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THE RIDDLE OF MZORAH

(Contribution No. 2973 from the Woods Hole Oceanographic Institution)

“For in these stones is a mystery,
and a healing virtue against many ailments.
Giants of old did carry them from the furthest ends
of Africa and did set them up in Ireland
what time they did inhabit therein.”

Merlin

Introduction

There stands in northwest Morocco a briefly published monument of acknowledged great antiquity but puzzling provenance. The tumulus and peristalith of Mzorah (Plate I, Fig. 1) are located at Latitude 35 degrees 24.59 minutes north, Longitude 5 degrees 56.73 minutes west, elevation above sea level, 118 meters. They are reached by travelling the road from Azilah toward Tetuan as far as the village of Tnine-de-Sidi-el-Yemeni and then a piste five kilometers to the northeast to the douar of Chouahed. The principal monument and other stone arrangements occupy the open tableland within the douar. Chouahed can also be approached by piste from the north side of the mouth of Wad el Helou. This pist is eleven kilometers in length and passes a number of villages. It follows the ridge forming the southern boundary of the valley of the Wad Ayacha which meanders within two kilometers of Mzorah. As much as eight kilometers inland, the elevation of this valley above mean sea level is but three meters.

Classical Greek and Roman writers refer to a great tomb associated with Tangier and Lixus that was seen by Sertorius during his action in Morocco. Some say that Antaeus, defeated by Heracles during his last labor, lies buried here.

This report presents the results of a recent study, 1969–1976. New discoveries, an up-to-date description and detailed maps, and conclusions and hypotheses regarding the date, origins and function of the monuments at Mzorah are provided.

Description of Mzorah Today

In April 1972, with the assistance of Si Belhoussine Drissi, Gordon Browne, Paul Vauquier and others, the author made measurements of the stone ring surrounding the tumulus and of the location of other monoliths in the locality. Additional measurements were made in May of 1974. This data combined with aerial and ground level photographs taken during four visits over a five year period resulted in the plans of Figure 1 through 6. The accuracy of the position of individual stones in

Figure 1 is considered to be better than one-half degree in azimuth angle and one-quarter meter in length. The diameter measurements which delineate the shape of the enclosure of monoliths are accurate to plus or minus 0.10 meters.

Measurements were made as follows:

1. The stone ring surrounding the tumulus.
 - a. Eight radial measurements from an assumed center to the mid-line of the standing stones.
 - b. A perimeter measurement in 13 sectors.
 - c. Individual stone positions using a combination of direct measurement, aerial photography and ground level photography.
2. Positions of many stones outside of the ring, now lying down or broken, which were probably upright in the past.
3. In the interior of the tumulus, the positions of indicated passages and possible cist graves.
4. Dimensions of the tumulus itself and the retaining wall within the ring of standing stones.

The enclosure of standing stones was found to be a perfect ellipse of the following dimensions referred to the mid-line of the stones. (Figures 1 and 4)

Major diameter oriented $70^{\circ} \pm 2^{\circ}$	59.29 meters
Minor diameter oriented $340^{\circ} \pm 2^{\circ}$	56.18 meters
Focal distance	18.95 meters
Perimeter	181.45 meters

The tumulus is constructed of small blocks of broken sandstone about 15 centimeters cube and is approximately five meters in height. It has been much destroyed by excavation and quarrying. The only guide to its former appearance is the sketch of BROOKE in Plate III. In the southeast sector where the retaining wall is visible, the radius to the outside of this wall is 27.5 meters in the north-south direction and 28.5 meters in the east-west direction measured from the ellipse center. All azimuths directions are given relative to true north. The polar coordinates of the stones are presented in Table I for those who wish to try further mathematical analysis on the ring of stones. Figure 4 presents the best fit ellipse from which the stones have a standard deviation of 0.021 meters which is less than the accuracy of the stone positions. The experimental accuracy of the ellipse orientation, $\pm 2^{\circ}$ is limited by the small eccentricity of the ellipse.

Locations noted in 1880 by WATSON (1) (Fig. 7) were visited. Some stones which had been observed by WATSON are no longer visible, but partially buried fragments and depressions in the soil remain. A number of stones were located which had not been recorded previously. Compare Figures 5, 6 and 7. In the interior of the tumulus, locations of three possible cist graves were found as well as the remains of interior passage walls. The azimuths of natural horizon foresights for possible astronomical alignments were recorded.

Table I Coordinates of Mzorah Ellipse to stone centers. Azimuth clockwise from true north, radii from ellipse center.

Azimuth- degrees, radii-meters											
Stone No.	Az	Rad.	Stone No.	Az	Rad.	Stone No.	Az	Rad.	Stone No.	Az	Rad.
1	2.5	28.4	49	96.3	29.0	97	192.8	28.2	145	298.2	29.0
2	4.8	28.6	50	99.2	29.2	98	194.9	28.6	146	300.0	29.0
3	—	—	51	102.2	29.3	99	198.0	28.6	147	301.8	28.8
4	—	—	52	104.8	29.3	100	200.4	28.8	148	304.5	28.5
5	12.1	28.2	53	106.9	29.1	101	203.0	28.9	149	306.1	28.7
6	15.1	28.1	54	108.4	29.1	102	—	—	150	308.2	28.8
7	18.0	28.3	55	110.0	29.4	103	—	—	151	310.2	28.9
8	20.0	28.3	56	111.5	29.4	104	210.1	29.2	152	312.1	28.9
9	22.5	28.4	57	113.2	29.4	105	—	—	153	314.1	28.6
10	25.0	28.6	58	115.0	29.2	106	215.1	29.1	154	316.0	28.6
11	26.8	28.7	59	116.9	29.2	107	217.6	28.9	155	318.1	28.9
12	29.6	28.9	60	118.4	29.1	108	219.9	29.4	156	320.1	28.5
13	32.4	29.0	61	120.2	29.2	109	—	—	157	321.8	28.4
14	35.0	29.1	62	122.1	28.7	110	224.0	29.5	158	324.3	28.4
15	37.6	29.1	63	124.3	28.9	111	226.4	29.4	159	326.2	28.4
16	39.4	29.6	64	126.0	28.7	112	228.4	29.6	160	323.2	28.4
17	41.9	29.6	65	127.5	28.9	113	230.4	29.6	161	330.2	28.4
18	44.5	29.7	66	130.0	28.9	114	232.9	29.8	162	333.0	28.4
19	46.5	29.7	67	131.5	28.8	115	234.8	29.8	163	335.1	28.3
20	48.1	29.8	68	133.7	28.6	116	236.8	29.6	164	337.0	28.3
21	49.9	29.8	69	136.2	28.7	117	238.5	29.4	165	339.0	28.0
22	51.0	29.8	70	138.1	28.7	118	240.2	29.4	166	341.0	28.0
23	52.8	29.8	71	139.9	28.6	119	242.0	29.2	167	343.3	27.7
24	53.7	30.3	72	141.8	28.6	120	—	—	168	345.3	27.9
25	55.0	30.2	73	143.6	28.5	121	245.8	29.4	169	347.3	28.1
26	56.3	30.2	74	145.5	28.5	122	248.1	29.4	170	349.9	28.4
27	57.5	30.2	75	147.5	28.6	123	250.0	29.6	171	351.8	28.9
28	58.5	30.3	76	149.8	28.6	124	252.1	29.2	172	353.8	28.9
29	60.0	30.3	77	152.2	28.5	125	253.9	29.2	173	356.3	28.9
30	61.2	30.3	78	154.2	28.6	126	255.2	29.4	174	358.1	28.6
31	62.5	30.2	79	156.6	28.5	127	257.5	29.4	175	0	28.5
32	63.9	30.4	80	158.9	28.6	128	259.9	29.7			
33	65.2	30.0	81	161.1	28.6	129	262.6	29.7			
34	67.1	30.4	82	163.0	28.6	130	265.6	29.6			
35	69.0	30.1	83	164.5	28.4	131	—	—			
36	70.1	30.0	84	166.2	28.4	132	—	—			
37	71.8	29.8	85	167.8	28.1	133	272.9	29.4			
38	73.8	29.8	86	169.0	28.4	134	275.2	29.4			
39	75.2	29.8	87	170.5	28.4	135	277.9	29.6			

Stone No.	Az	Rad.	Stone No.	Az	Rad.	Stone No.	Az	Rad.	Stone No.	Az	Rad.
40	77.0	29.6	88	172.5	28.4	136	279.8	29.4			
41	78.7	29.4	89	174.8	28.3	137	281.6	29.2			
42	79.8	29.4	90	177.1	28.3	138	283.9	29.4			
43	82.8	29.5	91	179.4	28.4	139	285.8	29.3			
44	85.0	29.1	92	181.2	27.9	140	287.4	29.2			
45	87.0	29.4	93	183.0	28.4	141	289.6	29.2			
46	89.0	29.3	94	185.4	28.3	142	291.9	29.1			
47	91.5	29.3	95	187.5	28.4	143	294.1	29.1			
48	93.9	29.3	96	189.8	28.4	144	296.1	29.1			

BROOKE (2), who visited Mzorah in 1830 protected by a troop of cavalry, saw no evidence of tool marks on the standing stones but yet it was felt by TARRADELL (3) that they had been hammered and polished by the human hand and were apparently of an unnatural shape. The reddish sandstone is known to be friable and it is clear that large fragments of stones have broken off as part of the weathering process even in the 40 years since the excavation of MONTALBAN. Cesar Luis de MONTALBAN excavated the tumulus of Mzorah in 1935–36. TARRADELL (3) asserts that no reports of his work remain. Unfortunately he published nothing before his death and he is the only person known to have excavated the site. However, he did leave two brief reports which have come to light recently and are in the possession of M. Paul Vauquier of Tangier. One is a brief description of MONTALBAN's findings which include a tomb with a skeleton to the west of El Uted and flints from the interior of the tumulus which he considered different from most found in the general area. In addition there is a sketch map. The group of stones southwest of El Uted is labeled "Cromlech destruido." A group to the northwest of the ellipse, probably Group D, Figure 5, is labeled, "Cromlech en construccion." Marthe de Chambrun Ruspoli, who knew MONTALBAN, claims to have seen a photograph of an altar supported by legs carved in the shape of sphinxes, taken in the excavation.

A comparison of Plates I and II shows that the stones have substantially damaged since 1935. Some tall stones have been broken off, possibly numbers 119, 122, 124 and others (Figures 1 and 3). In the northwest quadrant, stones 150, 152, 161, 165, 168 and 171 appear to have suffered recent breakage. In the southeastern quadrant, many stones shown intact in MONTALBAN's photograph (Plate II) are broken today. That natural weathering did not do more damage over the centuries can be attributed to the fact that many stones were covered with soil for most of the period and therefore protected. The observations of BROOKE (2), 86 upright stones; WATSON (1), 67 stones; and TISSOT (4), 40 stones, attest to this as there are presently 168 stones in place. Stone a, in the southwest group C (Figure 6) shows vertical striations which are commonly caused by weathering. While it cannot be said with certainty that the shaping of the standing stones is entirely due to natural causes, it is highly probable that they were much more nearly of the squared form in which the stone is naturally quarried than is the case today. The squared form of the

stones of the retaining wall surrounding the tumulus within the ring of standing stones, Plate IV, was cited by TARRADELL as evidence of post-neolithic date (3). Upon close inspection, these blocks, while requiring some local hand work, are of a shape which can be found occurring naturally in the vertically-bedded sandstone outcrops which frequent the region. In 1969, while walking northeast of El Had not far from the ruin of Ad Mercuri (circle in Figure 2), the author observed a particularly prominent outcrop of this nature where lay a long stone of rectangular section similar in size and shape to some of those found at Mzorah which clearly had been broken loose from its bedding by natural weathering or but the slightest of human assistance.

The nature of the geology always has a profound effect on megalithic architecture and construction. Where there was a relatively easy method at hand, it was generally used. In Orkney, Scotland, the spectacular circles of menhirs were built with sandstone slabs which have strikingly flat surfaces and are regular in shape. They are easily taken from the horizontally bedded and stratified material of which the islands are made. Weathering has rounded the edges of the standing stones at Mzorah. The magnificent megalithic temples of Malta are impressive in their architecture but they are built of the soft yellow limestone of the island which in its unweathered state can be easily carved by hand with a knife.

TARRADELL (3) noted that there are three planforms of the stones which make up the ring, circular, oval and rectangular. However, there seems to be no arrangement that would indicate whether or not this information contributes to interpretation of the function of the monument. Of more importance, perhaps, are the differences in size, both height and planform, which form identifiable patterns. Stone 130, named El Uted, the pointer, is the largest and most spectacular standing stone. It is 5½ meters in height and shows a nearly square plan near ground level changing to a nearly circular plan a short distance above. This probably represents a change of ground level relative to the stone and is evidence of weathering of the exposed portion. Future excavation around the stones may reveal many having this characteristic. BROOKE (2) was told of a tradition that Pharaoh, king of Egypt made use of El Uted as a peg upon which to picket his horse. Another tradition speaks of the great deluge when Noah sent forth a dove from the ark which first alighted on El Uted. Stones 131 and 132 are tall pointed stones similar to El Uted but shorter and presently lying flat. They are, apparently, next to El Uted, the tallest in the ring. They have been nearly buried for at least the last 140 years since BROOKE saw them (2), and do not appear to be rounded like El Uted. They appear to be pyramidal with sharp corners. There are at present 168 stones in place most of which are broken stubs. Figure 1 shows seven locations in which stones are presumed to have been positioned to fill out the complete ring forming a closed ellipse of 175 stones. Sixty-one of these are considered to be intact. In the northeast, there is a curious group of smaller stones of rounded rectangular section which are closely spaced and identical, 21–32. Stones 43–50 are large in plan and of oval section whose top elevations follow shallow curves. Number 69, remarked on by DAVIDSON (5) is coffin-shaped. Number 90, thin and long of square section is

fallen but intact and has a pyramidal top noted by BROOKE (2) and others. Numbers 91–100 are large in plan, domed and of circular section at the base.

The anomalous group of closely spaced stones from 21–32 in the northeast might be explained by the need to crowd the stones to achieve a certain total number in the ring. However, if analogy to the sophisticated works of Britain is valid, the builders of Mzorah probably had something less simple-minded in their design. The northeast quadrant contains 46 stones, the southeast 45, the southwest 40 and the northwest 44.

While there is much variation in the height, shape and spacing of the stones, and a generally irregular arrangement of the different planforms, it is difficult to believe that the design is random. Before weathering took its toll, the shape differences may indeed have been greater.

It is likely that the removal of most of the retaining stones from around the periphery of the tumulus was responsible for the erosion of the tumulus which caused the monoliths to be covered and preserved. Since stones of the retaining wall remain in only one quadrant, the southeast, it is not possible to say whether or not they formed an elliptical enclosure as do the standing stones. In this quadrant, most of the standing stones have been broken off, presumably by weathering because they were more exposed than elsewhere. Many of these stubs are today covered by dense prickly pear hedge. We do not know the original height of the retaining wall or to what extent it inhibited erosion of the tumulus.

Plate II, showing the condition of Mzorah in 1935 when it was excavated by MONTALBAN exhibits two walls within the tumulus oriented north-south and east-west. There appear no remains of these walls today.

Outside of the ellipse of standing stones, there are today three principal groups of fallen monoliths (Plate V). Group A contains three almost parallel giant stones and one upright stub broken off at ground level (Fig. 6). This stub bears 270.5 degrees from El Uted at a distance of 88 meters. Group B contains seventeen large fragments of monoliths and is located within a low stone rectangular enclosure 23 by 20 meters oriented north-south whose center lies 35 meters due north of El Uted. This group seems to lie on a circular arc and may have been part of another ring of standing stones as suggested by TARRADELL (3). Some of the stones in this group, not noted by previous observers, were probably exposed by MONTALBAN in 1935 but there is no record of it. Group C, about 35 meters south of Group A is within the enclosed yard of one of the elders of the village of Chouahed. This again may be part of another large ring of stones, but there is no tumulus. Here lie the largest monoliths of the region, two fallen broken stones which must have been a full six meters in height. One fragment has regular cup markings on its upper face, noted by BROOKE (2), which are probably a form of weathering which is seen on many natural outcrops in the region. They are used today to play a game called *kala*. Group C contains sixteen stones visible in the clearing and untold others covered by prickly pear hedge.

Group E, observed by WATSON (1) (Fig. 1), was due north of the ellipse center. There remains today only a depression in the earth where the stones once stood.

Group F, not previously reported, consists of four stubs of broken stones on a slope to the northeast 480 meters from the center of the ellipse. It bears the same direction from the ellipse center as an Islamic cemetery further to the northeast on the hilltop.

Of the many single stones presented in Fig. 5, the most impressive is stone b bearing 310 degrees 40 minutes to its southerly end from the main ring center a distance of 110 meters. It is a giant stone and has a deep gouge which has nearly cut it through.

In addition to the tumulus and monoliths at Mzorah, there are other ancient constructions which may bear a relation to the megalithic sites. Around the tumulus and four meters outside the ring of standing stones is the ruin of a low wall three stones and 0.67 meters in width made from the same small broken pieces of sandstone of which the tumulus is built. It extends from the southwest clockwise to the northeast. Both ends become lost beneath prickly pear hedge. On the west, facing the three tall stones of the ring, Nos. 130, 131 and 132, the wall opens out into a rectangular enclosure, 23 meters in north-south dimension by ten meters in the east-west direction. This enclosure is symmetrical about the east-west direction. Twenty-six meters to the west of El Uted is a trapezoidal enclosure of the same size stones of which the tumulus is built, largely reduced to rubble. The photographs published by TARRADELL (3) showing the area at the time of the MONTALBAN excavation in 1935 show this construction to have been an intact walled enclosure of unknown utility and origin. The rectangular enclosure was entirely missing in 1935 and the low wall surrounding the tumulus which exists today was more substantial (3). The debris from the 1935 excavation was discovered in 1972, after an indication by aerial photography, to be located 85 meters to the southsouthwest of the center of the ellipse.

There are remains of a level earth platform just north of the ellipse. It is an artificially filled area, presently much eroded on the north and east sides. The west and south sides, which can be detected clearly, are oriented approximately true north and west. The east-west dimension is about 50 meters and the north-south varies from 30 to 35 meters. It may be important that Kouass, excavated by PONSICH (6) includes a platform 50 meters square, also of earth, which is oriented also north-south. It is bounded by a retaining wall, but so could the one at Mzorah have been. The direction from Mzorah to the Kouass platform or pre-Roman camp as PONSICH calls it, indicated in Figure 2 and 14.9 kilometers away is 340 degrees, the orientation of the minor axis of the ellipse. Also shown in Figure 2 is a straight line from the Mzorah ellipse to the mouth of Wad Rharifa at Kouass, along which lie two Moslem koubbas and a cemetery.

Geometry

The most significant finding in 1972 was that the geometry of the ring of standing stones at Mzorah established evidence of a cultural relationship between prehistoric

Morocco and Great Britain. THOM (7) analyzed the geometry of some 400 megalithic stone rings in Great Britain and found them to have been constructed with great precision. He found a consistent unit of length, which he named the megalithic yard (MY), equal to 0.829 meters and a consistent practice of the builders to use integral multiples of this unit in laying out their stone arrangements. He suggests that the Spanish vara of 0.836 meters is descended from the megalithic yard. The megalith builders also made frequent use of the Pythagorean right triangle of three integral sides more than a thousand years before the Greek philosopher is said to have codified the relationship. The right triangle used most commonly in megalithic Briatin was that having lengths of sides in the ratio 5:4:3. The next most common was the 37:35:12 and this is the ratio used at Mzorah. This type of mathematical relationship can be applied to the construction of the ellipse because the ratio of major axis to minor axis to distance between foci for an ellipse is the same as that between the sides of a right triangle. THOM has tabulated the dimensions of 35 ellipses in Great Britain (7) and found a statistical indication of the way in which megalithic man compromised what he must have found to be a frustrating law of nature. If the measurements of the diameters and focal distance of an ellipse correspond to the sides of an integral right triangle, the perimeter cannot be integral. He decided, according to THOM, to give priority to the integral right triangle and altered his basic unit to $2\frac{1}{2}$ megalithic yards to try to make the perimeter fit.

The only certain geometrical similarity between the Mzorah ring and those of Great Britain is that Mzorah is an ellipse and that it is very close to a 37:35:12 ellipse. The ratio of principal dimensions is 37:35.07:11.83. The discovery of this triangle, used to construct the elaborate array at Woodhenge, is considered by THOM to be one of the greatest achievements of the megalithic ring builders.

Whether or not the megalithic yard of precisely 0.829 meters or some other standard length was used in the construction of Mzorah is uncertain largely because the size of the ellipse is large compared with the unit of length. WIERCINSKI (32) believes that THOM's megalithic yard is to be found in Mexico at Teotihuacan on the basis of astronomical significance of the number of megalithic yards used in the principal dimensions of the Pyramid of the Sun, a solid structure of well fitted cut stones. At Mzorah, no such basis has yet been discovered. Perhaps measurement of more monuments in Morocco will reveal a unit of length. However, the Mzorah ellipse dimensions in megalithic yards of 0.829 meters and 0.836 meters are.

	MY=0.829 m	MY=0.836 m
2a=Major diameter	71.52 MY	70.92 MY
2b=Minor diameter	67.77 MY	67.20 MY
2c=Focal distance	22.86 MY	22.67 MY
Perimeter	218.88 MY	217.00 MY

The ratio a:b:c is 37:35.07:11.83 which is very close to the 37:35:12 Pythagorean right triangle ellipse. If MY = 0.836 m, the major diameter and the perimeter are close to integral.

An ellipse at Daviot in Scotland is similar to Mzolah in that it is also a 37:35:12 ellipse. It has, however, an east-west major axis and it is smaller than Mzolah by a factor of three. Only at Stanton Drew near Bristol, England, are found ellipses which approach the size of that at Mzolah. The largest ring at Stanton Drew is larger than Mzolah but has not been identified as a certain ellipse (7). Thus Mzolah is the largest certain ellipse.

Astronomy

There is much current interest in early man's preoccupation with the heavenly bodies. He recorded great detail through a very long time, as much as 1500 years, at the time of the megaliths. He probably had a concept of the universe consistent with his observations. He was interested in the diurnal course of the sun, the oblique annual motion causing the seasons, the moon's phases and regular appearance and disappearance and eclipses of the sun and moon. The precession of the equinoxes was known to the ancients.

THOM (7, 8) has studied the astronomical significance of the megalithic enclosures and alignments of Britain and found many of them to have been observatories for viewing and recording the motions of the sun, moon and stars. If the ring of monoliths at Mzolah is truly in the megalithic tradition of the enclosures of Great Britain, an astronomical significance to the arrangement of the stones can be expected. Stone Number 132 marks the setting equinoctial sun within $\frac{1}{2}$ degree of azimuth for an observer at the center of the ellipse. This angle varies with the changing of obliquity of the ecliptic which has decreased one-half degree from 2000 B.C. to the present date.

The north-south direction is indicated only by a line from the ellipse center to group E (Figure 5). This could have been determined by noting the change in azimuth of a circumpolar star and recording the mean, or a gnomon, perhaps one of the larger stones, could have been used with the sun's shadow to establish north.

THOM (7) found that a star setting or rising azimuth was indicated by a slab, two or more stones not too far apart, a circle and close outlier, or two circles. For the sun or moon, a long alignment was required or two well separated stones, a circle with an outlier some hundred or more meters distant or a natural foresight such as a mountain peak identified by some simple indicator. The rising and setting azimuths of the sun and moon were studied with great accuracy and the stars with less precision probably because they could be seen only at night. The planets surely must have caught the interest of early people but it is uncertain whether or not their motions were recorded because of the complexity of their paths.

The change in the rising and setting azimuths of the stars with epoch due to the precession of the equinoxes can be used as a dating technique, provided the intended star sight can be identified. By noting the azimuth of possible star setting alignments at many sites in Britain and comparing this data with the calculated change of star declination with epoch, THOM has dated many megalithic circles and alignments to

the time span 2100 to 1600 B.C. with a concentration at 1800 B.C. If a number of certain star alignments can be established at Mzorah, a means for dating the stone arrays would be available. Most first magnitude stars were recorded in Britain and many have substantial changes of declination with epoch. Nine of the brightest stars shift their azimuths at rising and setting by more than one-half degree in 100 years, so-called "fast" stars. In Britain, THOM compared these azimuths during the period 2100–1600 B.C. with recorded stone alignments and a high frequency of matching was discovered (7). These stars were Aldabaran, Alcyon, Antares, Arcturus, Bellatrix, Betelgeuse, Capella, Sirius and Spica.

There is the possibility that the principal stone ring at Mzorah may have been a giant astrolab in which the stones represent the rising and setting azimuths of stars as viewed from the center in ancient times. If such were the case, there could hardly have been a tumulus within it for it would have obstructed the sights.

It is postulated that the stones are arranged by size and spacing in a plan, as yet unclear. Some stones listed in Table I have been selected as possible astronomical markers for the setting of previously listed important Zodiacal stars at horizon foresights.

Table II Azimuths

Stone	Shape	Azimuth	Setting Object	Date	Constellation
90	tall, cone top	177.1°	Near South		
130	El Uted, largest	265.6°	Bellatrix	1600 B.C.	Orion
131	Tall, pointed	268.0°	Betelgeuse	1800 B.C.	Orion
132	Tall, pointed	270.4°	Aldabaran	1800 B.C.	Taurus
136	tall	279.8°	Set sun Equ.		
145	double	298.2°	Spica	1800 B.C.	Taurus
146	double	300.0°	Set sun summer solstice		
149	tall	306.1°	Midwinter moonset (max. decl. of 18.6 year cycle)		
158	tall	324.3°	Arcturus	1800 B.C.	Bootis
Group A (exist bases)		273°	Aldabaran	1600 B.C.	
Large stone group C		254°	Antares	1400 B.C.	
Stone b		312.5°	Capella	1600 B.C.	
30		61.2°	Midsummer sunrise		
47		91.2°	Equinox sunrise		
61–62		121.0°	Midwinter sunrise		
146		299.8°	Midsummer sunset		
132		270°	Equinox sunset		
118		240.2°	Midwinter sunset		

An intriguing anomaly in the ring is the group of small closely spaced stones in the NE quadrant, numbers 19–31, the best preserved of which are 25–29. It is tempting to speculate that they may record moonrise over the eastern mountains. The moon in its 18.6 years cycle changes its rising azimuth, corrected for altitude, from 53.9° to 68.6° and back between stones 24 and 35. An azimuth of 54° is also indicated by the alignment b-k-c-m of Figure 5. The midsummer sunrise, which occurs at the same azimuth as moonrise in mid-cycle, appears over the eastern mountains at an azimuth of 61.4° in 1800 B.C. or at stone number 30. The major axis of the ellipse passes between stones 35 and 36 which gives added credence to a lunar theory for the Mzorah ellipse. DIODORUS refers to the lunar cycle. He said (24) that Apollo visits the land of the Celts every 19 years and “dances the night through from the vernal equinox until the rising of the Pleiades.”

Of the many fallen menhirs outside the main ring, there are several which were very large, comparable to or even larger than El Uted, when erect. These are the three in Group A, two of Group C and stone b. They may be outlier stones with astronomical alignments referred to the ellipse as suggested in Table II or they may be parts of independent complexes as implied by WATSON's map of 1880 (Figure 7).

In Table II it can be seen that all of the listed “fast” stars are present except for Sirius and give dates of 1400 to 1800 B.C. If the astronomical alignments postulated are valid, then the ring appears to be dated in this period. In addition to the alignments postulated, there are many possibilities, in fact there are so many stones in the ellipse that, within the measurement accuracy and limit of confidence in original locations of the stones, any further suggestion of alignments of individual stones is inconclusive.

The major axis of the Mzorah ellipse aims at the summit of Jbel Si Habib, the largest mountain on the horizon. This may relate to the orientation of a large elongated tumulus in the Rharb of Morocco near Lalla-Mimouna, some 50 kilometers south of Mzorah where the alignment points to the summit of Jbel Sarsar, the only mountain on the horizon. At the equinox, the sunrise is spectacular, its lower limb tangent to the summit 23 kilometers away (33).

The number of stones in the ellipse, 175, may be related to the 173 days between the times of year when eclipses are possible, when the earth, sun and moon are in line, or to six lunar months which total 177 days.

The Egyptians controlled their calendar by observing heliacal and acronical sightings of certain stars. A heliacal sighting occurs when a star is seen near the horizon at the same azimuth as the sun's rising or setting. When the star is opposite the sun, the sighting is called acronical. Twilight reduces the contrast between the star and the sky background and the typically long twilight of northern latitudes made this method unsuited to Britain according to THOM (7). However, heliacal and acronical behavior of the Pleiades is considered by WINKLER (9) to have been the signal to the Celts of Britain and other northern European people to mark their fall and spring festivals 2000 years ago. The coincidence of heliacal and acronical sightings of the Pleiades with the vernal and autumnal equinoxes respectively

occurred at the latitude of Morocco in 1700–1500 B.C. and is repeated on a cycle of 26,000 years. The event would have been spectacular and added to the significance of the equinoctial sun or east-west azimuth. This was possibly signalled by stone 132 and outlying Group A at Mzolah.

THOM (7) found a megalithic calendar based on division of the solar year into two equal parts, the tropical half-year of $182\frac{5}{8}$ days, by the equinoxes. He found evidence for a sixteen “month” year, each “month” having 22, 23 or 24 days. The beginning of each “month” was marked by a stone alignment corresponding to a solar rising or setting. The azimuths of solar rising or setting oscillate with the passage of time between the winter and summer solstices. The equinox marked by east-west is the midpoint of this oscillation. In spite of generally irregular patterns of arrangements of stones around the Mzolah ellipse, the spacing between the solstice azimuths is quite regular. If each stone were considered to represent five days, the sixteen month solar calendar of THOM could be identified with the stones of Mzolah. (See Tables I and II.)

THOM’s work (7) on British stone rings is circumstantial evidence that Mzolah probably has astronomical significance. It is worthwhile, therefore to pursue this possibility with more accurate measurements, more comprehensive numerical analysis and excavation around the stones to establish accurate original positions and to locate missing stones.

Megalithic rings have been found to have geometrical and astronomical sophistication so far only in Britain and Ireland (THOM, (7), HAWKINS (10)). Megalithic alignments in Great Britain and Brittany have been studied by Thom and shown to have a similar character.

Standing stone enclosures not yet shown to be of geometrical or astronomical interest are found in many parts of the world, in some cases enclosing tumuli as in Algeria. They are sometimes free-standing as at Peshawer, Pakestan, Tay Ayeh near Dayabger, Iran and in India (11).

The Megalithic Menhirs of Mzolah, part of the megalithic tradition of the second millenium, B.C.

The standing stones of Mzolah can be classed as true menhirs of the European megalithic tradition. It has been pointed out that the ring of standing stones is in the form of a perfect ellipse having the same proportions as several in Great Britain. The dimensions may make use of the same unit of length used in prehistoric Britain or Iberia. THOM has shown by astronomical dating that all megalithic circles, ellipses and alignments in Britain were built between 2100 and 1600 B.C. and postulated alignments at Mzolah are consistent with this. REYGASSE (12) believes that the age of the Mzolah monument appears related to the true European stone circles.

The tumulus, however, is similar in architecture and construction to other sepulchral tumuli in North Africa considered to have been built during the first millenium B.C. The nearest published similar tumulus is located at Souk el-Gour

near Meknes (13, 14). It is large and double-tiered with two concentric retaining walls. Since most of the stones making up the wall around the tumulus of Mzorah have been removed, probably because they make convenient building blocks, used in preference to the menhirs, it might be concluded that there could have been a second tier of stones as at Souk el-Gour. This is not out of the question, though nothing can be seen today of the remains of such a second wall without further excavation.

The question arises whether or not the ring of menhirs was built and used contemporaneously with the tumulus, which probably was sepulchral. In Scotland, the Clava cairns which are sepulchral, tumuli bounded by retaining walls of upright stones are surrounded by rings of menhirs at some distance from the tumuli which were apparently roughly contemporary. However, the ellipse of Mzorah was probably laid out before the tumulus was built because it is difficult to conceive of how the ellipse could have been constructed with the tumulus in place. The construction of the ellipse could have been accomplished with stakes at the foci with a rope fastened one end at each stake and a scribing rod allowed to run within the stretched rope. We can speculate that the ring of standing stones of Mzorah may have been built hundreds of years before the tumulus because it is apparently associated with a cultural tradition which existed in Britain in the early second millenium B.C. whereas the tumulus is associated with a tradition usually dated to the first millenium B.C. or later. The ring of menhirs was built, used and had geometrical and astronomical importance to the community. With the passage of time, its origins and function may have been forgotten but it remained a holy place as it is today. We might speculate that the time came to build a tomb worthy of a great Berber king. What more suitable place would have been selected for his burial than the hallowed ground at Mzorah?

Phoenecian settlement of the Atlantic coast of Morocco is dated 800 B.C. followed by the Punico-Mauretanian in which Kouass was reported to have been settled (21). PONOSCH recognizes a pre-Phoenecian northern Moroccan Bronze Age which dates with Early Bronze or Childe's Bronze II (21), exemplified by the Argaric culture of 1500 to 1400 B.C. (22). This is the same culture as that associated with the rupestral carvings of men and halberds at l'Oukaimeden in the High Atals (14).

In Morocco, the Bronze Age is indicated by weapons of Bronze and Bell Beaker pottery excavated in megalithic cist graves near Tangier. But Bell Beakers, found throughout Europe, are universally dated to a period of a few centuries about 1800 B.C. during the Early Bronze Age. Colonization between North Africa and Spain goes back at least to 3000 B.C. when people of the Capsian Neolithic of the Maghreb migrated to Almeria (22). The Spanish Bronze Age apparently started at Almeria introduced by prospectors from the east. Presumably the rather poor Bronze Age in Morocco was introduced from Almeria near the end of this cultural phase or from El Argar. There was evidently much traffic across the straits in prehistoric times and Camps (14) maintains that navigators during the Bronze Age were true mariners of extensive influence. It has been established that they travelled the coast from the Mediterranean to northern Europe (22).

A date for the menhirs of Mzorah during the Early Bronze Age is not unreasonable, at a time when the megalithic idea was widespread in the form of enclosures and tombs and the Beaker people were a dominant culture.

Physical Anthropology of the Riffian Berber

Coon (15) gained a strong impression that the Riffian Berber people have northern European origins on the basis of physical anthropology. By comparing eye color, hair color and head, face and other body measurements, he found striking similarities between the people of the Rif and those of England, Scotland and Scandinavia. He also found distinct differences between the Riffians and the people of the neighboring Mediterranean lands. The Beni Amart people were considered equivalent to a blond fishing village population on the east coast of England. In addition, the Riffian Berbers are associated with the most red-haired people in the world, the British of Celtic tradition.

This possible association of the ancient people of Morocco with those of the north is supported by the finding of an architectural geometry at Mzorah in Morocco and elsewhere uniquely in Great Britain.

The Estuaries of Prehistoric Morocco

Many of the rings of menhirs of Britain are located at the heads of navigable estuaries from Callenish in the Outer Hebrides to Stanton Drew near the Bristol Channel. This is not surprising if the megalithic idea was introduced by maritime adventurers.

Is there evidence that Mzorah also was accessible from the sea by water? Today it lies ten kilometers up a valley with but a meandering stream to connect it with the ocean.

Three themes dominate the effects of man and nature on the landscape of the Mediterranean and Atlantic Moroccan coasts and all support the existence of more extensive navigable estuaries in the second and first millennia B.C. than today. They are the historical report of forestation and therefore greater alluvial deposition in our era than previously, the evidence of higher sea level in pre-Roman times than at present and the evidence of high rates of alluvial deposition.

Classical authors leave the general impression that the Mediterranean lands were more densely wooded than they are today and that many areas had intact forest cover as late as 500 B.C. While devegetation is as ancient as man, most which has been caused by man appears to have occurred during the past 2500 years.

Both STRABO (16) and PLINY (17) say that in their time, the beginning of our era, northern Morocco was covered with forests of large trees, enjoyed a lush vegetation and was populated by tropical and steppe animals such as the lion, antelope, elephant and buffalo. It can be inferred that the major denudation of the foliage of the rolling hills and coastal plains of northern Morocco took place during

and after Roman times and that substantial amounts of alluvium have covered former estuaries creating today's tidal flats and filled-in river valleys which were formerly navigable.

STEARNS (18) has reconstructed a sea level and climatic sequence in the Cape Ashakar region. The Neolithic period, 4000 B.C. to the beginning of our era, was a time of warmer climate than today and sea level two meters higher. Since then the sea level has fallen slightly and then risen to its present level accompanied by cooling and moisture as the sea level fell. Borings in the mouth of Wad Mogaga show alluvium at least 40 meters thick which accompanied a change in sea level from minus 40 meters to the present during the post glacial period. This would infer a mean deposition rate of several meters per millenium which would have been accelerated during the present era. STEARNS concluded that all the river valleys of northern Morocco have thick alluvium including Wad Garifa (Wad Ayacha) which leads to Mzorah.

In Anatolia, historical records in the writings of classical Greece confirm the extent of aggradation in former estuaries which continues apace today. The Sakarya delta has extended a mile in 2000 years (19). The Adapazari plain has been drilled through recent alluvium to a depth of over 200 feet. Miletus was an important port of classical Anatolia and its harbor sheltered a large fleet of ships. Today it lies eight miles inland.

In the banks of the Wad Sebu in Morocco, Roman sherds have been found under five meters of alluvium which VITA-FINZI (20) considers was deposited by a "Rharbian" pluvial in historic times. Punic sherds have been found under nine meters of deposition at Banassa. At Wad Martin west of Tetuan, the plain has trenched to a depth of five meters through the Rharbian alluvium. The Mahacen near Larache similarly has at least five meters of fill covering part of the ruins of Lixus. Thus there is ample evidence for heavy Wad aggradation in Morocco since Punic times.

I believe that the rivers and flood plains of northern Morocco were navigable in most seasons for tens of kilometers inland. In fact, the marine aspect of the country was probably quite different from what it is today. It may well have been a more inviting coast line for the mariner than the present continuous sand beach with narrow and treacherous inlets.

Having, since ancient times, gradually been filled with alluvium from the bordering hills and more distant Rif mountains, it is likely that the Wad Ayacha was navigable by ship almost to Mzorah at the date the monument was built and in use. The ancient settlement of Kouass, excavated by PONSICH (6) is at the mouth of the river. At Kouass, alongside the coast highway, is an ancient horizontal platform built up from the surrounding field with retaining walls. It is 47 meters square and one edge bears 265.8 degrees. PONSICH calls it a pre-Roman camp. Inland of the highway nearby, PONSICH excavated a neolithic town, Fours. It is possible that the ancient settlement at Kouass had some relationship with the monuments at Mzorah. Perhaps an edifice upon the platform, which could be seen from Mzorah, signalled to sea voyagers the entrance to the estuary or river up which was to be found the holy place.

The Relevance of the Ancient Writings

PINDAR and later writers identify Antaeus, King of Libya, who was killed in battle by Heracles. Antaeus, a giant, associated in myth with Tangier and Lixus, was said to have been buried in a large tomb near these cities. PLUTARCH reports that Sertorius saw Antaeus' tomb and excavated it. He was informed that the tomb was that of an ancient and forgotten mythological person.

Because Mzorah is an impressive monument and unique in North Morocco, it is likely that the garbled stories are basically true and relate to a prehistoric time when foreigners came from the east and subjugated the native people. GEOFFREY OF MONMOUTH wrote of the founding of Britain by Trojans who, on the way, landed in Morocco and harried the entire land. This echoes the myth of Antaeus and Heracles. GEOFFREY's provocative statement that the stones of Britain and Ireland's stone circles came from Africa implies at least a cultural diffusion. Appendix I quotes from and summarizes the ancient and medieval texts.

Conclusions

The tumulus of Mzorah, taken alone, is architecturally similar to the large bazina of Souk el-Gour and other North African sepulchral tumuli. It is simpler in design than the great sepulchral monuments such as the Tomb of the Christian and El Madracen. On the other hand, it is larger and more complex than the many smaller tumuli of North Africa. All other North African tumuli or tombs known to be surrounded by a few standing stones such as the Cromlech d'Ouisert, the Dolmen de Ras-el-Ain Bou Merzoug, and the Dolmen sur socle de Sigus are considerably smaller and probably, though not necessarily, of cruder design. The tumulus was probably the sepulchre of a native Moroccan prince or king who lived during a time of early contact between the indigenous people and foreigners from the eastern Mediterranean as remembered by the story of Antaeus and Heracles (Appendix I).

The ellipse of standing stones may have been built somewhat earlier than the tumulus and by its complex and specific geometry indicates cultural ties between the people of Morocco and Britain in prehistoric times. The ellipses and other geometrical figures of standing stones in Britain have been dated astronomically by THOM (7) to 2100–1600 B.C. Thus it is possible that the Mzorah ellipse could have been built during the second millennium B.C. or earlier. As shown by the tombs and stone rings of Britain, a Neolithic or Bronze Age culture was quite capable of the technology required to build the tumulus and stone rings of Mzorah. That there was much coming and going of people, goods and ideas between the lands bordering the Mediterranean and northern Europe in the Bronze Age is acknowledged. The present evidence shows the involvement of the Maghreb in this traffic.

Pre-Roman Morocco had more navigable rivers and estuaries than is the case today. This would have made the Atlantic coast more attractive for maritime settlement and commerce. Mzorah at the head of a navigable estuary was located suitably for use by a seagoing people.

There was a complex of several rings of menhirs on the ridge at Mzorah in prehistoric times. It was considered a holy place, which is the meaning of the name, Mzorah.

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Appendix I

Possible early references to Mzorah in the literature

The writings of classical Greece and Rome refer to a great tomb in northern Morocco and the writings of medieval England cite cultural ties between Great Britain and North Africa and Troy in prehistoric times.

Pindar, 518–438 B.C. (23), tells of the defeat of the giant Antaeus, king of Libya (Africa), by Heracles. Gaius Curio, landing on the North African coast between the ruins of Carthage and Clypia, proceeded inland to where the river Bagada extended into the sandy wasteland. He found a rocky hill pitted with caves traditionally known as the tomb of Antaeus. The story of Heracles and Antaeus was given to him by an untaught peasant of the region who had the story handed down from father to son for many generations. Heracles travelled from Thebes, the city of Cadmus, to the home of Antaeus in corn-bearing Libya to wrestle with him and stay him from roofing Poseidon's temple with the skulls of strangers. After a desperate struggle in which Antaeus renewed his strength every time he touched the ground, Heracles slew the giant (23).

Diodorus of Sicily, first century B.C., (24), states that Heracles set sail from Crete and put in at Libya where he challenged Antaeus to a fight and slew him. After this, Heracles subdued Libya, which was full of animals, and brought large parts of the adjoining desert under cultivation. After Heracles had slain Antaeus, he went to Egypt and put to death Buciris, king of the land, who made it a practice to kill the strangers who came to his country. Afterward, Heracles set up the pillars near Gadera to commemorate his campaigns. Diodorus states (25) that Heracles' last labor took him again to Libya to bring back the golden apples of the Hesperides guarded by a formidable dragon. Diodorus is inconsistent as, a little further on (25), he states that Heracles while engaged in the performance of his last labor slew, in Libya, Antaeus.

Lucan, A. D. 39–65 (26) echoed Pindar. He expanded on Clupia or Clypia which was originally called Aspis, a city on a promontory in the northeast of the Carthaginian territory. It is presently called Klibiah. This is the location where Heracles is said to have landed in his expedition against Antaeus. Lucan recites that antiquity has named the realms of Antaeus the hills and rocks of Clypia. Strabo (16) mentions this mountain chain as the tomb of Antaeus and describes it as extending many hundreds of miles from Tingitana in Mauretania to the vicinity of Utica.

Strabo, 66 B.C.–A.D. 24 (16) describes Africa and cites Gabinius the Roman historian who spoke of a sepulchre of Antaeus at Lynx (Lixus) and a skeleton of 20 meters in length which Sertorius exposed and afterward covered with earth.

Graves, (27) reports that some say that the conflict between Heracles and Antaeus took place at Lixus where a hillock is shown as Antaeus tomb. If a few baskets of soil are taken from this hillock, the natives believe, rain will continue to fall until they are replaced. It is also claimed that the gardens of the Hesperides were the nearby island on which stands an altar of Heracles. It is said locally that Antaeus founded Tangier formerly called Tingis. Graves (27) in discussing the labor of Heracles in retrieving the golden apples comments that Heracles rescued the daughters of Atlas and that Atlas in gratitude taught him astronomy, Atlas being the first astronomer. Graves comments that Antaeus' bones were probably those of a stranded whale about which a legend grew at Tangier.

Plutarch, A.D. 45–120. (28) wrote that it was said that near Lixus there existed a great tomb that measures 60 cubits long where the cadaver of a huge mythological person was buried who according to the legend died at the hands of Heracles. The location is quite vague.

They say that it was seen by Sertorius in the time when he was in disgrace in Rome and the split of Pompeii and before his action in Spain and in Northwest Africa.

Pliny (Caius Plinius Secundus) A. D. 23–79, (17) reported that Tingi was said to have been derived from Ting, wife of Antaeus the giant. His tomb which formed a hill in the shape of a man stretched out at full length was shown near the town of Tingis to a late period. It was also believed that whenever a portion of the earth covering the body was taken away, it rained until the hole was filled up again. Sertorius is said to have dug away a portion of the hill. Upon discovering a skeleton 60 cubits in length he was struck by horror and it was immediately covered again. Procopius says that the fortress of this place was built by the Canannites who were driven by the Jews out of Palestine. At Lixus was the palace of Antaeus, and was the scene of his combat with Heracles and here were the gardens of the Hesperides. Pliny says that Lixus was the subject of many wondrous fables, incredulous in his opinion. He noted that an arm of the sea flows into the land here with a serpentine channel, and from the nature of the locality this was interpreted at the present day (Pliny's day) as having been what was represented by the story of the dragon keeping guard.

The consensus of the ancient writings identifies Antaeus, a contemporary of Heracles who was buried in a giant tomb. Antaeus is associated with both Lixus and Tangier. The tumulus of Mzolah is the only large sepulchral tumulus known in the locality and lies midway between Tangier and Lixus.

Geoffrey of Monmouth, A.D. 1100–1155, is credited, it must be admitted, with considerable literary license in his work. Nevertheless, one must expect kernels of truth in his accounts as well. He writes of the settlement of Britain by people from Troy who had migrated by way of North Africa in a prehistoric epoch.

Brute (after whom Britain is said to have been named), a native of Italy settled by Trojans, fell in with Trojans in bondage in Greece and became one of them. He led them out of bondage by defeating the King of Greece in battle. The Greeks of this time were called Danai. The Trojans with Brute left Greece in 314 ships. Brute married Innogen, daughter of Pandrasus, King of Greece. They sailed to an island called Leogecia which was uninhabited, three hundred men went ashore. They came to a certain deserted city where they found a temple of Diana in which was an image of the goddess that gave responses. Brute went to the place and set up three altars to Jove, Mercury and Diana. He asked where his people should settle. He repeated this nine times, walked four times around the altar, poured wine on the hearth, lay down on the fell of a hind and after invoking slumber fell asleep. In a dream it came to him,

“Brute, past the realms of Gaul, beneath the sunset
Lieth an island, girt about by ocean,
Guarded by ocean—erst the haunt of giants,
Desert of late, and meet for this thy people.
Seek it for there is thine abode forever.
There by thy sons again shall Troy be builded
There of thy blood shall kings be born, hereafter
Sovran in every land the wide world over.”

They sailed west and after a run of thirty days made the coast of Africa, still not knowing in which direction to steer their ships. They came to the Altars of the Phileni and the lake of the salt-pans. Then they steered betwixt Ruscicada and the mountains Azarae. They travelled to the mouth of the river Malva *and past it to Mauretania. They harried the whole region from end to end.* After revictualling they made sail for the columns of Heracles, where they saw many of the monsters of the deep called sirens. They escaped and came to the Tyrrhene sea where they found nigh the shore four generations born of the exiles from Troy. There they picked up Corineus (after whom was named Cornwall) and his people. Then they came to Aquitaine. There they fought and won battles but finally being outnumbered by the local people left and sailed to Britain where they landed at Totnes. In Britain they defeated the giants and settled. The giants were few and easily dominated. (29)

Geoffrey (30) tells also a story of the megalithic stone circles of Ireland and Britain and reports that they came from Africa.

“If thou be fain to grace the burial-place of these men with a work that shall endure forever, send for the Dance of the Giants that is in Killare, a mountain in Ireland. For a structure of stones is there that none of this age could arise save his wit were strong enough to carry his art. For the stones be big, nor is there stone anywhere of more virtue, and, so they be set up round this plot in a circle, even as they be now there set up, here shall they stand forever.”

“For in these stones is a mystery, and a healing virtue against many ailments. *Giants of old did carry them from the furthest ends of Africa* and did set them up in Ireland what time they did inhabit therein.”

“At last they made choice of Uther Pendragon, the king’s brother, with fifteen thousand men, to attend to this business. They also made choice of Merlin . . . Then as soon as the ships are ready, they put to sea and made for Ireland with a prosperous gale.”

“At that time Gilloman was king in Ireland . . . Are the stones of Ireland any better than those of Britain that our kingdom should thus be challenged to fight for them? Arm yourselves, men and defend your country, for never while life is in me shall they carry off from us the very smallest stone of the dance.”

“When they had won the day they pressed forward to Mount Killare, and when they reached the structure of stones rejoiced and marvelled greatly.”

“He bade Merlin set up the stones that he had brought from Ireland around the burial place . . . Merlin accordingly obeyed his ordinance, and set them up about the compass of the burial-ground in such wise as they stood upon Mount Killare in Ireland, and proved yet once again how skill surpasseth strength.”

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ABSTRACT

The tumulus and rings of standing stones at Mzolah in Morocco are of puzzling provenance. Measurements show that the principal ring is a precise ellipse of proportions and possible of dimensional units found heretofore only in Great Britain dated to the early second millenium B.C. and possibly earlier. It is furthermore the largest certain megalithic ellipse yet reported, consisting of 175 closely spaced menhirs. Astronomical and calendrical significance is strongly suggested but not conclusive. Aggradation of the river valley leading to Mzolah and change in sea level indicate that there was probably a navigable estuary leading to the monument in pre-Roman times which may have related to important sea voyages.

The possibility of a Bronze Age date for the Mzolah ellipse is examined and cultural ties between Morocco and Britain in prehistoric times are inferred. Ancient and medieval texts are cited which possibly relate to the monument and its cultural affinities with the east and north.

Submitted August 25, 1976

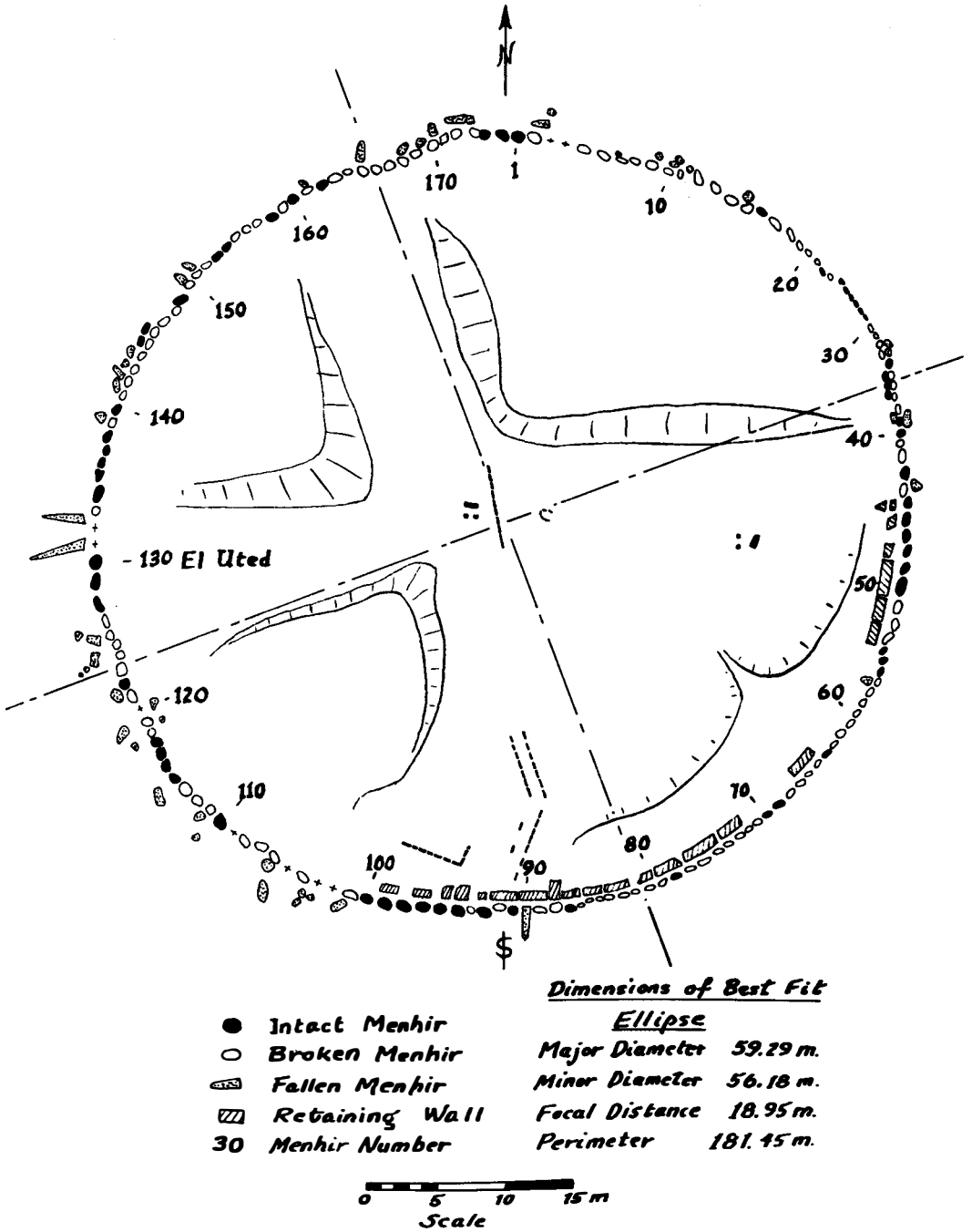


Fig. 1: The Ellipse of Menhirs and Tumulus of Mzorah, Plan view.

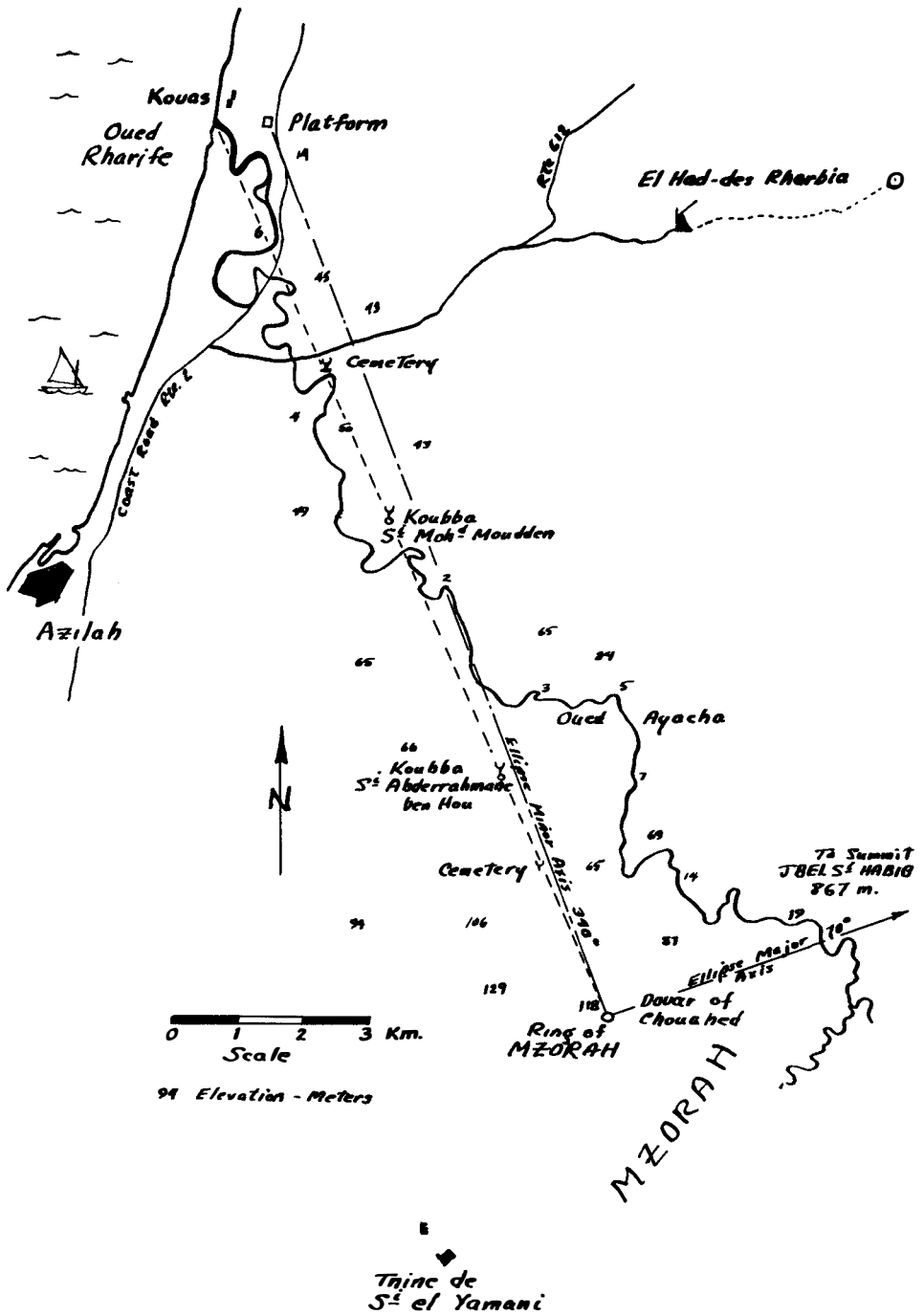


Fig. 2: Map of region of Mzorah near Azilah, Morocco.

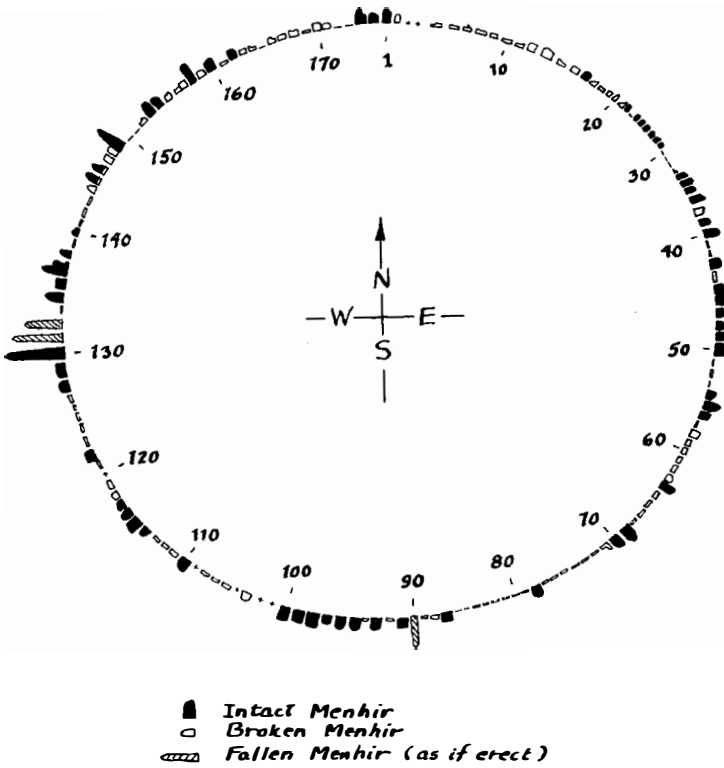


Fig. 3: Profile view of stones as seen from center of ring looking out.

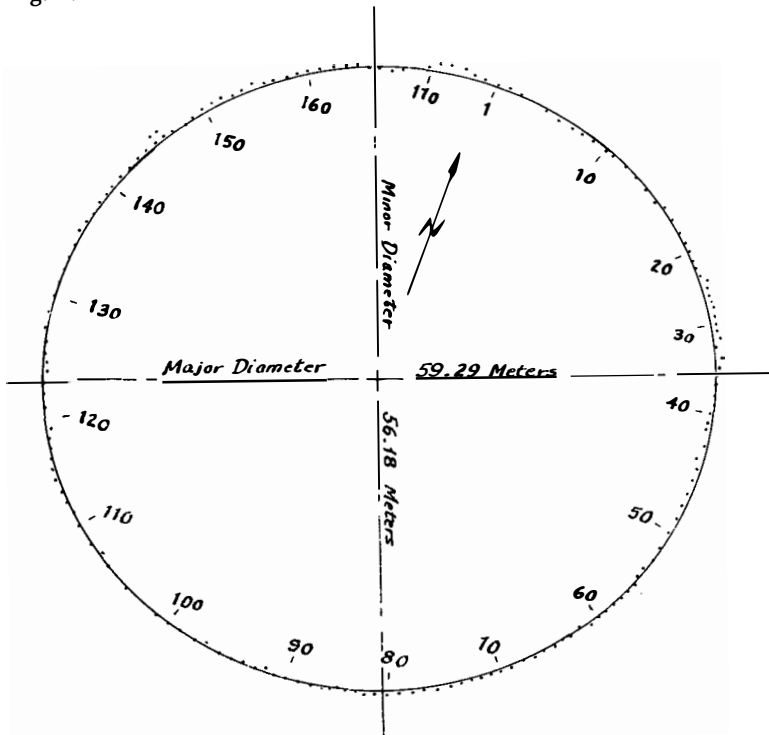


Fig. 4: Ellipse fit to menhir centers.

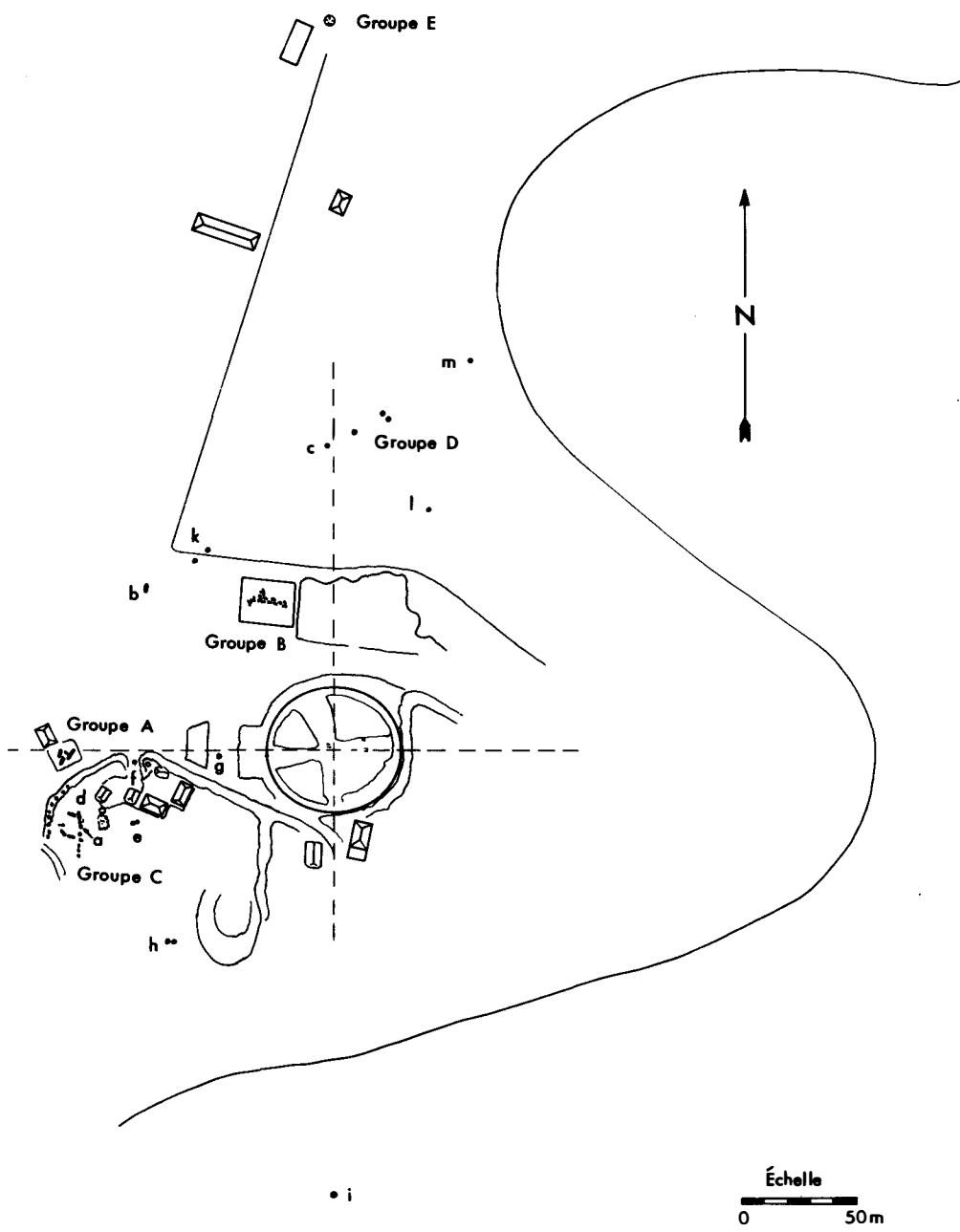


Fig. 5: Megalithic remains at Mzorah.

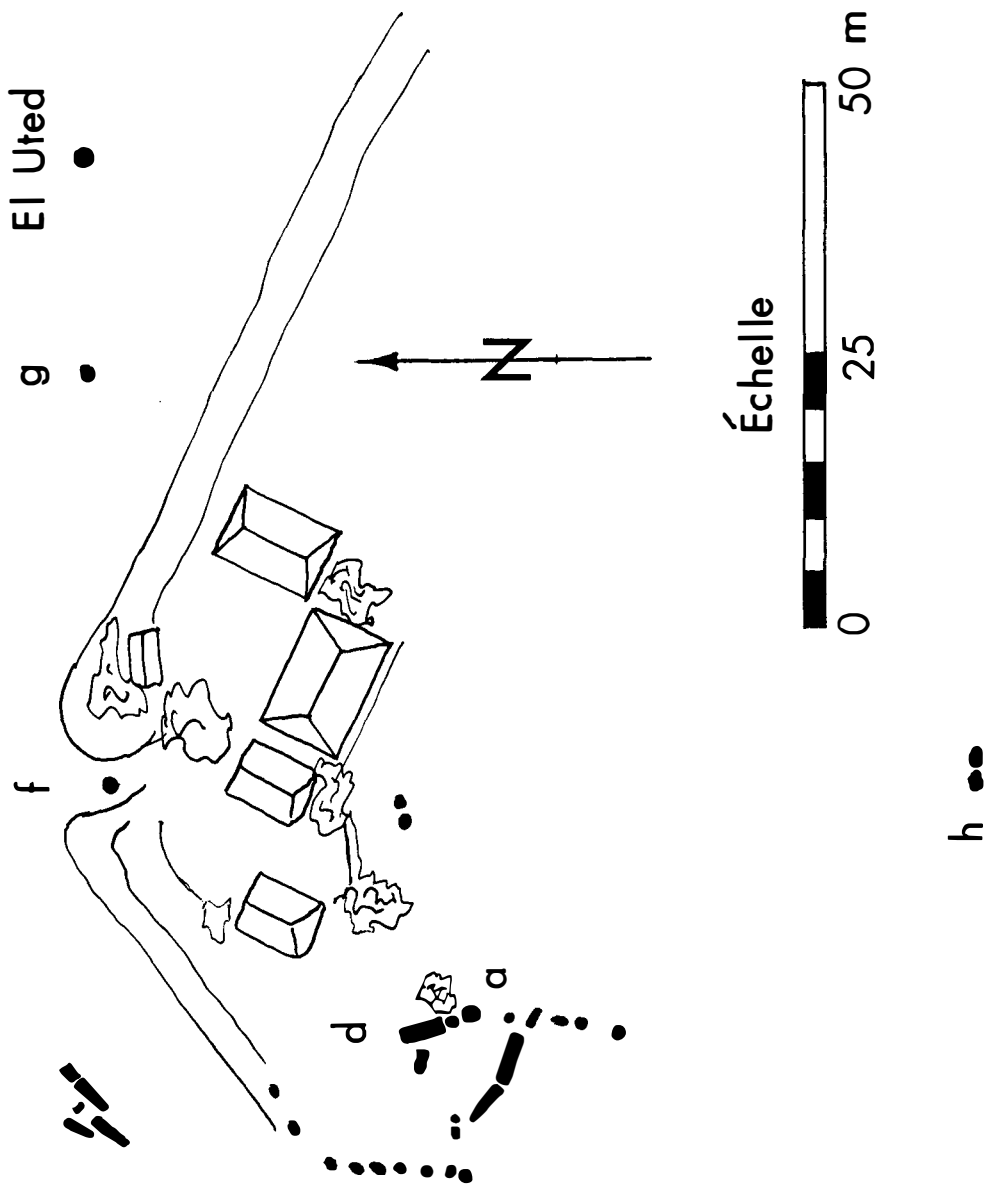
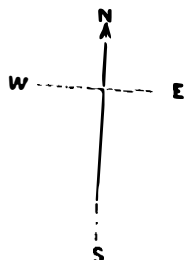
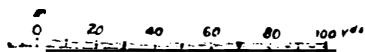


Fig. 6: Western groups of stones at Mzolah.

PLAN OF
EL UTED.



Cottage and Garden.



Principal Group.

Cactus Hedge and Cottage.

El Uted.



Cactus Hedge.

Cottage.



Plate I: Aerial photograph of ellipse and tumulus, 1970,



Plate II: Aerial photograph of Mzolah at the time of the Montalban excavation, 1935,

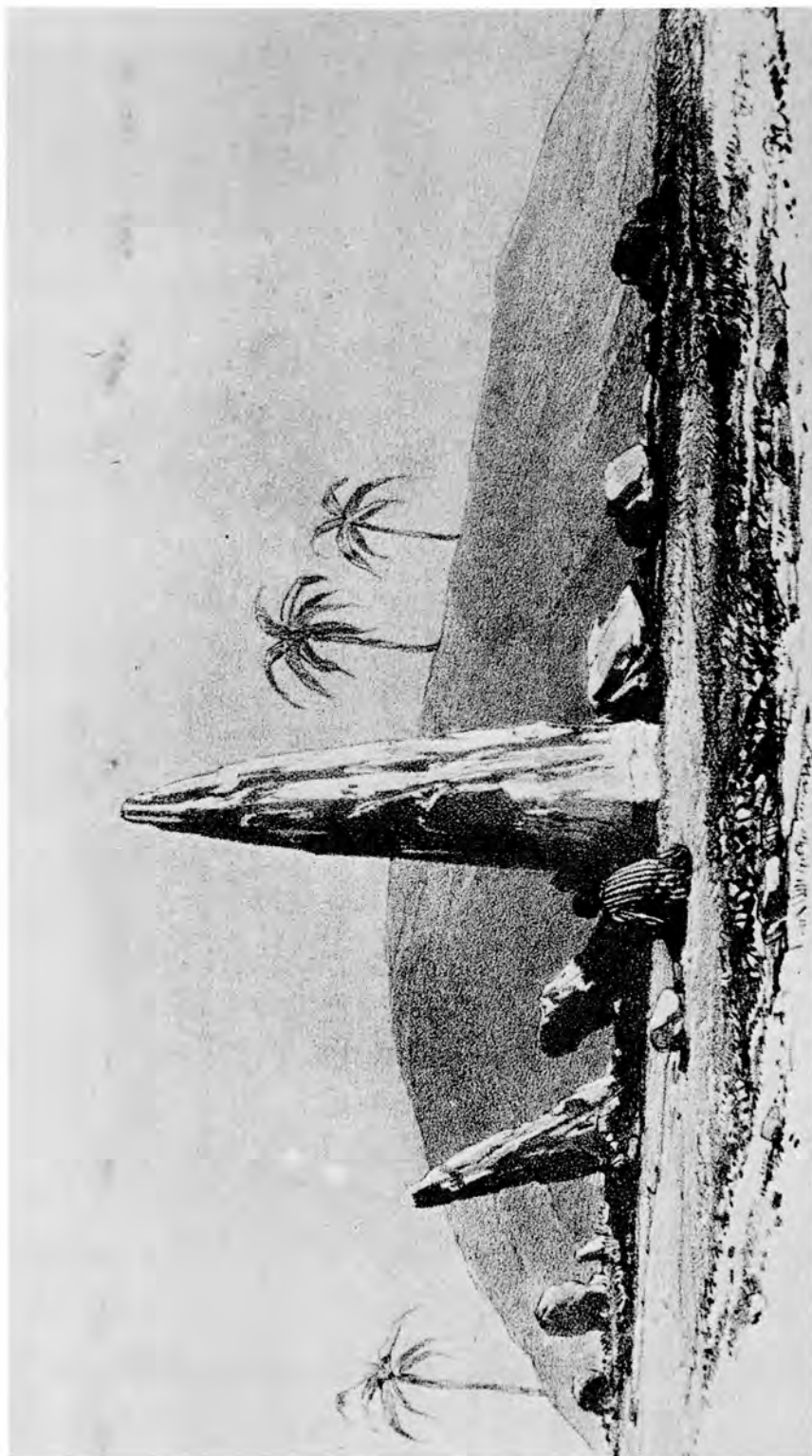


Plate III: Brooke's sketch of Mzorah, 1830,

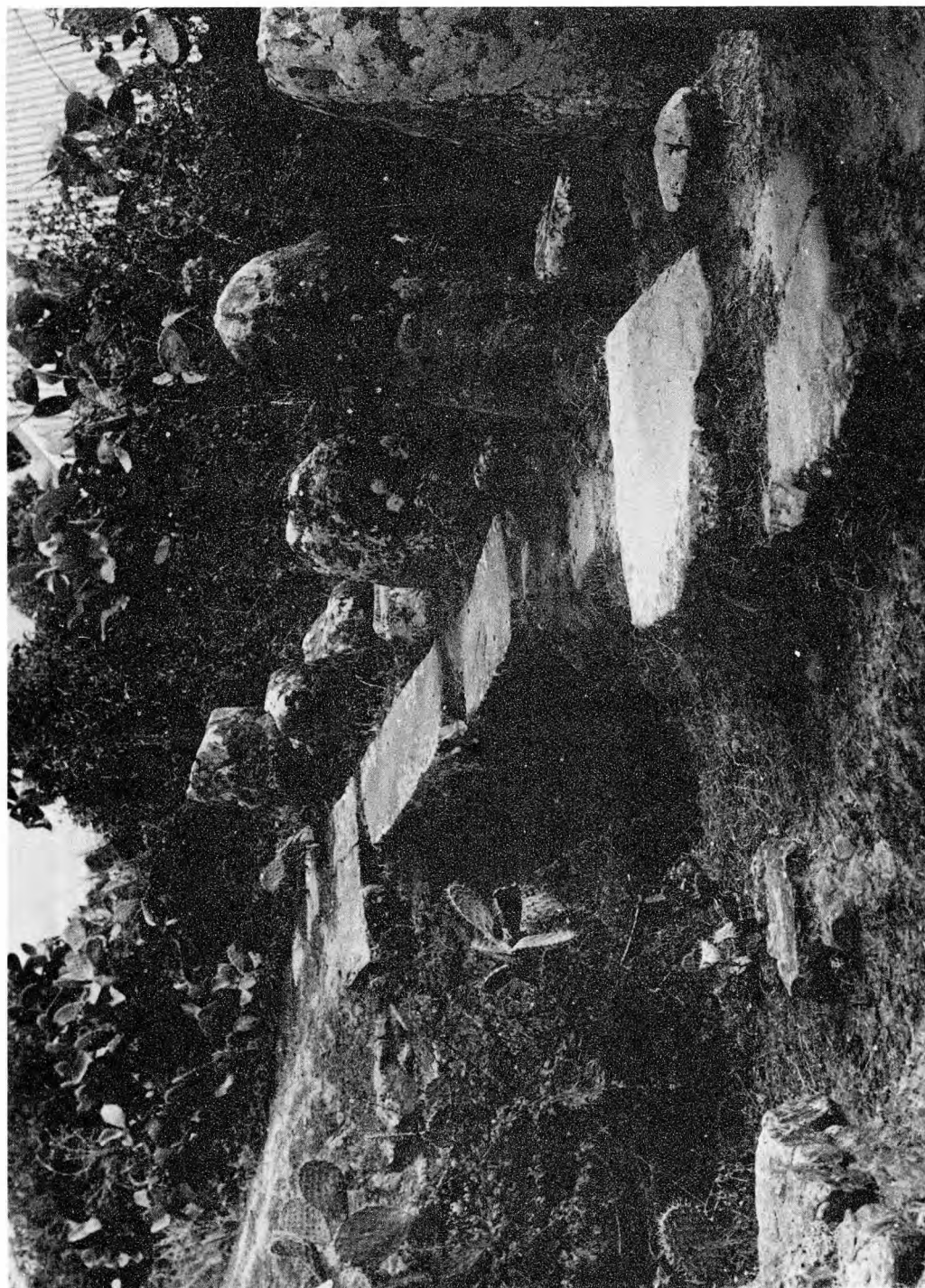


Plate IV: Photograph of south portion of ellipse and retaining wall, 1972. (Mavor)



Plate V: Aerial photograph of Mzora showing groups, 1970, (Mavor)