



## ANNOUNCING

### A TRAINING PROGRAM FOR SCHOLARS, CONSERVATORS, LIBRARY AND MUSEUM PROFESSIONALS, ARCHIVISTS AND RESEARCHERS IN THE USE OF REFLECTANCE TRANSFORMATION IMAGING (RTI) FOR DOCUMENTING ANCIENT TEXTS AND ARTIFACTS INCLUDING THE LOAN OF IMAGING EQUIPMENT

The University of Southern California's West Semitic Research Project ([www.usc.edu/dept/LAS/wsrp](http://www.usc.edu/dept/LAS/wsrp)) has received a grant from the Institute for Museum and Library Services (IMLS) Laura Bush 21st Century Librarian Program to establish a **Training Program** in advanced imaging technologies for the documentation of ancient texts and artifacts with an initial emphasis on **Reflectance Transformation Imaging (RTI)**. The IMLS has also funded the purchase of imaging equipment to support the Training Program.

The objective of this project is to develop an infrastructure for training scholars, conservators, archivists and researchers in the use of RTI technology and subsequently to lend the necessary imaging equipment to participants in the training program so they can do an initial RTI documentation project either in field environments (archaeological sites, etc.) or in libraries, museums and/or other similar venues, worldwide. This initial undertaking should be understood to be a pilot project that can develop into an ongoing, broader documentary effort and preferably may also serve as the catalyst for establishing a consortial network for image documentation of a given corpus (or corpora) of ancient texts and/or artifacts. All equipment to be lent out is both rugged and compact and is thus ideal for doing sophisticated imaging in remote locations. Twenty awards over three years (approximately seven per year) for traineeships will be provided based on the merit and intrinsic importance of a proposed pilot imaging project as well as the appropriateness of the subject matter for RTI imaging.

## Training Support

Support for each application will include the costs of transportation to USC, plus food and housing, for one week of training in RTI and related techniques. Each participant will be able to borrow all of the necessary equipment for carrying out an initial pilot documentation project at a remote location, using Highlight-RTI.

## Support for the Distribution of Image Data (as Desired)

Free, public accessibility to the data produced by this project within a reasonable period of time is a prerequisite for participation. This may be done through any appropriate venue; however, trainees will be offered the option of employing USC's InscriptiFact Digital Image Library (see [www.inscriptifact.com](http://www.inscriptifact.com)) as a password-protected image database, for world-wide distribution without charge.

## Criteria for Selection



The brush work in this mummy portrait has been enhanced by the use of the diffuse gain filter available in an RTI image.

Twenty trainees (approximately seven per year) will be selected for the Training Program through a competitive evaluation process. Trainees will be selected based on the following criteria:

- Proposed imaging projects should be well defined in terms of the number of cultural heritage objects to be documented and the amount of time available for the documentation.
- Applicants should be American citizens, or be involved in a project that benefits American researchers or projects.
- The proposal should include **evidence that appropriate permissions for the pilot imaging project and distribution of resulting images have been obtained or are assured in advance.**
- The proposal should include **evidence of funding for support of the pilot imaging project outside of documentation—that is, funding for travel and living expenses during the documentation component of the project—should have already been acquired or assured.**
- Cultural heritage objects for the imaging project must be ancient (that is, no later than the Early Islamic period [6<sup>th</sup>-7<sup>th</sup> Century CE]).
- Selection will have as its aim the inclusion of projects representing a broad range of cultural heritage areas and will *not* be confined to ancient Near East.
- Selection will be based also on the merits of the proposal (e.g., likelihood of success [reliable access, expectation of sustainability, etc.]); intrinsic importance in terms of the need to reclaim

and insure the survival of the data; potential of the project to stimulate collaborative networks; appropriateness of RTI technology for the proposed field work. RTI can be especially useful for

monumental art and inscriptions, coins, paintings, cuneiform tablets, seals and seal impressions, bas-reliefs, etc. Researchers associated with institutions with cultural heritage collections are also encouraged to apply.

- If equally meritorious proposals qualify according to all of the above criteria, the selection of trainees will be based on a “first come, first serve” basis.

Preference will be given to those trainees with pilot projects including texts/cultural heritage objects that will especially benefit from RTI imaging. It will be emphasized that this program-support should be viewed as *supplemental* funding. Our grant will provide training and appropriate equipment for the acquisition of superior RTI image-documentation and distribution of the image data. The qualified applicant will have to demonstrate that s/he has appropriate funding to carry out the actual project (e.g., travel to a given museum or cultural heritage site, living expenses, insurance, etc.) and approval for her/his proposed project from the appropriate venues (e.g., ministry of culture, museum, library, etc.).

The standard expectation will be that this will be a one-time rather than an ongoing grant for each project. The expected duration of each trainee’s pilot imaging project will be no more than one year, with the remote imaging phase (in which equipment will be on loan) expected to be approximately 3 months or less. After each project, we will work with participants and provide consultation, as desired, in planning the establishment of ongoing infrastructures for production and documentation of their particular ancient texts and/or artifacts. Emphasis will especially be placed on using this project to attract other participants, thereby developing networks of projects to bring together *corpora* from various institutions into a common image database environment.

During the first year of the grant, seven applicants were trained for a wide variety of projects, some of which have been completed, and some of which are currently underway. These projects include the imaging of:

- Wax tablets and clay seals from the Roman period and late antiquity
- Artifacts from the Tell Timai Excavation in Egypt
- Early Alphabetic inscriptions from Wadi Serabit, Sinai Peninsula
- Palmyrene Aramaic inscriptions
- Inscriptions and tablets from Jordan
- A collection of coins dating from the Persian period to the Crusader kingdoms
- Madaean metal amulets

A related grant is allowing us to train participants to image:

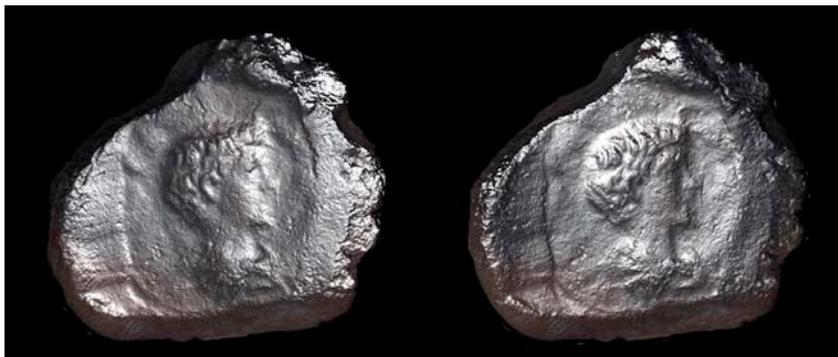
- Egyptian quartzite statues in the Louvre Museum
- Egyptian and Meroitic graffiti
- Korean stelas and artifacts
- Hebrew ostraca and jar handles

## Background

The West Semitic Research Project (WSRP) has been working for three decades on the documentation and distribution (through USC's InscriptiFact Digital Image Library) of ancient texts from the Near East.

“Reflectance Transformation Imaging” or RTI has proven to be transformative for the study of a wide variety of ancient inscriptions. For example, we have

been using this technology for the past five years to image the tablets in the Persepolis Fortification Archive. RTI facilitates the detailed study of both the cuneiform signs and the lightly impressed seal impressions used to endorse the tablets. This is because of the ability of the researcher to use a no-cost, easily downloadable viewer to examine a given target from any light angle (or with a combination of two virtual light angles) or boost the reflectivity/contrast of a surface to bring out optimal details in an easy and intuitive manner. Subsequent work done by ourselves and others has further demonstrated that RTI can be of decisive value for analyzing any text or artifact where a clear view of the textures supplies crucial information for interpretation and analysis—for example, ink thicknesses on the surfaces of Dead Sea Scrolls (invaluable for analysis of scribal *ductus*) and the brush work on early Buddhist cave-paintings from the Kizil/Kucha region of westernmost China (essential for revealing overall artistic techniques). (<http://www.youtube.com/watch?v=gUVDbWEvpqM>)



It is the *dynamism*, the ability to move the light around on an artifact that makes RTI such a valuable tool. The bulla shown above illustrates this point. If one only had the image on the left, one might be tempted to say that the person depicted on the sealing is a man with a goatee. However, as one moves the light around it becomes clear that the person is a woman or young boy, and what looks like a goatee is actually a defect in the clay.

## Reflectance Transformation Imaging (RTI)

The equipment required for doing highlight-RTI is relatively straightforward: a Digital SLR camera, a high-quality lens, a single strobe flash and transmitter, a tripod, a laptop computer loaded with associated RTI software, a back-up hard drive and a collection of “shiny balls” of different sizes. That is, the equipment necessary is of a type and kind that can be easily and compactly packed and transported. The method for doing the work in this fashion involves aiming a camera and lens mounted on a tripod at an object and then taking a series of images by moving the single strobe or other single light source all around the object by hand (a typical series is 36) with the light for each picture situated at a different angle and position but always from about the same distance. In other words, one builds the image by creating a virtual dome of light positions. Also placed in the picture to the side of the object is a shiny ball of appropriate size (typically colored red or black). This serves as a means of referencing the positions of the light in each successive picture. As the light moves, it registers a corresponding highlight on the ball that a software program can then read in order to automatically track each light-position. Once this is done, a second program can be utilized to construct

the RTI image. The image-series itself can be quickly done, usually in about 3-5 minutes (plus set-up time); post-processing of the final, RTI image usually takes 15-20 minutes but need not be done at the time of the image documentation and is usually deferred until later, since the time allocated for the imaging work, in a museum or library, for example, is usually limited. This “shiny-ball” (or, more formally, “highlight-RTI”) methodology requires no special skill in lighting by the documentary photographer. After all, no one picture is decisive for conveying the best texture-data; rather, it is the combination that is crucial. And the results are invariably successful.



The Persepolis Fortification Archive tablet pictured here in the InscriptiFact viewer (PF 0208) is shown with several different views using the interactivity derived from a single RTI (Reflectance Transformation Image). The top left image shows a light at a high angle; the image on the bottom left at a more raking angle from the left; the top right image utilizes two virtual lights (dominant light diagonal on the left with a buffering light diagonal on the right), in order better to define the edges of the wedges; the bottom right image uses “specular enhancement,” boosting the reflectivity and providing a detailed view inside the wedges.

As the Persepolis Fortification Archive Project (<http://oi.uchicago.edu/research/projects/pfa/>)—as well as a number of other projects—has well demonstrated, RTI imaging can have a profound impact on a researcher’s ability to analyze an ancient inscription or artifact. The data produced and displayed in an RTI-viewer is also invaluable for assessing the physical condition of the object for purposes of conservation monitoring. Subtle variations on the surface one is viewing become dramatically clarified, as the shadow-details seem almost to leap off a computer screen. If something is not clear from one angle, one can simply use a computer-mouse to move one’s cursor around like a virtual flashlight to examine it from another light angle. With a couple of command clicks one can switch from examination with one virtual light source to an examination with a combination of two virtual light—especially effective for the study of cuneiform tablets. One can easily and quickly switch to a mode called “specular enhancement.” In this case it looks as though the object has been overlaid with a virtual layer of silver. Then as the light moves, the object flashes a mirror-like finish that brings even the tiniest variation of texture into startling clarity. Yet another mode, “diffuse

gain” can be dialed up so that the contrast is enhanced to a point that even the smallest dimensional details are well delineated. Most importantly, the images are *dynamic* and in the control of the researcher. The result is akin to looking at the real object—only better, because the lighting can be controlled and moved around the target with a precision not otherwise possible, and one can also easily zoom in to examine even the smallest detail. Moreover, any perspective produced by RTI can be captured as a single “frozen” image and exported into other environments for further analysis (e.g., through Photoshop) or for purposes of publication.

### Application Information

Those wishing to apply to this training program should send:

- **Name, address, institutional affiliation, field of study, other contact information**
- **A description of their proposed pilot imaging project: what artifacts will be imaged, where they are located, when the pilot project will take place (no more than five standard-length pages)**
- **Appropriate letters of permission for documentation and distribution**
- **Evidence of funding for travel and related expenses for the project; this includes funding to cover the cost of equipment insurance and return shipping of the equipment**
- **A list, with contact information, of five experts who will be able to evaluate the usefulness of RTI for the field of study**



Specular enhancement makes every texture variation on the surface clear, thereby making it especially useful for matching die-stamps for ancient coinage.

Send the application to Dr. Bruce Zuckerman, University of Southern California, School of Religion, ACB 130 MC 1481, Los Angeles, CA 90089-1481. Electronic applications (PDFs) may also be sent to [bzuckerm@usc.edu](mailto:bzuckerm@usc.edu), or to Marilyn Lundberg, [mlundber@usc.edu](mailto:mlundber@usc.edu).

For more information, write to Marilyn Lundberg, [mlundber@usc.edu](mailto:mlundber@usc.edu), or Bruce Zuckerman, [bzuckerm@usc.edu](mailto:bzuckerm@usc.edu). Sample RTI images can be seen at <http://www.youtube.com/watch?v=gUVDbWEvpqM>.