Robert Ford, Dixon & Cody Spendlove, David Maxwell, Gordon Hutchings

WATERGLYPHS: ANCIENT CARTOGRAPHY OF THE ARIZONA STRIP

In an area lying between the high elevations of Utah's Markagaunt Plateau, Paunsagaunt Plateau, and the abyss of the Grand Canyon is a remote area known as the Arizona Strip. It is a beautiful but inhospitable place, lacking one vital resource; permanent water. There are but few springs and water pockets in its canyons, plus small holes in the rim rock holding water for short periods after infrequent storms.

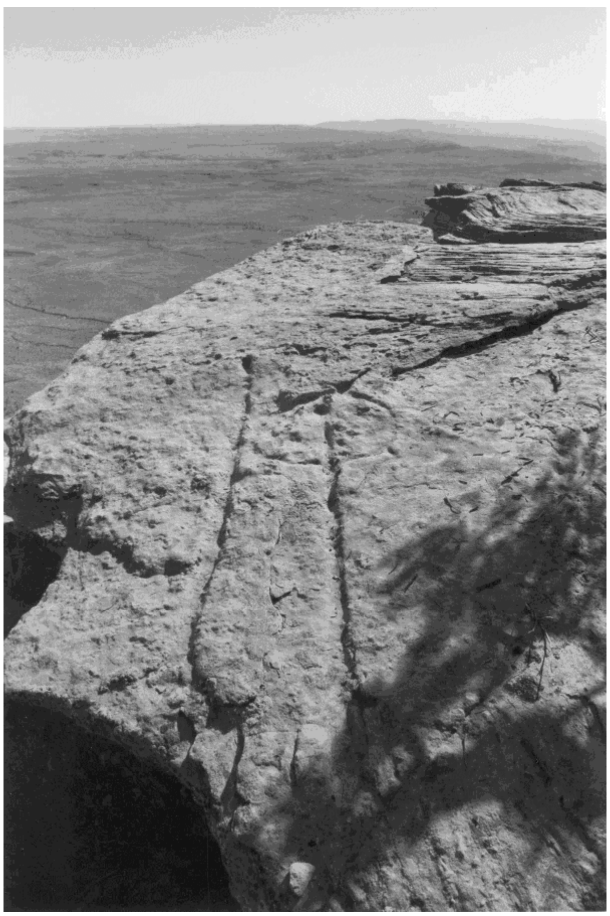

Figure 1. *Pair of waterglyphs, Washington County,Utah. Bob Ford Photo*

At the time that the United States founding fathers were signing the Declaration of Independence in Philadelphia, Spanish friars, Francisco Atanasio Dominguez and Silvestre Velez de Escalante, were preparing an expedition to explore a northern route from Santa Fe, New Mexico to Monterey, California.

On October 11, 1776, near present day Cedar City, Utah, the expedition, faced with worsening weather and dwindling supplies, decided to put their fate in the hands of God. By means of casting lots, the decision was made to return to Santa Fe by way of the Cosnina below the Colorado River.

The expedition turned south, entering through the lower Hurricane Valley, becoming the first known Europeans to traverse the Arizona Strip. Escalante's journal chronicled the barrier of the great canyon to the south and the many hardships they endured before finding a place to ford the river. On November 7th, 1776, Escalante noted in his journal:

"… about five o'clock in the afternoon they finished crossing the river, 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. And now,* ***after having suffered all this, we learned the best and most direct route where there were water holes adjusted to an ordinary day's travel****".*

Unknown to these Spanish explorers, an unknown culture, centuries before European occupation of the area, had already mapped and left guide marks for thirsty travelers beside these trails, using only minor modifications of basic petroglyphs, as in Figures 1 and 2.

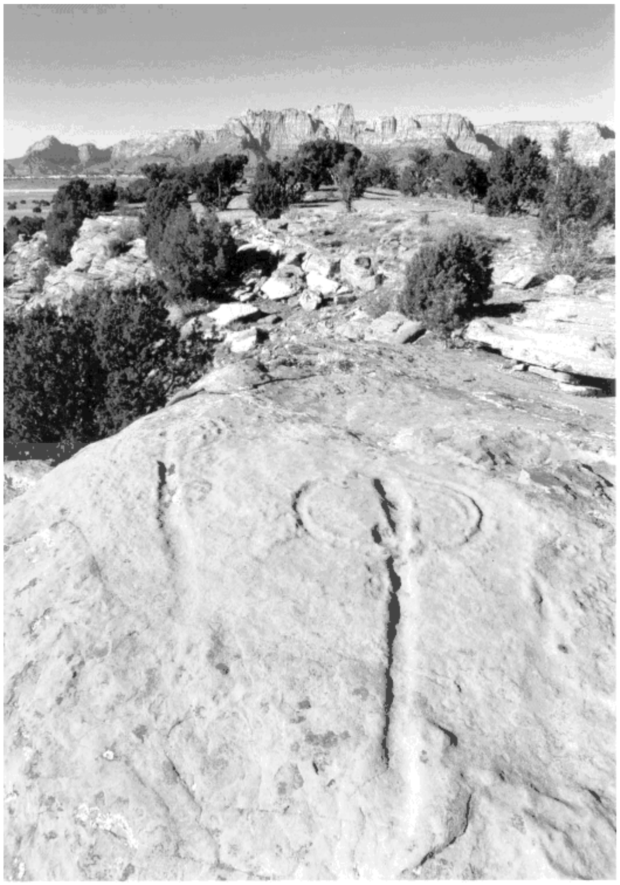

Figure 2. *Waterglyph in Mohave County, Arizona. Bob Ford Photo*

Eight years of research along these migration routes, trade routes and other thoroughfares has yielded more than 200 instances of this unique petroglyph known as the "waterglyph" scattered atop canyon rims and mesas, along this ancient trail system.

These waterglyphs are consistent in shape and size. Placement near the edges of cliffs that overlook a panoramic view can be shown, in a majority of instances to indicate the location of an existing spring, five to ten miles away… hence the name "water-glyphs".

Like many modern inscriptions, these glyphs may have additional secular or religious meanings. However, this article will focus on the only theory that has been consistently proven by the team, which is, they indicate distant sources of water.

BASIC GLYPH SHAPE

The waterglyph is cartographic information ground deep into horizontal sandstone and limestone surfaces offering a panoramic view of the surrounding landscape. Surfaces hosting them were not picked at random but rather carefully selected by the primitive cartographer. The location, aside from being chosen for its topocentric value, may have used natural features on the rock surface as a topographical representation of the field of view.

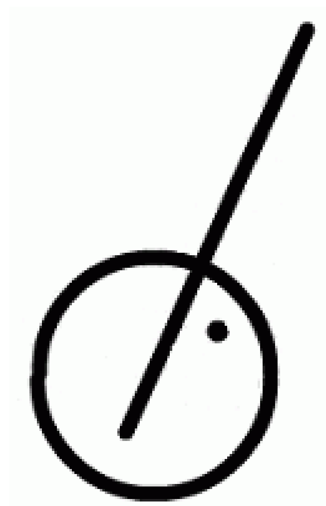

Figure 3. *Basic form of a waterglyph*

The common waterglyph has four simple components; an 18" to 24" diameter circle, a 36" to 48" line and two cupules. A cupule is ground into one end of the line; this line penetrates one side of the circle, bisecting the plane. The opposite end terminates either at the cliff edge, a crack or depression in the rock surface. The remaining, or floating, cupule is located, either within the plane of the circle, on the arc line, or outside the perimeter of the circle.

Variations include: additional circles or arcs, line with cupule termination area inside the circle plane, additional line cupules, additional floating cupules, and line angle change near cliff edge.

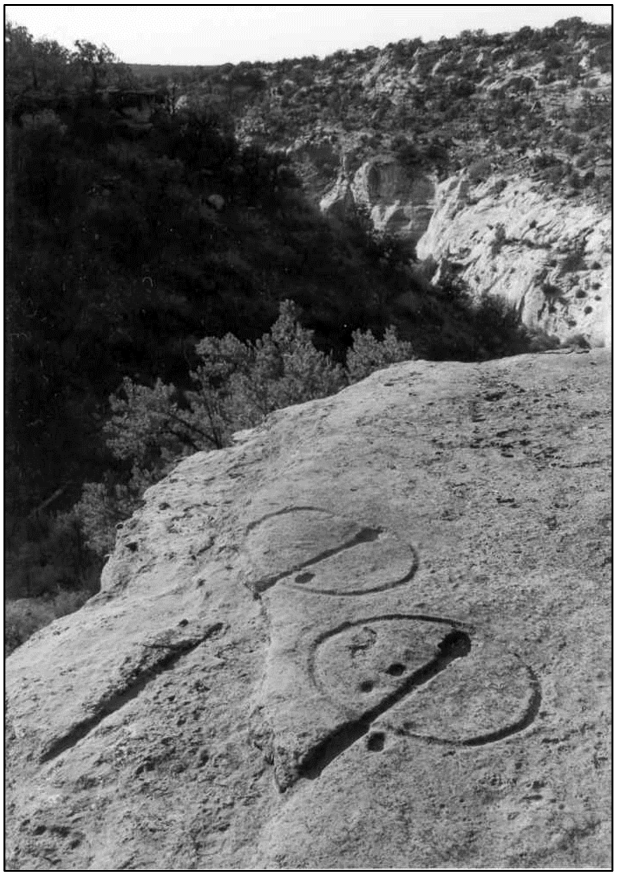

Figure 4. *Two waterglyphs from Kane County, Utah, Bob Ford Photo*

Currently, waterglyphs have been documented in Coconino and Mohave County, Arizona; Kane and Washington County, Utah; and Clark County, Nevada.

With more than 2.8 million acres and fewer than 100 permanent residents, this portion of the American Southwest remains remote and largely unknown.

The importance this petroglyph had to its makers, as well as with its users, is indicated by its extensive use, slight degree of variation, and depth of incision.

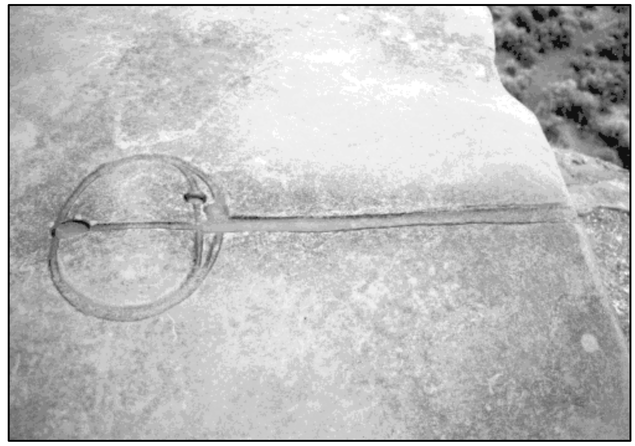

Figure 5. *Waterglyph from Mohave County, Arizona. Bob Ford Photo*

In order to prove this theory, twenty waterglyphs were chosen at three random locations and analyzed using ESRI's Geographical Information System (GIS), to verify the trail / spring correlations.

Figure 6. *Waterglyphs are found on the horizontal surface atop the cliff, not on the vertical cliff face.*

Of the 20, eight had fallen from the cliff face or been otherwise partially destroyed. Of the remaining 12, springs were found in the area indicated by the glyph in nine instances. Further analysis continues on the remaining waterglyphs.

PROJECT HISTORY

The existence of at least three of these unique glyphs has been known since the beginning of the modern historical record. Dixon Spendlove saw his first waterglyph as a boy in the late 1950's as part of a local Boy Scout outing, a tradition popular in local legend since 1914, when Freddy Crystal showed up in Kanab, Utah with tales of ritual sacrifice and a "map" of buried Aztec gold.

Bob Ford has known of several on the McDaniels brothers' farm since the early 1960's when, as a young man, he first began visiting Bruce McDaniels with his father.

However, it was not until 1996, while photographing some waterglyphs at sunset, that Bob remembered a passage from the journal of Major John Wesley Powell, in which he commented that their Native American guide would often leave the group around sunset, to walk nearby mesa tops. Then the guide would return and direct the group to a water source.

Powell mentions the incident only because he had to rebuke his men for making fun of their guide-- joking that their guide "went to pray to the rock gods". Powell pointed out that as long as he continued to find water, none of them should care what gods the man worshiped.

Sitting there, on the rim rock, staring down at one of these magnificent glyphs, in the setting sun, Bob's mind took a mental leap. What if the guide had not gone to the mesa to pray, but had gone instead to look for a message carved into the rim rock -- a message cut into the horizontal surface of the rock, like the singularly unique petroglyphs he was photographing?

Working on this hunch, Bob sought the aid of local resident Dixon Spendlove. By working together, pooling their knowledge and walking nearly two hundred miles of rim rock, they found 28 similar petroglyphs during the next two months.

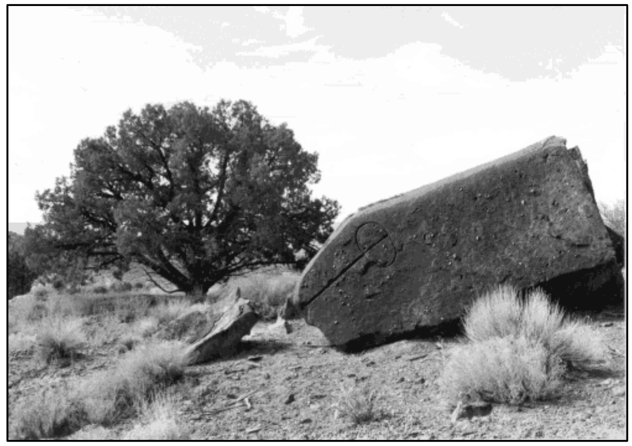

Figure 7. *Fallen Waterglyph, Coconino County, Arizona. Bob Ford Photo*

Figure 8. *Close up of Fallen Waterglyph*

Documenting The Discovery

Convinced that Bob was on to something, Dixon contacted his son, Cody, who had just finished a class at Dixie College in HTML and web page construction.

In June 1997 Cody published a three page article on the Dixie College Udvar-Hazy School of Business website. [Subsequently, moved to the website: www.waterglyphs.org

In the article, Cody made the comment that the glyphs were "left by its first known inhabitants, the Anasazi Indians". This statement quickly drew criticism from several different groups.

Spanish Mine Marker Theory

Many telephone calls and emails were received from the Lost Spanish Treasure theorists, explaining that these glyphs were clearly made by early Spanish explorers to mark buried mine entrances.

This theory was put to rest in 1999 when Robert and Dixon discovered a "mini" waterglyph among other rock art drawings two miles northwest of Fredonia, AZ, Figure 9.

Figure 9*. A "mini" waterglyph, among the other symbols at the "clam shell" site.*

This 4" miniature version does NOT seem to be a functional waterglyph, in that it does not point to any known water source. It appears, rather, to be some kind of teaching aid, similar to an illustration in a textbook. It is remarkably accurate, even in its placement, with the line extending to the edge of the rock upon which it is inscribed.

Whatever its function, it is clear that the author of the Clam Shell panel knew of the existence of these glyphs.

Because this panel has been dated to the Basketmaker period, or earlier (700 A.D.), the possibility of these glyphs having been created by early Spanish explorers was ruled out.

Solstice Marker Theory

Upon first sighting, the most common theory is their use as a solstice device. Perhaps this is because of the widely published accounts of "Sun Dagger" solstice makers at Chaco Canyon and Paint Rock in Central Texas.

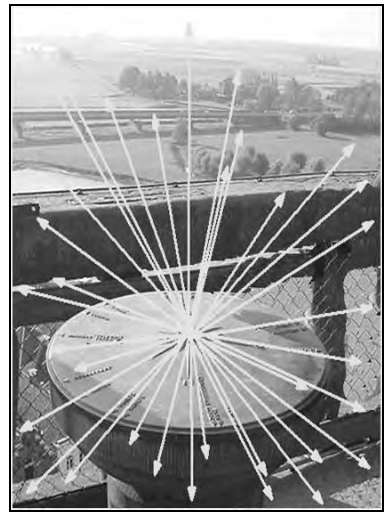

Figure 10. *Compass azimuths*.

However, the 200+ glyphs found to date, *point to more than 90 different compass azimuths* ranging from 0° to 359° degrees (Figure 10). Additionally, their topocentric nature and occasional multiple placement raises serious questions about any possible solstice solution (Figure 11).

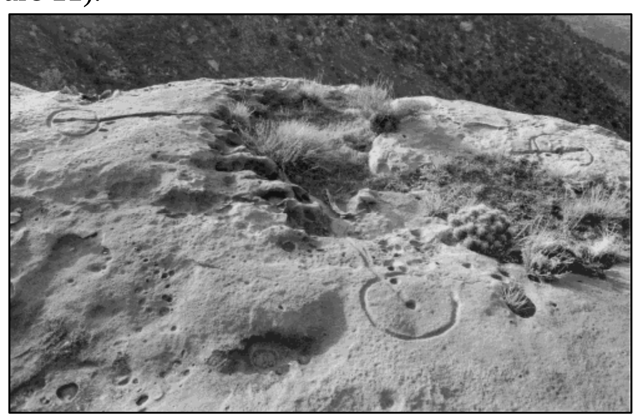

Figure 11*. Triple grouping, Mohave County, Arizona Bob Ford*

Although some of these glyphs may have served a dual purpose as a solstice marker, azimuth readings of all known waterglyphs clearly indicate that their primary function was not astronomical.

GIS / GPS 101: AN INTRODUCTION

In the meantime, Cody had enlisted the aid of Dave Maxwell, director of the Geographic Information Systems (GIS) program at Southern Utah University in Cedar City, UT.

Using the Global Positioning System (GPS) of satellites to pinpoint each glyph's exact location, and compass azimuth readings taken at each glyph, allowed the team to draw directional vectors over GIS data. This facilitated preliminary research on the geographical data in that general direction before ground based reconnaissance work was initiated.

However, because the U.S. military was still the primary user of the GPS system in 1999, the satellite signal was randomly scrambled, and commercial over-the-counter grade GPS units were only accurate to 200+/- meters on any given day. For obvious reasons, professional grade Trimble GPS units had to be used that allowed the data collected to be post processed in the GIS lab against known land based survey markers (Figure 12).

***Figure 12**. Trimble GPS system and survey markers.*

After post processing, this gave the team an exact location for each glyph with less than one meter accuracy.

BI-DIRECTIONAL THEORY

Maxwell was also the first team member to suggest that the glyphs should be read in both directions. As a professional cartographer, Dave pointed out to Cody on their first visit to collect data with the Trimble GPS units that any mapping system, in order to be functional must work "coming" and "going".

This concept helped explain a mysterious glyph discovered earlier by the team. Over time, this waterglyph had fallen off the edge of the cliff, and been re-cut by its creator.

***Figure 13**. Waterglyph from Kane County, Utah.*
Gordon Hutchings Photo

Although there were several feet of good flat surface farther along the cliff edge, this glyph had been carefully re-created in as near to the exact location of the original as possible, even to the extent of wrapping part of the circle around the edge of the cliff (Figure 13).

Maxwell's bi-directional cartographic model seemed to explain the exact placement of each glyph, because while a line can be geometrically drawn between any two points on the planet, a third point between the two, must be in an exact location to keep the line straight. The question was, what were they trying to keep aligned?

DECIPHERING MEANING I

Collecting GPS data points in such remote locations required at least two people to verify each reading. In order to expedite data collection a fifth team member was brought into the project.

As an amateur photographer, GIS student from Southern Utah University and long time friend of both Cody and Dave Spendlove, Gordon Hutching was a natural choice.

Gordon's contribution to the project was immediate. On his very first outing with the group, he dropped midway down a cliff and snapped a photo, (Figure 14), sighting directly down the line.

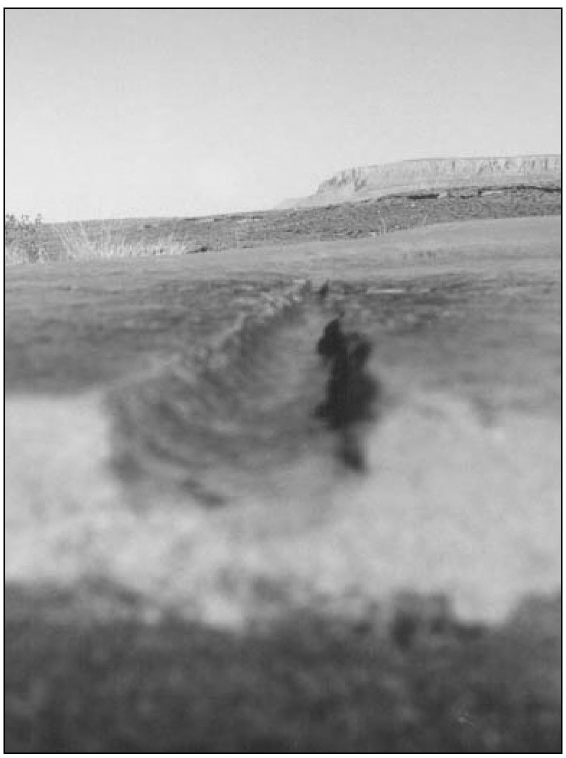

Figure 14. Sighting directly down the line. Mohave County, Arizona. Gordon Hutchings Photo

Although the image was not seen by Cody until the film was developed, it haunted him. The line clearly pointed directly at an obvious landmark. Could it really be that easy?

Cody began combing through the hundreds of other glyph photos the team had collected. There was an obvious pattern. The line in the glyph was not trying to indicate the direction to another glyph as previously suspected. Rather, it was pointing to an obvious landmark to use as a reference while traveling in much the same way that Boy Scouts or military personnel are taught to use a compass by selecting a prominent landmark in the direction of their bearing to use as a guide to avoid wandering off the path. (Figure 15).

Figure 15. Examples of line / landmark alignments

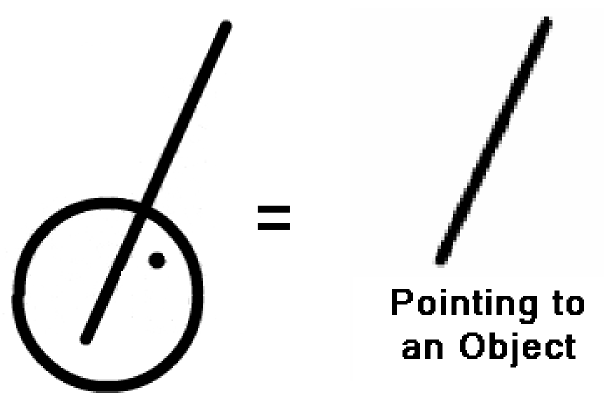

***Figure 16** – Line indicates object on the horizon*

Return trips to known waterglyphs, with careful attention to objects on the horizon now made easier by GPS coordinates, proved this theory to be accurate in nearly every case (Figure 16).

DECIPHERING MEANING II

The next major breakthrough came with the realization that the circle(s) somehow indicated the distance to be traveled.

Although the basic glyph was pretty universal in shape, there were often modifications as to how the circle(s) were drawn. The most common variations include: double front, double concentric, and double circles along the azimuth (Figures 17, 18, 19).

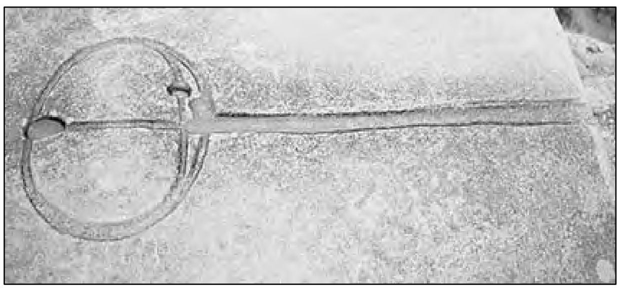

Figure 17. *Double front.*

Figure 18*. Double concentric.*

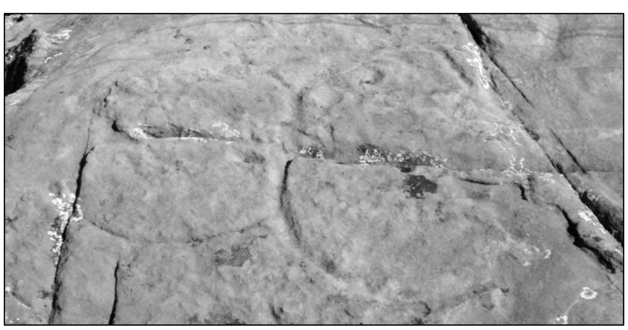

Figure 19. *Double circles along the azimuth.*

Clearly such variations were intended to convey meaning. Following a hunch, the team began looking for topographical correlations between the glyphs and the field of vision from that point.

Eventually the team found this glyph (Figure 20),

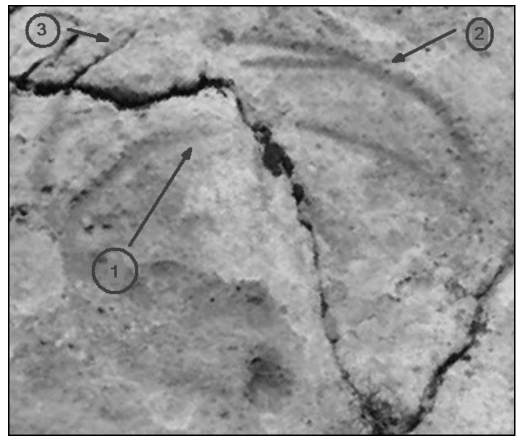

Figure 20. *Triple field of view*.

with this field of view (Figure 21).

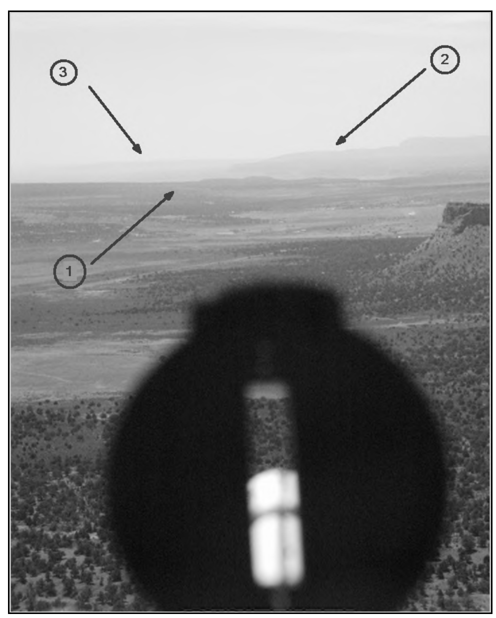

Figure 21*. Triple horizons*.

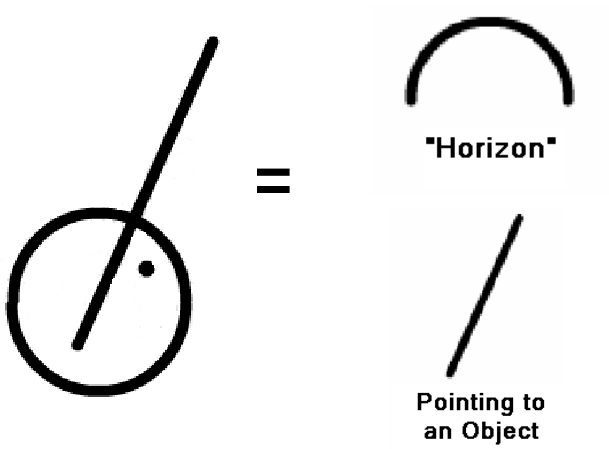

Figure 22. *Circle(s) represent Horizon(s)*

DECIPHERING MEANING III

With a working understanding of at least part of the glyph's meaning, knowing the intended direction of travel and the approximate distance, the team set about finding out what the "dot" indicated (Figures 22, 23 and 24).

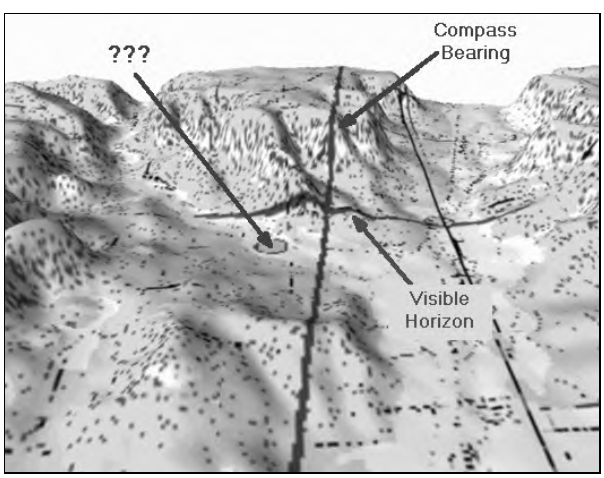

Figure 23. *Unknown target.*

It did not take a great deal of thought to realize that a ground reconnaissance for each glyph, looking for an unknown target near or beyond the visible horizon, 5 – 15 miles out, would take a least a lifetime, with no guarantee of success.

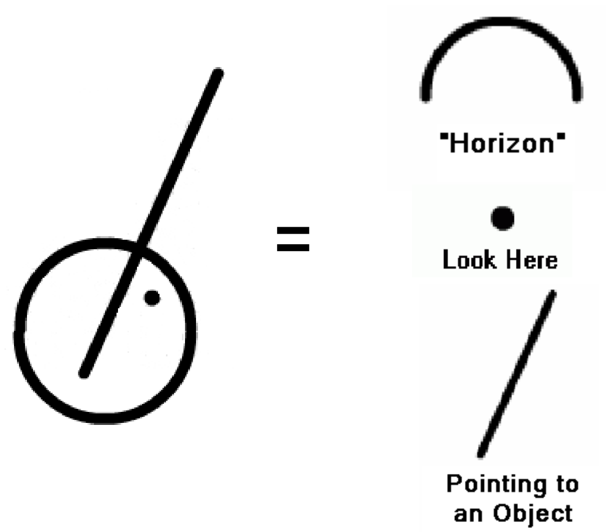

Figure 24. *Cupule indicates target.*

So, after many months in the field collecting data, the team turned indoors to the Southern Utah University (SUU) Geographic Information Systems (GIS) lab and some high tech computer help.

GIS 201: UNDERSTANDING LAYERS

The power of a GIS system comes from its ability to separate the different layers of information normally contained on a traditional paper map.

Separate data layers (also known as "sets"), such as roads data, stream and river data, topographic data and vegetation data, allow researchers to ask the computer questions looking for correlations between the layers (Figure 25).

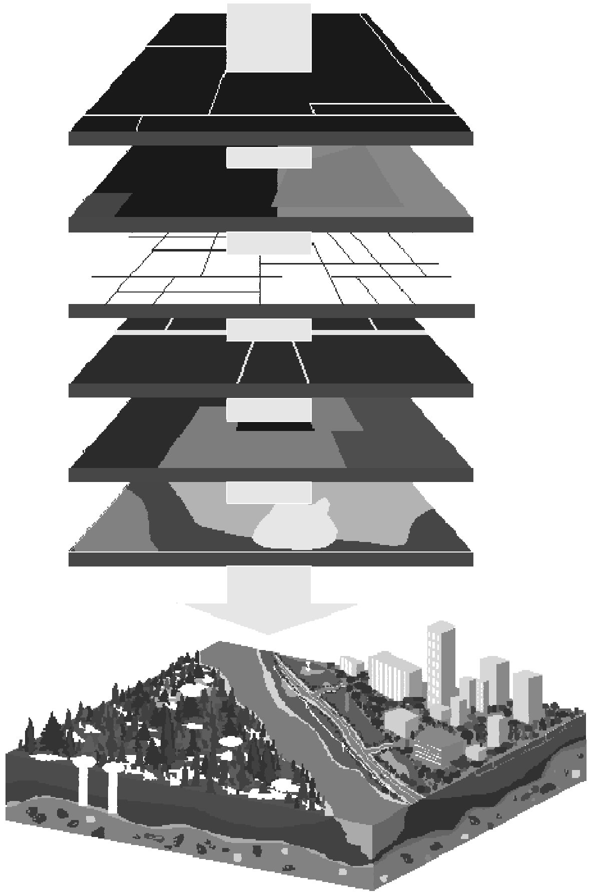

Figure 25. Layers of a GIS map

For example, "show me all the instances where the water layer crosses the road data". In the case of the waterglyphs, all modern data, such as roads, towns or state boundaries were eliminated.

Additionally, a special layer had to be constructed that would allow the computer to look with a defined field of view in the direction of the line and search the general area of the cupules associated with each waterglyph.

Gathering Layers

GIS works well when the data layers are seamless. However, GIS data sets are primarily created by government agencies that tend to create data sets that terminate along state, county or national park boundaries. This creates logistical nightmares for researchers with projects that straddle state or county boundaries (Figure 26).

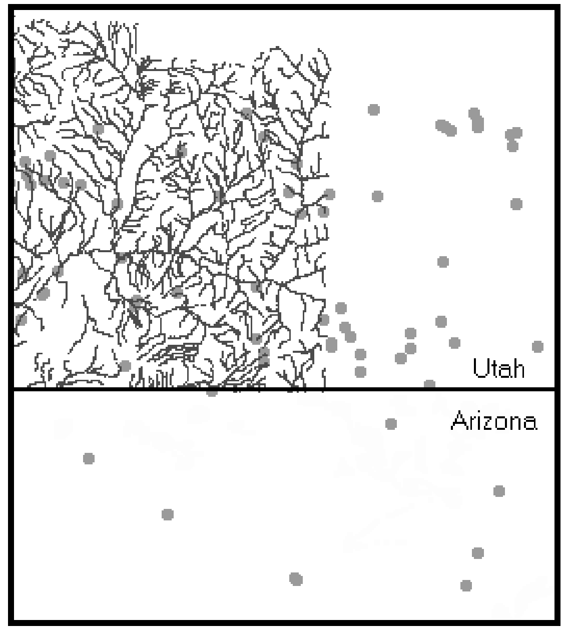

Figure 26*. Stream & river data layer has been "clipped" along county boundary. Springs are missing from Arizona data set.*

Accurate data (view from 25,000 ft) was readily available from the Utah Automated Geographic Reference Center (AGRC) website, but Arizona data was less accurate (view from 100,000 ft). Many of the springs on the Arizona side of the border were simply left off the data set.

However in 2002, after a couple of frustrating years attempting to locate the necessary data sets, Gordon Hutchings, now a senior at SUU, agreed to work full time on the problem during his last two semesters as part of his GIS capstone project.

One of Gordon's first tasks was to find and combine data sets from different government agencies into single seamless layers for the project area, most notably:

- Streams, rivers & springs
- Digital elevation models (DEMs)
- Satellite images

Digital Elevation Models (DEMs)

In much the same way that lines on a topographical map indicate elevation change, a DEM uses information encoded into the pixels of an image to represent elevation. However, unlike a topo map, this information can be used to create a 3D Model of the real world (Figure 27).

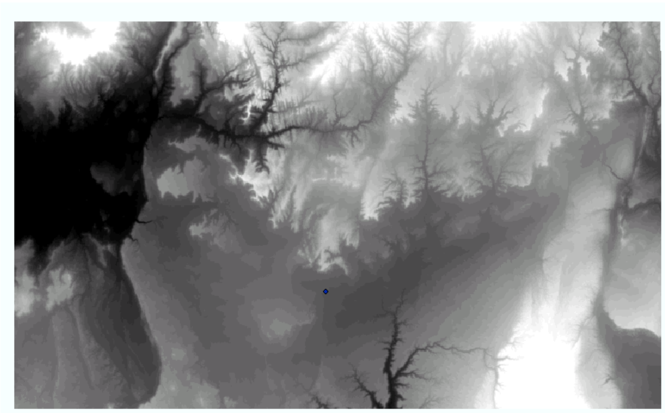

Figure 27. Example of a DEM data set.

This "virtual" model is then overlaid with other GIS data layers such as satellite images and spring locations. The net result is something that saves hundreds of hours of field work.

After two semesters, and many frustrations, Gordon eventually completed the task and the team was able to begin lab analysis of their field observations.

Note: The United States Geological Survey (USGS) has since created a website: http://seamless.usgs.gov, which automatically creates seamless data sets, including the National Elevation Dataset (NED).

The "Bowtie" Layer

In order to create this special layer, Dave Maxwell and Gordon Hutchings had to construct a wire frame drawing in AutoCad that would represent the field of view from each glyph.

The wire frame was divided every 5 degrees, in both the forward and backward facing view (Figure 28).

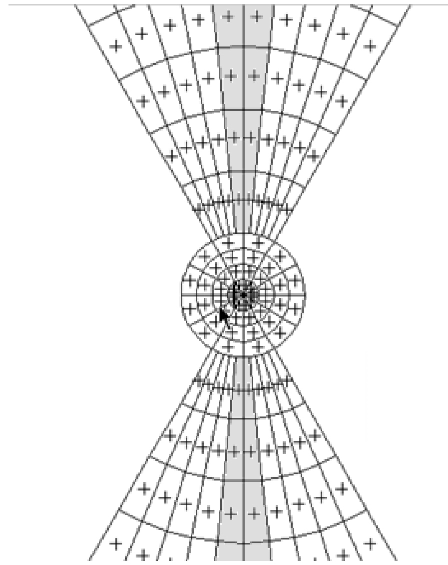

Figure 28*. Wire frame AutoCad "bow tie".*

Additionally, each five degrees of view had to be subdivided into segments of 5, 10, 15 and 20 miles of distance from the glyph.

After constructing this basic "bow tie" template, a separate GIS layer had to be created for each individual glyph, rotating the template to match the compass azimuth of the glyph (Figure 29).

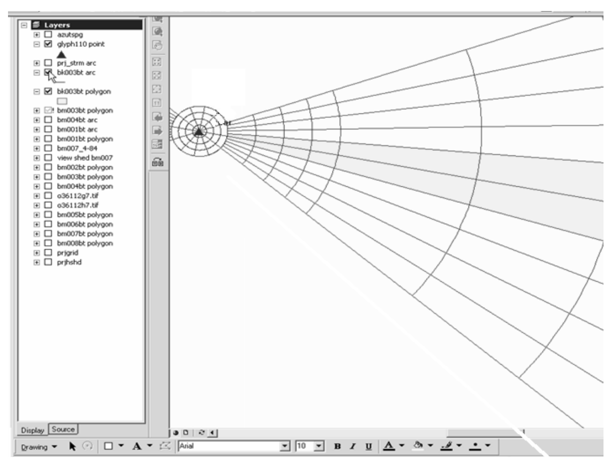

Figure 29*. Rotating the wire frame to the compass azimuth.*

A sample group of 20 glyphs (10% of known glyphs) from three sites were then selected as a test pilot of the system. Of the twenty, eight were broken, had fallen from the cliff or were otherwise unreadable.

The team then used the DEM data in conjunction with this bow tie layer to create a view shed, or field of vision, for the remaining 12 glyphs.

This established a virtual horizon for a person standing at that exact point. It also gave the GIS system an exact area to focus its analysis on, to the left or right of the centerline, and before or beyond the horizon, depending on the location of the "dot" in the actual glyph (Figure 30).

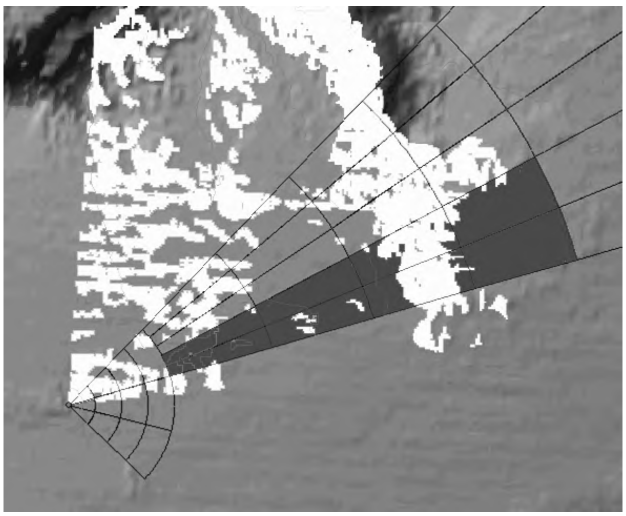

Figure 30. *Wire frame, DEM and viewshed show field of view (white areas) from each waterglyph.*

After running the analysis, nine of the twelve did in fact have a known water spring in the appropriate polygon.

Two additional glyphs had modern water tanks or cattle watering troughs in the area indicated, which could have originally been springs that were converted, and one glyph appeared to point at nothing.

Even without the other two questionable glyphs, *nine of twelve gave an amazing 75% accuracy rate* to the "waterglyph" or "hydroglyph" theory.

DECIPHERING MEANING IV

The final translation of the glyphs then is: As Far as You Can See "Horizon"; Look Here; Pointing to a Prominent Landmark; Water (Figure 31).

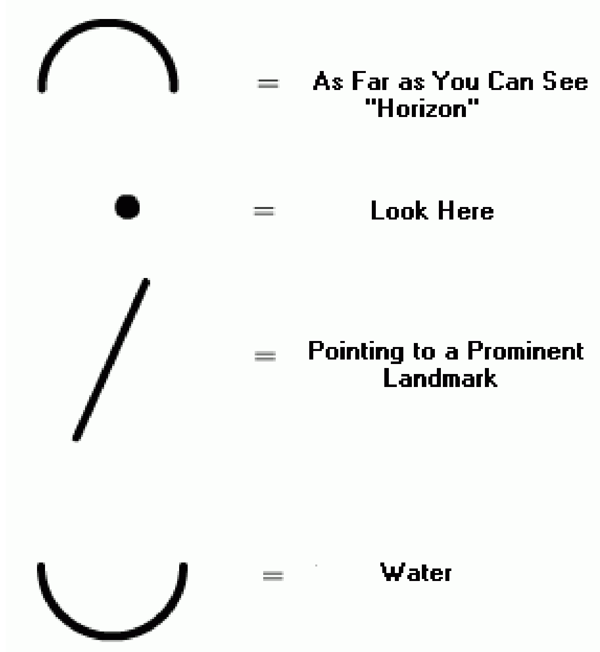

Figure 31, *As Far as You Can See "Horizon"; Look Here; Pointing to a Prominent Landmark; Water*

… Or .. Figure 32

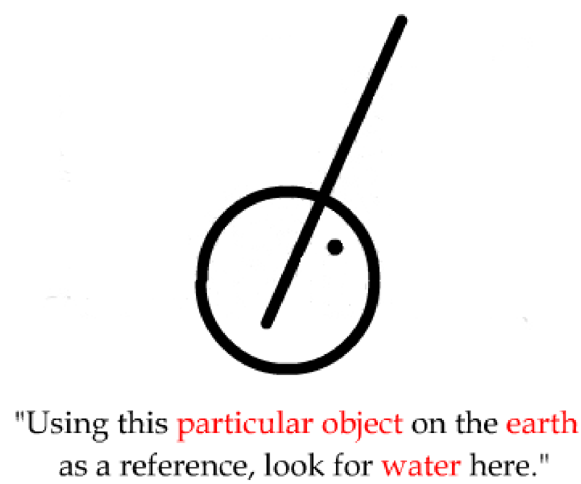

Figure 32. *Another Interpretation.*

Of course, the team reserves the right to alter this interpretation as new data comes to light, but at the time of this presentation to the URARA members, the "waterglyph" theory remains the most accurate model to date, for explaining the function of these unique glyphs.

CONCLUSIONS

The fundamental conclusions drawn from this project are that:

1. There is a predictable pattern of waterglyph locations; namely that they are found near the edge of a cliff with a prominent field of view.
2. That waterglyphs retain a fundamental shape and size; 24" circle with a 48" line and dot(s). The line will always run to the edge of the cliff or a crack in the rock.
3. That the line usually aligns with a prominent landmark on the horizon that can be used to navigate a hike of 5 to 10 miles.
4. That the circle(s) represent the visible horizon from that geographic point and functions as a general indication of distance to the "dot".
5. That GIS analysis has shown that in approximately 75% of the cases, the "dot" indicates a known spring of fresh water.

That these glyphs could have also served additional functional or religious functions is not questioned.

In fact, given the almost universal human tendency to reuse symbols, such as the "all seeing eye" on the U.S. dollar, which means little to the average citizen, quite a lot to a Master Mason, and something entirely different to an ancient Egyptian, it would seem fairly preposterous if they did NOT have additional meanings.

However, it remains the focus of this article, to give credit to Robert Ford, who somehow made the mental connections between an obscure comment from Powell's journal and the reality of the "waterglyph" before him…

NOTES

1. The content of this article in no way reflects the complete research behind the waterglyph project, but is limited only to the ideas shared during the half hour presentation at the 2004 fall URARA conference held in Kanab, Utah.

2. The research server that hosted the team's initial publication was originally located in the Udvar-Hazy Business building at Dixie College, http://144.38.20.128/cody/bobby.html. This server was removed in 1999 and the project website was relocated to its current domain: www.waterglyphs.org.

3. The reader is cautioned that the obvious antiquity of these waterglyphs in no way implies that they are not still in use by Native American tribes. As always, a healthy dose of cultural sensitivity is suggested while researching this particular petroglyph.

4. Team members are frequently asked why they have not previously shared this data with universities, state/federal government agencies or national science publications. The simple answer is that during the last eight years the local BLM, National Geographic and Discover magazines were all approached; none of them were interested.

ADDITIONAL CONTRIBUTORS

The contributions of Marty Heaton, linguistics; Kathy Webb, Meso-American research; Dr. Gary Schaffer, Navajo and Hopi cultural liaison & Dr. Tom Charles, North Carolina state archeologist to this project are here noted. However, because of the time constraints of the URARA presentation, their contributions were only briefly mentioned and will not be covered in this article.

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