Charles Phelps Taft Research Center
at the University of Cincinnati
Research Support Application

Each section (I-V) should be placed at the start of a new page. All required materials must be included in a single document, uploaded to the electronic submissions system, no later than 5PM on the published day of the deadline. Departmental review is not required for this program.

I. General Information

a. **Name:** XXXXXXXX
b. **M#:** XXXXXXXX
c. **Department:** XXX
d. **Position:** XXXX
e. **Project title:** Evaluating the Impact of the CE 535-536 Weather Event on Ancestral Puebloans
f. **Time Period:** Summer Semester 2019 to Spring Semester 2020
g. **Probable Results of a Grant (such as external funding, publications, and presentations):**

1. A professional meeting paper will be presented at the 2020 Annual Meeting of the Society for American Archaeology, the flagship professional organization for my discipline.
2. A peer-reviewed article will be submitted to the high-profile *Journal of Archaeological Science.*
3. Results of this study will be provide preliminary data for an external grant applications that will be submitted to NSF, NGS, and/or Wenner-Gren).

h. **Other Funding Applied for or Received for This Project (list source and amounts requested and awarded):**

A Taft Research Travel Grant has been applied for transportation and lodging for this project. No other internal (department, college, or university) or external grants have been applied for this research.

i. **If applying for a Cost-Share grant, please indicate whether or not Cost-Share is required by grant giving organization and/or the budget items are necessary for the project but not covered by grant.**

Not applicable.

II. Budget:

A Taft Research Support Grant is requested to fund the laboratory analysis of water-deposited sediment samples from ancient Native American water management features in Chaco Canyon, New Mexico. The results of these analyses will be used as seed data to seek external funding from NSF, NGS, and/or Wenner-Gren.

My 2016-2017 allotment for the Taft Departmental Allocated Research Support (DARS) was $250.00 and I currently have a $0.0 balance. This request exceeds my initial and current DARS fund balance.

Accelerator Mass Spectrometry (AMS) Radiocarbon Dates: $900.00

Two AMS radiocarbon dates at $450.00 each. Samples will be analyzed at the University of Georgia Center for Applied Isotope Studies. The University of Cincinnati does not have an AMS radiocarbon laboratory.

Inductively Coupled Plasma Mass Spectrometry (ICP-MS) Analysis: $1,440.00

ICP-MS analysis of 24 archaeological sediment samples at $60.00 each ($30 for Platinum and $30 for Paladium). Sediment samples will be analyzed at the University of Georgia Center for Applied Isotope Studies. The University of Cincinnati does not have an ICP-MS laboratory.

TOTAL: $2,340.00

III. Internal & External Grant History

Taft Funding (4 grants in the last 5 years)

2018. Charles Phelps Summer Fellowship. “The impact of maize on Native American agricultural soil.” $8,000.00
2017. Charles Phelps Taft Research Travel Grant. “Mineralogical and Elemental Sourcing Anthropogenic Sediments from Ancient Water Management Systems in the Dune Dam area of Chaco Canyon, New Mexico.” $900.00
2017. Charles Phelps Taft Research Grant. Mineralogical and Elemental Sourcing Anthropogenic Sediments from Ancient Water Management Systems in the Dune Dam area of Chaco Canyon, New Mexico.” $2,300.00.
2016. Charles Phelps Taft Travel Grant. International Conference Travel Grant. “Removing Coal Contaminants from Chaco Canyon Radiocarbon Samples.” $1,684.00.

Resulting Peer-reviewed Journal Articles

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IV. Project Proposal

I am applying to the Taft Faculty Research program for the opportunity to analyze sediment samples from Canyon de Chelly, Arizona that will be used to evaluate the impact of the CE 535-536 weather event on Ancestral Puebloan culture. These data will be used to prepare for publication a significant multi-disciplinary scholarly paper and external grant proposals (e.g., high-impact peer-reviewed journals such as *Nature*, *Science*, and the *Journal of Archaeological Science*, and proposals for external grants from agencies such as the *National Science Foundation* and *National Geographic*).

Theoretical Framework

One of the most profound natural periods of extreme weather in the past 2,000 years occurred, ~ CE 535-536. During this time, an extensive shroud of atmospheric dust covered the northern Western Hemisphere, which resulted in an episode of radical cooling. This extreme weather event led to economic and sociocultural downturns related to crop failure and starvation. The event was documented in written records in China, Europe, and the Middle East. The timing of this event is also documented in dendrochronological records from Chile, Finland, Ireland, Sweden, and the United States, which show correlative periods of interrupted and irregular tree-ring growth.

The cause of this cold snap remains unanswered, but current theories include a catastrophic volcanic eruption or a cosmic event such as an asteroid, comet, or large meteor impact. Microscopic spherules interpreted as micro-tecktites have been reported from Greenland ice cores, which date to the time of the CE 535-536 extreme weather event. They are believed to represent earthen debris in the form of molten glass that was created when a cosmic body impacted the surface of the planet and scattered the micro-tecktites widely through the air.

Ice cores extracted from opposite ends of the earth (Antarctica and Greenland) show an intense spike in sulfur compounds that are characteristic of a major volcanic event. During a catastrophic volcanic eruption, sulfur emission concentrations are significantly higher than in urban air. When sulfur dioxide gas reaches the stratosphere, it creates a pan-global ash cloud obstructing solar radiation and results in a global cooling event. Theoretically, a long-term

feedback loop is created when cooled ocean waters and an increase in sea ice result in unusually cold summers.

Methods

The Charles Phelps Taft Research Award will be used to investigate the impact of the CE 535-536 weather event on Ancestral Puebloans living in Canyon de Chelly, Arizona. More specifically, I will be focusing on sediment extracted from archaeological sites, which date to the Pueblo II (Basketmaker) to Pueblo III (Modified Basketmaker) transition. This research will include searching for archaeological fingerprints of this event and how Ancestral Puebloans responded to the rapid downturn in weather.

Positive anomalies in the elements Platinum (Pt) and Paladium (Pd) will be identified in archaeological sediments from Canyon de Chelly using Inductively Coupled Plasma Mass Spectrometry (ICP-MS) at the parts per billion levels. AMS radiocarbon dating will be used to determine the age of the sediments. Dating and elemental analyses of the sediments will be conducted at the Center for Applied Isotope Studies, University of Georgia, Athens.

At Canyon de Chelly, Arizona, the CE 535-536 event will be investigated on archaeological sites that date to the transition from Late Basketmaker II to Basketmaker III (Modified Basketmaker) cultural periods. At this time, there was a mass movement of Ancestral Puebloans from both the eastern and western regions of the Four Corners area. This transition is also marked by a significant change in pit-house location and architecture. Following the event, pit-houses were built with more substantial construction including larger hearths, vestibules, and walls lined with stone slabs and they were constructed on mesa tops and canyon rims.

Preliminary Results

My recent research demonstrates that positive Pt and Pd anomalies can be used as reliable tracers for the accretion of cosmic dust from comets, meteors, and extraterrestrial impacts and high-magnitude volcanic events that date to the CE 535-536 weather event. During the summer of 2018, my preliminary survey of Ancestral Puebloan Basketmaker II-III transitional archaeological sites in Canyon de Chelly found that they contain no or only minimal signs of natural or cultural

disturbance. These sites allow will allow me to test the occurrence of positive Pt and Pd anomalies at the timing of the event. Well-stratified and dated archaeological sites in Canyon de Chelly offer a unique opportunity to examine the occurrence of positive Pt and Pd anomalies associated with this significant weather event in prehistory.

Proposed Research:

Additional Faculty and Students

This project will have an interdisciplinary team, which includes Drs. Nicholas Dunning (Geography), Lewis Owen (Geology), and David Lentz (Biology). Additionally, the data from this project will be used for the completion of an M.A. thesis in anthropology.

***Summer Semester (August 1-7, 2019)*:**

Sediment samples will be collected from Ancestral Puebloan sites that date to the Basketmaker II-III transition archaeological sites in Canyon de Chelly, Arizona.

***Fall Semester, 2019*:**

Sediment samples from Basketmaker II-III transition sites in Canyon de Chelly, Arizona will be prepared for ICP-MS analysis in the Ohio Valley Archaeology Laboratory in the Department of Anthropology in Braunstein Hall at the University of Cincinnati. Concurrently, carbon for radiocarbon dating will be removed from the samples. The ages of the resulting radiocarbon samples and the elemental composition of the sediments will be determined at the University of Georgia's Center for Stable Isotope Analysis.

***Spring Semester, 2020*:**

The resulting radiocarbon ages and elemental content of the anthropogenic sediments will be used in a paper to be prepared and submitted to a paper to a high-profile peer-reviewed journal such as *Nature*, *Science*, or the *Journal of Archaeological Science*. Also, these data will be used as the basis for an external grant submission to NSF, NGS, and/or Wenner-Gren.

Significance

While there is a large body of archaeological literature on the CE 535-536 weather event, it is focused on regions far beyond Canyon de Chelly (e.g., the

Moche of Peru in South America, the northern and southern dynasties of China, the Gaelic of Ireland, the Migration Period of Scandinavia). In terms of the broader impact on world prehistory, it has been suggested that the event caused the decline of the Pannonian Avars in the North Caucasus, the Persian Empire of Iran, the Gupta Empire in India, Teotihuacán in Mesoamerica, and a pandemic in the Byzantine Empire. Currently, there is no body of literature, which focuses on the impact of this event on Ancestral Puebloans living in the American Southwest. Also, despite various evidence and theories, the exact cause of this event remains ambiguous. In addition to looking at the impact of the CE 535-536 weather event on Ancestral Puebloan culture, this award will be used to collect sediment samples, which have the potential of resolving this mystery.

This project is a continuation of my established record of research on catastrophic global changes that resulted in profound cultural changes. For more than a decade, I have conducted innovative and interdisciplinary team-based research on the influence of catastrophic volcanic events and cosmic impacts on global climate change and the resulting cultural adaptations. This research has resulted in more than 25 high impact, peer-review journal publications (e.g., *Nature: Research Reports*, *PNAS*, *Journal of Archaeological Science Reports*) and has been featured on the *National Geographic Channel,* the *Discovery Channel,* the *History Channel,* the *Animal Planet,* the *Weather Channel, BBC Nature, NOVA,* and *PBS*.