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On the Mars Observation Scheme Employed at Fukui in 2007/2008

Masatsugu MINAMI* and Takashi NAKAJIMA**

(Abstract) We here show a list of our Mars observations in the 2007/2008 Mars apparition. All observations were carried out at the Fukui City Observatory which belonged to the Fukui City Museum of Natural History. In the first half, we express our method or scheme of Mars observations which we have learned from our 60 years of experience and which we believe the best. The observations could be performed alone, but it may be the best if we could work in pairs. The observations in 2007/2008 were performed and listed in conformity with the scheme.

1. Introductory Notes

Observatory: The present article shall deal with our activity concerning the Mars observations in 2007/2008 performed at the Observatory of the Fukui City Museum of Natural History (which is located on top of a hill which commands a fine view of the Fukui City). This is an observatory (founded in 1952) where we traditionally have chased the planet Mars for more than 60 years. This observatory was renewed in 1985, and at present it is equipped with an *F*12 20cm refractor. We have been a pair since 1954 when we were just 15 years old. Who are we? We are here composed of Masatsugu MINAMI and Takashi NAKAJIMA, both have been visual observers. We were originally members of the Mars Section of the *Oriental Astronomical Association* (OAA) and at present members of the *International Society of the Mars Observations* (ISMO). In what follows, MINAMI and NAKAJINA are cited as abbreviated as Mn and Nj respectively. When we were engaged in the 2007 Mars apparition we both were 68 years of age, and at present we are writing this article, both of us are 78 years old.

Rotation of the planet Mars: First of all, let us recall how we could observe the markings on the surface of the rotating planet Mars. It has been known that the planet rotates about 14.6° per hour ever since the time of Christiaan HUYGENS (1629~1695), due to the presence of a dark marking called later Syrtis Major (Syrtis Mj). Is this rotation slow or rapid? From the view point of watching, it is rather rapid, and it is not good to take more than 20 minutes to watch because the markings steadily advance towards the east. So in our visual case we just spend 20 minutes for one observation (we spend the first half for watching and the latter half for drawing): If we started the observation at 23:50 JST and ended at 24:10 JST (from 14:50 to 15:10 GMT) for example, we shall regard the observation time as 00:00 JST (15:00 GMT). On the other hand, we should say the rotation is slow because it advances only 350° per day. It is known that the planet Mars rotates around its rotation axis every 24 hours plus about 40 minutes (more precisely, about 39 minutes and about 35 seconds). Note that this defines a solar day on Mars (not the sidereal day) and that the Martian solar day is just different from the Earth's period only by about 40 minutes. This residual period of 40 minutes plays a miraculous role and brings us somewhat pertinent opportunity as shown below.

Anyway the above readily makes us aware that it is impossible to watch the whole Martian surface within a single night since any inhabitant of the Earth cannot see the planet Mars in the daytime. Thus the 12 hours bright half of a day must be excluded. Furthermore, when the planet Mars stays near the horizon (morning or evening), it is not suitable for us to observe, and hence even if given the best conditions, the time interval when the observations are possible will be no longer than *eight* hours a day. Even if the opposition time is available, the hemisphere where the bright Mars

*3-6-74 Midori-ga-Oka, Mikuni, Sakai City, Fukui Prefecture, 913-0048, Japan
**1-407 Wakasugi-Hama, Fukui City, Fukui Prefecture, 918-8056, Japan

stays would go away from the western horizon after the night eight hours. That is to say, the bright Martian surface is to be chased then by the observers in Europe. Similarly, when we Japanese observers caught the bright Martian hemisphere, it implies the hemisphere must have just been lost in the American continents. In other words, to fully survey the whole Martian surface on a day we must pursue the planet Mars from at least three regions on the Earth separated each other by 120 degrees. We thus insist firstly that an international network of the Mars observers is quite necessary. Secondly it is important for us to play a responsible role to fully pursue even the part of surface from our partial side within the eight hours limit.

Meteorology of Mars: The Martian markings look quite stable since several global Martian maps have been made. However the Martian surface should have also been regarded as mutable. The Martian world could be liable to some unpredictable changes. As widely known, the white clouds or mists or white hazes have been active near the morning or evening limb or terminator or at the arctic or antarctic area, depending on the seasonal atmospheric capacities (due to the presence of the water vapour). These give a light and shade gradation to the markings on Mars.

Here we should recall another case which may be said much more important and much more interesting: The dark markings sometimes could be covered by dusty matters so that the markings turn to look different than the usual. If a dusty or sandy matter has a chance to be associated with a morning decisive updraft, the so-called dust storm occurs. Perhaps the dust storm observed in 1956 was a typical one and since then the dust storm has become a primary subject of interest. Really the dust storm, though quite infrequent, has then been regarded as a conspicuous atmospheric phenomenon which attracts us and at the same time works important for the Martian meteorology. We recall really that we both (Mn and Nj) watched the 1956 dust storms at the Fukui City Observatory, but unfortunately at that time we did *not* know utterly any effective and appropriate method how to treat and chase the dusty activities as a matter of meteorological importance.

Before stating our contemporary method or framework of the Mars observations, we would like to give a general commentary about the dust occurrences or disturbances based on our 60 years of experience. The dust storm usually starts when a rudimental ascending (quite low pressure) air mass blows up explosively to grow a dust tornado if a cold night air mass has happened to be seriously and abruptly warmed up, as soon as the area near the terminator begins to be subject to intense of the morning Sun. In the daytime, the dust will be explicit while it can be said rather stable, and macroscopically motionless. The dust disturbance will then rotate to the eastern side and then hide away to the rear, cool night side, to calm itself down. However if the disturbance has a further moment of inertia, it will show up again on the next morning in the vicinity of the original place with a differently reformed form at the morning terminator. We should say it will then be very interesting to chase the dust variations on the following days. Refer also to Minami, 2009.

Every 40 Minutes Observations: To do the day-to-day observations, it is recommended to employ the "every-40-minutes" observation method. As suggested, if one "twenty minutes observation" has been made, it will be advisable to take a next observation 40 minutes later. More concretely, if the first observation is made at 21:00 LT (Local Time), then the second observation should be made 40 minutes later at 21:40 LT. Thirdly, the third observation should be made at 22:20 LT, and so on. Since the observation at 21:00 LT implies that the observer observed from 20:50 LT until 21:10 LT, and he begins his next observation at 21:30 LT, and hence he has to take a rest of twenty minutes from 21:10 until 21:30 LT. The next interval from 21:30 to 21:50 should thus be for the second observation (at 21:40 LT). The interval from 21:50 LT until 22:10 LT is for the second rest. The fourth observation at 23:00 LT is a middle of the interval from 22:50 LT till 23:10 LT which corresponds to the beginning of the fourth rest. In our case, we (Mn and Nj) work in pairs. Consequently, when one member finished his 20 minutes observation, the other should readily take the chair to observe for another 20 minutes. That is, when one is taking a rest for 20

minutes, the other observes for 20 minutes. The rule of "every 40 minutes observations" implies that the observers draw the surfaces continually each different by 10° (because of the 40 minutes separation). Let us assume that the Longitude of the Central Meridian ω is 100°W (which we denote as ω=100°W where 100°W implies that the longitude is 100° separated westwards from the Martian Prime Meridian).

Here we shall put an advisable rule for the observer to observe on the following days at the same "observation times". As aforementioned, the Martian rotation on the other hand, shows every day a retardation of about 40 minutes, and so the distributions of ω for the first day and the second day prove as follows:

T, T+40m, T+80m, T+120m, ...
1st day: ω=100°W, 110°W, 120°W, 130°W, ...
2nd day: ω=090°W, 100°W, 110°W, 120°W, ...
3rd day: ω=080°W, 090°W, 100°W, 110°W, ...

It is now apparent that the third observation of the 3rd day also gives the same value of ω on 2nd day and 3rd day. Thus we can consent to the superiority of the "every 40 minutes" watching as "day-to-day" observations: It should be recalled here that we can thus secure a series of drawings at the same ω at least for a week if the other conditions were met. (Note: However, both 40 minutes used are a bit approximate (and irrational), and hence we sometimes need to make a minor adjustment.)

As a successful trial of the 40 minutes method was given by Yukio MORITA in 2001. He chased the same ω from 1 July to 4 July 2001, showing clearly a day-to-day developing of the global 2001 dust storm (which was first discovered on 24 June 2001 at the Fukui City Observatory). See Fig. 4 in MINAMI and NAKAJIMA, 2008. Also refer to the case in 2003 performed by Mn in Nakajima and Minami, 2011 (Plate IV at page 10).

The 2007/2008 Mars Apparition: The following descriptions shall be a record of our activities based on the "every 40 minutes" chasing the 2007/2008 Mars Apparition at Fukui. We thus take a style different from the usual presentation (we shall mostly remove a detailed Observing Notes), but we believe this scheme of the time schedule will be a good reference to the forthcoming generation.

In the 2007/2008 Mars apparition, the planet Mars was closest to the Earth on 18 December 2007, and the maximal angular diameter δ was no larger than 15.88". The opposition occurred one week later on 24 December 2007, and the apparent declination $\mathcal{D}$ was +26°46' which implied that the planet shined quite northerly higher. Usually if the planet shines higher, the seeing condition is expected excellent, but the instrument we use is a refractor and we don't use any prism and hence we were forced to skip a time zone (then we took a rest).

We shall now start to describe a detail of our observation programme performed in 2007/2008 (as given due warning, we shall however mostly remove the Observing Notes). Our first observation was made on 20 January 2007 at around 22:00 GMT (07:00 JST). At that time, the apparent diameter δ of Mars was just 4.1", and the Martian season was λ=170°Ls. Here λ denotes the Martian season described by the *Areocentric longitude of the Sun* (Ls). That is, we employ the value of Ls to denote the Martian season: λ=000°Ls corresponds to the northern spring equinox, and λ=180°Ls does to the northern autumnal equinox and so on. At 22:00 GMT, it was just before the sunrise in Japan and the Martian surface showed us the hemisphere with the central meridian at ω=206°W.

In January and February 2007 only a few observations were performed because of the morning poor conditions (tiny diameters and dismal weather). And even in March and April 2007, we had not so preferable conditions enough to continue the routine observations. Even at the end of May 2007, Nj and Mn obtained no more than a total of 13 drawings and 40 drawings respectively. We so would like to begin describing the detailed record from the beginning of June 2007. In May, however we began to meet some details of the surfaces: For example, on 11 May 2007 (λ=236°Ls, δ was 5.4"), Mare Sirenum and Mare Cimmerium were caught dark, and on 15 May (λ=238°Ls, δ=5.5"), the dark fringe of the south polar cap (abbreviated as the spc in the following) was visible, and Solis Lacus was dark witnessed (at ω=119°W). At the end of May, Sinus Sabæus was clearly seen (the tilt was ϕ=25°S). Since the opposition occurred at the end of 2007,

our observations continued up until the 2008 summer: During the period, the terrestrial season (on the northern hemisphere) moved from winter →spring→summer→fall→winter→spring→summer. Thus the observation season would continue until the end of July. During the period from 20 January 2007 until 13 July 2008, Mn secured a total of 451 drawings, and Nj did a total of 289 drawings.

2. Observations Made Until the Closest Month (December 2007)

We shall then set forwards a detailed record of the routine observations to show the scheme in 2007/2008 from the beginning of June 2007.

June 2007: On 2 June (λ=250°Ls, δ=5.8"), Mn and Nj alternately observed twice each at ω=289°W (Mn), ω=293°W (Nj), ω=298°W (Mn), ω=303°W (Nj). On 4 June (λ=251°Ls, δ=5.8"), Mn observed from 18:40 GMT (03:40 JST) and watched alone at ω=264°W (18:40 GMT), ω=274°W and ended at ω=283°W (20:00 GMT=05:00 JST). Syrtis Major was definite and came to the central meridian. The spc was whitish bright shown up at ω=274°W in a clear good shape. Hellas was dull. On 6 June (λ=252°Ls, δ=5.9"), Mn took two drawings at ω=251°W and ω=261°W. On 7 June (λ=253°Ls, δ=5.9"), Mn observed twice at ω=239°W and at ω=251°W (19:50 GMT). The Sun rose at 4:55 JST (19:55 GMT). The temperature was 21°C. On 11 June (λ=256°Ls, δ=6.0"), Mn took four drawings at ω=187°W, 197 °W, 207°W, 217°W (20:10 GMT). On 12 June (λ=256°Ls, δ=6.0"), Mn observed three times starting from ω=176°W (18:00 GMT) and ended at ω=195°W while Nj from ω=190°W and ended at ω=199°W (19:40 GMT). On 16 June (λ=259°Ls, δ=6.1"), Mn obtained four drawings from ω=136°W to ω=165°W every 40 minutes. On 19 June (λ=260°Ls, δ=6.1"), Mn secured three sketches from 18:00 GMT (ω=106°W) to 19:20 GMT. We got an urgent news from American side reporting on 24 June an occurrence of a dust cloud at Noachis at λ=264°Ls. For example, it was clearly proved on some images of David MOORE at Texas: See Minami and Murakami 2007a. On 27 June (λ=266°Ls, δ=6.3"), Mn obtained three sketches at ω=018°W, 027°W, 037°W. Towards the end of June the shrunk spc became quite clearer (now ϕ=19°S). They said that on 21 June the rainy season began at the Fukui District. On 30 June (λ=268°Ls, δ=6.3"), Mn and Nj started at 19:40 GMT and at 20:00 GMT respectively, and both obtained drawings at ω=022°W (Mn), 027°W (Nj), 032°W (Mn), and at 037°W (Nj). In June 2007, Mn and Nj thus obtained a total of 28 drawings and a total of 9 drawings respectively.

July 2007: On 3 July (λ=270°Ls, δ=6.4"), Mn made a single drawing at 18:20 GMT (ω=333°W). On 6 July (λ=271°Ls, δ=6.5"), Mn obtained three drawings at ω=301°W, 311°W, 321°W. On 7 July (λ=272°Ls, δ=6.5"), Mn and Nj took three drawings at ω=289°W (Mn), ω=294°W (Nj), ω=299°W (Mn). On 8 July (λ=272°Ls, δ=6.5"), Mn obtained four drawings at ω=282°W, 291°W, 301°W, 311°W (20:10 GMT twilight): Mare Serpentis looked dark. On 19 July (λ=280°Ls, δ=6.8"), Mn observed four times at ω=157°W, 167°W, 177°W, 187°W. On 23 July (ω=282°W, δ=6.9"), Mn observed at ω=118°W, 128°W, 138°W and Nj did at ω=123°W, ω=133°W, ω=143°W, both performed the observations every 40 minutes. Since ι=43°, Olympus Mons appeared as a dark spot: Even at ω=138°W it was dark. The area around the southern pole was whitish bright. On 27 July (λ=285°Ls, δ=7.0"), Mn observed four times at ω=079°W, ω=089°W, ω=099°W, ω=118°W every 40 minutes. On 31 July (λ=287°Ls, δ=7.1"), Mn observed 6 times from ω=040°W to ω=089°W every 40 minutes, and Nj did five times from ω=055°W to ω=094°W: Olympus Mons was faintly visible near the morning limb. In July 2007, thus Mn and Nj obtained a total of 26 drawings and Nj did a total of 9 drawings respectively.

August 2007: The angular diameter exceeded 7". On 1 August (λ=288°Ls, δ=7.1"), Mn observed four times from ω=041°W (17:40GMT) to ω=080°W. On 5 August (λ=290°Ls, δ=7.2"), Nj obtained three drawings from ω=007°W to ω=026°W. On 7 August (λ=291°Ls, δ=7.3"), Nj observed four times from ω=338°W to ω=017°W. On 8 August (λ=292°Ls, δ=7.3"), Mn, after the

observations at ω=313°W, 323°W, Nj joined Mn from ω=328°W, and we both (Mn and Nj) alternately observed every 20 minutes until ω=007°W (Nj) and ω=011°W (Mn), and thus we secured a total of 12 drawings a night. The sph was definite with a core and Hellas was light near the terminator. Syrtis Major was recognised. On 9 August (λ=293°Ls, δ=7.4"), Mn observed 8 times every 40 minutes from ω=303°W to ω=012°W, and Nj similarly did 6 times from ω=318°W to ω=007°W. We saw sunrise. On 10 August (λ=293°Ls, δ=7.4"), Mn observed six times from ω=293°W to ω=342°W and Nj did 5 times from ω=308°W to ω=347°W every 40 minutes. Syrtis Major was watched passing through the meridian. As well, Mare Serpentis and Sinus Sabæus were vaguely checked. On 11 August (λ=294°Ls, δ=7.4"), Mn started to observe from ω=284°W (16:20 GMT) to ω=333°W to obtain six drawings and Nj did 4 times from ω=299°W (17:20 GMT) to ω=328°W. On 12 August (λ=294°Ls, δ=7.4"), the seeing condition was poor, though Mn observed three times from ω=284°W to ω=323°W, and Nj did twice at ω=308°W and ω=318°W. On 13 August (λ=295°Ls, δ=7.5"), Mn obtained 7 drawings from ω=265°W to ω=323°W, and Nj did 5 drawings from ω=279°W to ω=318°W. Among these drawings on 13 August, we can find the drawings of the surfaces at the same angles as on 11 August, that is, the sketches at ω=304°W (Mn), ω=308°W (Nj) were repeated to be compared between 11 August and 13 August. The northwestern corner of Hellas looked lighter (λ=295°Ls). On 14 August (λ=296°Ls, δ=7.5"), Syrtis Major was quite definite and Nj obtained four drawings during ω=289°W (18:40 GMT) ~ ω=318°W (20:40GMT), and Mn did 7 drawings during ω=255°W (16:20 GMT) ~ ω=313°W (20:20 GMT), all being made employing the every 40-minutes-method of observations. However to chase the expansion of the dust at Noachis the diameter was not large enough. Refer to Minami and Murakami, 2007b. On 15 August (λ=296°Ls, δ=7.5"), Mn secured 7 drawings from ω=245°W to ω=304°W. In effect, we can find a series of the same ω among the work made from 11 August to 15 August. The same angles were sketched continuously through five days! On 18 August (λ=298°Ls, δ=7.7"), Mn observed from ω=216°W to ω=276°W (however no drawing at ω=266°W) and Nj from ω=231°W to ω=280°W (however no drawing at ω=260°W), and thus we obtained a total of 11 observations on the day. On 19 August (λ=299°Ls, δ=7.7"), Mn observed four times from ω=207°W to ω=236°W and Nj did three times from ω=221°W to ω=241°W. Outside, the temperature was 28.5°C. On 23 August (λ=301°Ls, δ=7.8"), Nj alone observed three times from ω=193°W to ω=222°W. On 25 August (λ=302°Ls, δ=7.9"), Mn observed continually 7 times from ω=139°W (15:40 GMT) to ω=197°W (19:40 GMT), and further did three times from ω=183°W (18:40 GMT) to ω=202°W (20:00 GMT). On 26 August (λ=302°Ls, δ=7.9"), Nj alone observed 6 times from ω=154°W (17:20 GMT) to ω=203°W (20:40 GMT). On the other hand Mn was not able to observe until 12 September because Mn was confined in hospital because his right leg was hurt badly (due to disk herniation).

September 2007: On 4 September (λ=308°Ls, δ=8.3"), Nj alone observed six times from ω=067°W to ω=116°W. On 12 September (λ=313°Ls, δ=8.7"), Mn left the hospital and came back to the Observatory to observe 7 times from ω=328°W (15:50 GMT) to ω=027°W, and Nj did three times from ω=002°W (18:10 GMT) to ω=022°W. On 14 September (λ=314°Ls, δ=8.8"), Nj alone observed four times from ω=334°W to ω=013°W. As well, on 15 September (λ=314°Ls, δ=8.8"), Nj observed alone four times from ω=314°W to ω=353°W. On 18 September (λ=316°Ls, δ=9.0"), Mn alone observed 6 times from ω=264°W to ω=312°W. Mn also observed 8 times on 19 September (λ=317°Ls, δ=9.0") from ω=254°W to ω=327°W. For instance, the observations at ω=293°W were accomplished twice by Mn on both days (on 18 and 19 September). On 22 September (λ=318°Ls, δ=9.2"), Nj observed once at ω=205°W. On 25 September (λ=320°Ls, δ=9.4"), Mn alone took a total of 8 sketches from ω=194°W to ω=262°W. On the day the morning Syrtis Major appeared slim sharply near the morning limb at ω=233°W which however was not apparent due to the morning mist over Syrtis Major at ω=224°W (17:10 GMT).

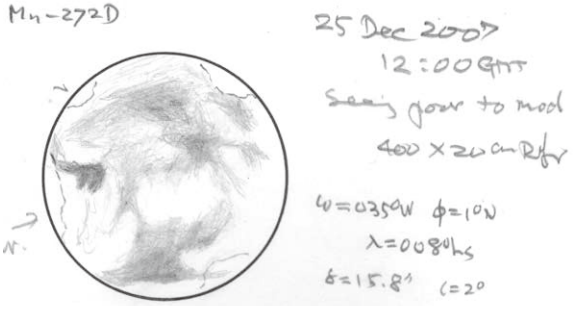
On 26 September (λ=321°Ls, δ=9.4"), (with the full Moon. Not windy, 22°C, used 600×), Mn followed the same chain of the central meridians and obtained also 8 drawings from ω=185°W to ω=253°W. On the day the image at ω=224°W (17:50 GMT) showed a slim and long Syrtis Major near the morning limb. At ω=253°W Syrtis Major showed up definitely. We were thus led to the conclusion that the dust storm started at Noachis in June at λ=264°Ls and had passed its half-life period at the end of September at around λ=320°Ls. Refer to Minami and Murakami, 2007c.

October 2007: On 5 October (λ=325°Ls, δ=10.0"), Nj started at ω=104°W (15:30 GMT) and ended at ω=163°W (observed 7 times until 19:30GMT). On 6 October (λ=326°Ls, δ=10.1"), Nj observed 7 times from ω=114°W (16:50 GMT) to ω=173°W (20:50GMT). On the day Mn observed 6 times from ω=090°W (15:10 GMT) until ω=138°W (18:30 GMT). On 10 October (λ=329°Ls, δ=10.3"), Nj observed four times from ω=086°W to ω=115°W. And on 15 October (λ=331°Ls, δ=10.7"), Nj made 6 drawings from ω=020°W to ω=068°W. On 23 October (λ=336°Ls, δ=11.4"), Mn observed 9 times from ω=280°W to ω=003°W. At ω=319°W, Hellas near at the evening terminator was purely white as bright as the core of the spc. Æeria-Arabia was reddish. On 24 October (λ=336°Ls, δ=11.5"), Nj observed 7 times from ω=305°W to ω=004°W. On 30 October (λ=339°Ls, δ=12.0"), Mn observed 9 times from ω=219°W (14:50 GMT) to ω=298°W (20:10 GMT). During the span, Syrtis Mj came up from near the morning limb and reached the central meridian. Hellas at the meridian was moderately light (quite less bright than the South Polar Hood). Valhalla was seen to the north of M Sirenum (ι=37°). At 15:40, Comet Holmes was caught. In October 2007, Nj obtained a total of 30 drawings while Mn 24 drawings.

November 2007: The first observation in November 2007 was made on 7 November (λ=344°Ls, δ=12.8") when Nj and Mn alternately replaced and each observed every 20 minutes from ω=136°W (14:10GMT, Mn) to ω=180°W (17:10 GMT, Nj) and secured 10 drawings. In the first half, some dark spots of Olympus and Ascræus Montes came into our eyes, and then Propontis I was darkly caught related with Cerberus. φ=7°N. On 13 November (λ=347°Ls, δ=13.4"), Mn alone observed for 20 minutes 5 times every 40 minutes from ω=105°W to ω=144°W. Solis Lacus was faintly seen. The colour of the deserts is not distinct, just looked white-yellowish due to a weak dust covering. *On 14 and 15 Nov, the Object Glass was cleaned and the optical axis was adjusted by the makers (GOTOs).* On 16 November (λ=348°Ls, δ=13.7"), Nj and Mn alternately observed every 20 minutes 10 times from ω=046°W (Mn) to ω=090°W(Nj). Auroræ S was conspicuous and Ophir light. The North Polar Hood was largely bounded by a dark fringe. Nilokeras complex remained with a tint of dark brown. On 23 November (λ=352°Ls, δ=14.3"), Mn drew 6 times every 40 minutes from ω=325°W to ω=014°W. Mare Acidalium and Nilokeras were dark brownish, the boundary of the North Polar Hood was dark from the angles where Sinus Sabæus was visible. On 29 November (λ=355°Ls, δ=15.0"), Nj and Mn observed 12 times alternately every twenty minutes continuously from ω=269°W (Nj) to ω=323°W (Mn). The North Polar Hood was large with a dark fringe, the part near the morning limb being bright. Syrtis Major passed the meridian, and Hellas came to the afternoon side with a roundish aspect, but dull though a bit light.

December 2007: At long last, the month came when the planet Mars was closest to the Earth. But at this district of Fukui the weather is usually dismal in December. On 7 December (λ=359°Ls, δ=15.6"), Mn was clouded after the observations at ω=213°W and 222°W. Elysium was near the meridian. The Ætheria patch was dark. The season was important since it was around the northern vernal equinox. On 16 December (λ=004°Ls, δ=15.9"), Mn watched and sketched the Martian disk of δ=15.9" near the maximal angular diameter at ω=109°W,119°W, 128°W, 138°W; Mn thus observed four times every 40 minutes. In the latter part, Mn saw the trailing of the white mist over the Tharsis region. On 19 December (λ=005°Ls, δ=15.9"), that is, on the day following the "closest" day (18 December), Nj started at ω=090°W, and

subsequently Nj and Mn repeated alternately every 20 minutes, and finally Mn closed the session at ω=161°W (17:00 GMT). On the night Nj and Mn sketched 8 times in all. At ω=151°W Olympus Mons was evident as a light speck (since ι=5°, it was because of the reflected light). The North Polar Cap was largely bright. On 20 December (λ=006°Ls, δ=15.9"), we observed four times at ω=056°W (Mn), ω=059°W(Nj), ω=093°W(Mn), and at ω=098°W (Nj). On 21 December (λ=006°Ls, δ=15.9"), the transparency was very poor, and so Mn observed just once at ω=075°W. On 24 December (λ=008°Ls, δ=15.8"), each of Mn and Nj observed twice every 40 minutes at ω=105°W (Mn), ω=110°W (Nj), ω=114°Ls (Mn), ω=119°W (Nj). On 25 December (λ=008°Ls, δ=15.8"), Nj observed four times every 40 minutes from ω=030°W (11:40 GMT) to ω=059°W (13:40 GMT), and then took a rest for about two hours because the planet shined too high up to peek upwards, and then restarted the observations from ω=101°W (16:30 GMT) and finished at ω=140°W (19:10 GMT), and thus obtained a total of nine sketches. Similarly, Mn started from ω=035°W (12:00 GMT) and continued four times every 40 minutes until ω=064°W (14:00GMT), and then Mn similarly took some rest for two hours, and then restarted from ω=096°W (16:10 GMT), and after taking five drawings every 40 minutes, then ended at ω=135°W (18:50 GMT). Both observers thus secured a total of 18 drawings a night of 25 December. The seeing condition on the night was preferable. At ω=035°W, Sinus Meridiani near the evening limb (at opposition on 24 December) was darkly evident with Aryn's Nails, and Mare Acidalium and Nilokeras nicely appeared. Auroræ Sinus was also independently definite. Refer to the Figure below. Around ω=054°W, Solis Lacus was seen dark as it moved to the eastern hemisphere. At



ω=096°W, together with Solis Lacus, Phasis was sharply evident. Nj thought even around ω=120°W that the seeing condition was durable. We should say however the fact that the planet shined near the zenith was frustratingly unfortunate. On 26 December (λ=009°Ls, δ=15.7"), Mn observed alone seven times each every 40 minutes from ω=357°W to ω=055°W. On 27 Dec (λ=009°Ls, δ=15.7"), Mn observed at ω=044°W, 054°W, 064°W, 086°W, and Nj at ω=049°W, 059°W, 071°W and thus totally 7 drawings were secured from ω=044°W to ω=071°W.

3. Observations In and After January 2008

January 2008: The New Year observation of Mars was suspended until 4 January (λ=013°Ls, δ=15.2"). Mars' culmination altitude was still very high with the apparent declination 𝒟=26°58'N. Outside of the dome was recording 3°C. On the day Mn observed four times at ω=283°W, 305°W, 314°W and at 324°W. At around ω=238°W, Syrtis Major faced towards us, and Hellas was misty whitish and the npc was whitish bright. At around ω=305°W, Æria looked pinkish light, and the Huygens crater was a bit seen, but at ω=314°W the crater was quite evident. Hellas looked roundish near the evening limb with an off-white colour. On 10 January (λ=015°Ls, δ=14.6"), Mn observed five times every 40 minutes from ω=234°W to ω=273°W. On 14 January (λ=018°Ls, δ=14.1"), Mn started from ω=206°W (11:10 GMT), and 40 minutes later observed at ω=216°W, and then Nj joined to observe at ω=221°W, and then Mn observed at 226°W. We then took a rest to avoid drawing since the planet was near the zenith. At 15:30 GMT, Nj restarted to observe from ω=270°W, and we continued to draw the surface at ω=274°W (Mn), ω=279°W (Nj), ω=284°W (Mn), ω=289°W (Nj), ω=294°W (Mn), and at ω=299°W (Nj); thus we took a total of 11 drawings. On 19 January (λ=020°Ls, δ=13.6"), under the outside temperature of -2°C, Mn and Nj started from ω=176°W and ω=181°W respectively, and after Mn's observation at ω=186°W, we took a rest. Mn and Nj restarted at ω=205°W and ω=210°W respectively and continued until ω=225°W and

ω=230°W respectively; thus observing a total of 9 drawings (every 20 minutes).

February 2008: In this month, the weather was generally dismal. The seeing condition remained poorer. On 1 February (λ=026°Ls, δ=12.0") (temperature was 1°C inside the dome, while -1°C outside), Mn observed four times from ω=085°W to ω=114°W. On 8 February (λ=029°Ls, δ=11.1"), Mn alone observed 8 times from ω=315°W to ω=044°W every 10 degrees. On 10 February (λ=030°Ls, δ=11.0"), Nj and Mn started at ω=340°W and ω=345°W respectively, and continued until ω=000°W and ω=005°W respectively to obtain six drawings, and after a rest, Nj and Mn finished the work at ω=019°W and ω=024°W respectively. On 21 February (λ=035°Ls, δ=9.8"), Mn obtained two drawings at ω=246°W and 255°W, Nj did twice at ω=251°W, 260°W. On 28 February (λ=038°Ls, δ=9.2"), Mn observed four times from ω=156°W to ω=185°W every 40 minutes.

March 2008: On 8 March (λ=042°Ls, δ=8.4"), Mn and Nj obtained five drawings each from ω=068°W to ω=106°W, and from ω=072°W to ω=111°W, respectively. On 10 March (λ=043°Ls, δ=8.3"), Mn and Nj obtained three drawings each: Mn at ω=045°W, 055°W, 065°W, and Nj at ω=050°W, 060°W, 070°W. On 12 March (λ=044°Ls, δ=8.2"), Mn obtained four pieces from ω=017°W to ω=045°W, and Nj did three pieces at ω=031°W, 041°W, 051°W. On 15 March (λ=045°Ls, δ=8.0"), Mn first watched Mars at ω=336°W (just before the dome was opened to the public to show them the planet Saturn), and after the open, restarted and watched at ω=025°W, 034°W, 044°W, and Nj did at ω=020°W, 030°W, 039°W and so we secured a total of seven drawings. On 17 March (λ=046°Ls, δ=7.8"), Mn obtained seven drawings every 10 degrees from ω=315°W to ω=013°W. At ω=315°W, before the dusk yet, the planet was already near the meridian. Near the evening limb Ausonia is lighter than Hellas. Syrtis Major was really dark. The North Polar Cap was whitish bright. Next at ω=325°W, the seeing condition improved and the inside boundary was clearer, and the area of Yaonis Fretum to Mare Serpentis was distinguished. At ω=344°W, Syrtis Major looked streaky shrouded in evening mist. On 21 March (λ=048°Ls, δ=7.6"), Mn observed six times from ω=286°W (09:50 GMT) to ω=335°W; During the interval Nj took two drawings at ω=301°W (10:50 GMT) and ω=311°W.

April 2008: On 1 April (λ=053°Ls, δ=7.0"), Mn obtained six drawings from ω=187°W to ω=235°W every 40 minutes. On 6 April (λ=055°Ls, δ=6.7") we observed as follows: at ω=127°W (Mn), 132°W (Nj), 137°W (Mn), 142°W (Nj), and at 146°W (Mn): The North Polar Cap was clear with ϕ=7°N. On 8 April (λ=056°Ls δ=6.6"), Mn observed 5 times from ω=115°W until ω=154°W every 40 minutes and Nj did 5 times, from ω=120°W to ω=159°W: We observed 10 times in all: The fringe of the North Polar Cap was seen dark. On 14 April (λ=059°Ls, δ=6.4"), Mn took two drawings at ω=055°W, and 065°W. On 15 April (λ=059°Ls, δ=6.3"), we both took a total of 8 drawings as follows :ω=046°W (Mn), 051°W (Nj), 055°W (Mn), 060°W (Nj), 065°W (Mn), 070°W (Nj), 075°W (Mn), and at 080°W (Nj) (15h GMT). Mare Acidalium was observed. Already the Eastern Quadrature was nearer. On 20 April (λ=061°Ls, δ=6.1"), we observed alternately every twenty minutes: at ω=355°W (Mn), 000°W (Nj), 005°W (Mn), 010°W (Nj), 015°W (Mn), 020°W (Nj), 025°W (Mn), and 030°W (Nj): The area from Sinus Sabæus to Mare Acidalium was seen. The sky was not clear because of the Yellow Sand from China. On 21 April (λ=062°Ls, δ=6.1"), Mn and Nj observed 8 times every 20 minutes from ω=346°W (Mn) to ω=020°W (Nj). At the last stage, Auroræ Sinus was darkened at the morning terminator and to its north a morning mist was whitish. On 22 April (λ=062°Ls, δ=6.0"), Mn observed five times every forty minutes from ω=336°W (09:30GMT) to ω=015°W. On the day the Sun set at 09:20 GMT and the Martian image came into the refractor at 09:05 GMT. The temperature was 17°C. On 25 April (λ=063°Ls, δ=6.0"), we observed four times as follows; ω=346°W (Mn), ω=351°W (Nj), ω=356°W (Mn), ω=001°W (Nj). On 26 April (λ=064°Ls, δ=5.9"), Nj watched once at ω=303°W. On 27 April (λ=064°Ls, δ=5.9"), Nj

alone observed four times at ω=293°W, 303°W, 313°W, 323°W: The fringe of the npc turned to be seen finely and clearly. On 28 April (λ=065°Ls, δ=5.9"), Mn and Nj alternately observed every twenty minutes from ω=276°W (Mn) and ended at ω=330°W (Nj), and thus we obtained a total of 12 drawings. Syrtis Major was definite near the meridian, while Hellas was dull, maybe a bit misty. On 29 April (λ=065°Ls, δ=5.8"), Mn observed four times from ω=267°W (Mn) to ω=296°W and then Nj observed the following degrees four times from ω=272°W to ω=301°W and then Nj left the Observatory, and Mn took over the observations at ω=306°W, 310°W, 315°W, and thus we made a total of 11 drawings (four by Nj, and seven by Mn). On 30 April (λ=066°Ls, δ=5.8), Nj observed 5 times from ω=262°W to ω=301°W, and Mn did 5 times from ω=267°W until ω=306°W. The check at ω=267°W was the subject of the preceding day's angles. Nj also observed on 29 and 30 April each twice at ω=272°W, ω=281°W. At around ω=272°W, 276°W, at the both sides of Syrtis Major there was seen a misty band belonging to the Equatorial Band Mist. Utopia was definite. The area of Hellas looked interesting, but difficult to see the details since ϕ=12°N.

May 2008: On 3 May (λ=067°Ls, δ=5.7"), Nj observed four times from ω=231°W to ω=260°W and Mn did from ω=235°W to ω=265°W. On 6 May (λ=068°Ls, δ=5.6"), we started before sunset, and observed six times at ω=197°W (Mn), 202°W (Nj), 207°W (Mn), 211°W (Nj), 216°W (Mn), 221°W (Nj). On 7 May (λ=069°Ls, δ=5.6"), we observed four times as follows: ω=192°W (Nj), 197°W (Mn), 202°W (Nj), 207°W (Mn). The npc was sharply white. On 11 May (λ=070°Ls, δ=5.5"), Nj alone observed four times from ω=164°W (10:10 GMT) to ω=190°W. On 15 May (λ=072°Ls, δ=5.3"). We observed continually seven times as follows: ω=115°W (Mn), 125°W (Mn), 130°W (Nj), 134°W (Mn), 139°W (Nj), 144°W (Mn),149°W (Nj). On 17 May (λ=073°Ls, δ=5.3"), we observed 8 times continually every twenty minutes from ω=101°W (Nj), 105°W (Mn), 110°W (Nj) 115°W (Mn), 120°W (Nj), 125°W (Mn), 130°W (Nj), until 135°W (Mn). On 21 May (λ=075°Ls, δ=5.2"), we did five times at ω=060°W (Nj), 064°W (Mn), 069°W (Nj), 074°W (Mn), 079°W (Nj), at the first half Mare Acidalium was seen lying near the eastern limb. On 27 May (λ=077°Ls, δ=5.1"), Mn observed every 40 minutes from ω=006°W to ω=036°W, and Nj did four times from ω=011°W until 040°W.

June 2008: On 4 June (λ=081°Ls, δ=4.9"), we observed three times at ω=301°W (Nj), 311°W (Nj), 316°W (Mn). The seeing condition was terrible. On 9 June (λ=083°Ls, δ =4.8"), Nj observed four times from ω=250°W to ω=279°W, Mn did from ω=245°W to ω=274°W: The North Polar Cap was small but clearly seen bright due to the dark background Utopia which was definite (tilt ϕ=20°N). On 10 June (λ=084°Ls, δ=4.8"), we observed four times at ω=240°W (Nj), 245°W (Mn), 255°W (Mn), 260°W (Nj).

July 2008: The planet was quite declined to the western horizon, and the observable interval was quite shortened. On 1 July (λ=093°Ls, δ=4.4"), we observed four times at ω=036°W (Mn), 041°W (Nj), 046°W (Mn), 051°W (Nj). Mare Acidalium was near the central meridian. The North Polar Cap looked small roundish (because ϕ=24°N). On 12 July (λ=098°Ls, δ=4.3"), we observed four times at ω=286°W (Mn), ω=291°W (Nj), ω=296°W (Mn), ω=301°W (Nj). On 13 July (λ=098°Ls, δ=4.3"), we chased four times from ω=276°W (Mn: 10:30 GMT), ω=281°W (Nj), ω=286°W (Mn) until ω=291°W (Nj: 11:30 GMT). This observation by Nj was the last one in the present 2007/2008 apparition. Though Syrtis Major was recognised, it was harder to witness Utopia and the North Polar Cap.

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2007/2008年の火星観測について

南　政次*、中島　孝**

（要旨）前半で，これまでの経験から導いた火星観測の最善の方法（40分置きに20分観測を繰り返す）を述べた後，この方法に沿って具体的に2007/2008年接近の2007年1月から2008年7月までの一年半に及ぶ観測を系統して数え上げた．

尚，われわれはこの報告文を本年（2017年）4月に永眠された花山豪氏のご霊前に捧げたいと思う．花山氏はわれわれの若き時代，光陽中学校サイエンス・クラブの先輩として足羽山での火星観測について1952－1954年以来われわれを先導されました．ここに故人を偲び，謹んで哀悼の意を表する次第です．

*〒913-0048　坂井市三国町緑ヶ丘3丁目6-74
**〒918-8056　福井市若杉浜1丁目407