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NEW CRITERION FOR LUNAR CRESCENT VISIBILITY

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Abstract. A new criterion for lunar crescent visibility has been established using 737 observations, almost half of them obtained by the Islamic Crescent Observation Project (ICOP). This criterion is based on two variables, viz. the topocentric arc of vision and the topocentric crescent width. The new model is able to predict the visibility of the lunar crescent both for naked eye and optically aided observations. From the database we found a Danjon limit of 6.4 degrees.

Keywords: Crescent, Moon

1. Introduction

The lunar crescent visibility has been studied by many astronomers since the Babylonian era, with as a result currently more than 12 different criteria for lunar crescent visibility, based on a number of sightings in different lunar conditions. Many of these criteria were developed by Islamic astronomers, since a number of Islamic religious events are directly related to lunar crescent sighting. For example, the new Lunar (Hijric) month begins on the next day of sighting the new crescent at west after sunset.

2. Lunar crecsent visibility criteria

2.1. Babylonian criteria

The Babylonian deduced that the lunar crescent is visible by naked eyes if the two following conditions are satisfied at local sunset:

1. Age of the Moon is larger than 24 hours.
2. Lag time of the Moon (The interval time between sunset and moonset) is larger than 48 minutes.

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2.2. Muslim astronomers

Many Muslim astronomers had developed their own criteria or had studied and discussed the issue of the lunar crescent visibility in their literatures. Such as: Ibn Tariq, Habash, Al-Khwarzmi, Al-Khazin, Al-Tabari, Al-Fahhad, Al-Farghani, Thabet Bin Qurrah, Al-Battani, Ibn Maimon, Al-Biruni, Al-Sufi, Ibn Sina, At-Tusi and Al-Kashani (Ilyas, 1994; Doggett and Schaefer, 1994). For example, Ibn Tariq's criterion depends on the Moon's altitude at sunset and the Moon's lag time. In our modern time, Mohammad Ilyas developed several criteria for crescent visibility.

2.3. Recent and modern criteria

At the beginning of the 19th century, Fotheringham and Maunder developed criteria for lunar crescent visibility, and in 1977 Bruin got his own criterion. Recently, Schaefer discussed the issue of the lunar crescent visibility extensively, and he included the atmospheric conditions in his work. Schaefer developed a criterion based on 295 observation records he obtained from several resources (Schaefer, 1988, 1996; Doggett and Schaefer, 1994). Yallop (1997) used the same database which Schaefer established, but he made a comprehensive revision and corrections for some of the records. South African Astronomical Observatory (SAAO) developed a criterion based on Schaefer's database in addition to some other observation records from different resources (Caldwell and Laney, 2001).

3. Islamic crescent observation project (ICOP)

The Islamic Crescent Observation Project (ICOP) was established in 1998 as a global project organized by the Arab Union for Astronomy and Space Sciences (AUASS) and the Jordanian Astronomical Society (JAS). Its primary aim as the only project of its kind is to gather information about the crescent observations at the start of each lunar month in different countries and regions through out the world.

At the beginning of each lunar month, ICOP members send their results of observations to the coordinator of ICOP, and these results are being published immediately on the Internet at ICOP's home page at http://www.icoproject.org. After seven years of extensive work for ICOP members, we were able to obtain a new large database for young lunar crescent observations. This database in addition to the old database were used to develop a new criterion to predict the visibility of the young lunar crescent, either by naked eyes or by optical aid.

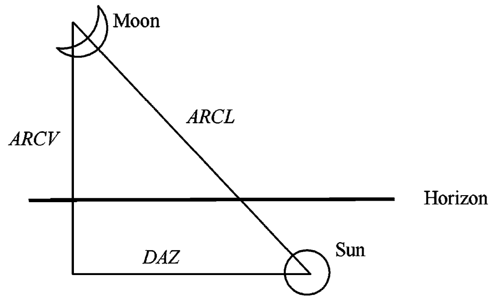

Figure 1. Basic geometric variables for crescent visibility prediction.

4. Visibility criteria variables

Below is a list of the most frequent observing parameters which have been used to predict the visibility of the lunar crescent. The three most basic parameters are shown in (Figure 1):

- Moon's age (*Age*): The interval time between conjunction and the time of observation.
- Moon's lag time (*Lag*): The interval time between sunset and moonset or moonrise and sunrise.
- Moon's altitude: The angular distance of the Moon above the horizon.
- Arc of light (*ARCL*): The angular separation (elongation) between the Sun and the Moon.
- Arc of vision (*ARCV*): The angular difference in altitude between the Sun and the Moon.
- Relative azimuth (*DAZ*): The angular difference in azimuth between the Sun and the Moon.
- Crescent width (*W*): The width of the lit area of the Moon measured along the Moon's diameter.

The visibility of lunar crescent cannot be predicted reliably using only one of the above parameters. In particular, using *Age* or *Lag* only, as quite frequently done, has no predicting value at all, as shown clearly by Schaefer (1996).

At least two parameters should be used together in order to obtain accurate results, one related to the intrinsic brightness of the crescent, the other to its distance to horizon (itself closely related to atmospheric extinction).

Contrary to a rather common assumption, the Moon's age is very poorly related to its intrinsic brightness. For example, a 10 hours Moon located on the ecliptic would have nearly the same brightness than a 0 hour Moon 5 degrees away from the ecliptic. A significantly better parameter for our purpose is the *ARCL*, since the width of the lunar crescent increases with the Moon's elongation from the

Sun. It is not perfect however, since for the same *ARCL*, the width of the crescent is maximum when the Moon is at perigee and minimum at apogee. The best parameter for incorporating the Moon intrinsic brightness is thus directly the width (*W*) of the crescent.

Regarding the second parameter, *ARCV* gives directly the angular distance of the Moon above the horizon and should be used in conjunction with *W*.

Tables I, II and III, show the criteria of Maunder, Indian and Bruin respectively (Yallop, 1997).

Table IV shows the SAAO criterion, where *DALT* is the apparent altitude, in degrees above the horizon, of the lower edge of the moon at sunset. If the crescent is below *DALT2*, naked-eye visibility will be improbable. Visibility with optical aid may be possible, but increasingly unlikely approaching *DALT1*. Below *DALT1,* visibility is impossible even with optical aid. (Caldwell and Laney, 2001).

TABLE I
Maunder criterion

DAZ	0°	5°	10°	15°	20°
ARCV	11·0°	10·5°	9·5°	8·0°	6·0°

TABLE II
Indian criterion

DAZ	0°	5°	10°	15°	20°
ARCV	10·4°	10·0°	9·3°	8·0°	6·2°

TABLE III
Bruin criterion

W	0′·3	0′·5	0′·7	1′	2′	3′
ARCV	10·0°	8·4°	7·5°	6·4°	4·7°	4·3°

TABLE IV
SAAO Criterion

DAZ	0°	5°	10°	15°	20°
DALT1	6.3°	5.9°	4.9°	3.8°	2.6°
DALT2	8.2°	7.8°	6.8°	5.7°	4.5°

5. New lunar crescent criterion

I've combined all the available lunar crescent observations into one large database, consisting of the following records:-

- 294 records from Schaefer list (Schaefer, 1988, 1996; Doggett and Schaefer, 1994).
- 6 records from Jim Stamm list (Private Communication).
- 42 records from SAAO list (Caldwell and Laney, 2001).
- 15 records from Mohsen Mirsaeed list (Private Communication).
- 57 records from Alireza Mehrani list (Private Communication).
- 323 records from ICOP.

So the new criterion is based on 737 records, and the visibility prediction is done adopting the following two variables:

- Airless Topocentric *ARCV*.
- Topocentric crescent width *W*.

The 737 records are listed in Table VI, and the calculations were done using the software Accurate Times found at (http://www.icoproject.org/accut.html). All the calculations were done at best time of observation, which can be approximated by the following equation (Yallop, 1997):

$$T_b = T_s + (4/9)Lag \tag{1}$$

where: T_b: Best Time; T_s: Sunset time; Lag: Moon's lag time.

The new criterion is shown in Table V.

Where:

- Zone A ($ARCV \geq ARCV3$): Crescent is visible by naked eyes.
- Zone B ($ARCV \geq ARCV2$): Crescent is visible by optical aid, and it could be seen by naked eyes.
- Zone C ($ARCV \geq ARCV1$): Crescent is visible by optical aid only.

TABLE V

New criteria

W	0.1′	0.2′	0.3′	0.4′	0.5′	0.6′	0.7′	0.8′	0.9′
ARCV1	5.6°	5.0°	4.4°	3.8°	3.2°	2.7°	2.1°	1.6°	1.0°
ARCV2	8.5°	7.9°	7.3°	6.7°	6.2°	5.6°	5.1°	4.5°	4.0°
ARCV3	12.2°	11.6°	11.0°	10.4°	9.8°	9.3°	8.7°	8.2°	7.6°

TABLE VI

Lunar crescent observation records (Group D)

No. 1	R 2	E 3	Date 4	Observer 5	Long 6	Lat 7	Ele 8	N 9	B 10	T 11	JD 12	*Age* 13	*Lag* 14	*ARCV* 15	*DAZ* 16	*ARCL* 17	*W* 18	*V* 19
514	I	E	12-02-2002	Sehbajraktarevic	018.4	43.9	630	I			2452318.180	9.3	4	0.7	5.7	5.8	5	-5.96
565	I	E	04-12-2002	Odeh	035.8	30.9	3800	I	I		2452613.118	8.5	9	1.7	3.1	3.6	2	-5.25
730	I	E	10-01-2005	Sani	007.6	11.2	686	I			2453381.230	4.9	9	2.0	5.1	5.5	5	-4.63
481	I	E	17-09-2001	Fahmy	073.3	04.1	3	I			2452170.049	1.2	11	2.7	3.7	4.6	3	-4.12
345	I	E	16-02-1999	Katbeh	044.4	33.3	40	I			2451226.122	9.0	16	3.1	1.9	3.6	2	-3.87
189	A	E	03-01-1984	McPartian	035.6	15.6	335	I			2445703.145	12.0	15	3.3	3.5	4.9	3	-3.49
582	F	M	02-03-2003	Mehrani	051.7	32.6	1800				2452700.618	-22.7	8	1.6	12.2	12.3	21	-3.45
620	I	E	25-10-2003	Khan	-123.1	44.6	60	I			2452938.557	13.8	18	3.0	6.2	6.9	7	-3.44
498	I	E	15-11-2001	Chalermthai	054.3	24.3	13	I	I		2452229.073	8.4	17	3.6	0.4	3.7	2	-3.32
699	I	E	14-10-2004	Al-Muhammad	050.0	26.6	10	I	I	I	2453293.097	13.2	16	3.4	4.4	5.6	5	-3.26
499	I	E	15-11-2001	Salie	018.4	-33.9	200	I			2452229.235	12.2	19	3.5	4.5	5.7	5	-3.16
721	I	M	11-12-2004	Stamm	-110.7	32.4	2256			I	2453351.082	-12.8	18	3.2	6.3	7.1	8	-3.15
700	I	E	14-10-2004	Hadi	035.5	30.4	1735	I		I	2453293.140	14.1	16	3.5	5.1	6.2	6	-3.13
500	I	E	15-11-2001	JAS	035.8	31.9	939	I	I	I	2452229.119	9.8	20	3.9	1.4	4.2	3	-2.98
566	I	E	04-12-2002	Dukku	009.8	10.3	600	I			2452613.215	11.3	18	3.9	2.4	4.6	3	-2.93
247	A	E	26-06-1987	Schaefer	-071.0	-30.1	2774	I	I		2446973.424	16.8	18	3.3	8.0	8.7	10	-2.79
731	I	E	10-01-2005	Hafiz	-080.3	26.0	1	I			2453381.456	12.3	18	3.6	6.8	7.7	9	-2.64
255	A	E	23-09-1987	Stamm	-084.1	37.2	305	I		I	2447062.488	20.3	17	3.3	9.0	9.6	13	-2.53
567	I	E	04-12-2002	Lukuman	003.4	06.5	35	I			2452613.235	11.8	19	4.3	2.1	4.8	3	-2.47
626	I	E	24-11-2003	Pazhouhesh	059.2	32.9	1468	I	I	I	2452968.051	15.1	20	3.7	7.3	8.1	10	-2.46
659	I	E	19-05-2004	Khushaish	048.0	29.4	30	I	I		2453145.158	12.4	23	4.5	0.2	4.5	3	-2.41
246	A	M	25-06-1987	Schaefer	-071.0	-30.1	2774	I	I		2446971.974	-18.0	19	3.6	8.6	9.3	12	-2.39
482	I	E	17-09-2001	Al-Muhammad	050.0	26.6	10	I		I	2452170.119	3.9	20	4.5	1.2	4.6	3	-2.34
664	I	E	18-06-2004	Ebrahim	018.4	-33.9	200	I	I	I	2453175.164	18.8	21	3.6	8.7	9.4	12	-2.31
724	I	E	12-12-2004	Kacem	003.7	32.5	550	I	I		2453352.204	15.9	20	3.5	9.1	9.7	14	-2.23
627	I	E	24-11-2003	Janghorban	051.7	32.6	1500	I			2452968.073	15.5	21	3.9	7.5	8.4	11	-2.14
221	A	M	27-04-1987	Stamm	-084.1	37.2	305	I		I	2446912.940	-16.4	23	4.3	5.6	7.0	7	-2.13
106	A	E	27-04-1922	MacKenzie	018.5	-33.9	30	I			2423172.182	13.0	23	4.6	2.6	5.3	4	-2.13
041	A	E	18-06-1871	Schmidt	023.7	38.0	122	I			2404597.253	16.6	27	4.5	4.6	6.4	6	-2.09
687	I	E	14-09-2004	Stamm	-110.8	32.4	2750	I	I	I	2453263.575	13.2	22	4.7	3.1	5.6	5	-2.02
368	I	E	13-07-1999	Saab	046.5	24.6	620	I			2451373.166	15.1	21	4.4	5.7	7.2	8	-2.00
190	A	E	03-01-1984	Stamm	-084.1	37.2	305	I		I	2445703.448	17.4	25	4.3	7.1	8.3	9	-1.93
654	I	E	19-04-2004	Stamm	-111.0	32.4	842	I		I	2453115.592	13.9	24	4.9	1.9	5.2	4	-1.91
444	I	E	23-02-2001	Salie	018.4	-33.9	200	I			2451964.238	11.1	25	5.0	1.3	5.1	4	-1.84
518	I	E	14-03-2002	Al-Muhammad	050.0	26.6	10			I	2452348.124	14.0	21	4.7	5.3	7.0	7	-1.81
519	I	E	14-03-2002	Mayoof	050.5	26.2	4	I	I	I	2452348.122	14.0	21	4.7	5.2	7.0	7	-1.79
520	I	E	14-03-2002	Odeh	035.5	30.4	1735	I	I	I	2452348.168	14.8	23	4.8	5.7	7.4	7	-1.60
501	I	E	15-11-2001	Dukku	009.8	10.3	600	I			2452229.214	12.3	23	5.2	0.0	5.2	4	-1.59
383	I	E	08-12-1999	Caldwell	018.4	-33.9	350		I		2451521.252	19.4	26	4.7	7.6	8.9	11	-1.40

(*Continued on next page*)

TABLE VI

(*Continued*)

No. 1	R 2	E 3	Date 4	Observer 5	Long 6	Lat 7	Ele 8	N 9	B 10	T 11	JD 12	*Age* 13	*Lag* 14	*ARCV* 15	*DAZ* 16	*ARCL* 17	*W* 18	*V* 19
701	I	E	14-10-2004	Khan	-123.1	44.6	60	I	I		2453293.570	22.2	22	3.8	11.4	12.0	21	-1.27
678	I	E	16-08-2004	Ebrahim	018.4	-33.9	200	I	I		2453234.189	15.7	26	5.0	6.2	7.9	9	-1.27
515	I	E	12-02-2002	Ebrahim	018.4	-33.9	200	I			2452318.248	12.1	28	5.5	1.3	5.6	4	-1.24
003	A	E	23-01-1860	Schmidt	023.7	38.0	122	I			2400433.162	16.0	31	5.4	3.2	6.3	5	-1.16
268	A	E	03-06-1989	Krisciunas	-155.5	19.8	4255	I		I	2447681.723	10.8	27	5.4	3.0	6.2	6	-1.13
571	F	M	02-01-2003	Mehrani	051.9	32.8	1500		I		2452641.636	-17.2	27	4.9	7.4	8.9	12	-1.05
521	I	E	14-03-2002	Salih	073.3	04.1	1	I			2452348.062	13.2	23	5.6	3.0	6.4	5	-0.97

(Group C)

No. 1	R 2	E 3	Date 4	Observer 5	Long 6	Lat 7	Ele 8	N 9	B 10	T 11	JD 12	*Age* 13	*Lag* 14	*ARCV* 15	*DAZ* 16	*ARCL* 17	*W* 18	*V* 19
737	I	E	02-11-2006	Stamm	-111.1	32.2	963			V	2453677.533	22.3	21	4.1	11.3	12.0	21	-0.96
502	I	E	15-11-2001	Siddiqui	-074.0	41.1	60	I			2452229.412	15.9	32	5.4	5.6	7.7	9	-0.88
660	I	E	19-05-2004	Kacem	003.7	32.5	550	I	I		2453145.290	15.2	32	5.8	0.7	5.9	5	-0.83
053	A	E	20-12-1873	Schmidt	023.7	38.0	122	I			2405513.141	19.6	28	4.5	10.3	11.2	18	-0.82
522	I	E	14-03-2002	Kacem	003.7	32.5	550	I	I		2452348.256	16.4	27	5.5	6.0	8.2	9	-0.72
612	I	E	26-09-2003	Al-Muhammad	050.0	26.6	10	I		I	2452909.115	13.3	27	5.9	2.8	6.5	6	-0.65
510	F	E	15-12-2001	Mehrani	051.7	32.6	1500				2452259.076	17.1	31	5.7	5.4	7.8	9	-0.60
381	I	E	08-11-1999	Odeh	035.9	32.0	984	I	I	I	2451491.125	12.9	30	6.1	0.6	6.2	5	-0.50
382	C	E	08-11-1999		034.7	31.8	60			I	2451491.126	12.9	31	6.1	0.7	6.2	5	-0.49
613	I	E	26-09-2003	Odeh	035.5	30.4	1646	I		I	2452909.159	14.2	28	6.0	3.8	7.1	8	-0.40
424	I	E	26-11-2000	Mehrani	051.7	32.6	1500			I	2451875.076	15.5	32	6.2	2.7	6.7	6	-0.36
258	A	M	15-05-1988	Stamm	-084.1	37.2	305	I		I	2447296.923	-13.7	35	6.1	2.9	6.8	7	-0.32
702	I	E	14-10-2004	Lukuman	003.4	06.5	35	I			2453293.239	15.9	26	6.2	3.6	7.2	8	-0.16
516	I	E	12-02-2002	Stamm	-111.0	32.4	843	I	I		2452318.560	17.6	30	6.0	6.3	8.7	10	-0.15
578	F	E	03-01-2003	Mehrani	051.9	32.0	1500				2452643.084	17.6	31	5.7	7.5	9.4	13	-0.13
335	C	E	28-03-1998		018.4	-33.9	350			I	2450901.211	15.1	30	6.0	5.2	8.0	10	-0.13
614	I	E	26-09-2003	Ebrahim	018.4	-33.9	200	I			2452909.209	14.6	30	6.1	4.7	7.7	9	-0.12

(*Continued on next page*)

TABLE VI

(Group C)

No. 1	R 2	E 3	Date 4	Observer 5	Long 6	Lat 7	Ele 8	N 9	B 10	T 11	JD 12	*Age* 13	*Lag* 14	*ARCV* 15	*DAZ* 16	*ARCL* 17	*W* 18	*V* 19
697	I	M	13-10-2004	Stamm	-110.7	32.4	2210			V	2453292.044	-14.6	32	6.5	0.4	6.5	6	0.00
507	I	E	15-12-2001	Tirhi	035.2	31.8	760	I	I		2452259.123	17.9	33	6.2	5.7	8.4	10	0.02
220	A	E	31-12-1986	Schaefer	-077.0	39.0	30	I	I		2446796.424	18.5	32	5.0	10.8	11.9	22	0.07
703	I	E	14-10-2004	Ebrahim	018.4	-33.9	200	I		I	2453293.220	15.2	33	6.5	2.0	6.8	7	0.09
425	I	E	26-11-2000	Murad	035.9	32.0	940	I	I		2451875.120	16.3	34	6.5	3.0	7.2	7	0.10
679	I	E	16-08-2004	Marzani	051.3	35.7	1100	I	I		2453234.156	15.9	35	6.6	3.4	7.4	8	0.20
369	I	E	13-07-1999	Salie	018.4	-33.9	200	I			2451373.176	14.7	36	6.6	2.3	7.0	7	0.21
257	A	E	16-04-1988	Stamm	-084.1	37.2	305	I		I	2447268.522	13.4	36	6.7	1.1	6.8	7	0.22
370	I	E	13-07-1999	Caldwell	018.4	-33.9	350	I	I	I	2451373.176	14.7	36	6.6	2.3	7.0	7	0.22
371	I	E	13-07-1999	Farooq	-079.9	43.3	88	I	I		2451373.553	22.3	32	5.1	11.4	12.5	23	0.23
192	A	E	02-02-1984	McPartlan	035.6	15.6	335	I			2445733.161	16.7	29	6.5	4.4	7.9	8	0.25
646	I	E	21-03-2004	Ebrahim	018.4	-33.9	200	I	I		2453086.217	18.8	31	6.3	6.3	8.9	11	0.27
680	I	E	16-08-2004	Amirzadeh	057.1	30.2	1820			I	2453234.135	15.5	33	6.7	2.5	7.2	7	0.31
628	I	E	24-11-2003	Singer	-117.5	47.6	650	I	I		2452968.517	24.7	30	4.1	14.4	14.9	34	0.32
523	I	E	14-03-2002	Touma	-011.3	27.7	7000	I			2452348.305	17.4	30	6.5	5.5	8.5	10	0.39
007	A	E	07-08-1861	Schmidt	023.7	38.0	122	I			2400995.236	28.0	21	4.0	15.3	15.8	36	0.41
400	I	E	06-03-2000	Farooq	-079.9	43.3	88	I	I		2451610.481	17.9	36	6.3	7.1	9.4	13	0.42
384	I	E	08-12-1999	Essa	039.7	-04.0	0	I			2451521.150	17.5	30	6.8	3.4	7.6	8	0.43
476	I	E	19-08-2001	Rahkooi	048.2	38.6	1600		I	I	2452141.167	14.6	36	6.6	4.7	8.1	10	0.47
388	I	E	07-01-2000	Sarker	090.4	23.7	13	I			2451550.988	17.5	34	6.9	1.5	7.1	7	0.49
305	C	E	02-03-1995		018.4	-33.9	350			I	2449779.233	29.8	22	4.5	14.5	15.2	32	0.57
211	A	E	23-11-1984	McPartlan	035.6	15.6	335	I			2446028.139	16.8	31	6.7	5.2	8.4	11	0.58
681	I	E	16-08-2004	Al-Muhammad	050.0	26.6	30	I		I	2453234.147	15.7	33	7.0	2.0	7.3	7	0.58
408	I	E	04-05-2000	Caldwell	018.4	-33.9	350	I	I		2451669.182	13.6	36	6.9	2.5	7.4	8	0.60
422	I	E	27-10-2000	Muttardy	-077.2	38.8	100	I			2451845.439	15.6	37	6.9	3.9	7.9	9	0.60
389	I	E	07-01-2000	Salie	018.4	-33.9	200	V			2451551.263	23.0	34	6.3	8.3	10.4	15	0.61
583	I	E	03-03-2003	Ebrahim	018.4	-33.9	200	I	I		2452702.235	16.4	34	7.0	3.4	7.8	8	0.67
704	I	E	14-10-2004	Alsup	-118.2	34.1	94	I			2453293.565	21.9	29	5.8	10.3	11.8	20	0.67
572	I	E	03-01-2003	Al-Muhammad	049.8	26.6	10	I	I	I	2452643.095	17.8	33	6.5	6.9	9.5	13	0.68
647	I	E	21-03-2004	Khushaish	048.0	29.4	30	I	I		2453086.136	16.8	33	7.0	3.6	7.8	9	0.69
705	I	E	14-10-2004	Khakoo	-118.0	33.9	19	I			2453293.564	21.9	29	5.8	10.2	11.7	20	0.69
426	I	E	26-11-2000	Essa	039.7	-04.0	0	I			2451875.147	16.9	31	7.1	2.2	7.4	8	0.70
020	A	E	06-05-1864	Schmidt	026.2	39.6	122	I			2401998.232	17.5	40	6.8	4.7	8.3	10	0.71
538	I	E	11-06-2002	Odeh	035.8	31.9	939			I	2452437.212	17.9	38	6.9	4.0	8.0	9	0.71
477	B	E	19-08-2001	Movahhed-Nezhad	056.8	29.5	2700		V		2452141.134	14.0	34	7.0	3.1	7.6	9	0.71
390	I	E	07-01-2000	Caldwell	020.8	-32.3	1800		I		2451551.258	22.8	34	6.4	8.1	10.3	15	0.73
682	I	E	16-08-2004	Hadi	035.9	32.0	940	I		V	2453234.194	16.6	35	7.0	3.3	7.8	8	0.74
549	D	E	07-09-2002	Mirsaeed	056.5	31.1	1700		V		2452525.120	13.4	34	7.0	2.8	7.5	9	0.75
216	A	E	20-04-1985	Stamm	-084.1	37.2	305	I		I	2446176.525	18.8	38	7.0	3.6	7.9	8	0.75
480	F	E	19-08-2001	Mehrani	051.3	32.5	2400		I		2452141.152	14.4	35	6.9	3.7	7.9	9	0.76

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TABLE VI
(*Continued*)

No. 1	R 2	E 3	Date 4	Observer 5	Long 6	Lat 7	Ele 8	N 9	B 10	T 11	JD 12	*Age* 13	*Lag* 14	*ARCV* 15	*DAZ* 16	*ARCL* 17	*W* 18	*V* 19
648	I	E	21-03-2004	Al-Muhammad	050.0	26.6	10	I	I	I	2453086.130	16.7	32	7.1	3.2	7.8	8	0.76
296	A	M	02-04-1992	Krisciunas	-155.5	19.8	4176	I		I	2448715.160	-14.8	31	7.2	0.8	7.2	7	0.78
706	I	E	14-10-2004	Hafiz	-080.2	25.8	0	I			2453293.463	19.8	29	6.4	8.1	10.3	16	0.82
683	I	E	16-08-2004	Katbeh	035.5	30.2	1680	I		I	2453234.195	16.6	35	7.1	3.0	7.8	8	0.84
551	F	E	07-09-2002	Mehrani	051.3	32.5	2400		I	I	2452525.136	13.8	34	7.1	3.2	7.7	9	0.85
707	I	E	14-10-2004	Stamm	-111.1	32.2	963		I	V	2453293.549	21.5	30	6.0	9.8	11.5	20	0.85
552	I	E	06-10-2002	Stamm	-111.0	32.4	843	I	I	V	2452554.557	15.3	33	6.9	4.7	8.3	11	0.86
385	I	E	08-12-1999	Fathy	032.7	26.2	75			I	2451521.135	17.0	36	7.3	1.2	7.4	7	0.86
386	I	E	08-12-1999	Khadraoui	010.4	36.8	30		I		2451521.181	17.7	41	7.2	3.2	7.9	8	0.88
720	F	E	13-11-2004	Mehrani	050.3	36.1	12700		V		2453323.088	22.6	30	5.4	12.2	13.3	27	0.92
207	A	E	25-09-1984	McPartian	035.6	15.6	335	I			2445969.158	14.1	31	7.2	1.7	7.4	9	0.95
427	I	E	26-11-2000	Kacem	003.7	32.5	550	I	I	I	2451875.209	17.8	38	7.2	3.8	8.1	9	0.96
299	C	E	03-12-1994		018.4	-33.9	350			I	2449690.253	18.4	36	6.5	8.3	10.5	17	1.01
308	D	E	22-12-1995	Mirsaeed	050.7	36.1	1500		I		2450074.078	12.8	41	7.4	0.3	7.4	8	1.06
649	I	E	21-03-2004	Odeh	023.7	38.0	170	I	I		2453086.206	18.0	37	7.2	4.9	8.7	11	1.08
428	I	E	26-11-2000	Touma	-006.8	34.0	50	I	I		2451875.234	18.2	39	7.2	4.3	8.4	10	1.08
557	D	E	05-11-2002	Mirsaeed	056.2	29.9	2300		V		2452584.076	17.5	34	6.9	6.4	9.4	13	1.14
650	I	E	21-03-2004	Katbeh	035.5	30.4	1646	I	I	V	2453086.175	17.5	35	7.4	3.8	8.3	10	1.19
590	D	M	30-04-2003	Mirsaeed	051.4	35.7	1100		V		2452759.560	-36.7	26	5.1	14.9	15.7	33	1.19
318	D	E	07-05-1997	Mirsaeed	050.8	36.0	1500		V		2450576.161	18.9	36	6.7	8.2	10.6	16	1.19
455	I	E	25-03-2001	Salie	018.4	-33.9	200	V			2451994.215	16.8	36	7.4	3.6	8.2	9	1.20
558	I	E	05-11-2002	Mehrani	052.1	30.1	2200	I	V		2452584.087	17.7	35	7.0	6.5	9.6	14	1.25
310	A	E	20-01-1996	Stamm	-111.0	32.4	853	I		V	2450103.547	13.4	39	7.5	2.0	7.7	9	1.27
340	I	E	19-12-1998	Odeh	035.8	31.9	939	I	I	I	2451167.125	16.6	40	7.6	1.1	7.7	8	1.28
559	I	E	05-11-2002	Mohammadi	052.5	29.6	1500	I	V		2452584.085	17.7	35	7.0	6.5	9.5	14	1.28
374	C	E	10-09-1999		034.7	31.8	60			I	2451432.174	18.6	35	7.3	5.5	9.1	12	1.31
274	A	E	25-02-1990	Pierce	-083.5	35.6	1524	V		V	2447948.493	15.5	39	7.6	0.6	7.6	9	1.31
275	A	E	25-02-1990	Bach	-083.5	35.6	1524	I		V	2447948.493	15.5	39	7.6	0.6	7.6	9	1.31
276	A	E	25-02-1990	Golden	-083.5	35.6	1524	I		I	2447948.493	15.5	39	7.6	0.6	7.6	9	1.31
528	F	E	13-04-2002	Mehrani	051.7	32.6	1500				2452378.142	19.4	36	7.3	5.6	9.2	12	1.32
638	I	E	22-01-2004	Mehrani	051.7	30.0	2500	I	V		2453027.101	17.4	36	6.9	7.6	10.3	16	1.32
391	I	E	07-01-2000	Mehrani	052.3	32.7	1500	I	V		2451551.087	19.1	40	7.5	3.3	8.2	9	1.33
311	A	E	20-01-1996	Schwaar	-113.2	32.8	259	I		V	2450103.551	13.5	39	7.6	1.9	7.8	9	1.35
429	I	E	26-12-2000	Mohammadi	052.5	29.6	1500	I			2451905.085	19.7	39	7.5	4.3	8.6	10	1.36
725	I	E	12-12-2004	Sani	007.6	11.2	686	I			2453352.227	16.6	33	7.1	6.5	9.6	14	1.37
101	A	E	31-10-1921	MacKenzie	018.5	-33.9	30	I			2422994.230	17.9	38	7.3	5.3	9.0	12	1.37
726	I	E	12-12-2004	Dukku	009.8	10.3	600	I			2453352.222	16.5	33	7.1	6.4	9.6	14	1.38
589	F	E	02-04-2003	Mehrani	051.6	32.6	1500		I		2452732.137	19.3	36	7.5	4.8	8.9	11	1.40
478	I	E	19-08-2001	Odeh	035.5	30.2	1724	I	V	V	2452141.194	15.2	37	7.5	3.8	8.4	11	1.42

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TABLE VI

(*Continued*)

No. 1	R 2	E 3	Date 4	Observer 5	Long 6	Lat 7	Ele 8	N 9	B 10	T 11	JD 12	*Age* 13	*Lag* 14	*ARCV* 15	*DAZ* 16	*ARCL* 17	*W* 18	*V* 19
181	A	M	30-07-1981	Schaefer	-071.3	42.3	30	I			2444815.885	-18.6	45	7.3	5.8	9.3	13	1.43
375	I	E	10-09-1999	Odeh	035.5	30.4	1646	I	I	V	2451432.176	18.6	35	7.4	5.3	9.1	12	1.44
326	C	E	02-10-1997		034.7	31.8	60			I	2450724.154	21.9	35	7.3	6.9	10.0	14	1.51
430	I	E	26-12-2000	Gharaybeh	035.9	32.6	500	I			2451905.125	20.4	41	7.6	5.0	9.1	11	1.54
321	F	E	07-05-1997	Mehrani	052.3	32.7	1500	I	V		2450576.153	18.7	37	7.1	7.7	10.4	16	1.54
560	I	E	05-11-2002	Hadidi	035.8	31.9	939	I	V		2452584.129	18.4	36	7.1	7.3	10.2	16	1.54
524	I	E	13-04-2002	Mohammadi	052.5	29.6	1500	I			2452378.137	19.3	36	7.5	5.2	9.1	11	1.55
312	A	E	20-01-1996	Patchick	-118.3	34.1	530	I		V	2450103.565	13.7	41	7.8	1.6	7.9	10	1.61
313	A	E	20-01-1996	Patchick	-118.3	34.1	530	I		I	2450103.565	13.7	41	7.8	1.6	7.9	10	1.61
431	I	E	26-12-2000	Al-Muhammad	050.0	26.6	10	I	I		2451905.092	19.8	39	7.7	3.9	8.7	10	1.63
663	F	M	17-06-2004	Mehrani	051.8	32.5	1500		I		2453173.541	-19.5	44	7.8	3.4	8.5	10	1.64
328	C	E	30-12-1997		018.4	-33.9	350		V		2450813.263	24.0	33	6.1	12.1	13.6	27	1.69
015	A	E	29-04-1862	Schmidt	023.7	38.0	122	I			2401260.233	18.1	45	8.0	0.2	8.0	9	1.70
573	I	E	03-01-2003	Kacem	003.7	32.5	550	I	V		2452643.218	19.9	39	7.1	8.4	11.0	18	1.71
184	A	E	05-11-1983	McPartlan	035.6	15.6	335	I			2445644.142	17.4	35	7.8	3.0	8.4	10	1.74
281	A	E	24-05-1990	Bach	-083.5	35.6	1524	I		V	2448036.547	14.5	47	8.0	0.4	8.0	10	1.84
039	A	E	20-04-1871	Schmidt	023.7	38.0	122	I			2404538.226	21.1	40	7.5	7.3	10.4	15	1.85
432	I	E	26-12-2000	Odeh	035.5	30.2	1680	I	V	V	2451905.132	20.6	41	7.9	4.6	9.1	11	1.87
643	F	M	19-02-2004	Mehrani	051.7	32.6	1800				2453054.621	-31.4	26	5.0	16.1	16.9	42	1.90
301	A	E	01-01-1995	Schwaar	-106.0	33.0	1219	I		V	2449719.524	14.6	43	8.1	0.3	8.1	10	1.96
591	F	M	30-04-2003	Mehrani	051.7	32.6	1800		V		2452759.561	-36.7	29	5.9	14.5	15.6	33	1.96

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TABLE VI

(Group B)

No. 1	R 2	E 3	Date 4	Observer 5	Long 6	Lat 7	Ele 8	N 9	B 10	T 11	JD 12	*Age* 13	*Lag* 14	*ARCV* 15	*DAZ* 16	*ARCL* 17	*W* 18	*V* 19
433	I	E	26-12-2000	Salie	018.4	-33.9	200	V			2451905.264	23.6	42	7.6	7.6	10.7	15	1.99
263	A	E	05-05-1989	Pearce	-097.0	30.3	183	I		V	2447652.562	14.7	42	8.1	2.5	8.4	11	2.01
341	I	E	18-01-1999	Salie	018.4	-33.9	200	V			2451197.263	25.2	36	6.8	10.8	12.8	23	2.01
094	A	E	08-02-1921		-006.2	36.5	0	I			2422729.262	17.5	43	8.2	1.7	8.4	10	2.02
199	A	E	01-05-1984	Stamm	-084.1	37.2	305	I		I	2445822.534	20.2	44	7.9	5.2	9.4	12	2.03
137	A	E	01-07-1973	Austin	170.5	-44.0	1189	I	V		2441864.736	17.7	51	7.7	6.2	9.9	15	2.03
105	A	E	29-03-1922	MacKenzie	018.5	-33.9	30	I			2423143.210	27.5	35	7.1	10.2	12.4	21	2.04
338	C	E	21-09-1998		035.2	31.8	760			I	2451078.166	22.1	37	7.7	6.8	10.3	14	2.05
599	F	M	30-05-2003	Mehrani	051.7	32.6	1800		I		2452789.543	-25.8	39	7.3	9.4	11.9	19	2.05
387	I	E	08-12-1999	Isiaq	003.4	06.5	35	I			2451521.242	18.9	36	8.2	1.6	8.4	10	2.07
434	C	E	26-12-2000		020.8	-32.4	1800	V			2451905.259	23.5	42	7.7	7.4	10.6	15	2.07
714	I	E	13-11-2004	Katbeh	035.9	32.0	953	I	I	V	2453323.124	23.3	34	6.4	12.2	13.8	29	2.08
435	I	E	26-12-2000	Caldwell	020.8	-32.3	1800	V			2451905.259	23.5	42	7.7	7.3	10.6	15	2.09
629	I	E	24-11-2003	Torabinejad	-112.0	41.5	1350	I	V		2452968.518	24.5	38	5.9	13.6	14.8	33	2.09
688	I	E	15-09-2004	Amirzadeh	059.0	36.6	2100		V		2453264.108	23.3	36	7.2	9.5	11.9	20	2.10
264	A	E	05-05-1989	Victor	-084.8	42.7	259	I		V	2447652.549	14.3	53	8.2	0.3	8.2	10	2.13
265	A	E	05-05-1989	Heaslip	-084.8	42.7	259	I		I	2447652.549	14.3	53	8.2	0.3	8.2	10	2.13
260	A	E	14-06-1988	Stamm	-084.1	37.2	305	I		I	2447327.559	17.1	51	8.3	1.7	8.4	10	2.14
095	A	E	08-02-1921		-009.1	38.8	0	I			2422729.268	17.6	45	8.3	1.3	8.4	10	2.15
266	A	E	05-05-1989	Hunefeld	-085.7	43.0	244	I		V	2447652.552	14.3	53	8.3	0.3	8.3	10	2.18
586	I	E	02-04-2003	Odeh	035.5	30.2	1680	I	V	V	2452732.181	20.0	39	8.1	4.5	9.3	12	2.18
212	A	E	23-11-1984	Stamm	-081.0	34.0	61	I		V	2446028.441	22.4	39	7.0	10.6	12.7	24	2.19
592	I	E	02-05-2003	Ebrahim	018.4	-33.9	200	I	I		2452762.184	27.9	38	7.3	9.7	12.1	20	2.20
600	I	E	31-05-2003	Hafiz	-080.3	26.0	1	I			2452791.519	19.7	42	8.4	1.8	8.5	10	2.22
658	F	M	18-05-2004	Mehrani	051.7	32.5	1500	I	V		2453143.548	-26.3	39	7.5	9.6	12.1	20	2.33
615	I	E	26-09-2003	Torabinejad	-111.8	41.8	1460	I	V		2452909.571	22.0	39	7.1	10.4	12.6	24	2.34
134	A	E	15-03-1972	McMahon	-117.6	35.5	914	I	I		2441392.599	15.3	42	8.3	2.5	8.7	12	2.36
135	A	E	15-03-1972	Moran	-117.6	35.5	1128	I	V		2441392.599	15.4	42	8.3	2.5	8.7	12	2.37
606	F	M	27-08-2003	Mehrani	051.4	32.0	2200		I		2452878.569	-16.3	43	8.4	3.0	8.9	11	2.38
319	C	E	07-05-1997		034.9	31.8	79	V			2450576.197	19.4	40	7.8	7.7	10.9	17	2.39
416	I	E	31-07-2000	Isiaq	003.4	06.5	35	V			2451757.265	16.8	36	8.4	1.8	8.6	11	2.39
331	B	M	27-01-1998	Pearce	-095.4	29.8	14		V		2450841.038	-17.3	41	8.3	4.1	9.2	13	2.40
051	A	E	27-04-1873	Schmidt	023.7	38.0	122	I			2405276.232	18.6	46	8.3	4.4	9.4	13	2.42
689	I	E	15-09-2004	Boroujerdi	051.4	35.7	1100	I			2453264.128	23.7	37	7.5	9.6	12.1	21	2.43
508	I	E	15-12-2001	Essa	039.7	-04.0	0	I			2452259.156	18.8	38	8.5	0.1	8.5	10	2.44
412	I	E	02-07-2000	Bahali	102.4	02.3	37	I	V	V	2451727.986	17.0	38	8.5	1.9	8.7	12	2.51
392	I	E	07-01-2000	Essa	039.7	-04.0	0	I			2451551.163	20.7	37	8.5	2.9	9.0	11	2.52
605	D	M	27-08-2003	Mirsaeed	050.9	35.0	1500		V		2452878.568	-16.3	45	8.5	2.5	8.9	11	2.54
690	I	E	15-09-2004	Marzani	050.9	34.7	930	I	I		2453264.129	23.6	38	7.6	9.4	12.1	21	2.60
172	A	M	27-01-1979	Skiff	-111.7	35.2	2469	I	V		2443901.084	-16.8	44	8.3	4.8	9.6	14	2.61
364	I	E	14-06-1999	Mohammadi	052.5	29.6	1500	I	I		2451344.164	20.4	40	7.6	9.3	12.0	22	2.67
248	A	E	26-06-1987	Victor	-084.5	42.7	244	I	V		2446973.576	20.2	59	8.6	4.4	9.7	13	2.73
324	C	E	04-08-1997		035.2	31.3	600	V			2450665.203	33.9	35	7.0	12.9	14.7	29	2.73

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TABLE VI

(*Continued*)

No. 1	R 2	E 3	Date 4	Observer 5	Long 6	Lat 7	Ele 8	N 9	B 10	T 11	JD 12	*Age* 13	*Lag* 14	*ARCV* 15	*DAZ* 16	*ARCL* 17	*W* 18	*V* 19
304	D	E	31-01-1995	Mirsaeed	051.3	35.6	1100		V		2449749.102	16.1	46	8.7	1.8	8.9	12	2.76
672	F	E	18-06-2004	Mehrani	050.0	33.3	2300		I		2453175.183	19.9	51	8.8	2.5	9.1	11	2.79
415	F	E	02-07-2000	Mehrani	051.7	32.6	1500		V		2451728.175	20.6	43	7.9	8.6	11.7	21	2.80
665	I	E	18-06-2004	Al-Muhammad	050.0	26.6	10	I		I	2453175.164	19.4	46	8.9	0.9	8.9	11	2.82
322	C	M	04-06-1997		034.9	31.8	79			I	2450603.596	-27.5	35	6.7	13.6	15.2	33	2.84
655	I	E	20-04-2004	Haji Ali Ahmad	114.9	05.0	63	I	I	I	2453115.948	20.3	37	8.8	2.4	9.2	11	2.85
691	I	E	15-09-2004	Mehrani	050.1	33.3	2600	I	V		2453264.133	23.7	38	7.9	9.3	12.2	21	2.86
337	C	E	26-05-1998		035.2	31.8	760			V	2450960.208	20.7	41	7.7	9.9	12.5	23	2.89
666	I	E	18-06-2004	Khushaish	048.0	28.4	30	I	I		2453175.173	19.6	47	8.9	1.3	9.0	11	2.89
282	A	E	24-05-1990	Bieda	-110.5	31.6	1372	I		V	2448036.615	15.9	49	8.8	0.2	8.9	12	2.92
277	A	M	24-04-1990	Bortle	-073.7	41.6	30	I		V	2448005.903	-19.2	46	8.1	8.0	11.4	20	2.92
365	I	E	14-06-1999	Guessoum	048.0	29.4	30	I			2451344.172	20.5	41	7.8	9.2	12.1	22	2.93
283	B	E	24-05-1990	Stamm	-111.0	32.4	842		V	V	2448036.617	15.9	50	8.9	0.3	8.9	12	2.94
667	I	E	18-06-2004	Saab	046.5	24.6	620	I	I		2453175.173	19.5	46	9.0	0.6	9.0	11	2.95
298	D	M	11-01-1994	Mirsaeed	051.3	35.6	1100		V		2449363.637	-19.3	48	8.7	5.0	10.0	14	2.97
270	B	M	02-07-1989	Stamm	-111.0	32.4	842			V	2447709.995	-17.7	51	8.9	1.6	9.1	12	2.98
048	A	E	03-10-1872	Schmidt	023.7	38.0	122	I			2405070.184	24.0	41	8.0	9.1	12.1	21	2.98
484	I	E	17-10-2001	Bahali	102.4	02.3	37	I	V	V	2452199.969	16.5	37	8.9	0.4	8.9	12	3.00
316	C	E	08-02-1997		018.4	-33.9	350	V			2450488.253	25.9	33	6.5	14.3	15.7	37	3.00
267	A	E	05-05-1989	Pearson	-105.5	39.7	3353	I		V	2447652.608	15.6	55	8.9	0.3	8.9	12	3.02
249	A	E	26-06-1987	Stamm	-084.1	37.2	305	I		V	2446973.561	19.9	55	8.9	3.2	9.5	12	3.02
727	I	E	12-12-2004	Stamm	-110.7	32.4	842	V	V	V	2453352.529	21.9	41	7.2	11.9	13.9	30	3.02
045	A	E	06-07-1872	Schmidt	023.7	38.0	122	I			2404981.261	22.9	52	8.7	6.2	10.6	15	3.06
639	I	E	22-01-2004	Kacem	003.7	32.5	550	V	V		2453027.230	19.6	44	8.1	8.6	11.8	21	3.07
010	A	E	05-10-1861	Schmidt	023.7	38.0	122	I			2401054.177	34.9	25	4.6	19.4	20.0	60	3.12
185	A	E	05-11-1983	Stamm	-084.1	37.2	305	I		V	2445644.457	23.6	44	8.0	9.6	12.5	23	3.16
393	I	E	07-01-2000	Mokhtari	-006.8	34.0	50		I		2451551.247	22.1	49	8.9	4.5	10.0	14	3.16
291	B	E	16-03-1991	Stamm	-111.0	32.4	842		V	V	2448332.581	17.7	44	9.0	3.2	9.5	13	3.16
593	I	E	02-05-2003	Tahir	114.9	05.0	63	I	I	V	2452761.948	21.1	39	9.2	1.3	9.3	12	3.23
661	I	E	19-05-2004	Stamm	-111.0	32.4	842	I		V	2453145.615	20.9	50	9.2	2.0	9.4	12	3.23
436	I	E	26-12-2000	Essa	039.7	-04.0	0	I			2451905.160	21.2	41	9.2	1.6	9.3	12	3.26
668	I	E	18-06-2004	Hadi	035.9	32.0	940	I	I	V	2453175.218	20.4	52	9.2	2.4	9.5	12	3.27
315	C	E	13-10-1996		034.9	31.8	79	V			2450370.146	24.1	41	8.3	8.7	12.1	21	3.27
317	C	M	08-03-1997		034.7	31.8	60		V		2450515.654	-21.0	39	8.1	9.1	12.2	23	3.27

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TABLE VI
(*Continued*)

No. 1	R 2	E 3	Date 4	Observer 5	Long 6	Lat 7	Ele 8	N 9	B 10	T 11	JD 12	*Age* 13	*Lag* 14	*ARCV* 15	*DAZ* 16	*ARCL* 17	*W* 18	*V* 19
284	A	E	24-05-1990	Bortle	-118.1	34.2	530	I		V	2448036.640	16.4	52	9.1	0.8	9.2	13	3.28
285	A	E	24-05-1990	O'Meara	-118.1	34.2	530	V		V	2448036.640	16.4	52	9.1	0.8	9.2	13	3.28
290	C	E	15-02-1991		073.1	33.4	500	V			2448303.053	19.1	46	9.2	1.0	9.3	12	3.30
485	I	E	17-10-2001	Mehrani	051.7	32.6	1500	I	V		2452200.100	19.0	43	8.7	6.2	10.7	17	3.30
036	A	E	12-05-1869	Schmidt	023.7	38.0	122	I			2403830.242	24.0	46	8.2	10.0	12.9	23	3.35
334	C	E	27-02-1998		018.4	-33.9	350	V			2450872.240	23.4	38	7.7	11.3	13.7	28	3.35
585	F	M	31-03-2003	Mehrani	051.7	32.6	1800				2452729.586	-41.9	28	5.7	18.5	19.3	51	3.43
088	A	E	28-11-1913	Long	018.5	-33.9	91	V			2420100.253	17.0	53	9.3	0.1	9.3	13	3.43
603	F	E	30-06-2003	Mehrani	058.4	33.7	1500		I		2452821.161	20.8	52	9.1	4.3	10.1	14	3.44
250	A	E	26-06-1987		-105.0	39.8	1676	I			2446973.630	21.2	60	9.2	4.4	10.2	14	3.44
162	A	E	09-03-1978	Bishop	-064.2	45.1	9	V			2443577.444	19.3	54	9.2	3.5	9.8	14	3.47
715	I	E	13-11-2004	Haji Ali Ahmad	114.8	04.9	30	I	V		2453322.931	19.3	39	8.9	6.2	10.8	18	3.49
109	A	M	13-08-1931	Danjon	007.7	48.6	122	I	V		2426566.657	-17.0	67	9.3	2.0	9.5	14	3.52
251	A	E	26-06-1987	Chamberlain	-111.9	40.7	1311	I	V		2446973.651	21.5	61	9.2	4.8	10.4	15	3.56
443	F	E	25-01-2001	Mehrani	051.7	32.6	1500				2451935.102	23.5	47	9.1	6.2	11.0	16	3.56
579	F	M	31-01-2003	Mehrani	051.7	32.6	1800	V	V		2452670.628	-33.3	38	7.1	14.6	16.2	37	3.58
486	I	E	17-10-2001	Mohammadi	052.5	29.6	1500	I	V		2452200.099	18.9	43	9.0	5.7	10.7	17	3.60
630	I	E	24-11-2003	Lukuman	003.4	06.5	35	I			2452968.240	18.6	41	9.1	5.1	10.4	17	3.61
692	I	E	15-09-2004	Khushaish	048.0	28.4	30	I	I		2453264.133	23.6	40	8.7	8.5	12.1	21	3.61
256	A	E	19-01-1988	Stamm	-111.0	32.2	780	I		V	2447180.549	19.1	47	8.8	7.4	11.4	20	3.62
332	B	E	28-01-1998	Pearce	-095.4	29.8	14		V		2450842.512	18.0	47	9.4	0.7	9.4	13	3.63
173	A	E	28-01-1979	ACAC	-081.3	29.9	0	V			2443902.472	17.1	47	9.4	0.1	9.4	14	3.63
174	A	E	28-01-1979	Olsen	-091.7	42.0	244	I	V		2443902.489	17.3	55	9.3	2.5	9.7	14	3.64
594	I	E	02-05-2003	Ibrahim	101.7	03.2	60	I		V	2452761.984	21.8	40	9.5	1.7	9.7	13	3.65
194	A	E	03-03-1984	McPartian	035.6	15.6	335	I			2445763.171	20.5	40	9.4	3.6	10.1	14	3.66
404	I	E	05-04-2000	Zainal	102.9	05.3	20	I	V		2451639.982	17.6	39	9.4	2.1	9.7	14	3.67
543	I	E	09-08-2002	Bahali	102.4	02.3	37	I	I	V	2452495.987	17.1	40	9.4	1.0	9.5	14	3.68
175	A	E	28-01-1979	Sherman	-082.4	29.7	0	I	V		2443902.475	17.2	47	9.4	0.1	9.4	14	3.69
252	A	E	26-06-1987		-100.0	30.0	457	I			2446973.592	20.3	52	9.5	1.9	9.7	13	3.70
376	I	E	10-09-1999	Shaukat	-077.0	38.8	36	I	V		2451432.490	24.8	44	8.5	9.7	12.9	23	3.72
286	C	E	20-09-1990		034.7	31.8	60	V			2448155.163	40.3	29	5.9	18.4	19.3	51	3.72
176	A	E	28-01-1979	Verne	-093.6	42.0	274	V			2443902.494	17.4	56	9.4	2.5	9.7	15	3.73
511	I	E	14-01-2002	Mohammadi	052.5	29.6	1500	I			2452289.097	23.1	47	9.1	7.0	11.4	18	3.74
633	I	E	24-12-2003	Kaufmann	008.7	49.6	175	V	V		2452998.164	30.8	53	6.3	16.6	17.8	47	3.74
320	C	E	07-05-1997		018.4	-33.9	350	V			2450576.184	19.2	48	9.3	5.2	10.6	16	3.77
177	A	E	28-01-1979	Fcfferman	-090.3	38.7	183	I	V		2443902.489	17.3	53	9.5	1.9	9.6	14	3.77
314	C	E	21-01-1996		018.4	-33.9	350	V			2450104.262	28.7	34	6.5	16.3	17.5	46	3.79
693	I	E	15-09-2004	Al-Muhammad	050.0	26.6	30	I		I	2453264.127	23.4	40	8.9	8.1	12.0	21	3.80

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TABLE VI
(*Continued*)

No. 1	R 2	E 3	Date 4	Observer 5	Long 6	Lat 7	Ele 8	N 9	B 10	T 11	JD 12	*Age* 13	*Lag* 14	*ARCV* 15	*DAZ* 16	*ARCL* 17	*W* 18	*V* 19
413	I	E	02-07-2000	Odeh	035.5	30.4	1646	I	I	V	2451728.217	21.3	46	8.7	8.6	12.2	23	3.83
694	I	E	15-09-2004	Mayoof	050.5	26.2	13	I	V		2453264.125	23.4	40	8.9	8.0	12.0	21	3.84
525	I	E	13-04-2002	Kaufmann	-009.7	30.5	75	I	V		2452378.310	22.4	45	9.4	5.5	10.9	16	3.84
616	I	E	26-09-2003	Stamm	-111.0	32.4	842	V	V	V	2452909.569	21.8	42	8.7	8.9	12.4	23	3.86
475	F	E	21-07-2001	Mehrani	051.7	32.6	1500				2452112.172	20.3	48	9.0	7.2	11.5	20	3.88
487	I	E	17-10-2001	Odeh	035.8	31.9	939	I		V	2452200.144	19.7	44	9.1	6.6	11.3	19	3.89
437	I	E	25-01-2001	Mohammadi	052.5	29.6	1500	I	V		2451935.104	23.5	47	9.4	5.6	10.9	16	3.90
218	C	E	12-12-1985	Laing	020.8	-32.4	1800	V			2446412.257	17.8	55	9.6	2.5	9.9	15	3.91
488	I	E	17-10-2001	Al-Muhammad	050.0	26.6	10	I	I		2452200.104	19.0	43	9.3	5.2	10.7	17	3.92
253	A	E	26-06-1987		-112.1	33.5	329	V			2446973.632	21.0	56	9.7	3.0	10.2	14	3.97
621	I	E	26-10-2003	Pazhouhesh	059.2	32.9	1468	I	V		2452939.072	23.8	41	8.2	11.4	14.0	30	3.98
163	A	E	09-03-1978	Bortle	-073.8	42.7	183	V	V		2443577.473	19.8	54	9.7	3.2	10.2	15	4.05
164	A	E	09-03-1978	Dessert	-073.8	42.7	183	V			2443577.473	19.8	54	9.7	3.2	10.2	15	4.05
165	A	E	09-03-1978	Dombrowski	-072.9	41.3	30	V	V		2443577.469	19.8	53	9.7	2.9	10.1	15	4.07
166	A	E	09-03-1978	Piaruli	-072.9	41.3	61	V			2443577.470	19.8	53	9.7	2.9	10.1	15	4.08
272	C	E	01-10-1989		034.6	31.3	175	V			2447801.155	42.3	31	6.5	18.1	19.2	49	4.08
254	A	E	26-06-1987	Klemola	-122.0	37.0	1494	V			2446973.671	21.8	59	9.7	4.2	10.6	15	4.09
143	A	M	10-11-1977	Patterson	-104.0	30.7	2408	V	V		2443458.033	-18.1	48	9.8	0.6	9.8	14	4.09
542	D	M	08-08-2002	Mirsaeed	051.3	35.6	1100		V		2452494.554	-18.0	55	9.8	0.4	9.8	14	4.10
405	I	E	05-04-2000	Mehrani	051.7	32.6	1500	I	V		2451640.141	20.2	46	9.3	7.2	11.7	20	4.13
394	I	E	07-01-2000	Isiaq	003.4	06.5	35	I			2451551.254	22.2	44	9.9	1.0	10.0	14	4.16
417	I	E	28-09-2000	Salie	018.4	-33.9	200	V			2451816.215	20.3	46	9.3	7.1	11.7	20	4.17
418	I	E	28-09-2000	Caldwell	018.4	-33.9	350	V	V		2451816.216	20.3	46	9.3	7.1	11.7	20	4.18
483	D	M	16-10-2001	Mirsaeed	052.3	35.7	2000	V			2452198.589	-17.3	50	9.8	2.5	10.1	15	4.18
077	A	M	22-11-1889	Degroupet	004.2	50.9	30	V			2411328.776	-18.5	71	9.6	4.3	10.6	17	4.19
142	A	E	18-02-1977	Schenk	-087.7	43.8	30	V	V		2443193.494	19.4	57	9.9	0.7	9.9	14	4.20
033	A	E	05-02-1867	Schmidt	023.7	38.0	122	I			2403003.179	20.7	54	9.9	1.6	10.1	14	4.22
607	I	E	28-08-2003	Zainal	102.9	05.3	20	I	V	V	2452879.983	18.4	41	9.9	0.4	9.9	14	4.23
347	D	E	18-03-1999	Mirsaeed	050.8	36.0	1500	V			2451256.135	19.6	48	9.4	6.3	11.3	19	4.24
302	C	E	01-01-1995	O'Meara	-155.5	19.8	4180	V			2449719.684	17.7	46	9.9	2.3	10.1	15	4.26
471	I	E	21-07-2001	Salih	073.3	04.1	1	V	V		2452112.071	18.2	43	9.9	0.6	9.9	15	4.27
489	I	E	17-10-2001	Al-Mustafa	046.5	24.6	620			V	2452200.117	19.2	44	9.7	5.0	10.8	18	4.28
622	I	E	26-10-2003	Mehrani	050.1	33.3	2600	V	V		2452939.099	24.5	42	8.3	11.7	14.4	31	4.29
669	I	E	18-06-2004	Kacem	003.7	32.5	550	I	V		2453175.309	22.0	56	10.0	3.1	10.4	15	4.30
695	I	E	15-09-2004	Kacem	003.7	32.5	550	I	V		2453264.260	26.9	42	8.8	10.5	13.7	27	4.30
623	I	E	26-10-2003	Janghorban	051.7	32.6	1500		V		2452939.093	24.4	43	8.4	11.6	14.3	31	4.33
096	A	E	08-02-1921	Campbell	-071.1	42.3	30	V			2422729.440	20.6	58	10.1	0.1	10.1	14	4.34
306	A	E	28-06-1995	Schaefer	-071.0	-30.1	2774	V			2449897.435	20.4	51	10.1	0.1	10.1	14	4.36
031	A	E	17-01-1866	Schmidt	023.7	38.0	122	I			2402619.166	18.8	56	10.1	0.4	10.1	15	4.40
303	D	M	30-01-1995	Mirsaeed	051.3	35.6	1100	V			2449747.630	-19.3	52	9.7	5.3	11.1	18	4.41

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(*Continued*)

No. 1	R 2	E 3	Date 4	Observer 5	Long 6	Lat 7	Ele 8	N 9	B 10	T 11	JD 12	*Age* 13	*Lag* 14	*ARCV* 15	*DAZ* 16	*ARCL* 17	*W* 18	*V* 19
396	I	E	06-02-2000	Caldwell	018.4	-33.9	350	V	V		2451581.258	28.3	46	9.0	10.0	13.4	25	4.41
348	I	E	18-03-1999	Caldwell	018.4	-34.0	350	V	V		2451256.225	21.9	45	9.2	8.7	12.6	24	4.43
349	I	E	18-03-1999	Salie	018.4	-33.9	200	V			2451256.225	21.9	45	9.2	8.7	12.6	24	4.44
089	A	E	16-03-1915	Schoch	008.7	49.4	213	V			2420573.251	21.0	64	10.1	1.7	10.3	15	4.47
178	A	E	28-01-1979	Peterson	-122.3	47.6	30	V	V		2443902.565	18.6	65	9.9	4.2	10.7	18	4.52
472	I	E	21-07-2001	Gharaybeh	035.9	32.6	500	I			2452112.214	21.1	50	9.4	7.6	12.1	22	4.54
544	I	E	09-08-2002	Ebrahim	018.4	-34.0	750	V			2452496.194	20.3	49	9.4	8.0	12.4	23	4.54
555	D	M	04-11-2002	Mirsaeed	051.3	35.6	1100	V			2452582.604	-17.9	53	10.1	0.0	10.1	16	4.55
419	I	E	28-09-2000	Nahli	032.7	26.2	105	V			2451816.167	19.8	45	9.9	4.9	11.1	18	4.55
608	I	E	28-08-2003	Mehrani	051.7	32.6	1500	I	V		2452880.147	21.6	47	9.6	7.3	12.0	21	4.56
723	F	M	11-12-2004	Mehrani	051.6	32.6	1500				2453350.622	-21.3	51	9.3	8.8	12.8	25	4.58
333	C	E	28-01-1998		-118.1	34.2	1740	V			2450842.576	19.2	53	10.1	1.8	10.3	16	4.61
323	C	E	05-07-1997		018.5	-33.9	10	V			2450635.177	20.4	55	10.3	1.2	10.3	15	4.61
556	I	M	04-11-2002	Mehrani	051.9	32.8	1500		V		2452582.599	-18.0	51	10.2	0.5	10.2	16	4.62
473	I	E	21-07-2001	Odeh	035.8	31.9	939	V		V	2452112.215	21.1	51	9.5	7.5	12.1	22	4.63
512	I	E	14-01-2002	Saab	046.5	24.6	620	I	V		2452289.119	23.5	48	9.9	6.1	11.6	19	4.63
574	I	E	03-01-2003	Ebrahim	018.4	-33.9	200	V			2452643.270	21.5	56	9.9	5.8	11.4	19	4.64
093	A	E	19-04-1920	Triou	007.0	43.5	15	V			2422434.282	20.3	60	9.9	4.8	11.0	18	4.64
438	I	E	25-01-2001	Saab	046.5	24.6	620	I	V	V	2451935.125	23.9	48	10.1	4.7	11.1	17	4.64
625	F	M	23-11-2003	Mehrani	051.4	35.8	1100	V	V		2452966.616	-19.4	55	10.0	4.6	11.0	19	4.75
002	A	E	27-10-1859	Schmidt	023.7	38.0	122	V			2400345.160	40.1	34	5.9	20.3	21.2	64	4.76
350	I	E	18-03-1999	Mohammadi	052.5	29.6	1500	V	V		2451256.130	19.6	47	10.0	5.1	11.2	19	4.77
456	I	E	24-04-2001	Mehrani	051.7	32.6	1500	V	V		2452024.152	22.6	50	9.8	7.2	12.2	21	4.78
300	C	M	31-12-1994	O'Meara	-155.5	19.8	4180	V			2449718.184	-18.4	48	10.3	0.7	10.3	16	4.79
545	I	E	09-08-2002	Janghorban	051.7	32.6	1500	V	V	V	2452496.162	20.6	51	9.9	6.7	11.9	21	4.84
546	I	E	09-08-2002	Mehrani	051.7	32.6	1500	V	V	V	2452496.162	20.6	51	9.9	6.7	11.9	21	4.84
167	A	E	09-03-1978	Cebula	-089.0	40.5	244	V			2443577.516	20.6	56	10.3	3.0	10.7	17	4.84
168	A	E	09-03-1978	Phelps	-089.0	40.5	244	V			2443577.516	20.6	56	10.3	3.0	10.7	17	4.84
722	I	M	11-12-2004	Khushaish	048.0	29.4	30		V		2453350.631	-21.1	51	9.6	8.2	12.6	24	4.84
414	I	E	02-07-2000	Caldwell	020.8	-32.4	420	V	V		2451728.174	20.0	54	10.0	5.7	11.5	20	4.84
503	I	E	16-11-2001	Kaufmann	008.7	49.6	175	V	V		2452230.174	35.0	57	7.8	15.5	17.3	43	4.85
420	I	E	28-09-2000	Kacem	003.7	32.5	550	V	V		2451816.249	21.5	48	9.9	6.9	12.1	21	4.89
406	I	E	05-04-2000	Odeh	035.9	32.0	850	I	I	V	2451640.184	21.0	48	9.9	7.2	12.2	22	4.93
553	I	E	07-10-2002	Kaufmann	008.7	49.6	175	V	V		2452555.219	30.7	48	7.5	16.0	17.6	47	4.95
079	A	E	07-12-1885	DeCroupet	005.7	50.6	213	V			2409883.174	26.4	75	9.9	8.2	12.8	22	4.97

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TABLE VI
(*Continued*)

No. 1	R 2	E 3	Date 4	Observer 5	Long 6	Lat 7	Ele 8	N 9	B 10	T 11	JD 12	*Age* 13	*Lag* 14	*ARCV* 15	*DAZ* 16	*ARCL* 17	*W* 18	*V* 19
169	A	E	09-03-1978	McGraw	-093.6	41.6	244	V			2443577.529	20.9	57	10.4	3.3	10.9	17	4.99
170	A	E	09-03-1978	Newman	-093.6	41.6	244	V			2443577.529	20.9	57	10.4	3.3	10.9	17	4.99
342	I	E	18-01-1999	Shammary	043.7	28.8	500	V	V		2451197.125	21.7	52	10.5	2.3	10.7	16	5.02
397	I	E	06-02-2000	Mehrani	051.7	32.6	1500	V	V		2451581.111	23.8	52	10.3	5.2	11.6	19	5.03
624	I	E	26-10-2003	Khushaish	048.0	29.4	30	I	V		2452939.103	24.5	44	9.1	11.2	14.4	32	5.04
561	I	E	05-11-2002	Salie	018.4	-33.9	200	V			2452584.239	20.4	54	10.2	5.4	11.5	20	5.06
609	I	E	28-08-2003	Odeh	036.2	32.4	700	I		V	2452880.189	22.4	49	9.9	7.7	12.6	23	5.07
122	A	E	08-12-1942	Oravec	-074.0	40.7	0	V	V		2430702.414	19.3	62	10.1	5.8	11.7	21	5.08
367	C	M	12-07-1999		035.2	31.8	200	V			2451371.595	-22.8	51	9.5	9.6	13.5	27	5.08
222	A	E	28-04-1987	Schaefer	-077.0	38.9	30	V	V		2446914.518	21.6	61	10.6	1.6	10.7	16	5.11
223	A	E	28-04-1987	McLeod	-081.8	26.7	0	V	V		2446914.515	21.4	52	10.6	1.1	10.7	16	5.11
224	A	E	28-04-1987	Doggett	-077.1	38.9	30	I			2446914.518	21.6	61	10.6	1.6	10.7	16	5.11
225	A	E	28-04-1987	Seidelman	-077.1	38.9	30	I	I		2446914.518	21.6	61	10.6	1.6	10.7	16	5.11
226	A	E	28-04-1987	Slowik	-077.1	38.9	30	I			2446914.518	21.6	61	10.6	1.6	10.7	16	5.11
227	A	E	28-04-1987	Chester	-077.1	38.9	30	V	V		2446914.518	21.6	61	10.6	1.6	10.7	16	5.11
228	A	E	28-04-1987	Schmidt	-077.1	38.9	30	V	V		2446914.518	21.6	61	10.6	1.6	10.7	16	5.11
113	A	M	20-08-1933	Danjon	007.7	48.6	122	V			2427304.663	-24.3	70	10.3	5.7	11.8	19	5.12
102	A	E	30-12-1921	MacKenzie	018.5	-33.9	30	I			2423054.264	38.3	44	8.2	15.5	17.5	42	5.13
028	A	E	24-06-1865	Schmidt	023.7	38.0	122	I			2402412.259	35.5	45	7.8	16.4	18.2	47	5.13
085	A	E	31-01-1911	Cave	-000.9	51.0	61	V			2419068.224	32.0	65	8.8	13.2	15.9	36	5.13
217	C	M	11-12-1985	Laing	020.8	-32.4	1800	V			2446410.618	-21.5	55	10.0	7.3	12.3	23	5.14
529	I	E	13-05-2002	Tahir	114.9	05.0	63	I	V	V	2452407.950	22.4	46	10.7	0.3	10.7	16	5.15
398	I	E	06-02-2000	Bilani	037.2	36.2	420	V	V		2451581.146	24.6	55	10.3	6.1	12.0	20	5.16
343	I	E	18-01-1999	Saab	044.0	26.1	640	I	V		2451197.127	21.8	52	10.6	1.7	10.8	17	5.16
229	A	E	28-04-1987	Williams	-082.5	28.0	0	I			2446914.518	21.5	53	10.7	0.8	10.7	16	5.19
595	I	E	02-05-2003	Hasanzadeh	046.0	38.2	1400	V			2452762.181	26.3	59	10.4	5.7	11.9	19	5.20
490	I	E	17-10-2001	Ebrahim	018.4	-33.9	200	V			2452200.227	20.9	51	10.1	7.0	12.3	22	5.21
517	D	M	12-03-2002	Mirsaeed	051.3	35.6	1100	V			2452345.604	-46.6	33	6.4	20.8	21.7	63	5.24
509	I	E	15-12-2001	Stamm	-111.0	32.4	843	V			2452259.535	27.2	54	9.9	8.8	13.3	25	5.25
407	I	E	05-04-2000	Salie	018.4	-33.9	200	V			2451640.209	22.0	50	10.1	7.4	12.5	23	5.25
108	A	E	27-05-1922	MacKenzie	018.5	-33.9	30	V			2423202.176	21.0	56	10.5	4.5	11.4	19	5.26
076	A	E	30-03-1881	Denning	-002.6	51.5	0	V			2408170.301	19.9	73	10.7	1.6	10.9	17	5.32
179	A	E	28-01-1979	Westfall	-122.4	37.8	61	V	V		2443902.581	19.0	59	10.7	2.3	10.9	18	5.36
439	I	E	25-01-2001	Kacem	003.7	32.5	550	V	V		2451935.236	27.2	54	10.4	6.7	12.4	21	5.36
230	A	E	28-04-1987	Caton	-081.7	36.2	1402	I			2446914.531	21.8	60	10.8	1.1	10.9	17	5.36
231	A	E	28-04-1987	ASU	-081.7	36.2	1402	V	V		2446914.531	21.8	60	10.8	1.1	10.9	17	5.36
232	A	E	28-04-1987	ASU	-081.7	36.2	1402	V			2446914.531	21.8	60	10.8	1.1	10.9	17	5.36
233	A	E	28-04-1987	Victor	-084.5	42.7	244	I	V		2446914.547	22.2	67	10.8	2.6	11.1	17	5.37

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TABLE VI

(*Continued*)

No. 1	R 2	E 3	Date 4	Observer 5	Long 6	Lat 7	Ele 8	N 9	B 10	T 11	JD 12	*Age* 13	*Lag* 14	*ARCV* 15	*DAZ* 16	*ARCL* 17	*W* 18	*V* 19
234	A	E	28-04-1987		-084.5	42.7	244	V	V		2446914.547	22.2	67	10.8	2.6	11.1	17	5.37
640	I	E	22-01-2004	Ebrahim	018.4	-33.9	200	V			2453027.268	21.1	56	10.3	6.3	12.1	22	5.39
351	I	E	18-03-1999	Odeh	035.8	31.9	939	V	V		2451256.176	20.4	50	10.4	5.6	11.8	21	5.39
596	I	E	02-05-2003	Mehrani	051.7	32.6	1500	V	V		2452762.157	25.6	56	10.7	4.4	11.6	18	5.40
602	I	E	30-06-2003	Kacem	003.7	32.5	550	I	V	V	2452821.311	23.5	59	10.6	5.2	11.8	19	5.40
656	I	E	20-04-2004	Aram	062.4	27.3	1195	I	V		2453116.116	23.6	52	10.9	1.8	11.0	17	5.40
352	C	E	18-03-1999		035.2	31.8	760	V			2451256.178	20.4	50	10.4	5.6	11.9	21	5.42
083	A	E	01-05-1908	Bac	003.1	44.1	183	V			2418063.306	26.2	60	9.8	10.2	14.1	28	5.42
235	A	E	28-04-1987	Seidelman	-084.4	33.7	335	I			2446914.533	21.8	58	10.9	0.5	10.9	17	5.43
353	I	E	18-03-1999	Saab	046.5	24.6	620	I	V	V	2451256.145	19.9	48	10.6	4.1	11.4	19	5.43
145	A	E	09-01-1978	Korycansky	-076.9	38.9	30	I	V		2443518.439	18.2	62	10.8	1.7	10.9	18	5.46
171	A	E	09-03-1978	Haasdyk	-119.3	50.3	610	V			2443577.603	22.4	68	10.6	5.5	11.9	20	5.46
457	I	E	24-04-2001	Gharaybeh	035.9	32.6	500	I			2452024.194	23.5	52	10.3	7.3	12.6	23	5.47
716	I	E	13-11-2004	Torabinejad	-081.8	36.8	630	V	V		2453323.447	33.8	45	7.8	16.5	18.2	50	5.49
236	A	E	28-04-1987	Byrd	-087.4	33.0	61	I			2446914.539	21.9	58	11.0	0.3	11.0	17	5.53
103	A	E	29-01-1922	MacKenzie	018.5	-33.9	30	I			2423084.259	42.9	40	7.9	17.5	19.2	49	5.53
237	A	E	28-04-1987	Pitluga	-087.7	40.8	244	I			2446914.552	22.3	65	10.9	2.2	11.2	17	5.54
597	I	E	02-05-2003	Mohammadi	054.4	27.7	700	V	V		2452762.142	25.2	53	10.9	3.3	11.4	18	5.54
288	C	E	18-12-1990		073.1	33.4	500	V			2448244.022	33.7	56	10.1	9.7	13.9	26	5.55
372	I	E	12-08-1999	Mohammadi	052.3	32.7	1500	I			2451403.158	27.7	48	9.6	11.3	14.8	32	5.55
259	A	M	13-06-1988	Stamm	-084.1	37.2	305	I		V	2447325.905	-22.6	65	10.7	5.5	12.0	20	5.55
327	C	M	29-11-1997		034.7	31.8	60	V			2450781.663	-21.0	57	11.0	0.2	11.0	17	5.56
458	I	E	24-04-2001	Dalee	035.8	31.9	939	V		V	2452024.195	23.5	52	10.4	7.2	12.6	23	5.56
238	A	E	28-04-1987	Richardson	-090.1	30.0	0	V			2446914.542	22.0	56	11.0	0.3	11.0	17	5.57
651	I	E	21-03-2004	Torabinejad	-081.8	36.8	630	V			2453086.506	23.7	55	10.7	5.3	12.0	20	5.62
081	A	E	19-04-1901	Johnson	-002.8	50.7	30	V			2415494.323	21.2	74	10.5	6.4	12.3	23	5.62
040	A	E	20-05-1871	Schmidt	023.7	38.0	122	I			2404568.251	30.8	60	10.3	8.7	13.5	25	5.64

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TABLE VI

(Group A)

No. 1	R 2	E 3	Date 4	Observer 5	Long 6	Lat 7	Ele 8	N 9	B 10	T 11	JD 12	*Age* 13	*Lag* 14	*ARCV* 15	*DAZ* 16	*ARCL* 17	*W* 18	*V* 19
128	A	E	06-04-1970	Quigley	-088.0	44.5	244	V	V		2440683.540	20.0	66	11.0	1.1	11.0	18	5.65
598	I	E	02-05-2003	McKenna	-009.5	51.7	50	V	V	V	2452762.360	32.0	77	10.2	9.6	14.0	26	5.65
547	I	E	09-08-2002	Odeh	035.5	30.4	1735	V		V	2452496.206	21.3	52	10.5	6.7	12.4	23	5.67
138	A	E	21-12-1976	Victor	-083.6	42.7	213	V			2443134.443	19.7	68	10.8	4.6	11.7	21	5.67
421	I	E	28-09-2000	Farooq	-079.9	43.3	88	V	V		2451816.480	27.3	54	9.6	11.5	15.0	33	5.69
058	A	E	22-06-1876	Schmidt	023.7	38.0	122	I			2406428.266	20.1	66	10.7	5.5	12.0	22	5.72
657	I	E	20-04-2004	Mehrani	051.0	32.8	2100	I	V		2453116.155	24.5	56	11.1	3.1	11.5	18	5.72
239	A	E	28-04-1987	Fry	-093.7	41.6	244	I			2446914.571	22.7	67	11.1	2.5	11.4	18	5.77
146	A	E	09-01-1978	Barrett	-087.6	41.9	244	V			2443518.466	18.6	67	11.0	2.6	11.3	19	5.77
147	A	E	09-01-1978	Hill	-079.8	36.0	305	V	V		2443518.454	18.5	61	11.0	1.1	11.1	19	5.78
148	A	E	09-01-1978	Talbert	-079.8	36.0	305	V			2443518.454	18.5	61	11.0	1.1	11.1	19	5.78
149	A	E	09-01-1978	Connor	-079.8	36.0	305	V	V		2443518.454	18.5	61	11.0	1.1	11.1	19	5.78
150	A	E	09-01-1978	Bohn	-089.8	43.0	274	V	V		2443518.470	18.7	68	11.0	2.8	11.3	20	5.79
491	I	E	17-10-2001	Essa	039.7	-04.0	0	I			2452200.148	19.6	46	11.1	0.7	11.1	18	5.83
492	I	E	17-10-2001	Mwinyifaki	039.7	-04.0	0	V			2452200.148	19.6	46	11.1	0.7	11.1	18	5.83
097	A	E	08-02-1921	Sykes	-110.0	32.2	2441	V			2422729.565	23.1	55	11.2	1.6	11.3	18	5.85
403	C	M	03-04-2000		035.2	31.8	200	V			2451637.630	-40.3	36	7.4	19.1	20.5	60	5.90
151	A	E	09-01-1978	Watts	-081.1	34.0	152	V	V		2443518.459	18.6	60	11.1	0.7	11.2	19	5.91
152	A	E	09-01-1978	Fleming	-081.1	34.0	152	V	V		2443518.459	18.6	60	11.1	0.7	11.2	19	5.91
336	D	M	25-04-1998	Mirsaeed	051.3	35.6	1100	V			2450928.561	-35.8	37	7.3	18.7	20.1	61	5.91
201	A	E	31-05-1984	McPartlan	035.6	15.6	335	I			2445852.188	22.2	52	11.2	1.0	11.3	18	5.92
240	A	E	28-04-1987	Duncombe	-097.7	30.3	183	V			2446914.565	22.4	57	11.3	0.2	11.3	18	5.92
098	A	E	08-02-1921	Lampland	-111.7	35.2	2469	V			2422729.567	23.2	58	11.3	0.9	11.4	18	5.96
153	A	E	09-01-1978	Guzman	-081.3	29.9	0	V			2443518.464	18.7	57	11.2	0.2	11.2	19	6.01
154	A	E	09-01-1978	Morris	-081.3	29.9	0	V			2443518.464	18.7	57	11.2	0.2	11.2	19	6.01
445	I	E	24-02-2001	Yucel	007.2	51.7	41	V	V		2451965.232	33.6	68	10.0	11.7	15.4	32	6.04
550	I	E	07-09-2002	Johnson	-061.5	10.7	0	V			2452525.439	19.2	47	11.2	2.4	11.4	20	6.06
155	A	E	09-01-1978	McGraw	-093.6	41.6	244	V			2443518.483	19.0	68	11.2	2.6	11.5	20	6.07
055	A	E	04-06-1875	Denning	-002.6	51.5	0	V			2406044.377	22.2	96	10.5	8.4	13.4	27	6.07
156	A	E	09-01-1978	Faber	-084.3	33.9	335	V	V		2443518.469	18.8	60	11.3	0.7	11.3	19	6.08
139	A	E	21-12-1976	Olsen	-091.6	42.0	274	V	V		2443134.467	20.2	69	11.1	4.7	12.0	22	6.10
157	A	E	09-01-1978	Bricker	-082.7	27.7	0	V	V		2443518.471	18.8	56	11.3	0.7	11.3	19	6.11
610	I	E	28-08-2003	Kacem	003.7	32.5	550	I	V		2452880.279	24.2	52	10.5	8.8	13.7	28	6.11
377	I	E	10-10-1999	Zainal	102.9	05.3	20	V	V	V	2451461.971	22.3	47	11.4	0.8	11.5	18	6.12
269	A	E	04-06-1989	Arnold	-001.0	50.8	0	V			2447682.370	24.0	93	10.5	8.8	13.7	28	6.13
144	A	E	11-12-1977	Keszthelyi	020.0	47.8	183	V			2443489.142	20.9	76	10.7	7.6	13.1	26	6.15
195	A	E	03-03-1984	Stamm	-084.1	37.2	305	I		V	2445763.501	28.3	56	10.9	7.9	13.5	24	6.16
677	F	M	15-08-2004	Mehrani	051.7	32.7	1500	V	V		2453232.558	-22.5	61	11.5	1.4	11.5	18	6.17

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TABLE VI
(*Continued*)

No. 1	R 2	E 3	Date 4	Observer 5	Long 6	Lat 7	Ele 8	N 9	B 10	T 11	JD 12	*Age* 13	*Lag* 14	*ARCV* 15	*DAZ* 16	*ARCL* 17	*W* 18	*V* 19
130	A	E	04-06-1970	Hoffler	-097.0	28.0	30	V			2440742.576	22.2	61	11.5	1.0	11.5	18	6.18
099	A	E	08-02-1921		-118.0	34.2	2012	V	V		2422729.585	23.6	58	11.5	1.1	11.6	18	6.18
131	A	E	04-06-1970	Fleming	-098.2	26.3	0	V			2440742.576	22.2	60	11.5	0.5	11.5	18	6.20
634	I	E	24-12-2003	Qureshi	073.1	33.4	500	V	V		2452998.024	25.6	56	9.8	12.2	15.6	37	6.24
587	I	E	02-04-2003	Singer	-117.6	47.6	604	V	V		2452732.622	31.1	67	10.8	8.9	13.9	26	6.25
329	C	E	30-12-1997		034.6	31.3	175	V			2450813.137	21.1	60	11.4	1.9	11.6	20	6.25
330	C	E	30-12-1997		035.2	31.3	600	V			2450813.137	21.1	60	11.4	1.9	11.6	20	6.25
241	A	E	28-04-1987		-104.0	30.6	2408	V	V		2446914.588	22.9	59	11.5	0.1	11.5	19	6.26
242	A	E	28-04-1987		-104.0	30.6	2408	V			2446914.588	22.9	59	11.5	0.1	11.5	19	6.26
187	A	E	05-12-1983	McPartian	035.6	15.6	335	I			2445674.147	25.5	52	11.2	5.8	12.6	22	6.29
339	C	E	21-10-1998		034.7	31.8	60	V			2451108.145	29.6	54	11.1	7.5	13.3	24	6.31
016	A	E	28-07-1862	Schmidt	023.7	38.0	122	I			2401350.248	44.8	39	7.2	20.8	22.0	67	6.32
463	I	E	22-06-2001	Kaufmann	008.7	49.6	175	V	V		2452083.342	32.0	72	8.9	15.4	17.8	48	6.39
038	A	E	20-02-1871	Schmidt	023.7	38.0	122	V			2404479.192	25.1	58	10.9	8.4	13.8	27	6.39
373	C	E	12-08-1999		034.7	31.8	60	V			2451403.203	29.2	51	10.2	11.5	15.3	34	6.39
670	I	E	18-06-2004	Singer	-117.6	47.6	650	V	V		2453175.692	31.8	85	10.7	10.0	14.6	29	6.39
378	I	E	10-10-1999	Odeh	035.9	32.0	850	V		V	2451462.152	27.5	53	11.0	7.9	13.6	25	6.40
158	A	E	09-01-1978	Rosamond	-090.2	30.0	0	V	V		2443518.489	19.1	59	11.5	0.0	11.5	20	6.44
159	A	E	09-01-1978	Schiffer	-090.2	30.0	0	V	V		2443518.489	19.1	59	11.5	0.0	11.5	20	6.44
160	A	E	09-01-1978	Meibaum	-090.2	30.0	0	V			2443518.489	19.1	59	11.5	0.0	11.5	20	6.44
119	A	E	13-06-1934	Tshernov	033.9	55.6	213	V			2427602.303	41.9	98	9.1	16.3	18.6	47	6.45
243	A	E	28-04-1987	Chamberlain	-111.9	40.7	1311	V			2446914.624	23.8	70	11.7	2.6	12.0	20	6.56
674	I	E	18-07-2004	Marzani	051.3	35.7	1100	V	V		2453205.183	27.8	63	11.2	7.8	13.6	25	6.56
539	I	E	11-06-2002	Stamm	-111.0	32.4	843	V	V		2452437.628	25.6	63	11.2	6.8	13.1	25	6.56
080	A	E	29-05-1900	Johnson	-000.7	38.7	305	V			2415169.327	27.6	64	10.7	10.1	14.7	31	6.59
140	A	E	21-12-1976	Jones	-081.3	29.9	0	V			2443134.456	19.9	61	11.7	1.7	11.8	21	6.65
575	I	E	03-01-2003	Khakoo	-118.0	33.9	19	I	V		2452643.558	28.5	60	10.6	10.9	15.1	33	6.65
356	C	M	14-05-1999		034.7	31.8	60	V			2451312.602	-35.0	40	8.0	18.5	20.2	62	6.66
580	F	E	02-02-2003	Mehrani	051.7	32.6	1500	V	V		2452673.110	26.3	57	11.1	8.5	14.0	27	6.68
732	I	E	11-01-2005	Sehbajraktarevic	018.4	43.9	950	V			2453382.170	27.2	65	9.7	13.8	16.8	43	6.71
307	C	E	25-09-1995		018.4	-33.9	350	V			2449986.218	22.7	58	11.8	1.4	11.9	21	6.71
399	I	E	06-02-2000	Essa	039.7	-04.0	0	V			2451581.170	25.2	50	11.8	3.0	12.2	21	6.73
188	A	E	05-12-1983	Stamm	-084.1	37.2	305	I		V	2445674.451	36.0	60	10.2	12.9	16.4	37	6.73
395	I	E	07-01-2000	Haque-Copilah	-061.5	10.0	45	V			2451551.433	26.5	53	11.9	0.1	11.9	19	6.74
635	I	E	24-12-2003	Almasi	051.3	35.7	1100	V	V	V	2452998.083	27.6	59	10.0	13.1	16.4	41	6.76
357	I	M	14-05-1999	Odeh	037.1	31.7	555	V	V	V	2451312.593	-35.2	40	8.0	18.6	20.3	62	6.77
479	I	E	19-08-2001	Khakoo	-118.0	33.9	19	V	V		2452141.624	23.2	55	10.8	9.3	14.3	31	6.78
576	I	E	03-01-2003	Stamm	-111.0	32.4	843	V			2452643.544	27.9	59	10.8	10.3	14.9	32	6.81
100	A	E	04-08-1921	MacKenzie	018.5	-33.9	30	V			2422906.192	19.5	61	11.8	0.4	11.8	21	6.82
278	A	E	25-04-1990	Bortle	-073.7	41.6	30	I		V	2448007.513	19.4	72	11.8	0.7	11.8	21	6.82

(*Continued on next page*)

TABLE VI
(*Continued*)

No.	R	E	Date	Observer	Long	Lat	Ele	N	B	T	JD	*Age*	*Lag*	*ARCV*	*DAZ*	*ARCL*	*W*	*V*
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
671	I	E	18-06-2004	Torabinejad	-081.8	36.8	630	I	V		2453175.559	27.5	71	11.7	6.0	13.1	23	6.82
570	F	E	05-12-2002	Mehrani	051.4	35.7	1500	V	V		2452614.079	31.1	59	10.1	12.9	16.4	40	6.85
493	I	E	17-10-2001	Dukku	009.8	10.3	600	V			2452200.228	21.1	50	11.8	2.9	12.2	22	6.86
161	A	E	09-01-1978	Ikels	-098.1	29.7	152	V			2443518.514	19.6	60	11.9	0.0	11.9	21	6.86
205	A	E	27-08-1984	McPartlan	035.6	15.6	335	I			2445940.180	20.4	50	11.7	3.9	12.3	23	6.86
440	I	E	25-01-2001	Hafiz	-074.0	40.8	1	V			2451935.441	34.6	66	11.1	9.5	14.7	29	6.87
215	A	E	21-01-1985	O'Meara	-155.0	19.0	4145	V			2446087.695	24.3	54	11.6	5.9	13.0	24	6.87
530	I	E	13-05-2002	Mehrani	051.7	32.6	1500	V	V		2452408.165	27.7	62	11.6	6.5	13.3	24	6.88
066	A	E	01-07-1878	Schmidt	023.7	38.0	122	V			2407167.265	28.9	63	10.6	11.2	15.4	35	6.89
675	I	E	18-07-2004	Mehrani	051.7	32.7	1500	V	V		2453205.177	27.6	63	11.6	7.0	13.5	25	6.91
459	I	E	24-04-2001	Kacem	003.7	32.5	550	V	V	V	2452024.286	25.6	58	11.4	7.6	13.7	27	6.94
441	I	E	25-01-2001	Shaikh	-074.2	40.4	29	V			2451935.443	34.6	66	11.2	9.4	14.7	29	6.98
379	I	E	10-10-1999	Saab	046.5	24.5	620	I	V		2451462.125	26.4	53	11.7	6.0	13.2	24	6.98
562	I	E	05-11-2002	Hafiz	-080.3	26.0	1	V			2452584.459	25.3	53	10.9	9.8	14.7	33	7.00
112	A	E	25-05-1933	Tshernov	033.9	55.6	213	V			2427218.295	32.5	123	11.1	10.1	15.0	30	7.01
563	I	E	05-11-2002	Stamm	-111.0	32.4	843	V	V	V	2452584.541	28.2	54	10.5	12.0	15.9	38	7.04
244	A	E	28-04-1987	Klemola	-122.0	37.0	1494	V			2446914.647	24.2	68	12.1	1.8	12.2	21	7.04
526	I	E	13-04-2002	Hafiz	-080.3	26.0	1	V			2452378.506	27.2	55	11.9	4.8	12.9	23	7.05
617	I	E	27-09-2003	Kaufmann	008.7	49.6	175	V	V		2452910.235	39.7	49	7.7	20.3	21.7	70	7.08
022	A	E	04-08-1864	Schmidt	023.7	38.0	122	I			2402088.244	50.1	40	7.4	22.3	23.5	74	7.10
531	I	E	13-05-2002	Katbeh	044.4	33.3	40	V	V		2452408.182	28.3	63	11.7	6.6	13.5	25	7.12
532	I	E	13-05-2002	Mohammadi	052.5	29.6	1500	V			2452408.158	27.5	61	11.9	5.7	13.2	24	7.12
092	A	E	01-04-1919	Whitmell	-001.6	53.9	183	V			2422050.307	21.2	87	11.9	4.2	12.6	24	7.14
344	I	E	18-01-1999	Isiaq	003.4	06.5	35	I			2451197.260	24.6	52	12.1	2.6	12.4	22	7.14
087	A	E	25-08-1911	Bougon	002.3	49.9	15	V			2419274.303	40.3	53	8.3	19.4	21.1	64	7.18
129	A	E	06-04-1970	Penegor	-122.0	48.0	152	V			2440683.641	21.9	78	12.1	2.4	12.3	22	7.18
696	I	E	15-09-2004	Ebrahim	018.4	-33.9	200	V			2453264.213	24.8	59	12.0	4.7	12.9	24	7.21
446	I	E	24-02-2001	Nasab	050.8	36.0	1100	V			2451965.125	30.1	60	11.7	7.9	14.1	27	7.21
708	I	E	15-10-2004	Pazhouhesh	059.2	32.9	1468	V	V	V	2453294.082	36.9	48	9.6	15.9	18.5	51	7.26
325	C	E	03-09-1997		034.7	31.8	60	V			2450695.185	41.5	49	10.3	14.5	17.8	42	7.26
124	A	E	05-03-1954	Quigley	-088.0	44.5	244	V			2434807.513	20.2	71	12.2	0.2	12.2	23	7.29
564	I	E	05-11-2002	Fituri	-117.0	32.0	100	V			2452584.556	28.8	55	10.6	12.1	16.1	39	7.29
717	I	E	13-11-2004	Garba	010.7	13.7	580	V			2453323.218	25.3	51	11.2	9.6	14.8	33	7.30
533	I	E	13-05-2002	Khushaish	048.0	29.4	30	V	V		2452408.167	27.8	61	12.0	5.6	13.2	24	7.32
354	I	E	18-03-1999	Touma	-006.8	34.0	50	V			2451256.294	22.7	58	11.8	6.5	13.4	27	7.32
133	A	E	25-04-1971	Pence	-088.2	39.5	183	V	V		2441067.552	20.4	71	12.2	0.3	12.2	22	7.33
641	I	E	22-01-2004	Torabinejad	-123.1	41.8	1400	V	V		2453027.578	28.0	66	10.7	12.2	16.2	39	7.33

(*Continued on next page*)

TABLE VI

(*Continued*)

No. 1	R 2	E 3	Date 4	Observer 5	Long 6	Lat 7	Ele 8	N 9	B 10	T 11	JD 12	*Age* 13	*Lag* 14	*ARCV* 15	*DAZ* 16	*ARCL* 17	*W* 18	*V* 19
380	I	E	10-10-1999	Touma	-006.8	34.0	50	V			2451462.269	32.0	57	11.5	9.4	14.8	30	7.35
698	F	M	13-10-2004	Mehrani	051.7	32.7	1500	I	I		2453291.585	-23.1	60	12.3	0.0	12.3	22	7.36
006	A	E	12-03-1861	Schmidt	023.7	38.0	122	V			2400847.208	25.5	64	12.4	1.6	12.5	21	7.37
078	A	E	12-03-1899	Schoch	013.3	52.5	61	V			2414726.239	20.8	83	12.3	1.6	12.4	23	7.38
197	A	E	02-04-1984	McPartlan	035.6	15.6	335	I			2445793.178	26.4	53	12.4	1.9	12.5	21	7.40
652	I	E	21-03-2004	Khakoo	-118.0	33.9	19	V			2453086.606	26.1	60	12.2	4.8	13.1	24	7.41
116	A	E	14-05-1934	Tshernov	033.9	55.6	213	V			2427572.280	29.0	119	11.7	8.6	14.5	29	7.45
534	I	E	13-05-2002	Mayoof	050.5	26.2	4	V	V		2452408.155	27.5	60	12.2	4.7	13.1	24	7.45
464	I	E	22-06-2001	Sehbajraktarevic	018.4	43.9	630	V			2452083.299	30.7	71	10.3	13.7	17.1	44	7.46
447	I	E	24-02-2001	Zainal	102.9	05.3	20	V	V	V	2451964.990	25.5	52	12.5	0.7	12.5	21	7.47
465	I	E	22-06-2001	Rahkooi	046.0	38.2	1400	V	V		2452083.209	27.8	67	11.0	11.4	15.8	37	7.48
448	I	E	24-02-2001	Salie	018.4	-33.9	200	V			2451965.248	35.3	57	11.4	10.4	15.5	33	7.51
535	I	E	13-05-2002	Al-Abdulmohsen	049.7	25.3	10	V			2452408.156	27.5	60	12.3	4.5	13.1	24	7.54
645	F	M	19-03-2004	Mehrani	051.7	32.7	1500				2453083.593	-44.2	39	7.8	21.5	22.8	74	7.54
183	A	M	09-07-1983	Stamm	-084.1	37.2	305	V			2445524.910	-25.0	69	11.6	9.0	14.6	32	7.59
636	I	E	24-12-2003	Mehrani	051.7	32.7	1500	V			2452998.088	27.7	61	10.8	12.4	16.4	41	7.62
536	I	E	13-05-2002	Odeh	035.8	31.9	939	V		V	2452408.208	29.2	64	12.1	6.4	13.7	26	7.62
685	I	M	13-09-2004	Stamm	-111.0	32.4	842	V	V	V	2453262.024	-24.1	62	12.5	1.9	12.7	22	7.63
710	I	E	15-10-2004	Janghorban	051.7	32.6	1500	V	V		2453294.103	37.4	49	9.8	16.1	18.8	52	7.63
709	I	E	15-10-2004	Mehrani	051.6	32.6	1500	V	V		2453294.103	37.4	49	9.8	16.1	18.8	52	7.64
454	F	E	24-02-2001	Mehrani	051.7	32.6	1500	V	V		2451965.125	30.1	60	12.1	7.1	14.1	27	7.66
568	I	E	05-12-2002	Janghorban	051.7	32.6	1500	V	V		2452614.084	31.2	60	10.9	12.2	16.4	40	7.67
466	I	E	22-06-2001	Hasanzadeh	051.3	35.7	1100	V	V		2452083.188	27.2	66	11.3	10.6	15.5	36	7.71
366	I	E	14-06-1999	Isiaq	003.4	06.5	35	V			2451344.268	22.0	54	12.2	4.8	13.1	26	7.71
554	F	E	07-10-2002	Mehrani	051.7	32.5	1500	V	V		2452555.112	26.7	54	11.1	11.4	15.9	39	7.73
001	A	E	01-07-1859	Schmidt	023.7	38.0	122	V			2400227.266	26.4	67	11.2	11.0	15.7	37	7.74
013	A	E	01-01-1862	Schmidt	022.9	37.9	122	V			2401142.162	24.6	71	12.1	6.4	13.7	28	7.76
136	A	E	05-03-1973	Hanford	-085.0	40.0	305	V	V		2441747.507	22.5	68	12.6	1.0	12.6	23	7.77
527	I	E	13-04-2002	Stamm	-111.0	32.4	843	V	V		2452378.600	30.6	61	12.3	6.5	13.9	26	7.78
588	I	E	02-04-2003	Khakoo	-118.2	33.8	0	V			2452732.612	31.2	62	12.5	5.7	13.7	25	7.87
297	C	E	23-02-1993		018.4	-34.0	60	V			2449042.242	52.0	39	7.9	22.7	24.0	77	7.88
141	A	E	21-12-1976	Patterson	-122.5	37.6	0	V			2443134.561	22.0	72	12.5	4.4	13.2	26	7.91
127	A	M	24-09-1965	Meuss	005.3	51.1	30	V			2439027.701	-21.3	84	12.6	1.6	12.7	24	7.94
577	I	E	03-01-2003	Ali	-061.3	10.4	20	V			2452643.432	24.2	57	12.6	4.6	13.4	26	7.98
718	I	E	13-11-2004	Dukku	009.8	10.3	600	V			2453323.224	25.4	53	11.9	8.9	14.8	33	7.99
449	I	E	24-02-2001	Mohammadi	052.5	29.6	1500	V			2451965.124	30.1	59	12.5	6.4	14.0	27	8.00
733	I	E	11-01-2005	Mehrani	051.6	32.6	1500	V	V		2453382.099	24.8	63	11.5	10.7	15.7	38	8.02
423	F	E	28-10-2000	Mehrani	051.7	32.6	1500	V			2451846.097	31.3	60	12.0	9.2	15.1	32	8.03
309	A	M	19-01-1996	Stamm	-111.0	32.4	853	V		V	2450102.077	-21.9	65	12.4	5.8	13.6	28	8.04

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TABLE VI
(*Continued*)

No. 1	R 2	E 3	Date 4	Observer 5	Long 6	Lat 7	Ele 8	N 9	B 10	T 11	JD 12	*Age* 13	*Lag* 14	*ARCV* 15	*DAZ* 16	*ARCL* 17	*W* 18	*V* 19
180	A	E	13-07-1980	Schaefer	-070.7	41.4	0	V			2444434.529	42.6	59	9.7	18.0	20.4	58	8.07
117	A	E	14-05-1934	Andreko	036.2	50.0	122	V			2427572.250	28.1	100	12.5	6.6	14.1	27	8.09
280	A	M	23-05-1990	Bieda	-110.5	31.6	1372	V			2448034.990	-23.1	65	12.2	7.6	14.3	31	8.11
548	I	E	09-08-2002	Dukku	009.8	10.3	600	V			2452496.257	21.9	55	12.7	2.4	13.0	25	8.12
711	I	E	15-10-2004	Amirzadeh	057.1	30.2	1800	V	V	V	2453294.090	37.1	51	10.4	15.5	18.6	51	8.13
126	A	E	05-04-1962	Thackeray	-028.2	-25.8	1372	V	V		2437760.346	23.4	56	12.3	7.3	14.3	31	8.18

- Zone D (*ARCV* < *ARCV1*): Crescent is not visible even by optical aid.
- Notice that *ARCV1, ARCV2* and *ARCV3* are airless and topocentric, thus the calculated *ARCV* must be the same as well.
- The visibility at the beginning of each zone highly depends on the atmospheric conditions, acuity of vision, experience of the observer and looking at the location of the crescent. That means you might not expect to see the crescent even by optical aid if your *ARCV* is just at the beginning of Zone C if the atmospheric conditions are hazy or unfavorable.

Predicting the visibility of the lunar crescent by this new criterion can be also calculated using the following equation:

$$V = ARCV - (-0.1018\,W^3 + 0.7319\,W^2 - 6.3226\,W + 7.1651) \qquad (2)$$

where: *ARCV*: Airless and topocentric arc of vision in degrees. *W*: Topocentric crescent width in arc minutes.

$V \geq 5.65$: Zone A.
$2 \leq V < 5.65$: Zone B.
$-0.96 \leq V < 2$: Zone C.
$V < -0.96$: Zone D.

6. Lunar crescent observations database

Table VI below lists the 737 records, where Columns numbered 1 to 19 have the following meaning:

1. Record number, sorted chronologically.
2. Reference source, where: A (Schaefer list), B (Stamm list), C (SAAO list), D (Mirsaeed list), F (Mehrani list) and I (ICOP).
3. Morning (M) or evening (E) observation.
4. Local date of observation, in the form dd-mm-yyyy.
5. Name of the observer.
6. East longitude of the location of observation.
7. Latitude of the location of observation.
8. Elevation of the location of observation in meters.
9. Visibility by naked eyes; Invisible (I), visible (V) or blank if not tried.
10. Visibility by binocular; Invisible (I), visible (V) or blank if not tried.
11. Visibility by telescope; Invisible (I), visible (V) or blank if not tried.
12. Julian date at the time of calculations (Best Time).
13. Topocentric age of the Moon (*Age*) in hours at Best Time.
14. Lag time of the Moon (*Lag*) in minutes.

15–17. Topocentric arc of vision (*ARCV*), topocentric relative azimuth (*DAZ*) and topocentric arc of light (*ARCL*), all in degrees at Best Time and are not corrected for refraction.

18 Topocentric crescent width (W) in arc seconds at Best Time.
19 Visibility prediction value (V) described in Section 5.

7. Youngest crescent observations

7.1. Topocentric age

From Table VI the youngest crescent seen by optical aid is Stamm #310 detection at a topocentric age of 13 hr. 14 min. Running a close second is Mirsaeed #549 observation with 13 hr. 18 min. With the naked eye, the youngest crescent detected is at 15 hr. 33 min. from Pierce #274.

Stamm's observation:
Geocentric new moon: 20 January 1996, at 12:50 UT.
Topocentric new moon: 20 January 1996, at 11:43 UT.
First visibility: 21 January 1996, at 00:57 UT.
Geocentric age: 12:07.
Topocentric age: 13:14.

Mirsaeed's observation:
Geocentric new moon: 07 September 2002, at 03:10 UT.
Topocentric new moon: 07 September 2002, at 01:29 UT.
First visibility: 07 September 2002, at 14:47 UT.
Geocentric age: 11:37.
Topocentric age: 13:18.

Pierce's observation:
Geocentric new moon: 25 February 1990, at 08:54 UT.
Topocentric new moon: 25 February 1990, at 08:22 UT.
First visibility: 25 February 1990, at 23:55 UT.
Geocentric age: 15:01.
Topocentric age: 15:33.

7.2. Lag time

Minimum crescent lag time is respectively 21 min. with optical aid (Stamm #737) and 29 min. with the naked eye (Ashdod #286).

7.3. Topocentric *ARCL* (elongation)

The minimum elongation crescent seen by optical aid is 6.4 degrees (Stamm #797, at the time of last visibility at 13:09 UT); for naked eye observations this is 7.7 degrees (Pierce #274, at the time of first visibility at 23:55 UT.).

8. Danjon limit

Danjon (1936) found that no crescent can be seen when the Moon is less than 7 degrees from the Sun, because the arc length of the crescent is then zero. He attibuted this effect to the shadow of the lunar mountains. McNally (1983) found a Danjon limit of 5 degrees and explained it by atmospheric turbulence (seeing) effects. Schaefer (1991) found that a Danjon limit of 7 degrees and showed that in that configuration the Moon brightness per unit length of lies actually below the eye's detection threshold. From our large database, we find a Danjon limit of 6.4 degrees from observation #697.

9. Conclusion

Based on a large database combining historical sightings plus our own observations in the frame of the ICOP project, we have derived an accurate criterion for crescent visibility prediction either by the naked eye or with optical aid.

The crescent width is a good parameter to describe the intrinsic crescent brightness, in contrast to the age of the Moon, as is the arc of vision to include the effect of atmospheric extinction, and hence estimate the apparent crescent brightness.

The Islamic Crescent Observation Project (ICOP) has been a vital contributor in crescent sighting, with more sightings done in 6 years than all combined observations from the year 1859 to 2000! Also, having several observers in different locations, especially those at high latitudes and altitudes did indeed provide very valuable additional information on crescent visibility.

The best Danjon limit by optical aid is 6.4 degrees.

Acknowledgments

I'd like to deeply thank ICOP members who participated seriously in the project, and made this large database available for establishing an accurate crescent visibility prediction criterion.

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Table of Corrections

Number	Location	Error	Correction
Error number one	Page 45, Table VI, Group (C), Observation number 737, column 4	02-11-2006	02-11-2005
Error number two	Page 62, Section 7.3, first line	(Stamm #797)	(Stamm #697)