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Authenticating Efforts related to a 1776 Spanish Inscription at Glen Canyon

Presented by: Paul Ostapuk, Arizona Director - Old Spanish Trail Association;

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This paper describes the field and research efforts related to authenticating the 1776 Inscription. This effort was coordinated by the Armijo Chapter of the Old Spanish Trail Association together with the Glen Canyon National Recreation Area. The field work included laser technology, used to create a digital elevation model (DEM), lichenometry to assess relative age, paleography, and analyses of rock varnish microlaminations. The latter project conducted by Arizona State University was useful in concluding that the inscription pre-dates the 20th century.

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Abstract

In September 2006, a group of volunteers removing graffiti in the Glen Canyon National Recreational Area reported a "Paso Por Aqui – Año 1776" inscription. The finding is historically significant and likely related to the Dominguez-Escalante expedition whose successful ford of the Colorado River became known as "The Crossing of the Fathers" (now Padre Bay, Lake Powell). This historic ford is also part of the Old Spanish National Historic Trail which began its formal existence in 1829 when a New Mexico merchant named Antonio Armijo's led a commercial mule caravan from Santa Fe to Los Angeles and utilized the same Colorado River crossing as the Spanish missionaries.

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Introduction

On September 7, 2006 a faint Spanish-style inscription was discovered by volunteers working for the Glen Canyon National Recreation Area's (GCNRA) Graffiti Removal and Intervention Team (G.R.I.T.) in Gunsight Canyon, Lake Powell. This volunteer team consisted of James Page (G.R.I.T. houseboat pilot and President of the Armijo Chapter of the Old Spanish Trail Association (OSTA), Robin Mueller, Mike and Ann Wenger, and Bob DeWees.

As part of normal procedures, G.R.I.T. volunteers first survey graffiti-containing sandstone surfaces for the presence of historic writings that might predate the modern era before actually beginning the graffiti removal work. The 1909 Antiquities Act provides a convenient 100-year benchmark for differentiating between modern and historic graffiti. Graffiti removal is a labor intensive process largely using spray water bottles, wire brushes, and elbow grease. With time the treated, graffiti-free, rock surfaces weather and become generally less conspicuous within a 1-2 year period.

The park volunteers were following a trail of graffiti and recording GPS locations when they climbed up and then down a narrow defile. James Page was recording the site with a camera while the other volunteers studied the many sandstone surfaces tagged by modern graffiti, an unfortunate activity of some recreational boaters and is an act of vandalism.

Graffiti volunteers Robin Mueller and Ann Wenger were the first to notice faint writings underneath the collage of contemporary graffiti. Mueller called to Page that they had found a date of 1776 amongst the graffiti. Page reviewed the 1776 date and then noticed the partially obscured 'paso por aqui' associated with it. Page was well acquainted with the journal of the Dominguez-Escalante expedition and having previously worked at El Morro National Monument immediately recognized the potential significance of this Spanish inscription.

The phrase "paso por aqui" (passed by here) was in common use during the Spanish period. Hundreds of Spanish inscriptions are preserved at El Morro National Monument located near Grants, New Mexico. The most famous writing on the El Morro rock is a 1605 inscription by Governor Don Juan de Onate that begins with the phrase "paso por aqui".

The Armijo Chapter of OSTA immediately notified the Glen Canyon National Recreation Area and officials confirmed that the inscription was a new find and not part of the park's existing archeological database. Nor were there any rumors of a Spanish inscription circulating among natural history enthusiasts or the boating recreational community.

Graffiti Removal volunteers at the inscription site panel.

Physical Description

The inscription site is located above Lake Powell's high water mark (3700' msl) in the area known as Padre Bay; named for two Franciscan friars who traveled the region in 1776 searching for a safe crossing of the Colorado River. The inscription is carved into a protected panel of relatively-soft Entrada Sandstone and measures approximately 30 inches in length and 12 inches in height. The lettering is approximately 3 inches tall in a style described by one calligrapher as "18th century New World Spanish Cursive."

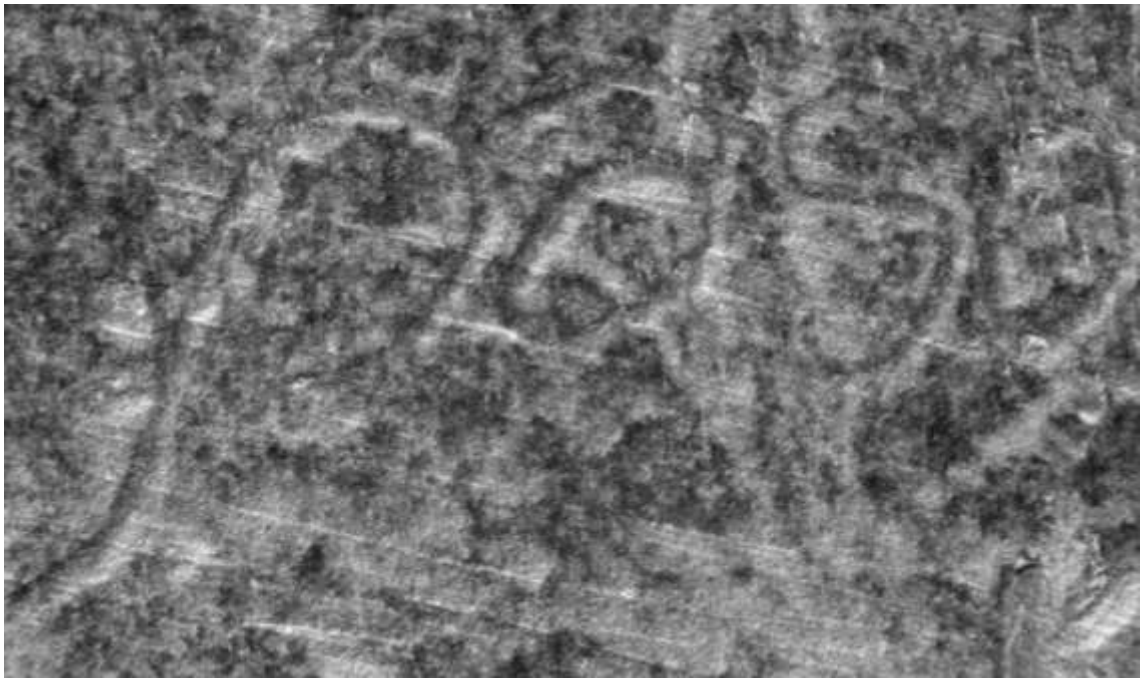
Modern graffiti at the site dates to 1978, a time period associated with rising lake elevations and the initial filling of Lake Powell. The construction of Glen Canyon Dam was completed in 1963 but the lake did not reach full pool until 1980. The inscription site can only be reached by boat. Most of the original foot path leading to the historic river crossing is today under water.

One important clue that suggests authenticity is the physical placement of the inscription in the front-row, chest high center position; the preferred location a person would logically choose when writing on a clean slate.

The site is largely protected from the sun and other weather elements. Most of the rock surface exhibits a covering of dark patina (desert varnish and other coatings). The relatively cool, moist, local environment and the physical properties of the Entrada Sandstone appear to contribute to active ongoing patina formation. In fact, some of the modern graffiti just two decades old have already become noticeably discolored.

Paso Por Aqui 1776 Inscription and modern graffiti.

The most distinctive features of the Spanish inscription include its shallow depth, the worn and weathered edges, and the distinctive font that demonstrates a certain writing discipline quite distinctive from the style of more modern graffiti carvings.



The Word PASO
Enhanced Close ups

The word POR

The word AQUI

The year 1776

Detail of the Numeral Seven

Initial GCNRA Assessment

The initial assessment by GCNRA officials was that "based on the location, the style, and the wording the inscription was probably authentic" and related to the Dominguez-Escalante expedition. However, there were certain curious aspects of the inscription that required further scrutiny and investigation.

For example, the Escalante diary does not mention the Glen Canyon inscription but goes into great detail describing Don Joaquin Lain's September 14th carving on a cottonwood tree near the Green River where he used…

"an adz cleared a small space in the form of a rectangular window, and with a chisel carved on it the letters and numbers of this inscription " Año de 1776" and lower down in different letters "LAIN" with two crosses at the sides, the larger one above the inscription and the smaller one below it.

Unfortunately this inscription has not survived for modern day scrutiny

Paso por Aqui 1776 Inscription Probably Authentic But…..
The diary does not mention this inscription but does reference the September 14th inscription carved by Lain on a cottonwood tree.
How could such an important inscription avoid detection for 230 years?
The inscription is located in an unexpected area more than 1.5 miles north from the previously accepted trail route and beyond Gunsight Pass.
If the D-E party was this far north why did they not follow the normally used Indian foot path through the pass?
Could the inscription be a later period forgery?
Is the style and font consistent with the historical time period?

Role of the Old Spanish Trail Association

The Old Spanish Trail Association (OSTA) is a 501(c)3 advocacy group whose mission is to study, preserve, protect, interpret, and promote appropriate use of the Old Spanish National Historic Trail designated by Congress in 2002. OSTA promotes public awareness of the historic trail and its multicultural heritage, by encouraging research, publication efforts, and partnerships with government agencies and private organizations. The formation of local Chapters along the trail and in each trail state is also encouraged.

Armijo Chapter

The Armijo Chapter of OSTA was formed in late August 2006. Coincidentally, a week later, the inscription was found and authentication efforts quickly became a priority focus. In January 2007, the Armijo Chapter established a formal working relationship with the Glen Canyon

National Recreation Area, through a Memorandum of General Agreement. This was subsequently followed with the issuance of a Scientific Research and Collecting Permit so that field authentication activities could begin.

Inscription Authentification Process – Armijo Chapter OSTA
Contact Federal Land Manager
Review historical documents
Obtain research permit
Perform Site Assessment and Documentation
Facilitate Research and Analysis
Pursue National Register Application
Assist Development of Site Management, Protection, and Interpretation Plans

History of the "Crossing of the Fathers"

The Glen Canyon geographical area has long remained a sparsely populated wilderness "of remarkable grandeur and almost unique in its loneliness" (Wheeler, 1872). "From the Paria eastward the area is desolate and abandoned even by Indians; it is a "no man's land" that separates the Utes from the roving Navajos." (Gregory, 1931).

Access through this region was limited by the Colorado River and the imposing deep canyons cut vertically into the Navajo Sandstone formation. Traveling through the maze of tributary canyons not only required navigational detours around the many narrow gorges, but also movement up and down precarious slopes. In addition, crossing the Colorado River was only feasible during times of low water or when abnormal cold winters formed ice.

The recorded history of Glen Canyon begins in 1776 when a small Spanish exploring party led by two Franciscan friars, Francisco Atanasio Dominguez and Silvestre Vélez de Escalante leave Santa Fe, New Mexico to survey the area, evaluate the missionary potential, and seek a route to Monterey, California. After nearly 100 days of travel, the party finds themselves in the Glen Canyon region rather hungry, cold, somewhat lost, and desperately seeking a safe crossing of the Colorado River (Crampton, 1986).

The Dominguez-Escalante expedition of 1776 is widely regarded as one of the great explorations in western U.S. history. Their 1,700 mile and 159 day journey represents the first comprehensive effort of the Spanish Empire to officially traverse the Plateau Province of the Colorado River and portions of the Great Basin. The diary kept by Dominguez and Vélez de Escalante along with the post expedition maps created by topographer Bernardo Miera y Pacheco represent some of the best historical documents for this vast region of the interior West.

After experiencing an early October snowfall in western Utah and facing a dwindling food supply, the attempt to reach Monterey is called into serious question and they "subject themselves entirely to God, and beg Him, with firm hope and lively faith, to make known His Will" by the casting of lots (Warner, 1976). The drawn lot redirects the party south and east toward the Hopi Villages in Arizona but further complications arise when their food supply is depleted and securing a Southern Paiute guide proves difficult.

It takes many weeks for the party to finally reach the Colorado River at present day Lees Ferry. Here they find the river running dangerously deep and fast. After several failed attempts to swim and then raft across the river, the party aborts the effort and sends two members of the party upstream to explore for the safer river crossing described by the Yubuincariri and Pagampachi Indians. Meanwhile back at camp, the missionaries order a second horse killed to ward off starvation.

After several days, the Muniz bothers return with news of another possible ford location. The whole party then ascends with great difficulty the steep 1,500 foot cliffs holding them trapped in the dead end of a box canyon. Once the cliffs are negotiated the party moves further upstream and deeper into Glen Canyon.

The second possible ford is located at the mouth of Navajo Canyon but the steep canyon walls and the lack of an appropriate exit route on the opposite side of the river, force the party to abandon this location and continue even farther upstream.

The situation worsens when a cold, wet winter storm moves into the area. The journal entries for November 5 and 6, 1776 highlight deteriorating weather conditions…

"Tonight it rained heavily here, and it snowed in some places."
"It was raining at daybreak and kept it up for some hours."

Following a brief break in the weather, the party travels northeast reaching Gunsight Canyon but they are…

> ***"Stopped for a long time by a strong blizzard and tempest consisting of rain and thick hailstones amid horrendous thunder claps and lightning flashes (fuerte borrasca y tormenta de agua, granizo grueso, con horrorosos truenos y relámpagos)."***
>
> ***"We chanted the Litany of the Virgin in order that She might ask some relief for us and God was pleased that the storm should cease."***

Historians have typically placed the Dominguez-Escalante party on the western side of Gunsight Creek and stopped there along the trail when the storm hits with full-force fury (Warner, 1976 and Miller, 1976).

Waiting out the November 6th severe storm in Gunsight Canyon (Architects/Planners Alliance (1976) - Dominguez-Escalante Trail Bicentennial Interpretive Master Plan and Final Report)

The prayers are soon answered and the storm finally abates. Later that day the proper river crossing is finally spotted. It is November 7, 1776 and the Dominguez-Escalante party descends to the river cutting steps into the sandstone ledges so that their livestock can obtain more secure footing on the way down.

After a safe crossing of the Colorado River, the historic event is celebrated with enthusiasm and a bit of relief by…

> ***"Praising God our Lord and firing off a few muskets as a sign of the great joy which we all felt at having overcome so great a difficulty and which had cost us so much labor and delay, although the principal cause of our having suffered so much since we reached the Parusis was our lack of someone to guide us through such bad terrain. For through lack of an experienced guide we went by a very roundabout route, spent many days in such a small area, and suffered hunger and thirst."***

Over time this important Colorado River crossing became known as the "El Vado de los Padres" or "The Crossing of the Fathers".

El Vado de Los Padres, Colorado River. (From a sketch made by John E. Weyss 1872) U.S. Geographical Surveys West of the 100th Meridian (1889).

The Dominguez-Escalante Diary

The actual diary manuscript kept by Silvestre Vélez de Escalante and Francisco Atanasio Dominguez is no longer extant. Once the party returned to Santa Fé, the original was signed by the missionaries and delivered to Pedro Fermin de Mendinueta, the New Mexico Governor, on January 3, 1777 (Warner, 1976 – Translator notes).

Although the original diary document remains missing today, several manuscript copies are known to exist. These include:

- The Fray Jose Palacio manuscript located in Chicago, Illinois at the Newberry Library in the Ayer Collection. Fray Jose Palacio served as acting secretary for Dominguez and therefore this manuscript is considered to be the first and most accurate copy in existence, made shortly after the expedition returned home.
- The July 26, 1777 manuscript located at the Archivo General de Indias in Seville, Spain. This scribe-copied manuscript was attested to by Antonio Bonillo. Copied several months later, this version contains editorial changes that removed certain sentences and phrases, substituted better spelling, and revised certain archaic terms.
- A manuscript created 20 years later and attested to by Manuel Merina is dated June 22, 1797 and located in the Archivo General y Público de la Nación in Mexico City.
- The 1854 first printed edition Documentos para Ls Historia de Mexico. This copy is only partially complete and contains many errors.

Various English translations of the diary include:

- W.R. Harris's The Catholic Church in Utah (1909)
- Herbert S. Auerbach's publication in the Utah Historical Quarterly (1943)

- Herbert Bolton's translation in Pageant in the Wilderness retold as a narrative of great adventure (1950).
- Ted Warner's The Domínguez-Escalante Journal. Their Expedition through Colorado, Utah, Arizona, and New Mexico in 1776 used the Ayer manuscript as translated by Fray Angelico Chávez. (1976)
- McDonald, Jarom, editor. Derrotero y Diario which used one of the Antonio Bonilla manuscripts.

19th and 20th Century Travelers

In 1829, fifty-two years after the Dominguez-Escalante expedition, a young Mexican merchant named Antonio Armijo used the same Colorado River crossing to officially open commerce along the Old Spanish Trail. This trail provided an overland trade route that for the first time linked Santa Fe, New Mexico with the San Gabriel Mission near Los Angeles, California.

Armijo was familiar with the Dominguez-Escalante expedition and the Armijo journal entry for December 6, 1829 reads:

> ***"At the Rio Grande [Colorado River] Crossing of the Fathers. On that day we reconnoitered the ford and found it passable."***
>
> After camping at the river for 2 nights the mule caravan proceeds forward and ***"repaired the upgrade of the canyon the same one which had been worked by the padres."***
>
> An official government report on the Armijo caravan issued separately from the Armijo diary stated that ***"on the banks of the said river, which are of smooth stone, there are some inscriptions which they inferred to be made by the missionary fathers…"***

After this one time use of the trail across Glen Canyon, the Old Spanish Trail was rerouted further north across central Utah where even though the trail was longer the route provided more reliable water and forage opportunities.

The next recorded use of the Crossing of the Fathers comes almost thirty years later when Jacob Hamblin, a Mormon missionary, travels from southern Utah to the Hopi Villages in 1858. Crampton notes that ***"Jacob Hamblin and his companions were guided across the ford by Paiute Indians who all clasped hands and waded into the water forming a line nearly 100 feet long"*** A subsequent trip in 1859 includes a Thales Haskell diary reference to the passage through a narrow cleft (Gunsight Pass). The next year a third trip used the Crossing.

The expansion of Mormon settlements in the 1860's led to increased contact with native peoples and sporadic raiding warfare ensued. The outbreak of the Black Hawk War (1865-1868) contributed to the murder of J.M. Whitmore and Robert McIntyre near Pipe Spring and the Mormon militia response chased the culprits back towards the Crossing of the Fathers.

However, an escape was accomplished when the Indians put sand across the frozen river. Several years later in 1869, another militia vigilante response resulted in two trips led by E.G. Woolley to the same area (Crampton and Miller 1961). The diary from these militia reports makes a specific mention to Gunsight Pass:

> ***"... a cleft in the solid rock mountain, wedged shaped, about a foot wide at the bottom, in narrowest place, and 200 feet through and a hundred feet high. Twenty men could guard this pass against an army."***
>
> ***"We passed through Gun Sight, down a steep rock, into an opening in rocks. Whichever way we look it is nothing but rock mountains in fantastic shapes. It is rocks around, rocks above, rocks beneath, rocks in chasms, rocks in towers, rocks in ridges, rocks everywhere. It is in fact all rock."***

This same militia report also references Steamboat Rock, the familiar landmark known today as Gunsight Butte.

John Wesley Powell during his second expedition of the Colorado River left the river at the Crossing of the Fathers on September, 1871 and traveled to Kanab with guide Pardyn Dodds. This represented one of the last uses of this historic ford, for beginning in 1873 the family operation of Lees Ferry effectively replaced the need to travel such a difficult route. And so for almost 100 years, the Crossing of the Fathers once again became "unique in its loneliness" a descriptive phrase used by Lieutenant Marshall of the Wheeler Survey who in 1872 visited the ford but did not cross it.

Early 20th century travel to the Crossing of the Fathers was limited to the occasional random visitor (the 1913 Gregory party, George C. Fraser and David Rust in 1922 and handful of Utah ranchers perhaps searching for a lost cow or two). In fact, the exact location of the crossing was lost for a time and shown inaccurately on survey maps of the time. Acting on a tip in 1937, Dr. Russell G. Frazier, Charles Kelly, and Byron Davies were able to successfully relocate the lost notched step near the mouth of Padre Canyon (Crampton, 1986). The next year a plaque was mounted near the site and later a site register was added that remained in place until Lake Powell was created.

The construction of Glen Canyon Dam in 1956 led to an extensive historic site survey conducted by C. Gregory Crampton for the University of Utah (Crampton, 1960). His report identified numerous historic sites associated with the Dominguez-Escalante expedition including several locations in Gunsight Canyon but the 1776 Inscription was never referenced.

In 1976, a significant federal grant created the Dominguez-Escalante State/Federal Bicentennial Commission. Field research took place to reconstruct the exact trail route (Miller, 1976) and a master interpretation plan was developed (Architects/Planners Alliance, 1976). The interpretive trail markers developed as part of this grant can be found today at regional interpretive centers along the trail, such as the Powell Museum in Page.

Geography of Gunsight Canyon

Gunsight Canyon, located east of Romano Mesa, is a long tributary of the north side of the Colorado River containing a perennial stream. Like many side canyons in Glen Canyon direct access to the Colorado River was either difficult or impossible due to narrow rock gorges, boulders, and precipitous dry waterfalls.

Deeply incised (theater-headed) valleys often impede direct travel to the Colorado River in the Glen Canyon Region

Travel in these canyons often involved long detours to bypass the deeply incised drainages common to the area. The safe transportation of livestock only complicated efforts to traverse these slickrock canyons.

The Native American footpath in this area traversed a good distance north into Gunsight Canyon before crossing the creek and utilizing a narrow, short-cut notch leading east to the Padre Creek drainage on the other side.

Gunsight Pass offered a shortcut to Padre Creek

As it happened, the Dominguez-Escalante party arrived at Gunsight Canyon on November 6th during a significant and rare 12-16 hour rain event. The long duration and the great volume of rain reported in the diary probably created flash flood conditions coming from a large upstream region of bare slickrock. The resultant combination of mud, rising water, and quicksand likely prevented a normal creek crossing and forced the Spanish missionaries farther to the north.

Muddy water and quicksand can complicate travel even in fair weather.
(1909 A.H. Jones – NAU Cline Library digital archives)

Perhaps this explains how the Paso Por Aqui 1776 Inscription remained undetected for over two centuries. Subsequent travelers to this remote section of Glen Canyon would have had little reason to deviate from the normal path that lead directly to Gunsight Pass or the circumventing route that wrapped around south end of Gunsight Butte.

Another important consideration that supports authenticity is that the inscription was found near a sheltered alcove, a spot more likely to be chosen to escape the weather than stopping along the main trail, out in the open, where no shelter existed. Ted Warner editorializes that the Dominguez-Escalante party was…

> *"probably on the west bank of that gulch, when the storm broke with all its fury, sending a flash flood down the canyon and causing the party to stop until the storm ended and the flood cleared."*

However, ground reconnaissance performed by the Armijo Chapter of the Old Spanish Trail Association revealed no suitable shelter on this section of the trail route on the west side of Gunsight Canyon.

In summary, the geography of Gunsight Canyon and the deteriorated weather conditions noted in the diary provide important clues explaining why the 1776 Inscription site was found north of the historical trail. And it is quite reasonable to conclude that the Spanish missionaries would have taken shelter in an alcove as the fury of the storm bore down upon them. Finally, the delay caused by the storm would have provided ample time and the opportunity to carve the inscription.

Did the Dominguez-Escalante party take shelter from the weather in this alcove?

And so, perhaps in the alcove shown above (near the inscription site) the Dominguez-Escalante party witnessed the wild tempest of snow, heavy rain, lightning, crashing loud thunder, and a thick coating of hailstones. A storm so severe, it prompted the prayer recital to engage the Holy Virgin Mary. It was a day when the trial and tribulations of the expedition reached a dramatic peak.

One can imagine the weary state of mind and the tattered condition of the traveling party. A combination of improper clothing , the mental fog of hypothermia, the fatigue of constant hunger and the continuous search for a safe river crossing; and now the heavens turned against them and unleashing a full ensemble of weather elements. It was a defining moment that, perhaps, tested the depth of their souls and moved one member to inscribe the words "Paso Por Aqui – Año 1776" on a nearby sandstone wall. The motivation being possibly the uncertainty of returning home or gratefulness, when a beam of illuminating sunlight broke through the clouds to answer their prayers and offer up a ray of hope.

Today, the inscription survives as but a faint whisper from the past but the words still loudly reverberate with the emotions of the day; becoming, in some ways the Anglo equivalent of a sacred Native American petroglyph site.

Marietta Eaton, Grand Staircase-Escalante National Monument science program administrator called the inscription site…

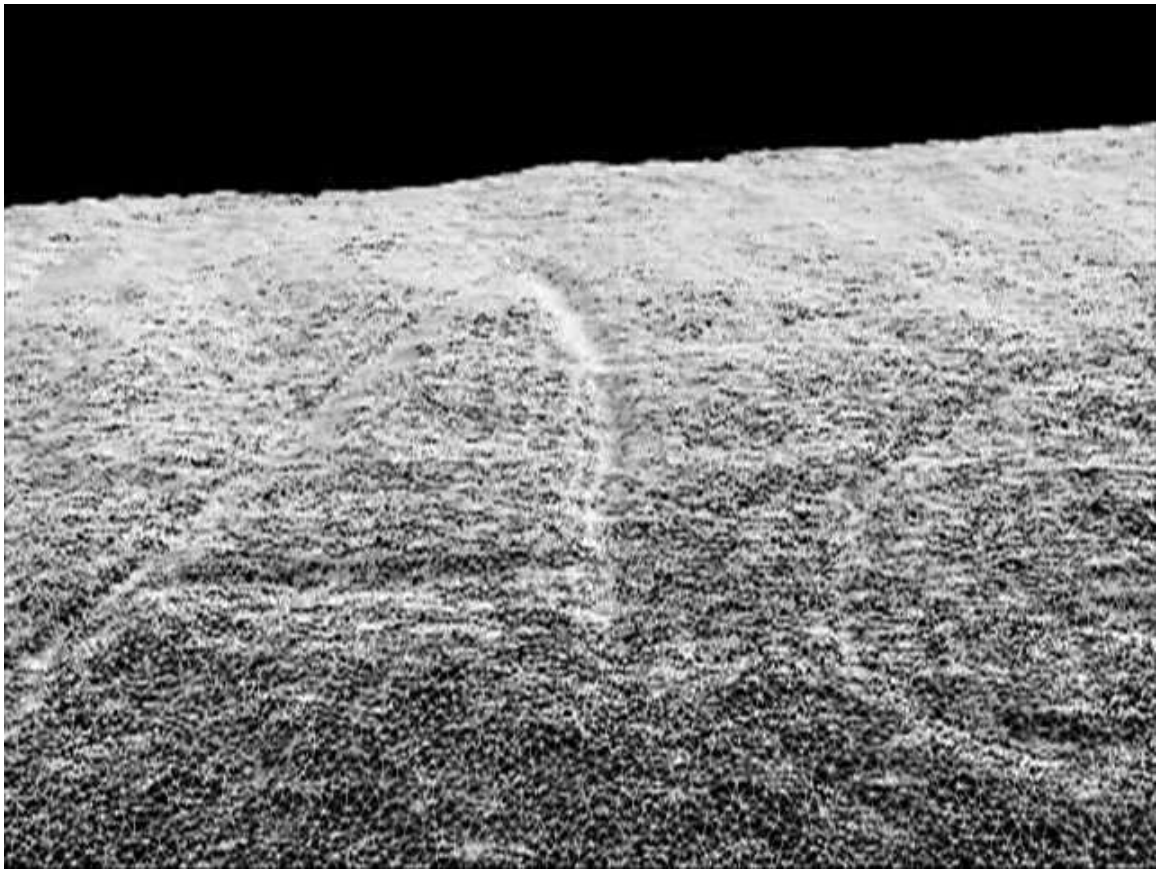
"one of the most important I have ever seen. It is a treasure for the Park Service and a primary document of that fateful trip. To be able to stand in the footsteps of such remarkable men was a deeply moving experience for me, and [it] can now be a wonderful experience for countless others."

Inscription Documentation using Laser Scan Technology

Creating an exact three-dimensional digital replica of the inscription before additional erosion and further vandalism took place was an important aspect of documentation provided by Jim Holmlund, Western Mapping Company.

A digital elevation model (DEM) was created using a high resolution "triangulation type" laser scanner that recorded the specific x, y, and z coordinates of both the host rock surface and the engraved inscription, down to a resolution of 0.2 to 0.4 millimeters.

The raw data was then further processed into a triangulated irregular network (TIN) product that allows digital display on the inscription and manipulation in three dimensions.



An example of the triangulated irregular network (TIN) model display

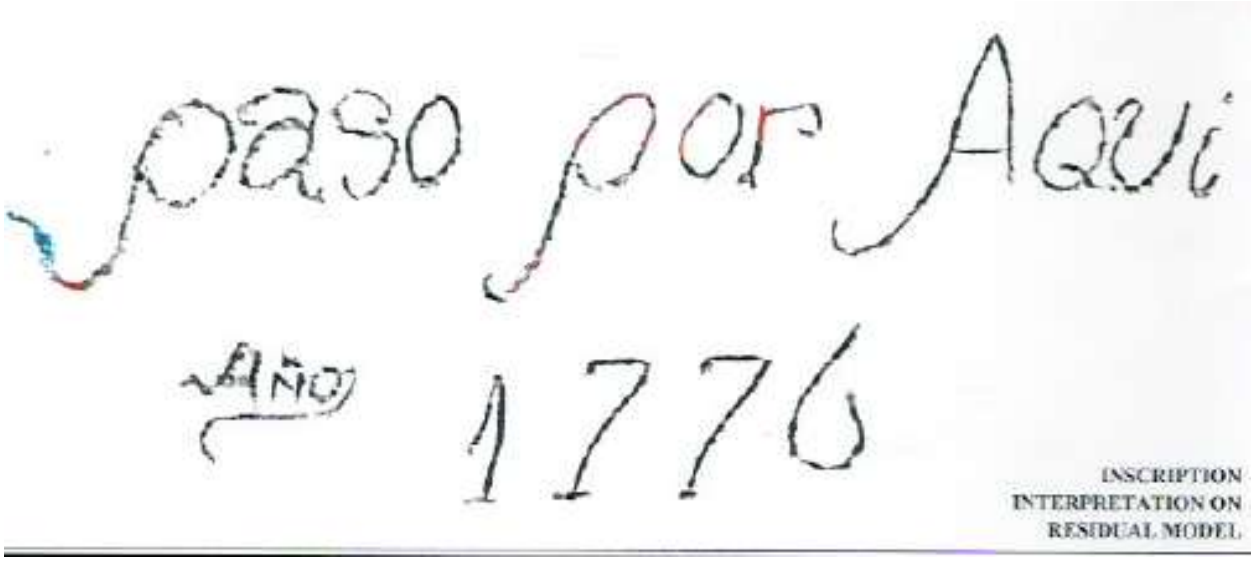
The deliverables produced by Western Mapping Company included:

- A digital 3D TIN model of the inscription, with digital color photo mapping
- A set of residual analyses that digitally removed the background bedrock and graffiti
- A hardcopy (11" x 17" color laser plots) and digital .pdf's
- The total station GPS coordinates for the site and the specific orientation of the inscription panel.

The laser scan also provided information related to the comparative reflectivities of the 1776 inscription and nearby modern graffiti**.** This provided another subjective technique to access authenticity and contributed to the "preponderance of evidence" that suggested the inscription was in fact authentic.

Additional future analysis of the TIN model display by paleographers and historians may reveal further insight into the type of instrument used to carve the inscription and the individual pressure strokes used to create each letter and numeral**.**

Joe Nicoli - Western Mapping Company - February 17, 2007



Preliminary residual model results – Holmlund 9-4-07

Total Station GPS

Lichenometry Report

Lichenometry is the use of lichens to date structures. It was another method used to provide a relative-age dating method of the inscription. The science of lichenometry has been used extensively in the dating of glacial deposits. The technique of lichen-dating was pioneered by Beschel who referred to its potential in dating rock surfaces (Beschel, 1961).

Kim Anderson Ph.D, ecologist for the Grand Staircase-Escalante National Monument (GSENM) and Marietta Eaton, GSENM science program administrator visited the site in February and April 2007. The lichen species Staurothele was identified. The largest individual colonies showed signs of necrosis with the perithecia breaking down and drying out. Past GSENM research has demonstrated that this particular species of lichen "may not live more than 100 years as individuals." Due to the coalescing and degraded conditions of the lichen colonies the results were less than desirable. But the field report's conclusion stated that "because of these conditions the inscription has probably existed for 100 years, if not more."

The field report submitted by Marietta Eaton concluded that "based on the inscription's mineral and organic skin coating, and the style of the script I feel secure that the inscription is authentic."

Handwriting Paleography

An evaluation of handwriting style was conducted by Marietta Eaton, GSENM and Joseph Sanchez Ph.D., Superintendent at Petroglyph National Monument and the Spanish Colonial Research Center.

Eaton summarized the inscription script as a combination of textualis and cursive writing also known as hybrida or bastards, developed originally in the early fifteen century. The Paso Por Aqui -1776 inscription is characterized by flourished descenders on the capital "A" and the two examples of the letter "p". The lower case is a "two-storey" allograph (like those in Times New Roman font). Serifs are also present as non-structural details on the ends of some of the strokes that make up letters. A flourish also occurs beneath the entire word Año.

Dr. Sanchez, a professional historian and paleographer of old Spanish script utilized the inscriptions at El Morro NM to provide a methodology and criteria in which to analyze the Glen Canyon inscription. He indicated that the "P" in "Paso," an uppercase letter could fit the style for eighteenth century writing noting that slight differences in presentation can be attributable to individual differences in writing on paper and on rock.

In regard to the upper case "Q" in "aqui" at Glen Canyon, Sanchez noted that its use is rare versus the commonly used lower case found with El Morro inscriptions. He concludes that "This is not to say that an uppercase "Q" could not have been used in carving an inscription on rock. It is merely a curiosity that…the more common lowercase "q" was not used." He also noted that the "o" in "Paso" seems to have been made in one attempt rather than in two as is characteristic of most of the El Morro inscriptions.

Sanchez's biggest concern was with the numeral "1" in 1776. His report indicated "The sweeping upward stroke on the left to join the downward stroke to finish the number appears to be modern. The most common way to inscribe a "1" during the entire Spanish period was a simple up and down stroke with no embellishments." However, by the late nineteenth century this style became the only way to write the number in Spain and other Latin American countries. He concludes that in the eighteenth century, such a 1, with a sweeping stroke, was rare if done at all.

Sanchez also noted that the Glen Canyon inscription was missing the inscribers name; a tradition common at El Morro NM and the part of the LAIN cottonwood tree carving previously mentioned as occurring earlier on the Dominguez-Escalante trip.

In conclusion and after considering the majority of the evidence, Dr. Sanchez in his report to the GCNRA indicated it was "best to err on the side that it should be classified, for now, as probably authentic, until a determination can be made using other interdisciplinary scientific and humanistic data." Furthermore, he noted that "the historical integrity of the inscription is of value and may merit consideration for protection from further damage."

Paul Ostapuk, Arizona Director of the Old Spanish Trail Association also visited El Morro NM to study the historical inscriptions. Several time period inscriptions were located that seemed to further validate the Spanish inscription style observed at Glen Canyon. Of particular time period interest are the 1737 inscriptions associated with Don Martin de Elizacoechea and Juan Ignacio de Arrasain (Slater 1961).

1737 El Morro inscription showing the time period use of a Carolina "a"

El Morro inscriptions showing flourishes of the numeral one.

Maps produced by Bernardo Miera y Pacheco provided another source of paleographic analysis. Miera produced at least three and probably four different maps after the expedition.

- 1777 - (Indians with the bows map) Derrotero hecho por Antonia Vélez y Escalante, misionero para mejor conocimiento de las misiones, pueblos de indios y presidios que se hallan en el Camino de Monterrey a Santa Fe de Nuebo Mexico.

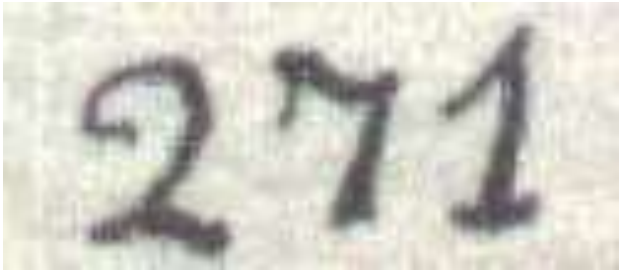
- 1777 (Twisted Snake and Tree Map) (in the Ministerio de la Guerra, Madrid) por Dn. Bernardo de Miera, y Pacheco al rumbo del Noroeste y Oeste, del Nuevo Mexico, quien sue en compania de los R.R.s P.P.s fr. Franco. Atanacio Domingues ... y fr. Silvestre Velez de Escalante.

- 1778 - (Map with no art drawings) Plano Geografico de los descubrimientos hechas por senior Bernardo Miera y Pacheco y los RRs. Ps. Fr. Francifico Atanasio Dominguez y Fr. Silvestre Veles. S. Felipe T. de Chiguagua Ano de 1778.

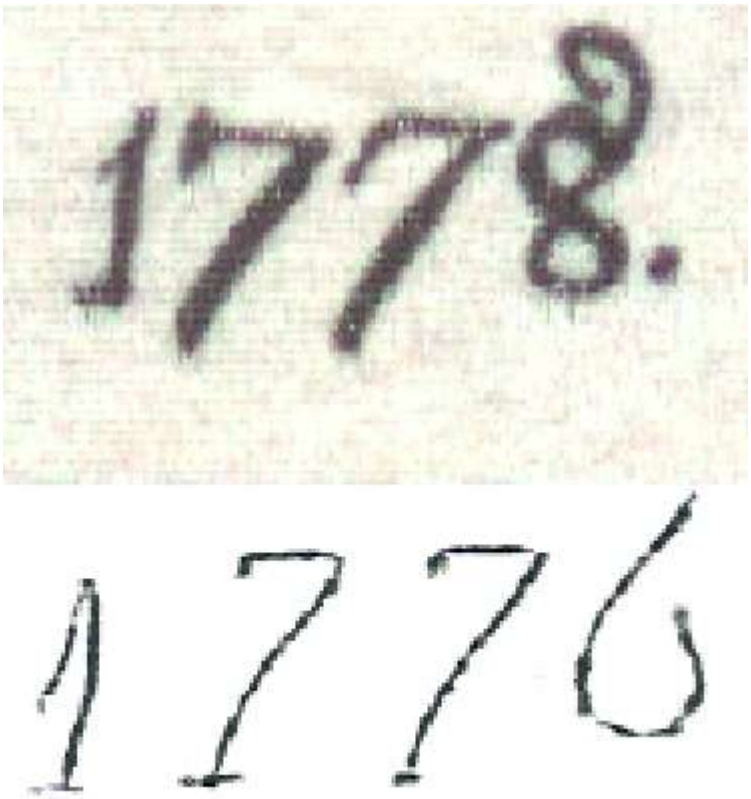
- 1778 - (Bearded Indians and Lion Carriage Map) Plano Geographico de la tierra decubierta nuebamente á los Rumbos Norte, Noroeste, y Oeste, del Nuebo Mexico, demarcada por mi Don Bernardo de Miera y Pacheco, á que entro á hacer su descubrimiento en compañia de los RR.s PP.s fr. francisco Atanasio Doming.s y fr. Silbestre Veles, segun consta en el Diario y Derrotero que se hizo y se remitió á S. M.d por mano de su Virrei, con otro Plano á la letra: el que se dedíca Al Sor, D.n Theodoro de la Crois, del Insigne Orden Teutonica, Comandante General en Gefe de la Linea y provincia de esta America Septentrional, por su Magd, Hecho en S.n Ph.e el Real de Chiguagua, Año de 1778.

A comparison of the Bernardo Miera y Pacheco's first 1777 map compared to the "Paso Por Aqui 1776" inscription found in Glen Canyon.

1777 – Derrotero hecho por Antonia Vélez y Escalante, misionero para mejor conocimiento de las misiones, pueblos de indios y presidios que se hallan en el Camino de Monterrey a Santa Fe de Nuebo Mexico.



1778 Miera expedition map demonstrating numeral "1" upstroke and serif embellishment



1778 Miera map vs. 1776 Inscription showing elevation of last numeral

Biography of Bernardo Miera y Pacheco

Expedition cartographer, Bernardo Miera y Pacheco, was a retired military captain, engineer, and mayor as well as the first Spanish artist in New Mexico. During the long and arduous trip Miera y Pacheco was repeatedly ill with stomach and intestinal troubles. He also proved to be very independent, often to the consternation of his companions. On at least one occasion he deliberately took a different course from that of the rest of the group and stayed away so long that another man was sent out to search for him. However, Don Bernardo was evidently the senior member of the expedition, and others often turned to him for practical information including the identification of metals encountered along the route.

During the return trip to Santa Fe, Miera y Pacheco suffered from the bitterly cold weather. Domínguez and Escalante wrote that he "was ready to freeze on us," and they feared that he "could not survive such cold." But survive he did, and from the data he had compiled along the way, he drew, two years later, a two-sheet map of the lands the expedition had covered. Miera y Pacheco mapped the route from Santa Fe northwest to Lake Provo, southeast to Glen Canyon, and back to Santa Fe through the Hopi pueblos and Zuni. Like his 1758 map, it is crowded with representations of landforms and various types of native settlements. Plotted according to latitude, are the nightly stops, or *parajes*, where the expedition camped. The dense style is uniquely that of Bernardo de Miera y Pacheco (Biographical information courtesy of the New Mexico office of the state historian).

Rock Varnish Investigation

The Glen Canyon inscription site was sampled on August 4, 2007 in order to investigate the possibility of using rock coatings to constrain the age of the inscription.

Rock Varnish Sample Collection

In many arid landscapes, thin layers of rock varnish and other coatings provide the opportunity to study weathering and biochemical processes, and perhaps to make constraining statements about a petroglyph or inscription's potential antiquity.

Common Rock Coatings (Dorn, 1998)

General type	Description	Related terms
Rock Varnish	Clay minerals, Mn and Fe oxides, and minor and trace elements; color ranges from orange to black in color produced by variable concentrations of different manganese and iron oxides	Desert varnish, desert lacquer, patina, cataract films
Oxalate Crust	Mostly calcium oxalate and silica with variable concentrations of Mg, Al, K, P, S, Ba, and Mn. Often found forming near or with lichens.	Oxalate patina, lichen-produced crusts, patina, scialbatura
Lithobiontic Coatings	Organic remains form the rock coating, for example lichens, moss, fungi, cyanobacteria, algae	Organic mat, biofilms, biotic crusts
Carbonate Skin	Coating composed primarily of carbonate, usually calcium carbonate, but could be combined with magnesium or other cations	Caliche, calcrete, patina, travertine, carbonate skin, dolocrete, dolomite

Case Hardening Agents	Addition of cementing agent to rock matrix material; the agent may be manganese, sulfate, carbonate, silica, iron, oxalate, organisms, or anthropogenic	Sometimes called a particular type of rock coating
Dust Film	Light powder of clay- and silt-sized particles attached to rough surfaces and in rock fractures	Clay skins; clay films; soiling
Iron Film	Composed primarily of iron oxides or oxyhydroxides; does not have clay as a major constituent	Ground patina, ferric oxide, staining, iron staining
Salt Crust	The precipitation of sodium salts on rock surfaces	Halite crust, sub-florescence efflorescence
Silica Glaze	Usually clear white to orange shiny luster, but can be darker in appearance, composed primarily of amorphous silica and aluminum, but often with iron.	Desert glaze, turtle-skin patina, siliceous crusts, silica-alumina coating, silica skins

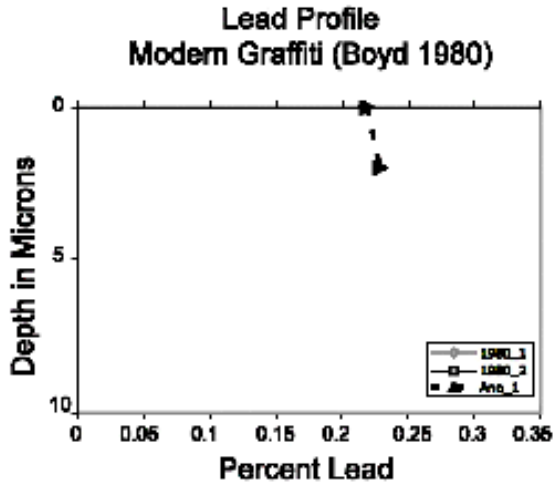
Rock varnish can be considered one of world's slowest accumulating sedimentary deposit, growing at rates of a few microns per a thousand years in very dry deserts to slightly faster rates in semi-arid regions (Dorn, 1988; Liu and Broecker, 2000). Varnish thickness can range from less than 5 microns (μm) to 600 μm, but typical thicknesses range from 20 to 100 μm. Varnish represents a composite of materials consisting including about 30% Mn and Fe oxides, up to 70% clay minerals, and over a dozen trace and rare earth elements.

It is known that twentieth century lead and other metal pollution can become incorporated into varnish coatings due to the ability of the iron and manganese oxyhydroxides to scavenge these heavy metals (Dorn, 2007). Evidence of global contamination has been recorded at distant locations such as Antarctica and Greenland and confidence is high in regards determining the heavy metal profiling of thin varnish samples. The analytical method has been replicated by several field scientists from locations across the western USA (Dorn, 1988; Fleisher et al., 1999; Thiagarajan and Lee, 2004; Hodge et al., 2005) with no publications yet critical of the technique.

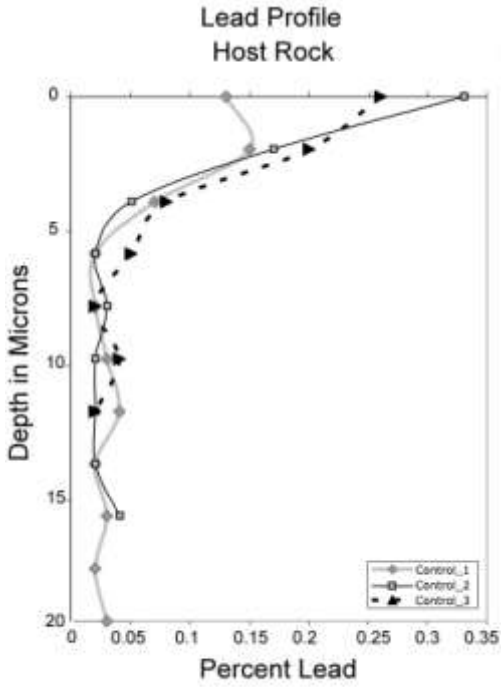
Lead (Pb) Analysis of Paso Por Aqui – 1776 Inscription

In August 2007, several small samples were collected from the 1776 inscription site using a tungsten-carbide needle. The sampled areas included the host rock, modern graffiti inscribed by Boyd in 1980, the Spanish Paso Por Aqui Inscription, and the word Año. The collected samples were embedded in epoxy and the varnish cross-sections were analyzed using an electron microprobe to measure the layered chemical changes on the micron scale.

The 1980 graffiti exhibited only a thin (1-3 micron) layer of lead-contaminated varnish consistent with recent formation. The faint "Año" engraving also showed only a lead-contamination layer of varnish but two of the three "Año" samples of this faint inscription carving were unsuitable for analyses rendering the age constraints for the word "Año" somewhat questionable.

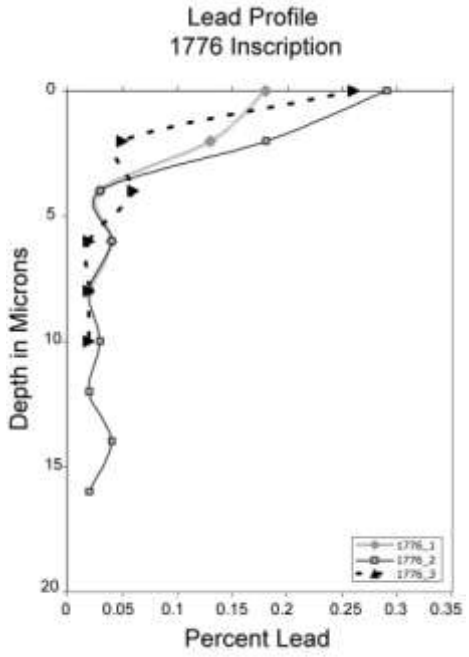


The three different varnish profiles for the host rock revealed thicker layers of varnish (10-20 microns thick). The lowest (base) layers of varnish showed low concentrations of lead (Pb), suggesting that the varnish formed prior to the 20th Century. In contrast, the top two microns of varnish (at the surface) revealed a spike in lead concentration, which is consistent with increased atmospheric pollution from automobiles and other industrial sources during the 20th Century.



Lead (Pb) Profile for the "Paso Por Aqui – Año 1776" Inscription

The varnish Pb profiles for the Paso Por Aqui Inscription were more consistent with the host rock profiles than those of modern graffiti carved in 1980. The Paso Por Aqui varnish was 8-16 microns thick and the base layers were relatively free of Pb contamination which, like the host rock, is suggestive that these base layers were deposited prior to the onset of global industrial pollution. The uppermost (two microns thick) surface layer of varnish revealed the same "spike" in lead contamination observed in the other samples.



Conclusion: The most reasonable interpretation is that the Paso Por Aqui 1776 Inscription pre-dates the global lead contamination of the 20th Century.

Varnish Laminations

Microlaminations in rock varnish were first reported by Perry and Adams (1978), who recognized their potential as a paleoenvironmental indicator in drylands. Microlaminations can be observed when the varnish is shaved thin enough (<5-10 μm) to see through in ultra-thin section with a light microscope.

Electron microprobe chemical mapping reveals that dark layers in varnish thin section are rich in Mn, but poor in Si and Al, while orange and yellow layers are poor in Mn, but rich in Si and Al. These alternating layers of manganese and iron rich layers imply a record of cyclic environmental conditions and/or biological activity.

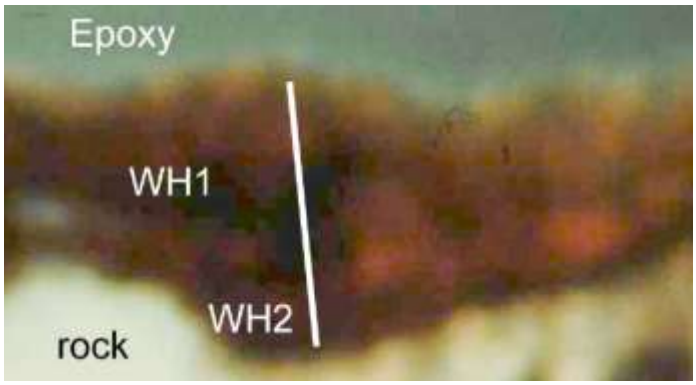
Researchers at the Rock Varnish Microlamination (VML) Dating Laboratory have constructed a calibration sequence of microlaminations the represent the entire Holocene sequence for the western U.S. (Liu and Broecker, 2007).

The exact process(es) influencing the layered banding appears to be controlled by regional-scale environmental change. Dry periods deposit the orange Mn-poor microlaminations, whereas wet periods deposit black Mn-rich microlaminations (Dorn, 1988; Liu and Broecker, 2007, 2008).

Holocene period varnish layers in arid environments naturally coat rock surfaces, engraved inscriptions, and petroglyphs (Image courtesy of the VML Dating Lab)

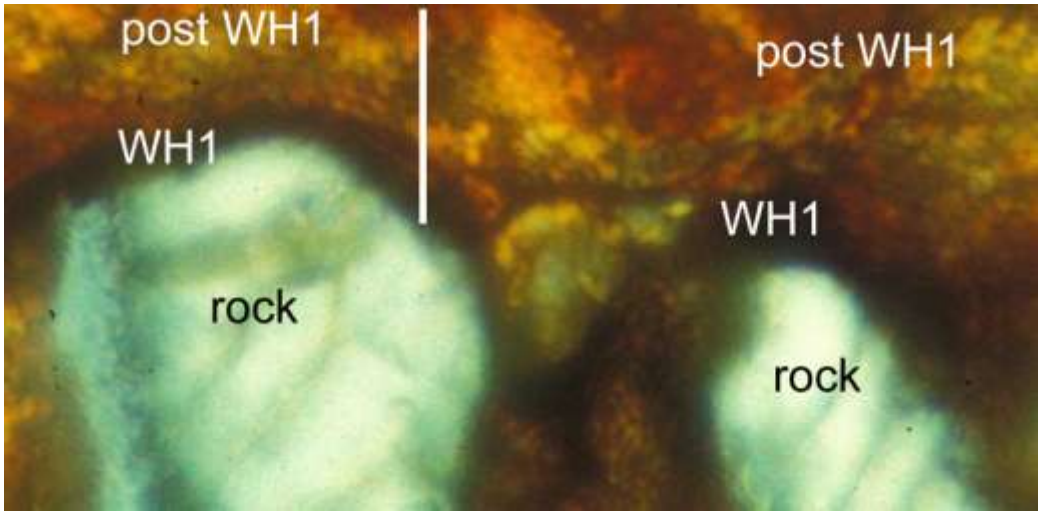
The microscopic thin sections for the rock samples collected at the Paso Por Aqui - 1776 Inscription site are shown below, starting with the sample collected from the host rock.

The host rock sample shows two black layers indicative of two wet periods. These layers are called WH1 and WH2 by Liu and Broecker (2007), standing for Wet Holocene layers 1 and 2. Each of these wet periods is followed by an orange layer indicative of a drier period. According to the calibration proposed by Liu and Broecker (2007, p. 9), the WH1 layer was deposited during the "Little Ice Age wet event" that ended about 1800-1850 A.D.

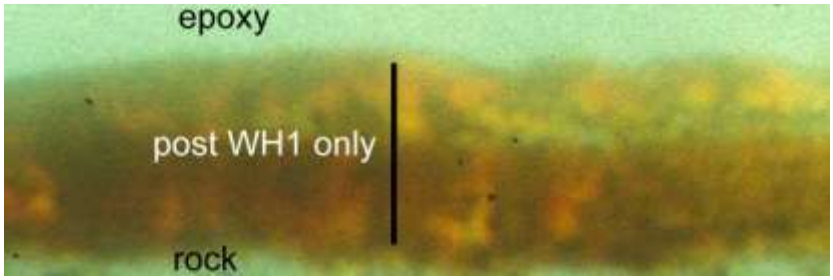


Host rock (control sample) showing presence of WH2 and WH1 dark layers.

Two different ultra thin sections from the 1776 Inscription show a pattern of a single black layer (WH1) under an orange layer. The presence of this manganese rich dark layer WH1 indicates the 1776 Inscription was made during the Little Ice Age. The last two cold snaps during the Little Ice Age occurred about 1770 A.D. and from about 1800 to 1850 A.D.



Cross section of 1776 Inscription showing the presence of WH1 dark layer. The white rocks are the individual sandstone grains. The WH1 microlamination rests on top of the quartz grains, indicating that the varnish started to grow during the Little Ice Age.



Cross section of the Boyd 1980 graffiti showing the approximate location of a lead analysis and the lack of a WH1 dark layer.

This finding combined with the lead profiling indicates together that the 1776 Inscription was made prior to the 20th century and probably is several centuries old. This is based on two independent lines of evidence.

First, the signal of lead abundance indicates that the carving was made well before 20th century pollution contaminated varnishes in the Four Corners region with lead. Second, the signal of varnish microlaminations indicates that the carving was made just before the end of the wet period of varnish formation or at the end of the Little Ice Age.

Summary Statements of Inscription Authenticity

Based on the preponderance of circumstantial evidence, officials for the GCNRA issued a press statement on November 5, 2007

"Paso Por Aqui" Inscription Celebrates its Anniversary
Recent Studies Point to its Authenticity

Page, Ariz. – Tuesday, November 6 marks the 231st anniversary of the recently discovered "Paso por aqui 1776"Iinscription believed to have been made by members of the Dominguez-Escalante expedition in 1776.
Located near Padre Bay within Glen Canyon National Recreation Area, this is the only known inscription remaining from the Dominguez-Escalante expedition.

Studies conducted over the summer indicate that the inscription appears to be authentic. One of these methods involved studying lead deposition on the inscription, while another studied the layers of desert varnish. Based on both of these methods, the inscription dates prior to the 20th century and is likely 200-300 years old.

Since the available evidence indicates the inscription is genuine, Glen Canyon National Recreation Area will pursue listing it on the National Register of Historic Places

Circumstantial Evidence Supporting Authenticity
The Gunsight Canyon location matches the diary itinerary for November 6, 1776
A nearby alcove provides shelter from rain
The inscription location on the panel is consistent with being first in time
The phrase Paso Por Aqui is consistent with the time period
The disciplined calligraphy differs markedly from modern graffiti
The unusual and distinctive flairs argue against forgery
The dark patina, the faintness and shallow depth, and the smooth worn edges all suggest significant antiquity
The coalesced and degraded conditions of lichen colonies (Staurothele) suggest an age of at least 100 years
Varnish lead (Pb) analysis indicates the inscription carving pre-dates 20th century pollution
Underlying magnesium-rich varnish microlaminations suggest the inscription is several centuries old

Application for National Register of Historic Places

Acceptance of applications by the National Register program are based on three key concepts--historic significance, historic integrity, and historic context--are used to decide whether a property qualifies for listing.

The National Park Service (NPS) recognizes the potential significance of this inscription. The dual mission of the NPS as defined by the Organic Act of 1916 is to "conserve" park resources and to provide for the public "enjoyment" of such resources in a manner that would leave them "unimpaired for the enjoyment of future generations." To this end, park staff and members of the Armijo chapter have been formulating a plan to provide protection for the inscription, while at the same time providing education and interpretation to the public about this important chapter of Southwest history.

The lead story for the 2008 park newspaper will feature the inscription with a broader message regarding the necessity for protecting all cultural resources. Exhibits that feature exact replicas of the inscription are also planned. Finally, the park is seeking to bolster support for the Graffiti Removal & Intervention Taskforce (GRIT). It was this group of volunteers who originally discovered the inscription. Hopefully, these and other efforts with park partners and the community will continue to foster a sense of stewardship among park visitors, ultimately providing the best protection for this unique piece of history.

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References

Anderson, Kim (2007). The Use of Lichens to Authenticate a 230 year-old Inscription. Report submitted to Old Spanish Trail Association, July 6, 2007.

Architects/Planners Alliance, Salt Lake City Utah (1976). Dominguez-Escalante Trail Bicentennial Interpretive Master Plan and Final Report: prepared for the Dominguez-Escalante State/Federal Bicentennial Commission. 168 pp.; plates, maps.

Beschel, R. 1961: Dating rock surfaces by lichen growth and its application to glaciology and physiography (lichenometry). Raasch, G. (ed.): Geology of the Arctic. 10441062. Toronto: University of Toronto Press.

Bolton, Herbert E (1950). Pageant in the Wilderness: The Story of the Escalante Expedition to the Interior Basin, 1776. Utah Historical Quarterly, 18, 1950.

Crampton, C. Gregory (1960). Historical Sites in Glen Canyon; Mouth of San Juan River to Lees Ferry. Glen Canyon Series Number 12. Anthropological Papers Number 46, Department of Anthropology, University of Utah, June 1960.

Crampton, C. Gregory and Miller, David E (1961) Journal of Two Campaigns by the Utah Territorial Militia Against the Navajo Indians, 1869. Utah Historical Quarterly, Volume 29, 1961

Crampton, C. Gregory (1986). Ghosts of Glen Canyon: History Beneath Lake Powell. St. George, Utah Publishers Place, Inc. 1986.

Dorn, Ronald I. (2007). Report on the Crossing of the Fathers Rock Carvings. Submitted to Max King, Glen Canyon National Recreation Area, August 14, 2007.

Dorn, R. I. (1998) Rock coatings. Amsterdam: Elsevier. 429 pp.

Eaton, Marietta (2007). Paso Por Aqui – Site Visit Report and Recommendations. Submitted to Glen Canyon National Recreation Area. March 14, 2007.

Francaviglia, Richard (2005). Mapping and Imagination in the Great Basin: A Cartographic History. Reno: University of Nevada Press, 2005. xx, 231 p.

Fraser, George C. (1953). El Vado del los Padres. Natural History, XXIII, No. 4, (April 1953), 344-357.

Gregory, H. E., editor. (1917). The Navajo country: A geographic and hydrographic reconnaissance of parts of Arizona, New Mexico, and Utah. U.S. Geological Survey Water Supply Paper No. 380. Government Printing Office, Washington, D.C.

Gregory, H.E., and Moore, R.C. (1931). The Kaiparowits region: a geographic and geologic reconnaissance of parts of Utah and Arizona. Pp. 33-35 In: U.S. Geological Survey Report 164. USGS, Washington, D.C.

Little, James A (1881) - Jacob Hamblin: A Narrative of His Personal Experience As a Frontiersman, Missionary to the Indians and Explorer - Disclosing Interpositions of Providence, Severe Privations, Perilous Situations and Remarkable Escapes. Salt Lake City: Juvenile Instructor Office, 1881.

Liu, T., and Broecker, W.S. (2007). Holocene rock varnish microstratigraphy and its chronometric application in the drylands of western USA. Geomorphology 84, 1-21.

Liu, T., and Broecker, W.S., 2008. Rock varnish microlamination dating of late Quaternary geomorphic features in the drylands of western. USA. Geomorphology 93, 501-523.

McDonald, Jarom, editor. (On Line). Domínguez , Francisco Atanasio and Silvestre Vélez de Escalante. Derrotero y Diario de los R.R.P.P. Fray Francisco Atanasio Domínguez y Fray Silvestre Vélez de Escalante, para descrubir el camino desde el Presidio de Santa Fe del Nuevo Mexico, al de Monterey, en la California Septentrional.

Miller, David E. (1976). The Route of the Domínquez-Escalante Expedition, 1776-77; A Report of Trail Research. Conducted Under the Auspices of the Domínquez-Escalante State/Federal Bicentennial Committee and the Four Corners Regional Commission.

Perry, R. & Adams, J. (1978). Desert Varnish – Evidence for Cyclic Deposition of Manganese. Nature, 276, 489−491.

Sanchez, Joseph P. (2007). Site Visit to Gunsight Butte, August 10, 2007. Memorandum to Superintendent, Glen Canyon National Recreation Area, August 15, 2007.

Slater, John M. (1961) El Morro Inscription Rock New Mexico; the rock itself, the inscriptions thereon, and the travelers who made them. Los Angeles: The Plantin Press.

U.S. Geographic Survey (1889). W. 100th Meridian Report, Volume 1, p. 53, 1889.

U.S. Geographic Survey and Southern California Edison (1921). Map of Crossing of the Fathers - Plan and profile of Colorado River, Lees Ferry, Ariz. to mouth of Green River, Utah ; San Juan River, mouth to Chinle Creek, Utah ; and certain tributaries, 1950-1959. 1921 survey maps by the Geological Survey in cooperation with the Southern California Edison Co.

Warner, Ted J., ed.(1976). The Domínguez -Escalante Journal. Their Expedition through Colorado, Utah, Arizona, and New Mexico in 1776, translated by Fray Angelico Chavez Provo, UT: Brigham Young University, 1976

Tanzhuo Liu, Ronald I. Dorn (1996). Understanding the Spatial Variability of Environmental Change in Drylands with Rock Varnish Microlaminations. Annals of the Association of American Geographers 86 (2), 187–212.

Tanzhuo Liu[1] and Wallace S. Broecker (200). How fast does rock varnish grow? Geology, February 2000; v. 28; no. 2; p. 183-186.