INTRODUCTION

The depth to which this paper penetrates comes to me as a complete surprise. What was to be a couple of Saturdays' work opened up to be an ever expanding field of investigation with little side paths leading off in endless different directions. Analysis of the panel's functions and symbols led us ever backward in time as we peeled away the strata of the Hopi, Aztec and Navajo layered universe. The broadening project was accompanied by an increasing commitment on my part to see the work to a conclusion, and now that it has come to some state of completion I find myself intrigued by other sites, ready to apply the techniques developed for this one. So what started as a couple of Saturdays rapidly increased to two years and thence to an on going endeavor. Already plans are underway for our next analysis of a suspicious looking panel.

From the beginning of the project to the present we have watched the site transform from an almost meaningless jumble of amorphous figures scratched on the rock by a strange and alien people, to a well executed symbolic representation of a people's understanding of their universe. The precisely functioning observatory revealed to us an intelligent and creative people who now seem like old friends that we know and respect. The site can rightly take its place as "The Rosetta Stonehenge of Utah". A rosetta stone because it is the first rock art panel to be interpreted this extensively and may prove to be the key to understanding other rock art sites, and a stonehenge because it rivals Stonehenge as an archeoastronomical observatory.

As you read the paper you may be surprised by how many technical methods and instruments were required to unravel the astronomical function of the panel. I want, at the outset, to answer a question that has been asked repeatedly. So oft people hear how computers were used to simulate the observatory or watch me at the site surveying with a very accurate theodolite or hear me muttering about the sun coming up a degree off and a few minutes late, and they ask:

"Why is all this technology required? The Indians didn't have theodolites, quartz watches and computers. If you require all that to make the observatory work, how could they have made it work?" And my explanation is this.

It is very easy to throw a needle into a haystack, but very difficult to pull it out. The Indians at this site figuratively threw a needle into a haystack. For me to pull it out, I must retrace their steps precisely, working backwards from what information is left on the panel. Rough data about the motions of the sun and topology of the site would help us guess the site's function, but only precise data can make proof.

To set up the observatory they required no more than some

shadow casting device, a simple method of counting days and marking the stone. For us this may seem quite complex because we live in houses with roof and thermostat, clock and calendar, but for them, who lived under the stars and sky, the yearly motion of the celestial entities were self evident and had direct bearing on their daily existence. For these reasons we felt that looking for a solar observational function of the site was not unjustified.

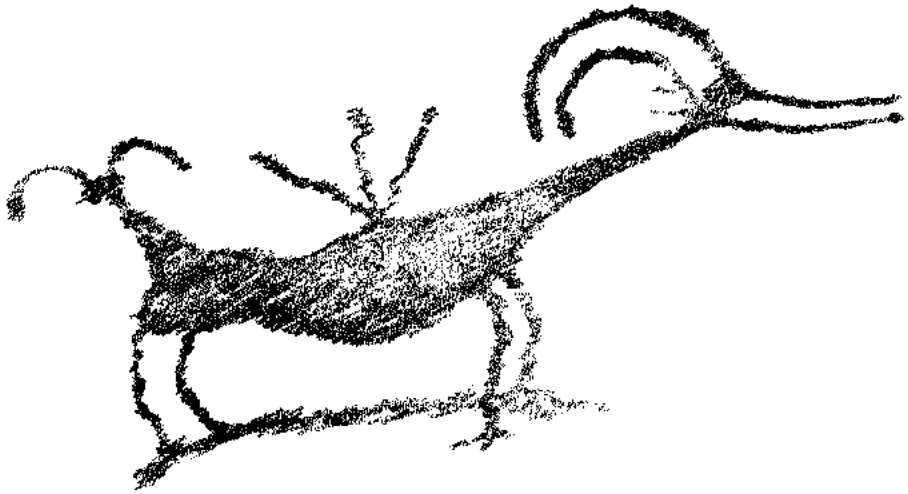
I want to express my profound appreciation and respect to the Navajo, Hopi and Pueblo Tribes for revealing to us some of the details of their religion. I must apologize for the inaccuracies and possible insensitivities that may have crept into the paper. It is not my intent here to be some kind of authority on their religion, but only to interpret the panel in terms of the most likely source of that interpretation.

This is not to say that this panel is from any one of these tribes. The Navajo, Hopi, Pueblo and even Aztec legends are the avenues through which some of the meaning of the panel has been passed to us. There is much of the panel that will never be understood, but because of the influences that must have existed over the whole southwest there must also have been a basic set of religious beliefs that evolved. Some of these found their way into the panel and into the legends. Where the legends and the panel overlap some reasonable intrepretation is possible.

The study has extended for two years and many people have participated to a greater or lesser degree. My profoundest gratitude to Jack Pitts for his help on several trips and for willingly manufacturing or modifying special equipments needed. Thanks to Jerold Lazenby for initially surveying and giving analysis of the earth and rock motions of the site. Ed Fasy gave extensive symbolic interpretation and initially turned the key to the creation message of the panel. Thanks to Ken and Elva Ogden for their tireless support and endless consultation in unraveling the mysteries of symbolic interpretation and observational functionality, through cold of winter and blazing sun of summer ... etc. etc. etc. Thanks to Joe Reese, Jim Simpson, Norm Eiting (and clan), Jay Frandsen and Paul Willard for their participation, those whose sturdy shoulders bore various equipments up and down the trail from camp to site. Thanks to Bob Murdock whose fine survey insturments made it possible to ring out the last remaining errors in the observatory operation. Thanks to Steve Joy and Creg Smith for making it possible to get pictures of the glyphs on the fallen rock and to Julie Pierce for proofing the final document. And last, but certainly not least, to my wife, Bonnie, and my two boys, George and Rick, for being there when nobody else could stand one more trip to Emery County.

.... oh yes, and thanks to the MRC.

Nal Morris
Salt Lake City
September, 1985



THE SOLAR OBSERVATORY

AT

MUDDY RIVER AND ROCHESTER CREEK

There is one characteristic of Utah Rock Art that separates it into two broad categories. Panels that are a jumble of non related forms and figures, and those panels that take on a mural quality. In the latter there is some relationship between the figures and forms, and consequently they give the impression that some kind of story is represented.

One of the panels that fascinated me because of this mural quality was the site at Muddy River and Rochester Creek (See Plate 1). Here there are several conspicuous figures that tie the panel together i.e. a long line running from the top of the panel to the ground and a large rainbow with some rain under it with a lightning strike down to a tree or corn stock. Additionally, there is a scene at the top of the panel with what looks like a herd of the world's wildest creatures about to meet in mortal combat. Also, there are three copulation scenes which I had never seen on Utah Rock Art before.

For these reasons the panel was designated in my thinking as the most interesting in the state. There are many rock art panels in Utah, many in more spectacular surroundings and many with more grandiose figures, but this had that something special which set it apart from the other rock art sites.

When the Sun Dagger Observatory site near Chaco Canyon, N.M. was discovered, I was fascinated by the possibility that some of the Utah Rock art sites could also be observatories. In a discovery like this several of my keenest interests were being combined: astronomy, archaeology, and our beautiful southwestern deserts. But it wasn't until an article appeared in the Sunday newspaper about the Utah Rock Art Research Association that it finally dawned on me that my favorite site could also have some solar alignments. I distinctly remembered that there was a large rock in front of the panel that would cast a shadow on the panel and could make photography difficult.

Pulling out my slides of the panel, I examined them for possible alignments. The most suspicious was that at sunrise on some significant date, a straightedged shadow would be cast by the rock in front of the panel on the long vertical line that we have since named the Creation Line.

RESEARCH BEGINS

In the fall of 1983 I started planning the methods and techniques of our study. I solicited the help and interest of two close friends and we decided to pursue the study of the panel as a interesting hobby item. My task was to analyze the possible astronomical significance and Ed Fasy decided to do an analysis of the symbolic interpretation.

My first task was to learn how to locate the sun in horizon coordinates for any time of day and for any day of the year. This was the only way to proceed in consideration of the very stormy winters and springs that Utah has been having in recent years. If we had decided to use pure observational methods this would have only allowed research on the solstices and equinoxes, and only if the weather cooperated. Later, analytical methods proved to be the only way to unlock the mysteries of the panel.

Being a wayward physicist, I have always been interested in astronomy but in the day of black holes, quasars, and planetary exploration, resource material for the more classical methods of positional astronomy is scarce. I first turned to a little book I picked up in Paris at the "Maison de l'Astronomy" located on the Rue de Revelie, "Practical Astronomy With Your Calculator", by Peter Duffet-Smith. This resource has proven invaluable in the research but I will hasten to add that the methods are more practical on a programmable calculator or personal computer. During the research, I bought a Sperry P.C. which facilitated the study considerably.

Through the winter of 83-84 I marked the shadow cast by a small tree on a wall at the Sperry Corp. facilities in Salt Lake City. This is where I consistently was at sunrise and my fellow employees thought me a little strange when I put the marks on the wall and even stranger when I measured the angle. By spring, I was able to predict the angle of a sunrise within one or two degrees which was much better than I had expected

considering the crudeness of the methods. I regarded the math and positional astronomy far more accurate than my ability to measure the sunrise azimuths, so we were ready to start the survey at the site. (See Appendix B)

In March '84, myself, Jack Pitts, and Jerald Lazenby, a civil engineer, traveled to Muddy River and Rochester Creek to make our initial survey. Though the weather was cooperating, we went not to record a sunrise, but to measure the azimuth from the shadow casting rock edge to the creation line on the panel. We were working with an old army surplus theodolite. Now ,"there is a right way, a wrong way, and the Army way" and the Army way is mills. That's right- a circle is divided into 6400 mills. This rather cumbersome way of measuring arcs was difficult to get used to at first and we apparently allowed some errors to creep into that first survey. The survey stake that we placed on that date has always been accurate but the azimuth from the creation line to the shadow rock's edge was off enough to make us think that we had stumbled on the find of the century! We drove home that spring evening very satisfied with ourselves but quite mistaken.

It was the middle of May before we returned to the site. I have often reflected on how fortunate a mistake that was. It kept our enthusiasm running high even though we had discovered nothing. In the mean time Ed Fasy was seeking some resource for the symbols interpretation, being a psycho-therapist he was most fascinated by this aspect of the study.

-ENTER THE HOPI-

In his research he ran across the "Book of the Hopi". We both became intrigued by the creation and migration legend of the Hopi because there were many of the characters and scenes of the panel that could be explained in terms of these legends. As we became more and more convinced that the scenes on the panel depicted general themes of the Hopi Creation Legend we also related them to the creation legends of the Navajo and Aztecs. In so doing we were able to interpret the panel in its general meaning. We gradually realized that we were looking at these people's attempt to order their universe.

On the night of May 18, 1984, Jack Pitts, Ed Fasy and myself sat around a campfire. Suspended over our heads was an endlessness of heavenly objects glistenning like diamonds on black velvet. To the background of the crackling fire, a choir of coyotes and recorded indian flute music, Ed read to us for the first time the Hopi creation legends. The effect was decidedly mystical as we penetrated the barriers between two cultures, theirs of peace, simplicity and environmental harmony, and ours of complexity, technology and rapid change.

The next morning as I was exploring in the pine forest on the other side of Rochester Creek I found a large eagle feather and paused long enough to place it in the band of my straw hat. I didn't understand the meaning of that at the time but when I

read the Kokopelli legend the significance of the event became clear. The eagle had accepted us into his land to unlock the mystery of this panel. When I picked up the eagle feather, when the shadow of First Woman fell on the panel face and when we heard the creation legends the first time, a feeling of mystical union would come over us.

While mysticism has very little to do with science and I sincerely hope that none of the arguments of this paper are based on mystical reasoning, nevertheless, these feelings of mystical union have a lot to do with the motivation and enjoyment of this research. I feel almost obligated to briefly mention this aspect of the study even though it should not enter into whatever true science we have done. But it may have, and I leave it to others to judge. I could not possibly pretend that I have not felt it and that it has never influenced my thinking.

The Hopi, Aztec and the Navajo believed in multiple creations of the Universe. The Aztec and Navajo believe in four and the Hopi in seven creations. For all groups there have been four previous creations placing the present in the fifth creation. In the story of previous creation, subsequent destruction and new creation, a recurrent theme becomes established that manifests itself in the panel in several ways. The story of birth, death and rebirth is placed in the symbolism and tableau of the panel as these masters of the symbolic weaved their story of creation. For clarity and brevity we are going to call the people that created this panel "The Muddy River Clan" or MRC. This is not to say whether they were Hopi as opposed to Navajo, Anasazi, or Fremont, we only know that the symbols seem to be interpretable in terms of legends from the Hopi and Navajo.

Let's consider the three ways in which the panel's symbols were used to teach the birth, death and rebirth theme. The first incidence of the theme is what we call the creation line. This is the line that starts at the bottom of the panel and proceeds vertically to the top of the panel such that it runs the full height of the rock face. Along this line are found a number of interesting features. The most pertinent to our point are the series of six circles which we have determined to be sipapu. The Hopi call the place of emergence from one creation to the next sipapu. This one symbol suffices for both the womb and the unclosed hole on the infant's head, the fontanel. The soul enters the world through the one and the spirit enters the soul through the other. The Kiva of the Hopi is similarly constructed with a hole in the bottom for emergence and a hole at the top for guidance from above.

Correlating the circles on the creation line with the number of Hopi creations and correlating the zoomorphic and anthropomorphic figures along the line in their upward sequence with the Hopi creation legends, it becomes a convincing argument that the circles do indeed represent sipapu. To follow the creation line upward is to follow the Hopi creation story. At the top of the line comes two symbols that bring their own set of

convincing circumstances.

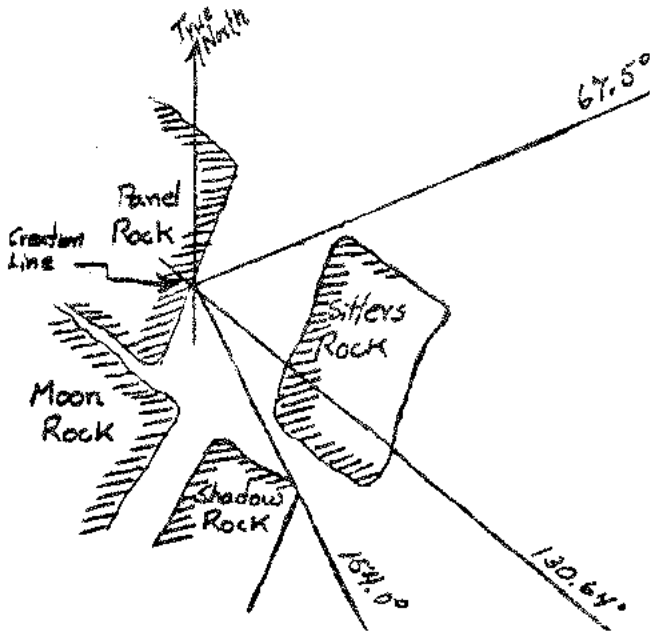
Up high on the line is a spider-like creature with outstretched arms as though beckoning to those below. We believe this to be Spider Grandmother, a key figure in the Hopi Godhead. The Hopi Godhead consists of three beings much like the Christian Godhead, but the total motif of the godhead differs because it contains the father, mother and child figures. Taiwa represents father sun, Spider Grandmother represents mother earth and Sotuknang, the nephew of Taiwa, represents the human family. Taiwa is represented on the creation line by a simple disk as the last feature on the line at the top above Spider Grandmother. Sotuknang is present on the panel as a separate figure away from the line but standing and assuming a position of adoration of Spider Grandmother and Taiwa.

The second occurrence of the birth, death, and rebirth theme is found in the rainbow on the panel face. In all three creation legends each previous creation was associated with a color. The color sequence of the legends do not precisely match the sequence of the rainbow but the implication is clear enough that the rainbow represented the layered universe of the Hopi or more specifically of the MRC. The number of concentric lines in the rainbow are approximately correct, varying from seven to nine depending on where you count. It is assumed that as these people looked at the rainbow, they felt that were getting a glimpse into the universes from which they had emerged in the distant passed. The parallel lines of the rainbow are crossed perpendicularly by lines like ladder rungs. These may represent places of emergence by different clans.

The third incidence of the birth, death and rebirth theme is in the panel's function as a solar observatory. In the religion of the Hopi the yearly motion of the sun and the stars in their ever recycling patterns is a testimony of the ever continuing rebirth of the universe. (I must admit that this has a great deal of appeal for me, too.)

By now we should be getting a good feel for the power this religion had over the lives and well-being of the Muddy River Clan. People who live in the outdoors are acutely aware of the change of seasons and how their welfare depends on those seasons. These peoples religion was intimately tied into the seasons and the determination of the time of their coming and going was of great importance to them, both in a religious and the practical sense for their planting, hunting and gathering the sustenance of life. All this is to lead us to the conclusion that this panel is not only a religious shrine, but is also of practical functionality.

There are several other tableaux that also agree with the Hopi creation and migration legends. These include an outlandish copulation scene, the fat eating bird, the big headed snake, and the Kokopelli legend.



*** FIGURE 1 ***

We next returned to the site in May of 84 to refine our survey data and find out how wrong our first measurements were. While the symbolic interpretation of the panel had made astounding progress, the astronomical significance and solar alignments had disappeared.

Figure 1 is an aerial view of the site. We have named the stones to help identify them during the documentation process. The stone opposite the panel face is about two feet high above the ground level and we have designated this sitters rock. The rock just south of sitters rock will be called shadow rock because it casts a shadow on the panel face at certain times of the year. The rock with the petroglyphs on it will be called panel rock and the rock just south of panel rock will be called moon rock.

As mentioned before, our first hypothesis stated that the vertical edge of shadow rock would cast its shadow on the creation line at the winter solstice. While the first erroneous survey indicated that this was possible, subsequent surveys did not bear this out. Calculations indicated that the winter solstice sunrise would be at 131 degrees south of true north while correct surveys indicated that the azimuth from the creation line to the shadow casting edge of shadow rock was at an azimuth of 154 degrees. Obviously it is not possible that the shadow of this edge was the source of the creation line. But now that the meaning of the symbols had become clear and we knew that the Hopi followed the motions of the sun as a part of their religious observances we felt that we were justified to dig deeper for some solar alignments.

At this time it was decided that if we were going to do serious research and uncover anything of significance we would have to improve our techniques. Two major improvements were added:

* The first was to do a more accurate and extensive site survey. This included the azimuth of the panel face and all possible azimuths of the sunrises for the whole year. We surveyed the eastern horizon across Rochester Creek every one half degree for azimuth and elevation. (See Appendix C)

* Secondly, instead of using the small programmable calculator to fix solar position we would program a

personal computer to give us the azimuth and elevation of all sunrises for any given day of the year. (See Appendix D)

With these two improvements we were now able to be much more diverse in our hypotheses and had some means of investigation and verification. With these new resources we pursued the following five hypotheses:

1. The creation line was indeed the shadow edge of a rock but not of shadow rock. At the time of operation of the panel, sitter's rock may have been whole and therefore would have been as tall as the other rocks in the group. A rough survey of the creation line and the northeast corner of sitter's rock put it in an approximate position to cast a shadow on the creation line at the summer solstice.

2. Our second hypothesis was more "far out". It was simply that the panel could have operated as a solar observatory by the same means that I used to test my skills with positional astronomy. Is there a spot in front of the panel that a post could be placed such that its shadow would fall on significant features of the panel on significant dates of the year ?

3. The third idea allowed the day of the winter solstice to proceed late into the morning before the shadow of shadow rock's northeast edge crossed the creation line. At that time it is conceivable that the upper corner of that shadow would mark the significance of the day depending on how high it was up the creation line. There are plenty of figures on the creation line that could signal these events.

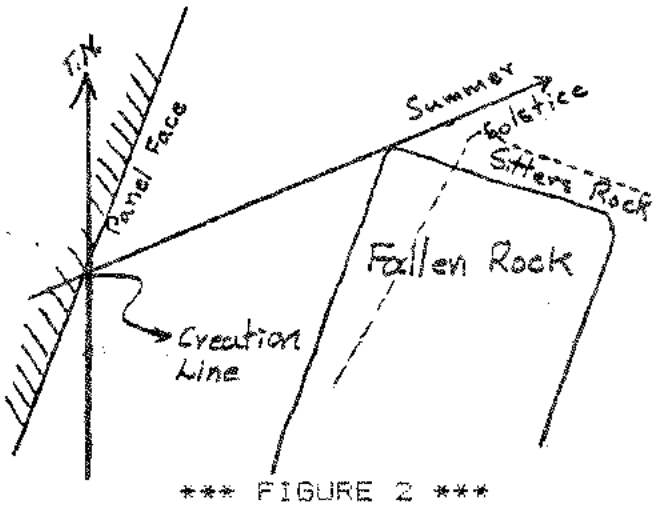
4. The next possibility dealt with the lunar cycles. It is conceivable that the panel has some lunar cycle and alignments encoded in it.

5. And the last alternative that had to be considered was that there may be no reason or need to assume any astronomical significance in the panel what-so-ever.

Each of the five possibilities has been given serious consideration. Each of the first four has been investigated and modeled by computer simulation. One of them, the third, looked incredibly good in the modeling but cannot be seriously tested in the field. I will now proceed to relate the story of the four studies and allow the reader his own conclusion on the fifth.

THE FIRST HYPOTHESIS
*** The Solar Temple ***

The first idea investigated was that sitter's rock was the source of the shadow that created the creation line on the summer solstice. What is now sitter's rock is just the base of a larger rock which came from the same sandstone formation that was the mother stone of all the rocks in this cluster of rocks that make up the site. At one time this rock was then the same height as the other rocks in the group and it is a virtual certainty that the west face of sitter's rock and the panel were contiguous at one time. As erosionary forces from Rochester Creek worked away at the foundation of sitter's rock it migrated eastward from the panel face and created a corridor between the two rocks. This corridor still exists today between shadow rock and moon rock. Now it is the contention of the first proposition that when the panel was first being written on, sitter's rock was still whole and an alcove existed between the rocks. At the time of the summer solstice the sun would be high enough in the north to shine down into the alcove. The sun's rays would proceed farthest south on the panel face at the solstice and was marked on that day. The sun would then start south again and the shadow would not return to that point until the following summer.



*** FIGURE 2 ***

Figure 2 is a drawing of the site from above with sitter's rock placed in position to cast the shadow edge of its northwest corner on the creation line at the summer solstice. Its present position is drawn in to show you the path of its probable migration. Figure 3 is a photo of the site taken from the north with sitter's rock drawn in as it was during what we'll call the "Solar Temple" stage of the observatory. At the time of the summer solstice the sun would have proceeded far enough to the north to shine down in to that little alcove. As the sun moved north the shadow's edge would move south in the alcove and at its southern most point the creation line was drawn. This then was possibly the first stage of the observatory.

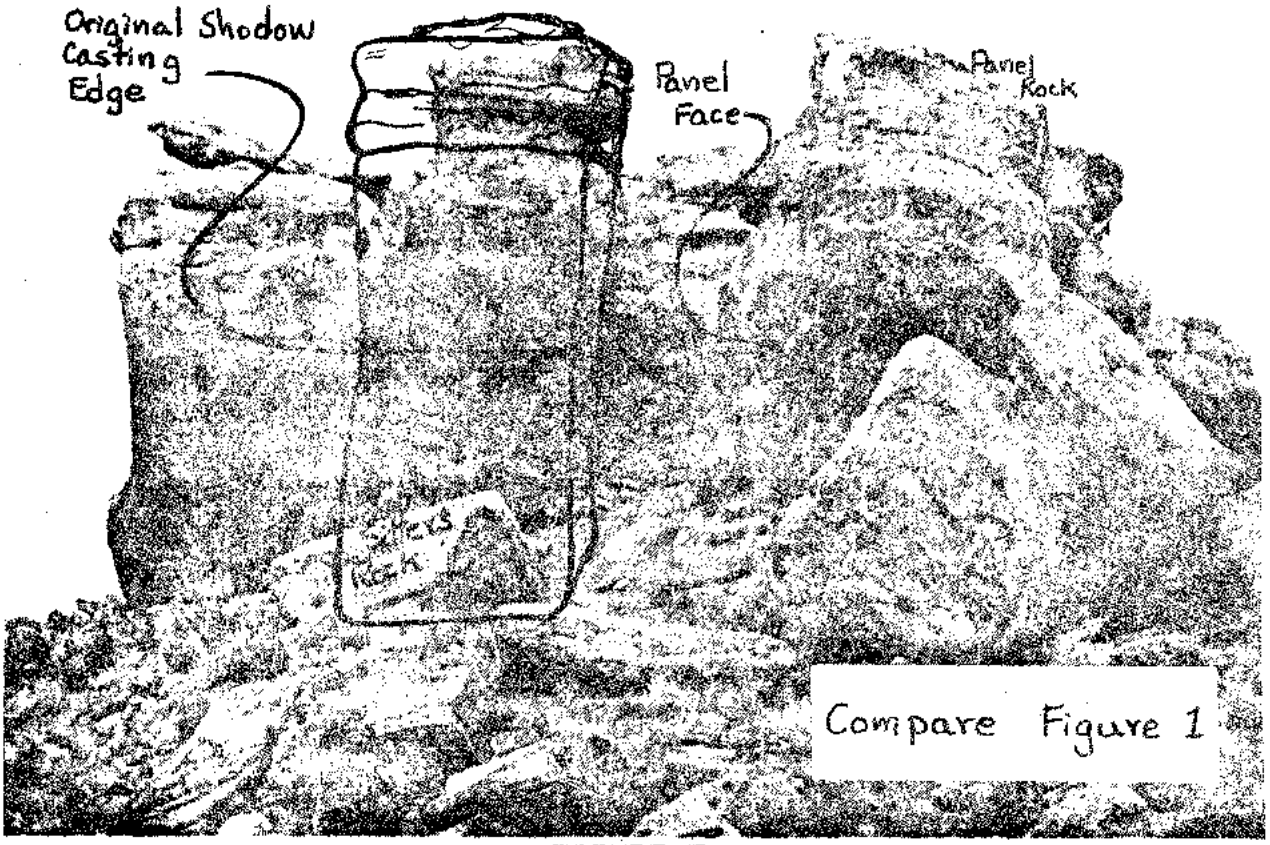
We knew that because sitters rock was part of the same strata as panel rock this hypothesis is possible but we had no hard evidence to back it up. If there was a solar temple there, and petroglyphs were put on the panel wall, it is logical to assume that glyphs would also be on what was then the top of sitters rock. We then went searching for the fallen rock.

Down hill and to the east, only two rocks were possible candidates for the fallen rock. I checked the rock closest and

did not find glyphs present. I sent my 13 year old boy down to see the other rock and if it had glyphs on it.

He yelled back up, "Dad, how did you know there were petroglyphs on this rock?"

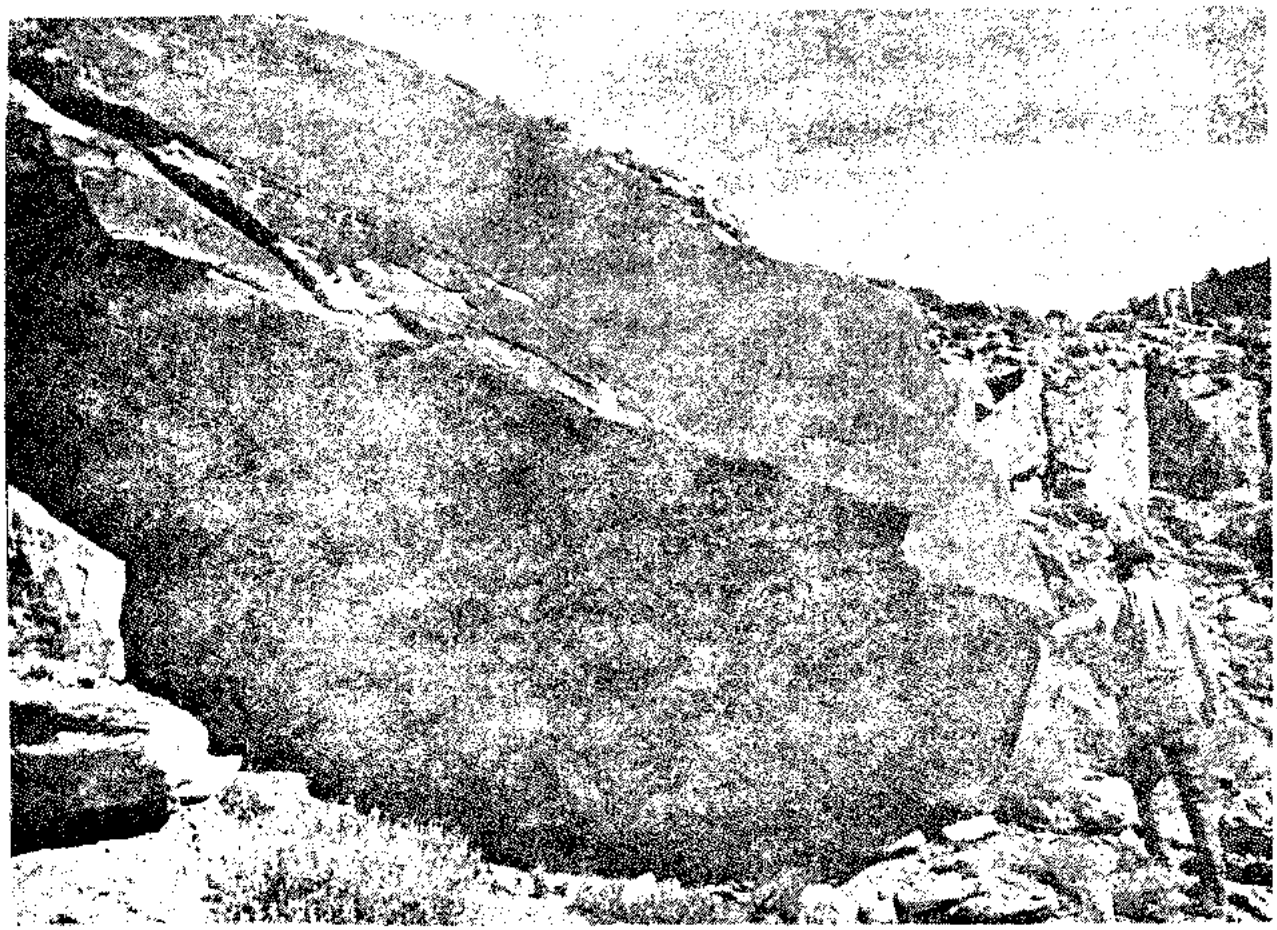
I called back "I'm coming down."



*** FIGURE 3 ***

The rock was down the hillside about fifty yards and over a small cliff. The capstone characteristic of the other rocks of Figure 3 was still leaning against it on the uphill side. The rock lay on its side and the glyphs were on the side now facing up and sloping to the east. The face of the rock with the glyphs is in a sufficiently difficult situation such that it would have been nearly impossible to place the glyphs onto its surface in its present position. Measurement of the rock's base indicates it sat on sitters rock with the "glyph" side facing east or out. The rock is resting on the canyon slope on the face that was inside the alcove of the Solar Temple. This face should also have glyphs on it but it is impossible to see in its present position. (See Plate 2 and Appendix F)

The petroglyphs on the rock are very old and repatenation is almost complete if not total. The only way the glyphs can be recognized is by the indentations on the otherwise smooth rock face. There is much less graffiti on this rock than on the main panel above it. This would indicate that the fallen rock was in place at "sitters rock" very early in the history of the site.



*** PLATE 2 ***

The glyphs themselves are of significance, consisting of what have become known as sun swirls, zoomorphs, and another figure which could be a spider, sun or meteor. If the swirls were used here as they were in New Mexico their presence on the rock could indicate an earlier functioning observatory. At the least it would indicate the presence of a Solar Temple in the alcove on the other side of this rock. The discovery of the fallen rock does not prove without doubt that the Solar Temple functioned as we have supposed, but it is a strong indicator that our first hypothesis could be true. That all depends on how skeptical a person is, but the next hypothesis dovetails into this one and as it proves out. will support our first hypothesis.

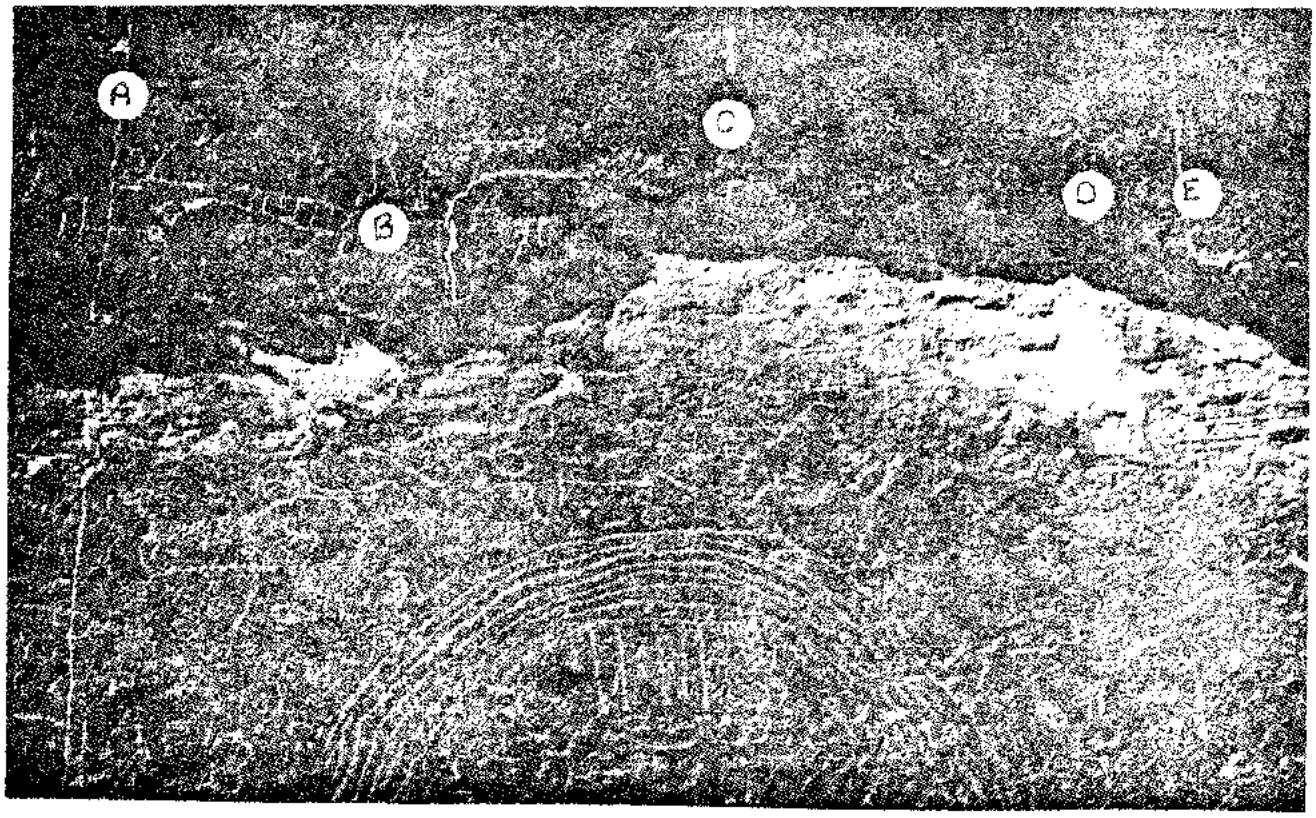
But before we start on the second hypothesis let's consider one scrap of evidence for the Solar Temple Stage that came quite by chance. If you examine the surface soil in front of the panel you will notice small flecks of charcoal from past camp fires. When we presented our findings to the Utah Rock Art Research Association it was mentioned that those bits of charcoal had been carbon dated at 4000 years ago. I do not guess these petroglyphs to be anywhere near that old, but it does prove human habitation at this site from ancient times and there would be no reason for habitation here if there had not been some kind of shelter at this place. The alcove assumed for the Solar Temple would be such a shelter.

THE SECOND HYPOTHESIS
*** The Post Observatory ***

The second hypothesis was based on the idea that a stake could have been placed in front of the panel to act as a gnomon to cast its shadow on the panel at different times of the year. But before we go on into this analysis lets go back to the Solar Temple Stage, just briefly, to link the two hypotheses together, such that the death of one stage will be the birth of the other. Let's assume now that the Solar Temple did function as we have theorized until an earth quake or tremor gave sufficient jolt to the foundation of sitters rock to tip it to the east, break off its top and roll it to its present position. This event exposed the full face of the panel to the sunrise for the whole year but also completely destroyed the solar temple. The keepers of the observatory must have considered this a grave sign from the gods. It is impossible for us to guess what rituals of propitiation were performed at this time, but we submit that the end result was a post or other object erected in such a way that its shadow would fall on the creation line at the summer solstice. In this way they restored their observatory but also it probably took them little time to discover that the functionality of their observatory had been greatly increased. The shadow of the post could now be observed year around. Would you suppose that these people would resist the temptation to mark the winter solstice, the equinox and other significant dates ? The second hypothesis suggests that they did.

We must now ask the question, by what means would we search for the proof of the post observatory? The first answer is that we will look for a set of marks on the rock face on which the shadow of the post will fall, on the equinoxes and solstices. We will start with the creation line, letting that be the shadow mark for the summer solstice as it was for the Solar Temple Observatory. This forces us to look north of the creation line for the other marks. But there are so many marks, the likelihood of the shadow falling on some mark on those dates is inevitable. However, there is a set of marks on the panel that are set apart both by their location, and conspicuous for their nonconformity. These are high on the panel and along an horizontal line about six or seven feet above the ground. Two of the marks are simply straight verticle lines contrasting with almost all the other figures on the panel which are symbolic in some way.

Looking at Plate 3 the marks we have chosen for analysis are designated A through E. We will start with the dot on the creation line at A and marks C and E. As a best guess, we will say that if the shadow of a post were to fall on the creation line at A, then let's find the spot on the ground that will compel the shadow to fall on E at the winter solstice. We will call the mark at E the winter solstice indicator from now on. Knowing the exact azimuth of the winter and summer solstices we will in Fig. 4 draw a line 66.7 degrees from true north from the creation



*** PLATE 3 ***

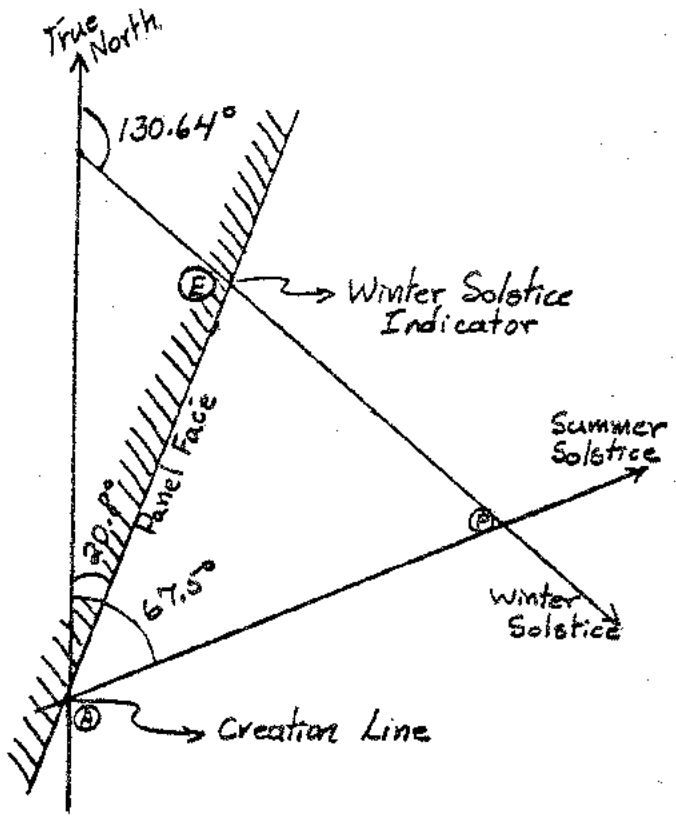


FIGURE 4

line at A and another 130.64 degrees from the winter solstice indicator at E. The two lines cross at point P. Now it is possible to do this on any wall running approximately north and south, that is to find a point to place a post such that its shadow will fall on any two given points on the solstices. So we haven't proven the post observatory yet, we have only shown that there is no obstacle at P that would prevent the placement of a post there. In order to find some proof of our second hypothesis, we must find some other date of significance which will be indicated by the shadow of the post at P. We will therefore use point C as our first test of the observatory. Drawing a line from C through P with a little trig we determine the angle of the line from true north to be 98.36 degrees.

Turning now to the sunrise tables, what are the dates on which the sun rises at that azimuth? Because the horizon is east across the canyon and above the site some 9 degrees the sun does not rise due east on the equinoxes. The tables indicate that the sun rises on the equinoxes at 97.2 and 97.4 degrees autumnal and vernal respectively. If we allow the point P to become a post with some thickness then the one or two degree errors start to disappear and this is all too close for coincidence. This post theory will have to be tested in the field.

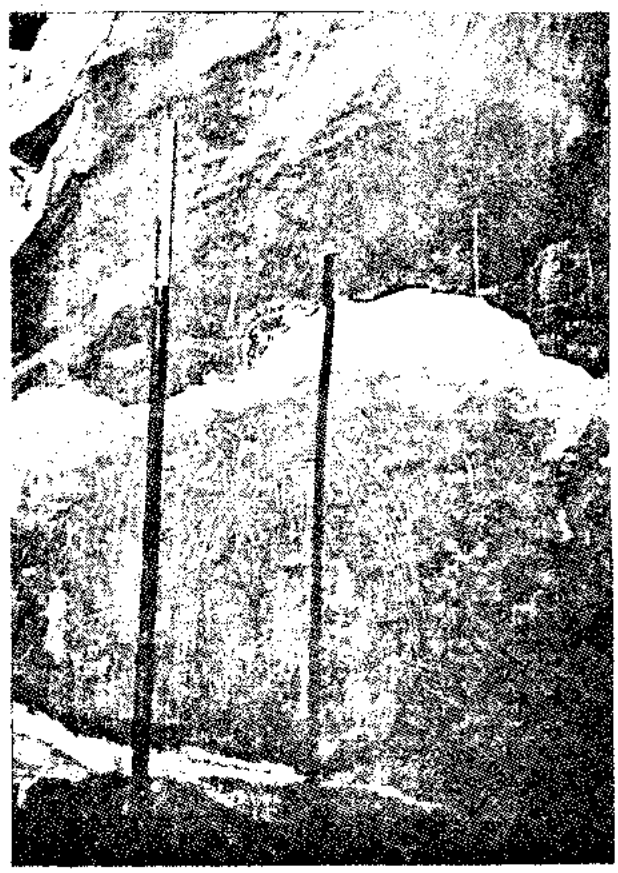
For further investigation to find additional proof of the post observatory, we became interested in the figure we have identified with Sotuknang. This turned out to be one of the more difficult mysteries to solve. The shadow of the post falls on Sotuknang on May 2nd and Aug. 8th, but what was the significance of these dates ? We could search the Hopi ceremonial calendar but even if we found a corresponding ceremony the relationship would be too tenuous to lend support to our post observatory. So the question remained, why did the MRC put Sotuknang on line with the other calendar events ? In Appendix A is the symbolic interpretation of the figures on the panel. In the process of analyzing the meaning of the figures and symbols, it was becoming increasingly suspicious that First Woman may be a constellation. When I identified the stars that made up the First Woman Constellation, I also started to search for a First Man Constellation. First Man or Sotuknang was found right where he was supposed to be. (More on this in Appendix A)

The Sotuknang Constellation looks remarkably like the figure on the panel and when (May 2) the shadow of the post will fall on the Sotuknang figure on the panel the Sotuknang Constellation will stand upright in the night sky.

All things considered it was now time to stop working on paper and to go the the site with a stake and instruments and test the second hypothesis in the field. On Friday, September 21, 1984 we went to Emery County to try the Post Observatory. The location of the post had been determined on paper in late summer. Any verification at that time was done by merely taking the azimuth of the sunrise and comparing it to our sunrise tables to check their accuracy. These always checked out within one degree of the measured sunrise coordinates but now came the time to test the second hypothesis by actually putting a post up and waiting for the sunrise to see if the shadow would fall as predicted. Checking the sunrise tables we found that the sunrise of the equinox was on September 22.

On the morning of the 22nd we rose at 5:30, gathered all the equipment together: the post, its stand, the theodolite, its tripod, a stepladder, notebooks, calculator, compass, level, and photographic gear and started down the trail to the site. There were six of us in the party and all hands were full. Ken Ogden and family were with me on this trip. Ken is a long time friend, good head and an invaluable resource of help and support. In fact it was Ken that made the original suggestion that maybe

the MRC put a post in front of the panel. Myself, Joe Reese, and the Ogden clan gave us all the porters needed. It took about 20 minutes from the camp site to the panel. Our tables indicated that the sun would come over the ridge the other side of Rochester Creek at 8:07 AM MDT. We were at the site about 7:00 AM which gave us the time needed to survey in the position of the post (see Figure E-1 and Appendix E). At point Ⓟ there are four possible positions that satisfy the boundary conditions for the post placement but only A and B were considered. We debated if the builders of the site would follow the leading edge or trailing edge as the seasons progressed. It was mathematically simpler to place the post in the south quadrant at position B and this position was tried first. Of course it turned out that the old shaman that set up this site didn't care two hoots about what was mathematically simplest and our shadow was off about two inches when the sun came up. If the post is placed at position A then the leading edge of the shadow would be correct at all times of the year, we resurveyed the point Ⓟ and placed the post in the west quadrant and waited for the next day's sunrise.



*** PLATE 4 ***

The first rays of the sun appeared over the ridge 8:04 the next morning about 4 minutes ahead of our tables. This is explained by the algorithm of the program calculating the center of the sun's position and not the edge of the disk. This plus the diffraction of the atmosphere pretty well made up the 4 minutes of error. The shadow of the post fell directly on top of the equanoctial marker (see Plate 4). By pure coincidence the post was just long enough to cast a shadow at the height of the marker but not completely cover it. The sunrise on the 23rd was 1/2 degree further south than on the 22nd, which would have placed the shadow on the panel 1/2 inch more to the north. Because of the width of the shadow it would have still have laid on the marker if we had had the post in the west quadrant the morning before.

Now in summary, where have we come? Where does this verification of the equinoctial marker put us? Firstly, the position of the stake was chosen so that the shadow of the solstice sunrises are compelled to fall on the solstice markers. Being there for the solstices would not prove that the site was indeed a functional solar observatory, but we were there at the

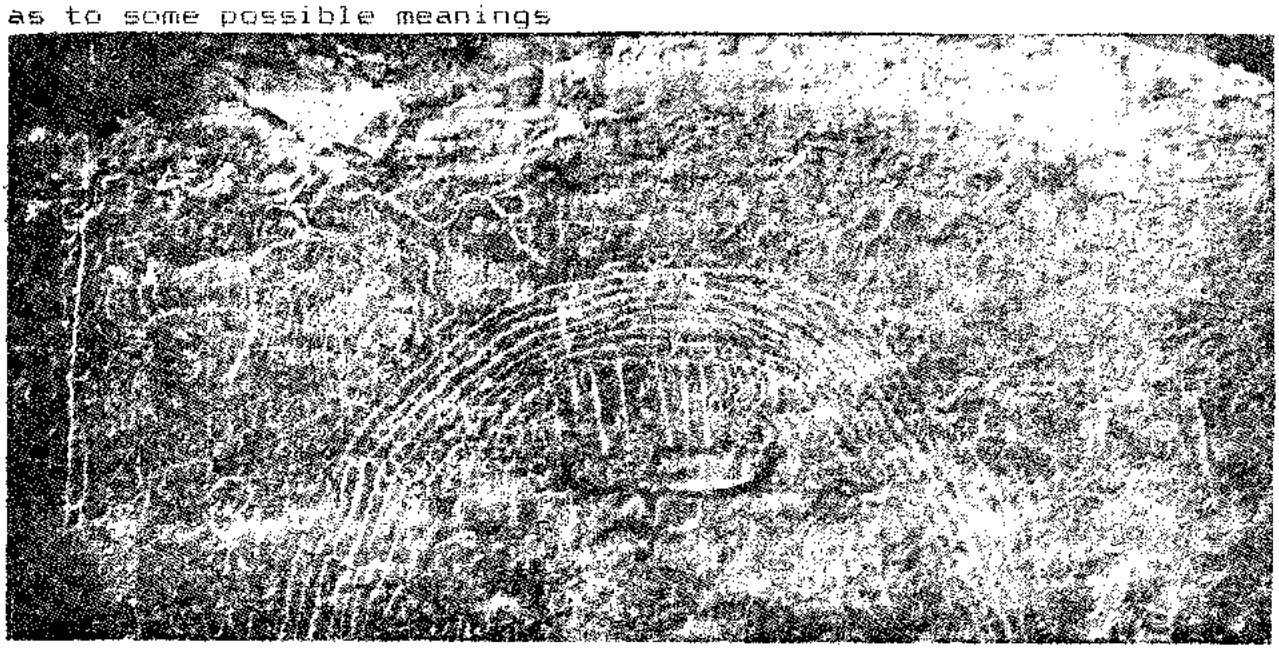
equinox, which did work. Therefore, we have found a place on the ground in front of the panel such that a post placed there will cast a shadow on the two solstitial markers of the panel at the solstices and on the equinoctial marker at the equinoxes. Secondarily, we have demonstrated that our analytical techniques can predict the angle of the sunrises on these dates or any date in the year. Remember that the equinoctial sunrise was not due east but was some 8 or 9 degrees to the south of east because of the elevation of the ridge across Rochester Creek and the equinoctial indicator takes all this into account.

But there is one more interesting marker in line with the equinoctial and solstitial indicators, it is a string of seven beads near the winter solstice marker. To identify the significance of this feature we will first determine the angle of the sunrise that will cast a shadow on the string of beads. By measurement and a little trig we determine the angle to be 125.9 degrees from true north. From the tables the date of the sunrise of that azimuth is Nov 17th. What event occurs at this date? In this century the Pleiades culminate on Nov 21st but because of the earth's precession the Pleiades (or Seven Sisters) culminated progressively earlier depending on how far back in time we go. In the 15th century AD they culminated or were directly overhead at midnight on Nov. 17th. This may be used to fix the date of the panel but this is a little premature at this time. Aside from the fact that there are seven pleiad stars and seven beads, is there any other supporting evidence that would justify the conclusion that this is indeed a pleiad indicator ?

We know that the present day Hopi watch for the Pleiades to culminate during high and sacred ceremonies in the late November and early December. They believe that there are seven creations of the universe and that there are seven pleiads one for each creation. As the Pleiades culminate the very special Soyal Ceremony climaxes, but this is not all, the ancient Mesoamerican Indians watched for the culmination of the Pleiades to climax their most sacred of ceremonies at the end of a 52 year cycle. At this time their sacred and secular calendars coincided and the sun was reborn and would last for at least another 52 years. This was called the New Fire Ceremony by the Aztecs and was accompanied by human sacrifice. If the MRC believed like the Aztecs that the sun might die at the culmination of the Pleiades then there is great reason for them to mark this event on their calendar.

This in concert with the equinoxes, solstices and Sotuknang figure make a very strong supporting case for the Post Observatory. For that many events to be indicated by the shadow of a post placed in front of the panel by pure coincidence is too absurd to seriously consider.(See Appendix G.) There is only one conclusion possible: These Indians created a fairly sophisticated solar observatory at this site. The level of sophistication approaches Stonehenge for solar observation, and may indeed surpass it.

How could I be so brash to state that these "scrubby indians" could do such a thing? How could this scratching on the rock surpass concentric rings of massive stones in all their fame and mystery? Well, let me explain. First off, these people used their brains and not their backs to accomplish as much in the astronomical sense. In the austere economy of their environment there was not the resource to waste effort on moving massive stone many miles, so with less effort they accomplished more. Additionally there are other markers that we may be able to decipher significant dates for. In Figure 7, other possible date markers are designated in addition to the ones already discussed. These are marked "x" and "y" and the shadow of the post will pass over all of them. Let's consider the date of each and speculate as to some possible meanings



*** FIGURE 7 ***

x East Marker

There is a matched set of markers on the panel that have eluded interpretation up to this time. They both look the same and one is drawn to the left. One of the markers appears on the creation line. The other is on the top/left of the rainbow and since the one on the creation line is a date indicator we assume that the one over the rainbow also indicates a date. The post's shadow passes the date indicator at (X) about April 14 and Aug 29 every year. The azimuth of the sunrise on those dates is about 85 degrees east of due north. The south side of the shadow hits the marker a couple of days earlier when the sun is at 87 degrees to the east of north. It has been speculated that the MRC was trying to indicate a due east sunrise and hit it within 3 degrees. Another explanation may be that these are good times to plant and harvest corn. But is it all that important that we know what date is being indicated? Our point here is that this is a date indicator of some kind and demonstrates how the MRC used the observatory as a yearly calendar.

y Rain Markers

The shadow will pass these rain markers between March 7th and April 4th in the spring and between September 7th and October 5th in the fall. Are these rainy times of the year in Utah? Did the ancients confuse the cause and effect? Or in other words by making the shadow pass over the rain markers the old shaman made the rains come and go. Notice that the shape of the rain markers change from straight lines to wavy lines under the rainbow. The shadow will pass this point on March 15th and September 27th, did the shaman change the rain to snow and visa-versa if the straight lines represent rainfall and the wavy lines represent snowfall?

It is hard to say all this for certain but surely if these people knew that significant solar events were marked (or caused) by the shadow then the shadow could also be used to indicate other seasonal events of weather, planting, harvesting, hunting, migration and ceremonies. But we are thinking like 20th centuryites, because these people probably believed that as the shadow passed or arrived at significant points it caused the event--like the sun to turn around and start south again--or north, as the case may be. It caused the rain, or the Pleiades to rise high in the sky at midnight. This is characteristic of the "mythical religious consciousness" as described by Ernst Cassirer.

THE THIRD HYPOTHESIS
*** The Creation Line Observatory ***

*** PLATE 5***

As to this hypothesis let us dismiss it quickly even though extensive work was done. The idea was that maybe the day of a given event was allowed to progress later in the morning past sunrise to when the sun passed the 154 degree azimuth. At this passage the upper extent of shadow rocks shadow casting edge would act as an indicator of the significant date. This worked out very well on paper and complete computer runs were done to establish various dates as the shadow passed over the creation line. While the observatory worked well on paper and in computer studies there is no way to verify it at the site because the upper corner of

shadow rock's edge has been rounded off by weathering. In fact some time this fall (1984) the northeast upper corner of panel rock has likewise broken off.

While we were looking at the shadow cast by shadow rock late one morning in November we did notice something that I will include just for fun and mystique. As the shadow crosses the panel face it makes the outline of a well-rounded indian squaw, looking very much like First Woman as she is described in "The Book of the Navajo". (See Plate 5)

THE FOURTH HYPOTHESIS
*** Lunar Alignments ***

The fourth avenue of investigation concerned possible lunar alignments and/or significance. We have not as of yet actually looked for any lunar alignments which are still a possibility and some software has been written to search these out. The work associated with the other observatories has been too consuming, and when complete we may yet investigate lunar alignments. There is, however, some evidence concerning lunar monthly cycles. On the north face of moon rock (of which only a small part is exposed) there is a glyph that seems to have lunar significance. This panel, though small is very interesting in both its symbols and also its numerology. The panel is reproduced in Plate 6. It consists of what we will call the fat eating bird and an anthropomorphic figure surrounded by approximately 28 dots, but not sufficiently defined to count precisely, and two supernatural figures somehow threatening the human figure but protected by the halo of dots.

*** PLATE 6 ***

The items we want to consider next are a series of 22 small circles or moons with a set of three large moons above them. If we number the moons from the left we will notice that moons 14, 15 and 16 are a bit larger then the others. This is to be expected but it asks a question for which I can't find a good answer. If the larger moons in the series of 22 represent the time of full moon they are precisely in the right sequence, but this assumes that the shaman started counting at the new moon when the moon is not visible. If they had counted the whole monthly cycle why is there not 28 or 29 moons in the series ?

I am going to offer three possible explanations for this panel, all dealing with the lunar month. The first and last deal more from an observational point of view and the second more from the pure numerology built into the panels. As to which one is correct, I guess the first would be a more likely explanation but none have been proven.

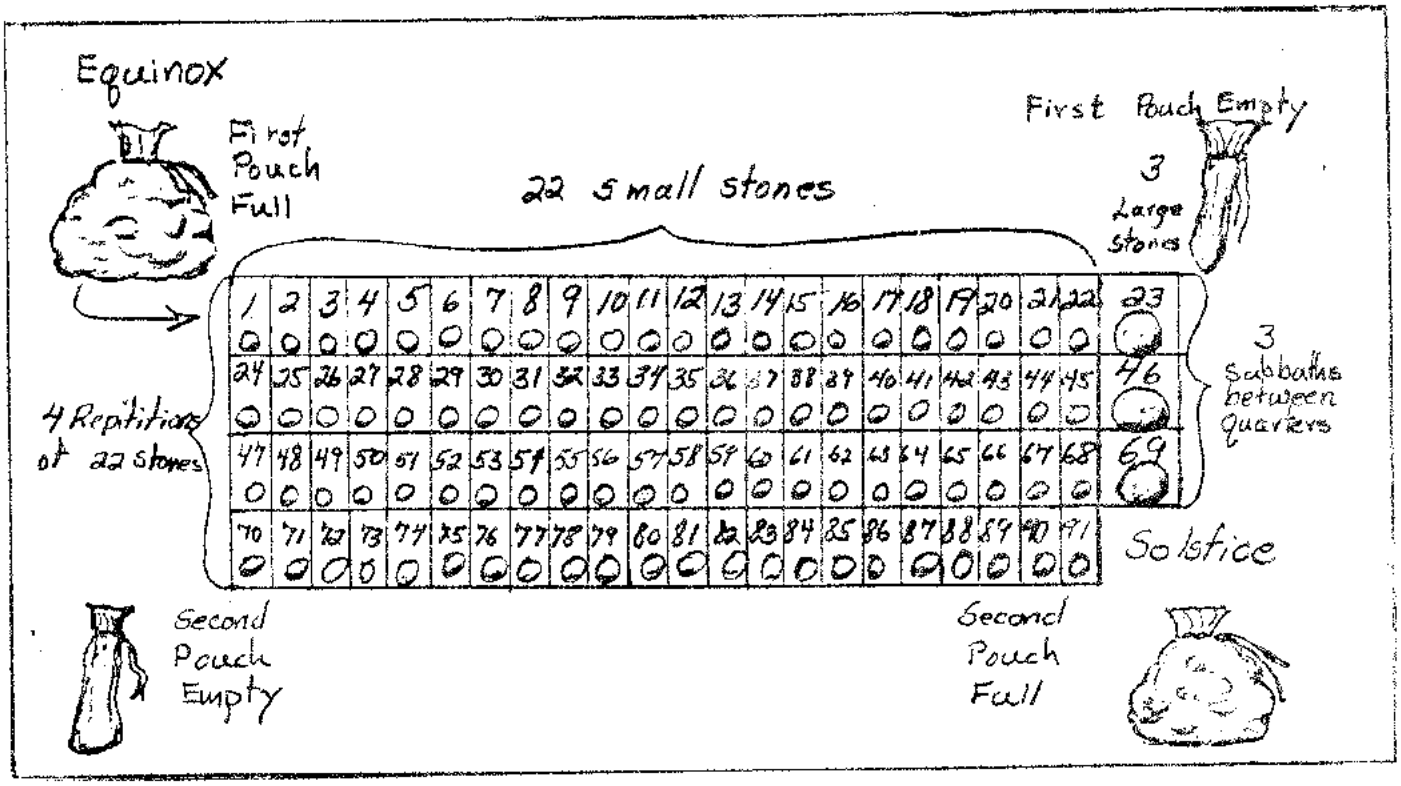
If a person were working graveyard shift outside and there were clear skies for a whole lunar month he could observe that there are only a few nights in that month that the moon did not shine for some signficant part of the night. For these few days during the month there is no moon or the moon would only be visible for a short time in the morning or evening as a thin crescent. During these times a mysterious looking phenomenon (the earthshine) could make it look to the primitive mind that the moon was contesting a battle between light and darkness or dying and being reborn again. These nights could be considered to be times of high danger from threatening spirits as the forces of evil killed or the fat eating bird eats the moon until it was reborn again in all its splendor. The number of these days through this death and rebirth of the moon would fairly well average seven. The seven days of dark nights and danger would require special incantations to ward off the evil spirits that would prevail during that time. This explains the human figure on this small panel which is being guarded by the halo of dots from the aforementioned evil spirits. The MRC here did the most logical thing in counting the lunar month by counting the 22 nights when the moon was present. For you and me in this century we would count the seven days with no moon because we have a pure concept of number as an independent thing. For the primitive he counted that which existed, not that which didn't exist. To put a moon on the rock for the nights when there was no moon just wouldn't make sense to him. The 22 moons on the rock for the nights when there was a moon plus the seven days when there was no moon makes 29 days--a full lunar month. This gives a possible explanation of the number 22 and also some feeling for the meaning of the rest of this little panel. But there is one more set of numbers that we need to address before we are through here. Above the series of 22 moons there is a set of three larger moons. I suggest that these are indeed full moons and are a count of full moons in any given quarter. How did they know the length of a quarter ? By the large panel, of course, which gave them the time of the four quarters of the year.

*** The Two Pouch Calendar ***

The second interpretation of this small panel is based on more supposition and pure numerics. It is offered here without proof but is included because it works well and has a logical derivation from the Navajo creation legends. Contemporary with this people in Mesoamerica there were much larger and more grandiose civilizations. We know that there were some links and influences from these larger civilizations on the people of this site. Principal among these are the creation legends, the layered universe and the belief about the Pleiades. Many of the Mesoamerica people had a sacred and a secular calendar. The sacred calendar had a 20 day week or month (whichever). The 20 day month probably originated very early because that was as high as a man could count having only 20 fingers and toes. It is also possible that the 20 day week came from their creation story just like our 7 day week comes from our creation story. As the Mesoamericans gained more sophistication for counting and following yearly cycles (which they did very well) they still, for reasons which remain their own, retained the sacred calendar with the 20 day month. Having two calendars was the cause of much folderol and especially when the two calendars came into synchronization every 52 years. At this time came their most holy ritual or New Fire Rite which entailed human sacrifice.

Let's assume that migrating north with the other traditions came the 20 day month. But the Muddy River Clan being far less encumbered by tradition and religious dogmas and not near so well off as to a have a professional priesthood to keep track of two calendars found it eminently more practical to add two days to the month to make a 22 day month. In so doing these people solved one of the Aztec's most cumbersome problems, that of reconciling their two calendars.

Assume that the shaman of the tribe carries two small pouches tied around his middle. (See Figure 8) He has just observed the passing of the solstice or equinox. At this time one of the pouches is empty and in the other pouch there are 22 small round stones smooth, with wear from years of handling. In addition with the 22 small stones are three larger stones in like condition. On the next day after the observance he moves one of the small stones to the other pouch and continues likewise one small stone each day until all the small stones are in the second pouch. On the next day he now must move one of the large stones and this will be a special day we will call, for lack of a better word, a sabbath. On the sabbath maybe the tribe rested or celebrated or otherwise marked the day but the shaman also went through another small ritual of sorts. He moved all the small stones from the second bag back to the first. At the first sabbath 23 days had passed. On the first day after the sabbath he started the process over again moving a small stone to the second bag each day until they are all gone. On the second sabbath he moved the second big stone into the second bag and 46 days have passed. On the second sabbath he again moves all the



*** FIGURE 8 ***

small stones back into the first bag and on the next day the cycle starts over again. On third sabbath he will move the last big stone into the second bag and the small stones back into the first bag and 69 days have passed. On the first day after the 3rd sabbath he starts moving the small stones for the last time this quarter. When all the small stones are in the second bag he will have completed only 22 days this time and 22 plus 69 make 91 days since the last equinox or solstice. It is now time to be back at the site to observe the next equinox or solstice.

It is important to realize that the shaman could not always stay at the panel watching the shadow move up and down the panel as the seasons passed. This little two pouch calendar gave him the freedom he needed to follow the tribe as they migrated to hunt, gather and harvest but he could always know when the next event was about to take place. He also bested the Aztecs because his calendar was self correcting, no 52 year cycle to bring the whole thing back in line. If the 1/4 day accumulated when he got to the site for a equnoctial or solstitial observance he simply waited a day and the whole system was brought back into beautiful alignment. If it was cloudy on the day of the observance or he was somewhere else, the rites and ceremonies could go on without a hitch very close to their proper day if not right on it.

One supporting bit of evidence for the two pouch calendar comes to us from the Navajo . When the Navajo insect people were told to leave the first creation they proceeded to the second through a hole in the sky. When they got there they were peacefully hosted by the Swallow People for 23 days until they offended the chief of the Swallow People by using his wife.

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done on this observatory but when it was time to test it in the field the indexing point on "shadow rock" was too ill-defined to work toward a conclusion and the effort was stopped.

Our fourth postulate was a lunar observatory and we explored this in several avenues which are pretty interesting but without hard evidence to support them. A person could plot the course of the moon over a full Saros cycle, 18 years 11 days and 8 hours but the work would be prodigious and the rewards could very likely be zero.

But with all this we can only make a case, never call for a verdict. I believe the case is strong when taken in its entirety but it can never approach the level of historical fact. But let's say, for the sake of argument, that we give it up, it's too far out, too neat, because rock art just can't be interpreted that completely. OK, but the strange marks are still there (equinoctial and solstitial indicators) the here-to-fore undefined spot in front of the panel still exists, the seven beads of the Pleiades are still there, and when the post is in place it would still mark the Pleiad culmination as of 1500 AD. The sipapu are still spread up and down the creation line and Spider Woman still looks out on the millenia of sunrises (or at least until ignorance destroys her). The Fat Eating Bird protrudes his ominous presence on the scene with great hollow eyes inviting deeper introspection. What I'm saying is that we can't make it go away, if this interpretation fails,someone else will read "The Book of The Hopi" and see the panel and the whole thing will start over again. Once the public knows that the post observatory works, it works! Just because these Indians weren't supposed to be that smart doesn't make it unwork. And at this late stage of the game it may introduce more questions and problems to deny this interpretation than to accept it.

Appendix A

SYMBOLIC INTERPRETATION

It is highly appropriate that we add a section to this report explaining how the symbols in this panel interact with the legends of the Navajo and Hopi. The fact that the panel can be considered both Navajo and Hopi, showing the early branching between the two tribes is in such a logical/interesting way. We are not asking you to believe that the interpretation comes from outer space or the Old Testament, nor even the Book of Mormon, but we will show that there is good symbolic evidence that the panel can be understood by considering legends from Indian tribes that are related to our region.

Because of the rough correlation of most and it is easy to interpret a individual figure or two, so is we should only see figure or part of a figure as have proven lacking, but as we go through the panel finding multiple symbols that relate to the legends, a kind of synergy is set in motion. We have identified as 15 or 16 such relationships, and the geometric nature of probability tells that the likelihood of making that many (even) rough correlations from pure chance is as getting minutes. Some of the relationships between symbol and legend are much better than rough and seem quite convincing by themselves, so as we ponder the panel as the pictorial representation of the Navajo-Hopi creation stories we have a whole matrix of mythical events in which to lay these symbolic representations. Therefore, as this path the question arises: Is the acceptance of this interpretation justified? In this section I will list the figures interpretable from the legends in support of this contention.

Another thing that must always be kept in mind is the difficulty of the media and the techniques. While we are accustomed to seeing great sculpture in stone we should not judge these works by the same criteria. If you were given the same tools as were your more your would find it quite difficult to duplicate this rock art. But you must also understand that you have years more much richer tools at hand and potential to develop eye/hand skills to produce artistic form. All things considered, I am somewhat pleased with the artistry of rock art.

Before we go into a figure by figure interpretation let's consider the creation legends of both Navajo and Hopi to illustrate how the legends arrived and how they influenced the lives of the tribes. In the Navajo and Hopi creation stories there are multiple versions of the creation. The two legends are in rough agreement in this regard, but an interesting point is how the legends differ as the transition from one creation to the next takes place. The Navajo tend to be rescued by through the roof of the universe to escape into the next creation, while the Hopi, on the other hand, took refuge in an underground as the old creation was destroyed and a new one created. Just a little knowledge

about the dwellings of the two tribes tells you that this facet of their creation legends was modeled after their respective traditional domiciles.

The Navajo build hogans which are above ground and much like an inverted bowl. Traditionally there is a smoke hole at the top center. In their creation story they were first created as insects and as they are dispelled from the first and second creations they fly up to the sky, poke around at the roof of the earth until they find a hole and fly through to the succeeding creation. Now, what Navajo child had not watched an insect in his hogan take flight, bump its head on the roof a few times, find the smoke hole and fly out into the sunlight ? When he was told the story of his creation it related to his experience and fit harmoniously into the facts of his existence. It is this relatedness that intrigues me most and generated the unity that these people felt with their environment. While the existence of this people may well have been austere on the surface psychically it may have been far more harmonious than ours.

Likewise, the Hopi lived in kivas or pit houses which were in the ground. As they were preserved from one creation to another they lived with the ant people in their kiva or ant hill. Here they avoided the destructions of fire, flood, and freezing cold to emerge into the next creation. As each Hopi child heard the creation legends for the first time he or she related to the kiva in which they lived and how it preserved them from the freezing cold of winter, the burning heat of summer and kept them dry during the cloud burst.

These little examples are given to help the reader get a feel for the function of symbol and legend in the lives of this people. While the legends are indeed myth, they are not just myth. There is a very real component to most of the legends. This real component had an important function in their daily existence such that the legends helped them cope with a universe of things that they did not otherwise understand. By using the seemingly mundane experiences of daily life to be the building material of their cosmic model, they elevated their daily existence and put the universe into terms that they could deal with. The simple life processes took on more meaning. For instance the routine task of growing, grinding and preparing corn (maize). For the Hopi corn is a sacred food and the milk of mother earth, it is found in ritual and legend, but it is also their main staple.

Consider the function of the solar observatory as it operated here. It was not just a calendar device but an object, a temple, a place for ritual of extreme power. As the shadow of the post or rock reached the summer solstice indicator, the sun was turned back by the power of the symbols on the panel causing the old sun to die and the new sun to be reborn. This always worked, demonstrating their power over the universe, which alleviated their feelings of helplessness in an austere environment.

One other point will help us as we look into the meaning of these figures. These people were more right-brained than we are today. As we look at the panel we are frustrated by the lack of organization or sequentialization of the symbols. We have been taught to linearize our thinking in order to understand and deal with a highly technical and very complex society. None of this would have been appropriate or advantageous for The Muddy River Clan. Their daily life routine demanded a more right-brain orientation of their thinking, like our daily life demands a more left-brained orientation. Hunting, gathering, planting and harvesting are not left brain tasks. If you have ever tried hitting anything with a bow and arrow without sites you will have a better understanding of what I mean. Of course this all concedes that because of speech all men are left-brain dominated. Here we address only the question of more or less domination which I believe becomes an issue as we try to understand the conceptualizations of a very different people from ourselves. It will therefore be common during this explanation that a given symbol will mean two different things or that the same thing may be represented by two quite different symbols.

Let's now proceed through the symbols on the panel and place them into the setting of these legends, and when I'm finished you will have a profound respect for these people's conception of the universe. In many ways it betters western society's philosophical/religious view of the creation.

TAIOWA
The Sun God

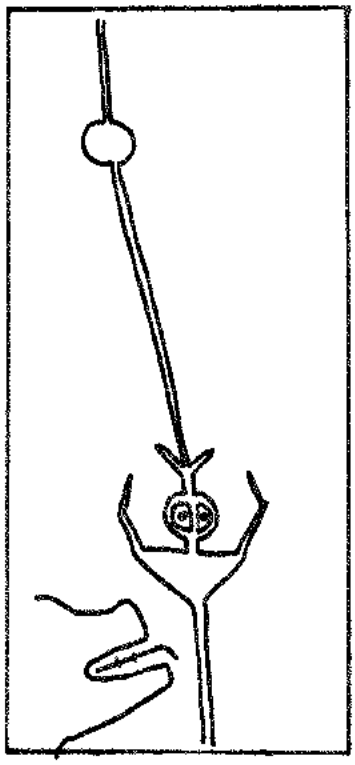


PLATE A1
Taiowa and
Spider Woman

For the Hopi, Taiowa is the creator of all things and the supreme god of the universe. He is essentially the sun and that is his face. He is the father of all living and represented on the panel by a single disk on the creation line. This disk is the last object on the line at the top. This is consistent with Hopi religion because he is the highest deity and is never represented by other than the sun. When a person believes that his ultimate father is the sun, which for biological and astronomical reasons makes good sense, I find myself intrigued as to the impact such a simplification of religion would have on the human psyche. Like the warmth of mother's arms said mother's love did the warmth of the sun say god's love. In a society as complex as ours a person can hunger for such simplicity. Not assuming that they had any special scientific knowledge, but this perfect overlap of science and religion must have had a unifying influence on their emotional selves and they and may never have experienced the psy chic disunion we live with today.

SPIDER GRANDMOTHER

Descending down the creation line we find the next principal figure in the Hopi Godhead. Spider Grandmother represents the earth who is the mother of all living, so the Hopi Godhead now has a father and a mother figure. Here we find the same unity between science, practical experience, and religion. As the sun is the father of all living and the photon is the cosmic sperm of all life, so is the earth the womb, the mother of all living. This is a possible source of the spider woman motif, as these people saw life emerge from the soil, ant hills, and spider dens they assumed that this was the origin of life (and were not so very wrong). Here, one cannot help but think of the Egyptian scarab and the same associated significance. (Another possible source of the Spider Woman Legend will be considered later when we show you a Spider Woman Constellation.) Just as the earth is more accessible than the sun,and as mothers are more accessible to their children than fathers, Spiderwoman is more accessible to the Hopi than Taiowa. In fact Taiowa was only accessible through Sotuknang, his nephew.

SOTUKNANG
The Star God

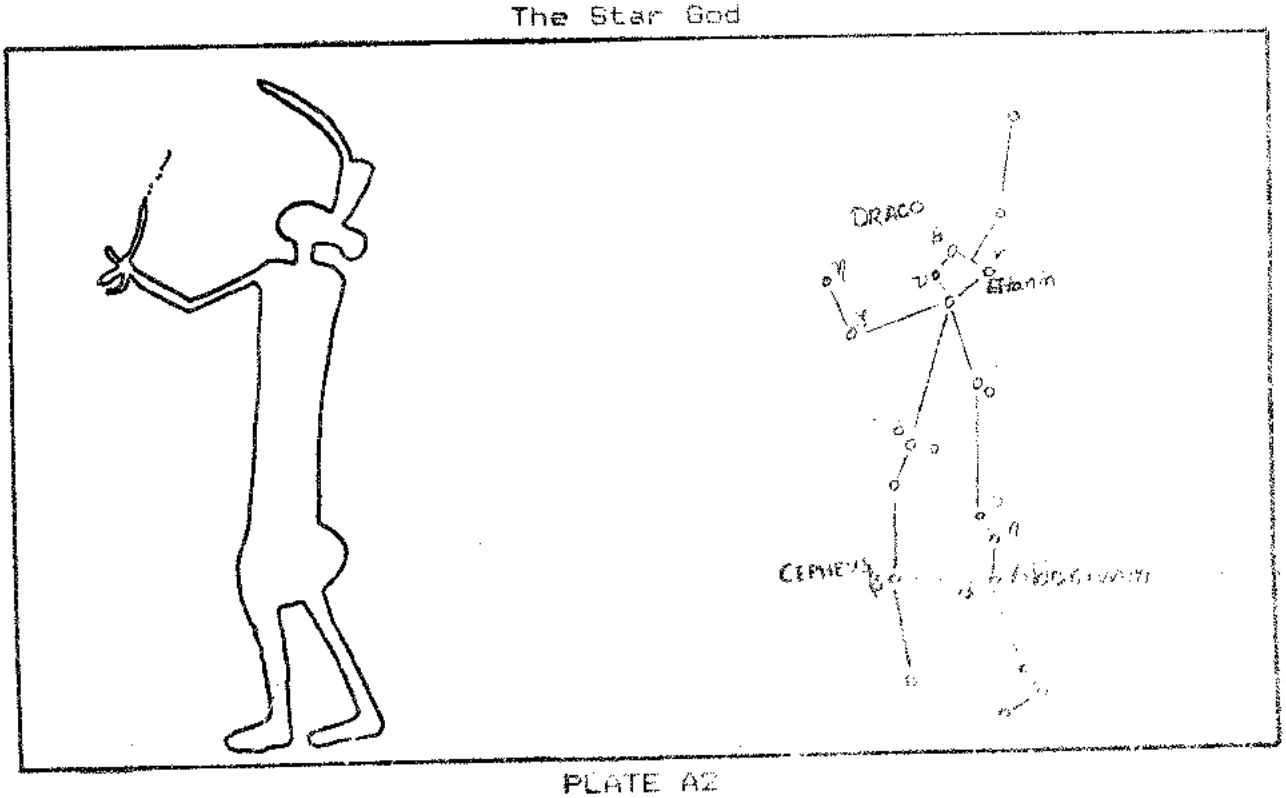


PLATE A2

The next figure on the panel we will address we have identified as Sotuknang. Sotuknang is the nephew of Taiowa and so the godhead now is complete, it has father, mother and child figures. A more complete godhead motif than many Christian religions where the mother figure is missing. In the Hopi tribe

there are one- and two-horn societies. This panel probably provides us with an explanation for the significance of the horns and we will cover that below, but Sotuknang is a member or patron saint so to speak, of the One Horn Society and he appears several times on the panel. The occurrence that we are concerned with here is near the top of the panel and to the right of the creation line. He is seen here holding a stick or possibly a flute in his hand and showing some form of respect for Spiderwoman in contrast to the fighting animals around him. As you study him you will notice that he has one long horn or more like an antenna protruding from the top of his head and a bun hair do, his body is long and legs and feet well defined. Tyler in"Pueblo Gods and Myths" tells us that Sotuknang is referred to as the "Star God" and uses a different spelling for his name "Sho'tokunangwa" which may be derived from the word for star, "sho'hu". Tyler leaves it as a mystery as to why Sotuknang is called the star god but I believe this panel sheds some light on that question. Sotuknang is also a constellation made up of stars from Draco and Cepheus (more on this later when we discuss First Woman). Compare the Panel figure with the constellation and you will notice that the legs curve back on both figures and they both have the little protruding buttocks. Additionally, they both have one horn on the head and both heads protrude back oddly. Their arms are out stretched and their bodies are elongated.

If we search the panel for other occurrences of this person we find him about halfway down the creation line to the left,(See Plate A4) this time holding a large circle or sipapu in his hand. As you study The Book of The Hopi and read the creation legends you will note that it is Sotuknang that provides the sipapu or places of emergence as The People make their transitions from one creation to another. With this figure holding out a large sipapu and standing near the creation line having one horn and the bun on his head it seems certain that this is Sotuknang. Two other occurrences of Sotuknang may be on the panel that we can briefly mention. Lower down the panel to the left of the creation line is another figure with approximately the correct headdress but this time the body is fat and the action of the figure is indeterminate. Again on the right at the third sipapu from the bottom there is another possible Sotuknang figure with one hand on the creation line and one hand outstretched toward one of the possible constellation figures. I will address the possible significance of this when we consider the constellations.

RAINBOW
*** The Layered Universe ***

For the explanation of the rainbow we will draw mostly on the Navajo legends. The Navajo, much like the Aztecs, believed in a layered universe, and for both the Navajo and the Hopi each of the creations was associated with a color. The colors that are associated with creations don't match in sequence those of the rainbow but I don't doubt that the MRC accepted the rainbow as

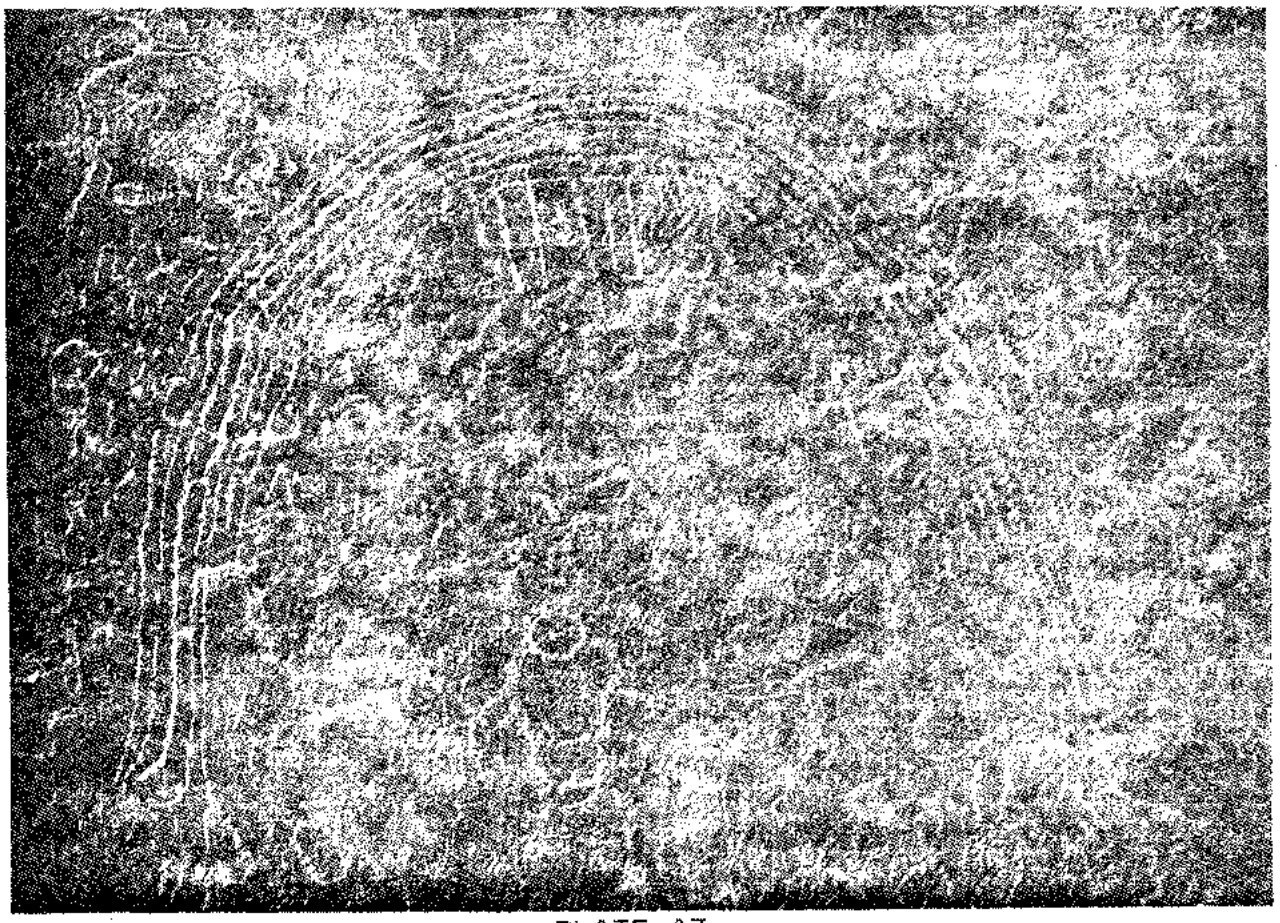
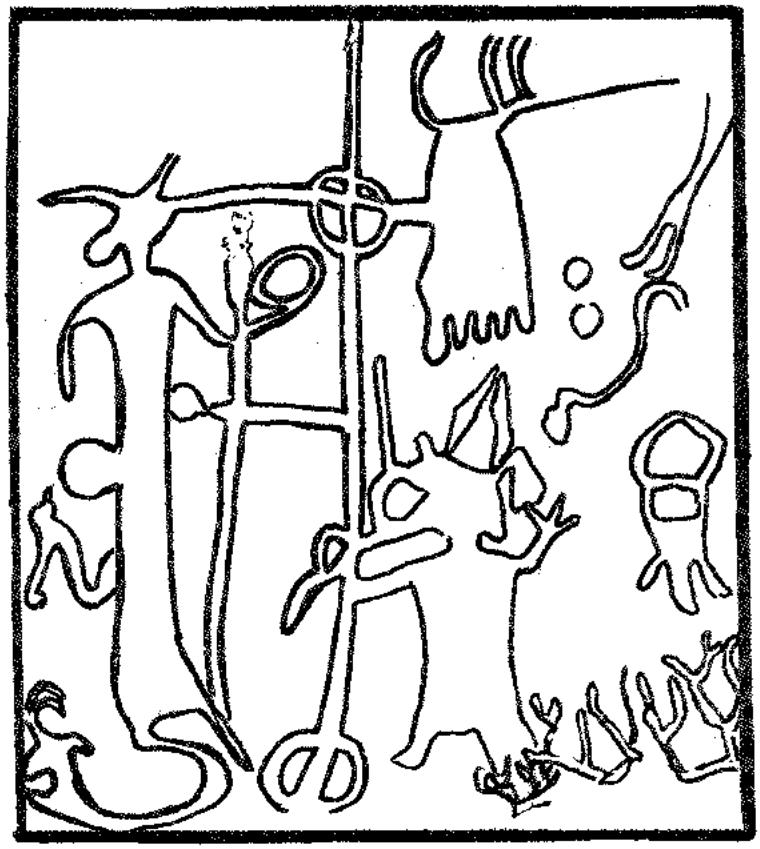


PLATE A3

the basic model of their universe, with each color representing some previous existence. This rainbow has too many layers for the Navajo but is about right for the Hopi. It is the Navajo that believed in the inverted bowl shaped world and as they flew up to the roof of the world they looked for an opening through which to pass into the next world. As they looked, blue body (a Navajo mythical creature) poked his head through the sky and told them that here in the east is a hole. They entered the hole and emerged into the next world. If you look closely at the bottom of the rainbow you will see to the left a head coming down with some antennae and a small cluster of other beings around it. At the top of the rainbow you will see to the right an anthropomorphic creature emerging from the rainbow and at center a bug head just looking out of the rainbow. Knowing that the Navajo and Hopi first creatures were (or were associating with) insects, and that the Navajo even today include the rainbow into many sand paintings, and understanding their belief in the layered universe it takes a very little stretch of the imagination to see how this rainbow fits into the creation story. The Navajo in their sand paintings include the rainbow in the form of a man with an elongated body. This also appears here with the variation that the neck is elongated instead. Look at the left end of the rainbow and you will see a bug head coming down from one of the lines. Now trace that line to the other side of the rainbow and you will see for that line a crude stick figure body.

SIPAPU AND CREATION LINE
The Thread of Spider Woman

As we look at the symbolic interpretation of sipapu we will see how one symbol will take on a complex of meanings. The sipapu that are first to draw an observer's attention are those that lay over the creation line and these are the first to be interpreted. The creation line we have always understood to represent the upward course of man's growth and progression. It is also the thread of spider woman, a spiritual analog of her web strung down from the sky which the people can climb either literally in legend or figuratively to worlds above. This interpretation seems terribly occidental but it is very consistent with both Hopi and Navajo creation stories. There is one statement from the Hopi legends that seems to talk about a creation line motif when Sotuknang comes to Spider Woman at the end of the third world and says "there is no sense in waiting until the thread runs out". What was meant by this statement, what thread was he talking about ? Of course he was not specifically referring to this panel or creation line but he was referring to something that the creation line does represent quite well. Within all the possible meanings of sipapu is the fontanel, the soft spot in a baby's skull. Several times in Hopi legend the people are cautioned not to let the soft spot in their heads to close, thus allowing continued guidance and light to enter their souls. The creation line starts at the top of this panel where it extends upward to God or The Sun (more on this later). The first item on the creation line is a solar disk or the Sun God, Taiowa. The line passes downward through Spider Woman and thence through a series of sipapu. The sipapu simultaneously represent a place of emergence from one creation to another, the womb as the literal place of emergence, the hole at the top of the kiva, and the fontanel. So through this "thread" comes the guidance, the song of creation and the vibrations that keep all things in tune.



Assuming the true antiquity of this panel it may be used to demonstrate that the Hopi and Navajo legends have not been influenced by white society as much as we might have thought.

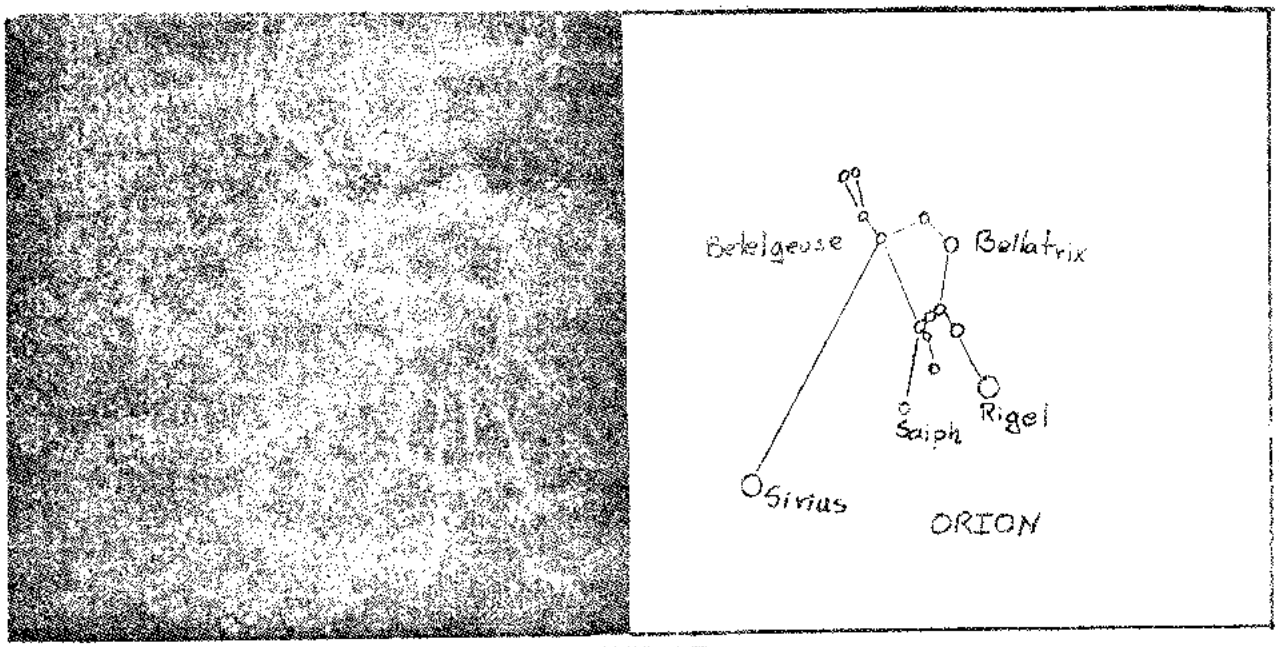


PLATE A5

On the panel are several representations of star formations, the best of them being Orion at the bottom left of the creation line. The stars are arranged to look like a man, but yet not a man. This is definitely intended to be other than just another anthropomorphic figure, they had no problem in producing the human form. The two bottom stars are Saiph and Rigel and the two top stars are Betelgeuse and Bellatrix with the belt of Orion used to form a body and something that looks like a breach cloth. At the end of a long line extending downward and to the left, right where it ought to be, is the brightest star in the heavens, Sirius, the Dog Star. Another star group that appears on the panel is the Bootes. Working up the creation line just to the right between the third and fourth sipapu is a Sotuknang figure. He has his right hand holding to the creation line and left hand is extended out toward, and he is facing a stellar grouping. This group is not open like Orion but quite close together and looks somewhat like an insect crawling down the rock. (See Plate A4) From our identification of Orion we have learned a few things about how these people represented stars. In the Orion figure the bright stars are drawn as a circle, the brighter the star the bigger the circle, and where the stars are quite close together they let a circle suffice for a group, for instance the belt of Orion is not depicted in the large figure (although it is elsewhere). The Bootes constellation is depicted with Arcturus at the top and is given the biggest circle. Bootes alpha, beta and gamma are distinguishable at the bottom, the two central stars of the kite are not drawn. (more about Bootes in Appendix G)

At the right end of the rainbow just below the stick figure of the man with the neck extending over the rainbow we find the three stars of Orion's belt.(See Plate A3) These are represented again as circles and are made to touch each other. Why are the stars of these heavenly forms drawn as circles and not as spots ?

They had no difficulty representing the sun as a disk and there are spots all over the panel for what ever purpose. What I mean is these people had no problem with the media or conceptualization of a point or spot. The stars of the constellations are drawn just like the sipapu on the creation line because they were just that. When the MRC looked at the night sky they made the most logical conclusion possible and consistent with their concept of the universe. Each star or at least those depicted on the panel were understood to be the sipapu through which they would some day pass into the next creation. In the Hopi town of Laguna the expression for emergence is "put out" which is to say "the stars came out at night".

CORN MOTHER OR FIRST WOMAN

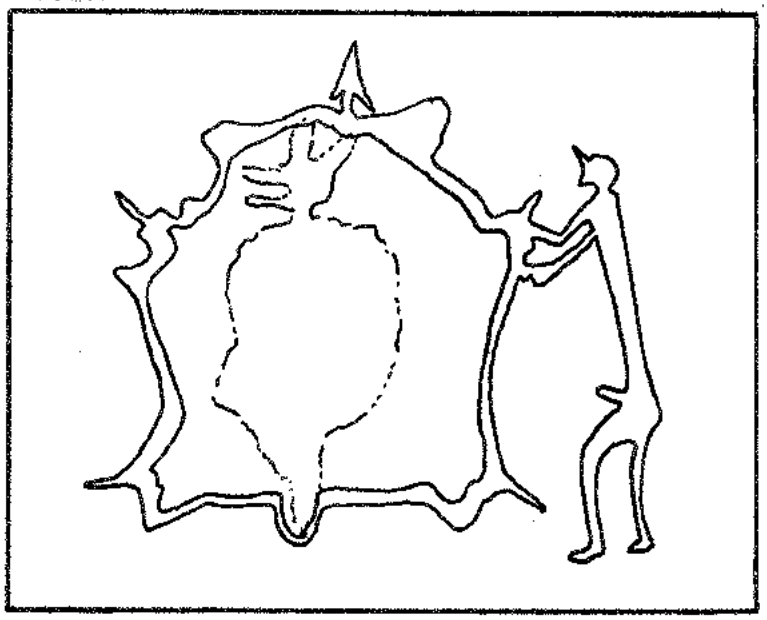


PLATE A6

There are five possible occurrences of first woman on the panel and all of them link better to the Navajo than to the Hopi. There is also evidence that First Woman may have formed a constellation. Let's look at the figure that is almost squarely in the center and under the rainbow.(See Plate A3) Here you see a fat woman with no neck, short arms and legs, line for a navel and a spot for a vagina. In back of her is the buckskin (I believe the buckskin to be a fertility symbol or literally the conjugal bed.) The buckskin appears in the Navajo legends and is associated with the creation of the first man and first woman. The buckskin is represented on the panel three times, twice below the rainbow and once in the upper righthand corner close to the winter solstice indicator. The body of first woman is fat as the Navajo described her and can be seen to look like an ear of corn with a head and no neck. As she appears on the buckskin both in the upper righthand corner and under the rainbow she has four stars on her head. (See Plates A6 and A7) I have searched the constellations for these four stars and it seems that the best guess is to pick the most obvious four stars in the sky which the naked eye would notice. These are the four stars in the cup of the big dipper and if you let these be her head, lets plot out where her body would be. Her left arm is the handle of the big dipper and her right arm extends southwest to Ursa Major Omega. Kappa Draco is her navel and the cup of the little dipper is her vagina (the vagina is included in both First

Woman representations under the rainbow). Lambda Draco marks her right side and Thuban her left. Her right leg extends out to Polaris for a knee cap and her right heel is Cepheus Gamma. Her left knee, heel and toe are Draco Iota, Eta and Theta respectively. When she is plotted out from a star chart she looks startlingly like the representation (Plate A10) of first woman in copulation scene under the rainbow. Her body position is spider-like and looks ready for birth or entry so the cup of the little dipper becomes then the ultimate sipapu through which all people entered this creation. In fact in one incidence the buckskin is shown and the sipapu included but First Woman is left out. I believe this constellation should be placed in argument as a highly probable origin of the Spider Woman legend.

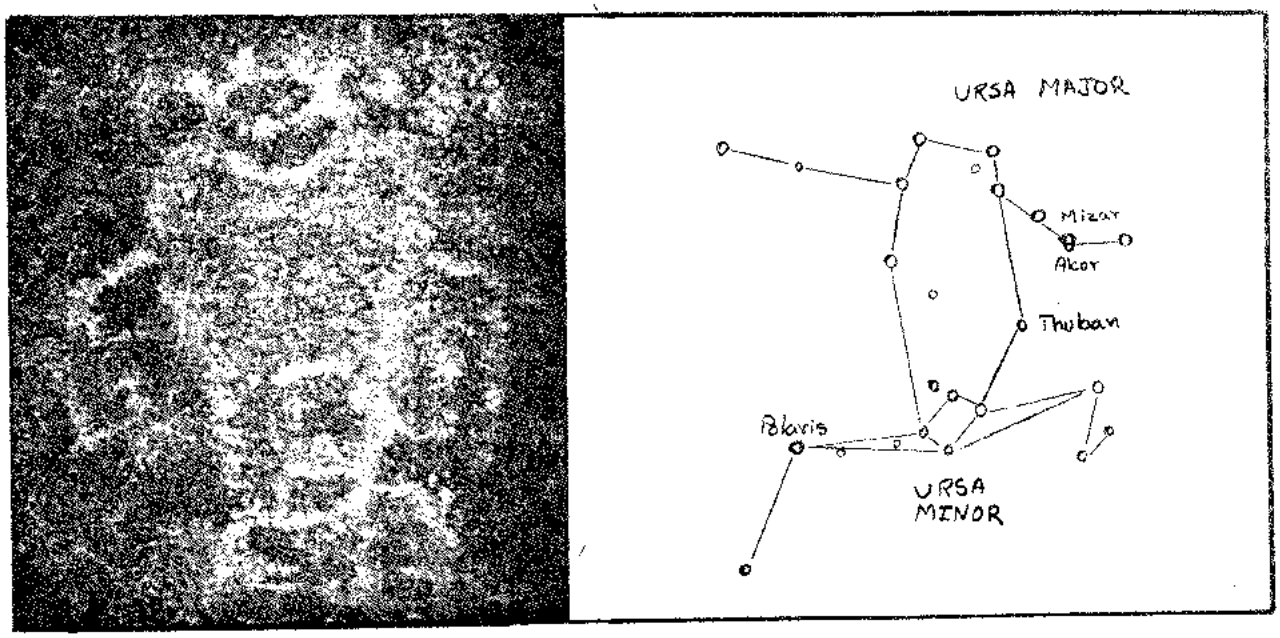


PLATE A7

First Woman and Corn Mother are such important figures in the legends and belief of the Navajo and Hopi that I think that it is impossible to merge the two without first separating them into their two different tribal origins. There are so many legendary figures pointing at the same motif: First Woman, Corn Mother, Mother Earth, Changing Woman, Spider Woman, corn's milk, corn meal, and sipapu.

In the Hopi creation legend Spider Woman is the second personage created after Sotuknang and by Sotuknang. Immediately after creation she is creator of the Hopi Twins which we will talk of latter. Spider Woman becomes the helper of The People, those who keep the song of creation in their hearts, and the messenger of Sotuknang. She is the principal friend of The People who sees them through the death of the old and into the new creations. Her image as a spider connects her to the earth and the living things emerging from the earth. Additionally as she appears in the sky she looks to have a spiderlike crawl. Likewise with Corn Mother, she is less a personage to the Hopi than a ritual,a symbolic object, that represents a very real

PLATE A8

living thing, the earth. The Corn Mother is used modernly in ritual to bear the profound message that the earth is the mother of all living (here again we find the beautiful overlap of the religious and the real). The corn is milk from the bosom of the mother earth and a manifestation of a mother's love for her children. The Corn Mother is a symbol to teach the children to love their mother earth. This is a beautiful and harmonious concept of life that white society will have to learn if we are going to survive. As I said to one young Navajo, "If we destroy this world you people may be taken up to the next, but we whites have no such guarantee,we had better make this one last."

At the birth of a Hopi child the Corn Mother is placed beside the baby and the baby is kept in the dark for nineteen days. At the sunrise of the twentieth day the mother and grandmother take the child out to meet the sun, his father, and enact a brief ritual. Thus almost by the process of imprinting the baby is introduced to the cosmology of his universe.

The most beautiful of the Navajo names for the mother earth motif is Changing Woman. She has four moods: summer, winter, spring and fall and much like all women changing her mind and moods at her capricious will. But like a woman she remains beautiful whether warm or cold and always the source of all living things. In the Navajo legends we detect some humor about the battle between the sexes and in fact there is just that as First Man and First Woman start the human race. First Woman is described as being obese and untidy and prone to argue with First Man.(See Plate 5) One day she declares that if it were not for her vagina First Man would not love and provide for her. (Sound familiar ?) A battle or standoff ensues between the sexes with the women living on one side of the river and the men on the other. Questions about who plants and harvests or hunts are resolved with the men coming out a slight victor. At least that's the way the men tell it. In reality I think it may have been the other way around because in the Navajo Culture like the Hopi, all property and family lines go through the mother and not the father.

First Man and First Woman were created through a process that is of interest to us here. When the insect people were in the third creation the gods told them that they were to make more people not like themselves but human like the gods. The gods provided two buckskins and two ears of corn. The ears of corn were perfect and laid on one buckskin and the other buckskin was laid on top. The wind blew the breath of life in between the

skins and when the top skin was removed a man and a women had been created. The man and the woman were told to be husband and wife and she bore hermaphrodite twins in four days (the twins to be discussed later).

We now have enough background to discuss the four possible occurrences of First Woman and the three occurrences of the buckskin or conjugal bed. While not very enticing First Woman appears on the buckskin twice with a body shaped like an ear of corn both times with the four stars on her head. This has elements of both the Navajo and Hopi legends. A third time she appears in the copulation scene with the two twins by her side. Here we see elements of Navajo and Hopi because twins appear in legends of both tribes. In the Navajo twins were born of the union of First Man and First Woman while the Hopi have only the implied union between Spider Woman and Sotuknang at the creation of the twins. If indeed First Woman was a constellation to the MRC she may have always existed, but where she appears on the buckskin in the upper right hand corner of the panel, (See Plate A6) she is only partially formed having a body like an ear of corn. Did the artist want to show her being formed just as the Navajo legend tells ? While we are looking at this figure notice the man standing by the buckskin. He has an erect phallus implying our interpretation of the buckskin as being the conjugal bed. (The phallus is included on only a few of the male figures.)

In the Hopi legends it is Spider Woman that is a principal aid to the people to help them through the destruction of the third world and finding their place of emergence in the fourth. On the panel she is seen a fourth time helping some creature through a sipapu.(See Plate A8) This creature looks at first to have rabbit ears, but there is an unfortunate overlay of figures and the ears may be the copulating man's lower leg and foot.

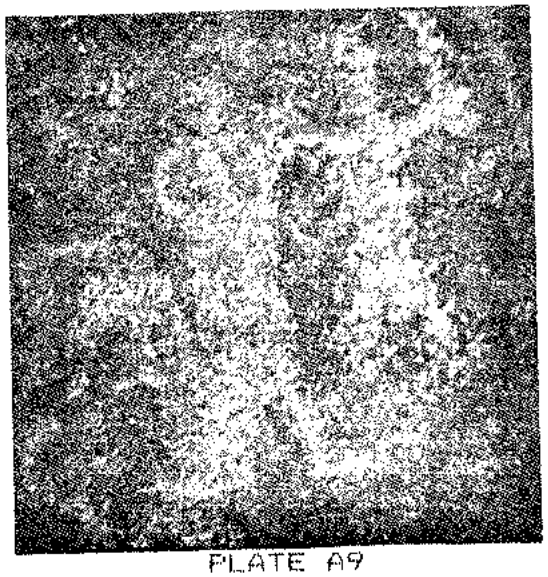


PLATE A9

THE TWINS

In the Hopi creation legend Spider Woman at the command of Sotuknang made the twins from spittles. These two twins had special duties, one was to form the mountains and and valleys of the earth and then to take his place at the north pole to keep the earth properly rotating. The other twin was to set the vibratory centers of the earth properly in tune to the plan of creation and go to his post at the south pole to keep the earth properly rotating. As a person reads this he become a little doubtful that the ancient Pueblos really understood that much about the geography of the earth, but here on the panel we may have a possible explanation as to what

the legend referred to. On the right side or the north end of the rainbow at the termination of one of the rainbow lines you see the twins that we have been referring to next to the copulation scene. The twin on the north has his hand on one of the terminating lines of the rainbow. This is Poqanghoya and is stationed at the north pole or at the north end of this rainbow which was these people's model of their universe. The other twin has big ears and no arms and his function was to send sound throughout the world. He was sent to the south pole of the earth so let's look at the south end of the rainbow to see what's there. (See Plate A3) Here we find a figure with no arms at the termination point of one of the rainbow lines with the line terminating on the top of his head, this is Palongawhoya. Remember, the Hopi were enjoined not to let the fontanel heal completely, but to keep this open because this was one of the principal vibratory centers of body. Here it certainly seems more than a coincidence that the figure on the south end of the rainbow is connected to the rainbow by the top of his head and it was his duty to keep the earth in proper vibration.

Turning now to the Navajo for their interpretation of the twins. If we assume that the twin on the left has big breasts then this scene indicating the offspring of First Man and First Woman fits perfectly well into the Navajo legends. After the hermaphrodite twins there were multiple boy/girl twin pairs born to First Man and First Woman which were the beginning of the race.

FIRST WOMAN / FIRST MAN / TWINS
CONTELLATION

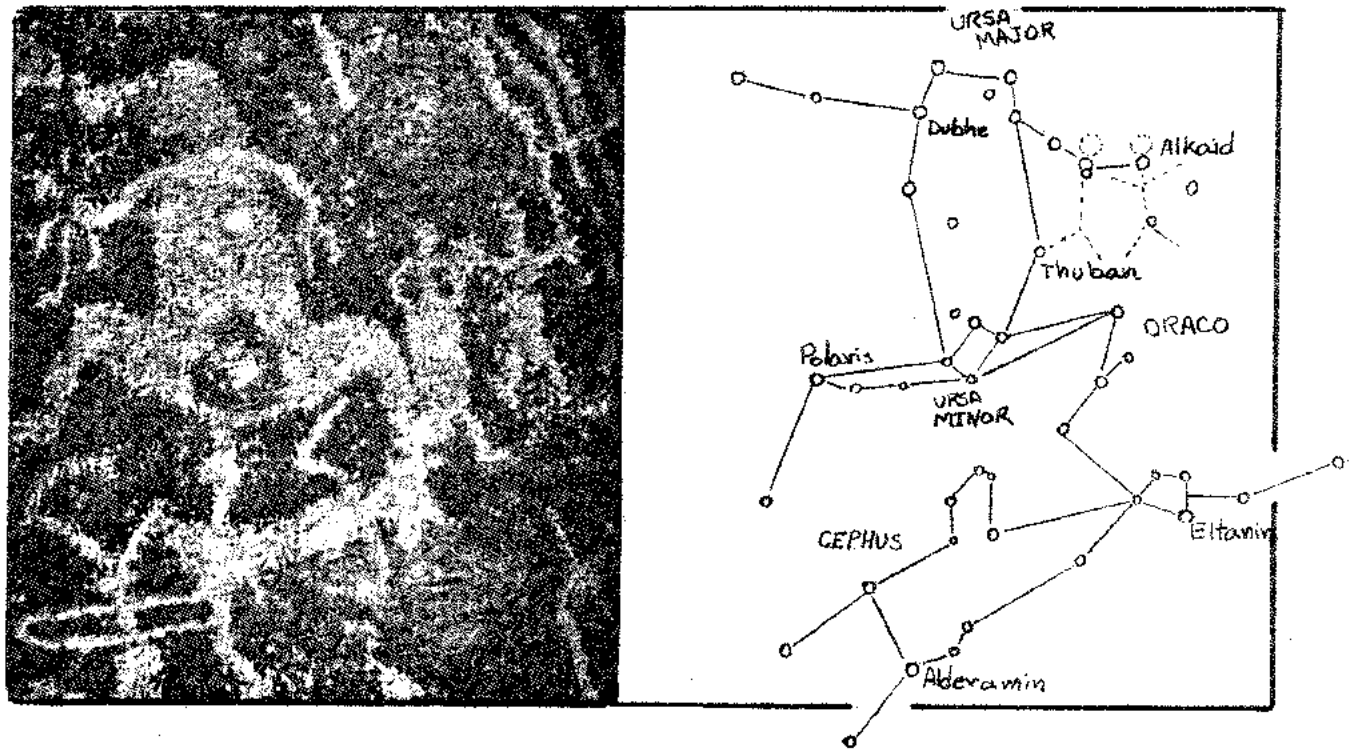


PLATE A10

We now have good reason to believe that the MRC believed in a constellation comprised of 4 mythical personages: First Woman, First Man, and The Twins. We have discussed each of these above. Let's now look at the four as they appear on the panel and in the northern sky.

These figures are constructed from star charts and can be like most constellations, sometimes quite difficult to see in the night sky if the moon is bright or there is too much light pollution and the sky is hazy. But, as constellations go, they are much easier to recognize than most of our present day constellation, and actually look like what they represent. The big question in most people's minds is: Are these figures correctly interpreted. They have been drawn side by side above to illustrate their correspondence with the stars, so let's do a little score sheet to test plausibility of correlation.

1. In two different places on the panel First Woman is depicted with four stars on her head.

2. Assuming her head is the Big Dipper her womb is always included in the proper location to be the cup of the Little Dipper.

3. The twin on the left is designated with two stars as stars are drawn on this panel. This is a visual double star, Mizar and Alcor and they are in the correct position if First Woman's head is the cup of the Big Dipper.

4. The Phallus of First Man points at the Womb of First Woman in the sky as it is depicted on the panel.

5. There is one horn on the head of First Man as there is on the panel and leaning in the forward direction.

6. First Man has the little protruding buttocks in the sky as he is depicted on the panel above.

7. The legs of First Man as he is depicted as Sotuknang lean back the same way they do in the sky.

8. The corresponding positions of the four people are similarly arranged on the panel and in the sky. (After all a person must admit that this is not one of your standard position and there must have been some reason why the artist placed them in this rather awkward configuration.)

9. The body position of first woman looks rather like a spider and this may be the origin of the Spider Woman legend.

10. Sotuknang is referred to as the Star God.

11. The Constellation looks like what it represents

12. And when the shadow of the pusk passes over the figures on the stone in March they are upright in the evening sky.

THE FIGHTING ANIMALS

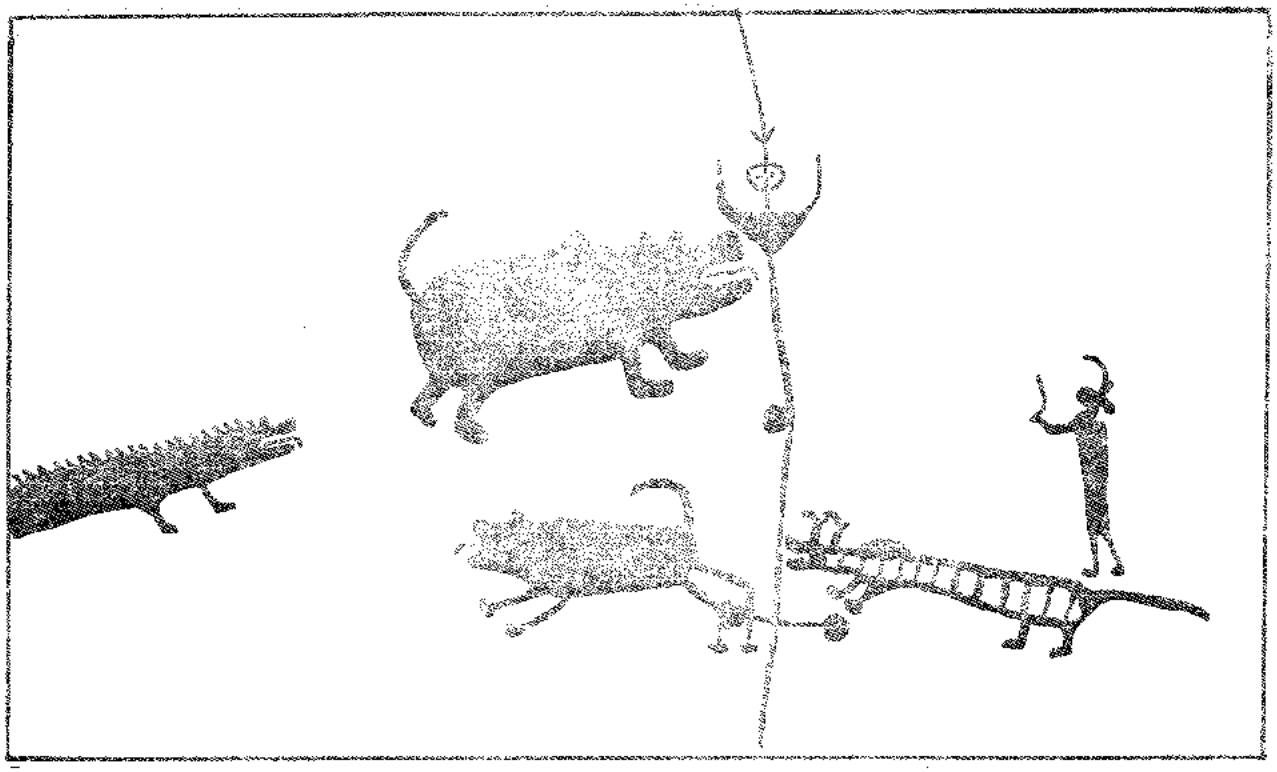


PLATE A11

One of the most pronounced features on the panel is a large group of fierce looking animals with bared teeth and protruding tongues. These seem to be rushing at each other from the north and south about to meet in the center of the panel in a ferocious encounter. In the middle of all this is Spider Woman and Sotuknang seemingly oblivious to the fray. These fighting animals fit nicely into both the Navajo and Hopi legends. The Navajo legends tell us that monsters were born during the separation of the sexes because of unnatural acts on the part of the women. These monsters then represent evil in the world both from their origin and behavior. The Hopi believe that the animals couldn't hear the song of peace and fought each other and were therefore of lower level of creation. While the animals best depict the Navajo Monsters the true significance of the scene must be understood from the Hopi legend of Kokopelli.

Notice how the largest of the animals is directly confronting Spider Woman. This is probably a bear with teeth bared and the nap of his neck standing up, but Spider Woman takes no notice of the impending attack. (It might be thought that this is simply juxtaposition of characters but in a place on the panel where there is much clear space it seems unlikely. Additionally, Spider Woman, Sotuknang and the animals look like they are from the same period and even by the same hand.) Now, with elements of the scene clearly in our minds let's talk about Kokopelli. The legend of Kokopelli tells the story of two crickets or flute players. (It might have been thought that crickets make their song with little flutes.) The crickets were a holdover from the days of previous existences when the people lived with or were insects. The two crickets were accompanying the clans on their migrations. Climbing a high mountain they encountered an eagle. One of the crickets acting as spokesman asked the eagle if the Hopi could live in his land for a while. The eagle replied Yes, but you must pass a test. The eagle pulled an arrow from his quiver and thrust it very close to the eye of one of the crickets. The cricket did not flinch or blink. The eagle was impressed by this and decided to test the crickets further. He put an arrow in his bow and shot one of the crickets through. The cricket pulled out his flute and played a sweet melody. He then shot the other cricket and the two played even a sweeter melody until their wounds were healed. The eagle said that they had passed the test and the people could live in his land and wear his feather.

The wisdom of this legend may first escape you, unless you have been wounded deeply enough for the anger to fester your soul. But Hopi means the "People of Peace", and if a people are ever going to have peace this lesson must be learned. The MRC put this theme on the panel with fighting animals around Spider Woman and Sotuknang as they continued with the Song of Creation in their hearts. Here is a deeply "Christian" theme told in a very Indian way. The scene with the fighting animals is to illustrate the struggle between two ways of life. The MRC were probably a peace loving people as best as they could manage. As the panel and observatory reveals, they loved to spend great effort in explaining the universe and watching it work. As this rock art site demonstrates, they were of superior intelligence in contrast to other contemporary tribes (judging them by the other rock art sites in the area). It must have been difficult for them to maintain such a philosophy in a community of more warlike tribes. But they had a back-handed insult for the more warlike depicting them as animals, a lesser form of life.

I am now going to go through as many of the figures on the panel that appear, which incidentally have an interpretation from the legends.

THE BIG HEADED SNAKE

Low on the panel between the creation line and the rainbow you can find the snake with the big head. This animal appears in Hopi legend in the first creation.

PLATE A12

ANT PEOPLE

Very low on the panel below the big headed snake is a very good drawing of what ant people might have looked like. These are the people that the Hopi stayed with during the destruction between creations. It might be objected that there is no distinction between thorax and abdomen which is characteristic of ants but the Hopi have an explanation for that of course. The legend goes that before the ant people hosted the Hopi they did not have such thin waists. But the Hopi stayed with them so long that the food supply got very low and the ant people gave all their food to the Hopi and pulled their belts a little tighter. And that's how their waists got so thin.

PLATE A13

ONE AND TWO HORNED SOCIETIES

In the Hopi tribe there are One and Two Horned Societies. The Two Horned Society is higher than the One Horned Society for reasons I will leave to the Hopi. This panel has men and anthropomorphic figures with one and two horns. Sotuknang has one horn while Spider Woman has two horns or antennae. This may be the origin of the one and two horned societies meaning that those figures that have two horns or antennae are closer to the primal insect people while those figures with one horn are more toward Sotuknang a human creation.

PLATE A14

MIGRATION SYMBOLS

PLATE A15

When the Hopi found their place of emergence in the fourth creation they were told by Sotuknang to start their migrations. This meant that before they could settle down in their present homeland they had to migrate to the four corners of the American Continents. This is represented on the panel at the fourth sipapu by a large foot print. There are also many other migration markers of curving and spiral lines. On the left of the panel there is a zig-zag line with a foot at the end which is a very likely migration symbol.

FAT-EATING BIRD

PLATE A16

One of the animals of the first creation, Topela, was the fat-eating bird, probably an owl. There is a fat bird on the panel at two different locations. One on the left of the panel and another on moon rock. The birds have the same basic features but don't look as though they were done by the same hand. The bird on the panel face has the bug eyes and antennae characteristic of so many of the other figures while the bird on moon rock has just the antennae. I think it is a fair guess at this point that antennae were placed on a figure to indicate that it was more primal than those with out antennae. The fat eating bird is from the first creation and therefore would be considered very primal by the MRC. We might wonder what the meaning of the fat-eating bird might be. I will hazard a guess from our analysis of moon rock. An owl flies at night and the moon flies at night. My guess would be that the fat-eating bird is the moon and what does it eat ? It eats the sun.

BADGER

At the lower right side of the creation line and near the big headed snake is a rather well drawn badger. We think of the mole as the ultimate digging machine, but the indians of the southwest know that when it comes to digging nothing digs like a badger and digging is why this little creature is on the panel. As the Acoma Pueblo tell the story of their emergence it sounds much more like that of the Navajo than the emergence story of the Hopi around Oraibi. For both the Acoma Pueble and the Navajo it was badger that dug through the roof of the last creation and made the place of final emergence. For this reason he takes his place of honor on the panel with the other players in the creation legend.

PLATE A17

MOCKING BIRD

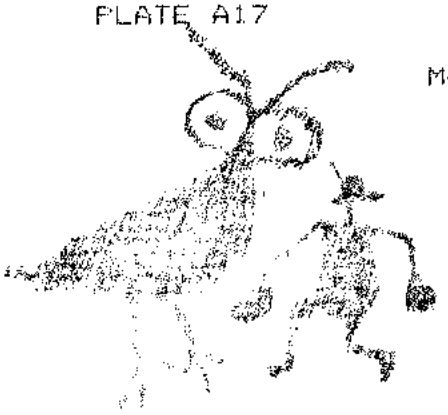


PLATE A18

In the second world a subversive, Lavaihoya The Talker, enters among the people. He comes in the form of Mochni, a mocking bird. He convinces them of the differences between themselves and engenders contention and discontent. He pointed out the differences between animals and men and between man and man. His efforts brought about the contention between the animals depicted on the panel and infighting among the people which eventually resulted in the destruction of the second world. You can see Lavaihoya on the panel with the bug head talking to an very attentive listener with big ears. He's upper left of the rainbow.

KOKOPELLI

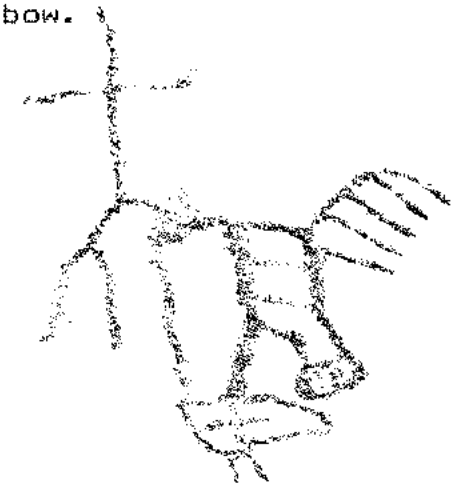


PLATE A19

There is a figure associated with the panel, on the north face of the same rock as the panel. Here is a scene of a large bird attacking a stick figure man by pulling his penis to an enormous length. The legend of Kokopelli is the story about two locust people who are confronted by a eagle during the Hopi migrations. The legend as it is in "The Book of the Hopi" says nothing about Kokopelli being attacked in this way but in many places Kokopelli is pictured with a tumescent phallus and this may explain that.

LA PIECE DE RESISTANCE

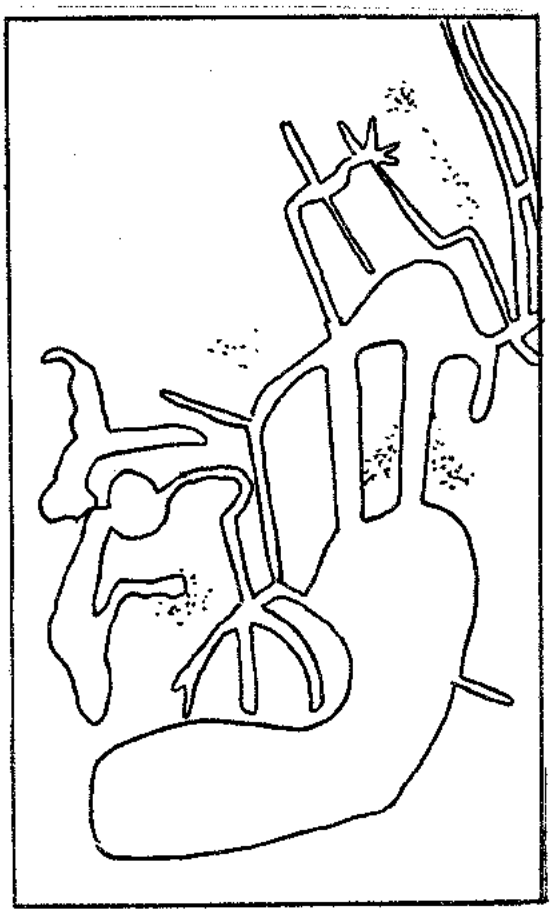


PLATE A20

Et maintenant la piece de resistance: Just below the right end of the rainbow is a strange figure that would defy all explanation if we had not previously discovered the function of the panel as a solar observatory. Here the shaman or priest of this site tries to relate something that almost totally exceeds the capability of his medium: He tries to draw the functioning observatory. Because he can not overlay one object on another he turns the observatory sideways and draws it true to north. He draws what looks to us like the cushioned bucket seat from a small car. Sticking up from the seat is the post with two lines coming down on both sides diagonally which may have represented the direction of the shadows at winter and summer solstice or could be some supports that accompanied the post. To the left of the post is a possible representation of the rising sun with a curved line from the top of the post to the solar disk. On the back of the seat we see two lines extending upward. One is shorter than the other and looks like a mushroom or fat arrow. For our purposes we will call it an arrow and follow it to where it points to the winter solstice indicator. The other line on the left ext ends beyond the shorter one and turns to the right and points at a star or sun. The short arrow is obviously to represent what it is pointing at the winter solstice indicator and the long line is to represent the equinox line on the panel. I have no explanation for the "V" shaped line in between the post and the panel. If any person were to try to draw the the solar observatory not using dimension and not overlaying any figures a drawing, something like this would be the result.

CONCLUSION

We have now covered a significant portion of the panel figures and symbols to demonstrate that they can be interpreted from the Navajo and Hopi legends. These are tribes that are native to the Southwest and it shouldn't come as a great surprise to anyone that this would be the source of interpretation. If the observatory and symbolic interpretation stands the test of all the "ifs ands and buts" then the site becomes a kind of "Rossetta Stonehenge". It gives us insights into the religion of these tribes and may give us some keys to understand a few of the other rock art panels. (Although, I have always felt that this site is somewhat unique among rock art sites of Utah.) It also functions as an observatory with some sophistication. We may even have shown that the panel contains its own operators manual. Let's now recap the number of corresponding interpretations that have been given:

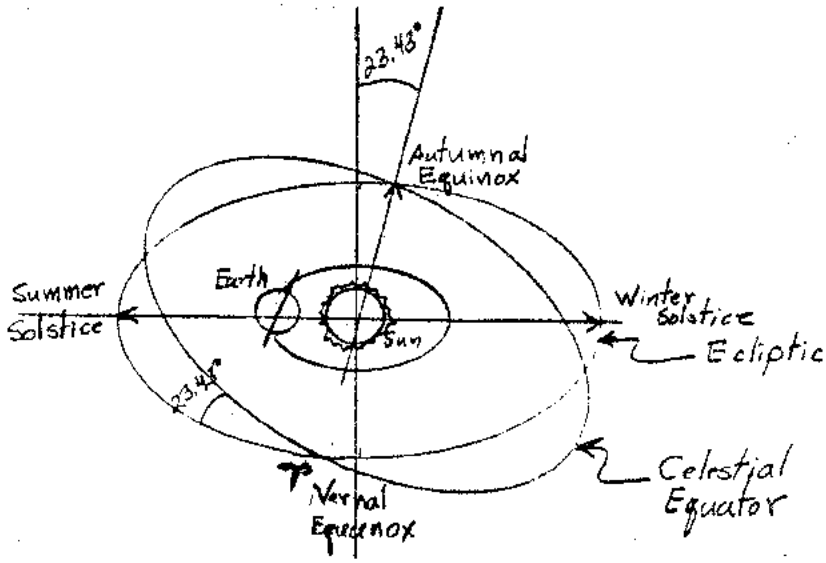
1. Taiowa the sun god of the Hopi
2. Spider Woman
3. Sotuknang, The Star God
4. Sipapu
5. The Navajo Twins
6. First Woman
7. The Hopi Twins
8. The Navajo Rainbow Protector
9. The Big Headed Snake
10. The Ant People
11. The One and Two Horned Societies
12. The Hopi Migration Legends
13. Badger the animal that dug through to this creation
14. The Fat-eating Bird
15. The Layered Universe
16. The Fighting Animals
17. Mocking Bird from the Hopi Second Creation
18. The Buckskin
19. Orion Constellation
20. The Pleiades
21. Kokopelli
22. The Panel's Own Picture of Operation

APPENDIX B

Positional Astronomy

For those readers that may be interested in the mechanics by which we located the sun for all possible sunrises for any given year, I will give a short discussion of positional astronomy. I am not going to try to give you the formulae because it is well out of the scope of this paper. But enough methodology will be given so if you are interested, with the help of a good book on the methods of classical astronomy, you could retrace my steps on this site or any other.

The first thing to explain is that there are three coordinate systems involved: ecliptic coordinates, equatorial coordinates, and horizon coordinates. We will talk about all three, define them and why we must convert from one coordinate system to another.



ECLIPTIC COORDINATES

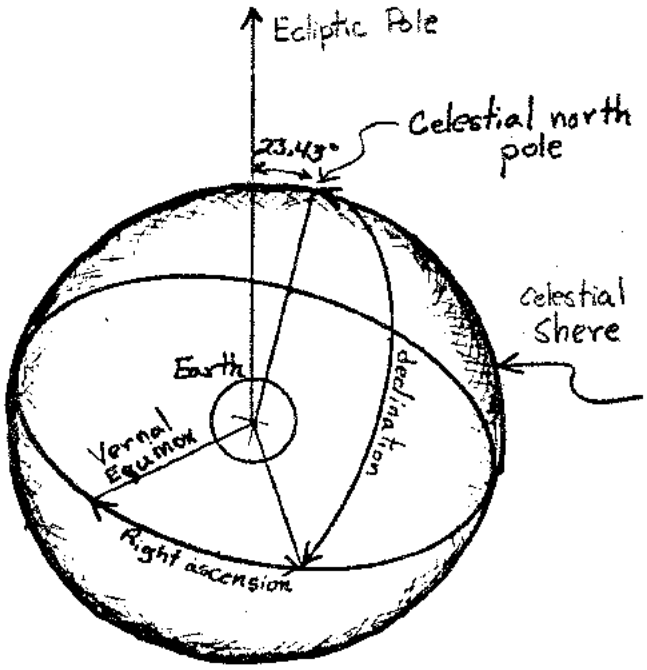
In ecliptic coordinates we place the sun at the center of the universe. It marks the point from which all angles and distances are measured. These are essentially spherical coordinates with the plane of the earth's orbit (ecliptic) being the separator between positive and negative angles. The angles along the ecliptic are defined from a place in the sky called for historical reason "The First Point of Aries". This was in the Constellation of Aries but has drifted because of the precession of the earth's axis. In order that our seasons may stay in their proper place on the calendar, astronomers have redefined the first point of Aries as being one of the two places in the sky where the plane of the ecliptic and the earth's equatorial plane intersect. When the earth and sun are on the line of intersection it is the Vernal or Autumnal Equinox (See Figure A1).

The Vernal Equinox is defined as the first point of Aries and the Solar Coordinates are 0.0 , 0.0. Indicating that since the sun can never be off the plane of the ecliptic its coordinate north or south must always be zero and since it is at the starting point in its horizontal travel its horizontal angle is also zero. At the Summer Solstice the angle will be 90 degrees. at the Autumnal Equinox, 180 degrees and at the Winter Solstice 270 degrees. As the Vernal Equinox approaches in the Spring the angle will approach 360 degrees and restart at zero degrees again at the moment the Sun passes through the First Point of Aries.

Table D1 is a portion of the sunrise tables at the Vernal Equinox. These tables give the coordinates of the sun in all three coordinate systems for the moment of sunrise at the site. You can see that the Ecliptic Coordinates go from close to 360 through 0 degrees on the day of the equinox.

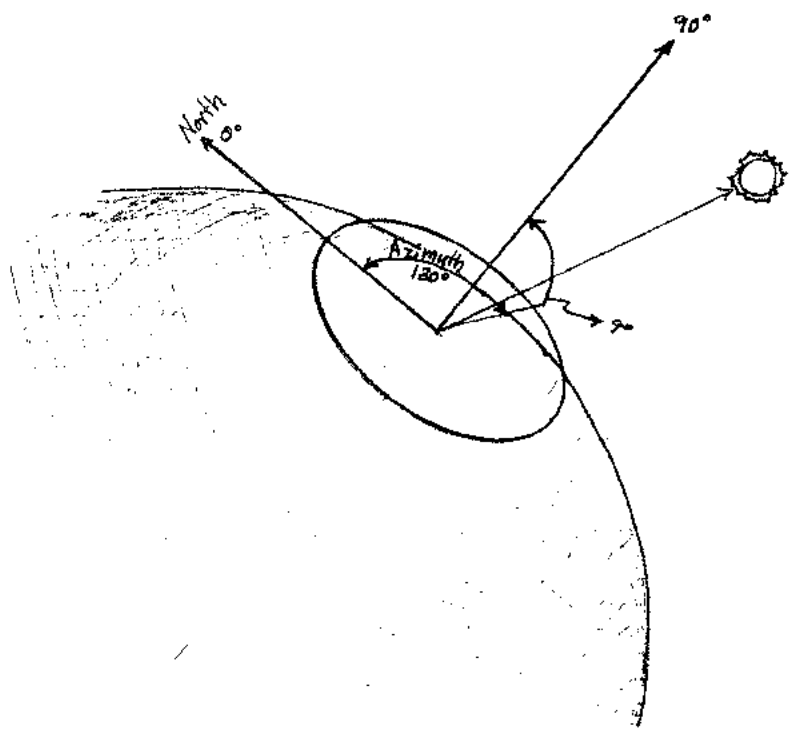
To locate the sun in Ecliptic Coordinates one works forward from the beginning of the Epoch. Epochs are usually started every five years and all of the calculations in this paper are started from the Epoch 1980. At the beginning of the Epoch the Sun's position and many other celestial objects are measured very precisely in Ecliptic Coordinates. From that position the sun is rotated around the earth (as if) a fraction of a year for every day since the beginning of the Epoch. But the Sun is not near so good a time keeper as might be expected. The Sun moves slower or faster in its orbit (as if) depending on the time of the year. This is caused by the ellipticity of the earth's orbit and in order for the sun's position to be precisely determined slight corrections must be applied before we have a precise fix of the sun's ecliptic coordinates.

EQUATORIAL COORDINATES



Equatorial Coordinates are a set of spherical coordinates with the earth at the center. As the name would imply the earth's equator serves as the defining plane with a perpendicular through that plane at the earth's axis defining the north and south directions. The north pole is exactly +90 degrees and the south pole exactly -90 degrees. The definition of the angle around the equator again uses the "First Point of Aries" as a zero point. You may be able to visualize that at one time during the year at the Vernal Equinox the horizontal angles of two coor-

dinate systems will overlap precisely. The coordinates of this system are called declination and hour angle. The horizontal angle in equatorial coordinates is measured in hours, minutes and seconds, although for my calculations I never let this happen and kept all angles in degrees. Because the earth's equatorial plane is tilted some 23.43 degrees from the plane of the ecliptic the sun's declination varies from +23.43 degrees at the summer solstice to -23.43 degrees at the winter solstice with it passing through zero at the two equinoxes. (See the Equatorial Coordinates in Table C1)



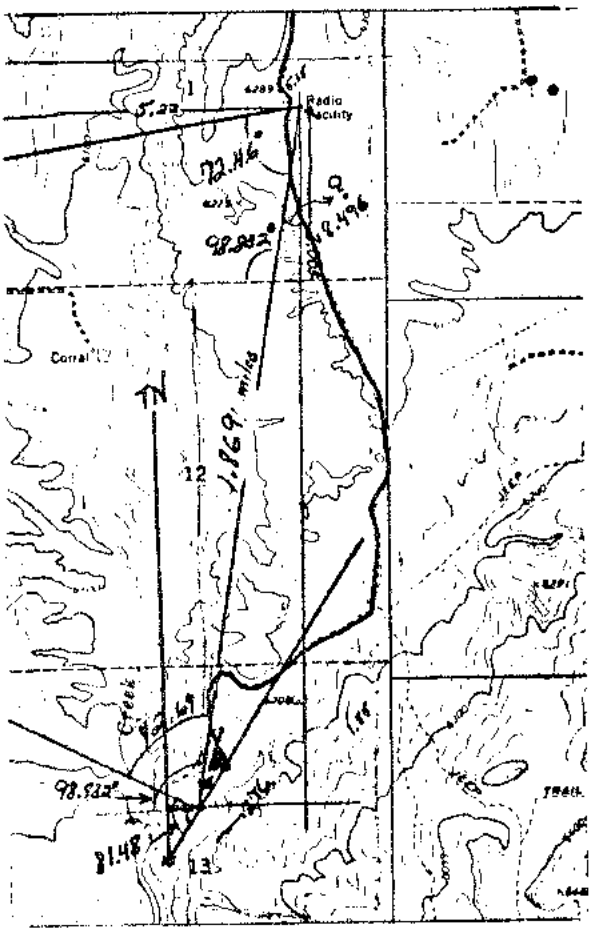
HORIZON COORDINATES

Horizon coordinates are those directions, in altitude and azimuth, as measured from the observer's location. Altitude is measured up from the horizontal to the zenith at 90 degrees. Azimuth is measured from true north rotating to the east at 90 degrees, south at 180 and west at 270 degrees. This is the set of coordinates that are useful for our purposes. The sun's position is first determined in ecliptic coordinates, transformed to equatorial and then to horizon coordinates for our research at the site. This conversion is quite complex needing the local sidereal time and the latitude and longitude of the site. These coordinates for the sunrises around the vernal equinox can be found in Table D1.

APPENDIX C
Site Survey

I have been tempted to call the name of this appendix "Reality is a Special Case". Those processes which were very familiar to me, astronomy and computer modeling, went smoothly and told us the probable function of the site very early in our research. Survey was not familiar to me, our instruments were crude, methods allowed errors to creep into our simulation data and while data was good enough to reveal the fundamental functions of the site it was not good enough to find the precise location of the post and how big around it should be. (more on in Appendix E) But this is just belaboring the point. Let me just put down the fundamental survey methods that the study demanded and skip over the blunders.

Because the sun's position was given to us by our computer programs in horizon coordinates, we had to survey to give us all the details of sites topology in the same coordinate system. It is at this survey that astronomy and archaeology intersect. Our astronomical theory had been well established, but it was up to us to make our measurements of the solar position at the site coincide with established theory. Four things were vital in the survey to analyze the observatory.



*** Figure C1 ***

* The direction of true north.

* A complete profile of the sunrise horizon.

* The angle of the panel face.

* The horizontal distance between the equinoctial and solstitial markers on the panel.

The direction of true north was established by two methods. We first triangularized from the chapel steeple in Emery, the radio transmission tower, and the survey stake at the top of hill. Later we refined this by sighting on Polaris. (See Figure C1)

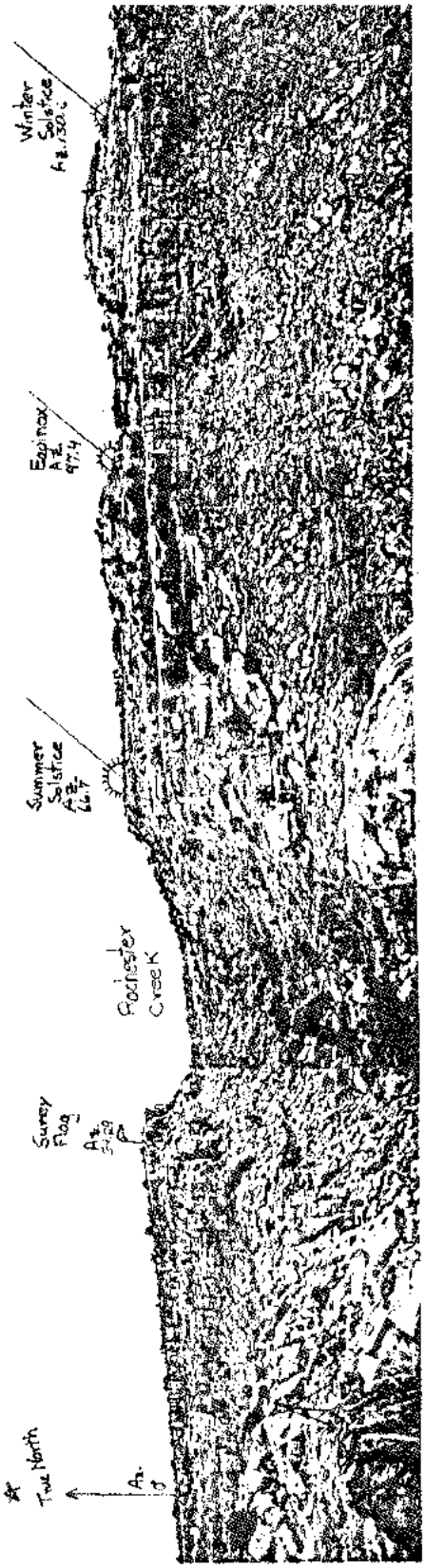


Figure C2

We recorded for every half degree the elevation of the eastern horizon where any possible sunrise could be. (See Figure C2) Each of these angles and elevation were taken from our survey stake and measured up from the horizontal as defined by our survey instrument.

Using two methods we recorded the angle of the panel face . This turned to be very close to 20 degrees to the east from true north.

We measured the distances across the panel face with a tape.

TABLE C1

Distances along Panel Face from Creation Line to:

Sotuknang ..... 1 ft 5.5in
Equinoctial
Indicator ..... 3 ft 4.0in
Pleiad Indicator .. 5 ft 6.0in
(Pleiad Indr. 6 in's wide)
Winter Solstice
Indicator ..... 6 ft 0.0in

APPENDIX D

Computer Programs and Algorithms

There were only two major programs required by the analysis. Both of these were written in Pascal which proved very adequate even though Pascal doesn't have a full set of trigonometric functions. I wrote the complete set of functions and arcfunctions using the sine, cosine and arctangent that Pascal usually has included. Pascal's facility to implement procedures and functions came in very handy and I have been quite pleased with the way the computer simulation of the project has gone.

The largest of the two programs generated the sunrise tables. (See Table D1) The program first located the sun in ecliptic coordinates, converted these to equatorial coordinates and then to horizon coordinates. It would then test to see if the sun had risen over the horizon as profiled in the computer memory. If yes, it would subtract an hour from the Greenwich mean time and add a tenth of hour and calculate the new set of coordinates. When the sun was up it would subtract a tenth of an hour and add a hundredth of an hour until it came over the horizon. This algorithm gave us the sunrise of the disk's center to the nearest 36 second interval.

The second program took the azimuth of the summer and winter solstice sunrises, found the spot on the ground such that the leading edge of the post's shadow would fall on the two solstitial markers at the solstices. It then accessed the sunrise tables and calculated the leading and trailing edge of the shadow for every sunrise of the year. (See Table D2) These two programs were run a multiple of times as more refined survey data was obtained.

Epoc Day 1.9055979167E+03 Julian Date 78 MAR 19 1985
Ecliptic Longitude 3.5892697232E+02 GMT 1.4350000000E+01
Mtn Strd Time 7:20 Mtn Dlite Time 8:20
Equatorial Coordinates - RA 3.5901542896E+02 Dec -4.2664524920E-01
Horizon Coordinates - Az 9.8009293526E+01 Alt 9.1265840657E+00

Epoc Day 1.9065966667E+03 Julian Date 79 MAR 20 1985
Ecliptic Longitude 3.5991991934E+02 GMT 1.4320000000E+01
Mtn Strd Time 7:19 Mtn Dlite Time 8:19
Equatorial Coordinates - RA 3.5992652226E+02 Dec -3.1842332129E-02
Horizon Coordinates - Az 9.7458080703E+01 Alt 9.0874763896E+00

Epoc Day 1.9075962500E+03 Julian Date 80 MAR 21 1985
Ecliptic Longitude 9.1314675333E-01 GMT 1.4310000000E+01
Mtn Strd Time 7:18 Mtn Dlite Time 8:18
Equatorial Coordinates - RA 8.3786587209E-01 Dec 3.6308011546E-01
Horizon Coordinates - Az 9.7100256461E+01 Alt 9.2797764437E+00

Epoc Day 1.9085954167E+03 Julian Date 81 MAR 22 1985
Ecliptic Longitude 1.9054097929E+00 GMT 1.4290000000E+01
Mtn Strd Time 7:17 Mtn Dlite Time 8:17
Equatorial Coordinates - RA 1.7484040784E+00 Dec 7.5752741827E-01
Horizon Coordinates - Az 9.6646212954E+01 Alt 9.3557940715E+00

Epoc Day 1.9095945833E+03 Julian Date 82 MAR 23 1985
Ecliptic Longitude 2.8971204045E+00 GMT 1.4270000000E+01
Mtn Strd Time 7:16 Mtn Dlite Time 8:16
Equatorial Coordinates - RA 2.6586009381E+00 Dec 1.1515639728E+00
Horizon Coordinates - Az 9.6192530147E+01 Alt 9.4312774712E+00

Epoc Day 1.9105941667E+03 Julian Date 83 MAR 24 1985
Ecliptic Longitude 3.8886897573E+00 GMT 1.4260000000E+01
Mtn Strd Time 7:15 Mtn Dlite Time 8:15
Equatorial Coordinates - RA 3.5689196808E+00 Dec 1.5452538599E+00
Horizon Coordinates - Az 9.5835316964E+01 Alt 9.6223802241E+00

Epoc Day 1.9115941667E+03 Julian Date 84 MAR 25 1985
Ecliptic Longitude 4.8801152892E+00 GMT 1.4260000000E+01
Mtn Strd Time 7:15 Mtn Dlite Time 8:15
Equatorial Coordinates - RA 4.4794436684E+00 Dec 1.9384967181E+00
Horizon Coordinates - Az 9.5574355931E+01 Alt 9.9292042995E+00

Epoc Day 1.9125933333E+03 Julian Date 85 MAR 26 1985
Ecliptic Longitude 5.8701563533E+00 GMT 1.4240000000E+01
Mtn Strd Time 7:14 Mtn Dlite Time 8:14
Equatorial Coordinates - RA 5.3891180879E+00 Dec 2.3307021069E+00
Horizon Coordinates - Az 9.5121525129E+01 Alt 1.0002672711E+01

Epoc Day 1.9135925000E+03 Julian Date 86 MAR 27 1985
Ecliptic Longitude 6.8596378346E+00 GMT 1.4220000000E+01
Mtn Strd Time 7:13 Mtn Dlite Time 8:13
Equatorial Coordinates - RA 6.2987845380E+00 Dec 2.7220991587E+00
Horizon Coordinates - Az 9.4669184734E+01 Alt 1.0075145308E+01

*** TABLE D1 ***

Julian Date 73 Mtn Strd Time 7:25 Mtn Dlite Time 8:25
South Side of Shadow 3.4120098634E+00 from CR line or 3:4.9"
North Side of Shadow 3.5786765301E+00 from CR line or 3:6.9"

MAR 15 1985
Julian Date 74 Mtn Strd Time 7:25 Mtn Dlite Time 8:25
South Side of Shadow 3.3836604844E+00 from CR line or 3:4.6"
North Side of Shadow 3.5503271511E+00 from CR line or 3:6.6"

MAR 16 1985
Julian Date 75 Mtn Strd Time 7:23 Mtn Dlite Time 8:23
South Side of Shadow 3.3475356070E+00 from CR line or 3:4.1"
North Side of Shadow 3.5142022737E+00 from CR line or 3:6.1"

MAR 17 1985
Julian Date 76 Mtn Strd Time 7:22 Mtn Dlite Time 8:22
South Side of Shadow 3.3113099675E+00 from CR line or 3:3.7"
North Side of Shadow 3.4779766342E+00 from CR line or 3:5.7"

MAR 18 1985
Julian Date 77 Mtn Strd Time 7:21 Mtn Dlite Time 8:21
South Side of Shadow 3.2749811147E+00 from CR line or 3:3.2"
North Side of Shadow 3.4416477813E+00 from CR line or 3:5.2"

MAR 19 1985
Julian Date 78 Mtn Strd Time 7:20 Mtn Dlite Time 8:20
South Side of Shadow 3.2463016901E+00 from CR line or 3:2.9"
North Side of Shadow 3.4129683568E+00 from CR line or 3:4.9"

MAR 20 1985
Julian Date 79 Mtn Strd Time 7:19 Mtn Dlite Time 8:19
South Side of Shadow 3.2020039716E+00 from CR line or 3:2.4"
North Side of Shadow 3.3686706383E+00 from CR line or 3:4.4"

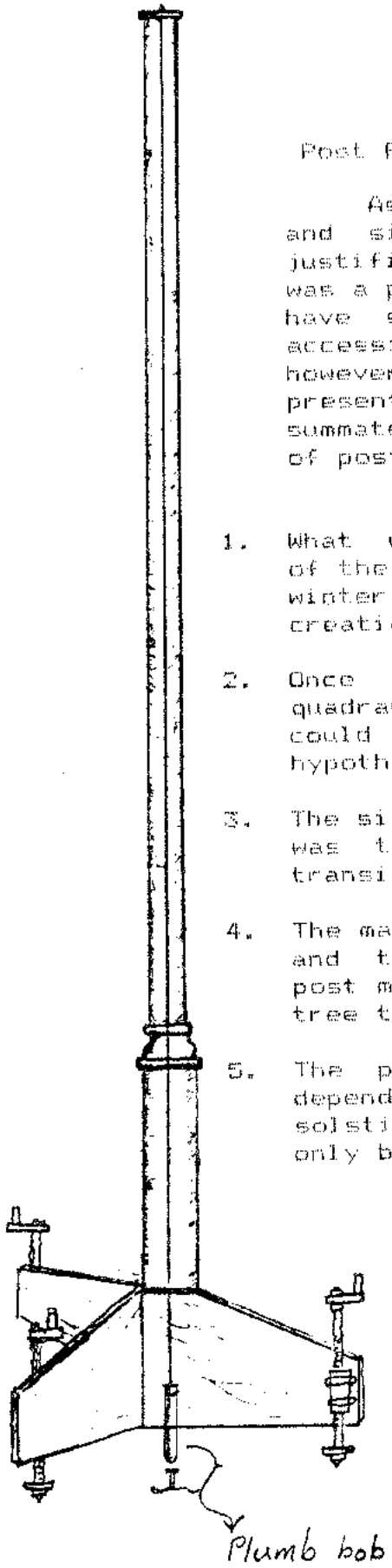
MAR 21 1985
Julian Date 80 Mtn Strd Time 7:18 Mtn Dlite Time 8:18
South Side of Shadow 3.1731423915E+00 from CR line or 3:2.0"
North Side of Shadow 3.3398090582E+00 from CR line or 3:4.0"

MAR 22 1985
Julian Date 81 Mtn Strd Time 7:17 Mtn Dlite Time 8:17
South Side of Shadow 3.1363957390E+00 from CR line or 3:1.6"
North Side of Shadow 3.3030624056E+00 from CR line or 3:3.6"

MAR 23 1985
Julian Date 82 Mtn Strd Time 7:16 Mtn Dlite Time 8:16
South Side of Shadow 3.0995345478E+00 from CR line or 3:1.1"
North Side of Shadow 3.2662012144E+00 from CR line or 3:3.1"

MAR 24 1985
Julian Date 83 Mtn Strd Time 7:15 Mtn Dlite Time 8:15
South Side of Shadow 3.0704067334E+00 from CR line or 3:0.8"
North Side of Shadow 3.2370734000E+00 from CR line or 3:2.8"

*** TABLE D2 ***



APPENDIX E

Post Placement and Configuration

As indicated in the text finding the position and size of the post was not trivial. There is justifiable doubt that the shadow casting device was a post at all. A long shaft of sandstone may have served just as well and may have been more accessible to the area. (This is not to say however that the acquisition a post would have presented an insurmountable problem.) I will summate the some of the questions and alternatives of post placement and selection:

1. What was the precise location of the intersection of the line from the winter solstice indicator to winter solstice sunrise and the line from the creation line to the summer solstice sunrise ?

2. Once that spot was located there were four quadrants around the spot into which the post could be placed all of which fit the post hypothesis boundary conditions.

3. The size of the post became an issue because if it was too large or small it would change the shadow transit dates for the equinoctial indicator.

4. The material and shape of the post became an issue and there are good supporting arguments that the post may have been a shaft of sandstone and not a tree trunk.

5. The placement of the post was very precisely dependent on the azimuths of summer and winter solstices and up to this date (9-23-85) the winter Solstice has only been calculated and never yet measured.

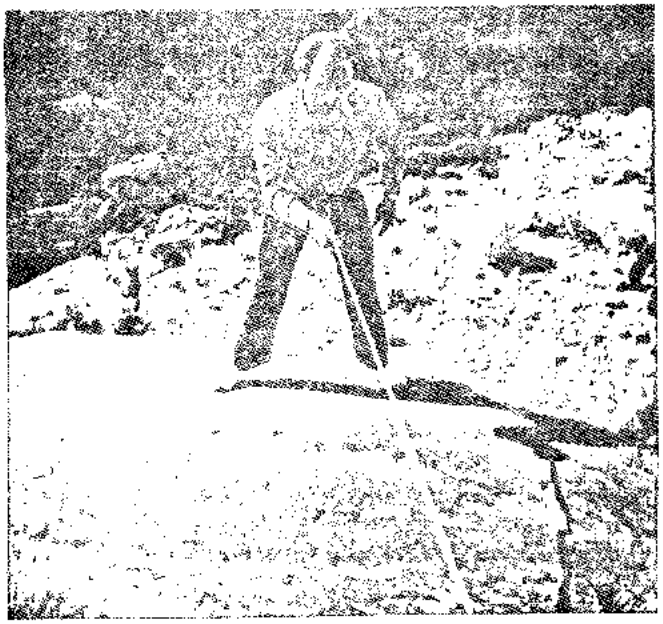
Let's talk about the placement of the post and how we resolved some of the questions and left others unanswered. Up to now we have used a 2 inch steel pipe for the post and when we felt it was necessary to enlarge the posts shadow we placed some tin cans on the top to make them a more reasonable tree trunk size (about 4 inches). We have placed the post in the west quadrant which means that the leading edge of the shadow will mark the dates of the solstices. This leaves some questions

APPENDIX F

*** The Fallen Rock ***

Up to this point we have said very little about the fallen rock itself. In this appendix I want to give some details about the matching dimensions of the fallen rock and its base, sitter's rock. We also, with some difficulty, photographed the petroglyphs on the face of fallen rock. By comparing the dimensions and angles of the two rocks we will show that these glyphs were on the east face of the rock or were on the outside wall of what we call the "Solar Temple". Some of the glyphs on this face are sun swirls and with the panel facing east just as the main panel above, it becomes an intriguing question, if this panel also functioned as a solar observatory. I have avoided analyzing this because of the prodigious amount of work required on the panel above, but it still remains an intriguing project for some one that enjoys a scientific "who done it" or more specifically "how done it".

It is also important to add here that there are at the bottom of Rochester Creek other rocks with glyphs fallen from the ledges above. I mention this because there is south of the main panel another vertical line drawn on an east facing rock that may have been a shadow projection, but there is no rock today that could possibly have cast a shadow on that rock face. This all goes to say that the site has changed considerably since petroglyphic writing was first started there.



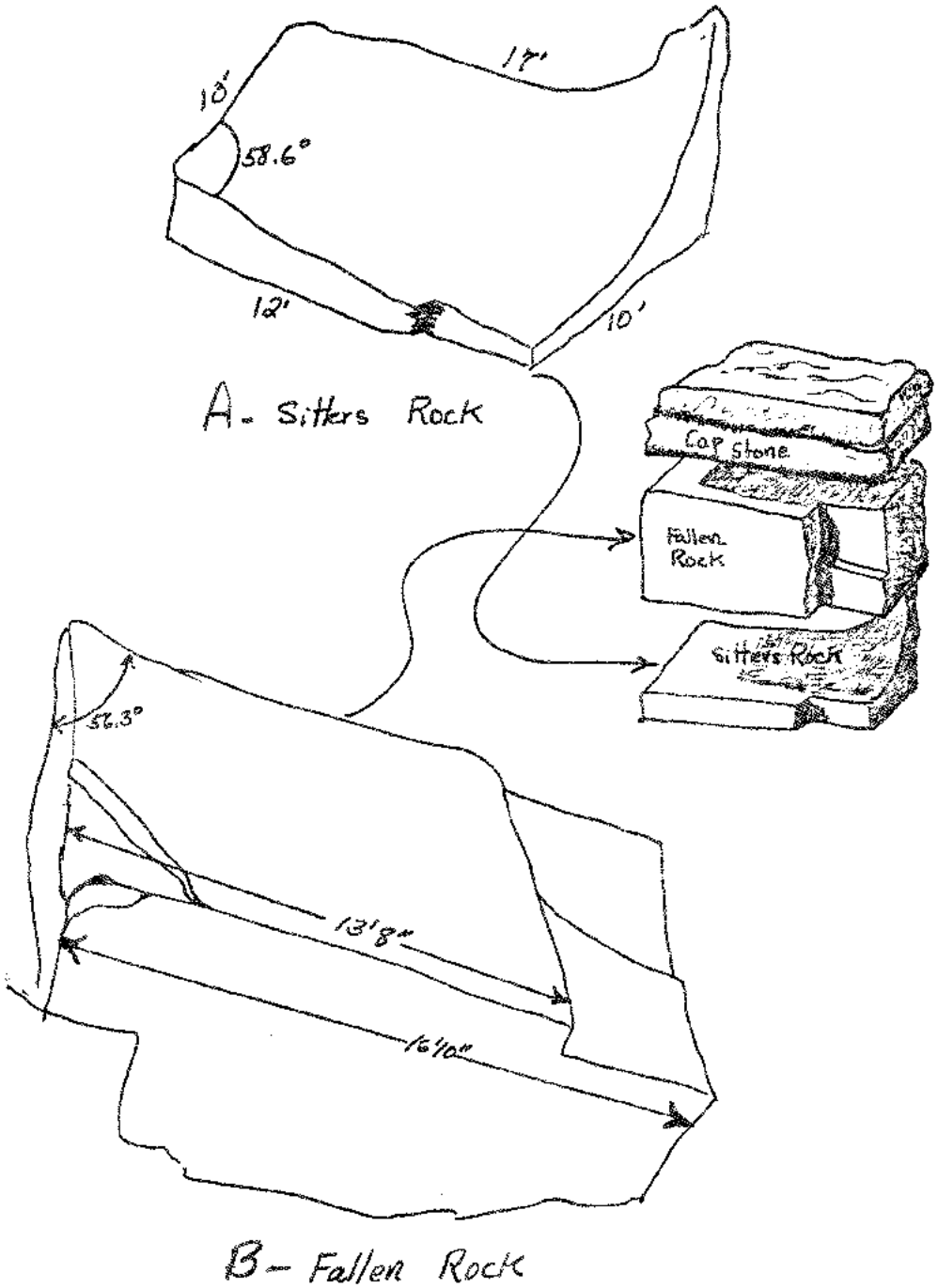
*** Plate F1 ***

Figures F1 A and B are drawings of the sitter's rock and fallen rock respectively. The dimensions and one angle are included on the drawings and with a little inspection you can see how the two rocks fit together in situ. This would place the glyphs facing east such that when the rock broke from its base it rolled down the canyon side without turning end over end.

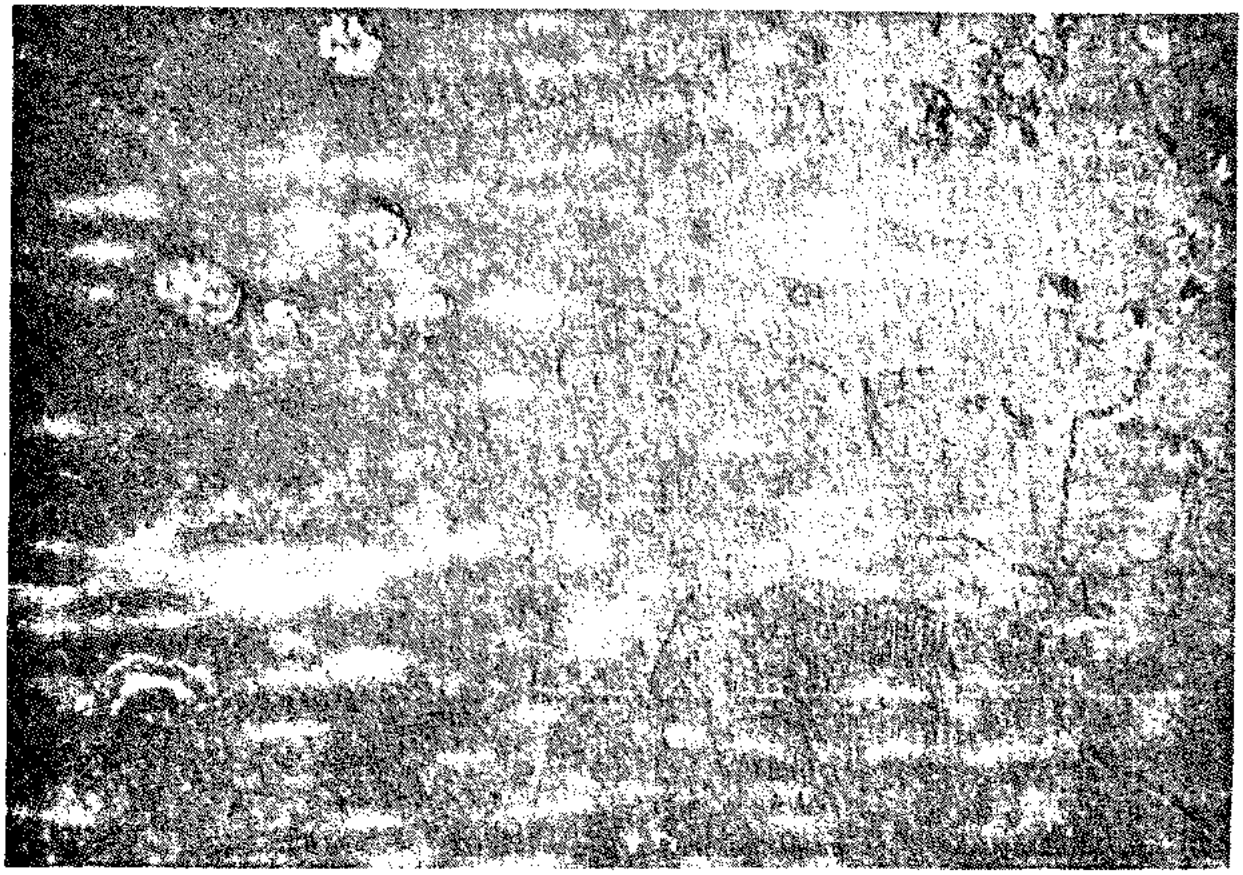
Plate F1 is a picture of Greg Smith photographing the glyphs on the fallen rock. I think this picture will give you a feel for how awkwardly the rock is positioned for

serious examination of the rock art. Not only are the glyphs positioned badly for photography but they are also hard to photograph because the repatenation of desert varnish leaves almost no contrast.

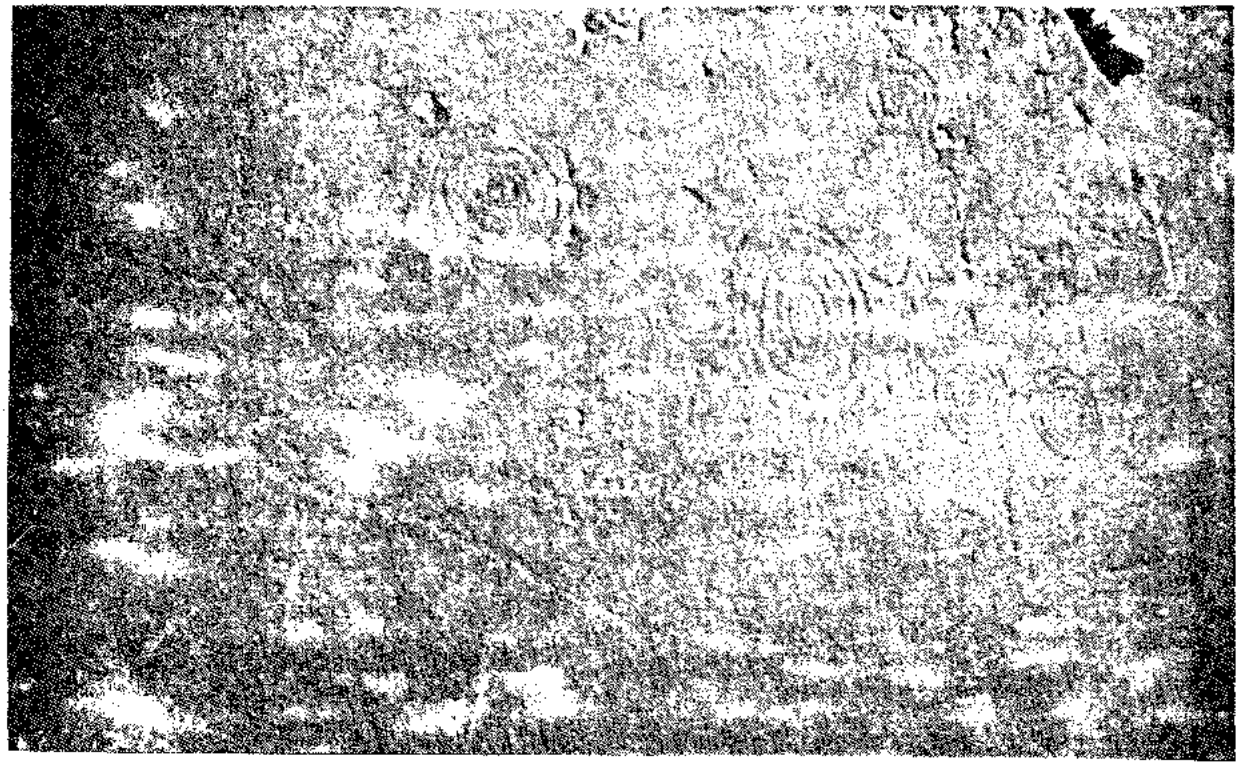
Plates F2 and F3 are photos of the petroglyphs containing sun swirls, anthropomorphic and zoomorphic figures. It can be seen that this panel is much less cluttered, indicating that it had fewer years to accumulate rock art before it tumbled from its original position.



*** FIGURE F1 ***



*** PLATE F2 ***



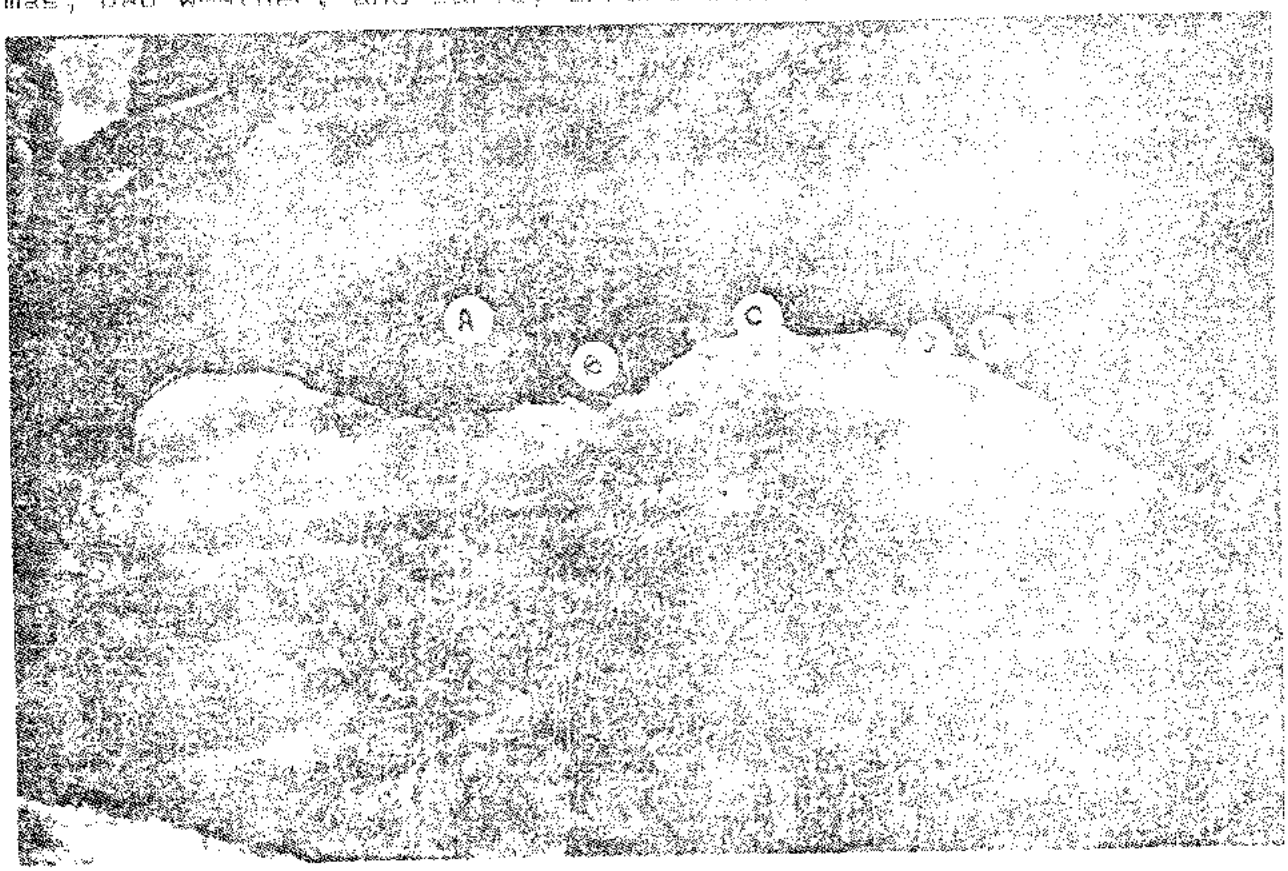
*** PLATE F3 ***

APPENDIX O

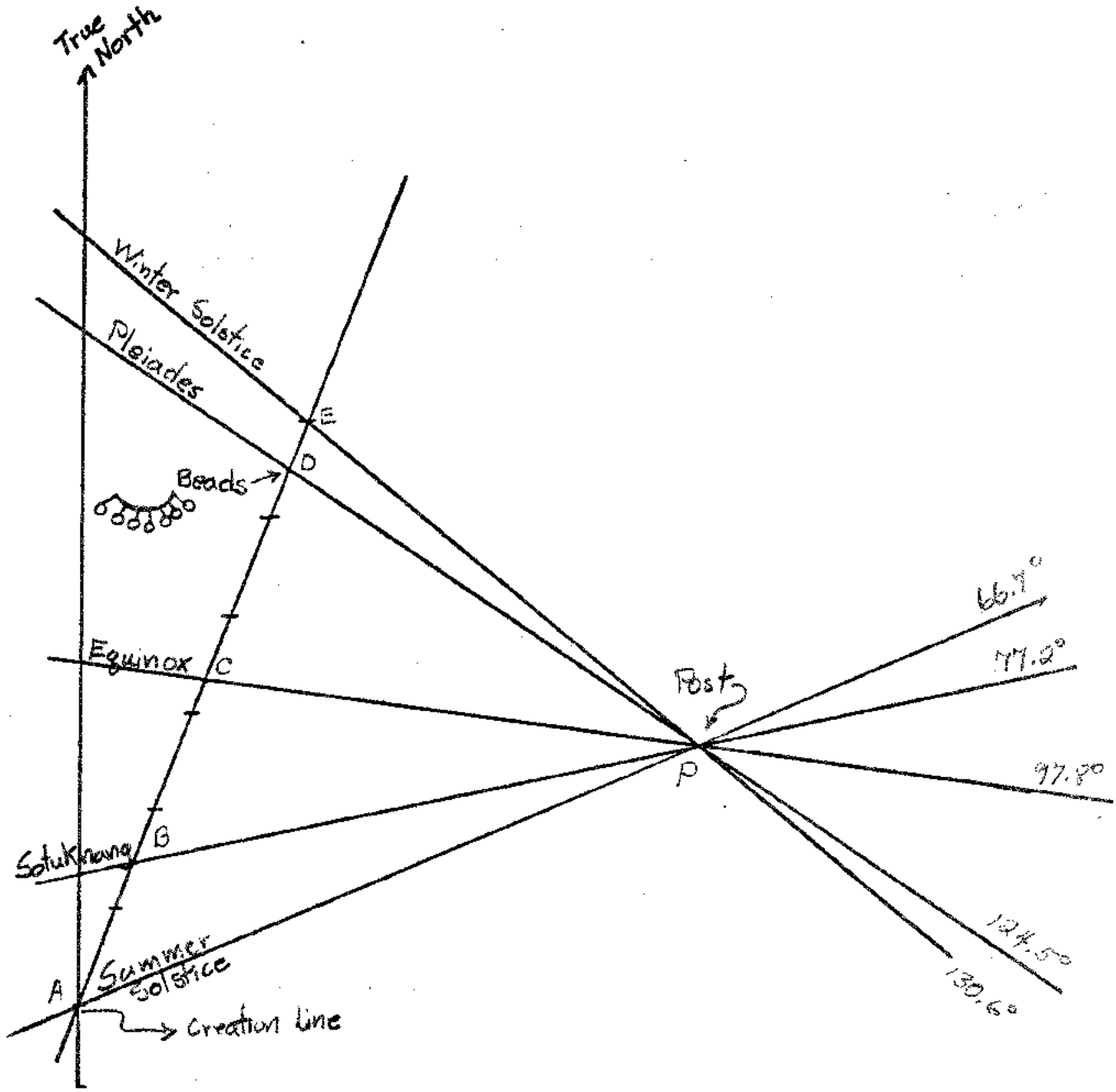
The MRC Calendar

In Plate G1 there are points marked "A" through "E". All of these points are at the same level on the panel and we will call this the calendar line. In Figure G1 the panel and the five points are diagramatically drawn from above. Locating the point "P" as described in the text, the angles of the sunrises are given for each of the calendar events. The table gives the event, the indicator on the panel, the significant date and the sunrise azimuth on that date. For the Pleiad indicator and Sotuknang there two dates of shadow passage, but only the dates considered significant have been included on the table. Just in case the reader has some possibly more significant interpretation of the alternate dates, I will include them here. For the Pleiad indicator it is Jan. 29 and for Sotuknang it is Aug. 10.

In plates G2, G3, G4, and G5 we have photos of the shadow as it passes the Pleiad Indicator, the Equinoctial Marker, Sotuknang and the Creation Line respectively. I regret that we do not have a photo of the sunrise on the Winter Solstice, but due to Christmas, bad weather, and survey errors this date was missed.



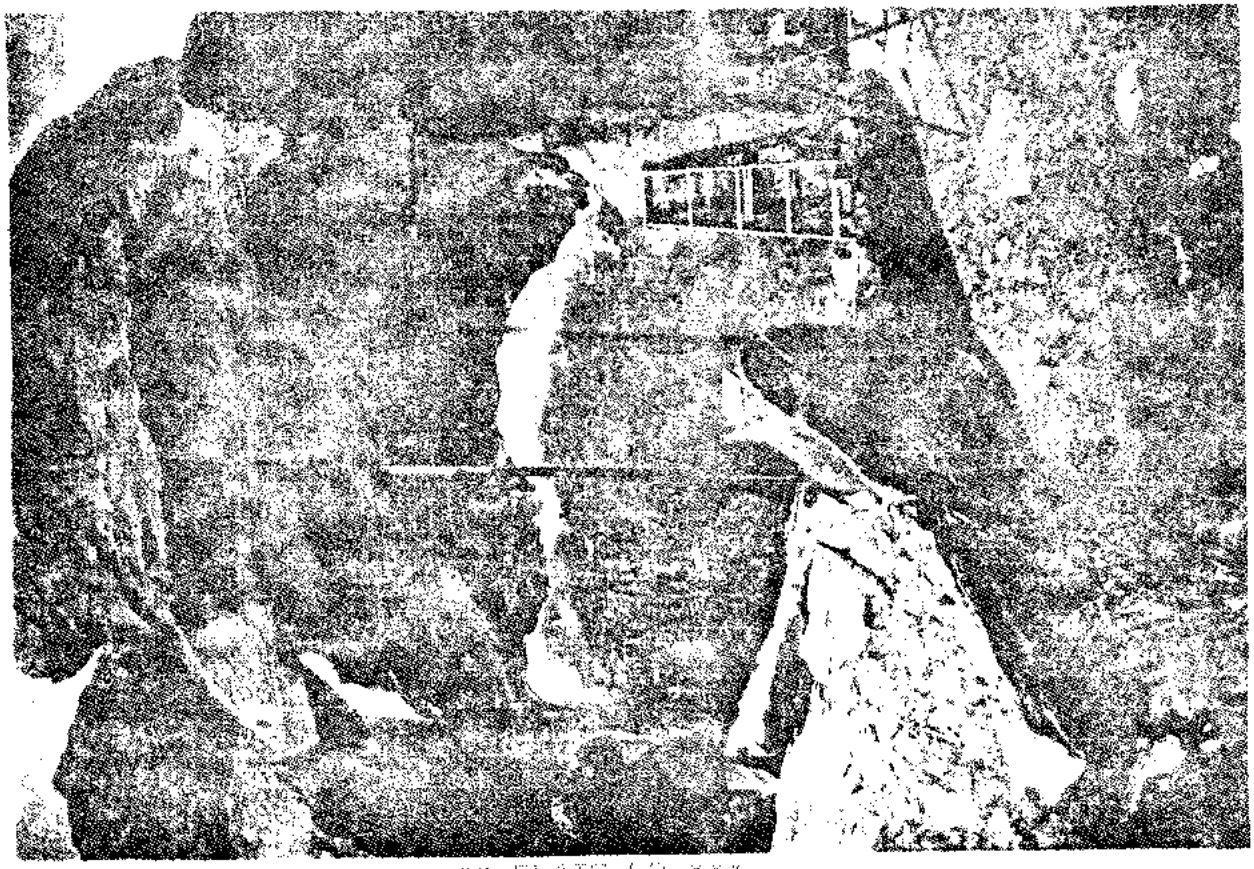
*** PLATE G1 ***



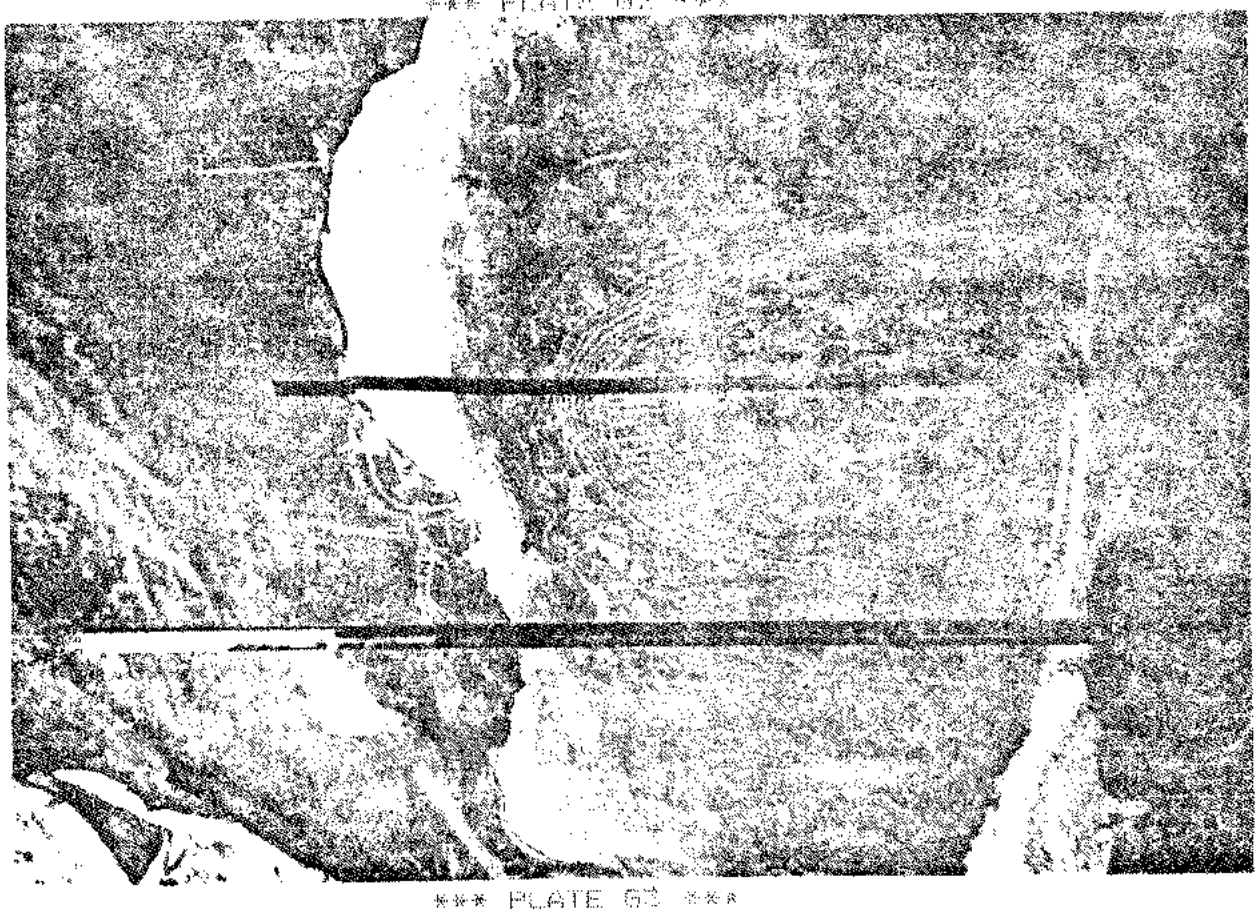
*** FIGURE 61 ***

EVENT	PANEL INDICATOR	POINT ABOVE	DATE *	SUNRISE AZIMUTH
Winter Solstice	Winter Solstice Indicator	E	12-21	130.6 deg.
Vernal Equinox	Equinoctial Indicator	C	3-21	97.4 deg.
First Man Constellation	Sotuknang	B	5-2	77.4 deg.
Summer Solstice	Creation Line	A	6-21	66.7 deg.
Autumnal Equinox	Equinoctial Indicator	C	9-22	97.2 deg.
Pleiades Culmination	Pleiad Indicator (Beads)	D	11-13	124.6 deg.

* All dates are for 1985



*** PLATE 62 ***



*** PLATE 63 ***

Thus far we have concentrated our efforts decipherring the dates along the MRC Calendar Line. The event/dates have been given to us by computer model and tested at the site, but there are other dates that are recorded more crypticly on the panel and I will open Pandora's box just long enough to show where some of them are and where research will go in the future.

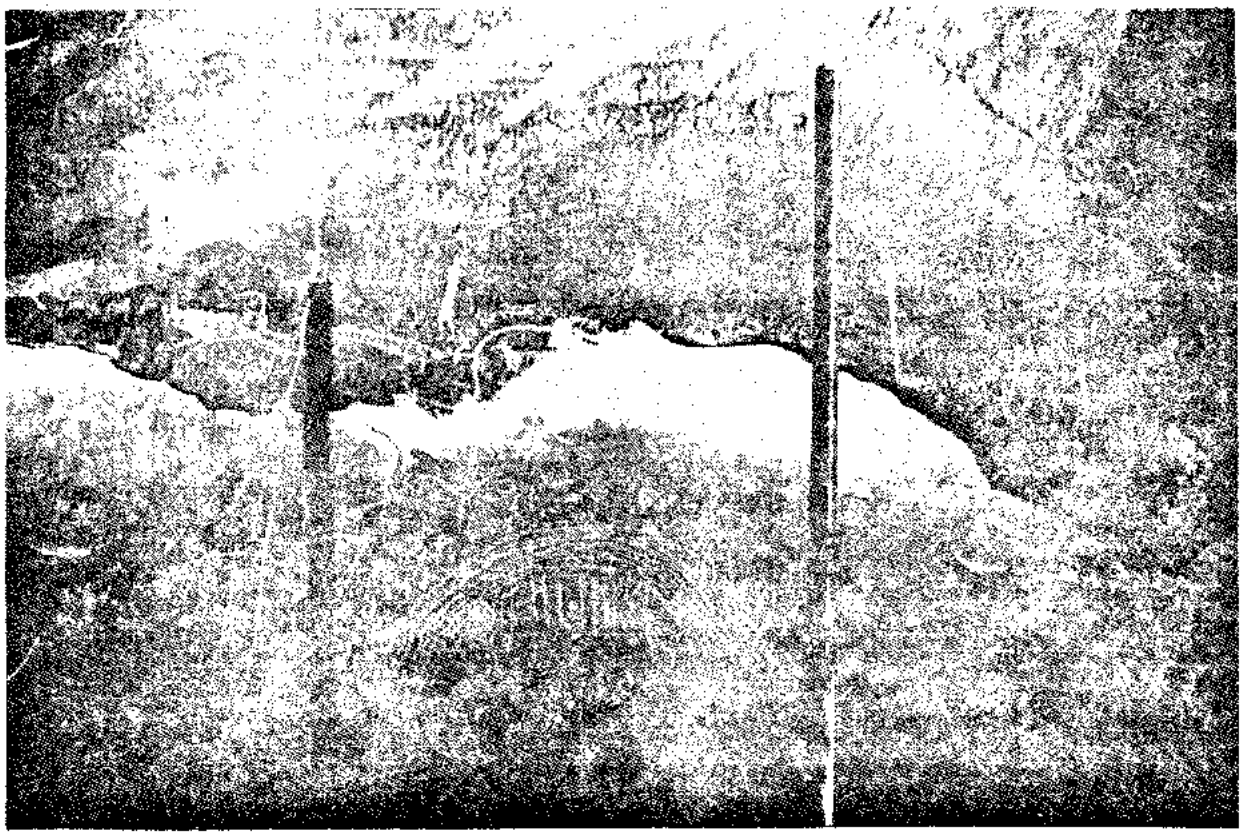
The Hopi and Zuni Calendars recycle at half year intervals. This agrees with what we observe at the site because the shadow traverses the calendar line twice in any given year. Since this is the way these tribe have traditionally calendared their years it easy to see how this semiannual calendar got started. The MRC were no different, so how then did they distinguish between events on the calendar line during summer and fall v.s. winter and spring? The Hopi believed that the sun went to the lower world during the winter where it was summer and was in the upper world during summer while it was winter below. Following this clue let the dates for summer/fall be read from the calendar line above and take the dates for winter/spring from below the calendar line and under the rainbow. In a schematic way, the lower panel represented the lower world.

Let's now pursue a couple of ideas that have been previously discussed, the rain markers on page 19 and the real post on page 55. If we assume that the post was a sandstone pillar or slab standing on end and that its north shadow casting edge had a slant to it that precisely fit the slant of the winter solstice indicator,(E in Plate G1) then it would cast a simularly slanting shadow as it made its semiannual traverse of the panel face. Since we are interested in the dates under the rainbow, in Figure G2 let's extend the winter solstice indicator at C downward, then draw a line parallel to line E through each of the rain markers (lines F through K). By extending these lines upward, where they intersect the calendar line we are able to determine from our tables the date that the shadow would pass each of the rain markers. These are in Table G1. Now examine the set of parallel line as they pass through the rain markers. Notice that they lay very precisely over the markers maintaining a parallel with them and with the line through the winter solstice indicator; therefore, not only have we found a new set of dates to study but we have also found a new proof of the observatory. Unless there were a shadow edge moving accross the panel as the post observatory assumes (now better called the gnonom observatory) there would have been no way or reason for the MRC to make these lines parallel as they are.

Consider now the dates in Table G1, are these good dates for the planting of corn, squash and beans? We can't be sure but we do know that corn growing tribes were in the area and that they must of had some way of determining their times of planting.

And there is more, let's see where the shadow will fall on the lower calendar at the summer solstice. Extending a parallel line down from the big dot on the creation line what interesting feature does it cross? The line passes through the here-to-fore

*** PLATE 64 ***

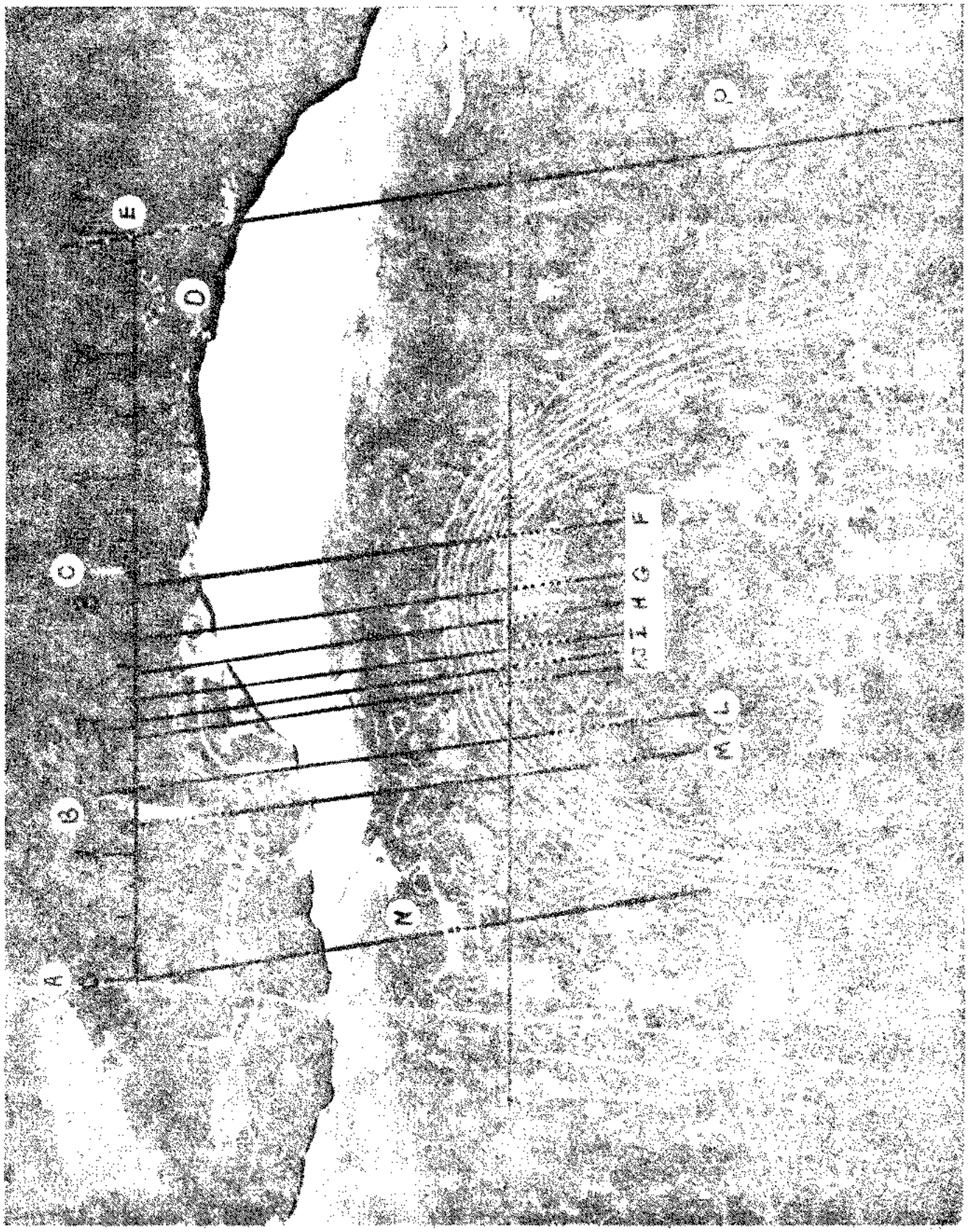


*** PLATE 65 ***

enigmatic two headed big horn sheep right at the curious vertexing lines coming out of the sheep's back. It is now almost too compelling not to interpret the two headed sheep as a Janus symbol looking both directions at the end of the MRC year, and this may not be too far from correct, but being well acquainted with the MRC we can also be sure that this symbol indicated the birth of a new year or more specifically the rebirth of the sun and that the sun runs in both directions up and down the panel or in-other-words up and down the horizon. The MRC may have taken the big horned sheep as a sun symbol or believed the horns of the sheep represented the sun. Notice the sheep's head on the right, how the horns arch almost in perfect concentric semicircles to take on a rising sun appearance.

Now follow the line N on down the to where it just touches a strange looking creature that looks like a bug. If we had not established that a circle represents a star there would be no way to interpret this figure.(See Appendix A, Constellations) We know that the MRC were star watchers and if the proximity of this symbol to the shadow is significant, we may now look for a constellation that is prominent in the night sky at the summer solstice. We must keep in mind that the largest star gets the biggest circle and this will distort the shape of the constellation. Arcturus is the second or third brightest star in the sky and it deserves a big circle, but so would Vega. Which of the two constellations, Lyra or Bootes would the bug fit best? Both are tight little constellations and might fit, but Bootes has three stars at the top of the kite and these can be seen on the panel, let's call it Bootes. The constellation is drawn on the panel up-side-down from the star charts as is Sotuknang.

I mentioned above that I was about to open Pandora's box when I considered other dates off of the MRC calendar line. As we look around the panel there are so many other symbols it becomes very arbitrary as to which would be considered date markers. The lines under the rainbow have always looked suspicious and a little serious analysis rapidly yealded a plausible explanation, but now it becomes more abstract as we consider other possible date indicators. At L and M I have drawn parallel lines which extend down through a funny stick horse figure whose legs have the same slant as the other parallel lines. So some dates were being delineated but why is the same figure repeated to the far right of the panel. If the lines are extended upward from the stick horse then they span Sotuknang above. Which leads us to the next suspicious item to pursue and that is the "Stick Horse Constellation". This little constellation consist of the legs and rump of the Sotuknang Constellation and looks very much as drawn above L and M and at F in Figure 81. At present I don't know what to make of the Stick Horse Constellation, the evidence may be to tenuous to seriously call this a constellation with the others. The only clue is that if the constellation was identified by the MRC then it would have the same celestial motions as the Sotuknang Constellation and the MRC did in deed simultaneously designate it with the Sotuknang.



*** FIGURE 6Q ***

At the far left of the panel there is another janus sheep, if we have correctly interpreted this figure, does this mean that the south shadow edge of the gomon lay on this second janus sheep at the summer solstice when the north shadow edge lay on the large janus sheep. If this is so, then this is exciting because we have not only established what the north porfile of the gomom looked like but we also know how thick the gomon was. Ah, but there are problems, the same line of reasoning can apply to a second pleiad indicator located on the left side of the creation line. Can we make the second janus sheep and the second pleiad indicator synchronize with each other and the well established dates from the MRC calendar line?

*** TABLE 61 ***

G	2' 9"	April 2	Sept 8	91.6 degrees
H	2' 6"	April 8	Sept 3	88.6 degrees
I	2' 3"	April 14	Aug 29	85.1 degrees
J	2'1.5"	April 17	Aug 26	83.8 degrees
K	1' 11"	April 21	Aug 21	82.2 degrees
N	0' 0"	June 20		66.5 degrees