geophysics. I am interested to work as a collaborator and a member of the KImballton team to bring this to fruition and make the dream a reality.

The specific features of the Kimballton site which are of special interest are the the possibility of large well shielded neutrino detectors to measure a variety of fluxes of low energy neutrinos from the sun, the earth as well as possible search for proton decay .

The research community of theorists/phenomenologists would bring a different point of view and would be a very valuable addition to the team. Many large collaborations carrying out complex measurements are beginning to have some theorists/phenomenologists as part of their e.g. KamLAnd, BeLLe, BaBar, LHC collaborations etc.

Sincerely,

Sandip Pakvasa

Michigan Technological University

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Houghton, Michigan 49931-1295
906/487-2531 I Fax 906/487-3371
www.geo.mtu.edu

9 March 2005

LETTER OF COMMITMENT TO DUSEL SITE SELECTION AND PROJECTS

Dear Committee Member,

My field of research is applied geophysics, specifically seismology. I have been involved with activities associated with the underground experimental facility for over three years, and have reviewed the potential qualities of all of the available proposed sites. The Kimballton site offers a highly preferred location for appllied geophysical research to be pursued, and I would work as a member of the Kimballton team to help make this a reality.

There are several features of Kimballton which appeal to me. These are primarily based on the fact that it is in sedimentary rocks of varying quality, at depths within the earth's crust which make observations there applicable to fields of study that are of huge importance to mankind and the future of natural resource evaluation and environmentally sound extraction. All of the other sites are in igneous or metamorphic rocks that, while providing interesting scientific observations, will not provide results, nor enable experiments, that will be as useful as those at Kimballton for improving our country's abilty to safely develop resources in manners that meet today's and tomorrow's requirements for environmental protection.

The engineering research community of which I am a member of should be represented in DUSEL because they include those people and organizations who actually develop and deploy the methods of most concern to the citizens of this country in the development and safe extraction of natural resources from within the earth's crust. This includes academicians and their research-engineering counterparts in industry and natinoal laboratories. Typically, research in the areas of shallow-crustal geologic characterization and flow of fluids are in the environmental and petroleum areas; only occasionally do the researchers in these two areas collaborate, often due to lack of common sites – a problem which Kimballton would alleviate. The petroleum-style researchers often work in collaborative teams representing several entities; often these are in the form of consortia of companies and universities, usually (although not always) operating under the leadership of one academic unit. Participation by industry can be either through monetary support or in-kind support, lending expertise, time, and often hardware and products.

The development of DUSEL at the Kimballton site will allow the output of DUSEL to have some actual applications that will return as benefits to the taxpayers of the country, as well as the interesting basic-science aspects available at any of the proposed sites.

Yours truly,

Wayne D. Pennington
Chair and Professor of Geophysical Engineering

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THE UNIVERSITY OF TENNESSEE
KNOXVILLE

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February 27, 2005

Dear Committee Member,

I would be happy to collaborate with you on the proposed Kimballton DUSEL project. As a research assistant professor, my research has focused on increasing our understanding of the heterogeneity, microbial community structure, physiology and ecology of the subsurface microbial community and applying this knowledge to monitor subterranean environs, improve remediation processes, and develop biotechnological advancements. My field site experiences include (1) Subsurface Science Projects at Aiken, SC (Savannah River Site); Cerro Negro, NM; Parachute, CO; Oyster, VA; (2) Bioremediation Projects at the Savannah, Columbus AFB, MS; General Motors, Warren, MI; Dover AFB, DE (Remediation Technology Development Forum Consortium); and other DOE sites (ORNL, INEL, Kansas City Plant, Portsmouth); and (3) Life In Extreme Environments involving South African gold mines.

I have worked to link research to education and outreach activities by leading the U.S./South African Undergraduate Education and Research Workshops and a REU Site, Biogeochemical Education Experience – South Africa. These NSF-funded programs targeted underrepresented minority undergraduates with the goal to engage them is the scientific experience and to encourage them to scientific careers. As part of the Indiana-Princeton-Tennessee Astrobiology Initiative, I lead the education and outreach activities at the local, regional and national level.

I am honored to participate in Kimballton DUSEL as the education and outreach team leader. The Kimballton site will allow for research and educational bridge building between Virginia and Tennessee, as well as, provides a facility to bring in the Appalachian community through economic and educational developments. It would be a pleasure to transfer technologies gained through my South African REU and use them for the basis of an REU at this DUSEL facility. From a microbial ecologist, perspective the Kimballton DUSEL provides a site with long-term access to sedimentary rocks.

Sincerely,

Susan M. Pfiffner, Ph.D.
Research Assistant Professor

OAK RIDGE NATIONAL LABORATORY
MANAGED BY UT-BATTELLE FOR THE DEPARTMENT OF ENERGY

T. J. Phelps, Ph.D.
Env. Sciences Division
P.O. Box 2008
Oak Ridge, TN 37831-6036
(865) 574-7290

Dear DUSEL Selection Committee, February 20, 2005

I am a microbial ecologist quite experienced in the art and science of deep terrestrial subsurface investigations currently working with the Oak Ridge National Laboratory. I and many peers look forward to the Kimballton site being selected for further investigation as a U.S. Deep Underground Science and Engineering Laboratory (DUSEL). The Kimballton site is unique among candidate sites in that it is in a heterogeneous sedimentary environment, important for geological and microbial ecosystem diversity. Of considerable interest are the repeating sedimentary units providing numerous interfacial boundaries with increasing depth, pressure and temperature. The advantages of being relatively uncompromised with considerable subsurface heterogeneity and proximity to a major university are unsurpassed by other candidate sites.

As an employee of a Federally Funded Research and Development Center (FFRDC) and never supported by the NSF one can judge my interest and investment by service to the NSF community; including being the first DOE rep on the U. S. Science Advisory Committee of the Ocean Drilling Program (ODP) as it transitioned to the IODP. That era saw the incorporation of microbiology into the field of oceanic drilling, the participation of DOE scientists on cruises and post-cruise research, and DOE co-sponsorship of a fraction of ODP-related efforts. As an advocate for the U.S. DUSEL and a participant in the S1 DUSEL process I look forward to the scientific community and agency management yet again uniting to advance science through sharing of resources and expertise. In that regard, the heterogeneity of the Kimballton site maximizes interdisciplinary interactions and scientific advancements on more fronts than other proposed sites, and I look forward to participating in its progression as a DUSEL location.

The biogeoscience community, though poorly funded and with sporadic limited access to the deep subsurface has developed appropriate tools for investigation of life in extreme environments; has made significant strides in understanding limits of life on this planet and others; developing theories and rigorous investigations of evolution and adaptation; characterizing diversity and genomics in numerous surface and subsurface ecosystems; and accessing novel traits observed in extreme environments for societal benefits. As evidenced by the coauthors of Fredrickson, Onstott or myself it becomes evident that biogeoscience community represents hundreds of potential investigators poised for DUSEL collaborations.

I look forward to the development of the U.S. DUSEL concept at one or more locations and I am an advocate of the Kimballton site who looks forward to long term bio-geo-DUSEL collaborations. If you have any questions or comments please feel welcome to contact me.

Sincerely,

Tommy J. Phelps,

Tommy J. Phelps
Distinguished R&D Staff
Environmental Sciences Division
Oak Ridge National Laboratory
Oak Ridge, TN 37831-6036
Email: phelpstj@ornl.gov
Ph: 865-574-7290

Dear Dr. Bodnar:

I am writing in support of the proposal entitled "Conceptual Design for DUSEL at Kimballton, Virginia" that is being submitted in response to the National Science Foundation's solicitation NSF 05-506. If the proposal is selected for funding, I agree to assist the Kimballton Team to assess the level of support for the Project.

As my attached Biography indicates, I currently serve as the Director of the Conflict Resolution Institute at Virginia Commonwealth University at Richmond, and I have 15 years of experience in assessing public support/opposition to proposed public projects, as well as in negotiating solutions to protracted public policy disputes.

I anticipate a total budget amount to be $75,000 for my staff's services.

I look forward to working with you on this very important Project.

Sincerely,

James D. Phillips

James D. Phillips J.D. Ph.D.
Director, Conflict Resolution Institute
Center for Public Policy
L. Douglas Wilder School of
Government and Public Affairs
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VIRGINIA POLYTECHNIC INSTITUTE
AND STATE UNIVERSITY

DEPARTMENT OF PHYSICS

February 28, 2005

Dear Kimballton Principal Investigators,

My field of research is experimental nuclear physics, with a current emphasis on parity-violating electron scattering as a probe of nucleon strangeness and as a testing ground for the Standard Model. Due to my long-standing interest in fundamental symmetries, my future research could naturally evolve into a program involving neutrinos and their properties. There is every current indication that neutrinos could continue to yield the most interesting new developments in particle physics over the next couple of decades. Shifting to the study of neutrinos would also make sense because of the presence of the already existing neutrino physics group led by Professors Raghavan and Vogelaar here at Virginia Tech. The Kimballton site offers a suitable location for this research to be pursued, and I am working as a member of the Kimballton team to help make this a reality.

One of the features of the Kimballton site that appeals to me very much (besides the obvious physical proximity) is the fact that there are existing drive-in access caverns at depth. If DUSEL were to come here one could start small-scale experiments and prototyping of larger experiments immediately, thus getting graduate students and postdocs involved in underground activities right away. Another personally appealing thing to me is the fact that the close proximity of the lab would bring in an influx of visiting scientists in physics and other fields of science and engineering. In particular, I look forward to working during the upcoming S2 to insure that the proposed DUSEL-Kimballton laboratory can accomodate the vast majority of the exciting physics activities that have come out of the S1 process. This will insure that the lab is designed such that the national and international physics community can stage the most exciting underground experiments here.

Sincerely,
Mark L. Pitt
Associate Professor of Physics

BLACKSBURG, VIRGINIA 24061-0435 TELEPHONE (540) 231-3015
pitt@vt.edu FAX: (540) 231-7511

Memorandum

To who it may concern

From: Jean-Claude Roegiers
McCasland Chair & Professor
Mewbourne School of Petroleum & Geological Engineering
The University of Oklahoma, Norman Campus

Concern: DUSEL – Kimballton Site

My field of research is Rock Mechanics, especially as it applies to the problems associated with the production of hydrocarbons. The Kimballton site definitely offers a preferred location for such research to be pursued and I am working as a member of the Kimballton team to help make this a reality.

The features of Kimballton which appeal to me are:

- Access to naturally fractured sedimentary formations; typical of some carbonate reservoirs.
- These formations have porosity as well as permeability, allowing the study of fully coupled phenomena; i.e. thermal, poroelastic media.
- Interactions between the fractures and the porous medium can be validated.
- Large rock masses can be isolated and local conditions can be changed, such as in-situ stresses, pore pressure, temperature, etc…
- The strength of the formation is such that large stable cavities could be constructed at minimal cost.
- A sedimentary site will appeal to the oil and gas industry as a potential site to validate new concepts and new technologies.
- Having both primary and secondary porosity/permeability will add an 'additional dimension' to geophysical investigations as far as separating 'storage' from 'transmissivity'.

A limited number of research and engineering applications are included in appendix to this S2-proposal.

Virginia Tech
VIRGINIA POLYTECHNIC INSTITUTE
AND STATE UNIVERSITY

Department of Geosciences

Llyn Sharp, Science Outreach Program
5070 Derring Hall MC 0420
Blacksburg, Virginia 24061
phone 540-231-4080 fax 540-231-3386
llyn@vt.edu

February 7, 2004

Dr. Bob Bodnar
Department of Geosciences
Virginia Tech MC 0420
Blacksburg, VA 24061

Dear Dr. Bodnar,

I am writing to lend full support to Virginia Tech's NSF proposal for a Deep Underground Science and Engineering Lab (DUSEL) at Kimballton. This is a tremendous opportunity for outreach to K-12 schools as well as to other public audiences. I am actively involved with VT-STEM, a university-wide outreach initiative in Science, Technology, Engineering and Math (STEM). VT-STEM seeks to promote STEM literacy for non-technical audiences, and has a particular focus on tapping VT resources to enhance K-12 STEM education. What a bonanza DUSEL would be!

If this project is funded, we intend to pursue additional funding and projects to provide teacher and student learning experiences along with state-of-the-art public interpretation. In addition, we would work with undergraduate education in regional 4-year colleges and community colleges, and we would explore the professional development needs for a variety of technical personnel and faculty. The "Big Science", international, and multidisciplinary nature of the DUSEL makes some very unusual outreach activities possible here in our area of the Southern Appalachians. I believe many funding sources would be available to us.

Respectfully,

Llyn Sharp
Assistant Director
Science Outreach Program

February 21, 2005

Dear Committee Member,

My field of research is experimental particle physics, with a particular interest in neutrino physics. I am interested in the construction of a large underground detector for neutrino oscillation research. Recently I have been exploring the capabilities of a large scintillation detector, which could offer a wide range of neutrino physics and astrophysics (solar and geoneutrinos), as well as proton decay sensitivity. This type of project involves a large community of researchers, and collaborations of typically one or two hundred members. I am currently a member of the Super-Kamiokande collaboration, at an underground laboratory in Japan, and have worked on the MACRO experiment at the Gran Sasso laboratory in Italy; both of these collaborations are of roughly comparable size to that which would form to work on a large scintillation detector.

The Kimballton site offers a possible location for this project. The achievable depth will be entirely adequate. The baseline from existing accelerator laboratories (Fermilab and Brookhaven) may be appropriate for a scintillation detector.

If Kimballton is selected as the DUSEL site, I will work as a member of the Kimballton team to help make this a reality.

Sincerely,

Kate Scholberg
Duke University Department of
Physics

Dear Committee Member,

My field of research is CP violation in the quark sector. My future interest is the measurement of CP violation with neutrinos. The Kimballton site offers a suitable location for this research to be pursued, and I will work as a member of the Kimballton team to help make this a reality.

The features of Kimballton which appeal to me are:
The research community I am a member of should be represented in DUSEL because it presents the unique opportunity among other characteristics to measure CP violation in the neutrino sector using the existing accelerator facilities at the east coast of the United States. For this a large neutrino detector shielded from cosmic and natural radiation is needed.

Sincerely,
Stefan M. Spanier

Dear Committee Member,

An important part of my research activities is in neutrino physics and especially in double-beta decay. The Kimballton site offers a preferred location for this research to be pursued, and I will work as a member of the Kimballton team to help make this a reality.

The features of Kimballton which appeal to me are: proximity, easy access and low radioactivity from Uranium and Thorium decay products.

The research community I am a member of should be represented in DUSEL because double-beta decay studies are the number one recommendation of the recent American Physical Society neutrinophysics study.

The TUNL group, consisting of undergraduate and graduate students under my leadership, is part of the larger Majorana Collaboration. The goal of the Majorana Collaboration is to determine the neutrino mass from the neutrinoless double-beta decay search on ^{76}Ge. The Standard Model of Particle Physics assumes that neutrinos are massless. However the recent neutrino oscillation experiments clearly showed that neutrinos have mass. Only the observation of the neutrinoless double-beta decay can provide an accurate determination of the neutrino mass, assuming that the neutrinos are their own antiparticles.

The TUNL group focuses on double-beta decay to excited states of the daughter nucleus. For this type of experiment the Kimballton mine is ideal.

Sincerely,

Werner Tornow

MichiganTech
Michigan Technological University

Department of Geological Engineering and Sciences

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February 19, 2005

Prof. Bruce Vogelaar
Department of Physics
Robeson Hall
Virginia Tech.
Blacksburg, VA 24061

Dear Bruce

The Kimballton Mine and the mining operations/capabilities at that mine offer extraordinary scientific opportunities in the field of seismic imaging. Fifty percent of the world's oil is found in carbonate reservoirs, therefore the correct imaging of carbonate features (fracture volumes, dolomitized zones, reef and algal mounds, etc.) is extremely important. Recently several oil companies have been forced to restate (lower) their reserve estimates and while many factors go into a reserve calculation it is obvious that getting the image right is one of them.

One can seismically image carbonate formations anywhere in the world but only at Kimballton is the mining machinery and manpower available to "mine-back" into a seismic image dramatically exposing the errors in the image. Once the errors have been found, and understood, one can correct the imaging operation both in the field and in the theory.

Today, the leading edge of our science lies at the intersection of fluid flow and seismic imaging. This is an awkward, but extremely important intersection because there is no physics that connects the two phenomena. At Kimballton one can conduct special fluid flow experiments (dyes, tracers) that highlight the permeability of a carbonate reservoir, especially its anisotropy, which can then be compared to seismic anisotropy. Again, it is only the "walk through the seismic image" that properly identifies the permeability anisotropy.

The number of seismic imaging experiments that can be conducted at Kimballton is endless but it is only during the gentle mine-back operations that "blinding innovation" will strike. I am eager to be a member of the Kimballton research team.

Sincerely

Roger

Roger Turpening
Research Professor

www.mtu.edu
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Dear Committee Member,

My field of research is Astroparticle Physics. The Kimballton site offers a preferred location for this research to be pursued, and I will work as a member of the Kimballton team to help make this a reality.

The features of Kimballton which appeal to me are:
The unique possibility to create an underground laboratory with sufficient space und shielding against cosmic background radiation which would allow to perform a next generation project in the field of low energy neutrino astronomy (LENA), a project we are now developing with an underground site in Europe in mind. Kimballton offers another site of interest to us. Our goal is to set up a new observatory based on a ~50-100kt large liquid scintillator detector. The scientific topics that can be studied in such a detector are:

- search for proton decay modes,
- study of a galactic Supernova type II by detecting the thereby emitted Supernova neutrinos,
- measurement of relic Supernovae neutrinos,
- precise study of solar thermo-nuclear fusion reactions,
- search for small solar neutrino flux variations,
- test of geophysical models by measuring terrestrial neutrinos from the crust, mantle and core.
- Long baseline experiments to study oscillation phenomena of high energy neutrinos from accelerators

Sincerely,
Prof. Franz v. Feilitzsch

Environmental & Engineering Geosciences Department of Geology
Radford University, Box 6939
Radford, Virginia 24142

February 24, 2005

Dear Committee Member,

My field of research is Engineering Geoscience. The Kimballton site offers a preferred location for this research to be pursued and I will work as a member of the Kimballton team to help make this a reality.

The features of Kimballton which appeal to me are:

1. The location within the world class tectonic feature that is the foreland thrust belt of the Southern Appalachian Mountains.

2. The variety of conditions and rock types available for diverse experimentation, including massive competent sedimentary rocks (primarily carbonates and sandstones) and thinner weaker rock layers (primarily shales and sheared fault zones).

3. The variability in fractured nature of some of the rock formations, as induced by both ancient and recent tectonic activity.

The science community that I am a member of should be represented in DUSEL because:

1. There remains a great deal to be learned about the physical and chemical nature of sedimentary rocks at great depth within a major thrust fault belt.

2. A long-term study of the distribution and orientations of joints and fractures within these intensely folded rock masses will help the science community to better understand ancient and current stress fields.

3. Experiments that induce and examine the propagation of fractures within unfractured or lightly fractured portions of rock masses may be performed that will be of universal benefit to workers in water and petroleum resource management and recovery. Both of these are of utmost importance today.

There truly is a great deal to be learned from the Kimballton DUSEL site from which society as a whole will benefit, and that could not be studied elsewhere. Thank you for giving the Kimballton site your full consideration.

Sincerely,

Chester F. Watts, PG, PhD
Dalton Professor of Geology

Dear Committee Member,

My field of research is tomographic imaging of rock masses for improved understanding of failure. The Kimballton site offers a preferred location for this research to be pursued, and I am working as a member of the Kimballton team to help make this a reality.

The features of Kimballton which appeal to me are the repeated layers of differing rock types. By accessing several rock types, each occurring at different depths, and therefore at different stress levels, we can better understand the complex relationship between stress and seismic wave velocity and attenuation. While tomographic imaging is used extensively in the medical field, its use is immature in the geo-engineering field. The Kimballton site offers the best location for further developing this technology.

The research and engineering community I am a member of should be represented in DUSEL because there are many valuable experiments that we can conduct at a dedicated, long-term facility. Typically we conduct our research at underground mines, which places many limitations on our ability to achieve the greatest possible results from the experiments.

Sincerely,
Erik C. Westman

Dear Committee Member,

My field of research is particle and nuclear physics. The Kimballton site offers a preferred location for neutrino research to be pursued, and I would work as a member of the Kimballton team to help make this a reality.

Kimballton is located in the same geographical region as the laboratory in which I do my research: the triangle universities nuclear laboratory in North Carolina. An underground laboratory at Kimballton would permit us to make maximum use of our local resources to contribute to the US neutrino physics program, and would provide the perfect staging site for some of our envisioned experiments. As a regional project, the draw for our students and research associates will be very strong, and provide a large body of young scientists to contribute to the projects at Kimballton.

In short, as a member of NCState University and the Triangle Universities Nuclear Laboratory, I strongly endorse and support the establishment of an underground laboratory at Kimballton.

Sincerely,
Albert R. Young