Repeat Illumination Observations for *The 1963 Aristarchus Events*

Anthony Cook and Robert O'Connell

Introduction

In 'Revisiting The 1963 Aristarchus Events' we encouraged observations of the Moon's Aristarchus Plateau to determine if the appearances and behaviors of the transient lunar phenomena (TLP) reported by the Lowell observers can be duplicated under similar viewing geometry and observing conditions.[1] Terrestrially induced factors which can contribute to observational misinterpretation of spurious colors for real lunar phenomena include (alone, in total, or in some combination) atmospheric prismatic dispersions, optical chromatic aberrations, lunar altitude and seeing conditions. On October 30, 1963 UT, James Greenacre and Edward Barr reported three reddish TLP appearing during a 25-minute period. (See Figure 1, *Left*).

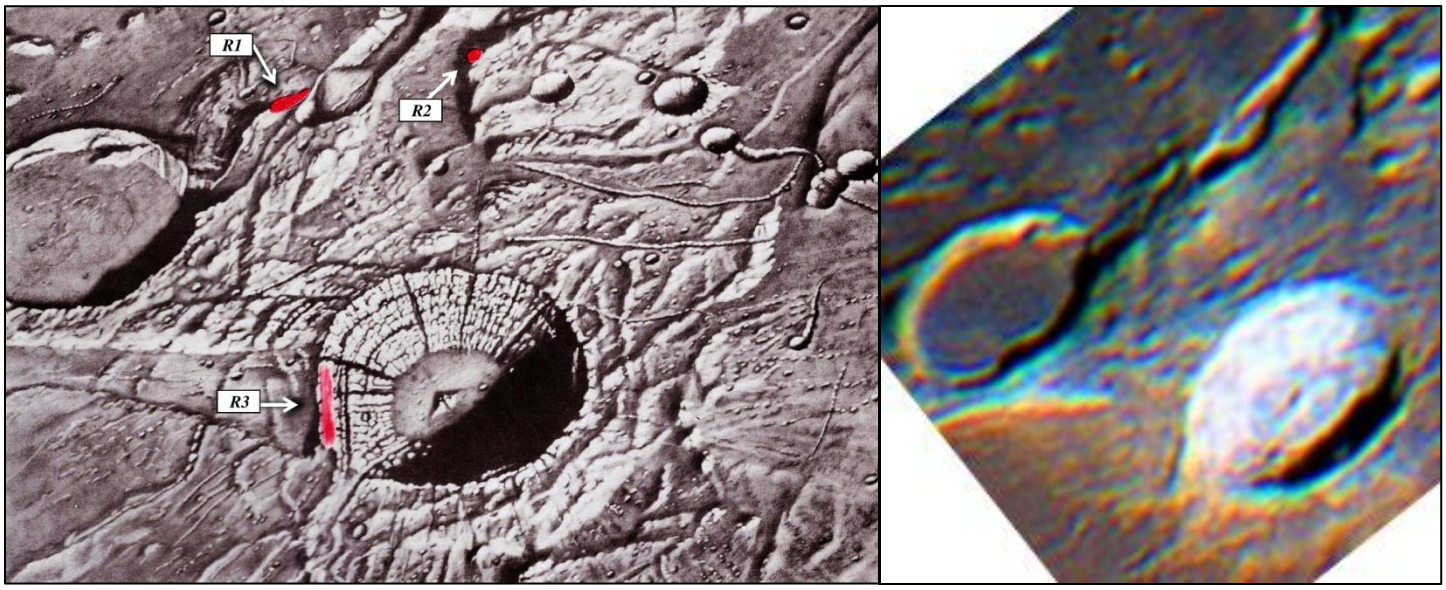

Figure 1 (*Left*) Patricia Bridges rendition of the TLP observed by James Greenacre and Edward Barr on October 30, 1963. Image originally published in 'Lunar Color Phenomena: Technical Report No. 12', USAF Aeronautical Chart and Information Center, St Louis, MO, 1964, May. (*Right*) One of Anthony Cook's artificial atmospheric spectral dispersion simulations produced with a 2011 repeat illumination color image by Bev Ewen-Smith. See our paper Revisiting the 1963 Aristarchus Events for additional information on these images. IAU north to upper right in images.

Note the following aspects of this report when attempting digital or visual observations under repeat illumination conditions:

1. The observation was made with the Lowell Observatory 24-inch f/16 Clark achromatic refractor with a zoom eyepiece.
2. A 16-inch reflector or a 20-inch refractor were considered the minimum apertures required for visual detection.
3. No TLP were seen for the first 20 minutes of the observing run as the Moon rose in the eastern sky from 25 to 29 degrees.
4. These TLP were only seen during a 25-minute period during which the Moon rose in altitude from 25 to 31 degrees.
5. Seeing *during* this 25-minute TLP event varied with *initial* best moments of seeing reported as 3-to-4 on a scale of 0-10.
6. R1 and R2 did not appear until several minutes after magnification had been increased from ~430x to 500x.
7. R1 and R2 formed and brightened over several minutes as the Moon was rising.
8. R3 did not appear until several minutes after R1 and R2 began forming and increasing in intensity.
9. Highly localized surface obscurations were only reported at R1 and R2.
10. Rapidly flowing white lights streaming outward and downward over the lunar topography were only reported at R1 and R2.
11. As seen in Figure 1, the three TLP reported were highly localized and well defined reddish color phenomena.
12. No other similar anomalous colors were seen despite repeated wide-area scans both with and without the Wratten 15 filter.
13. R1 and R2 were saturated red in color with no bluish colors reported during this observation.

Relevant aspects of the appearances and behaviors of the other TLP reported by the Lowell observers on both nights can be derived from the observing chronologies in our paper and from the primary source material posted online at: www.the1963aristarchusevents.com

Rev. 2013-12-03 (***inclusion of Figure 1, Right***)
Previous posting 2013-10-08

Repeat Illumination Observing Opportunities

Table 1 lists dates and times though 2017 when repeat selenographic colongitude will occur for the R1, R2 & R3 TLP.

Table 1: Repeat illumination opportunities (UT) for R1, R2, R3 TLP [1,2]

2013 Oct 16	23:28	2014 Jan 13	17:57	2015 Jan 03	02:03	2016 Jan 22	00:50	2017 Jan 10	08:55
2013 Nov 15	13:01	2014 Feb 12	08:25	2015 Feb 01	16:39	2016 Feb 20	15:09	2017 Feb 08	23:25
2013 Dec 15	03:18	2014 Mar 13	22:13	2015 Mar 03	06:44	2016 Mar 21	04:44	2017 Mar 10	13:19
		2014 Apr 12	11:07	2015 Apr 01	19:59	2016 Apr 19	17:24	2017 Apr 09	02:21
		2014 May 11	23:07	2015 May 30	19:49	2016 May 19	05:11	2017 May 08	14:28
		2014 Jun 10	10:24	2015 Jun 29	06:51	2016 Jun 17	16:21	2017 Jun 07	01:49
		2014 Jul 09	21:22	2015 Jul 28	17:48	2016 Jul 17	03:16	2017 Jul 06	12:46
		2014 Aug 08	08:23	2015 Aug 27	05:04	2016 Aug 15	14:21	2017 Aug 04	23:42
		2014 Sep 06	19:53	2015 Sep 25	17:00	2016 Sep 14	02:00	2017 Sep 03	11:05
		2014 Oct 06	08:09	2015 Oct 25	05:53	2016 Oct 13	14:31	2017 Oct 02	23:16
		2014 Nov 04	21:23	2015 Nov 23	19:42	2016 Nov 12	04:00	2017 Nov 01	12:25
		2014 Dec 04	11:27	2015 Dec 23	10:09	2016 Dec 11	18:16	2017 Dec 01	02:26
								2017 30	16:59

1. All dates and times listed are for lunar selenographic colongitude 60.2º corresponding to the approximate mid-point of the original R1, R2 and R3 observation at 01:58, October 30, 1963 UT
2. Lunar librations for each observing opportunity will vary and therefore solar illumination conditions will not precisely match those for the original observation. Lunar librations for the original observations were N-S 06º 56', E-W -06º 20'

To determine if a particular repeat illumination opportunity in Table 1 will be visible from your location, see the online 'Project for the Verification/Elimination of past TLP Reports'. This web site lists monthly TLP repeat illumination visibility dates and timeframes for more than 2000 TLP at more than 160 locations around the world. We also provide a more restrictive set of illumination constraints that take into account the sub-solar latitude, namely both the sub-solar longitude and latitude must be similar to within +/-0.5 degrees to what they were on the night of the Oct 30th Greenacre and Barr R1, R2 & R3 observation. The same predictions web site also can be used to look for occasions when both illumination and libration were similar to the night in question to a tolerance of +/- 1.0 degrees for these parameters.

Conclusion

Repeat illumination observations from amateur astronomers have been useful in evaluating historical TLP reports like 'The 1963 Aristarchus Events'. Analyses and discussions of these observations are presented monthly in both The A.L.P.O. Lunar Section newsletter *The Lunar Observer* and in the B.A.A. *Lunar Section Circulars*. Occasionally papers are also published by researchers reporting results from the continuing study of repeat illumination observations. For example see:

Lena R. & Cook A., 'Emergence of low relief terrain from shadow: an explanation for some TLP', *J. Brit. Astron. Assoc.*, **114**(3), (2004 June), pp. 136−139 (Accessed 2013-10-06)

Phillips J. & Lena R., 'GLR investigation: A plausible explanation for Transient Lunar Phenomena. Red Glow in Aristarchus', *Selenology Today*, **24**, (2011 May), pp. 1−11 (Accessed 2013-10-06)

Cook A. & Dobbins T., 'The Pseudo-Peak in Herodotus', *The Moon: Notes and Records of the Lunar Section of the British Astronomical Association*, **2** (2012 Dec.), pp. 22-35 (Accessed 2013-10-06)

High-resolution digital observations attempting to duplicate 'The 1963 Aristarchus Events' are useful for continuing efforts to determine whether these were real lunar phenomena or merely some odd and rarely occurring terrestrially induced manifestation of what might be termed *selective transient dispersion* (STD). Observers interested in participating in repeat illumination observations are encouraged to contact Tony Cook at this email address: atc@aber.ac.uk

Tony Cook & Bob O'Connell
October 6, 2013

1 O'Connell, R. & Cook, A., 'Revisiting The 1963 Aristarchus Events', *J. Brit. Astron. Assoc.*, **123**(4) pp. 197-208, (2013 August).

Rev. 2013-12-03 (***inclusion of Figure 1, Right***)
Previous posting 2013-10-08