INTER-OFFICE

AMBASSADOR COLLEGE

To: Dr. Hoeh

Date: January 12, 1967

Department: Dean of Faculty

Subject: Stonehenge Lecture by Dr. Fred Hoyle

From: Kenneth C. Herrmann

What were these early builders of Stonehenge looking for and how did they operate their "machine"? Dr. Hoyle is a very unusual man and not above teasing his colleagues in a pedantic manner. Does he really believe the theories he puts out? Of course not, only the general public believes.

If as you state these were Israelites in the time of Joshua putting a fine polish on their calendar calculations, then we can come to certain conclusions, tentative at least. They were watching the sun along the eastern horizon carefully determining the date of the summer solstice by means of the heelstone. Some source of smoke was used to cut out the ultraviolet and blue light, making it possible to look directly into the rising sun and see its outline clearly.

Why go north to Britain? Because the calculations could then be more exact. Watching the solstices from a position near the equator, one would see them with an amplitude (distance in degrees north and south of the east or west point) of $23\frac{1}{2}$ degrees. By going north to Britain the ampitude increases to 40 degrees. This would be the most northern practical location to build this observatory. If one were to go further north to the arctic circle, sunrise would be due north on June 21 and due south on December 22. On June 21 the day would be 24 hours long--on December 22 the length of the day would have diminished to zero. These builders of Stonehenge chose a northern area free from ice early after the Flood, an area where the horizon in these critical directions at least was level and relatively free from trees.

At Stonehenge the two stones set for marking the solstices are not quite far enough apart, and yet this seems to be deliberate as Dr. Hoyle pointed out. As with an eclipse of the sun, there would be the "first contact" of the northward moving sun with the heelstone (about June 2). This would occur some nineteen days prior to the solstice. The sun would still be making quite rapid progress northward at this point. A second calibration would be the morning when the sun rose directly behind the heelstone (June 5) and could be compared to the beginning of totality. A "third contact" would be June 12, nine days before the equinox with the sun's northern edge touching the northern edge of the heelstone. The fourth calibration would be the morning when the sun was fully clear of the heelstone and rising to the north of it, the "last contact" of an eclipse. The sun's northward movement (and return, June 19-23) would be very slow during these days and it would be difficult to determine just the exact day when its northward progress reversed. It would then go through this given sequence in reverse order. The date of the solstice could be very accurately established by a comparison of these four contacts. Dr. Hawkins, on the other hand, is convinced that only the northern most rising on June 21 was sought.

The reason for the northern location of Stonehenge was to increase the amplitude of the sun's swing from $23\frac{1}{2}$ degrees to 40 degrees northward from the east point. Setting these stones several degrees short of that 40 degree mark where the sun would reverse, would increase the accuracy of the observation because the sun would be moving northward faster in these days prior to the day of the solstice. The early contact with the heelstone (and the final contact) plus the magnified effect in a northern latitude would give much greater accuracy than could be obtained in Palestine. The additional fact that an even more northerly circle was built in Scotland is convincing evidence that men would use this feature of increased amplitude to get a more accurate measurement.

The pattern of 56 Aubury holes is a puzzle and its actual purpose is difficult to prove. If they were merely dividing a circle halving it repeatedly, they would have come out with 64. We can make repeated guesses as to the purpose of these 56 positions and if we guess right can almost prove that that was its use. Absolute proof is another matter. One might space eight stones at even intervals and move them once a day in order to determine the arrival of the weekly Sabbath. That seems a doubtful guess.

The 56 could be a rough estimation of three revolutions of the moon's nodes, since they make a revolution in 18.61 years. Or they might refer to a 56 year eclipse cycle including two 19 year Metonic cycles, plus a Saros cycle, minus half a Synodic month. An eclipse of the sun on say July 20 one year would be followed by an eclipse of the moon on July 16 fifty-six years later. That July 16 eclipse would stand a better than 60 percent chance of being visible from Stonehenge, or any spot on earth. Lunar eclipses during the winter would stand an even higher chance of being seen from Stonehenge because this moon would rise in the northeast and set in the northwest being above the horizon for far longer than the average 12 hours. Thus we see the logic of the observations toward the northeast. In summer they were observing the sun and the summer solstice. In winter they were observing the moon in that same northeast location measuring its distance north of the heelstone by four additional markers and also watching for lunar eclipses.

Suppose that July 20 solar eclipse was central (but not necessarily total) then the July 16 lunar eclipse would be both preceded and followed by solar eclipses 14.765 days earlier and later than the moment of the new moon. The chances of these solar eclipses being seen from Stonehenge are rather slim, but the chances of one of the two being seen from the area of Europe or the Mediterranean are considerably greater.

Lunar eclipses visible from Stonehenge would occur almost yearly. Thus if these observers wanted to "see" an eclipse they would do well to predict lunar ones. If they were to depend on solar eclipses, they would want to hear of the eclipse and be told of the time of day that it reached its mid-point. For this they could have depended upon news from Europe and the Mediterranean region.

The vital statistics that we assume they were looking for would be the length of the tropical year and the length of the Synodic month. The tropical year is a stable unit. Yet there was a factor in those early years following the Flood of melting ice caps (or changes in the size of the ice cap) and that these changes would have shifted mass to the equatorial regions slowing the rotation of the earth and thus putting more days in the tropical year (and months also). Our tropical year today is stable as a length of time, yet the rotation of the earth has minor fractional variations. Our present day "second" is based on a fractional length of the tropical year, not a 3600th of a 24th of a day.

The Synodic month presents a much more difficult problem. Its length varies considerably but one of its major variations could be corrected by knowledge of the Saros cycle. This major variation would be due to the fractional portion of the anomalistic month that was included in any period of time. Using the Saros cycle however would cause another error in that the missing portion of the tropical year in this 18 year, 11 1/3 day cycle might affect the average length obtained for the tropical year. If that missing section were at or near the perhelion point, it would represent a different portion of time than if it were near aphelion.

Dr. Hoyle's comment that the early scientific observation at Stonehenge later deteriorated into pagan practices was good. Note the modern "Druids" that gather at Stonehenge today. Were later structures actually inferior in design and logic? Probably so.

The four postholes to the left of the heelstone must have been used for lunar observations for the sun never moved that far north. If we watched for the full moons nearest the winter solstice, they would rise near the heelstone. At the winter solstice, the sun would have reached its farthest point south on the eastern horizon, but the moon would reach its farthest point north and be rising in the direction of the heelstone. If an eclipse season were to coincide with the winter solstice then these full moons would rise over the heelstone and an eclipse of the moon would take place on the day of the full moon. Observers in Britain would normally have about a 60 percent chance of seeing every eclipse of the moon. But they would have a far better chance of seeing an eclipse of the moon occurring in the winter.

If the eclipse season were to be occurring near the equinoxes, then the full moons at the time of the winter solstice would swing out to their widest limit north or south of the heelstone. By carefully observing the amount of swing northward or southward from the heelstone, the observer would be able to determine the location of the eclipse season in the year. No smoke would be needed to cut the brightness of the full moons and thus the "slaughter" stone is only needed in its alignment with the heelstone and used only for solar observation.

The Station Stones allowed two "witnesses" for each observation, and even a third witness for the critical summer solstice points. This procedure would also allow the training of additional observers to take over in succeeding generations.

Obviously all these heavier stones were moved in the winter on ice when the effort needed would have been so much less and the energy of the men (or beasts) supplying the muscle so much greater. A wooden sled-like affair supporting only the front half of the long stone would have worked well and is a standard method of skidding logs, apart from dragging them directly over the ground. The people of Easter Island demonstrated their ability by dragging a huge stone over dry ground and setting it up without the elaborate platform these booklets picture. No one would use rollers to transport rocks 20 miles. The Egyptians skidded boats around cataracts in the Nile by using mud as a lubricant and manpower as the motive force.

If we were to watch the midwinter moon rise year by year in the vicinity of the heelstone, we would see it move from an extreme northerly position to an extreme southerly position in a period of nine years. Nine years later it would have returned to its northern position once more. An additional fractional year would bring the total cycle to 18.61 years. This is the period of the regression of the moon's nodes.

If we assume that the 56 Aubury holes were stations on which to set stones, then we might logically assume that six stones were used spaced nine and ten positions apart giving an average spacing of half the 18.61 year cycle. A spacing of nine followed by nine would equal the 18 year Saros cycle and be a valuable eclipse predictor. A spacing of nine followed by ten would be the Metonic cycle and would also be an eclipse cycle. If every other stone were of a different color or type the arrival of one color might be used to indicate an eclipse of the sun, the other the eclipse of the moon. The moon's nodes move westward $1\frac{1}{2}$ degrees per month or about one 56th of a circle in a year. These six stones might then logically be moved clockwise, one stone might represent the ascending node, the following node a descending node. Every nine or ten years a node and thus an eclipse season would be indicated with a stone in position before the heelstone, indicating either an eclipse of the sun or an eclipse of the moon depending on which stone it was. Indication of an eclipse would also be evident if one of the six stones were to be near any of the Station positions.

Dr. Gerald Hawkins also indicates 30 stones arranged in a smaller central circle and uses these with a moon stone indicating the date of the Synodic month. Logically this moon stone should move counterclockwise in that the moon moves eastward through the stars. The full moon position would be toward the heelstone. The new moon position would be toward the west where the observer would be watching to see for that first crescent of a new moon.

Rather than follow the pattern of Dr. Gerald Hawkins in using six stones, Dr. Hoyle uses only one set of stones to represent the nodes of the moon. He has these revolving in a counterclockwise direction, moving three positions per year. We might choose the moments of the winter solstice, the spring equinox and the summer solstice to move these stones each one position. They would thus make three revolutions in 56 years or one revolution in 18.67 years. Since the period of revolution of the moon's nodes is 18.61 years, after a period of several centuries both stones would have to be advanced an extra notch. Dr. Hoyle also used a sun stone which revolved counterclockwise and might be moved one position per week plus three extra moves per year because there are only 53 weeks in a year. Whenever the sun would catch up with either of the node stones the sun would obviously be entering an eclipse season. A moon stone was also added to this arrangement. It would also revolve counterclockwise moving two positions per day, thus making the full revolution in 28 days. Since the Synodic month is $29\frac{1}{2}$ days, obviously this stone would have to hold and wait for the actual moment of the new or full moon.

If we begin with one of the node stones in position 56 in line with the heelstone, and if the sun stone and the moon stone are also at this position, and if we have an eclipse of the sun at the moment we are beginning our Stonehenge mechanism, then we should be able to make these stones predict the approximate time of the occurrence of eclipses. The counterclockwise moving sun would meet the clockwise moving node every 346 days. The moon stone could be moved at such a rate so as to catch up with the sun every Synodic month. If the sun at this time were also in time with the node stone an eclipse would occur. In 56 years minus four days all four stones would line up again except that the moon stone would be one-half cycle further around and in conjunction with the opposite node stone. Since we began our cycle with an eclipse of the sun we would now have an eclipse of the moon.

There would be numerous ways in which this 56 position circle might be used to indicate eclipses. But was this the basic intent of the builder or were they using solstice measurements and eclipse measurements to carefully build the framework of a calendar?

KCH/rmj

Kenneth C. Herrmann