Mercury & Venus Section

Recent BAA studies of Mercury

Successful photography or imaging of Mercury has always been a difficult task. The amazing skill of Camille Flammarion's observer Ferdinand Quénisset in the early 20th century made him the first person to photograph actual albedo features on the planet using the 9¾-inch (248mm) refractor of the Juvisy Observatory near Paris.[1] This early result was not repeated until the 1930s at the Lowell Observatory,[2] and the first really good early photos were obtained at Pic du Midi from 1942 onwards by Bernard Lyot and his successors. Closely following the 1960s radar discovery of the 59-day rotation period, the first reliable Earth-based maps were drawn in the late 1960s by Henri Camichel, Audouin Dollfus and John Murray, and these cartographers were largely dependent upon the Pic du Midi and New Mexico datasets of photographs and drawings.[3–5] Even higher resolution has been achieved in recent decades by a group from Boston University using the Mt Wilson 60-inch reflector (though on one date only in 1998 August), whilst our own Section member Johann Warell achieved very high resolution through multi-filter imaging with the Swedish vacuum solar telescope on La Palma in the course of his professional research.[6,7]

Since 2000, BAA observers have contributed several hundred CCD and webcam images of the innermost planet to the Section. Early results were published by R. M. Steele[7] and the writer.[8] As NASA's *Messenger* spacecraft nears its first encounter with Mercury,[9] this seems the right time to illustrate what has been achieved in the last few years.

For the record, Table 1 provides a list of all those who have contributed observations of Mercury to the Section since its reformation in 1991. We are not publishing pre-1991 BAA work in this note, with two exceptions. Firstly, David Gray contributed high resolution observations at a number of morning elongations up till 1998,[10] and we have found it useful to include some of his earlier drawings here. Secondly, we take the chance to publish some work by the late Paul Doherty (a former BAA Mercury Coordinator) who also observed with a large telescope: his observations covered several evening elongations during 1976–'78 (Figure 1). (Doherty's earlier observations with a small instrument have not been reviewed: many of his beautiful drawings have appeared elsewhere.[11])

Figure 2 (which, like all the others, has south uppermost) presents a black and white collage of the best images of Mercury that have been submitted to the Section up to 2007 late November. In many cases the objectivity of the features was confirmed by multiple images taken during the same observing session, or by comparison with images on adjacent days. As the caption shows, the work of Chris Hooker (Wantage, Oxon.), Ed Lomeli (Sacramento, California, USA) and the late Erwin Van der Velden (Brisbane, Australia) was especially useful in this compilation, while high resolution was also achieved by others such as Bruce Kingsley (during a visit to Barbados). Figures 1 and 3, for comparison, are montages of drawings by Paul Doherty (Stoke on Trent, Staffs.) and David Gray (Kirk Merrington, Co. Durham). Other visual observers have also made superb series of drawings, above all Mario Frassati of Italy (who has published his own work[12]). Frassati's recently updated map (received a few weeks ago) covering all work up to 2006 is reproduced here as Figure 4. Doherty and Gray were two of the few observers who made useful ▸ *p.8*

Table 1. Contributors of BAA Mercury observations, 1991–2007

We exclude observers who provided only images of transits of Mercury or of its occultations by the Moon. Observers were UK-based unless otherwise stated.

Observers who provided drawings of Mercury, 1991–2007

G.–L. Adamoli (Italy), S. Beaumont, R. Braga (Italy), O. Cole–Arnal (Canada), D. Fisher, M. Frassati (Italy), M. A. Gélinas (Canada), M. Giuntoli (Italy), D. Gray, P. T. Grego, W. H. Haas (USA), A. W. Heath, C. Hernandez (USA), A. P. Johnson, L. T. Macdonald, G. Macleod, R. J. McKim, C. Meredith, R. W. Middleton, P. Milanese (Italy), D. Niechoy (Germany), I. S. Phelps, R. W. Schmude (USA), P. A. Smith, D. del Valle (Puerto Rico), J.–F.Viens (Canada).

Observers who provided photographs of Mercury, 1991–2007

R. Buggenthien (Germany), J. C. D. Marsh, R. W. Schmude (USA), A. Vincent.

Observers who provided CCD/webcam images of Mercury, 1999–2007

A. Allen (USA, *per* F. J. Melillo), D. L. Arditti, M. Brown, C. J. Hooker, T. Ikemura (Japan), B. A. Kingsley (UK and Barbados), W. Kivits (Netherlands), P. R. Lazzarotti (Italy), H.–G. Lindberg (Sweden), E. Lomeli (USA), F. J. Melillo (USA), C. Meredith, M. Morgan–Taylor, R. Nunes (Portugal), T. Olivetti (Thailand), D. A. Peach (Barbados), C. Pellier (France), J. Sussenbach (Netherlands), E. Van der Velden (Australia), S. Walker (USA), K. Yunoki (Japan).

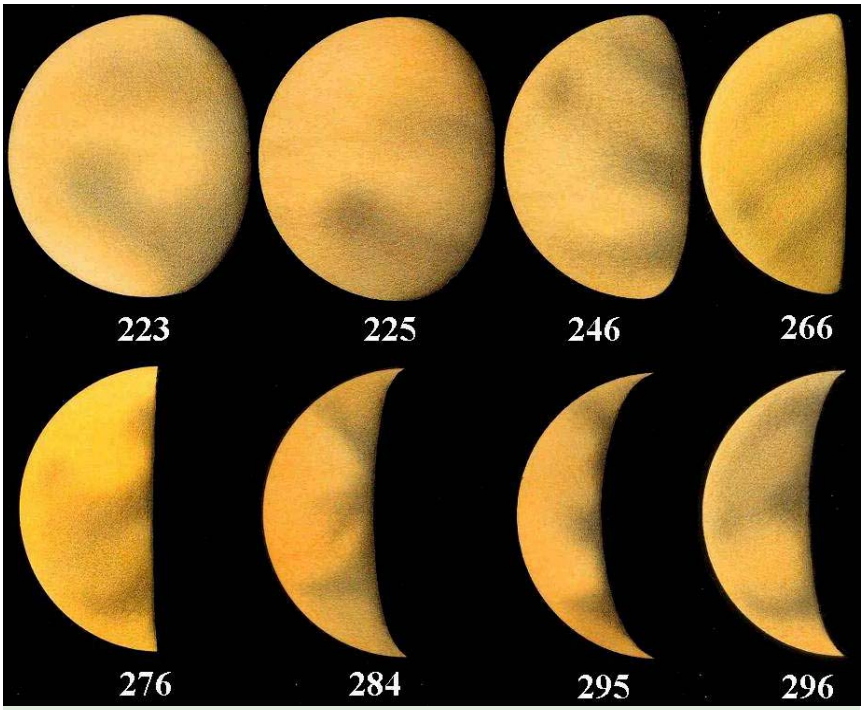

Figure 1. BAA Mercury drawings by Paul Doherty with 254mm refl., ×280, ×320 (1976) and 419mm refl., ×248, ×372 (1977–'78), in order of increasing CM longitude.

First row: CM 223: E 1978 Mar 12; 225: E 1977 Mar 28; 246: E 1977 Apr 2; 266: E 1976 Apr 22.

Second row: CM 276: E 1976 Apr 24; 284: E 1978 Mar 25; 295: E 1978 Mar 27; 296: E 1976 Apr 28.

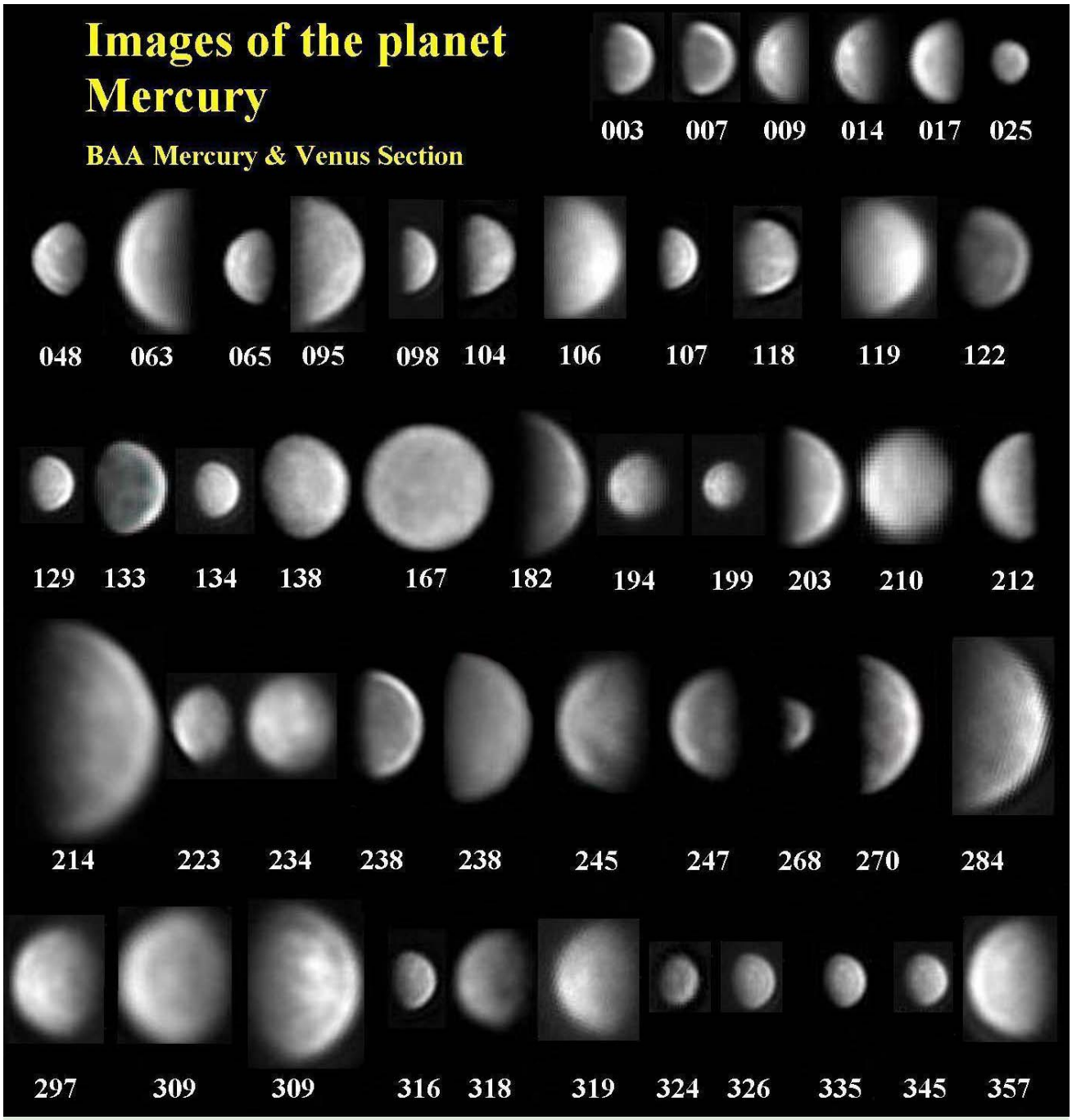

Figure 2. BAA Mercury CCD/webcam images by A. Allen (254mm refl.), C. J. Hooker (254mm refl.), B. A. Kingsley (279mm Schmidt–Cass.), W. Kivits (356mm Schmidt–Cass.), E. Lomeli (235mm Schmidt–Cass., except for CM 309° (A) taken with 102mm OG), F. J. Melillo (203mm and 254mm Schmidt–Cass.), M. Morgan–Taylor (203mm catadioptric), Z. Pujic (310mm refl.) and E. Van der Velden (203mm and 235mm Schmidt–Cass). South is uppermost in all Figures. The CM longitude is stated beneath each image. 'W' denotes a morning elongation and 'E' an evening one.

First row: CM 003: W 2003 Feb 11, Van der Velden; 007: W 2003 Feb 12, Van der Velden; 009: E 2007 Sep 25, Lomeli; 014: E 2007 Sep 26, Lomeli; 017: E 2006 Oct 12, Lomeli; 025: W 2006 Dec 16, Hooker.

Second row: CM 048: E 2007 May 15, Lomeli; 063: E 2006 Oct 21, Lomeli; 065: E 2007 May 18, Lomeli; 095: W 2005 Aug 26, Lomeli; 098: W 2006 Aug 11, Lomeli; 104: W 2005 Aug 28, Lomeli; 106: W 2006 Aug 13, Lomeli; 107: W 2006 Aug 13, Lomeli; 118: W 2005 Aug 31, Lomeli; 119: W 2007 Jul 31, Lomeli; 122: W 2007 Aug 1, Hooker.

Third row: CM 129: W 2006 Aug 18, Lomeli; 133: W 2006 Aug 19, Hooker; 134: W 2006 Aug 19, Lomeli; 138: W 2006 Aug 20, Lomeli; 167: W 2006 Aug 27, Kivits; 182: W 2005 Apr 24, Pujic; 194: E 2007 Jan 22, Lomeli; 199: E 2007 Jan 23, Lomeli; 203: W 2005 Apr 28, Van der Velden; 210: E 2006 Feb 10, Lomeli; 212: E 2002 Sep 5, Van der Velden.

Fourth row: CM 214: W 2006 Apr 15, Kingsley; 223: E 2006 Feb 13, Lomeli;234: E 2007 Aug 27, Lomeli; 238 (A): W 2005 May 5, Van der Velden; 238 (B): W 2005 May 5, Pujic; 245: E 2007 Feb 3, Morgan-Taylor; 247: E 2007 Feb 3, Hooker; 268: W 2002 Jun 29, Melillo; 270: W 2006 Nov 22, Allen; 284: W 2007 Nov 7, Lomeli. ▸ *next page*

drawings at large gibbous phase: most drawings of Mercury show little detail, and tend to favour the dichotomised disk or the smaller phases, and as such are rarely useful for mapping.

Figure 5 reproduces the standard albedo chart of the planet.[3] Readers are left to make their own comparisons between these illustrations. The BAA CCD images – excellent though they are – do not reveal any details not already recorded on the best ground-based drawings or photographs, so that they aid previous studies only by very marginally improving positional accuracy. Note that only half the planet, covering longitudes *circa* 20° through 190°, was imaged by *Mariner 10* during its three encounters in 1974–'75,[13] so the detailed appearance of the rest of the surface remains – until *Messenger's* programme commences very soon – unknown territory. It will be fascinating to see (for example) the whole of Mercury's most striking feature, the *Caloris* basin (centred at about +30°, 190°).

One image from Figure 2 was obtained by Ed Lomeli with an aperture of only 102mm, and clearly demonstrates (if proof were needed) that visual observers using similar instruments really could objectively record such markings in the past. For example, Henry McEwen, Director of the Section between 1895 and 1955, studied Mercury during a long lifetime with nothing larger than a 5-inch Wray refractor.[8,14] The white patches at the limb, understandably regarded as white clouds by Eugène Antoniadi[15] and others, are in reality related to groups of bright ray craters. Indeed, the suggestion that these patches might represent lunar-like rayed craters was (as far as I am aware) first made by McEwen in 1948.[16] Gerard Kuiper independently reiterated this view in 1970[17] immediately prior to the flight of *Mariner 10*. David Graham[18] and Frassati *et al.*[12] have further discussed these features of the planet in previous volumes of the *Journal*, whilst Davies *et al.*[19] neatly summarised the entire matter as follows: 'On Mercury, the albedo variations seem to be due to the brightness of the extensive ray systems, because the albedos of the large flooded basins do not differ greatly from those of the surrounding cratered terrain.'

In concluding, it will be apparent from Figure 2 that not all longitudes have been recorded with equal success by our members, and I will be glad to continue to receive further good images for the satisfaction of improving our ground-based record of this most elusive little world.

Richard McKim, *Director*

Figure 2, continued from previous page

Fifth row: CM 297: E 2007 Sep 10, Lomeli; 309 (A): E 2006 Sep 28, Lomeli; 309 (B): W 2007 Nov 14, Lomeli; 316: W 2006 Dec 1, Lomeli; 318: E 2007 Sep 15, Hooker; 319: E 2007 Sep 15, Lomeli; 324: W 2006 Dec 3, Melillo; 326: W 2006 Dec 3, Lomeli; 335: W 2006 Dec 5, Lomeli; 345: W 2006 Dec 7, Lomeli; 357: E 2006 Oct 8, Lomeli.

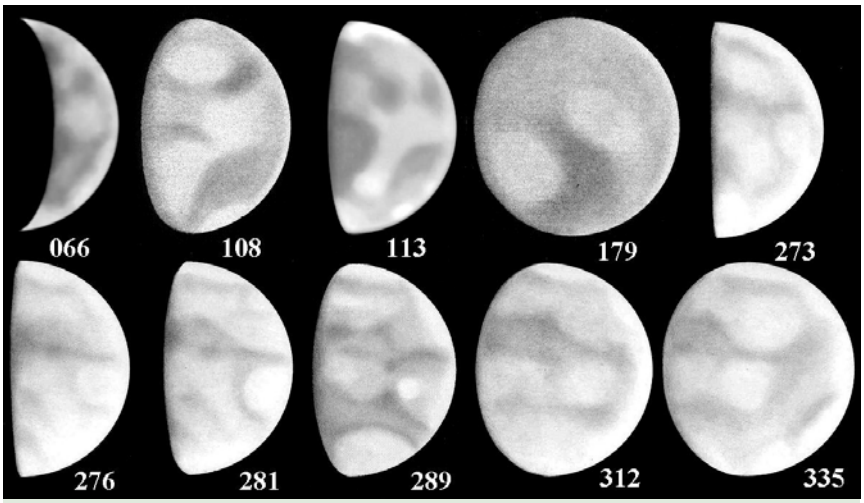

Figure 3. BAA Mercury drawings by David Gray with 415mm Dall–Kirkham Cass., ×248–415, arranged in order of increasing CM longitude. Gray often employed an apodising screen and/or a W22 orange filter (and sometimes others) to enhance contrast. Seeing good throughout except for CM 179° (fair).

First row: CM 066: W 1998 Dec 11; 108: W 1988 Oct 29; 113: W 1998 Dec 19; 179: W 1988 Nov 13; 273: W 1995 Oct 20.

Second row: CM 276: W 1996 Oct 4; 281: W 1996 Oct 5; 289: W 1997 Sep 21; 312: W 1995 Oct 28; 335: W 1995 Nov 2.

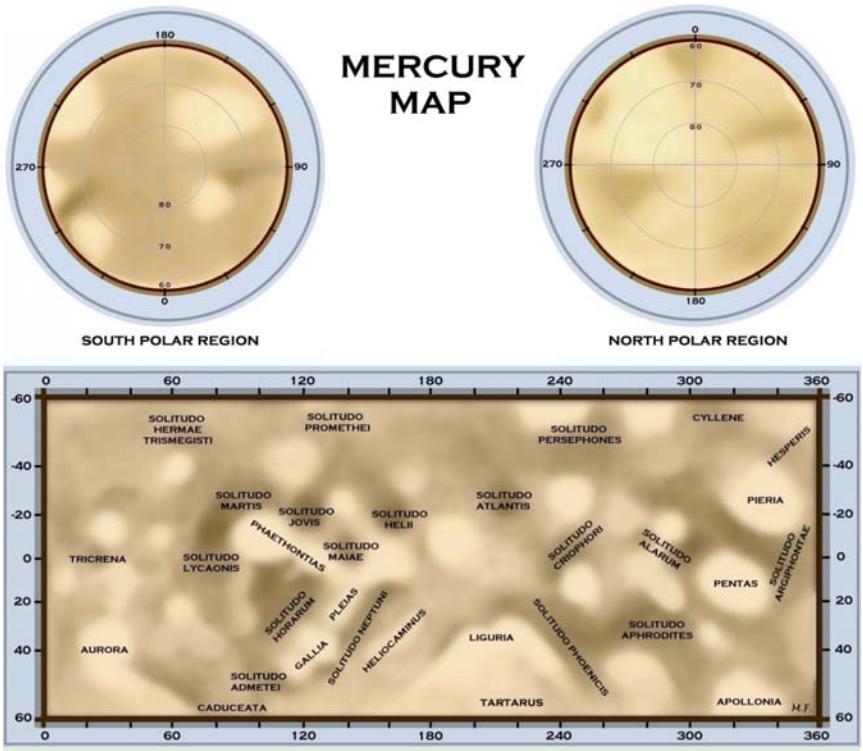

Figure 4. Chart of Mercury by Mario Frassati (Crescentino, Italy) from personal observations (203mm Schmidt–Cass). The chart covers the years 1997 to 2006.

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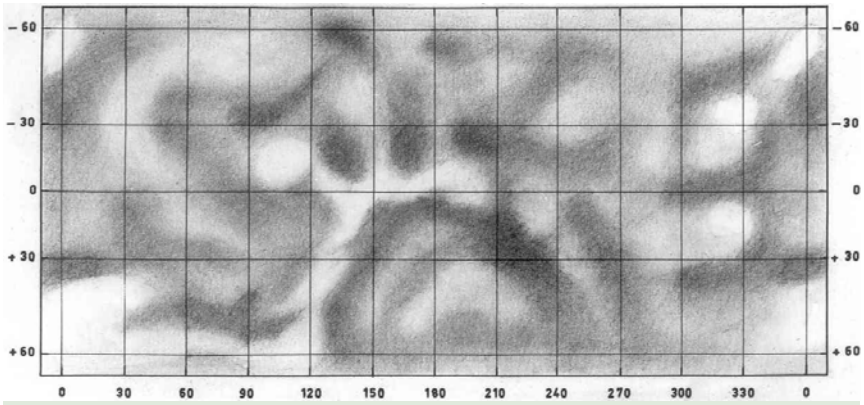


Figure 5. The standard albedo map of Mercury, compiled from ground-based photographs and drawings, after Camichel & Dollfus, 1968.[3]

Jupiter Section

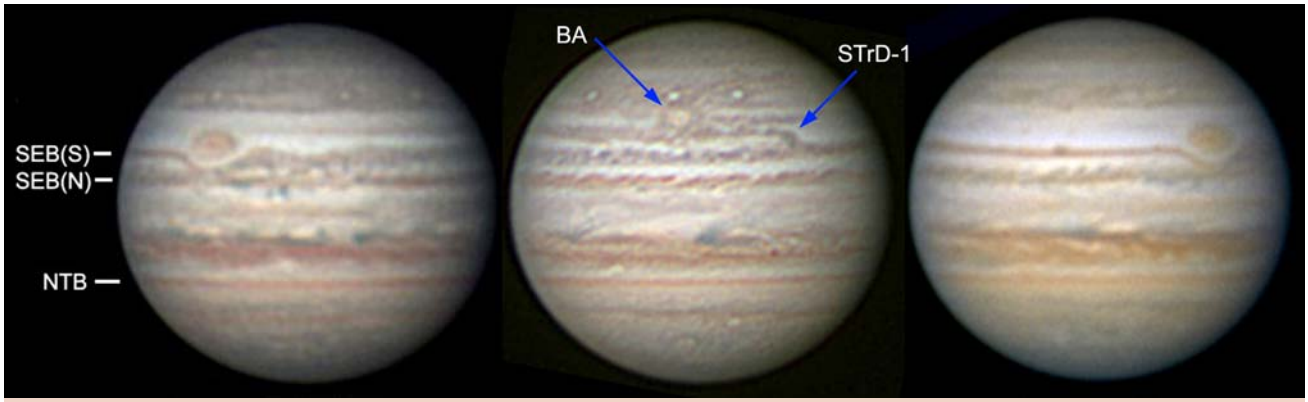
Progress of Jupiter's global upheaval

Jupiter's planet-wide changes were still continuing as the 2007 apparition drew to a close. In September and October, the events that had been so remarkable in earlier months were winding down. The North Temperate Belt, newly revived, had a strong orange colour all around the planet. The revival of the South Equatorial Belt was also approaching completion, both north and south components being dark at all longitudes. There was still turbulence in the belt following the Great Red Spot, but on a small scale; the GRS was still a conspicuous orange oval.

The South Tropical Disturbances (STrDs) persisted, and the retrograding dark spots on SEB(S) continued to recirculate at STrD-1. These spots also still tended to merge, so by the end of August, 16 of the 17 spots produced on SEB(S) had recirculated and merged to form just two dark spots in the prograding current. But these spots broke up again within a few days, and subsequent SEB(S) retrograding spots were smaller and less distinct, so that it was not possible to track them thoroughly in September, although the Circulating Current may have still been operating. By this time a massive dark STB had formed preceding STrD-1.

The Equatorial Zone had been exceptionally dark in the first half of the year, but this grey and brown shading was fading gradually from July onwards. Thus the planet was gradually returning to a more normal appearance.

John H. Rogers, *Director*



Images showing the state of the planet in 2007 September.

Left: Sep.18, 09:18 UT, CM1=72, CM2=155, CM3=68; Kenkichi Yunoki (Japan), by courtesy of the ALPO-Japan web site; includes the GRS and the source region of the SEB Revival.

Middle: Sep.23, 21:33 UT, CM1=228, CM2=269, CM3=183; Fabio Carvalho (Brazil); includes oval BA and STrD-1.

Right: Sep.23, 10:41 UT, CM1=33, CM2=86, CM3=358; Stefan Buda (Australia); GRS at right.