VII. *Some Additional Notes on the Orientation of Greek Temples; being the Result of a Journey to Greece and Sicily in April and May*, 1900.

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A journey to Greece and Sicily in the spring of last year enabled me to obtain a few more examples of the orientation of Greek temples, and to make a correction in the case of one of those previously published.

Delphi.

At Delphi the complete clearance of the site of the Temple of Apollo allowed of the measures of the existing foundations being taken by direct observation, and I found the orientation angle to be 227° 8′; that is, east amplitude + 42° 52′. I also examined more particularly the openings between the mountains which would be available for the sunrise. Of these there are two, one with amplitude — 7° 42′ E. has the altitude above the temple floor of 3° 8′, reduced as respects the sun by refraction to 2° 49′. The other at amplitude — 23° 16′ E. with altitude 2° 6′, reduced to 1° 40′.

The temple seems to have been rebuilt at least twice. Of the middle building (if the number was three) there is historical record. The terrace on which the temple area stands is supported by a wall of polygonal masonry, covered with inscriptions, from which the orientation of the present foundations differs by about 4°: I have presumed that this marks the line of probably the earliest foundation. The amplitude of —23° 16′ seems to agree best with this, and that of — 7° 42′ with the existing foundations. I have accordingly given the elements of the two separately.

Delphi. Latitude 38° 27′ 33″.

Name of temple.	Orientation angle.	Ref. letter.	Details	Stellar elements.	Solar elements.	Name of star.
Ancient temple of Apollo.	231° 17′	A	Amplitude of star or sun	− 42° 12′ W.	− 23° 16′ E.	ε Canis Majoris; setting towards south-western axis.
		B	Corresponding altitude	3° 30′	1° 40′	
		C	Declination.	− 29° 9′	− 16° 55′	
		D	Hour angles	$3^h\ 51^m$	$5^h\ 58^m$	
		E	Depression of sun when star heliacal	—	10°	
		F	R. A.	$5^h\ 5^m$	$14^h\ 54^m$	
		G	Approximate date—930 B.C., November 8.			

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Delphi. Latitude 38° 27′ 33″—*continued.*

Name of temple.	Orientation angle.	Ref. letter.	Details.	Stellar elements.	Solar elements.	Name of star.
Later temple of Apollo.	227° 8′	A	Amplitude of star or sun	−44° 1′ W.	−7° 42′ E.	
		B	Corresponding altitude	3° 30′	2° 49′	
		C	Declination.	−30° 18′	−4° 15′	β Lupi; setting.
		D	Hour angles	3h 45m	7h 8m	
		E	Depression of sun when star heliacal	—	16°	
		F	R. A.	12h 28m	23h 21m	
		G	Approximate date—585 B.C., March 9.			

Delos.

The Isle of Delos, besides a group of five (or more) temples of the classical period, is remarkable for containing a very ancient religious structure, certainly one of the most ancient shrines now remaining in Greece or her colonies. A short stay in the sland enabled me to examine this example, but I was obliged to confine myself to this one.

This Cynthian Grotto has no structural flank walls, but two masses of natural rock are connected by a solid roof formed by large wrought stones placed rafterwise, and well jointed at their meeting line at the apex. This meeting line is the only leading architectural line in the whole structure. The access was from the east, where are remains of a wall of polygonal masonry.

The west end of the grotto was closed : near it there seems to have been a statue. The northern jamb of the doorway in the eastern wall remains. The return or southern face of this door jamb is not parallel with the line given by the roof stones. As it is probable that this obliquity may have had some astronomical reference to the star which seems to have been connected with the line derived from the roof, I have added elements on the hypothesis of such an intention.

This doorway is to all appearance of later work than the roof, and this seems to point out that a structural alteration was made so as to follow the star.

Delos. Latitude 37° 22′

Name of temple.	Orientation ange.	Ref. letter.	Details.	Stellar elements.	Solar elements.	Name of star.
Grotto on Mt. Cynthus sacred to Apollo.	276° 2′	A	Amplitude of star or sun	+0° 13′ E.	−6° 2′	
		B	Corresponding altitude.	3° 30′	0 0	
		C	Declination.	+2° 18′	+4° 47′	
		D	Hour angles	5h 49m	6h 46m	α Libræ; rising.
		E	Depression of sun when star heliacal	—	12°	
		F	R. A.	11h 47m	12h 44m	
		G	Approximate date—1550 B.C., October 5.			

The same Temple. Elements calculated for a Line parallel to the Southern Face of the Door Jamb.

Orientation angle.	Ref. letter.	Details.	Stellar elements.	Solar elements.	Name of star.
282° 38′	A	Amplitude of star or sun	− 1° 44′ E.	− 12° 38′ E.	
	B	Corresponding altitude	3° 30′	0 0	
	C	Declination.	− 3° 10′	− 10° 27′	
	D	Hour angles	5h 34m	6h 39m	α Libræ; rising.
	E	Depression of sun when star heliacal	—	14°	
	F	R. A.	12h 35m	13h 40m	
	G	Approximate date—580 B.C., October 19.			

Syracuse.

In the temple at Syracuse, vulgarly attributed to Diana, but really, as determined by an inscription, sacred to Apollo, I found that both the architectural remains and the character of the inscription referred to, required a much earlier date than I had previously derived from the orientation as measured along the axis.* I have, therefore, changed the elements to those which are given by the northern limit of the eastern intercolumniation—an alternative not always possible, but not unfrequently found to be the only satisfactory one, having respect to the proper depression of the sun.

Syracuse. Latitude 37° 3′ 30″.

Name of temple.	Orientation angle.	Ref. letter.	Stellar elements.	Solar elements.	Name of star.
Temple of Apollo (incorrectly called Temple of Diana).	271° 45′; the northern limit of east opening 269° 53′.	A	+ 2° 30′ E.	+ 0° 7′	Spica; rising.
		B	3° 0′	0 0	
		C	+ 4° 0′	+ 0° 6′	
		D	5h 56m	6h 50m	
		E	—	10°	
		F	11h 6m	11h 59m	
		G	700 B.C., September 21.		

The date so derived is 30 years subsequent to the Hellenic foundation of the city. This improved determination led to the examination of the elements of the Syracusan temple on the site of the present *duomo*, of which the architectural detail points out a date decidedly later than the Temple of Apollo; whereas the orientation date† already published is nearly 100 years earlier than the arrival of the Greeks; the

* 'Phil. Trans.,' A, vol. 190 (1897), p. 59.

† *Ibid.*, p. 58.

result was the discovery of an error I had made in working out the example, which showed that the orientation angle should have been 271° 2′ instead of 269° 12′. With this alteration, and taking as usual the line of the axis, and with the same star, the approximate date becomes 550 B.C. instead of 815. If in this case the northern limit of the intercolumniation had been used instead of the axis, it would have made the date still earlier.

Selinus (*a newly discovered Temple named in* KALLOWAY *and* PUCHSTEIN'S *Work* '*Megaron of Demeter*'). *See Plan.*

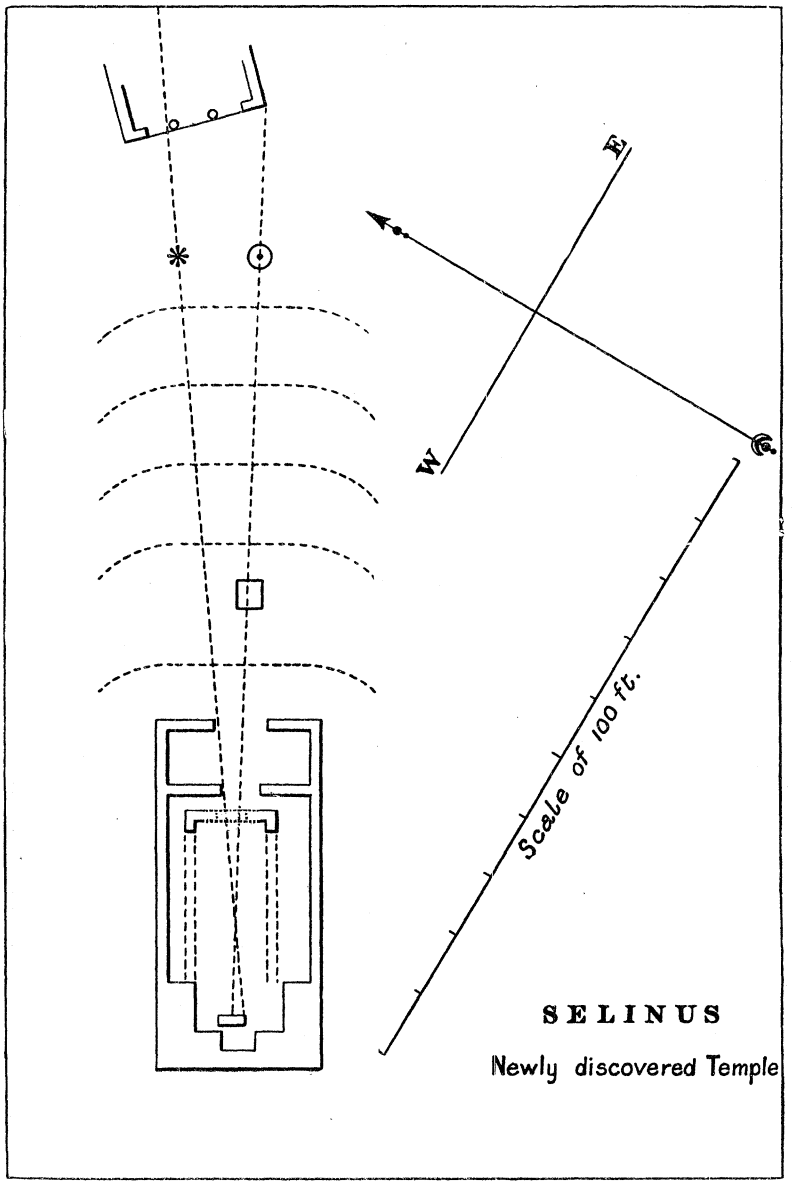
This small temple, which lies apart from the two great groups of temples, and near the right bank of the little stream (the Selinus), must have been of great sanctity, judging from the great number of votive offerings which have been found near it. Its plan is remarkable, and would be difficult to explain, except on the astronomical theory of its orientation.

It is clear from the angle of its orientation that, if intended for a solar temple, it could only have been so at the summer solstice. The eastern axis has the amplitude of + 30° 11′. That of the sunrise in that latitude and at the presumed date, hereafter given, and on a level site, would have been + 30° 35′, but the eastern horizon in this case is not level, and when first shining into the temple the sun would have had the amplitude of 28° 16′. To account for the presumed error made in setting out the work, let it be assumed that the normal amplitude at the solstice of $30\frac{1}{2}°$ had been ascertained elsewhere, and that at some other time of year the lines of the temple had been laid down on the actual site to that angle (for the meridian could be ascertained very nearly at any time), and that some progress had been made with the work, when the solstice came round and the error was noticed. Instead of taking the work down and beginning again, other means were taken to meet the difficulty; what these were is very clearly pointed out by the plan.

It would have been observed that the sun's first ray entering centrally the eastern door would have fallen considerably to the north of the niche which seems to have been provided for the statue, which niche is centrally placed between the flank walls. To meet this difficulty, a narrower *naos* was constructed, of which the foundations remain, hugging the north wall of the temple; the centre of which, marked also by a foundation-stone for the statue, would have received the ray in the desired manner. What further marks the incident is that the southernmost angle of the Propylæa, which gives access to the temple area, is exactly kept clear of the line required for the sunrise. The altar, which stood nearly in front of the eastern door, could not have interfered with it, being itself low, and standing on rather lower ground than the temple.

The warning star would, indeed, have to be seen over the roof of the Propylæa, but there is sufficient difference between the level of the ground at the two sites to

allow this to have been done. The star at the place calculated for it would have the advantage of about a degree of elevation more than the sun (more could have been



given if it had been necessary), and the detail of the Propylæa is sufficiently well preserved to enable its height to be computed with sufficient accuracy.

Selinus. Latitude 37° 35′.

Ref. letter.	Stellar elements.	Solar elements.	Name of star.
A	+35° 29′ E.	+28° 16′	
B	3° 30′	2° 38′	β Geminorum;
C	+29° 46′	+23° 46′	rising.
D	7^h 23^m	8^h 15^m	
E	—	10° 30′	
F	5^h 8^m	6^h 0^m	
G	520 B.C., June 21.		

Taormina.

Lately, some foundations of a small Greek temple have been discovered adjoining the celebrated Theatre of Taormina. Although the architecture of the theatre now visible is evidently Roman work, it is clear from some remains of foundations and an inscription that originally it was truly Greek. But these do not supply distinct information as to the antiquity of the first construction; but the orientation of the temple seems to do so. The important city of Naxos, the earliest of the Hellenic colonies in Sicily (founded 735 B.C.), lay immediately below the site, but this city was utterly destroyed by the Syracusans about 400 B.C. Some remnants, however, of the population were collected about fifty years afterwards by a leader named Andromachus and established in a new city on a ridge adjoining this theatre, which is about 800 feet above the site of the city of Naxos, and he named it Tauromenium.

The very great scale of the theatre might, indeed, of itself suggest that it had been the work of the flourishing population of the ancient city in the palmy days of Greek civilisation, and not that of a town inhabited by returned exiles, and nearer to the days of Grecian decadence. And it would not have been out of parallel with Greek habits (as seen, for instance, at Segesta) for a theatre to be placed at a great height above the inhabited parts of a town, and in this case on a site so remarkable for its beauty.

But, in addition to such arguments, the temple seems to give convincing evidence that the Taormina Theatre is not that of Tauromenium but of Naxos. Its situation is exactly where a small temple dedicated to Bacchus is found in connection with several of the Greek theatres. The orientation angle lies between 281° and 282°. Owing to a slip in my record, I cannot be positive as to the minutes, but 281° 25′ which I have adopted must be very near the mark, and I make out the elements to that figure. Towards whichever of the limits it should be placed, it points out α Libræ as the star, and the date derivable as at least 300 years earlier than the foundation of Tauromenium.

Taormina. Latitude 37° 48′.

Name of temple.	Orientation angle.	Ref. letter.	Stellar elements.	Solar elements.	Name of star.
Supposed Temple of Bacchus.	281° 25′ (approximate)	A	− 5° 41′ E.	− 11° 25′	α Libræ; rising.
		B	3° 30′	0 0	
		C	− 2° 20′	− 9° 0′	
		D	$5^h\ 35^m$	$6^h\ 33^m$	
		E	—	12°	
		F	$12^h\ 28^m$	$13^h\ 26^m$	
		G	715 B.C., October 16.		