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ARTICLE IV.

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IT may not be uninteresting at a time when the theory has been promulgated that some connection may possibly exist between Sunspots and Famines, to place on record the dates of the occurrence of Sunspots and Sun-shadows observed by Chinese astronomers.

The first observation of these solar phenomena, according to the *T'u Shu Tsih Ch'êng*,[1] 圖書集成, was in the year B. C. 28; and, as will be seen from the accompanying tables, only one other instance is recorded anterior to the birth of Christ, namely, in the year 20. A reference to the third column of the tables will show that these two phenomena have, together with the two afterwards recorded in the years A. D. 188 and 300, been classed as *black shadows* 黑氣 on the sun and not as Sunspots 黑子. The first observation of an undoubted Sunspot 日中有黑子[2] may be said to have been made in the year A. D. 301. From 301 to 1617, both inclusive, fifty-six observations of Sunspots and eight of Sun-shadows have been recorded; but there are long intervals which contain no mention of these solar phenomena. During the Yuan dynasty (1260-1367), for example, only one instance of their occurrence is recorded namely in 1276 ; and during the following or *Ming* dynasty only four observations seem to have been made.

Solar *maculae* were first observed in Europe in the year 807[3] and a reference to the accompanying tables will show that in that year the same phenomenon was observed by Chinese astronomers. It is also stated that a Sunspot was seen by Averröes in the year 1161.[4] During the 8th moon of the year 1160 a solar spot is recorded to have been observed in China. This corroboration of the occurrence of these solar phenomena at so early a period is some what remarkable.

It is now generally admitted that the Chinese were the first to discover Sunspots. Arago says "Dans les 'Annales de la Chine' du Père Mailla, on lit qu'en l'an 321 de notre ère il y avait sur le soleil des taches qui s' apercevaient à la simple vue.[5] He goo on to say : " En prenant à la lettre les assertions do Père Mailla ....., les libres des Chinois ..... seraient de meilleur aloi," It will be found, however, that, although the first four observation recorded in the accompanying tables have been classed as black shadows on the sun, 黑氣, solar spots were seen in the years A. D. 301, 302 and 307.

Angry discussions have often taken place regarding the first discovery of solar spots by European astronomers after the invention of the telescope. That honour seems to rest between Fabricius and Galileo, both of whom are said to have discovered them independently early in the year 1611.[6]

The first publication on Sunspots appeared in 1611, and is entitled : *Joh. Fabriciii Phrysii, de Maculis in sole observatis et apparente earum cum Sole conversione Narratio, et Dubitatio de modo eductionis specierum visibilium. Wittebergae*, 1611.[7] Tb work by Galileo on the same subject appeared in the following year.

It has been proved that there is a cycle of eleven years in the occurrence of Sunspots, but no proof has yet been forthcoming 0f a like cycle in the occurrence of droughts and consequent famines. Assuming the Sunspot cycle to the correct, we give here one or two instances of the concomitant occurrence of droughts. Sunspots were observed by the Chinese in the year 1160 ; and, according to the cycle, they should again be visible in the years 1171, 118.2, 1193, 1204, 1215, etc. Now, it is recorded in the

T'u Shu Tsih Ch'êng 圖書集成 [8] that the province of Chêkiang suffered from drought in the years 1160, 1171, 1182, 1193, 204 and 1215 ; that the province of Kiangsi was similarly affected in the years 1160, 1171, 1182, 1204 and 1215 ; and the province of Kiangsu in the years 1171, 1182, 1193 and 1215. It should be mentioned, however, that droughts have also occurred in the same provinces *within* these various cycles of eleven years.

The following tables may help to supply the blank that exists in European solar observations prior to the invention of the telescope.

Year.	Moon.	Remarks.
B. C. 28	3	Black shadows.
20	2	
A.D. 188	1	
300	1	
301	9	
302	11—12	
307	11	
321	2	
322	10	
342	1	
344	10	
345	3	
359	10	Size of an egg.
360	4	
361	2	
372	11	Size of a plum.

Year.	Moon.	Remarks.
373	3, 11	Size of an egg.
388	2	Two spots. Size of plums.
389	6	
395	11	
400	11	
499	2	Three spots. Size of peaches.
501	8	
502	1— 2	Two spots visible.
509	8	Black shadows.
510	2	,, ,,
513	1— 4	,, ,,
577	11	
580	2	
807	10	
826	3	
832	3— 4	
837	11	Size of an egg.
840	2	Black shadows.
841	11	
865	1	Black shadows.
874	...	
974	1	
1077	2	Size of a plum.

Year.	Moon.	Remarks.
A.D. 1078	1,12	Size of a plum.
1079	2	,, ,, ,, ,,
1104	10	Size of a date.
1105	10	
1112	4	
1118	11	Size of a plum.
1120	5	
1129	3	
1131	2	Size of a plum, visible four days.
1136	10—11	Size of a plum.
1137	2— 4	,, ,, ,, ,,
1138	2,10	
1139	2,10	
1145	6	Black shadows and spots.
1160	8	
1185	1	Size of an egg.
1186	5	,, ,, ,, ,,
1193	11	
1200	8,12	
1202	12	Size of an egg.
1204	1	,, ,, ,, ,,
1205	4	
1238	10	
1276	...	Size of a goose's egg.
1370	...	Spots were frequently observed during
1511	5	Black shadows. [this year.
1529	2	,, ,,
1617	...	

NOTES

[1] 庶微典, Küan 17-21.
[2] *Jih Chung Yeo hêh tsze*—lit. In the sun there were black spots.
[3] "Adelmus, a Benedictine monk, makes mention of a black spot being seen on the sun on March 17th, 807," Chamber's Astronomy, p. 8.
[4] Chamber's Astronomy, p. 8.
[5] Astronomie Populaire, Vol. II, pp. 107-8.
[6] Chamber's Astronomy, p. 5.
[7] Arago; Astronomic Populaire, II, p. 109-10.
[8] 庶微典, Küan 89-96, heading 旱災