The University of Arizona
Instructions and Approval Sheet
Proposal for New Academic Organizational Unit
or
Re-organization of Existing Academic Unit(s)

Directions:
1. Provide information regarding the proposed unit in the form requested on the attached pages. Respond to each item individually using “not applicable” where appropriate. Attach this approval sheet to the front of the proposal.
2. Obtain signatures of the proposed unit administrator and department or committee head.
3. Forward the original and one copy to the college office for the dean’s signature and retain a copy for departmental files.
4. The dean should forward the original to Curriculum and Registration, Academic Programs, Attn: Sandra Beeler, CCIT 337, and retain the remaining copy for college files.

Note: In some situations signatures of more than one dean or department head may be required. If you have any questions, please contact Sandra Beeler, CCIT 337, 621-1847.

Initiating college, department, or committee: College of Science

Description of the proposed organizational unit change:
New department ( )
New committee ( )
New laboratory, center, institute, or bureau ( x )
Reorganization ( )
Other ( )

Title: Arizona Geochronology Center (AGC)

Unit Administrator (title and signature) Peter W. Reiners, Interim Director

John Chesley, Interim Co-Director

Department Head Susan Beck, Geosciences__________Date 12/18/06

Department Head Michael Drake, Planetary Sciences __________Date 12/13/06

Department Head John Olsen, Anthropology __________Date 12/13/06

Department Head Tom Swetnam, Laboratory of Tree-Ring Research __________Date 12/13/06

Dean Joaquin Ruiz, College of Science __________Date 12/13/06
Proposal to the Arizona Board of Regents for the Creation of
The Arizona Geochronology Center (AGC)

Proposed Starting date: ASAP

I. Description of the Proposed Organizational Unit Charge

A. The Arizona Geochronology Center (AGC) will be a research and outreach center shared among the Department of Geosciences, the Lunar and Planetary Laboratory, the Laboratory of Tree Ring Research, the Arizona Accelerator Mass Spectrometry Laboratory, and the NSF-UofA Archeological Sciences IGERT Program. The AGC will serve these research entities and the UofA College of Science; the AGC Director will report to the Dean of the College of Science (COS).

B. The AGC will be a new unit at the UofA that will serve as a scientific, technologic, and organizational focal point for research involving the measurements, interpretations, and applications of ages and rates in earth and planetary materials and processes. The AGC will enhance interdisciplinary interaction among researchers with parallel scientific objectives in the field of geochronology and will provide the temporal framework required by different researchers at the UofA for understanding and modeling Earth processes.

II. Purpose and Activities of the Unit

A. Rationale and Relationship to the Mission and Scope Statements

Quantitative measurements of dates and rates of events and processes provide some of the most fundamental foundations of earth and planetary science. Geochronology establishes the basis for our understanding of phenomena ranging from condensation of the solar nebula 4.6 billion years ago to the nature and pace of climate change in the last ten thousand years. While geochronology is an essential tool for nearly any field of earth and planetary science, it is also important to recognize it as a rapidly evolving and dynamic field in its own right. In the last few decades, major theoretical and technical advances in geochronology have influenced the research directions in earth and planetary research and directly driven some of the most important breakthroughs. These include advances in tectonic geomorphology, ore and petroleum migration, and climate dynamics. As geochronology continues to evolve, it will continue to not only inform and support the diverse fields that draw from it, but play a major role in influencing their courses and interactions. An initiative enhancing collaboration, innovation, and leadership in geochronologic research has the potential to produce a distinguished center of excellence and motivate some of the most important fundamental and applied research in earth and planetary science.

With its active programs in a wide variety of geochronologic research, the University of Arizona is in a uniquely strong position among peer institutions and research organizations in the discipline of geochronology (including thermochronology, cosmogenic isotope analysis, dendrochronology, and other approaches). Extant geochronologic research programs at UofA include these:
• Cosmogenic isotopes: including \(^{14}\text{C}\), \(^{10}\text{Be}\), \(^{26}\text{Al}\) for dating biologic materials, artifacts, and extraterrestrial materials, and exposure age and sedimentation and erosion rate studies on timescales of \(10^2\) to \(10^6\) yr.

• The radiogenic isotope systems U/Pb, Rb/Sr, Lu/Hf, Sm/Nd, and Re/Os, for dating rocks and minerals over timescales of \(10^6\) to \(10^9\) yr, and tracing sources and cycles of hydrocarbons, economic ores, groundwater, and environmental contaminants. Much of the initial work establishing the now widely used Lu/Hf system was done at the UofA.

• The radiogenic noble-gas isotope systems \(^{40}\text{Ar}/^{39}\text{Ar}\) and \((\text{U-Th})/\text{He}\) for dating formation ages of rocks and minerals over timescales of \(10^4\) to \(10^9\) yr, and establishing time-temperature histories of rocks through the shallowest parts of the earth’s crust.

• Uranium- and Thorium-series isotope systems, with an enormous range of applications from magmatic processes to climate reconstructions over timescales of \(10^2\)-\(10^6\) yr.

• Dendrochronology, for combining precise absolute dating with climate dynamics, geologic events, and human history, over timescales of \(10^0\) to \(10^4\) yr.

These research strengths are currently distributed among the Department of Geosciences, Lunar and Planetary Laboratory, Laboratory of Tree-Ring Research, the Arizona Accelerator Mass Spectrometry (AMS) Laboratory, and the NSF-UofA Archeological Sciences IGERT Program. We propose to capitalize on these existing strengths by establishing a Geochronology Center that will facilitate greater interdisciplinary interaction, foster scientific innovation among research groups, attract outstanding visiting and permanent researchers and resources in geochronology and earth and planetary science in general, and position the UofA for distinguished leadership in these fields.

A formal affiliation of geochronologic research, teaching, and outreach efforts from all of these units will serve two primary goals. First, it will provide a vehicle for interdisciplinary interaction among colleagues and visiting researchers with parallel but widely ranging skills and interests. This interaction is expected to lead to technical and interpretational innovations, cross-fertilization of student research and training, and better integration of a wide range of approaches and techniques in research at the UofA. Second, the center will be designed to attract resources and personnel that augment its mission and that of all fields of earth and planetary science that draw from it. Examples include recruiting new graduate students to allied programs, attracting personnel and resources from U.S. Geological Survey and other State and Federal agencies.

B. Goals and Objectives

The long-term goal of the AGC is to generate an internationally recognized center of excellence in geochronology that will provide research leadership and distinguish the UofA’s earth and planetary science programs. More specific objectives contributing to this goal are these:

1) The AGC will facilitate interaction among researchers at the UofA and beyond that will promote innovation and transfer of technologic and scientific approaches. This interaction will also encourage interdisciplinary approaches to temporal aspects of earth and planetary science, provide a common resource for UofA researchers to share, test, and improve interpretations and analytical resources, and inspire new research directions in general.
2) Establishment and advertisement of the AGC will generate awareness in the larger earth and planetary science community of the UofA’s outstanding personnel, facilities, and cross-disciplinary interaction in geochronology. This will attract visiting users and collaborators to broaden the research scopes, identify promising new directions, and enhance analytical and interpretational innovation. It is also intended to recruit and retain outstanding faculty, researchers and students with geochronologic interests, and attract personnel and resources from other state and federal research agencies. Finally, this awareness in the larger community is intended to enhance the ability of AGC researchers to attract research funds from both conventional and unconventional sources, public and private.

3) Establishment of the AGC will allow the earth and planetary community at the UofA to identify and attract resources for important instrumental, infrastructural, or personnel needs to satisfy critical research objectives of the community. Identification and pursuit of critical analytical and other capabilities through the AGC will primarily consider the ability of new resources to promote interdisciplinary research, lead to innovative new research, and place the AGC and earth and planetary science at UofA in a position of scientific leadership.

4) Initial or ongoing research emphases that will be primary foci for the AGC over the next few years include the following:

*Integrated studies of mountain belts*

Mountain belts provide natural laboratories for studying a wide range of geologic processes such as plate tectonics, crustal magmatism and metamorphism, erosion and sedimentation, and climate phenomena. Interdisciplinary geochronologic approaches that measure ages and rates and trace mass transfer among reservoirs are essential requirements for any meaningful understanding of these processes and the larger scale behavior of mountain belts, the lithosphere, and plate tectonics. Highly integrated large-scale study of mountain belts with essential geochronologic components is, and has been for several decades, a distinctive strength of UofA Geosciences. An example of this approach is a recent successful grant for integrated study of the central Andes involving upwards of a dozen PIs in Geoscience, whose fields range from seismology to climate dynamics. Essential components are the basic understanding of spatial and temporal patterns (and mantle vs. crustal contributions) of magmatism from U/Pb dating and Sm/Nd and Lu/Hf isotope systems, metamorphism and crustal deformation from Rb/Sr and \(^{40}\text{Ar}/^{39}\text{Ar}\) dating, erosion and tectonic exhumation from (U-Th)/He dating and cosmogenic isotopes, sedimentation and volcanic stratigraphy from \(^{40}\text{Ar}/^{39}\text{Ar}\) and U/Pb dating, and paleoalitmetry and climate change through time, from \(^{14}\text{C}\), U-series, and cosmogenic dating, and tree-ring studies. Integrative research using all of these techniques is necessary to understand some of the most pressing and scientifically rich problems surrounding orogenic dynamics and lithosphere-atmosphere interactions. These include the nature and extent of dynamic coupling between erosion and tectonics, and links between punctuated episodes of crustal shortening, uplift, magmatism, and lithospheric foundering (crustal-scale “dripping” of material into the mantle) on \(10^6-10^7\) yr timescales.

*Integrated study of Pleistocene and Holocene climate records*

One of the most exciting, rapidly expanding, and important areas of geochronology today is its application to climate records during the Pleistocene ice ages and in more recent (Holocene) time. Some powerful influences on our climate today, such as the El Niño—Southern Oscillation (which gives Arizona half or more of its annual rainfall), or the flow of warm tropical water into the northern Atlantic Ocean that warms Europe, may have been radically different in the past.
There may be tipping points in global temperature change, when large shifts in climate or ocean circulation occur in response to very small additional warming. Understanding that past history of global changes during the Pleistocene and Holocene should enable better prediction for humans as global temperature creeps upwards in the coming century. Integrating climate records across huge distances and latitudinal gradients is critical for understanding past (and future) climate change, and requires much precise geochronologic work. The three techniques best suited to this task—\(^{14}\text{C}\) and U-series radioisotopic dating and tree-ring dating—are especially strong at the UofA. Carbon-14 dating has been a distinctive strength of UofA for decades, and recent innovations here in sample extraction and measurement now make it one of the best facilities in the world for this method. U-series dating has recently (since 1997) been developed at the UofA. The modern field of dendrochronology was created at the UofA early in the 20\(^{th}\) century, and the Laboratory of Tree-Ring Research remains the world leader in tree-ring applications to a broad range of fields, including climatology, ecology, and geology. The large cadre of climate researchers focusing on modeling, coral or cave records, radiocarbon and tree rings, make the AGC ideally poised, as perhaps no other institution nationally or globally, to make a major contribution to global Pleistocene/Holocene climate connections. U-series dating allows rigorous dating of carbonate deposits, like coral and cave calcite, back to 400,000 years before the present, encompassing all of the last three glacial/interglacial oscillations, and complementing \(^{14}\text{C}\) extremely well. Faculty at Arizona have the expertise and collaborative connections needed to identify and obtain critical cave and coral records from all latitudinal belts of the Earth, and to make a major contribution to climate prediction. Tree-ring dating currently provides seasonal and annual resolution dating of woody materials back through most of the Holocene (9,000 plus years before present), and there is great potential to extend these records to 20,000 years or longer with buried and submerged wood that is now being extracted in various places around the world. There are opportunities to use such records for extension of the calibration of radioisotopic dating, with payoffs in improved understanding of climatic phenomena, such as rapid climate changes of the past. Again, the combination of radioisotopic and dendrochronological expertise and facilities at UofA make our institution particularly well suited for pursuing these research opportunities.

**Technical innovation in geochronology**

Development of new analytical technology has always played an important role in geochronology. The advent of both multi-collector ICP-MS and SIMS technology, for example, revolutionized geochronology, and also attracted much favorable attention to the labs and departments that achieved these developments. Routine analyses with standard geochronologic techniques may serve conventional applications, but innovation in methods and instrumentation has the potential to produce establish real research leadership. In this light, a potentially important priority that the AGC will consider in the next several years is pursuing directions and funding for technological advances in geochronology. One way to accomplish this is by encouraging and facilitating interactions between geochemists, engineers, and researchers with innovative approaches. Two areas in which AGC researchers currently have a leadership edge and could focus their attention in the near future are experimental development of small-scale accelerator mass spectrometry, and in-situ geochronologic devices suitable for field or spacecraft use. Small, self-contained geochronologic analytical systems would be valuable both for use in situ on planetary surfaces and in remote terrestrial environments. Although such a system could not hope to compete with the kind of laboratory-based analyses of which AGC is capable, they could revolutionize analyses of planetary surfaces in cases where samples will not be returned for many years or decades and the absolute calibration of stratigraphic chronologies is in doubt, as is the case for Mars. For terrestrial applications, the use would be as a reconnaissance tool,
enabling geoscientists in remote or inaccessible regions to quickly establish basic chronologic relationships in the field, and choose the best samples to return for laboratory analysis. Researchers in UofA’s LPL have done extensive development work on a noble gas-based system, for K/Ar analyses or (for planets without an atmosphere or magnetic field) cosmic-ray-exposure ages of surfaces. Based on test measurements, uncertainties of 20% or less (far worse than laboratory measurements but useful for either the martian surface or many terrestrial locations) should be possible. Under the acronym AGE (Argon Geochronology Experiment), this has already attracted more than $2 million in external funding. Although an instrument for spacecraft applications would be different in some details from a “backpack” instrument, the basic traits of low mass, volume, and power consumption would be common to both.

C. Activities, Projects and Programs

The AGC will initiate a biweekly seminar featuring research presentations by visiting scientists and AGC researchers. The seminar, to start in Fall 2007, will facilitate cross-disciplinary interaction and provide a forum for the discussion and identification of new research questions and directions.

The AGC will encourage and provide opportunities for interaction leading to the submission of collaborative proposals for geochronologic research, such as integrated projects to provide formation, cooling, and exposure ages of large numbers of samples through initiatives like NSF-Earthscope.

The AGC will coordinate and develop outreach programs such as summer workshops, public lectures, and research opportunities for undergraduates, high school students, and underrepresented groups, in AGC projects.

The AGC will encourage collaborative exploratory research on unconventional projects such as development of small mass spectrometers for planetary rovers or field use, or the exploration of new analytical techniques.

Although not an immediate goal, in the long term the AGC intends to seek funds from various entities for the establishment of several programs to support and distinguish it. Potential examples include a visiting scientist program to bring outstanding researchers in geochronology to the UofA for sabbatical or shorter term visits, and a postdoctoral program or graduate student fellowships, to recruit outstanding young researchers with critical skills and/or interdisciplinary approaches that would benefit the AGC’s larger goals. One possible source of funding for these initiatives is the new Science Foundation Arizona, whose stated missions are highly consonant with the AGC.

D. Units Eliminated

No units will be eliminated. The AGC will assume all new responsibilities.

E. Number of Majors for Instructional Units

The Center will not have a major program.
III. Resources

A. Faculty and Staff

The following list provides faculty who have committed a percentage of time to the geochronology center effort, and provides a cross-section of disciplines with existing strengths in geochronology.

**Department of Geosciences**
Susan Beck, Professor and Chair, PhD
John Chesley, Research Scientist, PhD
David Dettman, Research Scientist, PhD
Mihai Ducea, Associate Professor, PhD
Christopher Eastoe, Staff Scientist, PhD
George Gehrels, Professor, PhD
Clark Isachsen, Staff Scientist, PhD
Tim Jull, Professor, PhD
Nathaniel Lifton, Research Scientist, PhD
Jonathan Patchett, Professor, PhD
Stefan Nicolescu, Staff Scientist, PhD
Jay Quade, Professor, PhD
Peter Reiners, Associate Professor, PhD
Joaquin Ruiz, Professor and Dean of the College of Science, PhD

**Anthropology**
David Killick, Professor, PhD
Ron Towner, Adjunct Assistant Professor, PhD
Steven Kuhn, Professor, PhD

**Laboratory of Tree-Ring Research**
Tom Swetnam, Professor and Director, PhD
Jeff Dean, Professor, PhD
Malcolm Hughes, Professor, PhD
Mike Evans, Assistant Professor, PhD
Steve Leavitt, Professor, PhD

**Lunar and Planetary Laboratory**
Tim Swindle, Professor, PhD

All of the above faculty will spend approximately 5% of their time on Center work with the exception of Peter Reiners and John Chesley, at approximately 15% and 10%, respectively.

2. Existing Clerical and Support Staff Positions

Department of Geosciences Business Office personnel
Dean of College of Science personnel

3. Graduate Assistants
None.

4. New Faculty And Staff Positions Needed During The Next Three Years

Establishment of the Center does not commit the University to salaried lines. However, it is the intention of the AGC to request that future faculty appointments in associated departments and programs consider augmenting and complementing the UofA’s distinctive strengths in geochronology and its broad applications. The AGC will, however, request funds ASAP for a student worker with experience in website design and maintenance, to help establish the AGC website.

B. Physical Facilities and Equipment

1. Physical Facilities

Extant facilities will be used for all AGC activities, at least for the foreseeable future. Laboratories in Gould-Simpson and Physics-Atmospheric Sciences are currently satisfactorily equipped to handle routine procedures and can be used for new method development. As the AGC grows and acquires additional funding from external sources it is anticipated that new space could be needed to accommodate visiting researchers, postdocs, students, labs, and sample preparation facilities.

2. Additional Equipment

No additional equipment outside of currently planned projects of individual PIs is anticipated for the AGC for the next five years.

C. Library Resources, Materials and Supplies

No additional requirements.

D. Other Information

1. Accreditation – not applicable

2. Other Relevant Information – see section IV.

E. Financing

1. University’s plan for providing adequate financing for the unit

The Department of Geosciences, College of Science, and Laboratory of Tree Ring Research have each committed $1500, $1500, and $750 per semester, respectively to help finance an AGC Seminar Series for three years, beginning in Fall of 2007 (see budget projection sheet). These funds will be used to help fund visits by invited speakers and small expenses associated with running the seminar series (room costs, advertising, refreshments, etc.). At this point we do not anticipate any additional state funds for financing the unit. In the future, should it appear that the AGC provides significant benefit to research programs at the UofA by attracting resources, students, and personnel, we may consider requesting some funds to support creative outreach.
programs, visiting scientists, postdoctoral fellowships, or matching funds for new instruments or facilities.

2. Potential Sources for External Funding for the Unit

Potential funding sources for innovative or interdisciplinary geochronology through the AGC may come from conventional federal sources such as NSF and NASA, or private funding sources such as ACS-PRF. Funding may be provided to individual researchers through conventional proposals, or groups of researchers for larger-scale or innovative proposals for projects such as intermethod calibration, regional analysis, analytical development, or visiting researcher or shared postdoctoral funds.

We also anticipate seeking funding from unconventional sources such as petroleum and mining companies, and private foundations interested in supporting regional applied studies or geochronologic research in general. Exxon-Mobil has provided funds to Geosciences faculty research programs in the past and we intend to continue our long-standing relationship with this company and others, to support innovative initiatives in geochronology.

3. State Funding

We do not anticipate requesting any new appropriations for state funds at this time, though in the future we may investigate the possibility of leveraging matching funds from funding agencies with COS or other funding, for objectives of visiting scientist, postdoctoral, or student support.

4. New Organizational Unit Budget Projection Sheet

The attached budget projection sheet shows only the funds committed from Geosciences, COS, and LTRR for the AGC Seminar Series beginning Fall 2007.

5. Amount of Funds to be Received for Each of the First Three Years

At this point it is premature to predict the success of external grants directly associated with the AGC.

IV. Other Information

A. Sunset Date

The proposed initial sunset date for the AGC will be three years after official establishment, following approval by the Board of Regents.

B. Other Information

N/A.
### ARIZONA BOARD OF REGENTS
#### NEW ORGANIZATIONAL UNIT BUDGET PROJECTIONS

**Name of proposed New Academic Unit**  
Arizona Geochronology Center (AGC)

**Name of University**  
University of Arizona

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*List major sources of local funds with a brief explanation of each source.  ABOR #4, 11/8