Mars Section

Mars 2011–'12: 2nd interim report

Mars Science Laboratory and *Curiosity*

The successful landing in Gale crater was covered in the October *Journal* (**122**, 255–256 (2012)).To date the mission is continuing successfully and may be followed online in real time: **http://mars.jpl.nasa.gov/msl/news/whatsnew/index.cfm**

Observations of Mars in 2011–'12: a sequel

An interim report dealt with aspects of the observations up to opposition (R. J. McKim, *J. Brit. Astron. Assoc.*, **122**(2), 75 (2012).) The planet is heading towards solar conjunction in 2013, and as I write this note in 2012 early November it is less than 5 arcsec in diameter and in extreme southern declination. The number of contributors so far is 98.

As mentioned in our Council report (*ibid.*, **122**(5), 295 (2012)) the UK weather deteriorated considerably after opposition but several interesting features were noticed, and we shall mention just a few phenomena here. Some typical drawings and images feature in Figures 1 and 2, due to Paul Abel, Manos Kardasis, Tom McCague and Andy Hedley Robinson.

A strikingly large projection over the morning terminator was reported in BAA e-bulletin no. 661 (2012 Feb 22) and an email alert to Section members, which detailed how it developed during 2012 Mar 19–21. The Director noticed a small projection on images by Efrain Morales Rivera (Puerto Rico) on Mar 19 under CM= 151°; by CM= 156° it had vanished. The same observer saw it again next day, as did others. Wayne Jaeschke put an alert on his website: he captured it particularly well on March 20 at CM= 146°, and it had clearly increased in size since the previous day.

On Mar 21 Jim Phillips (USA) emailed details of a much larger projection captured by his own images of that date (CM= 153°), and confirmatory images by Don Parker (USA) taken on Mar 21 (Figure 3A, CM= 146°) were soon forthcoming. On the latter images it appeared as a nearly detached cloud lying along the terminator, anchored at the S. end. The cloud was visible in red, green and blue images, so it would seem that suspended dust is involved.

There are other records of a small feature in the same location captured by many European observers over a week earlier, but its sudden increase in size on March 20 and 21 (Ls= 85–86°) was remarkable. Marc Delcroix recorded it on March 12 (CM= 152–155), for example. He measured the projection on Mar 20 to be located at lat. –45°, long. 193°, at the border of *Electris* and *Eridania*. Damian Peach measured the same image to obtain a position of –44°, 190°.

Terminator projections due to both white cloud and suspended dust have been reported by many past observers, particularly when using large telescopes visually, and when Mars was close to quadrature and the phase defect at a maximum. It is therefore unusual for such a prominent projection to be visible just weeks after opposition, though the direction of maximum phase defect did lay within the S. following quadrant of the planet's disk as we can see from the ephemeris for *P* (the position angle of the aerographic N. pole) and *Q* (the position angle of the greatest defect of illumination), from the BAA *Handbook*:

Date	*P*	*Q*
2012 Mar 14	16º	128°
2012 Mar 24	14º	119°

Terminator projections due to dust activity have been described at some length in more recent BAA reports. For instance, there was an obvious projection to be seen in the longitudes following *Hellas* during the large regional dust storm prior to the arrival of *Mars Express* in 2003 December. This projection was easily seen visually by the writer and was captured on several images. At the time the phase defect was large.

The BAA *Memoir*, 'Telescopic Martian Dust Storms: A Narrative and Catalogue' (*Mem. Brit. Astron. Assoc.*, **44** (1999)) includes an extensive discussion of the history of terminator projections. Of those that appeared at high southern latitude the most remarkable is that observed by E.–M. Antoniadi over *Eridania* with the 83cm OG of Meudon Observatory on 1933 Apr 14 (Ls= 96°). Note the similar seasonal date to 2012. He estimated its height at 35km. Antoniadi's drawings (Figures 3B–C, reproduced from E.–M. Antoniadi, *Bull. Soc. Astron. France*, **47**, 345–361 (1933)) much resemble Parker's image of (2012 Mar 21. The old telescopic observers unwittingly exaggerated the height of the projections they recorded, owing to the falling off of illumination at the terminator.

The 2012 terminator projection was also observed on later occasions and was a frequent discussion topic on internet forums.

Another interesting seasonal phenomenon is the regular formation of small white clouds over *Baltia*, a region adjacent to the subliming north polar cap. HST observations of the 1990s showed that these were seasonally recurring clouds, and NASA dubbed them 'polar cyclones'. The last

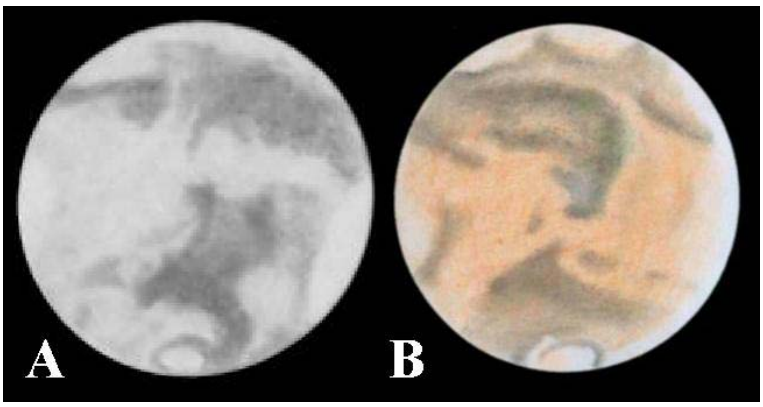

Figure 1. Drawings of Mars in 2012. (South is uppermost in all figures.)
(A) Feb 25d 16h 50m, 333mm refl., ×250–500, *T. McCague (Chicago, USA).*
(B) Mar 2d 01h 12m, CML= 280°, 203mm refl., ×250–400, *P. G. Abel (Leicester). Olympia* is seen next to the NPC.

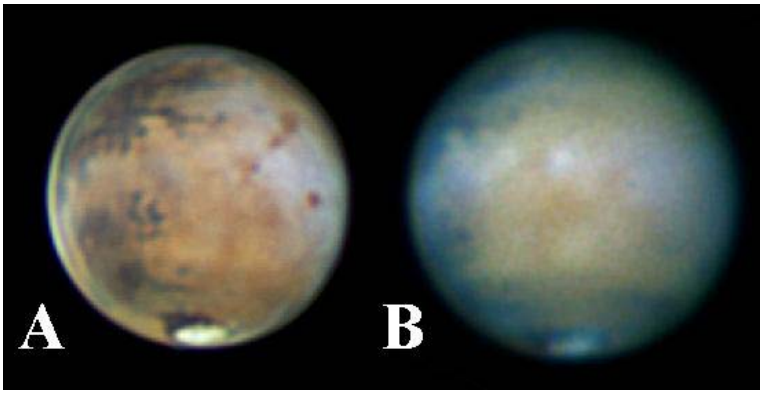

Figure 2. Images of Mars in 2012.
(A) Mar 17d 21h 28m, CML= 86°, RGB image, 279mm SCT, *M. Kardasis (Athens, Greece)*. Volcanoes visible as dark spots amidst morning cloud. Irregular NPC with outlier(s).
(B) Mar 17d 23h 19m, CML= 114°, RGB image, 279mm SCT, *A. Hedley Robinson (Dawlish)*. Two hours after (A); note the orographic and diurnal clouds.

few oppositions have not been favourable for us to witness the appropriate season, but in 2012 it was again possible to watch the clouds, whose appearance had been predicted by the Director (*J. Brit. Astron. Assoc.*, **121**, 258–259 (2011)). Figure 4 shows one such cloud captured by Trevor Barry.

Richard McKim, *Director*

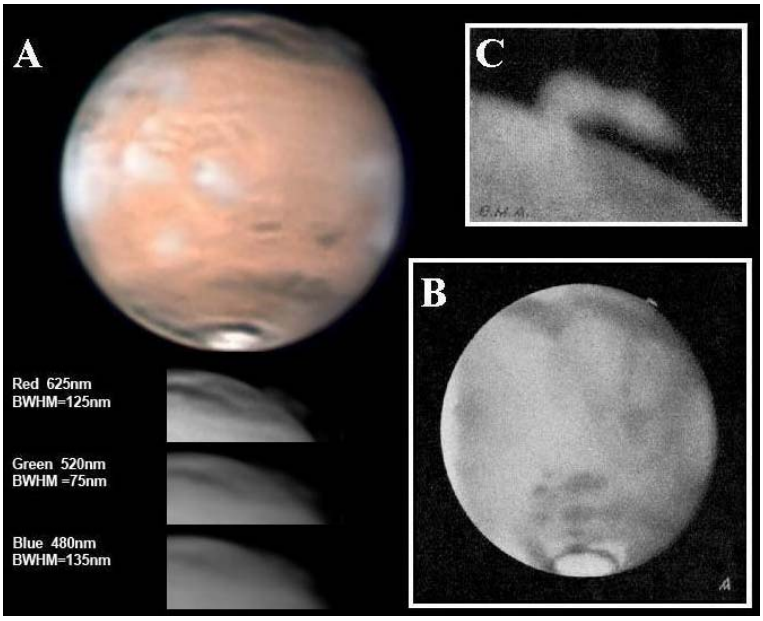

Figure 3. (A) 2012 Mar 21d, CML= 146°, RGB image with individual Astrodon filter images shown (03h 22m (R), 03h 23m (G) & 03h 25m (B)), 410mm SCT, *D. C. Parker (Miami, Florida, USA)*.
(B) 1933 Apr 14d, CML= 182°, drawing with 830mm OG, ×650, *E.–M. Antoniadi (Meudon Observatory, France)*.
(C) Enlarged portion of (B) (drawn at 19h 30m) to show the large terminator projection on the Sf. part of the disk.

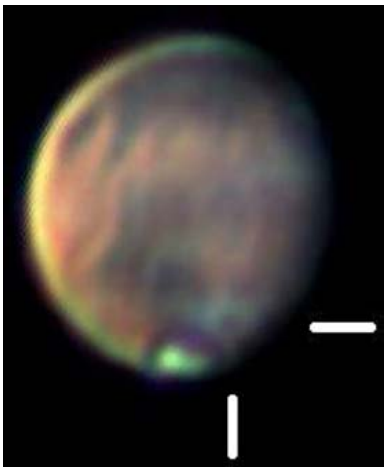

Figure 4. 2012 Jun 24d 08h 12m, CML= 41°, 406mm refl., RGB image, *T. Barry (Broken Hill, Australia)*. The morning cloud over *Baltia* – which shows up as a white ring – is indicated in this image taken at Ls= 129°. The same observer caught another such cloud on Jul 3. In 1995 BAA observers recorded these clouds from Ls= 127° onwards.