Eyewitnesses to the Past:

Reclaiming Ancient Inscriptions with Modern Technologies

Through USC's West Semitic Research and InscriptiFact Projects

by

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West Semitic Research Project: Reason and Rationale

Over the past year and a half newspapers and magazines worldwide have chronicled the account of the discovery of what may be the oldest alphabetic inscriptions ever found.[i] The two small inscriptions were found in the Egyptian desert by Yale University archaeologists John Coleman Darnell and Deborah Darnell and photographed by a team of scholars from the West Semitic Research Project of the University of Southern California. This photographic project was one of the latest in an on-going series of endeavors by the West Semitic Research Project to use the most advanced technology for the decipherment and preservation of documents from the ancient Near East.

The West Semitic Research Project came into being in the late 1970s in response to a growing awareness that the study of ancient inscriptions was seriously impaired by the lack of access to reliable visual data. The field of ancient Near Eastern studies depends to a large extent on the reclamation of ancient inscriptions, for example, cuneiform tablets from Mesopotamia, papyri and monumental inscriptions from Egypt, scrolls and stelae from Israel and Canaan. But in order to read these texts, scholars first have to be able to *see* them. Therein has existed the most serious problem inhibiting proper interpretation of the ancient past. For example, scholars for generations have been forced to rely on what is essentially "eyewitness testimony," that is, the handdrawings or transcriptions of initial editors for various text collections. To be sure, such editors are almost always highly

[i] John Noble Wilford, "Finds in Egypt Date Alphabet in Earlier Era," *New York Times,* Sunday, 14 November 1999, sec. 1; Karin Bojs and Daniel Famer, "Äldsta alfabetet funnet i Egypten," *Dagens Nyheter,* 17 November 1999, sec. 1; Steve Connor, "Alphabet's Ancestor Discovered on Desert Rock," *The Independent* (London), Monday, 22 November 1999, sec. 1; Constance Holden, ed., "An Egyptian Birthplace for ABC's," *Science,* 26 November 1999, 1675; Thomas H. Maugh II, "Earliest Known Use of Alphabet Established," *Los Angeles Times,* Monday, 29 November 1999, sec. A; Pierre-Yves Frei, "L'alphabet remonte le temps," *L'Hebdo,* 2 Décembre 1999, 79; Alexandre Moix, "La vallée des lettres," *Sciences et Avenir,* Janvier 2000, 10; Karine Jacquet et Caroline Péneau, "A-t-on découvert le premier alphabet?" *Ça m'intéresse,* Janvier 2000, 60-62; "Earliest alphabetic writing discovered in Egypt," *Minerva,* January/February 2000, 2; "Origin of our alphabet unearthed in Egypt," *Focus,* February 2000; 32; "Die Wiege des Alphabets," *Specktrum,* 2 Februar 2000, 10; "Gastarbeiter erfanden deas Alphabet," *PM,* Juni 2000, 24.

trained, often brilliant scholars, who have been given the responsibility of being the first to publishing new inscriptions precisely because they have formidable expertise. Still, in most instances it is *only* the initial editor who has worked with a given document or manuscript, examining it by eye and transcribing the text as he or she has best understood or interpreted it. Recognition of a particular script has often depended on the editor being a kind of "connoisseur" of texts—one who has studied enough inscriptions to have an informed if still subjective sense of script, language and sense.

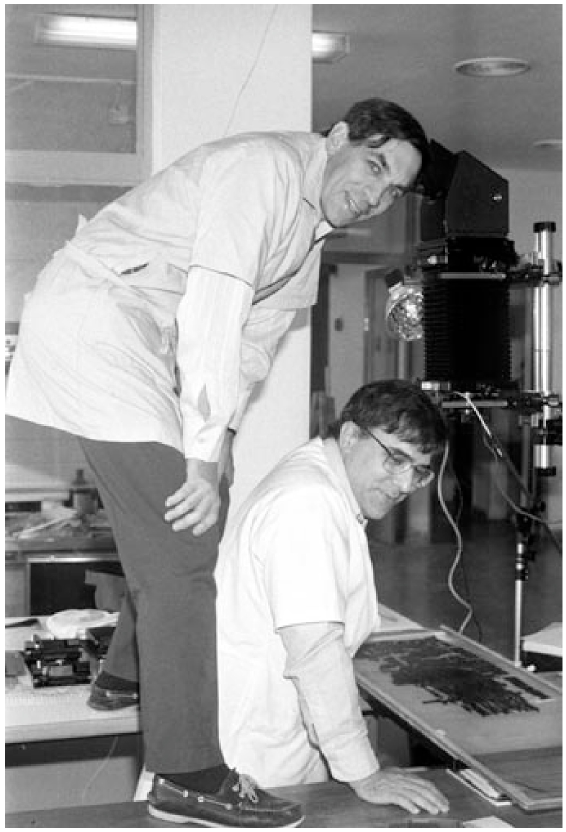
This traditional approach to the dissemination of inscriptions would not be a problem if all texts were clear, complete, and in such good condition that they could be read by anyone with the requisite knowledge and background. The difficulty arises because, in fact, most ancient inscriptions are damaged and incomplete, and thus the readings are open to question. New or revised editions of texts have therefore often presented competing readings of incomplete or degraded areas—readings which a scholar or student has had no way of checking except by examination of the original text in a museum or at an archaeological site far distant and not readily accessible to the scholar.

Photographs of ancient inscriptions have, of course, existed as long as photography has been widely used in archaeological and museum contexts, and many publications of texts have included photographic plates. However, existing photographs rarely have been good enough to clear up questions of controversial readings essentially for these three reasons: 1) photographs have been taken by scholars or archaeologists who can read the texts well enough but do not have technical knowledge and command of the most effective photographic techniques; 2) or photographs have been taken by professional photographers who have the technical skills but cannot read the texts and therefore do not know what data to look for; and/or 3) photographs have been taken primarily for purposes of keeping an inventory or illustrating the general appearance of a text, rather than for serious study. Moreover, in far too many cases the photographic data has not been properly appreciated in terms of being the best overall reference to the primary data. Indeed, following the official publication of a text the original negatives all too often have been lost, thrown away, or allowed to deteriorate beyond usefulness.

A good example of this attitude toward photographs may be seen in reference to the collection of Dead Sea Scrolls photographs taken at what was then the Palestine Archaeological Museum in Jerusalem in the 1950s-1960s. Thousands of these photographs (referred to as the PAM images) exist, and they are still used and published today by those who study the Dead Sea Scrolls. However, there are serious flaws in the quality and usefulness of these photographs which inhibit a scholars ability to *see* and thus properly interpret the data. First, because the photographs seem to have been taken largely to document the gradual sorting of fragments into discrete manuscripts, little attention was paid to proper lighting technique. The museum plates of fragments were almost always lit with only one rather harsh light from above, and without backlighting. Readings in the resulting negatives are often obscured by strong shadows, especially along fragment edges and in holes in the parchment. One cannot always tell what the true edge of a piece is, and holes can be mistaken for ink traces. Second, the PAM images were only taken with black and white infrared film. While this often allows data to be reclaimed that is unclear in visible light, IR films are notoriously poor in resolution. As a result, spots that can be seen as simple discoloration in a color photograph can be mistaken for ink, especially when the contrast is boosted in a black and white reproduction. Third, those old photographic negatives were not properly archived until the 1990s and suffered deterioration and (in the case of glass negatives) breakage. A significant number are now lost and some were even inadvertently thrown out as trash, leaving only inferior prints behind.

To further complicate the availability of good Dead Sea Scrolls data, the published photographs (using the old PAM negatives) are distorted in publication by the process of "masking" in which a clean edge is painted around a fragment. While aesthetically attractive, the masking process sometimes creates false data, or paints out data that was in the original photograph.

As a student of ancient Near Eastern inscriptions in the 1970s Bruce Zuckerman and his colleagues were faced, therefore, with a highly frustrating state of affairs. The texts everyone was studying had often been transcribed in vastly different ways by different editors, but there was no readily available way of visually examining the inscriptions themselves to resolve the disagreements in readings. Zuckerman determined to address this problem through the establishment of the West Semitic Research Project at USC. The goal was simple: to make a visual documentation of inscriptions with sufficient quality that they could be used for detailed study, and so that recourse to the original, often fragile, original object, would not be constantly necessary. The aim was to make anyone who so desired the eyewitness who could access the data for him or herself. The key to achieving this goal was to combine academic knowledge of the texts with technologically advanced photographic techniques. In this way truly readable photographs could be made available to a wide community of students and researchers—images created not just to illustrate, but to be used for serious study.



Bruce Zuckerman (bottom) and Kenneth Zuckerman (top) photographing Dead Sea Scrolls in Jerusalem. West Semitic Research photographers typically use large format cameras and strobe flash systems when photographing inscriptions. When photographing manuscripts of parchment or papyrus, backlighting is also used. Photograph West Semitic Research.

The original team of the West Semitic Research Project (WSRP) consisted of Dr. Bruce Zuckerman, newly arrived at the University of Southern California in the School of Religion, and Kenneth Zuckerman, Bruce's brother and highly skilled technical photographer. Bruce originally provided the knowledge of the ancient languages, Ken the photographic know-how. Together they began to develop an array of techniques and approaches to inscriptions that took into account the wide variety of media, script and language encountered by the student of the ancient Near East. The Zuckermans began by adopting techniques from commercial photography, such as the use of Polaroids to test the lighting and exposure of a shot, and the use of more than one kind of film to collect different kinds of data. In essence, the thought was, "if professional photographers can take a hundred pictures to get one good photograph of a box of Corn Flakes, then why couldn't the same principal be used for the documentation of ancient inscriptions?"

Marilyn Lundberg photographing one of the Wadi el-Hol inscriptions in Egypt. When photographing incised inscriptions West Semitic Reserach photographers typically shoot from alternating light angles. Here the lights set up to illuminate the inscription from the upper left. Photograph by John Melzian, West Semitic Research.

Since its formation in the early 1980s the WSRP team has been supplemented by Dr. Marilyn Lundberg and, for specific projects, scholars from a variety of universities around the world, such as Dr. Wayne Pitard of the University of Illinois, Dr. Theodore Lewis of the University of Georgia, Dr. P. Kyle McCarter of the Johns Hopkins University, Dr. Frederick Dobbs-Allsopp of Princeton Theological Seminary and many others. As of this time the West Semitic Research photographic archive includes photographs of many of the Dead Sea Scrolls, the primary mythological and literary texts of the Ugaritic corpus, a wide variety of Northwest Semitic inscriptions, the world's oldest complete Hebrew Bible (the *Leningrad Codex*), numerous important Mesopotamian cuneiform texts and many other inscriptions from all over the ancient Near East and Mediterranean.

Photographing for Decipherment

There are a number of procedures pioneered by the photographers and scholars at West Semitic Research to document these important texts from the ancient world. We generally prefer to use a large format (4 inch by 5 inch) view camera on either a copy stand or highly flexible tripod, although during the early days of the Project mid-format cameras (using 120 film) were used. We use four or five different kinds of film in addition to

Polaroid film for testing: color reversal (that is, transparency film), color negative, usually two types of black and white negative (a medium resolution/medium contrast film and a high resolution/high contrast film) and, occasionally, black and white infrared film. A Polaroid is used to check for the correct setup, lighting and exposure, and then a series of exposures with the various other kinds of film are taken. Like commercial photographers, we bracket the shots, that is, we vary the exposure settings of the film in order to ensure that we get good coverage of the inscription. We have found that the use of strobe flash is the best way to provide the lighting. Not only can the light be controlled most effectively, but flash is far less harmful to most objects than any other form of lighting.

There has long been a tendency in the field of ancient Near Eastern studies to take one picture of the entire object, no matter how large, since the primary objective is not to study a photograph, but use it for illustration purposes. There are two ways in which West Semitic Research has gone beyond this approach. First, for inscriptions of significant size we have found that at least three levels of documentation are preferable: reference shots (photographs of the whole inscription or column of text); sectional shots (for example, the top, middle and bottom of a column); and selected detail shots (of particularly problematic areas of the inscription). Second, for many different kinds of inscriptions on three-dimensional media it is necessary to photograph at several different light angles to capture all of the relevant data. Thus, we will commonly have multiple images for each inscription, so that a researcher can have a broad choice of data from upon which to base his or her analyses.

Each inscription, or type of inscription, presents a unique challenge to the photographer. The "tool box" of methods developed at West Semitic Research is an ever-expanding one as new inscriptions are encountered and recorded for research and preservation. Space does not permit a complete description of those methods, but below are examples of the kinds of methods used in our work.[ii]

Manuscripts on soft media such as parchment (used here to refer to animal skin in general, regardless of preparation) or papyrus are best photographed using a system of three lights. Two of the lights (sometimes with diffusing "soft boxes" to spread the light) are set up at an equal distance on either side of a manuscript. A third light is used beneath the manuscript as a backlight to avoid the creation of shadows on edges or along holes in the manuscript. This is particularly important if the manuscript is mounted in glass or similar media which otherwise would result in the material casting a shadow onto the background. For many manuscripts this kind of setup is adequate for taking a high-quality image—that is, if the ink is visible and the manuscript in relatively good condition. Unfortunately, this is not always the case.

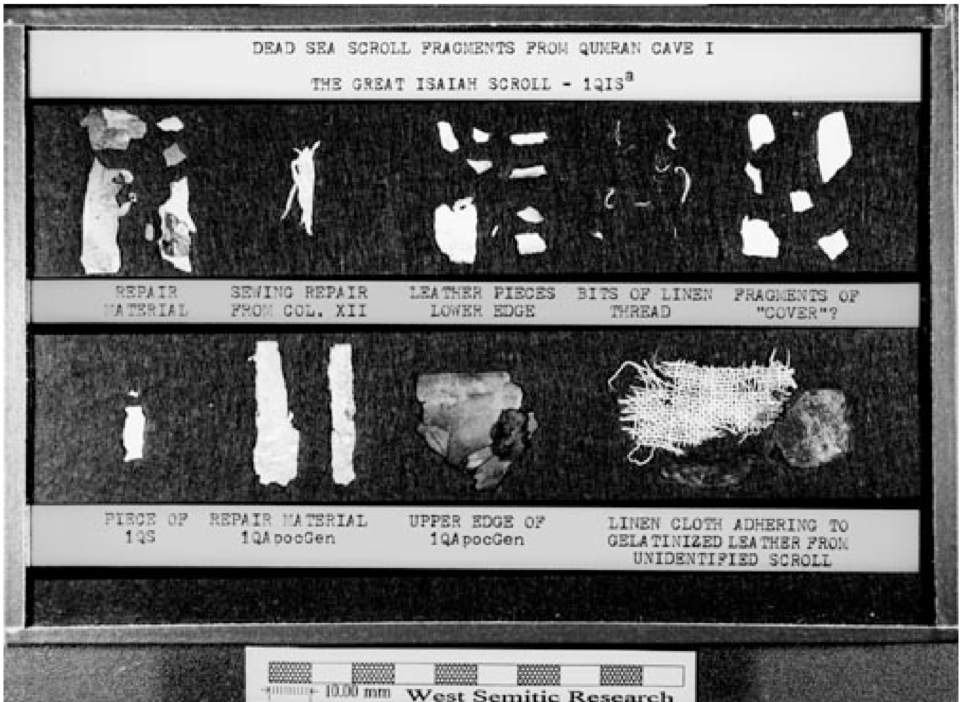
[ii]For a more detailed discussion of our photographic and digital imaging techniques, see Bruce Zuckerman and Kenneth Zuckerman, "Photography of Manuscripts," in *The Oxford Encyclopedia of Archaeology in the Near East,* Vol. 4 (ed. Eric M. Meyers; New York: Oxford Press, 1997), 336-347; Bruce Zuckerman, "Bringing the Dead Sea Scrolls Back to Life: A New Evaluation of Photographic and Electronic Imaging of the Dead Sea Scrolls," *Dead Sea Discoveries* 3 (1996), 178-207; Bruce Zuckerman and Kenneth Zuckerman, "Photography and Computer Imaging," in *Encyclopedia of the Dead Sea Scrolls* (eds. L. H. Schiffman and J. C. VanderKam; Oxford: Oxford Press, 2000), 669-675.

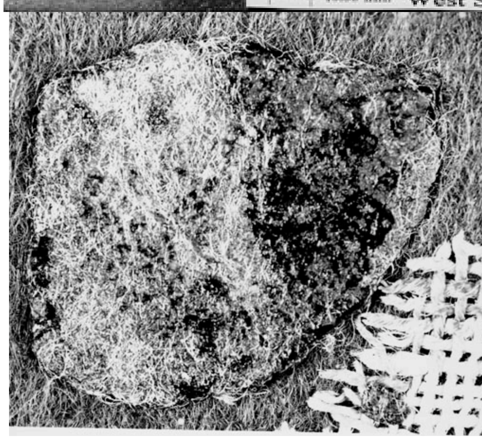
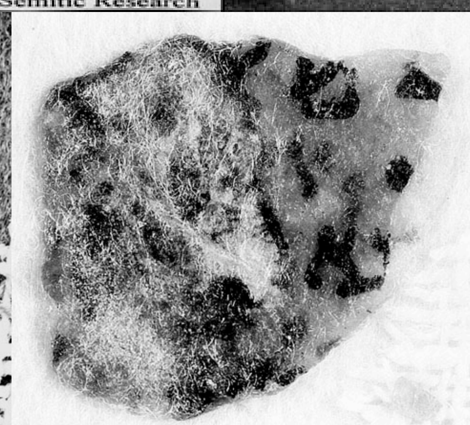
Picture of a Dead Sea Scroll—4Q109 Qohelet[a]*, a biblical text from the book of Ecclesiastes. Note that this picture is evenly lit from the top and is also backlit so that all the edges and holes are clearly illuminated. Photograph by Bruce and Kenneth Zuckerman, West Semitic Research. Courtesy Department of Antiquities, Jordan.*

It has long been known that certain kinds of manuscripts which are unreadable in visible light respond well to the use of infrared photography. For example, as noted above, most Dead Sea Scrolls photographs taken in the 1950s and 1960s are infrared images. Until recently, however, IR film was used without great concern regarding filtration, with the result that photographs were typically taken over a broad spectrum of infrared wavelengths. In the 1990s we discovered that the use of a particular filter plus IR film (Kodak Wratten 87C) blocked cut off all but a narrow band of wavelengths in the IR spectrum—and it happens that this bandwidth works in a superior fashion to reclaim data from the Dead Sea Scrolls.[iii] Dead Sea Scrolls are often unreadable because they were written with a carbon-based ink on animal skin or parchment, which, over time, has carbonized to the point that the skin is as dark as the ink—at least in visible light. At a particular band of the IR spectrum the dark background of the parchment "drops out" quite

[iii]This was observed independently by Greg Bearman of the Jet Propulsion Laboratories, see G. Bearman and S. Spiro, "Archaeological Applications of Advanced Imaging Techniques," *Biblical Archaeologist* 59 (1996), 56-66.

dramatically and becomes highly reflective while the ink remains black, providing the necessary contrast for reading. Infrared works most effectively for these conditions. We have found it unhelpful for metal-based inks (in which case ultraviolet light can be effective), or for situations in which there is a light background and faded ink (in such cases colored filters for use with black and white film can provide some additional gain in data).



A fragment from 1QDaniel^b illustrates the gain in information through the use of infrared imaging. Image A [SchoyPlt.tif] above is a plate of Dead Sea Scrolls fragments from the Schøyen Collection in Norway. These scraps were originally thought to be uninscribed. However, two of the fragments were found to be inscribed once viewed in infra red.. Image B, one of the fragments was later matched to a larger text from the book of Daniel (1QDaniel^b). Note that it is completely obscure in visible light [B: SchDanvs.tif] while the text is partially claimed in infrared illumination [C: SchDanir.tif]. Note that the infrared image actually reveals traces of text in several layers of parchment that are now ireevocably bonded together. Subsequently this text fragment (photographed in the 1990s) was electronically matched to a larger scroll fragment (photographed in the 1950s, Image D *below), even though the former currently resides in Norway while the latter currently resides in the United States. Photographs by Bruce Zuckerman and Marilyn Lundberg, West Semitic Research. Courtesy Martin Schøyen Collection.*

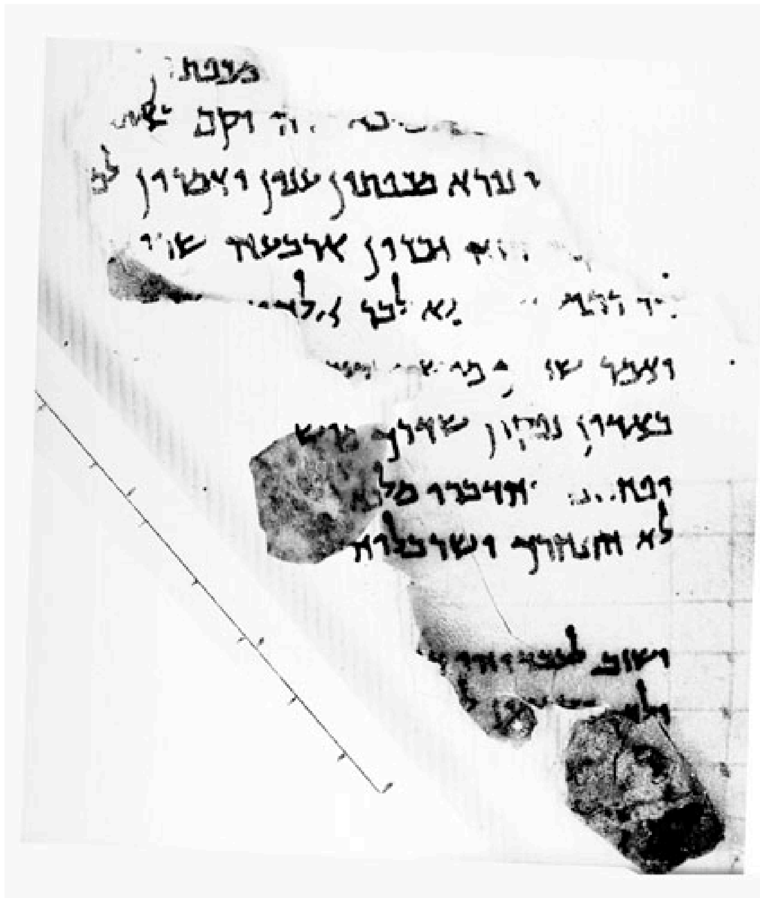


Image D shows the fragment in A, B, and C above, matched to the larger scroll fragment in a computer reconstruction. Photographs of small piece by Bruce Zuckerman and Marilyn Lundberg, West Semitic Research. Courtesy Martin Schøyen Collection; photograph of large piece by John Trevor.

Incised inscriptions on hard media (such as stone or clay) require an entirely different approach. Rather than minimizing shadow, one needs to create it. We generally use one light as the "key," i.e., the primary light, placed at a raking angle, with a reflector or "fill" light or reflector placed approximately opposite the main light. The primary light is placed so that shadows are created along the strokes of letters or symbols, taking care not to place the light angle parallel to the strokes. If an inscription has a rounded surface two equal lights placed opposite one another might be used, each light thus acting both as a primary light, and as fill for the light opposite, what might be called a "fill-fill" lighting set-up. In many cases one particular light angle does not suffice to highlight all of the data, so images will be captured from different light angles and then studied side-by-side.

These two images of the Amman Citadel Inscription (c. 800 BCE) illustrate the importance of proper illumination. The photograph at left [AmmCitb.tif] shows the inscription as it appears in ambient light while the photograph at right shows the same inscription when illuminated by a raking diagonal light from the left hand corner. Note that this lighting technique to some degree imitates how the inscription was meant to be seen in its original setting, that is, illuminated by sunlight, which would be a high-angled diagonal light. Photograph by Bruce and Kenneth Zuckerman, West Semitic Research. Courtesy Department of Antiquities, Jordan.

Cuneiform tablets have usually been photographed using a key-and-fill setup. Traditionally the light is placed at the top left corner of the tablet, since this is thought most closely to emulate the way ancient scribes would have seen the tablet as they were reading or writing. Since many tablets are curved, they may need to be rotated so that all parts of the writing can be clearly seen. This method of photographing cuneiform, while effective, tends to be quite time consuming, especially considering the hundreds of thousands of tablets in museums and collections all over the world. Lately we have been experimenting with digital technologies that might be both faster and more effective (see below).

Clay tablet recording an economic transaction from ancient Mesopotamia (c. 2000 BCE) from the University of Southern California Archaeological Research Collection. This tablet has been illuminated to bring out the details of the seal impression (in bas relief) rather than the details of the transaction (impressed wedges). Photograph by Kai Quinlan, West Semitic Research. Courtesy University of Southern California Archaeological Research Collection.

Among incised inscriptions, stamp seals provide their own challenges. Seals that are relatively flat and non-reflective can often be photographed using a key-and-fill technique. If a seal is rounded, the fill-fill approach may be needed, with at least two lights, but as many as four. In such situations we have sometimes used fiber-optic light sources and a time exposure so that we could "paint" with the light. If a seal is highly reflective, it can almost act like a mirror when light is shone on the surface at a particular angle. That reflection cannot be captured if the seal is laid directly under the camera lens, and both surface and lens plane are flat. However, if the object is tilted at just the right angle, the light bounces off the surface into the lens at the optimal angle to show every aspect of the surface, down to the smallest detail. Some distortion of the object will occur, but this can be minimized if the lens plane and film plane are also tilted.

An ancient Moabite seal in its original bronze setting (c. 700 BCE). This seal was photographed using the "tilt technique" in which not only the seal, but also the lens and the film plane are all tilted at the same angle so as to optimize the reflective qualities of the polished jasper stone surface. Photograph by Bruce and Kenneth Zuckerman, West Semitic Research. Courtesy Shlomo Moussaieff.

Photographing for Preservation

The West Semitic Research Project began as a way to document inscriptions for detailed study, but over the years an equally important goal has become a driving force of the organization: the preservation of data on texts that are in danger of deteriorating, or of being lost or destroyed. Many of our projects are as much "rescue operations" as they are attempts at documentation. Our mission to photograph the two early alphabetic inscriptions in the desert of Egypt amply demonstrates these two principles by which West Semitic Research operates.

In the late 1990s what may be the earliest known alphabetic inscriptions were discovered by the husband and wife team of archaeologists, John Coleman Darnell of Yale University and his wife Deborah Darnell. The Darnells have spent several years exploring and documenting archaeological finds along the ancient Luxor-Farshût road that runs over the Saharan plateau between Qena and Luxor in Egypt as part of the Theban Desert Road Survey.[iv] For hundreds of years the road was used as a shortcut over the bulge of land created as the Nile curves to the east and around before heading south. The ancient Egyptian Pharaohs used the route for a regular courier service, and stationed soldiers at either end to guard approaches to the ancient capitol of Thebes (now Luxor).

Along the Farshût road are thousands of inscriptions on cliffs and rock faces—ancient graffiti. At the point where the road comes down off the plateau on the Qena side there is a wadi, or gulch, called the Wadi el-Hol, or "Gulch of Terror." Hundreds of graffiti are found there, most of them in Middle Kingdom script (2040-1650 BCE). There were two inscriptions, however, which did not appear to be Egyptian. Rather, Darnell thought they resembled inscriptions found in the Sinai Peninsula and the area of ancient Canaan which have been identified as early alphabetic (often called Proto-Sinaitic and Proto-Canaanite respectively). If the Wadi el-Hol inscriptions were indeed alphabetic, this represented a significant find indeed.

[iv]John Coleman Darnell and Deborah Darnell, "The Luxor-Farshût Desert Road Survey," *1992-1993 Annual Report of the Oriental Institute* (Chicago: University of Chicago), 48-55; "The Luxor-Farshût Desert Road Survey," *1993-1994 Annual Report of the Oriental Institute* (Chicago: University of Chicago), 40-48; "The Luxor-Farshût Desert Road Survey," *1994-1995 Annual Report of the Oriental Institute* (Chicago: University of Chicago), 44-54; "The Theban Desert Road Survey (The Luxor-Farshût Desert Road Survey)," *1995-1996 Annual Report of the Oriental Institute* (Chicago: University of Chicago), 62-69; "Theban Desert Road Survey," *1996-1997 Annual Report of the Oriental Institute* (Chicago: University of Chicago), 66-76; "Theban Desert Road Survey," *1997-1998 Annual Report of the Oriental Institute* (Chicago: University of Chicago), 77-92.

The Wadi el-Hol, near Luxor, Egypt. Photograph by John Melzian, West Semitic Research.

Over the next couple of years Darnell showed the inscriptions to one or two scholars without much reaction, but in 1998 he showed them to his colleague at Yale, Frederick Dobbs-Allsopp, a specialist in Northwest Semitic languages (now at Princeton Theological Seminary). Dr. Dobbs-Allsopp confirmed Darnell's belief that these were indeed early alphabetic inscriptions, as did noted scholars Dr. Frank Moore Cross of Harvard University and Dr. P. Kyle McCarter of the Johns Hopkins University.

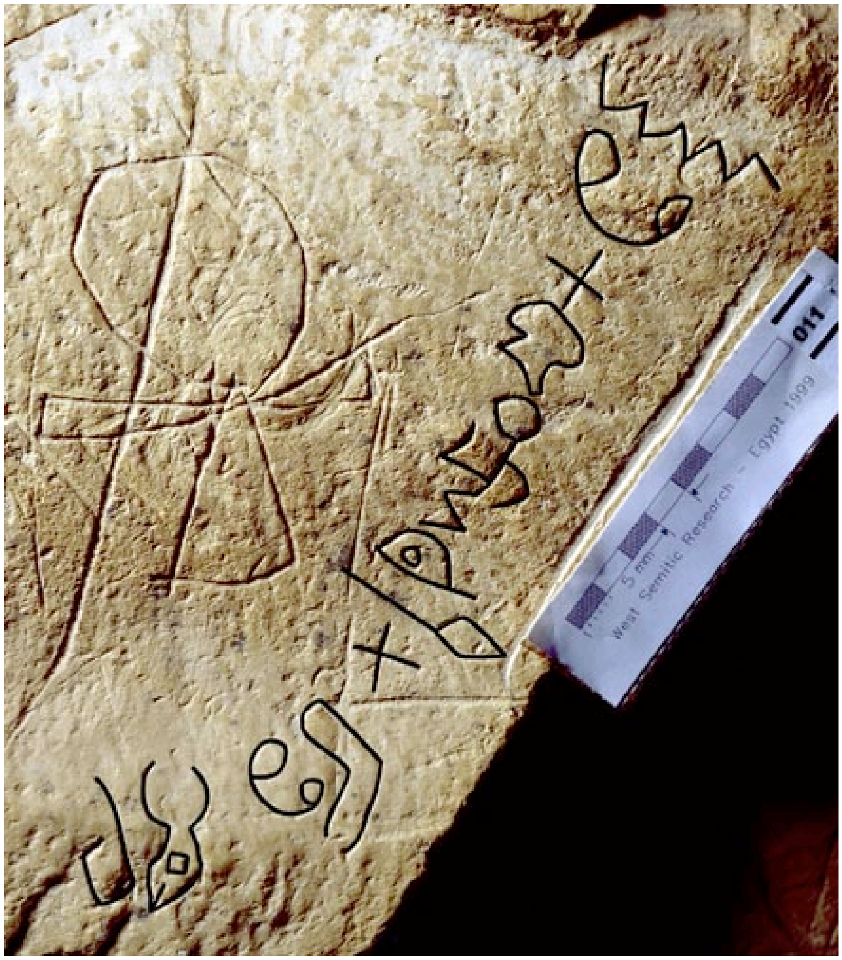
Shortly after Dr. Dobbs-Allsopp was shown the inscriptions he suggested that the West Semitic Research Project be consulted on the proper way to photograph the inscriptions. The Darnells had taken photographs of the inscriptions (and of the other graffiti in the area) but had been limited by lack of time and the necessity of using natural light. It was determined that a team from WSRP would go to Egypt to do an extensive documentation of the inscription in order to obtain high-quality, high resolution photographs using their best photographic techniques.

Members of the team at the Wadi el-Hol: from left to right, John Coleman Darnell, Kara Sargent, Frederick Dobbs-Allsopp, Bruce Zuckerman, Marilyn Lundberg, and Deborah Darnell. Photograph by John Melzian, West Semitic Research.

The project took place over three days in June of 1999 in the 120-degree heat of the eastern Sahara desert. Dr. Bruce Zuckerman and Dr. Marilyn Lundberg of the WSRP went as principal photographers, accompanied by Dr. Dobbs-Allsopp and Dr. Lundberg's husband, John Melzian. It was Dobbs-Allsopp's task to study the inscription as much as possible by eye, and then examine the Polaroids to see if the data he saw had been captured. We have found it is helpful to have a scholar along who is not distracted by the actual mechanics of image-capturing. Melzian's job was to aid in setup, notetaking, and fixing anything that broke. The Darnells took us out to the area, where there own work continued. We were all joined by several of the Darnell's assistants and twelve Egyptian soldiers (to protect us from terrorists and bandits).

Despite the roughness of the terrain and the extreme conditions, we took our standard 4x5 view camera and strobe flash setup. The view camera was mounted on a special tripod, which can be opened out to the point where it becomes horizontal with the ground. The strobe flash system worked off of batteries (since there was obviously going to be no power source). The team took numerous pictures of the two early alphabetic inscriptions, both of which are on a vertical cliff face, roughly 4 1/2 feet off the ground. Our usual practice of photographing from different light angles was made difficult for the first inscription by the presence of a rock overhang on the left side of the inscription. However, the photographs have proven to be more than adequate for the close study of the texts that has taken place since the project.

Inscription #1 from the Wadi el-Hol (c. 1700 BCE). In this illustration, an electronic drawing has been superimposed over the original incised inscription. The letter forms, which seem to derive from Egyptian hieroglyphics, appear to document one of the earliest known usages of alphabetic writing.



Inscription #2 from the Wadi el-Hol (c. 1700 BCE). Once again, an electronic drawing has been superimposed over the original incised inscription. Unlike the first inscription, which is read right to left, this one is read from top to bottom, curving to the left. Neither of the inscriptions is completely decipherable, but it may be noteworthy that the last two signs in this inscription are alep and lamed, respectively, which may connote the Semitic term ʾel (or ʾilu), the common word for "god."

In addition to the alphabetic inscriptions, we photographed one Egyptian inscription nearby which seemed to provide a possible explanation for the presence of the alphabetic inscriptions in an area so far removed from areas where other alphabetic inscriptions had been found. The Egyptian Inscription names one "Bebi, General of the Asiatics." "Asiatics" was the term given by the Egyptians to anyone from the land northeast of Egypt. Determinatives around the term indicate that the "Asiatics" in question form part of work group or mercenary force in service to the Egyptian government. The group would have included women and children.

Many who have studied the early alphabetic inscriptions on the Sinai Peninsula have argued for an Egyptian derivation of the symbols used in the Semitic alphabet.[v]

The Egyptian hieroglyphic script includes hundreds of symbols, some representing two consonants, some representing three consonants, others representing concepts or words. Among the hundreds of symbols are twenty-four that stand for just one consonant, i.e., one symbol=one sign. This is called the "acrophonic" principle, and it is that principle that the alphabet is based on. Like the 24 Egyptian characters that each represent one consonant, the first alphabet as it developed among Semitic-speaking people used only symbols for consonants. The symbols seem to be based on Egyptian shapes, although it is thought that the symbols in the alphabet stand for different sounds. Thus, a wavy line, or water, stands for the sound *n* in Egyptian, while in the early alphabetic script it represents the sound *m* (Hebrew *mem*).

The finds at the Wadi el-Hol strengthen the alphabet's Egyptian connection. Whether the alphabet was invented in Egypt itself (possibly by one person), or in a Semitic context with Egyptian influence,[vi] the "Bebi" inscription suggests a scenario for the writing of the two alphabetic inscriptions. Semitic-speaking workers or soldiers travelling along the ancient Luxor-Farshût road may well have learned this new way of writing, specifically adapted to their language, and scratched the inscriptions into a cliff wall as they rested in the heat of the day.

The context of the inscriptions, the hieroglyphic and hieratic Egyptian graffiti in the are, suggests that they were written about 1850 BCE, during a time when Thebes was capitol of Egypt. This is approximately two hundred years before the inscriptions on the Sinai Peninsula are thought to have been written (although it is possible that those may need to be redated in light of the Wadi el-Hol finds).[vii] This context, plus comparison with features of the Egyptian scripts of the Middle Kingdom period puts the invention of the alphabet at around 2000 BCE, older by a few hundred years than previously thought.

The project at the Wadi el-Hol, while important for documentation purposes, was made even more urgent by the fact that a number of other important inscriptions in the area have already been destroyed by vandals. Just two weeks before we arrived in the desert, an Egyptian inscription nearby had been completely defaced. Unfortunately, this type of loss is not uncommon in the world of antiquities and makes our task even more crucial if generations following us are to have access to the data of these precious remains of the past.

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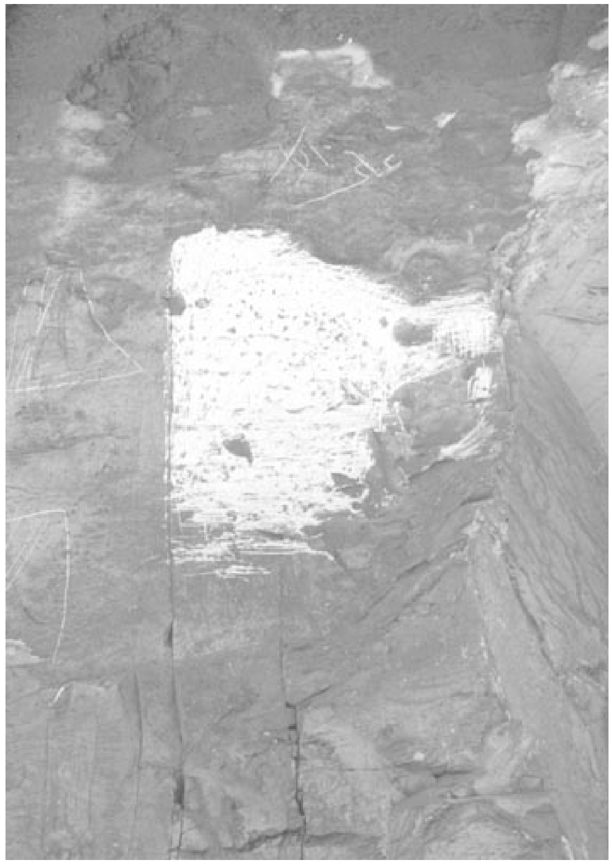
[v]See, for example, Benjamin Sass, *The Genesis of the Alphabet and its Development in the Second Millenium B.C.* (Ägypten und Altes Testament 13; Wiesbaden: Harrassowitz, 1988), 106.
[vi]Following the finds at the Wadi „erabit on the Sinai Peninsula, it was thought that the alphabet might have been invented in that are by Semitic workers under Egyptian influence. Similar inscriptional finds in the area of ancient Canaan, however, has led some to argue that the alphabet was invented in that region. See Joseph Naveh, *Early History of the Alphabet* (Jerusalem: Magnes Press, 1987) 23-42.
[vii]See Sass, *op. cit.,* 3.



A defaced Egyptian inscription on a cliff wall at the Wadi el-Hol. Photograph by John Melzian, West Semitic Research.

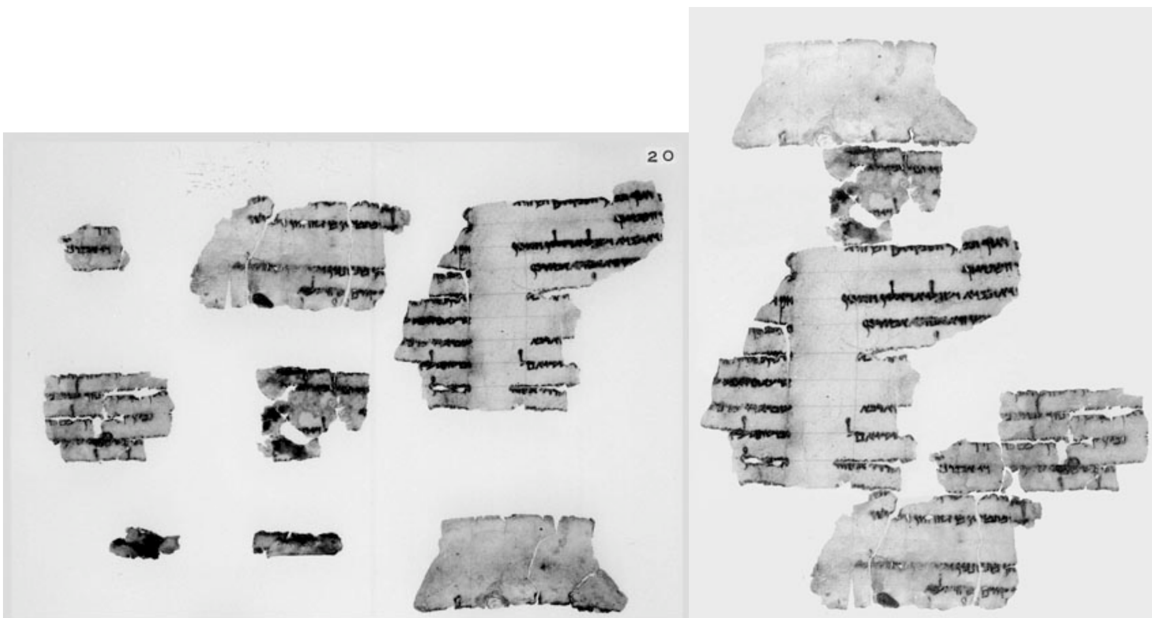
Digital Imaging

In the 1980s, even before digital imaging of photographs became affordable or practical for researchers in the Humanities, WSRP began to plan for the day when digital technology would become sufficiently inexpensive that it might be utilized in the study of ancient texts. At that time scanners alone cost in excess of $100,000, but we envisioned a day when prices would come down and we would be able to save our images in digital form, enhance them, and distribute them to scholars and researchers all over the world.

There are several compelling reasons to enhance photographic documentation with digital documentation. It has been our experience that high quality scanning using the PMT (photo-multiplier tube) technology of a drum scanner can faithfully reproduce the photographic detail needed by researchers for the close study of documents. A digital environment also offers the possibility of high quality image distribution without the time and cost investment associated with photographic reproduction or the loss of data that inevitably takes place when copies are made of original negatives or transparencies.

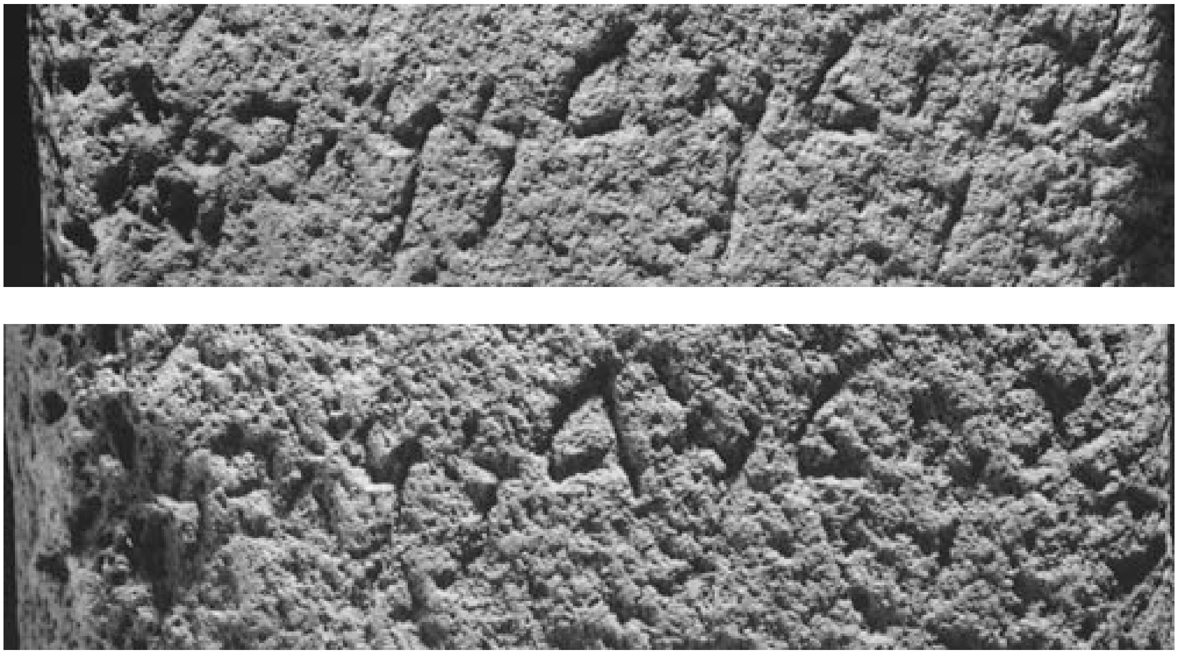
The significant barriers that obstruct access to these ancient documents can be more readily addressed in a digital environment. Below are some examples of barriers routinely encountered by researchers, with possible digital solutions.

a. Often original manuscripts belonging to one collection or corpus are scattered in various museums, libraries and archaeological sites. Text fragments, and images of text fragments, are often separated, so that pieces of a single text reside in various, frequently remote, institutions throughout the world, each with its own security protocols and national, cultural and political issues. Even where photographic images are available, they are usually poorly catalogued, in inadequate archival storage and condition and invariably difficult to find.   Within this context, the digital environment presents the potential of a networked database in which images of texts and text fragments can be brought together virtually to facilitate access.



Dead Sea Scrolls fragments (1Q20 Genesis Apocryphon, c. 1st century CE) illustrate the fragmentation common to ancient texts. Image A shows fragments as currently mounted and Image B shows one possible reconstruction. Based on this work, an entirely new running column of this text was reconstructed. The fragments of the full document are found in three different collections in Israel, Jordan, and Norway. Some of the original negatives that preserved otherwise unattested data on the Genesis Apocryphon are now lost and in the meantime areas of the original text have dramatically deteriorated so that the text can no longer be reclaimed using photographic or diginal imaging techniques.

b. Close analysis of a text often requires the use of a number of images taken at different magnifications, from differing light angles, and, at times, at different time periods. The digital environment facilitates the analysis of a text using multiple images. Not only can several images be compared side-by-side, a procedure which can be done with photographic images as well, but the digital images can be easily magnified for the study of very small details—a task far more difficult to do with photographic reproductions.



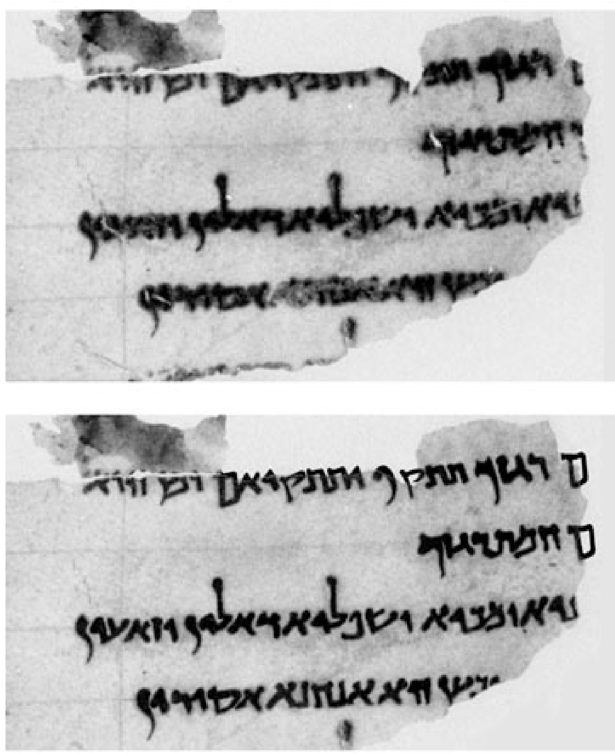
The images above represent photographs taken of the Incirli Inscription, a Phoenician inscription from the 8th c. BCE. The top image was photographed with light from the left, the bottom with light from the right.. A comparison of both images is needed in order to properly decipher the text. Images from photographs taken by Bruce Zuckerman and Marilyn Lundberg, West Semitic Research.

c. When analyzing a text, especially one found on a three-dimensional object, it is often useful to be able to superimpose one image upon another. This sounds simple in theory (just lay transparencies on top of one another); however, in practice, images taken by conventional means will often have a problem of "skew"—that is, the images may match at one corner of the text, but at the opposite corner be misaligned. This occurs because the plane of the camera lens may be different in relation to the object in photographs taken at different times. By digital means images of text fragments can be registered to a reference image or to one another, so that the same text portion may be viewed at the same scale and skew. If one has the capacity to locate common points, and there are limited differences in the physical relief, (for example, of stone, clay or other rigid surfaces), the transformation of one image to match another is a straightforward mathematical process.

d. Texts written on rigid surfaces present special problems. Among them is the difficulty of distinguishing "noise" from meaningful data, particularly when the object is broken or degraded. Surface analysis and three-dimensional analysis may facilitate the decipherment of these ancient texts. It is possible, using digital technology, to obtain images showing the object from multiple light angles in a way that is difficult if not impossible to obtain by conventional means, even if the object itself is freely available for analysis. In some cases, digital technology can also simulate surface textures and reflectivity that do not actually exist in reality, but which highlight features of the text not otherwise visible.

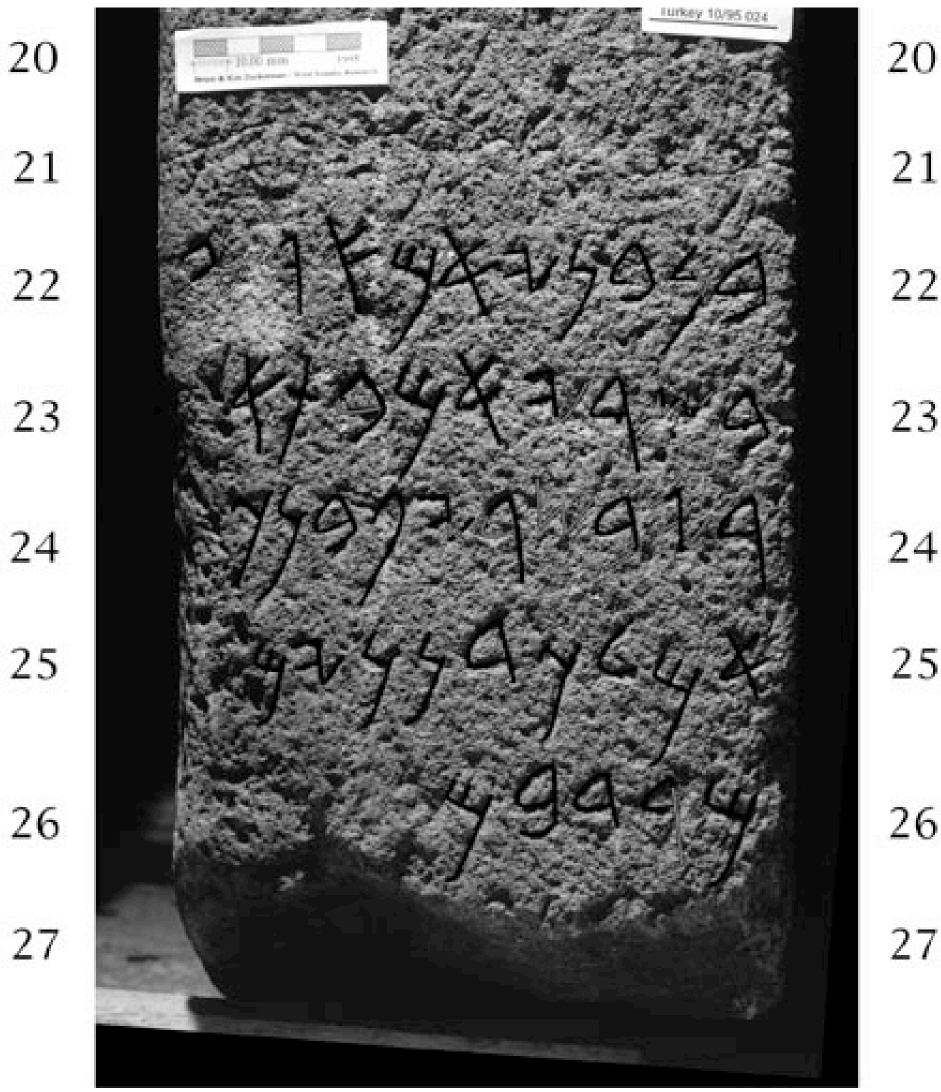
e. Ancient texts are almost universally in poor condition due to centuries of deterioration. Often sections of texts are simply missing. Either fragments no longer exist or sections are no longer recognizable and are beyond recovery. It is, however, the responsibility of the scholar to, as far as possible, reconstruct these ancient texts. In the context of a large body of texts, computational linguistic tools that help scholars determine the probability of occurrence of degraded or missing characters can become useful.

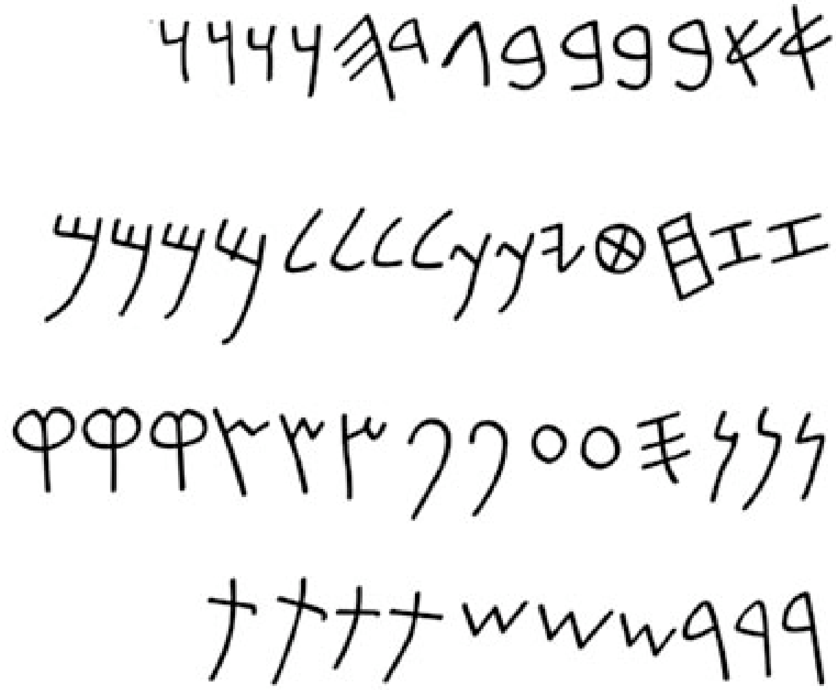
The application of computational linguistics can be achieved by compiling information on all known texts of a various language from the ancient world. The computer can analyze those texts to determine such things as word and phrase frequency, possible letter combinations, and grammatical forms. The database of results can then be made available to scholars working on similar texts. Computational linguistic tools would facilitate text restoration, not by automatically reconstructing a text, but by narrowing down the possible choices appropriate to a particular language or context.



Currently text restoration is a laborious and highly subjective process. In the above example, a fragment of a Dead Sea Scroll, 1Q20 Genesis Apocryphon, has been electronically restored. By "cloning" and moving letters in the scribe's own hand, a scholar can test to determine if a reading best fits the available evidence. Images from a photograph by Bruce and Kenneth Zuckerman, West Semitic Research. Courtesy Department of Antiquities, Jordan.

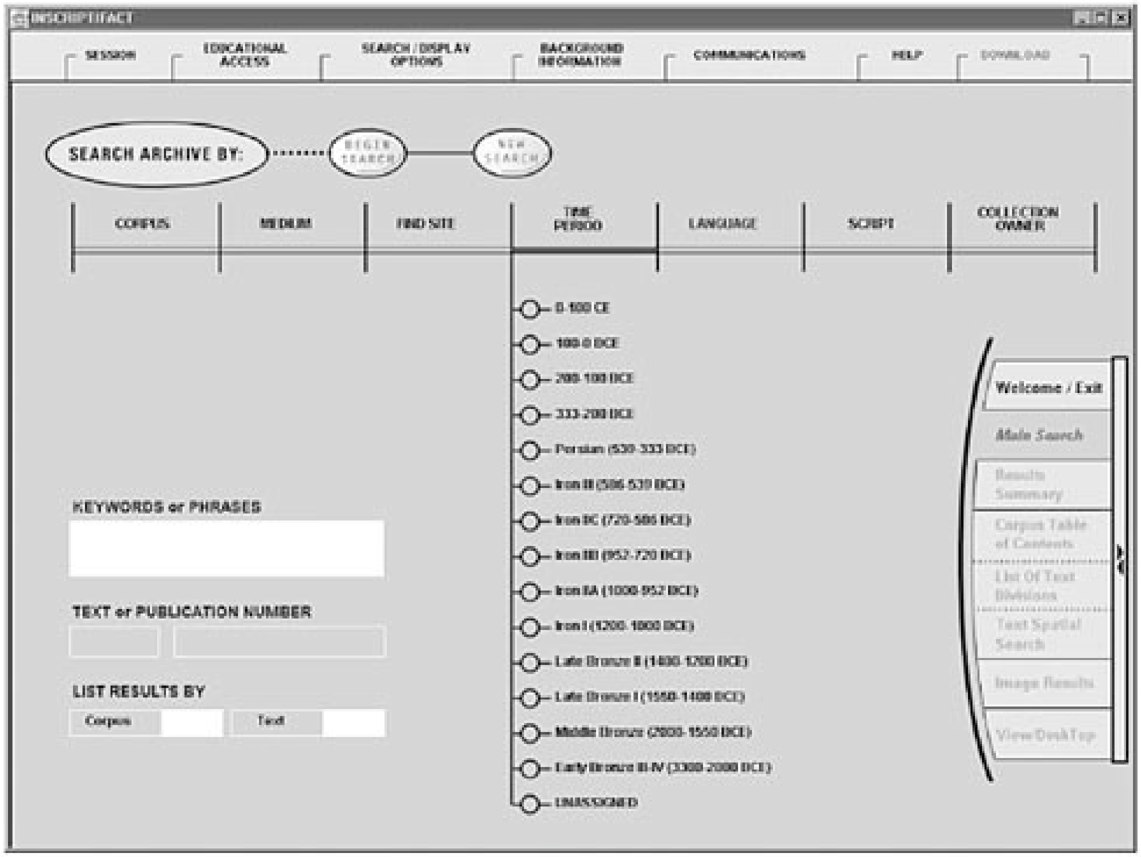
f. In addition to reconstructing, deciphering and translating an ancient text, scholars attempt to place a text in a wider historical context, often without specific indications of when a document was written. The field of epigraphy, or the study of scripts, is intended to provide an alternative way of dating manuscripts that have no historical information. This is possible because conventions for character formation change over time. This fact can be exploited to facilitate paleographical dating through close analyses of scribal hands. In fact, paleographical analysis is the primary means of dating most ancient manuscripts. Tools to aid scribal hand analysis become possible as a large body of texts become accessible within a digital information system environment. Such tools might include 1) a database of all possible forms found in a body of ancient inscriptions; 2) ways to easily measure and quantify aspects such as angles and proportions within letters, and 3) extremely high-resolution images so that stroke order of letters can be studied in detail.





Analysis of scribal handwriting is necessary for paleographical dating, among other purposes. Conclusions are normally based on informed impressions of "connoisseurs." In this instance a section of the Phoenician text of the Incirli Inscription (8th c. BCE) has been electronically drawn (illustration A). At right (illustration B) an electronically drawn script chart of the entire alphabet in its representative forms has been generated. Electronic drawing, copying and comparison in this fashion are much more accurate than the hand pen-and-ink drawings that have been utilized in the past. Moreover, letters generated in this fashion can be computer measured precisely both in terms of stroke length and angle of stroke. This allows one to build a statistical profile of a given scribal hand which is invaluable for more precise paleographical analysis. Photograph by Bruce Zuckerman and Marilyn Lundberg, West Semitic Research. Drawings by Bruce Zuckerman and Stephen Kaufman, West Semitic Research.

Given the need for a means to preserve and bring together images of texts and text fragments within a global context for scholarly analyses, and given the rapid advancement of network and database technology, we have proposed the InscriptiFact project, a networked database of ancient Near Eastern inscriptions.

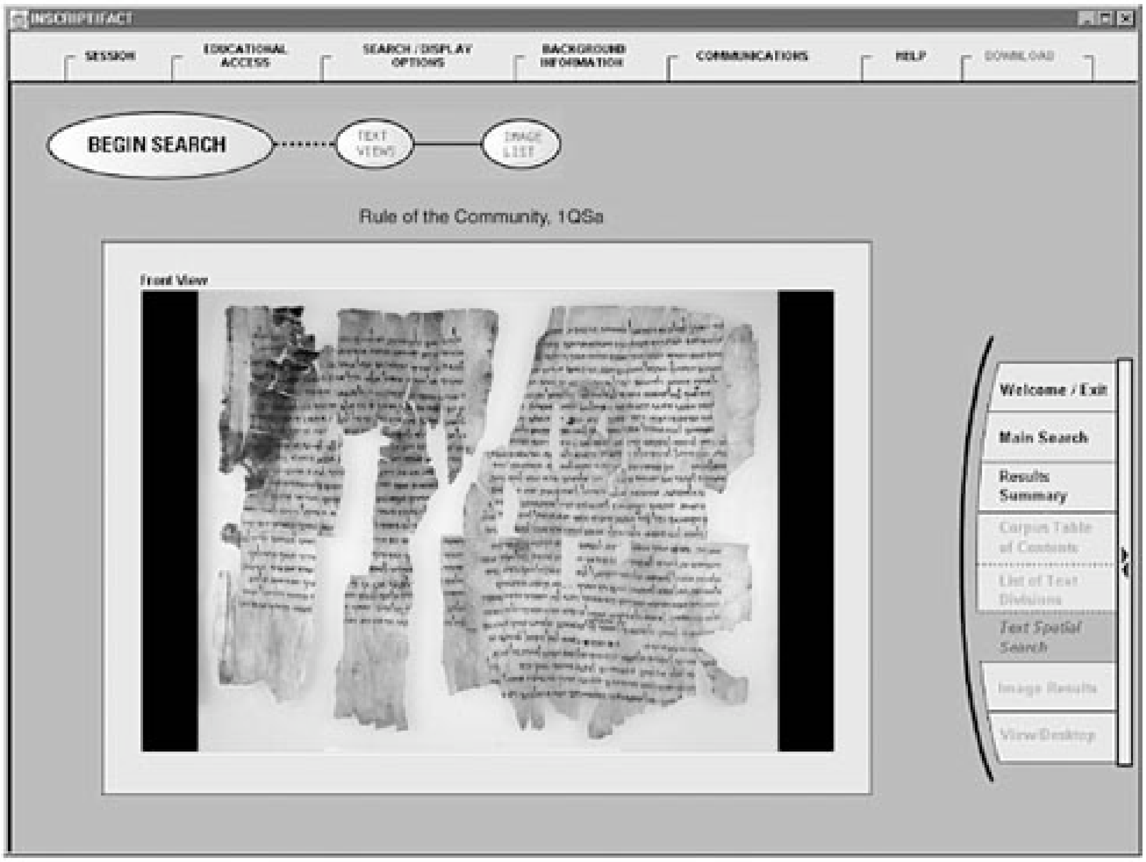


InscriptiFact Prototype - Main Search Screen.

The InscriptiFact digital library will facilitate the availability of materials on a global network irrespective of where image objects reside. Since text fragments are often stored in scattered locations, search and retrieval of a given text will result in presentation of the available fragments in logical order, regardless of the collection or location of individual fragments. The InscriptiFact application will be available over the Internet.

A multitude of images may exist about the same text captured at various dates and locations using a variety of film types, light sources and at several scales. It would be helpful if scholars were able to retrieve the images in a logical and intuitive fashion depending on the type of text presented. Some texts are conducive to an approach based on text divisions, for example, texts organized in columns. Some texts, such as seals or Elephantine papyri, are small and a simple presentation of the associated images is adequate.

Other texts, such as the Ugartic Texts, might be better accessed by the option of a 2D geometrical spatial search. Users would be able to retrieve images appropriate to a spatially defined area of text.



Some texts have numerous associated detailed images at various magnifications. In such cases, a 2D geometrical spatial search engine may allow InscriptiFact to query images for a spatially defined area.

The capacity to define, bring together, view, and compare images of inscriptions located at various institutions at high resolution will decisively enhance the ability to reclaim inscriptions and interpret their meaning. InscriptiFact is expected to result in new technologies for analyzing the documents that serve as the foundation and point of reference for Western culture. It will facilitate the integration of scientific tools with the acquisition, preservation, analysis and distribution of essential knowledge that stands at the base of western civilization.

Most importantly, it will establish a methodology and model for the analysis of ancient inscriptions with broad application. This model will facilitate scientific inquiry and the fullest interchange of information.